The impact of the Doha round of WTO agricultural negotiations on the South African economy

by

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at

University of Stellenbosch

Thesis submitted in partial fulfilment of the requirements for the degree of Master of Science in Agriculture (Agricultural Economics) at the University of Stellenbosch

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March 2009

DECLARATION

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March 2009

SUMMARY

The Doha Round of negotiations on the liberalisation of agricultural trade inherited complications from its predecessor - the Uruguay Round (UR). It needs to be noted, as one of the fundamental differences, that agriculture sectors in the developed countries of the Organisation for Economic Co-operation and Development (OECD) get support from their governments. In contrast to the situation, in the developing countries, agriculture is taxed to generate government revenue. The subsidies that farmers receive in the developed countries affect farmers globally through world prices (world prices depression). Therefore protection and greater subsidies should be not encouraged. As such, after a long time of preferential treatment, agriculture trade was tabled as a separate issue of negotiations at the UR and resulted to the round to be prolonged. However, one of the achievements of the UR was imposing of bound tariffs on agricultural products and determining tariff equivalence for non-tariff measures. Then, the Doha Round (DR) also known as the Doha Development Agenda (DDA) which is the first round to place development and focus strongly on agricultural liberalisation as a tool for development.

International trade theory supports agricultural liberalisation, as negotiated in the DDA. Therefore, the DDA, in seeking more liberalised agricultural markets, continues a theoretically sound approach, as in the UR. The effects of liberalising agricultural trade in the DDA will differ across countries, whereas some will gain, others may loose, and the same situation is true for different sectors within an economy. The focus of the DDA on agriculture, as a tool of development, links well to the fact that agriculture in the developing countries accounts for a substantial share of their gross domestic products (GDPs) and exports. This situation, therefore, calls for a closer consideration of the possible impact of agricultural liberalisation in South Africa even though agricultural share of GDP is less than 4 percent.

Consequently, the objective of this study is to reveal the impact of liberalising agriculture trade on the OECD countries to the welfare of South Africa. Liberalisation of the OECD countries agricultural and food commodity trade was simulated assuming a reduction of import tariffs, the tax rate on factor use and export subsidies organised in terms of four steps of 25% points each. The initial changes in world prices were taken from a global model called GLOBE. Results from this model were used to calculate the weighted average world prices that South African producers are to face. Those weighted average world prices were used as a policy shock to the PROVIDE model.

The results of the study show that the changes in world prices from the OECD's proposed liberalisation (75 percent liberalisation) of agriculture and food commodities prices range between -19.6 and +3.8 percent for imports, and between -3.0 and +29.7 percent for exports. The results show that South Africa would respond positively to world price changes, with government and macro variables showing minimal but positive responses.

OPSOMMING

Die Doha Rondte (DR) onderhandelings rondom liberalisering van handel in landbou produkte het verskeie komplikasies geërf van sy voorganger, die Urugauy Rondte (UR). Een van die fundamentele verskille tussen ontwikkelende en ontwikkelde lande wat binne die Organisasie vir Samewerking en Ontwikkeling (OECD) val is dat landbou bedrywighede tipies in laasgenoemde lande gesubsidieer word. In teenstelling word landbou bedrywighede in ontwikkelende lande tipies belas en dien dus eerder as ‘n bron van inkomste vir regerings. Die subsidies wat boere in ontwikkelde lande ontvang plaas afwaartse druk op wêreldpryse tot nadeel van boere reg oor die wêreld. Om hierdie rede behoort beskerming deur mate van subsidies afgeraai te word. Dus, na ‘n lang tydperk waar landbou voorkeur behandeling geniet het, het handel in landbou produkte ‘n afsonderlike item op die agenda geword by die UR, wat toe ook daartoe gelei het dat die onderhandelings langer geduur het as verwag. Een van die belangrike uitkomste van die UR was egter dat tariefgrense op landbou produkte gehef is. Ekwivalente tariewe is ook vasgestel vir nie-tarief maatstawwe. Die DR, ook bekend as die Doha Ontwikkelings Agenda (DOA) wat gevolg het plaas ‘n groter klem op liberalisering van handel in landbou goedere as ‘n manier om ontwikkeling te bevorder.

Internasionale handelsteorie is ten gunste van landbou liberalisering soos in die DOA onderhandel. Die DOA sit dus die prosesse van die UR voort op ‘n gesonde teoretiese grondslag. Die impak van landbou liberalisering verskil van land tot land, met sommige wat sal baat vind daarby en ander wat verloor. Dieselfde geld vir sektore binne ‘n land. Die DOA se fokus op landbou is belangrik, aangesien hierdie sektor dikwels ‘n groot bydrae tot bruto binnelandse produk (BBP) maak in ontwikkelende lande. Alhoewel landbou slegs 4 persent bydrae tot die BBP in Suid-Afrika, is dit steeds belangrik om die impak van landbou liberalisering te ondersoek ook vir hierdie land.

Die doelwit van hierdie studie is om die impak van handelsliberalisering in landbou in OECD lande te ondersoek, spesifiek met die oog daarop om te bepaal wat dit inhou vir welvaart in Suid-Afrika. Verskeie simulasies is uitgevoer om die impak van ‘n verlaging in tariewe op landbou- en voedsel kommoditeite te bepaal, asook die effek van verlagings in wêreldpryse as gevolg van laer vlakke van beskerming in ander lande. Laasgenoemde simulasies is gebaseer op resultate van die GLOBE model wat elders gebruik was. Die impak op Suid-Afrika word gesimuleer met behulp van die PROVIDE model.

Die resultate dui daarop dat liberalisering in OECD lande (75 persent liberalisering) op landbou- en voedsel kommoditeite beteken dat wêreldpryse met tussen -19.6 en +3.8 persent kan verander vir invoere, en met tussen -3.0 en +29.7 persent vir uitvoere. Die resultate wys verder dat Suid-Afrika positief reageer op hierdie veranderinge in wêreldpryse, met regerings- en makroekonomiese veranderlikes wat op klein maar positiewe resultate dui.

ACKNOWLEDGEMENTS

Each moment of life will never be repeated, and for that reason, I feel obliged to use this opportunity to convey my appreciation to the following people and organisations whose contributions to the completion of this thesis have been of immeasurable importance.

- **Prof Nick Vink**, **my supervisor,** thank you for the confidence and support that you have given me since I joined your department. Thank you, too, for accepting the role of being my supervisor and for the insight that you have given me into the nature of world agricultural negotiations.
- My mentor, **Cecilia Punt**, for the determination and support that she has lent to the project at all times, as well as to all the other members involved in the PROVIDE project (especially **Melt van Schoor** and **Kalie Pauw**).
- **Dr Scott McDonald**, for developing the GLOBE model, which enabled me to ascertain world prices.
- The **Young Professionals Programme (YPP)** of the Western Cape Department of Agriculture and the Department of Agricultural Economics at Elsenburg for their valuable motivational support, as well as **Dr Dirk Troskie** who was acting as Director of Agricultural Economics section of the Department.
- The following people deserve to be acknowledged for their brotherly/sisterly advice in all areas of life and their support of my interest in becoming an agricultural economist: **Dr ASM Karaan**; **Mrs B Matoti**, **Mr M Mjonono** and **Mr BM Gilimani**.
- I feel humbled to say thank you to all of my family members for the emotional support that they have given me during the course of this study.
- The **Ou Huis** housemates and **YPP** of 2004–2006: Mr Bhiya Clovis; Ms Chue Kedibone; Mr Mashabela Tebogo, and Mr Mentani Phumlani. Thank you all for the key advice that you have given me.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

Tables

Figures

LIST OF ABBREVIATIONS

AoA	Agreement on Agriculture
CGE	Computable general equilibrium
CPI	Consumer price index
DDA	Doha Development Agenda
DR	Doha Round
EU	European Union
GAMS	General algebraic modelling system
GATT	General Agreement on Trade and Tariffs
GDP	Gross domestic product
LDC	Least developed countries
OECD	Organisation for Economic Co-operation and Development
SADC	Southern African Development Community
SAM	Social accounting matrix
SDT	Special and differential treatment
SSG	Special safeguard mechanism
TRQ	Tariff rate quota
URAA	Uruguay Round Agreement on Agriculture
WTO	World Trade Organisation

CHAPTER 1: INTRODUCTION

1.1 Background

Under the General Agreement on Trade and Tariffs (GATT), agricultural trade negotiations have always fallen under trade in goods. However, agriculture received special treatment. The preferential treatment that agriculture received secured its prevalent status as one of the highly protected or subsidised sectors of world trade. Attempts to address this situation came during the Uruguay Round (UR), where agricultural trade was tabled separately from trade in goods (Indikadahena, 2005). Consequently, the UR of negotiations is regarded as a historical turning point in agricultural negotiations. These agricultural negotiations resulted in one of the celebrated achievements of the UR: the conversion of all non-tariff barriers into their tariff equivalent, a reduction in applied tariffs and the setting of bound tariff levels (Hertel, Anderson & Martin, 2000). The UR was followed by the Doha Development Agenda (DDA) that was launched in 2001 and the ninth round of World Trade Organisation (WTO) negotiations (Fisher, 2006). In its declaration market access, domestic subsidies and export subsidies were tabled as the three pillars of agricultural negotiations to negotiate. However, Stiglitz & Charlton (2004) argue that the development of developing countries should form the basis of the DDA. Their stance was affirmed by Hertel & Keeney (2007), who argue that the DDA emphasises development and focus on agricultural liberalisation inspired developing countries.

The focus on agricultural trade liberalisation and development raised the expectations and hopes of developing member countries. However, the labelling of the DDA as developmental round caused concerns as to whether the round was going to be beneficial to developing countries (Stiglitz & Charlton., 2004). The developed countries, on the other hand, in affirming their commitment to development, made further promises that the round would indeed be beneficial to the developing countries. The European Union (EU) promised to abide by the principles of development (Oxfam briefing note, 2003). Furthermore, liberalisation of agricultural trade was highlighted to have the ability to reduce poverty in poor countries (Oxfam briefing note, 2003). Agriculture accounts for more than 60% of the gross domestic product (GDP) of these countries, employs more than 60% of their labour force, represents a major source of their foreign exchange, supplies the bulk of their food and provides income for a large percentage of the rural population (Amani, 2004). However, in

South Africa, agriculture accounts for about 3% of the GDP, 7.7% of employment and 7% of total exports (Vink, 2003). Given the value of agriculture in developing countries (measured in real GDP terms), liberalisation of agriculture will have pronounced effects on developing countries. Hertel & Keeney (2005) argue that the general effect of liberalising the three pillars of agricultural negotiation[1] will vary. Net exporters will gain while net importers will lose (unless they become net exporters in the course of adjusting to the new conditions).

It is expected that liberalisation of agricultural trade would, therefore, encourage the demand for developing countries' products, thereby increasing their export prices, which would, in turn, result in improved terms of trade. However, the elimination of preferential markets will force the beneficiaries of these policies, which include South Africa, to face tough competition from other exporters. Such a situation could erode demand for the exports of developing countries, resulting in the deterioration of terms of trade (Hertel *et al*., 2000). Viewing the two possible implications of world trade, it is important to look at the effect of possible liberalisation of agricultural trade without eroding the preferential market access. Liberalisation of agricultural trade could cause the integration of the agricultural sector into the world trade economy. This could be either beneficial or detrimental for producers, because the economies of scale will ultimately determine the potential gainers or losers (Foster & Valdes, 2004). Consumers will then face price increases for certain products and decreases for others. In many developing countries, policy makers will face the challenge of finding instruments that could cushion the impact of liberalised trade on both domestic producers and consumers (Foster *et al*., 2004). Prices of agricultural commodities are expected to increase.

The effect of agricultural trade liberalisation will come through changes in world prices. At the time of commencing this study (2005), the world prices of agricultural and food commodities were depressed. It is argued that the complete liberalisation of agricultural trade in the DDA will cause an aggregate increase of almost 12% in the world price of agricultural commodities, relative to an index of all prices (Shapour & Trueblood, 2003). Therefore, the removal of all tariff rates will result in an 11% increase in world prices, while the removal of all domestic support will cause a 30% increase in the world prices of agricultural products. The agricultural subsidies and protection given by developed countries are the primary cause of low agricultural prices and account for 80% of the depression of world prices of

[1] These pillars are market access (reduced tariffs), domestic subsidies (reduced tax rate on factor use) and export subsidies (reduced export support).

agricultural and food products (FAPRI, 2002). FAPRI further highlights that the world prices of oilseed will increase by 3.1%, cotton by 15%, dairy by a massive 27–34%, wheat by 4.8% and maize by 5.7% under full liberalisation of all trade distortions. This increase in world prices will come about because of a reduction in outputs, and outputs will decrease as support is reduced in the subsidising countries. This, in turn, will lead to a reduction in supply to the world market, which will result in prices being pushed up, as countries will no longer have excess supply to export.

The impact of world price increases on developing economies is important to note. It is also important to note that the distribution of gains from the DDA is complex. It is argued that the greater share of the forecasted rise of US$355 billion in global income by 2015, because of trade liberalisation, will go to the developed countries of Western Europe rather than to the developing countries of the Southern Hemisphere (Stiglitz *et al*., 2004). South Africa may gain or lose because of agricultural liberalisation as negotiated in the Doha Round.

1.2 Motivation and problem statement

During the Uruguay Round, economic forecasts showed that benefits from that round were to go to developing countries. In 2004, Stiglitz *et al* (2004) argued that about 70% of benefits from the Uruguay Round went to the developed countries and the remaining 30% went to export-oriented developing countries. Despite the disappointment from the previous round, at the ministerial launch of the Doha Round in 2001, developing countries' expectations rose again as the round was said to focus on issues of development and was even labelled as the Doha Development Agenda (DDA). One of the areas of interest to developing countries, agricultural liberalisation, was put at the core of negotiations. However, the Doha negotiations have not been smooth. A conflict of interest emerged on what was to be tabled at Cancun and the Singapore issues between developed countries of the OECD and a group of developing countries known as the G-20. These differences continued until the Doha Round was even labelled to have collapsed in 2006.

Despite all the complications and expectations of the negotiations, interest of what the DDA possible mean to South Africa especially liberalisation of agricultural trade in the developed countries of the OECD is vital. This study serves as one of the first studies to use the PROVIDE model to assess the impact of the DDA on the South African economy. This will also contribute to the innovative and increasing literature on model-based assessments of the impact of the DDA on reform proposals. Some of these papers include those by the FAO

(2002); the OECD (2002); Poonyth, Sharma and Konandreas (2004); and Stiglitz and Charlton (2004. Although the list of works in this area is growing, none has focused on South Africa. The challenge facing South Africa is whether the agricultural outcomes of the DDA will benefit its economy. The problems identified require that the present study focus on enhancing the value of information that can be used in formulating South Africa's agricultural negotiating position, which should benefit South Africa as a whole.

1.3 Research question

The central question that this study seeks to address is whether the South African agricultural sector stands to benefit or suffer losses from the current round of negotiations on agriculture. Moreover, what would the gains or losses be and what would they entail? This core question can be further divided into the following questions:

- What is likely to happen to the world prices of agricultural commodities if agricultural trade is liberalised in the OECD countries?
- What is likely to happen to agricultural production in South Africa?
- Does the average household stand to benefit from the potential outcomes, and if so, what is likely to happen to factor returns?
- Would the South African economy grow or decline due to the liberalisation of agricultural trade?
- How is the South African labour market likely to respond to this scenario?

1.4 Methodology

The model[2] used for the analysis is a computable general equilibrium (CGE) model, which is a computer-simulated model of the economy. The model is a numerical one, based on general equilibrium theory. It is capable of presenting a holistic view of the entire economy as a web of interrelated activities consisting of seven different types of agent: commodities, activities, factors, households, government investment or savings, enterprises and rest of the world. Such a model allows for the consideration of a two-way trade flow, assuming that both foreign and domestic products are but imperfect substitutes. The CGE models are a class of models with the defining characteristics of endogenising all transactions and flexible relative

[2] The model used to analyse the results of this study is the PROVIDE model. However, another model was used in another study to derive the policy shock used to shock the PROVIDE model and that model is the GLOBE model. The GLOBE model was developed and applied by McDonald *et al* (2007). It is a global model that runs in GAMS and is based on the GTAP dataset.

prices. All CGE models are price responsive in that shocks to the system and changes in policy cause changes in the price signals to agents, which, in turn, necessitate changes in patterns of production, consumption and trade (McDonald & Punt, 2004).

Consumer and producer behaviours are based on the neoclassical economic assumption that consumers maximise utility, subject to budget constraints, while producers simultaneously maximise profits, subject to the technology available to them. The CGE models are comprised of the production, consumption and trade of a country or can be multiregional in nature, with the latter accommodating the consideration of interregional economic links (Mabugu & Chitiga, 2004). Utility maximisation generates a product's demand function, and when the labour supply is not fixed exogenously, the labour supply function can have an effect through increasing employment or number of persons employed. The CGE models organise the economy into markets and it is assumed that all markets are in equilibrium and that the quantity supplied equals the quantity demanded, constituting a general equilibrium. The interdependence of markets means that the prevalent price in one market enters the supply and demand functions of the other markets. Such interdependence allows for the relative complexity of the CGE models compared with the partial equilibrium models, which only focus on one market while taking the environment as a constant, in accordance with the *ceteris paribus* assumption (Gilbert & Wahl, 2002; Mabugu *et al*., 2004).

The CGE models, specifically the PROVIDE model, are based on a social accounting matrix (SAM). The SAM serves to identify the agents present in the economy and provides a database for calibrating the model. The success of the SAM in portraying the desired outcomes depends upon its grouping of agents in terms of behavioural relationships. The SAM traces all transactions between agents in the economy, it uses a factor-use matrix to identify the quantities of each different factor by each activity for the period to which the SAM refers (PROVIDE, 2006). The SAM, the factor-use matrix and the elasticities are the three separate sets of data that are used collectively for modelling purposes. The SAM uses a supply-and-use structure that allows for the possibility that all activities can produce multiple products, which is indeed the case for all activities in the SAM.

According to the PROVIDE SAM, agricultural activities should refer to regions of the country that should, ideally, be agronomic in nature, whereas the agricultural census data are organised according to magisterial regions. An agronomic classification of agricultural activities implies a number of issues. Firstly, it implies that every agricultural activity can

produce a range of commodities. Secondly, it implies that land should be used for a specific form of agricultural activity, without the possibility of alternative use. Finally, it implies that the probability of farming for all agricultural activities depends on the effect of policy shocks, which are felt across the ranges of the commodities' output prices. This paper uses data arranged into two groups: a SAM that records all transactions that take place between agents in the economy and a series of elasticities that control the model's behavioural functions. The full explanation of the PROVIDE SAM for South Africa is available in the PROVIDE technical paper, 2006.

The SAM for this study has 28 commodities (consisting of 11 agricultural and 6 food commodities); 28 activities (consisting of 10 agricultural and 6 food activities); 41 factors consisting of gross operating surplus (GOS) known to be capital, land and 31 labour factors; and 32 different types of household. The full list of SAM accounts for this study is provided in Appendix 3. The study focuses on the treatment of agricultural activities; however, the SAM that was used applies to all activities, including the production of multiple products.

1.5 Model limitations and strengths

As appealing and influential as models are, they suffer from a number of weaknesses that are recognised in the published literature. However, these weaknesses are usually overlooked in practical application, and such oversight can potentially lead to inaccurate conclusions being drawn with regard to policymaking. The CGE can thus be criticised on several accounts:

- Firstly, the model is based on the assumptions of neoclassical economics, which are sometimes unrealistic. In addition to this, the model is based on the assumption of utility and profit maximisation.
- The second problem is that there are no missing markets. Though prices are the main drivers of economic activity, in reality, there are no markets and, hence, no price adjustments for phenomena such as environmental quality and social cohesion. Such factors, however, constitute an important impact through their influence on human behaviour (Shoven & Whalley, 1992).
- The third problem is that CGE models have convex production technologies, which rule out increasing returns to scale. This problem is a real-world phenomenon that plays an important role in technical changes (Arthur, 1994).

- Lastly, there is a concern that the underlying theory itself focuses on equilibrium and disregards the fact that equilibrium can be unstable and is a situation that is difficult to reach and maintain (Ackerman, 1999).

However, the CGE model is still regarded as a powerful tool for simulating an economy, for numerous reasons. Where assessing the impact of trade on many agents in the economy is required, many modellers regard this model as the best tool to use, for the following reasons:

- Since the model accommodates detailed economic data and is capable of tracing indirect effects, it allows for the distribution of policy impacts over different groups of the population and takes into account a number of different variables, including occupation, race and income.
- The model is multisectoral and in many cases multiregional, which implies that it covers a whole range of sectors and that the behaviour of economic agents is modelled.

As has been explained in previous sections of this chapter, the research undertaken in this study is very necessary in terms of the South African economy. The analytical tools and CGE models used in this study are believed to be the best available and most suitable tools to answer the research question and subquestions posed in this study. The limitations of the analytical tools have been discussed and it was shown that the CGE models suffer from a number of weaknesses. However, the discussion of their strengths justifies their use rather than the use of other models, such as the econometric model, which may be useful in addressing other research questions. To achieve the object of this study clearly and sequentially, an outline of the study is presented in the following section.

1.6 Outline of the study

This structure of the study is as follows:

- Chapter 2 reviews free trade and its associated critique. It also reviews the importance of agriculture to the economies of developing countries, with specific reference to South Africa.
- Chapter 3 analyses the WTO agricultural negotiations until the collapse of the DDA.
- Chapter 4 presents a detailed explanation of the research methodology used in this study.

- Chapter 5 presents a discussion and analysis of the research results.
- Chapter 6 presents the conclusions and recommendations of the study.

CHAPTER 2: TRADE THEORY AND IMPORTANCE OF AGRICULTURE

2.1 Introduction

International trade theory provides some of the information required for agricultural trade negotiations at a multilateral level. Trade literature comprises theories that are in favour of free trade as well as those that are against it**.** This leads to the need for an analysis of the agricultural trade liberalisation policy of the WTO. Trade literature suggests that liberalisation is necessary but under certain circumstances protection is justified. The literature thus recognises the protection of infant industries as a necessary policy option (Lindert & Pugel, 1996). Sound international trade theory, be it of a protectionist or free trade nature, can clearly provide valuable information in support of informed decision making at negotiations on agricultural trade. Free trade, or trade liberalisation, can result in developing countries not benefiting from negotiated outcomes if policy adjustment mechanisms do not exist because a movement from existing circumstances to free trade may cause structural changes. It is also important to recognise the role of agriculture in the economies of developing countries such as South Africa because this will lead to sensitivity in the handling of negotiations.

Agriculture contributes more than 60% to the GDP in developing countries although in South Africa, it contributes only approximately 3%. Agriculture also contributes significantly to employment and foreign exchange earnings (Amani, 2004; Vink, 2003). Therefore, if trade policy decisions are based on misleading[3] information or wrong perception, developing countries could be adversely affected. In an attempt at verifying whether free trade or trade protection is the best possible option for developing countries, the formulation of an objective for this chapter became clear.

Hence, the objective of this chapter is to uncover the attributes of trade liberalisation, or free trade, and to link them to the importance of the agricultural sector, with specific reference to the South African economy. Accordingly, this chapter provides a critique of free trade as well as possible ways of benefiting from liberalisation. It also considers the overall role of agriculture.

[3] Portrayal of either free trade or protection as the only policy option of socio-economic value.

2.2 The basis of trade liberalisation and its challenges

Ackerman (2001) argues that economists have fought the battle for and against free trade on all levels. This implies that certain economists are in favour of free trade while others are against it. The battle has been fought along the lines that free trade is a desirable policy measure that will enable all countries (developed or developing) to improve their welfare. At the centre of the dispute are complex economic arguments. These economic arguments are based on assumptions in which other assumptions are said to be unrealistic. In defence of these arguments, Shafaeddin (2000) argues that trade theorems do not suggest that free trade is the best policy option. Trade theorems argue that free trade is better than no trade, given certain conditions. Shafaeddin (2000) also argues that free trade fails to recognise that the different stages of development of countries cause different reactions to changes in protection.

Along the same lines, economists like Facchini & Willmann (2001) argue in favour of free trade and suggest that while its principles are clearly understood and respected by economists, the logic behind it is often misunderstood. They argue that free trade has an important role to play in income generation and distribution. However, their arguments suggest that competitive sectors will withstand competition from imports while uncompetitive sectors will lose due to import substitutes. The following section looks at classical theories of trade in order to analyse whether free trade or protection together with support do create a desirable environment.

2.2.1 Trade theories

The first international trade theory to acknowledge gains from the exchange of goods is the theory of absolute advantage,[4] formulated by Adam Smith. It must be noted, though, that this theory compares an initial situation without trade to a situation with trade. However, this theory fails to address the existence of trade where one country has an absolute advantage in the production of two traded commodities (Lindert *et al*., 1996; Parrish, 2004). Immediately following the theory of absolute advantage was the theory of comparative advantage. The theory of comparative advantage developed an answer to the question that Adam Smith could not answer. In his theory of comparative advantage, David Ricardo developed the idea that trade patterns among countries should be based on relative efficiency rather than on absolute

[4] The theory argues that certain countries produce certain goods more efficiently than others do and that this advantage is absolute. Accordingly, it is postulated that a country should export those products in which it has an absolute advantage and import those in which it does not.

efficiency. According to this theory, even if a country has an absolute advantage in the production of two commodities, it still has a relative advantage in the production of one commodity over the other. This means that it should specialise in the production of that particular commodity. The theory further argues that the determinant of relative advantage is the relative productivity of labour (Lindert *et al*., 1996; Parrish, 2004). Since its introduction, the theory of comparative advantage has become a core concept in international trade literature and thought, and economists generally accept it as a valid viewpoint, regardless of the inherent weaknesses pointed out below.

Despite the recognition that the theory of comparative advantage has received and its popularity, the theory makes an unrealistic assumption, even in its simplest form – the two-country, two-commodity model. The assumption is that price determinants are relative to labour productivity only and have nothing to do with demand and supply, zero transport costs, the absence of trade barriers, the maximal use of resources or conditions of perfect competition (Parrish, 2004). The other weakness is that it accounts for only one factor of production and fails to explain the reasons behind the differing levels of labour productivity encountered in different countries (Parrish, 2004). This weakness is considered in the Heckscher-Ohlin (H-O) theory, which follows.

The H-O theory agrees with and recognises the concept of comparative advantage introduced by Ricardo. However, the H-O theory postulates that a country will export a commodity that intensively exploits a factor of production that it has in abundance and will import a commodity that intensively uses its scarce resources. In extrapolating this concept, the Stolper-Samuelson theorem emerged. This theorem states that a situation could exist in which an impact on the commodity prices in a country could raise real returns to the factors used intensively in an industry where prices are rising and could lower real returns to the factors in an industry where prices are decreasing, regardless of the preferences of sellers and consumers (Lindert *et al*., 1996; Parrish, 2004). Even after a number of theorems attempted to intensify the defence of comparative advantage in the H-O model, a number of problems prevailed.

As with the classical theories, the H-O model suffered from a similar problem in its basic assumptions. Again, one of the assumptions of concern is that countries use the same technologies and that the influence of technological change on trade and specialisation does

not feature at all in the H-O theory. This contradicts the technological gap theory,[5] which notes that technology differs across countries. However, despite the challenges, Bhagwati (2002) argues that if an open economy allows for market-determined allocations of resources and if prices reflect social costs, Adam Smith's invisible hand can be trusted to guide the world economy to efficiency. In terms of this view, free trade can be argued to be the best policy. Balassa's theory of revealed comparative advantage later emerged in criticism of the H-O theory of comparative advantage.

Balassa (1965) assumed that with protective pressures such as tariffs and quantitative restrictions on trade, which trading nations frequently impose, trade should be valuable in reflecting international differences in relative costs and non-price factors. He maintained that differences in relative costs and non-price factors are reflected in the patterns of trade in the sectors assumed to 'reveal' the comparative advantage of trading nations. According to Balassa (1965), former theories overlooked non-price variables, such as quality differences, goodwill, servicing, the existence of repair facilities and differences in weights and measures, all of which have a significant bearing on international trade patterns in developed countries. The value of using comparative advantage as a concept for evaluating patterns of trade is widely accepted and is often featured in theoretical and policy discussions. However, measuring a country's comparative advantage in a particular commodity is difficult (Balassa, 1965).

Revealed comparative advantage (RCA) indicates the contribution of each sector to a country's overall trade balance. Various attempts have been made at providing indirect approximations of this concept, using information derived from, or revealed by, post-trade situations and assumptions about the relationships between observable and unobservable variables (Greenaway & Milner, 1993). Revealed comparative advantage shows that developing countries' comparative advantage is limited to simple processing as it relates to agriculture or other resource-intensive primary activities (Greenaway *et al*., 1993). Such a limitation raises concerns about the share of agricultural trade that these countries enjoy in world trade. Using observed trade patterns to identify comparative advantage is problematic because in reality, such trade flows are often distorted by government policies and

[5] Trade can be influenced by the availability of technology in one country and the nonavailability of it in another country, which can give the former a short-term comparative advantage. There is a lag in reaction time before other countries acquire such knowledge, which means that by the time they do, the innovative country might have invested in discovering other new technology.

interventions. This is particularly the case in agriculture, where government support of the sector and explicit use of import restrictions and export subsidies distort trade. Government subsidies to agriculture distort the indices of revealed comparative advantage. Thus, using revealed trade performance to show comparative advantage has an obvious drawback in that policy-induced barriers to trade affect actual trade flows (Greenaway *et al.*, 1993).

Comparative advantage is difficult to estimate, due to the non-observability of autarkic prices. The assumption that Balassa's (1965) theory of revealed comparative advantage made is that trade patterns of comparative advantage could be observed in authentic post-trade data. This resulted in his inability to capture the effect of government intervention in terms of the theory of comparative advantage. Consequently, economists agree that, at least theoretically, within international trade, liberalised trade will cause some sectors to benefit while others will suffer a loss.

2.2.2 Shortfalls of free trade theories

- Shafaeddin (2000) asserts that theories in favour of free trade do not argue that free trade is the best trade policy; instead, they argue that, given certain conditions, free trade is the best trade policy. Samuelson (1938) reiterates that free trade theories argue that free trade is better than no trade, but they do not suggest that free trade is the optimum trade policy for all countries. Samuelson (1938) further claims that it is not necessarily true that free trade is, in fact, the best trading policy.
- The fundamental point of departure of free trade theories involves the concept of general equilibrium, and the general equilibrium is questioned. The critiques of free trade theory question a number of assumptions concerning general equilibrium (Shafaeddin, 2000).
- Another reason why free trade theories fail to persuade some economists is the neoclassical theory of comparative advantage. This theory predicts that gains from trade maximise the welfare of all those in the countries concerned and that a situation of free trade inevitably leads to a situation of economic prosperity (Bender & Li, 2002).

2.2.3 Strengths of free trade theories

Liberalised trade plays an important role in world economics and social welfare (Ackerman, 2001). Ackerman uses the example of aluminium and bananas and argues that even in

countries that do not produce bananas, people do eat bananas, and people drive aluminium-made cars in countries that do not produce aluminium. He further states that the main problem with economists who favour comparative advantage is that they view free trade as a truth that fits all situations. Another point worth noting is that liberalisation policy on its own is not enough and if there are no other policies to complement it, it will fail. This calls for a relook at a number of attributes by the trade theories in favour of free trade. The economic development of the developed world was achieved through a number of policy interventions and not only through trade liberalisation (free trade). These interventions included setting up tariffs and picking and supporting key sectors. Development through a pure form of free trade only occurred in parts of Hong Kong and Switzerland.

Facchini *et al*. (2001) argue that free trade can have positive or negative effects on different sectors within a country or among countries. The same can be said about the protectionist approach. The basic decision behind choosing a negotiating policy, therefore, will be to discern between the positive and negative effects that result from free trade. Free trade is often thought of as a good policy option for a number of reasons. For example, the fundamental benefits resulting from free trade are the positive production and consumption efficiency gains expressed in general equilibrium analysis. These gains accrue to a country when it moves from not trading to free trade. Production efficiency improvements indicate the amount by which a country can increase its production while using the same resources. These efficiency improvements occur when allocated resources lead to a shift from less comparative sectors to comparative sectors of the economy, thus increasing the productivity of the economy. It is clear that these efficiency gains imply that some sectors will expand while others will contract (Facchini *et al*., 2001). Trade models suggest that total production in a particular country will rise if the resources used in production shift from one sector to the other. This would cause increases in the country's GDP. Therefore, free trade would have caused an increase in the level of the country's national output and income.

Consumption efficiency expansion occurs on an individual basis when changes in the relative prices of commodities allow consumers to achieve a higher level of utility. Since changes in prices give consumers more choice, consumption efficiency implies that choices that are more satisfying become available. When numerous varieties of commodities are available within a product category, consumption efficiency implies that consumers are able to consume greater varieties and are able to purchase a product or service that is closer to their

highest possible utility curve (Facchini *et al*., 2001). A consumption efficiency increase is easy to describe for an individual consumer but it is much more difficult to describe conceptually in terms of the aggregate economy. Nevertheless, the aggregate indifference curves resulting from individual indifference curves can be used to describe community or societal gains resulting from trade liberalisation; it is possible to portray aggregate consumption efficiency improvements. However, it is necessary to note that the use of an aggregate indifference curve generally involves two assumptions. Firstly, all consumers have identical preferences, and, secondly, there is no redistribution of income because of the changes in the economy. Yet, international trade literature reveals that in most trade models, income redistribution does in fact occur as an economy moves towards free trade (Facchini *et al*., 2001).

Despite the shortfalls highlighted in the previous section, it can be seen that while free trade may be ideal for countries, it does pose numerous challenges. Therefore, agricultural trade liberalisation is clearly relevant and important; however, one must bear in mind the shortfalls, such as adjustment costs, that are discussed in the following section.

2.3 Adjustments to trade liberalisation (free trade)

Blandford *et al* (2005) define adjustment as the process undertaken by farms, households and firms to adapt to a new policy framework. It is possible that the adaptation process will prove to be worthless or otherwise. Such adjustments include production, factor allocation and management decisions. This definition can be altered to include the process undertaken to mitigate the unfavourable effects that may arise with liberalisation while maximising the favourable effects. Although trade liberalisation is valuable and necessary in achieving free trade status, it has undesirable outcomes for developing countries and least developed countries (LDCs). The long-term benefits of free trade are desirable for all world economies, but unfortunately it has not been well recognised and documented that in the short to medium term certain countries may experience a loss. Such losses may be due to technological gaps and the political environments in those countries. It is costly for countries to shift their production into the sectors of their comparative advantage as advocated in trade literature. In terms of equilibrium, such problems may arise because of asset specificity, bounded rationality associated with the new sectors, capacity and the costs of such a change (Bacchetta & Mario, 2003).

Jean-Christopher (2003) argues that openness and integration of countries within the world economy promote growth and reduce poverty. However, policy changes often result in gains and losses accrued to different sectors of the economy. As a country responds to liberalisation by shifting its resources to the productive sectors, the cost of shifting resources may be higher or lower than the benefits in the short term. Therefore, mechanisms should be put in place to reduce the negative effects, and in situations where gains do not exist, compensation for those sectors should be awarded. Adjustments in agriculture pose a considerable challenge, however. Agriculture, like all sectors of the economy, is subject to economic and political pressure. Furthermore, agriculture seems to be rigid in nature. This is due to factor immobility and remoteness of farm resources (Blandford & Hill, 2005). Two ways of considering adjustment costs are through efficiency and equity. When the neoclassical assumption of perfect information and frictionless relocation of resources is removed or relaxed, the need for government to play a bigger role emerges. In such a situation, the welfare gain or loss will be measured in terms of output and consumption forgone as the economy moves from one point of equilibrium to the other. The justification for efficient government intervention in the adjustment process relates strongly to the existence of goods that are either unpriced or incorrectly priced in the market place. It must also be noted that the existence of imperfect competition, due to government inaction, further justifies government's active role.

There are three cases worth citing regarding adjustment policy reforms. Firstly, there was the Canadian grain one-time capital payments to farmers after the removal of transport subsidies in 1995 Secondly, there was the Australian dairy restructuring package of 2000. Thirdly, there was the financial assistance provided for day-to-day living expenses in New Zealand that farmers experiencing cash flow deficits received after the reduction of subsidies from about 36% of output to 4% (Blandford *et al*., 2005). The above cases give insight into the issue of adjustment costs. As can be seen from these cases, governments may need to be flexible in order to implement limited domestic and, perhaps, international compensatory policies to manage the temporary negative effects of an overall reduction in agricultural support. Such may be the case for some farmers in both developing countries and LDCs when they lose preferential market access (Hoda, 1994). Considering the significance of agricultural trade to developing countries, it is necessary to look at the impact of trade liberalisation on the agricultural economies of developing countries.

2.4 The potential effects of trade liberalisation on developing countries

The liberalisation of agricultural trade may play a vital role in improving the lives of people in developing countries. This is because agriculture plays an important role in the livelihoods of the people living in such countries, contributes a large share to their GDPs and accounts for the employment of a significant number of people. The link between agriculture and livelihood in developing countries reveals that people are dependent on agriculture. This means that government support of agriculture in developed countries has a detrimental impact on producers in the developing world (South Centre, 2007). Furthermore, subsidies in developed countries benefit consumers in developing countries, as they drive prices down.

2.5 The role of agriculture in the development of the poor

Agriculture has a major role to play in improving the lives of the poor in the developing world. It plays three fundamental roles in reducing poverty (Nagarajan, 1999):

- It contributes to economic growth and to the quality of such growth in terms of the degree to which it benefits the poor by equitably distributing gains.
- It is the livelihood of hundreds of millions of the world's poorest people.
- It remains a substantial part of most developing countries' economies.

In Africa, the agricultural sector employs approximately two-thirds of the labour force, accounting for 37% of the gross national product (GNP) and a bigger share of exports. In South Asia, despite rapid urbanisation and economic diversification, agriculture continues to generate 27% of the GNP. Therefore, agriculture remains the most likely source of significant economic growth in many developing countries. Evidence suggests that agricultural growth and increases in agricultural productivity may be a prerequisite for broad-based sustained economic growth and development (Amani, 2004). Furthermore, the global rapid rate of urbanisation notwithstanding, an estimated 70 to 75% of the world's poorest people, the 1.2 billion living on less than US$1 per day, live in rural areas where their livelihood largely depends upon agricultural production (Nagarajan, 1999).

In addition to these, agricultural trade generates the foreign exchange needed for public services in industries such as the pharmaceutical and information technology industries. Strong agricultural growth has also been a feature of countries that have successfully reduced their levels of poverty, such as India, Bangladesh, Indonesia and China (FAO, 2001). The extent to which the poor benefit from agricultural growth, however, depends on a number of

factors, which include the relative importance of agriculture to the livelihood of the poor. In many parts of sub-Saharan Africa and South-East Asia, agriculture remains a key component of the livelihood strategies of the poor. Nevertheless, agricultural growth is not a universal remedy because its relative importance declines as economies grow. As the livelihood strategies of the poor diversify, for whatever reasons, agriculture becomes just one of many different forms of economic opportunity available to them. Such increases in opportunities are often the result of higher agricultural productivity.

2.6 Conclusion

The objective of this chapter was to present theories relating to both trade liberalisation and the role played by agriculture in the economies of developing countries. It became clear that agricultural trade liberalisation policies are important for stimulating development in developing countries; nonetheless, these policies should be implemented with caution. Also, it became evident that agriculture is an important economic sector and it is the predominant livelihood of people in developing countries.

CHAPTER 3: THE SEQUENCE OF AGRICULTURAL NEGOTIATIONS OF THE WTO

3.1 Introduction

This chapter presents an overview of the sequence of agricultural negotiations of the GATT/WTO, especially the UR and the DDA. The reason for this is that agricultural trade negotiations were initially dealt with as a separate issue at the UR (Indikadahena, 2005). A brief overview of the evolution of the agricultural negotiations of the GATT, which dates back to the mid 1940s,[6] is presented. Prior to the UR, the first seven rounds of negotiations of GATT saw agricultural trade forming a component of trade in goods but with special treatment. Trade literature points to this as being the cause for the lengthy duration of the UR. Despite the long time taken to conclude the round, the UR marked a historical turning point in multilateral trade negotiations. Nevertheless, its conclusion did not address all of the issues of interest to agricultural trade, and hence the Doha Round became a necessity (Indikadahena, 2005).

The DDA, which is the ninth round of multilateral negotiations and is based on the work of the UR, was launched towards the end of 2001. The DDA was entitled the Doha Development Round as its purpose was to consider issues affecting poor countries (Clapp, 2006) and to focus on development and agricultural liberalisation. In terms of agricultural liberalisation, the round addressed the improvement of market access, the reduction of a wide range of tariffs with the aim of eliminating them and the reduction of both domestic and export subsidies given to farmers in developed countries. At the time, it was believed that the commitments made at the round would be met by March 2003, though this turned out not to be the case (Clapp, 2006). This means that progress in agricultural trade negotiations tends to be very slow.

The fundamental objective of this chapter is to view, analyse and follow the progress of the three pillars of agricultural trade liberalisation. Secondly, it is to take a closer look at the positions of the USA, the EU, the G-20 and South Africa in approaching the DDA. To achieve these objectives, the chapter is organised as follows:

[6] It needs to be noted that South Africa was one of the 23 founding members at the launch of the first round of multilateral negotiations in 1947.

- Firstly, a brief overview of the history of agricultural negotiations and their effects is given.
- Secondly, a discussion of the three pillars of agricultural negotiations covering in sequence the UR, the July package, the Hong Kong meeting and the collapse of the DDA (July 2006) is provided.
- Lastly, suggestions for the way forward, if the round is reinstated, and some conclusions are offered.

3.2 Agricultural trade negotiations before the Uruguay Round

Agricultural trade negotiations have always formed a part of multilateral trade negotiations under trade in goods, with special treatment that excludes agriculture from reduction commitments on trade distortions. This special treatment of agricultural trade has caused the present state of affairs in which agriculture is arguably among the most highly distorted sectors of multilateral trade. These distortions, unlike most other areas of international trade, exist in the form of tariffs, quotas, subsidies and other forms of agricultural support (Indikadahena, 2005). The UR of 1986–1994 was the first round to address agricultural trade distortions by including agriculture in the multilateral trade liberalisation process as an issue requiring separate negotiations. The three areas of concern identified in the UR were market access, domestic subsidies and export subsidies. Market access includes issues such as tariffs, quotas and quantitative restrictions. Domestic subsidies, such as input subsidies, subsidies on environmental issues and subsidies given for research and development, include programmes aimed at helping farmers to reduce their costs. Export subsidies, which include subsidies on transport, involve support given to farmers to export their products. It is also worth noting that issues concerning non-tariff barriers were also considered.

3.3 The effects of the special treatment of agriculture

It is argued that the GATT policies that regulated agricultural trade before the UR produced extreme distortions in the production, consumption and trade of agricultural and food commodities. These are particularly detrimental to the terms of trade of the developing countries and the LDCs. Because of subsidies farmers receive in the developed countries there has been an increase in the supply of agricultural commodities on the world markets, thereby depressing world prices (Diaz-Bonilla, Robinson & Thomas, 2002). On the other hand, if domestic and export subsidies are reduced the world prices of agricultural commodities will increase because reduced supplies of commodities will cause the world

prices to increase. It needs to be understood, however, that a possible tariff reduction will have a different effect on world prices than subsidy reductions. The reason for this is that a tariff imposed on any commodity increases the cost of that commodity, resulting in increased prices (Diaz-Bonilla *et al.,* 2002).

The magnitude of world price changes, which overall are expected to increase, will be determined by the extent of the support (domestic and export subsidies) and protection (tariffs) provided. Logically, the more support and protection are provided, the greater the magnitude of change will be. In summary, it is argued that world prices will increase by approximately 12% relative to the index of other prices if all agricultural trade distortions (domestic and export subsidies and tariffs) are removed. Such an increase in world prices may negatively affect the net importers of agricultural commodities, most of which are developing countries. The reason for this is that an increase in the cost of importing will translate into an increase in the domestic prices of imports. It is important to note that such domestic price increases will affect food security (Diao & Dorosh, 2003).

It is necessary to distinguish which of the three pillars distorts trade the most or will account for the biggest proportion of the possible 12% world price increase (Diao *et al*., 2003). It was indicated that domestic subsidies account for 4% of world prices depression and that export subsidies depress world prices by 1.5%. The highly supported commodities include sugar, pork, beef and poultry (FAPRI, 2005). However, it is worth looking at the different pillars of agricultural trade.

3.4 The three major areas of agricultural negotiation within multilateral trade

The three pillars of agricultural trade negotiation, as outlined by the WTO, merit some attention. Opinions differ regarding the negative effects each pillar may have on developing countries, including South Africa. It is therefore important for this study to discuss these pillars in relation to both the UR and the DDA.

3.4.1 Domestic subsidies in the UR

Domestic subsidies refer to the funding that farmers receive from the government, regardless of commodity market conditions. This kind of funding is most common in the EU, Japan and the USA. It is argued that the EU, Japan and the USA account for approximately 90% of known domestic subsidies. One of the problems with domestic subsidies is that they are generally considered not to have a direct effect on the trading partners of the country

providing them. Any form of domestic support that directly influences commodity prices and quantities produced is regarded as detrimental (Beierle, 2002). According to Beierle (2002), there are three different boxes or descriptions of domestic subsidies:

- The amber box includes payments to farmers that are linked to quantities or prices, such as those made in the form of market support, input subsidies and direct per-unit payments.
- The blue box is closely related to the amber box in that it entails the adoption of policies that are linked to quantities and prices while limiting production. Although exempt from any disciplinary measures, it is recognised as being trade distorting. Beierle (2002) argues that this box was created as the last compromise at the UR to allow the EU to continue with its compensatory payments. At the same time, it also allowed the USA to continue with its annual domestic support, aimed at supporting the amount of farm income used.
- The green box includes decoupled payments to farmers made in terms of the policy goals laid out in the AoA, such as those relating to environmental protection and research and disaster relief. For such programmes to qualify for the green box they should be publicly funded and must either not distort trade at all or minimally distort trade.

The OECD aggregate measure of support was used to trace the amber box reductions. It was agreed that developed countries would have to cut their spending on this box by 20% over a six-year period, using the 1986–88 baselines. Developing countries promised to cut their spending by 13.3% over a 10-year period while LDCs did not have to reduce their subsidies. There was, however, a loophole in the commitments made with respect to the amber box. The amber box is based on total spending rather than on a product-to-product basis and this resulted in total spending declining significantly while spending on certain products increased. This scenario emerged in Iceland where the total spending on the amber box declined by 27% in 1997 while spending on milk increased by 240% (Anderson, Martin & Van Der Mensbrugghe, 2005). It is regretful to note though that even where developing countries are willing and able to grant amber box relief to their farmers, the Uruguay Round Agreements on Agriculture (URAA) only permit them to give such support if they are below the *de minimis.*

The green box does not distort trade; it was therefore not subjected to any reduction commitments. Interestingly, the blue box was also exempt from reduction commitments. The blue box exemption raised a number of questions from developing countries about the fairness of keeping such a box. A reduction in the value of the amber box may be recovered by increasing the allocations to the green box, as was the case with the USA. Developing countries regarded this readjustment as a reclassification of the amber box (Anderson *et al*., 2005). Subsidies such as those in the blue box stimulate domestic production, not only through the way in which they directly affect prices but also through the indirect effects arising from reduced risk, an enhanced cash flow and increased producer wealth (Anderson *et al*., 2005).

The second pillar of agricultural trade negotiations is market access and this is discussed below.

3.4.2 Market access in the UR

Market access refers to access granted to foreign commodities by the domestic markets of an economy. It is argued that tariffs and quotas that take the form of instruments that deny market access are used to protect domestic producers but at the expense of consumers. It is argued that such an intervention pushes prices upwards, making commodities more costly for consumers. Tariff protection reduces supply to a domestic market against a given demand, resulting in increased prices of both the domestic and imported commodities (Beierle, 2002). The partial equilibrium effect of imposing a tariff gives a clear indication, in its simplest form, of the likely outcomes of such a tariff, which is a reduced welfare gain. The likely effect of a tariff on consumers is welfare loss as it will inflate prices while producers will benefit from price increases and the government will gain in terms of revenue. The results will ultimately be a dead-weight loss, which means that the economy will suffer an overall loss, notwithstanding all changes (Lindert *et al*., 1996).

The UR dealt with market access and its most important achievement in this regard was the conversion of non-tariff barriers[7] to their equivalent tariffs. Bound tariffs were introduced to ensure that trade in the agricultural sector is transparent and relatively easy to reduce (Josling, 1998). After the tariffication[8] of non-tariff barriers, tariffs were subjected to a 36% reduction

[7] The non-tariff barriers include quantitative import restrictions, variable import levies, minimum import prices, discretionary import licensing and non-tariff measures maintained by state trading enterprises and VERs.

[8] Conversion of non-tariffs of trade into fixed tariffs.

across the board for developed countries over a six-year period from the 1986–88 baselines and to a 24% reduction for developing countries over a 10-year period (Beierle, 2002). It is important to note that countries tended to put bound tariffs at a ceiling of bound.

The section below considers the third and last pillar of agricultural trade, which are export subsidies.

3.4.3 Export subsidies in the UR

Export subsidies exist in many forms and typically consist of payments that make up the difference between world prices and a guaranteed price for domestic farmers (Beierle, 2002). Because of subsidies in the 1980s, the EU and USA engaged in subsidy wars by increasing their budgetary allocations for agricultural sectors, making their commodities cheaper on the world market. While some countries (Argentina, Australia and Canada) appear to have suffered from the waging of such warfare, the EU seems to have benefited from the situation, having increased its world market share of wheat, while the USA experienced a concomitant decrease (Beierle, 2002). Generally, export subsidies are the most trade-distorting agricultural support practice as they affect the world prices of agricultural commodities directly. Allowance for the use of export subsidies only occurs in a few sectors of multilateral trade, with agriculture being one example. It can be argued that farm export subsidies are inconsistent with GATT rules and therefore deserve to be eliminated. However, as detrimental as export subsidies appear to be, their elimination could negatively affect a number of food-importing and food aid-dependent countries. Nonetheless, poor net buyers in these countries could be assisted in far more efficient ways than through the adoption of such measures (Anderson *et al*., 2005).

The WTO member countries agreed not to employ any export subsidy mechanisms except as specified in the rules of the WTO. Under Article 3.3 of the GATT regulations, the use of export subsidies on products not specifically listed in the country schedules is prohibited. For the products listed, the budgetary expenditure has to be reduced by 36% (24% for developing countries) over a six-year period while subsidies on quantities exported have to be reduced by 21% (14% for developing countries) (Beierle, 2002). Many countries brought the export credit issue to the attention of the UR and requested that countries that practice it and who make use of export subsidies be disciplined. As is the case with export subsidies, export credits allow the government to influence commodity prices and quantities. The negotiations that were held on export credits were followed by negotiations on food aid. More than half of

the wheat exports from the USA in 1999 and 2000 consisted of food aid, which has been acknowledged as an important tool in ensuring the food security of the poorest countries. As food aid provides food to the world market free of charge, it is regarded as a disguised form of export subsidy, for which it has been heavily criticised (Beierle, 2002). The utilisation of export subsidies has been reduced by the high prices prevailing from 1995 to 1996. For some products, such as cereals, the number of export subsidies has fallen significantly. Other products, such as dairy and cheese, are still subsidised at the maximum level allowed, even though it was argued in 1996 that such products did not require subsidisation.

Outlined earlier in the discussion about the three pillars were the challenges involved in dealing with each of these pillars. The other important issue that this study has not yet explored is special and differential treatment (SDT). The following section looks at this because it forms a fundamental component of the survival of a number of exports from developing countries.

3.4.4 Special and Differential Treatment (SDT) of the UR

The framework of the AoA calls for SDT for developing countries. SDT involves longer implementation periods and lower reduction magnitudes for all types of trade-distorting subsidies and for continued access involving tariff reductions. The 10-year implementation period for developing countries can be seen as an aspect of SDT, compared to the five-year period for developed countries (IPC, 2003). It is important to note that a number of proposals were put forward for SDT in the case of export subsidies for developing countries. Developing countries have been given 10 years in which to reduce the value of their export subsidies by 24% and the volume of their export subsidies by 14%. These countries are given a longer transition period than that given to developed countries for the elimination of their remaining export subsidy commitments (IPC, 2004).

For a long time SDT in developing countries has allowed specific products to enjoy duty-free access to developed countries, and this preferential treatment still exists. These duty-free dispensations are the result of the AGOA and Everything but Arms treaties that grant certain developing countries' products access to the USA and EU markets respectively. Even though there are such preferences, there is increasing evidence that preferential treatment has not helped developing countries as much as is sometimes assumed or portrayed. It can be said to some extent that preferential treatment has locked certain countries into trading in certain commodities in which they may not actually have a comparative advantage. It is also argued

that preferential treatment has shielded producers from competition, which, in turn, has caused production to become so costly and inefficient that the producers of such goods cannot effectively compete on the world markets. Importers, not farmers, often benefit from the economic rents gained by preferential treatment. Finally, applying preferential treatment is a very inefficient way of transferring income to farmers in developing countries. Thus, most developing countries should begin to make the transition away from dependence on preferential trade treatment towards more sustainable and competitive trading (IPC, 2004).

In the above sections, various trade-distorting measures have been discussed in relation to the UR. As has been previously mentioned, the UR was the first round to make much progress with regard to agricultural trade. The DDA followed the UR in advancing agricultural trade and is discussed in the following section.

3.5 The Doha Round of multilateral trade negotiations

The DDA was launched at the fourth ministerial conference or meeting of the WTO held in Doha, Qatar, on 9–14 November 2001. The DDA was called a 'developmental round' because it focused on integrating developing countries into the world trading system. It was the first round of multilateral trade negotiations to put the liberalisation and development of agriculture at the core of its business (Hertel *et al*., 2007). The developmental focus caused member countries to anticipate a successful round, and the date for the completion of agricultural trade negotiations was set for March 2003. This deadline, however, was not met because of disagreements on fundamental issues. In September 2003 at the Cancūn meeting in Mexico a major dispute occurred between the USA and the EU, on the one hand, and the G-20 group of developing countries, on the other, concerning their relative standings. This dispute ended in a walkout by the representatives of the developing countries (WTO, 2007). The Cancūn meeting, therefore, failed to reconcile the differences of the aforementioned parties with regard to agricultural issues as well as the differences between developed and developing countries regarding the expansion of the negotiating agenda to include matters such as competition and investment policy.

The meeting, consequently, ended without an agreement as to a framework within which multilateral negotiations on the liberalisation of agricultural trade could continue. Such failure indicated that the 'development agenda' of the Doha Round was feigned, leading to the round being rescheduled for the end of January 2005, a date which was also missed. In July 2006, the round collapsed. It is, however, still worth examining the proposals of the

major WTO trading countries and regions (Bergsten, 2005). To understand the reasons for the lack of a consensus at the DDA, the negotiating position of selected countries or regions needs to be highlighted. Accordingly, the following section presents the negotiating positions of SA, the USA and the EU as leading exporters and importers and the G-20 as the representatives of developing countries.

3.6 Selected countries' positions on the pillars of the DDA

Different countries have different views on the DDA. These views emerged from the various countries' proposals relating to the DDA. Some of these differences included the EU wanting a more rapid reduction in domestic support given mostly in the USA while the USA called for greater reductions in export subsidies. However, one of the major areas of focus at the DDA was market access, with more protection in the form of tariffs prevailing in developing countries. Yet, a reduction in support given through market access may expose the farming sector in developing countries (CRS, 2005). To address these issues, the countries and regions identified and their initial positions are considered in the next section.

3.6.1 South Africa

South Africa, a member of the Cairns group and the G-20, submitted a proposal that seeks to advance the objectives proposed by these groups. These include a substantial reduction of export and domestic subsidies and support for the continuation of SDT for developing countries' commodities in the developed countries' markets. A consideration of the proposal on a per pillar basis is provided below (Grant, 2006).

Market access: A number of agricultural commodities enjoy protection through tariffs imposed on imports to SA. For example, the average bound tariff is approximately 40% and the average applied tariff is approximately 9%. On the export side, SA enjoys preferential market access for certain commodities to the EU under the Everything but Arms treaty and to the USA under the AGOA. Accordingly, tariff escalation and tariff picks are two other areas of contention in SA (Grant, 2006).

Domestic support: The Doha Declaration agreed that domestic subsidies that were not specified under the green box would be reduced substantially. SA's position in this regard was that in their efforts to reduce domestic subsidies, developed countries should also make sure that their remaining support did not distort trade. A firm stand entails the reduction of current spending on domestic subsidies and the identification of other ways of dealing with

the amber and blue boxes. These should as far as possible confirm the position of the Doha Declaration. SA also suggested special and differential treatment for LDCs, together with the elimination of domestic support given in developing countries and the elimination of the considerable domestic support given in developed countries.

Export subsidies: It is interesting to note that SA is considered, within WTO circles, to be one of the major users of export subsidies, judging by the total number of commodities (62) receiving subsidies, although these supports were denied. SA also supported the rapid reduction of all forms of export subsidies, including the proposal that by 2010 all forms of export support should be eliminated (Grant, 2006).

3.6.2 The United States of America

The USA proposed a three-stage reform: five years of considerable reductions in trade-distorting subsidies and tariffs, followed by a five-year pause, and then five years for the total elimination of all remaining trade-distorting domestic measures and import tariffs (Grant, 2006).

Export subsidies: The USA's proposal clearly promotes the elimination of all agricultural export subsidies. However, the second issue raised in this regard was the establishment of set disciplines for export credit guarantees and food aid.

Domestic support: The USA proposed a reduction of the USA amber box limits by the 60% set during the 1999–2001 period and at the same time a reduction of the EU and Japanese amber box limits by 83%. The USA also took a clear stand on reducing the overall level of trade-distorting subsidies by 75% for the EU and by 53% for the USA and Japan. Furthermore, the USA proposed a restriction of 2.5% of the value of production for blue box spending and the maintenance of green box criteria without limits. This led to an increase of related concerns among other members, including the belief that such a position demonstrates bias (Hanrahan & Schnepf, 2005).

Market access: The USA's proposal clearly supports market access, borne out by its proposal of a 90% cut in the highest tariffs, cuts to other tariffs in the order of approximately 55–90% and a restriction of the maximum agricultural tariff to 75%. A proposal to limit sensitive products to 1% of tariff lines was also advanced.

3.6.3 The European Union

Overall, the proposal advanced by the EU did not appear to favour preferential market access. This proposal was opposite to the USA's proposal and presents a big challenge to developing countries.

Export subsidies: The EU called for the removal of all agricultural export subsidies by 2012. Regarding food aid, the EU proposed that food aid that leads to commercial displacement should be eliminated and that the commitment to maintain adequate food aid levels should gradually move to food aid in untied and cash forms, with in-kind food aid only being permitted in exceptional emergencies, under certain agreed-upon criteria (Grant, 2006).

Domestic subsidies: The EU proposed a reduction of the amber box by 70% for itself and by 60% for the USA and that the list of amber box commodities specified at the UR be used in this regard. Furthermore, the EU proposed an 80% reduction in the *de minimis* exemptions ceiling. In terms of the blue box, it proposed that the existing price difference be linked to support and that the price gap be limited to a percentage of the base price difference. The EU also proposed a reduction in overall trade-distorting support in three bands: 70% in respect of the EU, 60% in respect of the USA and 50% for the rest of the world. Lastly, the EU proposed that the green box be maintained without limits.

Market access: The EU proposed a reduction of the highest tariffs by 60%, a reduction of other tariffs in the range of 35–6% and a reduction of the tariffs for sensitive products to 8% of tariff lines. Furthermore, the EU proposed the use of tariff cuts and expanding the tariff rate quotas (TRQs) to cover sensitive products with no caps for sensitive commodities; the establishment of higher tariff bands; lower tariff cuts; a maximum tariff of 150% percent for developing countries; and no tariff cuts for the WTO member LDCs (Grant, 2006).

3.7 The group of 20 developing countries

The G-20 members are not uniform as some are net importers while others are net exporters. This poses a big challenge in terms of their objectives and causes some complications in assembling a unified proposal. Ultimately, in their attempt to formulate a unified position, the G-20 developed the following stance on the three pillars (Grant, 2006):

Export subsidies: The G-20 proposed the elimination of all forms of export subsidies over a five-year period. In their reexamination of food aid disciplines that do not compromise

emergency human assistance, it was urged that food aid should not be used as a dumping tool. With reference to domestic subsidies, the G-20 proposed an overall cut in the limit of trade-distorting subsidies in terms of the following three bands:

- In the over US$60 billion band, the reduction should be 80%.
- In the US$10–60 billion band, the reduction should be 75%.
- In the US$0–10 billion band, the reduction should be 70%.

The G-20 also proposed that the cut in the amber box ceiling should take place in terms of the following three bands:

- In the less than US$25 billion band, the reduction should be 80%.
- In the US$15–25 billion band, the reduction should be 70%.
- In the US$0–15 billion band, the reduction should be 60%.

Market access: The G-20 proposed that developed countries' tariffs be reduced by 45 to 75%, with a simultaneous reduction of developing countries' tariffs by 25 to 40%. The developed countries' maximum agricultural tariff should be limited to 100%, with the developing countries' maximum tariff set at 150%. The number of sensitive commodities should be limited, with compensation granted for those products designated as sensitive and a combination of tariff cuts and expanded TRQs. A special safeguard mechanism (SSG) should be maintained for developing countries while it should be eliminated for developed countries. The issue of erosion of preferred markets for developing countries' commodities should be addressed, with expanded access being granted to LDCs (Hanrahan *et al*., 2005).

The different countries' positions with regard to their priority areas in relation to the DDA reveal major differing interests. It would, therefore, be worth considering the evolution of negotiations at the DDA, with reference to the aforementioned differences.

3.8 The July 2004 framework agreement (on the three pillars) of the DDA

The WTO meeting held in July 2004 was called the July package. The July package was formulated to have annexes outlining the negotiating framework for agriculture as well as for other issues. The agricultural framework was the most important and set the stage for negotiations aimed at determining modalities (specific targets, formulas, timetables, etc.) in an effort to increase market access, reduce domestic and export subsidies and set dates by which to satisfy the agreed-upon commitments. This meeting was followed by the Hong

Kong meeting, which was scheduled to look at the crucial deadlines missed (Blandford *et al*., 2006).

Export subsidies: At the start of the July package, 36 of the WTO members categorised as LDCs were allowed to use export subsidies as listed in their countries' schedules, although only 24 countries actually used these export subsidies. Most countries with acceptable export subsidies have used them very carefully. However, from 1995 to 2001, the EU accounted for nearly 90% of all export subsidies used by WTO members (Blandford *et al*., 2006; IPC, 2004). Owing to these irregularities in export subsidies, the member countries agreed to establish a detailed framework that would ensure the parallel elimination of all forms of export subsidies and disciplines on all export measures with an equivalent effect by a feasible date. Even though the end date was not agreed upon for export credits, export credit guarantees or insurance programmes with repayment periods beyond 180 days, the terms and conditions of interest payments and minimum interest rates were aimed at being eliminated. However, the member countries failed to establish the rules for exporting in respect of state trading enterprises (STEs), and they failed to implement new disciplines for food aid to prevent commercial displacement, including assessing whether and to what extent food aid should be provided in the form of grants (IPC, 2004 and 2005).

Domestic subsidies: By July 2004 approximately 35 of the 149 member countries had used the domestic subsidies in their schedules. The EU, USA and Japan accounted for approximately 91% of such subsidies in the period between 1995 and 2001. Thus, the Doha Ministerial Declaration called for a considerable decrease in domestic support, with special and differential treatment given to the LDCs. This call was seen, though, by the exemption given through Article 6.2, which allows for investment and input subsidies. A closer look at the different domestic support boxes is, therefore, necessary.

- **Amber box:** The allowance was bound at 5% of the total value of agricultural production for non-product specific subsidies and at 5% of the value of production for each product for product-specific subsidies. More allowances were made for developing countries, which were bound at 10% in respect of both measures (Blandford *et al*., 2006).
- **Blue box:** The allowance given was to include only a production limit on direct payments, as members recognised its role in promoting agricultural reform. It is

important to note that the total value of production support was bound to 5% of the value of each individual commodity.

- **Green box:** Allowances were reviewed and clarified to ensure that they had no or at most minimal impact on production.

In essence, the sum of domestic support, consisting of the amber and blue boxes, is currently unlimited. A substantial reduction could potentially translate into a 20% reduction in the first year, with further cuts to be negotiated in the years to come.

Market access: There is an underlying awareness that all countries have market access barriers of some sort or another whereas only a few have export subsidies and domestic support. Therefore, there is a growing interest in market access reforms, which are complex and hence prove more difficult to achieve. It was agreed that for all commodities there must be a reasonable improvement in market access or, in other words, a reduction in tariffs. However, no tariff reduction formula was derived, although a certain amount of progress in terms of this direction was made, namely that all countries except the LDCs must improve their market access in terms of the bound, as opposed to the applied, tariff. A relatively short reduction period for developed countries and a longer implementation period for developing countries were also put in place. It could also be argued that a higher tariff reduction for sensitive or highly protected commodities would also assist in this regard (Blandford *et al*., 2006). The July package shows that less progress was achieved, hence the Hong Kong Declaration.

3.9 The Hong Kong Ministerial Declaration of the DDA

This meeting was held in December 2005 in Hong Kong to further agricultural trade liberalisation. In spite of the basic objective of the meeting being to set these formulae and to propose a deadline for the completion of the DDA, the Hong Kong meeting made limited progress in agreeing on the exact numerical formulas or targets (modalities) for the three areas of interest. Consequently, the deadline for agreement on modalities to cut tariffs on commodities, to reduce export subsidies and to reduce support was set for April 2006 (Chemingui, Bchir, Haammouda & Karingi, 2006; Blandford *et al*., 2006). The Hong Kong package achieved the following:

Export subsidies: The most concrete outcome of the Hong Kong package was an agreement to eliminate agricultural export subsidies by the end of 2013. The EU, the largest user of

export subsidies, had until then opposed setting an end date, maintaining that WTO members first needed to determine how other forms of subsidised export credit programmes, insurance, state-trading enterprises' (STEs) export activities and food aid would be monitored. The USA and Brazil, among others, demanded an end to such export subsidies by 2010. As a compromise, the Hong Kong package called for the parallel elimination of all forms of export subsidies and disciplines on measures with equivalent effects by the end of 2013. Even though the end date was set, it would, however, only be confirmed after the finalisation of the modalities for the elimination of all forms of export subsidies (Blandford *et al*., 2006).

Domestic subsidies: The member countries agreed on three bands of reductions, with the percentages for reducing support in each band to be decided during the negotiations on modalities. The EU was placed in the highest band and was subject to the largest reduction commitments while Japan and the USA were placed in the middle band. All the other members, including the developing countries, were placed in the lowest band. The declaration states that the overall reduction in domestic support needs to be made even if the sum of the reductions in the three categories would otherwise be less than the overall reduction required (Blandford *et al*., 2006).

Market access: Member countries called for four bands for structuring tariff cuts, with the relevant band thresholds and within-band reduction percentages to be calculated during the negotiations on modalities. The treatment of sensitive products was also deferred to the modality negotiations. A preliminary draft of the declaration required WTO member countries to ensure that for sensitive products, the greater the deviation from the agreed-upon tariff-reduction formulas, the greater the increase in tariff-rate quotas. It is argued that the extent to which TRQs for sensitive products get expanded remains a key determinant of the market access gains resulting from the round. The Hong Kong Declaration also ensured that developing countries would have two privileges not available to the developed countries. Firstly, they have the right to designate tariffs to a number of commodities based on certain criteria. Secondly, they can give special treatment to some products, including lower cuts in tariffs, and they can impose an SSG on imports, based on both import quantity and price triggers (Chemingui *et al*., 2006). Ultimately, though, instead of progressing on the liberalisation of agricultural trade, the DDA collapsed.

3.10 The collapse of the DDA and possible way forward

The collapse of the DDA on 24 July 2006 delayed the process of building a more prosperous global agricultural market and a more peaceful world. This collapse not only negatively affected the prospects of trade and global economic growth and governance but also had broader implications. Since the WTO's establishment in 1995, the institution has been very sensitive, even though numerous new states have joined as members or are seeking accession. This fragility also applies to the negotiating function of the WTO. The dispute settlement function has been far more successful in addressing disputes tabled, although whether it can continue in this vein after the collapse of the DDA remains to be seen, and this brings the legitimacy of the institution into question. Notwithstanding the collapse of the DDA, it is still necessary to develop possible methods of dealing with the three pillars that are in the best interest of all the member countries of the WTO.

Domestic subsidies: A modest approach would potentially involve reducing domestic subsidies from an amber box scenario to a continuation reduction to the same base line. The second box of domestic subsidies, the blue box that contains the USA's the OECD's and the EU's direct payments should be eliminated or reduced over time. Lastly, the green box needs to be re-examined as it contains policy instruments that distort trade minimally but still encourage an increase in output. It is argued that some supports, such as crop insurance, increase the incentive to produce by reducing the risk. Furthermore, it is suggested that certain environmental payments can also result in an increase in output. However, reopening the green box for purposes of redefinition could result in its coverage being increased as some countries may argue that food security measures have already been amply dealt with in the green box in its current form (Josling, 1998).

Market access: There are possible ways to advance agricultural liberalisation in terms of market access if the overall goal is to minimise the gap between agricultural tariffs and other sectors of multilateral negotiations. It could be argued that the use of the same baseline for tariff reductions may improve the situation. If such an approach were to be taken, 72 and 48% for developed and developing countries respectively would reduce the tariffs. This would mean that continuing WTO negotiations would involve expanding on existing agreements, based on the belief that it is simpler to extend existing agreements than to devise a new formula (Tangermann, 1997). The use of the same baseline for all products would simplify

negotiations because reopening the baseline issue would cause controversy. The possible ways of dealing with the issues relating to market access are presented below.

- The first option involves tariff cuts to maintain the average by cutting the less sensitive commodities by more than 36%. Perhaps constraints could be averaged, which would mean larger reductions for those commodities that escaped previously or a trade balance between those with higher- and lower-than-average cuts (Josling, 1998).
- The second option is derived from the work of Tangermann (1997) and comprises the rule of 'no exception'. This allows countries to agree to a further round of negotiations on differentiated tariff reductions. These could then become across-the-board tariff reductions whereby a country can aim at a 50% cut in all tariffs over a period of five years. Such a reduction commitment could be combined with the use of the same baseline or the application of a bound tariff at an agreed-upon date. However, such an approach has a loophole because the cuts made could still result in some tariffs remaining at very high levels.
- The third option is derived from Josling (1998) and allows for an alternative to uniform cuts, in the form of a formula whereby higher agricultural tariffs are reduced at an increased rate. The Tokyo Round used the 'Swiss formula' to reduce tariffs on industrial goods, which could be an appropriate technique for ensuring agricultural market access. The main advantage of using this formula is that it would reduce the distribution of tariff levels among products. However, reductions in terms of the formula may place more of a burden on countries that have more widely dispersed tariff rates.
- The fourth and last approach has already been successfully implemented in the field of information technology and involves tariff reductions of zero for no agreement. Such an approach involves negotiating for the complete removal of tariffs on particular goods. Clearly, this approach has some advantages, together with certain disadvantages. The political economies that support the protection of some commodities will resist such an approach. The zero-for-zero approach stems from the recognition that the isolation of markets that are highly protected will force them to eventually liberalise their economies.

Export subsidies: As with market access, export subsidies may be subject to the same conditions. An emphasis on continuity, based on the provisions of the URAA, is important for export subsidies. The simplest way of effecting this would be to extend the schedules of reduction agreed on at the UR to the same base year lines. This implies reducing expenditure on export subsidies by another 36%. Continuing quantity restrictions would imply that 40% of subsidies could be removed from the world market over a period of two reforms, as long as they are governed by the rules. If these rules could be tightened to prevent the accumulation of export subsidy rights, this practice would be discouraged. The process of continued reductions, though limited in scope, may bear good results. The quantification and reduction of export subsidies would result in a more clearly observable distinction being drawn between countries whose exports are privately sold and countries whose government institutions control such trade policies. Lastly, the prohibition of export subsidies should serve to bring about fair trade.

This study argues that as a consequence of reducing subsidies, the world prices of exports and imports will increase. In spite of the collapse of the DDA, this study could shed light on the implications of future negotiations if the round is reinstated or new negotiations. A number of incidents indicated a possible alternative outcome for the DDA (Athukorala & Kelegama, 1998).

3.11 Conclusion

It can thus be seen that agricultural trade liberalisation did not progress as quickly as was expected. However, the perceptions of agricultural trade liberalisation have changed since the UR and this is an achievement that shows that positive moves have taken place. The proposals of the EU, the USA, SA and the G-20 countries comprise some fundamental differences that need to be dealt with carefully. The progress of agricultural negotiations has been characterised by these differences, and this has ultimately lead to the collapse of the DDA. Proposals to deal with the challenges and to bridge the differences are outlined. It can be argued that the negotiations still have the potential to produce workable approaches to the pillars agricultural trade. However, as promising as liberalisation appears to be, some awareness concerning the difficulties involved in agricultural negotiations needs to be created. It is clear that changes in agriculture tend to be neither simple nor fast, as conflicts of interest arise repeatedly.

An analysis of the possible effects of reducing the subsidies in the agricultural sectors of the countries of the OECD[9] is modelled in this study. This modelling involves the use of two computable general equilibrium models – a global and a single-country model. The rationale for using them is based on their strong capability to track changes in the economy due to policy changes. The global model is capable of tracking world price changes resulting from possible policy changes made at the DDA, and the single-country model is most suitable in providing the distributional effects of the domestic economic agents when influenced by world price increases. The following chapter provides a detailed discussion of these models.

[9] The membership of the OECD is dominated by countries of the EU, USA and a number of developed countries.

CHAPTER 4: APPLICATION OF THE MODEL

4.1 Introduction

This chapter provides an explanation of the procedure used to derive policy shocks implemented in the GLOBE and the PROVIDE CGE models. Provided in this subsection is an explanation of the extent of the shock together with an overview of the prevailing conditions. The description covers both the GLOBE[10] (McDonald, Thierfelder & Robinson, 2007) and the PROVIDE models. The GLOBE model was developed (not as part of this study) to establish world price changes that could result from the liberalisation of trade in the OECD countries. As liberalisation intensifies, the prices of agricultural commodities are bound, on average, to increase. Such an increase is in line with the findings discussed in the trade literature, which indicate that world prices of agricultural products are depressed due to domestic and export subsidies granted in the agricultural sectors of developed countries.

The weighted average change in the world price of exports derived from the GLOBE model, at 75%, ranges between -3.0 and 29.7%. Increases in the world export price (PWE) are more profound in some products, such as wheat (29.7%), sugar (10%) and other cereals (8%). The GLOBE model's results also reveal that changes in the world import price (PMR), at 75% liberalisation, range from -19.6 to 3.8%. These were used to put as a policy change to the PROVIDE model, and then the distributional implications for the economy of South Africa are discussed in detail.

However, it is vital to note that one key difference between the GLOBE and the PROVIDE models is that the GLOBE model has an extra-regional dimension that can provide important information about regional trade with South Africa. The results of the GLOBE model relate specifically to South Africa, but similar results could, in fact, be extracted for any other country. Though the PROVIDE model only accommodates a single trade account (the rest of the world) and cannot be used to say anything more about the trade situations of other countries, its advantage lies in the institutional details that it allows regarding distributional implications.

[10] The GLOBE model was developed by Scott McDonald, who is a scholar at the University of Sheffield (UK) and a technical expert in the PROVIDE project.

The objective of this chapter is to present the steps involved in obtaining the required results and, in so doing, to justify the use of the chosen methods as opposed to other tools of economic research. The results of the GLOBE model have been adjusted, with the procedures and conditions for such adjustment being shown and discussed, together with policy shocks in the PROVIDE model.

4.2 Model application – deriving the shock from a global model

The policy shocks in the PROVIDE model were derived from simulations in the GLOBE model. The world price of imports (PMR) and exports (PWE) for each commodity and the quantities of world exports (QER) and world imports (QMR) from and to different regions have been used to calculate the average weighted price of commodities. The weighted average price for each commodity had to be calculated because there is only one international trade account (ROW) in the PROVIDE model, compared to the eight international trade accounts in the GLOBE model. The GLOBE model, as a multi-country or multiregional model, gives reliable world price and quantity changes that would result from the liberalisation of trade by the OECD countries. Even though the GLOBE model has many more international trade accounts than the PROVIDE model, the latter is better able to provide a clear picture of the changes in the South African economy, which substantiates its use for analysing the responses of all economic agents or the political economy. The GLOBE model has not been explained in detail. For further insight into this model, refer to McDonald *et al* (2007). The reason for this is that only its results were used in this study; however, the conditions that were set for the GLOBE model are highlighted.

4.3 The GLOBE model (multiregional or multi-country model)

This explanation of the GLOBE model is based on the aforementioned work of McDonald (2005) and of McDonald *et al* (2007). The model was, in essence, used to derive the change in the world price (PMR and PWE) that would be caused by a reduction in the trade of the OECD countries. The reduction commitments and the extent of those reductions and conditions are presented, and the GLOBE model's results, in terms of world prices and quantities, are shown.

4.3.1 Dataset

The trade accounts in the GLOBE model include the following groups of countries: Europe (excluding the EU); the North American Free Trade Agreement (NAFTA); the rest of

Southern African Development Community (SADC); the rest of Africa; South Africa; Japan; Asia; the EU; and the rest of the world. The model was set to give world prices (PWE and PMR) and quantities (QER and QMR) for each commodity per region or country. This model was used primarily to derive the world price changes that would result from the reduced trade distortions indicated in Table 4.1. The SAM for the GLOBE model was aggregated to 28 commodities (11 agricultural, 5 food commodities and 12 non-agricultural, non-food commodities); 28 activities (11 agricultural, 5 food and 12 non-agricultural, non-food activities); 1 household account; and 4 factors of production. The four factors comprise land, capital, unskilled labour and skilled labour.

4.3.2 Shocks

Simulations in the GLOBE model specify the amount by which the import tariffs (tm), export subsidies (te) and taxes on factor use (tf) have been reduced. Table 4.1 shows all the simulations run in GLOBE, SIM-A and SIM-B. These tax reductions are simulated from a base of 0 to 100% liberalisation. From the base simulation (0%), the percentage change in reduction commitment is not the same as it is for the last simulation (100%). The difference in reduction commitments is first 10%, then 15%, and lastly 25%. **SIM-A** presents the liberalisation of agriculture and food commodities only, covering sim 01–06. Sim 01 demonstrates a situation in which no reduction commitment in the world trade of agricultural commodities is undertaken while sim 06 demonstrates the complete liberalisation of food and agricultural commodity markets. **SIM-B** provides for the liberalisation of all commodity markets. This covers sim 07–12, and as with the first set of simulations, sim 12 presents full liberalisation while sim 07 presents none.

Table 4.1 provides all the simulations run in the GLOBE model. The results of the GLOBE model demonstrate the changes in world prices (PER and PMR) and the quantities (QER and QMR) per trading partner. As the GLOBE model is a multi-country model and the PROVIDE model is a single-country model, adjustments to the world price changes to be implemented in the PROVIDE model, as policy shocks, were called for.

Table 4.1: Simulations of liberalisation

	SIM-A	SIM-B
	Agriculture and food liberalisation (tm, te and tf)	**Non-agriculture and non-food liberalisation (tm, te and tf)**
Sim 01	0.00	0.00
Sim 02	0.10	0.00
Sim 03	0.25	0.00
Sim 04	0.50	0.00
Sim 05	0.75	0.00
Sim 06	1.00	0.00
Sim 07	0.00	0.00
Sim 08	0.10	0.10
Sim 09	0.25	0.25
Sim 10	0.50	0.50
Sim 11	0.75	0.75
Sim 12	1.00	1.00

Source: McDonald (2005) simulations

The weighted average world prices of imports and exports after the simulations that were run on the GLOBE model and then adjusted are presented in appendixes 1 and 2, which present the actual shocks to the PROVIDE model. The weighted average world prices of exports and imports constitute the actual policy shock to the PROVIDE model. For the sake of simplicity, liberalisation levels rather than world price changes are used to explain the results. These world price changes were derived from a number of conditions known as closure rules and modelled in the GLOBE model. The closure rules are presented in the following section.

4.3.3 Closures

Based on the aggregation of the GLOBE model, two broad categories of closure rules were developed. Closure 1 assumes a flexible exchange rate (ER); a fixed share of investment absorption; a fixed share of government absorption; a flexible tax rate to households; and fixed government savings. Land, skilled and unskilled labour, and capital are mobile and fully employed. The consumer price index (CPI) is a numeraire, and all the assumptions cover all regions in the model. Closure 2 assumes the same situation as Closure 1 except that it uses unskilled labour that is assumed to be fully mobile and unemployed. This indicates that even though unskilled labour is not fully employed, it is mobile between sectors. For realistic results, Closure 2 is used to derive shocks for the PROVIDE model. This is because

Closure 2 is more representative of the South African situation of substantial levels of unemployment, especially regarding unskilled labour.

4.3.4 Results

The GLOBE model results are the weighted average prices of imports and exports, as provided in appendixes 1 and 2. These are the policy shocks shocked into the PROVIDE model that were derived from the liberalisation of trade in the OECD countries, as expressed in the GLOBE model simulations. The output of the GLOBE model is used as the input for the PROVIDE model. Further explanation of the actual price change implications is provided in the results analysis, which shows the direct effect of liberalisation.

4.4 A single-country model (the PROVIDE model)

Having derived world price and quantity changes for both exports and imports in the GLOBE model, it is now necessary to consider the single-country PROVIDE model's basic features and conditions. The distinguishing characteristic of the model is that it has one account for international trade (ROW), compared to the multiple trade accounts in the GLOBE model. Therefore, the results of the GLOBE model were adjusted and used in the PROVIDE model. The process of adjustment was used to establish the weighted average price of imports and exports. The rest of the world's account in the GLOBE model could not be used separately in the PROVIDE model, as some of South Africa's major trading partners, namely Japan, the EU and the SADC, were excluded from that account. The rest of the world, when referring to the PROVIDE model, means all the trading partners of South Africa, whereas in the GLOBE model, the same category refers to all trading partners, excluding those specified.

Single-country models, in contrast to global models, are limited to the domestic economic analysis of changes in trade policies. The single-country models combine other markets or regions into a single account, namely the rest of the world. Consequently, they consider the structural characteristics of a country and address the distributional impact of trade with respect to the domestic economy. The PROVIDE model (PROVIDE 2005) is fully described in this chapter and is based on the technical literature. The model allows for a broad treatment of trade. By assuming a fixed proportion of output in terms of activity, the model promotes modelling of multiple activities, with commodities being differentiated in terms of the activities that produce them. The Cobb Douglass or constant elasticity of substitution (CES) specifies the production technology. The PROVIDE CGE model is a SAM-based model.

The PROVIDE CGE model contains coding that makes the SAM structure consistent with the model. It is common practice to convert data to be consistent with the model rather than adapting the model. An outline of a macro SAM database is presented in which *X* identifies active submatrices and 0 indicates inactive submatrices. Transactions of an account with itself is set to zero as a way of simplifying calculations as such values will not influence the model results.

Table 4.2: Macro SAM for the model

	Commodities	**Activities**	**Factors**	**Households**	**Enterprises**	**Government**	**Capital Accounts**	**RoW**
Commodities	0	X	0	X	X	X	X	X
Activities	X	0	0	0	0	0	0	0
Factors	0	X	0	0	0	0	0	X
Households	0	0	X	0	X	X	0	X
Enterprises	0	0	X	0	0	X	0	X
Government	X	X	X	X	X	0	0	X
Capital Accounts	0	0	X	X	X	X	0	X
RoW	X	0	X	X	X	X	X	0
Total	X	X	X	X	X	X	X	X

Source: PROVIDE, 2005

The PROVIDE project's CGE model is a single-country model that uses GAMS software. The model is SAM based, with the SAM serving a number of functions which include identifying the agents in the economy and providing a database by which the model is calibrated. Furthermore, it serves an essential organisational role, since the group of agents identified by the SAM structure is also used to define the submatrices of the SAM, which requires that behavioural relationships be defined (PROVIDE, 2005).

The model can be briefly described in four of five stages. The first stage consists of explaining the constant elasticity of substitution for import (CES) and constant elasticity of transformation for exports (CET), thereby giving a clear view of trade flows and their behavioural relationships. Secondly, the relationships among the transactions are recorded in the SAM, which explains the connections between domestic prices and world prices. Thirdly, an explanation of the quantity and price system used in the model forms the third stage, which indicates the association between ERs and prices of imports and how these affect the quantities imported. The fourth stage sets out an algebraic statement (this stage is not

explained in this thesis), which gives the model's equations and variables. Lastly, a description of the default and optional rules is given (PROVIDE, 2005).

4.4.1 CET for exports and CES for imports and their behavioural relationships

The behavioural relationships describe the ways in which agents in the economy respond to exogenous changes. Table 4.3 presents a summary of the behavioural relationships present.

4.4.1.1 CET for exports

Since the world prices of exports are used to shock the PROVIDE model, it is necessary to show their association with the CET. The CET function is used to differentiate domestically produced goods according to the markets concerned in order to overcome the problem of perfect substitution. The CET is specified in the model in order to show the relationships between domestic production (QXC), production for the domestic market (QD) and exports (QE) of agricultural commodities.

$QXC = at^{*} (\gamma^{*}QE^{rhot} + (1-\gamma)^{*} QD^{rhot})^{1/rhot}$ …………………………………..(1)

Where

QXC is domestic production

QE is production for exports

QD is production for the domestic market

rhot is the elasticity of transformation

γ is the share parameter

at.is the shift parameter

In order for the model to obtain necessary and logical results in line with the profit maximisation assumption, a first-order condition allows the model to determine the level of exports (QE) relative to production for the domestic market (QD) in response to changes in the price of exports (PE) relative to the domestic price (PD) (PE/PD):

$QE/QD = [PE/PD^{*}(1- \gamma)/\lambda\ ]^{1/rhot -1}$……………………………………………(2)

Where

PE is the price of exports

PD is the domestic price

The total production value (PXC*QXC) is expected to equal the value of production for the export market (PE*QE) plus the value of production for the domestic market (PD*QD):

PXC*QXC = PE*QE + PD*QD……. (3)

Where

PXC is the agricultural producer price

The PWE multiplied by the exchange rate (ER) gives the domestic export price (PE in the absence of export taxes.

4.4.1.2 CES for imports

The treatment of imports in the CGE model can best be described with reference to the CES or Armington function. The Armington assumption, which differentiates products according to their country of origin, is used to model imports. Domestic supply (QQ) consists of a combination of imports (QM) and domestically produced and marketed commodities (QD), according to the CES specification. Changes in relative prices between domestic and imports cause partial substitution, casing some adjustments in the model.

$QQ = ac * (\delta * QM^{-rhoc} + (1-\delta) * QD^{-rhoc})^{-1/rhoc}$ …….(4)

Where

ac is a shift parameter

δ is a share parameter

rhoc is the elasticity of substitution

An assumption of cost minimisation is made, and the value of domestic supply (PQS*QQ) has to equal the value of imports and domestically produced supply, hence the following two equations:

$QM/QD = [PD/PM * \delta/(1-\delta)]^{1/(1+rhoc)}$……..(5)

PQS*QQ = PD*QD + PM*QM……..(6)

The world price of imports (PWM) multiplied by the ER plus any import tariffs gives the domestic import price (PM). A shock to either the world price or exchange rate will therefore influence the domestic price of imports. In addition, a decrease in import tariffs associated with domestic liberalisation will translate into decreases in domestic import prices relative to the price of domestically produced goods. The first round effect will be a shift in demand away from domestically produced goods towards imported goods, causing a contraction of the domestic industry.

Table 4.3: Behavioural relationships for the model

	Commodities	Activities	Factors	Households	Enterprises	Government	Capital	RoW	Total	Prices
Commodities	0	Leontief Input-Output Coefficients	0	Utility Functions (CD or Stone-Geary)	Fixed in Real Terms	Fixed in Real Terms and Export Taxes	Fixed Shares of Savings	Commodity Exports	Commodity Demand	Consumer Commodity Price Prices for Exports
Activities	Domestic Production	0	0	0	0	0	0	0	Constant Elasticity of Substitution Production Functions	
Factors	0	Factor Demands (CD or CES)	0	0	0	0	0	Factor Income from RoW	Factor Income	
Households	0	0	Fixed Shares of Factor Income	Fixed shares of income	Fixed Shares of Dividends	Fixed (Real) Transfers	0	Remittances	Household Income	
Enterprises	0	0	Fixed Shares of Factor Income	0	0	Fixed (Real) Transfers	0	Transfers	Enterprise Income	
Government	Tariff Revenue Domestic Product Taxes	Indirect Taxes on Activities	Fixed Shares of Factor Income Direct Taxes on Factor Income	Direct Taxes on Household Income	Fixed Shares of Dividends Direct Taxes on Enterprise Income	0	0	Transfers	Government Income	
Capital	0	0	Depreciation	Household Savings	Enterprise Savings	Government Savings (Residual)	0	Current Account 'Deficit'	Total Savings	
Rest of World	Commodity Imports	0	Fixed Shares of Factor Income	0	0	0	0	0	Total 'Expenditure' Abroad	
Total	Commodity Supply	Activity Input	Factor Expenditure	Household Expenditure	Enterprise Expenditure	Government Expenditure	Total Investment	Total 'Income' from Abroad		
	Producer Commodity Prices Domestic and World Prices for Imports	Value Added Prices								

Source: PROVIDE, 2005

4.4.2 Transaction relationships

The price of commodities consumed in the domestic market is the same for all agents buying such commodities. The domestic demand varies between intermediate and final demand. Final demand is divided into household demand, enterprise demand, government demand, investment demand and stock exchange demand. Domestic producers receive a common price for commodities supplied to the domestic market, regardless of the activities used to produce the commodity. The ER plus import taxes (*ad valorem*) express the PM as world prices multiplied. All the commodities consumed in the domestic market are subject to sales tax. Activities are flexible and pay production taxes and purchase primary inputs, for which they pay an average price. The model allows for the domestic use of both domestic- and foreign-owned factors of production for payments of foreign activities for the use of domestically owned factors. Factor income accrues from payments by domestic and foreign activities, where payments by foreign activities are assumed to be determined exogenously and are denominated in foreign currencies. After allowing for depreciation and payments for factor taxes, residual factor incomes are divided between domestic institutions, which consist of the household, the enterprise and government, and the rest of the world in fixed proportions.

Household expenditure attracts income taxes, which are fixed exogenously, while consumption expenditure determines the utility function of the household. Enterprises obtain income for sales of factors (retail profits), government transfers and transfers from the rest of the world. Enterprise expenditure consists of direct tax consumption, which is assumed to be fixed regarding real terms and savings. One of the few alternative specifications is that government consumes fixed quantities of commodities and, hence, government expenditure will differ in relation to consumer prices. Government transfers to other domestic institutions are fixed, although they may vary. Government income comes from various tax instruments, such as sales tax and tariffs. Transfers from the rest of the world are denominated in foreign currencies. Fixed capital formation and stock changes constitute domestic investment demand. The model is a static model and capital composition is not available, which results in fixed capital formation while stock changes are flexible. The value of fixed capital formation will vary according to commodity prices. The volume of fixed capital formation can vary according to changes in the volume of savings or because of changes occurring in exogenously determined parameters. Domestic savings consist of savings by households, enterprises, the government (in the form of internal balance) and foreign savings. The various closure rules available within the model allow different assumptions to be made about the determinants of domestic savings, either in terms of a flexible or fixed savings rate for households

or for the value of foreign savings, in terms of a flexible or fixed ER. The value of imported commodities and factor services constitutes expenditure by the domestic economy while the value of exported and net transfers by institutional accounts constitutes income to the domestic economy. The ER plays an important role in determining or transforming these transactions. The balance on the capital account can be fixed at some level, denominated in foreign currency. However, this assumption can be reversed, where appropriate, on closure of the model.

Table 4.4: Transaction relationships for the model

	Commodities	Activities	Factors	Households
Commodities	0	$(PQD_c * QINTD_c)$	0	$(PQD_c * QCD_c)$
Activities	$(PXC_c * QXC_c)$ $(PX_a * QX_a)$	0	0	0
Factors	0	$(WF_f * FD_{f,a})$	0	0
Households	0	0	$\sum_f hovash_{h,f} * YFDISP_f$	$(\sum_{hh} hohoconst_{hh,h})$
Enterprises	0	0	$\left(\sum_f entvash_f * YFDISP_f\right)$	0
Government	$(tm_c * PWM_c * QM_c * ER)$ $(te_c * PWE_c * QE_c * ER)$ $(ts_c * PQS_c * QQ_c)$ $(tec_c * PQS_c * QQ_c)$ $(tfue_c * PQS_c * QQ_c)$	$(tx_a * PX_a * QX_a)$	$\left(\sum_f govvash_f * YFDISP_f\right)$ $(tf_f * YFDISP_f)$	$(ty_h * YH_h)$
Capital	0	0	$\sum_f deprec_f$	$(caphosh_h * YH_h)$
Rest of World	$(PWM_c * QM_c * ER)$	0	$\left(\sum_f worvash_f * YFDISP_f\right)$	0
Total	$(PQD_c * QQ_c)$	$(PX_a * QX_a)$	YF_f	YH_h

	Enterprises	Government	Capital	RoW	Total
Commodities	$(PQD_c * QENTD_c)$	$(PQD_c * QGD_c)$	$(PQD_c * QINVD_c)$ $(PQD_c * dstocconst_c)$	$(PWE_c * QE_c * ER)$	$(PQD_c * QQ_c)$
Activities	0	0	0	0	$(PX_a * QX_a)$
Factors	0	0	0	$(factwor_f * ER)$	YF_f
Households	$hoentconst_h$	$(hogovconst_h * HGADJ)$	0	$(howor_h * ER)$	YH_h
Enterprises	0	$(entgovconst * EGADJ)$	0	$(entwor * ER)$	$EENT$
Government	$(TYEADJ * tye * YE)$	0	0	$(govwor * ER)$	EG
Capital	$(YE - EENT)$	$(YG - EG)$	0	$(CAPWOR * ER)$	$TOTSAV$
Rest of World	0	0	0	0	Total 'Expenditure' Abroad
Total	YE	YG	$INVEST$	Total 'Income' from Abroad	

Source: PROVIDE TP, 2006: 3

4.4.3 Price and quantity systems

Figure 4.1 and 4.2 present an outline of the interrelationships between prices and quantities respectively. The weighted average price of domestic produce consumed domestically (PD) and the domestic price of imports (PM) constitutes the supply price of a composite commodity (PQS). The domestic price of import is given by way of the world prices of commodities (PWM) and the exchange rate (ER). In a situation where tariffs are levied, the domestic prices of imports are bound to increase. In the models these weights are updated through the first order condition for optima. The composite consumer price (PQD) results from a sales taxes (ts), excise taxes (tex) and fuel taxes (tfue) being levied on commodities.

The weighted averages of prices of domestic produce consumed domestically (PD) and the prices of export (PE) constitute the producer prices of commodities (PXC). The export price defined to consists of export duties (*ad valorem)* (te), the ER and the world prices of exports (PWE). The weights in the model are updated through the first order condition for optima. The domestic producer price defines the average price per unit of output received by activities (PX), which is divided between payments in order to aggregate value-added (PVA) and aggregate-intermediate inputs (PINT), all of which occur after production or indirect or output taxes have been deducted. The factor price paid by activities (WF) constitute components of value added, while total payments for intermediate per unit of aggregate intermediate input are defined as the weighted sums of the inputs (PQD) for all this explanation see Figure 4.1.

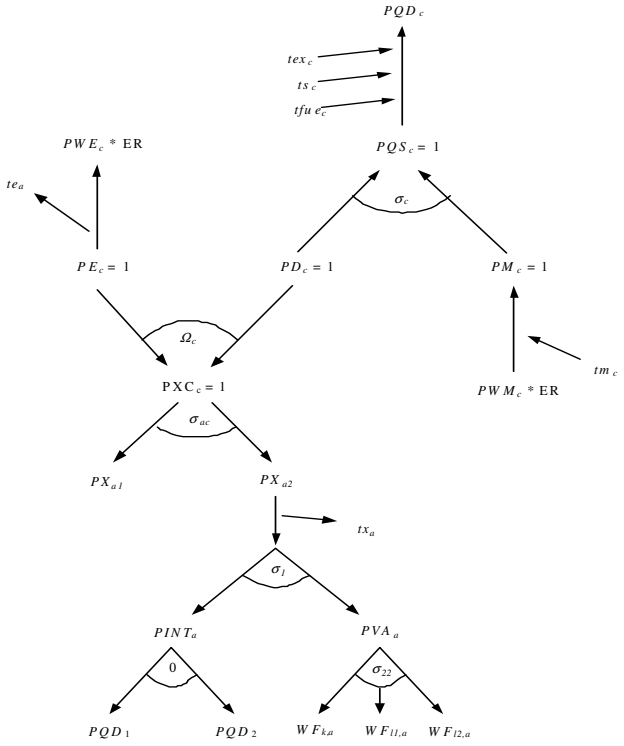

Figure 4.1: Price relationship for a model

Source: PROVIDE, 2005

Having discussed the price relationships (in Figure 4.1), it is important to discuss the quantity relationships. Figure 4.2 presents the quantity relationships. It is shown, in Figure 4.2, that total demand for composite commodity (QQ) is defined as demand for intermediate inputs (QINTD), household consumption (QCD), enterprises (QENTD) and government (QGD), gross fixed capital formation (QINVD) and stock charges (dstocconst). The equilibrium condition (whereby all total supplies equate total demand) is met when domestic supplies (QD) together with imports (QM) equal the demand for these commodities. Commodities (or domestic production, QXC) are supplied to both the domestic (QD) and exports (QE) subject to the equilibrium condition that all domestically produced commodities can either be consumed domestically or exported.

The multi-product activities are modelled using the assumption that commodities are differentiated by sources but that activities product output in fixed proportions. Consequently the domestic production of commodities (QXC) is constant elasticity of substitution (CES) aggregate of the quantities of that commodity produced by a number of different activities (QXAC), which are produced by activity in activity fixed proportion where the output of QXAC is a Leontief aggregate of the output of each activity (QX).

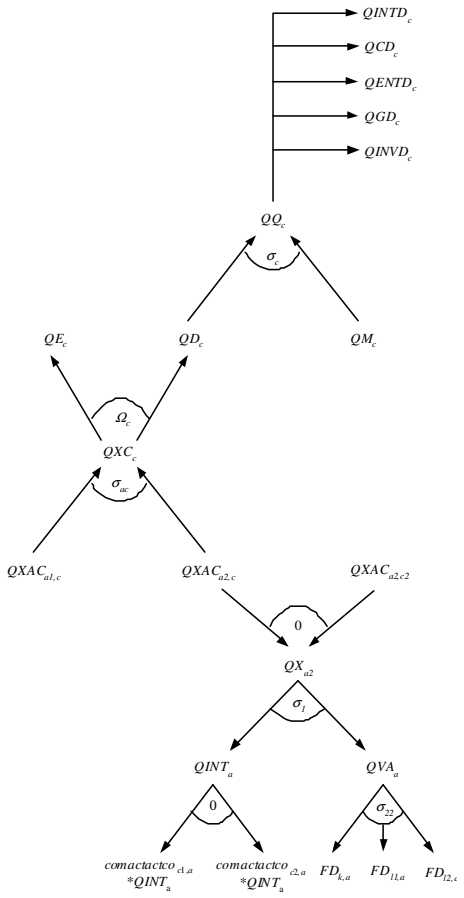

Figure 4.2: Quantity relationship for a model

Source: PROVIDE, 2005

Production relationships for activities are defined by a series of nested CES production functions. The nesting structure, namely two intermediate and three primary inputs ($FD_{k,a}$, $FD_{l1,a}$ and $FD_{12,a}$), is defined and shown in the lower part of Figure 4.2. Activity output is a CES aggregate of the quantities of aggregate-intermediate inputs (QINT) and value-added (QVA) while aggregate-intermediate inputs are a Leontief aggregate of the individual,

intermediate inputs, and aggregate value-added is a CES aggregate of the quantities of primary inputs demanded by each activity ($FD_{f,a}$). The allocation of the supplies of factors (FS) between competing activities depends on relative factor prices via first-order condition for optima while the base model works on the assumption that all the factors are fully employed and mobile. This assumption can be, and often is, relaxed.

4.4.4 Closures rules set in the PROVIDE model

The policy shocks were derived under certain closure rules in the GLOBE model. For the PROVIDE model, the closure rules relate to the external account, the factor market account, the government account and the investment-savings account. Reflecting the economy realistically was a determining factor in the selection of the closure rules, which are discussed below:

- External balance: The current account balance or external balance is fixed; hence, the exchange rate is flexible. Changes in the international prices of commodities and tariffs lead to changes in the value of exports relative to the value of imports, which typically affect the exchange rate.
- Factor market closure: While the base model contains the assumption that all the factors are fully employed and mobile, such assumption is relaxed in this study. It is assumed that the skilled labour of all race groups is fully employed and mobile while unskilled labour is regarded as not being fully employed. There is only one white labour account in each province, which is assumed to be fully employed. Capital is scarce, mobile and fully employed and is associated with a long-term closure because it is assumed that there is sufficient time for capital to relocate to other more productive industries of the economy. Land is fixed according to agricultural production area.
- Government closure: Government income is generated from transfers and the income from different taxes. In contrast, government expenditure includes consumption and transfer payments. The government deficit or surplus is the difference between government income and expenditure. Two government closures were selected, each with different distribution implications:
- Govt Inter: Government consumption expenditure as a share of total demand in the economy is fixed. Tax rates are kept constant at the base levels. Government deficit

reflects all shocks to government income, with the deficit adjusting to maintain fiscal balance.

- Govt Dom: Government consumption expenditure as a share of total demand in the economy is fixed. The government deficit is fixed. Fiscal balance is achieved through adjustments in import tariff rates (tm). For the purposes of this study, the Govt Dom is used as it gives an indication of what the response of domestic policy in reaction to international liberalisation should be in order to maintain the fiscal balance.
- Savings-investment closures: The total share of investment expenditure in the final demand remains constant. The volume of investment is allowed to vary, depending on changes in the prices of investment goods and changes in the value of domestic absorption. The savings rate of households and incorporated business enterprises serves as an equilibrating variable for these two sets of accounts. Net foreign savings are fixed.
- Numeraire: The consumer price index (CPI) is set as a numeraire and all prices are relative to the CPI, expressed in relative terms.

It was noted that the algebraic explanation of the model is not provided in this thesis and for this information the PROVIDE (2006) can be seen.

4.5 The data

The data used in this study are arranged into two groups: a SAM of the year 2000, the base year that records all transactions that take place between agents in the economy, and a series of elasticities that control the model's behavioural functions. A full description of the PROVIDE SAM for South Africa can be found in PROVIDE (2006). For this study, the SAM is aggregated to match the accounts in the GLOBE model SAMs as closely as possible. The SAM for the study includes 28 commodities (11 agricultural and 6 food commodities); 31 activities (10 agricultural and 6 food activities); 41 factors (GOS [capital], land and 23 labour factors by race and provinces); and 32 households. The SAM treats agricultural activities as multi-product firms based on agronomic regions. The implications of this classification are that a range of commodities can be produced by a single agricultural activity and land cannot be transferred from one region to another region. The sequence of additional data consists of the constant elasticities of substitution for the CES production function; the income elasticity for expenditure systems; and the marginal utility of income for household. A general

algebraic modelling system (GAMS) data exchange server (GDX file) records all relevant data (PROVIDE 2006).

4.6 Method of adapting the GLOBE model's results for PROVIDE model

The weighting process was carried out to ensure that the weighted average world prices of exports derived gives a true reflection of world trade partners' share of world trade. In this subsection, the sequential procedure that was used to derive the weighted average world prices of exports changes is presented. However, it needs to be noted that a similar activity was carried out for imports.

The results (new levels, not percentage changes) from the GLOBE model were used to calculate the value of exports (VE) with each trading partner by multiplying the world price of exports (PWE) by the quantities of world exports (QE) for each trading partner (w) as follows:

$$VE(w) = PWE(w) * QE(w) \quad (7)$$

Where

PWE(w) is the price of exports for trading partner w

QE(w) is the volume of exports to trading partner w

In order to calculate a weighted average world price, it is necessary to determine the value share of exports for each trading partner, which is the value of exports for each trading partner divided by the total exports from South Africa as follows:

$$weightVE(w) = PWE(w)*QE(w)/(\sum(PWE(w)*QER(w)) \quad (8)$$

The weighted average price is the price of exports for each trading partner multiplied by the share of that trading partner's exports in total exports from South Africa as follows:

$$weightedPWE = \sum(weightVE(w)* PWE(w)) \quad (9)$$

Changes in these weighted average world prices were calculated by expressing the difference in the base level prices and the levels of prices after simulating liberalisation as a percentage of the base level values. These weighted average world price percentage changes were then implemented in the PROVIDE model.

4.7 Conclusion

The analytical tool chosen for this study suits the questions advanced. In this study, the world prices of export and import changes are derived from the GLOBE model (developed outside the scope of this study). The analysis of the impact of such a change on the South African economy is provided (from the PROVIDE model) in the following chapter. Adjustments were made to derive the weighted average world price (imports and exports) change to be used in the PROVIDE model because the PROVIDE model uses only one trade account.

CHAPTER 5: DISCUSSION OF THE PROVIDE MODEL RESULTS

5.1 Change in the world price of exports and imports (GLOBE model[11] results)

The results of the GLOBE model demonstrate that world prices of exports and imports respond to liberalisation of the OECD countries' agriculture and food trade. Liberalisation (done by McDonald) was modelled by reducing import tariffs, the tax rate on factor use and export subsidies, in keeping with the three pillars of agricultural trade discussed in the previous chapters. Simulations 1 to 6 looked at a stepwise liberalisation (0%, 10%, 25%, 50%, 75% and 100%) of agricultural and food commodities while simulations 7 to 12 looked at a stepwise liberalisation (0%, 10 %, 25 %, 50%, 75% and 100%) of all commodities. It is important to note that these simulations were run using the GLOBE model.

The weighted average world price changes calculated from the GLOBE model results were used as a policy shock to the PROVIDE model. The calculation of the weighted average world prices of imports and exports appears in Section 4.6.2. It is clear from the results that changes in world prices of imports (PMR) are smaller than changes in the world prices of exports (PWE). Changes in the weighted average world price of exports (PWE) range from -3.5% to 45.7% when only agricultural and food commodities are totally liberalised (Simulation 6) and from +0.2% to +45.7% for all commodities (Simulation 12). This is much higher than changes in the weighted average world price of imports (PMR), which range from -28.5% to +5% when only agricultural and food commodities are totally liberalised (Simulation 6) and from -30.7% to +6.2% for all commodities (Simulation 12).

For the purposes of this study, the results of Simulation 5, that is a 75% reduction in import tariffs, a reduction of the tax rate on factor use and a reduction in export subsidies on agricultural and food commodities in OECD countries, are reported. This is due to the fact that it is almost extremely unlikely that agriculture and food trade will be fully liberalised as an outcome of the DDA. Therefore, 75% reductions in import tariffs, the tax rate on factor use and export subsidies on agricultural and food commodities in OECD countries will affect the PWE within a range of between -3% and +29.7% while changes in the PMR will range from -19.6% to +3.8%. The wide variation in world price changes is due to the influence of just a few commodities. However, when the three most highly affected commodity prices are

[11] It needs to be noted that the GLOBE model was not developed as part of this thesis; only the results were used.

excluded, the price changes are more modest, ranging from -3% to +3% for exports and from -0.2% to +1.5% for imports. In light of the wide range of world price changes, it is necessary to present the most affected commodity prices.

The increase in world export prices – at 75% liberalisation – of the three most affected commodities are as follows:

- Wheat: 29.7%
- Other cereals: 8.4%
- Sugar: 10%

On the other hand, the changes in world import prices – at 75% liberalisation – of the three most affected commodities are as follows:

- Other cereals: 3.8%
- Dairy products: 2.6%
- Sugar: -19.6%

Once more, it should be noted that the weighted world prices of exports and imports for all the commodities were used to shock the PROVIDE model. The results from the PROVIDE model are discussed in the next sections.

5.2 The PROVIDE model results

5.2.1 Effect of world price changes on domestic prices and quantities

The analyses of the results look at the potential long-term effects[12] of the liberalisation of the agricultural and food sectors of the OECD countries, using the effect of world price changes on domestic price changes as a starting point. The effect of liberalising the agricultural and food sectors of the OECD countries, specified at 75% and 100% (which is normally referred to as full liberalisation) respectively, is addressed. The justification for this is the contention of Poonyth *et al* (2004) that in global trade models, changes in prices drive all the other results covered by the model. In a single-country model (such as the PROVIDE model) price changes determine changes to the other variables. The domestic prices of wheat and sugar are presented in Figure 5.1. The domestic export prices (PE) of wheat and sugar increase by 28.6% and 9.1% respectively at 75% liberalisation. The domestic price of domestic supply

[12] In CGE modelling, 'long-term' refers to the relocation of all the factors of production after a policy change has occurred and a new equilibrium has been reached.

(PD) (not shown here) increases by only 1.63% for wheat and decreases by 0.04% for sugar. The increases in producer price (PXC) (wheat 3.8% and sugar 0.47%), which is a weighted average of the PE and the price of domestic supply (PD), are much smaller than those experienced with the PE. The decrease in the purchaser price (PQD) of wheat (-0.02%) and sugar (-0.13%) is the weighted average price of domestic supply (PD) and domestic import prices (PM), which decreases by 2.75% for wheat and by 20.3% for sugar.

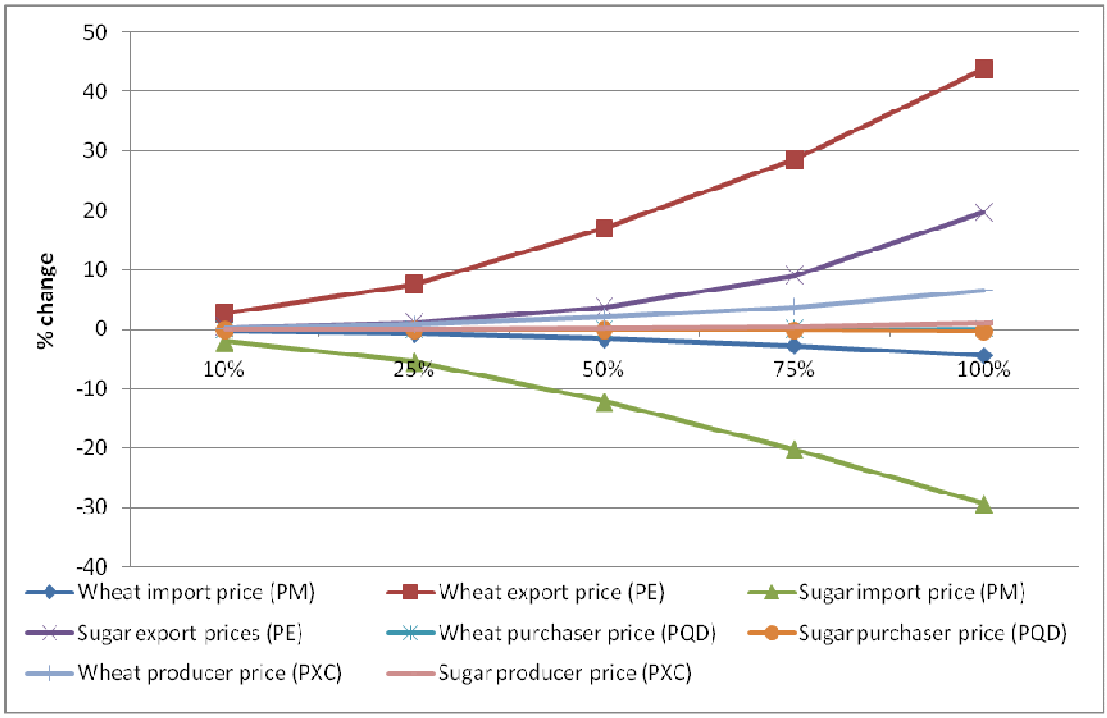

Figure 5.1: Wheat and sugar price effects (PM, PE, PQD and PXC)

Figure 5.2 shows the quantity changes caused by changes in prices, with an upward trend in all quantities identified for wheat and sugar. The producer price increase of wheat is larger than the quantity increase. This may indicate that the supply of wheat is relatively inelastic, due to the fixed amount of land available for agricultural production. In a 75% liberalisation scenario, import quantities show substantial increases for sugar (56.9%) and wheat (5.4%), following the decrease in domestic import prices. There are also substantial increases in volumes of exports for both sugar (18.8%) and wheat (54.6%), due to the increases in domestic export prices. The production for the domestic market (QD) of wheat and sugar decreases by -3.47% and -0.22% respectively (not shown here). Composite (domestically produced commodities, regardless of the market) goods (QXC) still show increases for wheat (0.7%) and sugar (0.8%), but these increases are much smaller than the increases in export

volumes (QE). The increases in production (QXC) follow the increases in the producer prices (PXC) for wheat and sugar shown above and indicate that more resources will be devoted to their production. There is a decrease in the composite (domestically produced and imported) supply (QQ) of both wheat (-0.3%) and sugar (-0.03%) in response to the decrease in the composite price PQD described.

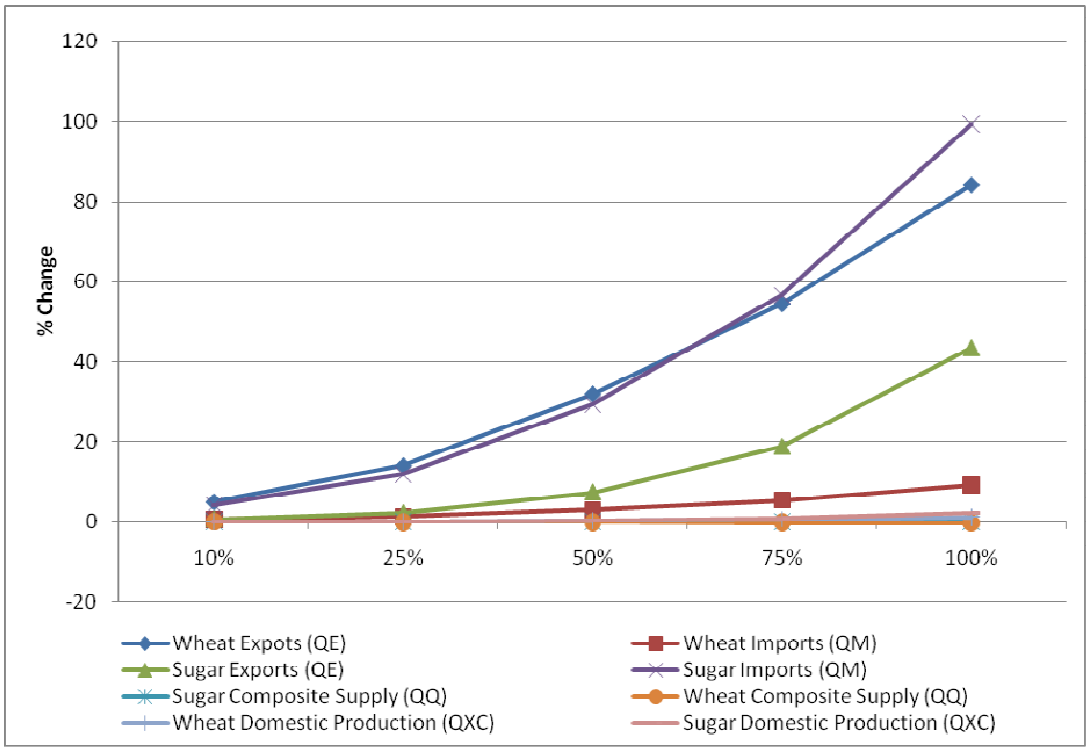

Figure 5.2: Wheat and sugar quantity effects (QE, QM, QQ and QXC)

5.2.2 Producer effects

The producer price increase for wheat is greater than the quantity increase, and then domestic supply must be relatively inelastic. In contrast to this situation, the producer price increase for sugar is smaller than the quantity increase, and therefore the domestic supply of sugar must be relatively elastic. As Figure 5.2 illustrates, the export price of wheat is substantial, which is accompanied by substantial increases in wheat quantity, resulting in an increase of the value of domestic production of this product. In such a situation, the producers of wheat will benefit from the increase in domestic prices.

5.2.3 Effects on agricultural production

Agricultural production regions are identified at a provincial level in the model. The changes in value added for agricultural production in each of the provinces is shown in Figure 5.3. The

main sugar-producing provinces (KwaZulu-Natal and Mpumalanga) and the main wheat-producing provinces (North-West and Free State) show expansions of between 0.6% and 2% in production value added (QVA). The dominant enterprises in the other provinces are horticulture and livestock, and these production areas show contraction, ranging from 0.1% for the Northern Cape to 2.2% for Gauteng. Production therefore follows price incentives, which in general decrease for horticulture and livestock and increase for grains.

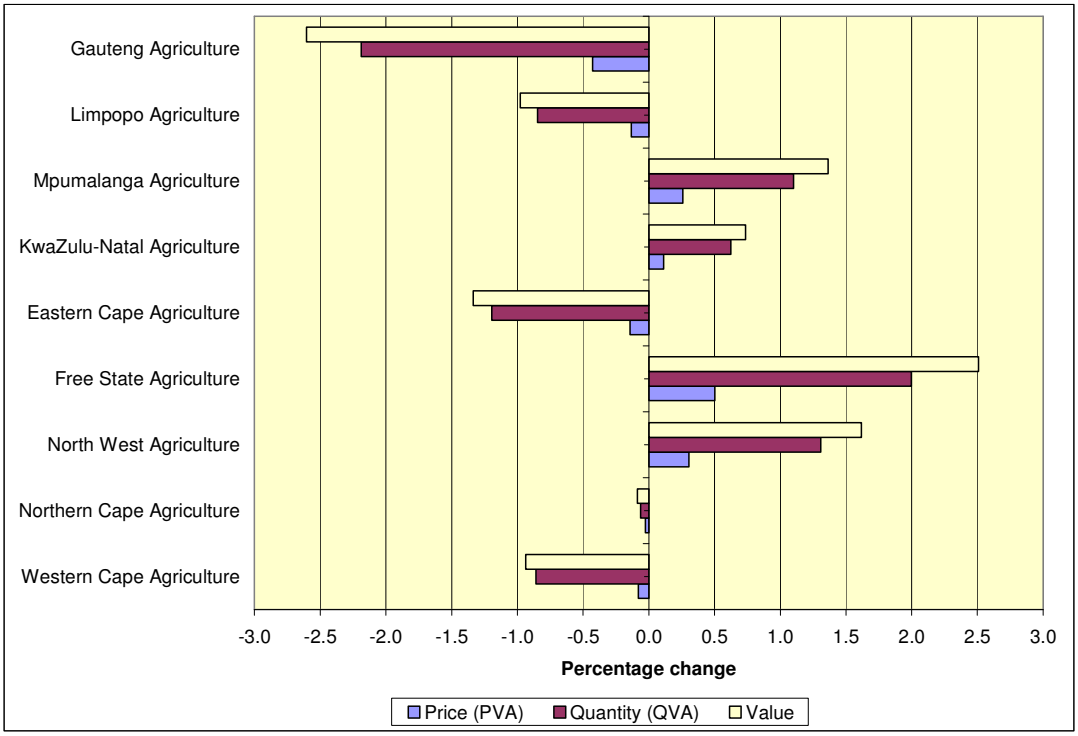

Figure 5.3: Value added during agricultural activities at 75% liberalisation

5.2.4 Other commodity prices and factor relocation

Food prices react differently (increase or decrease) to world price changes (see Figure 5.4). Those reactions have different implications for individual households, depending on their expenditure patterns. An increase in prices for dairy and other food products may negatively affect poor households, as a larger proportion of the budget is spent on food purchases, suggesting that an increase in the income of the poor may be absorbed by increases in food prices. The price of live animals and meat products decreases significantly, followed by oil seeds, vegetables, fruit and nuts, and, lastly, sugar. A decrease in the prices of these commodities is explained by an increase in their supply. However, a decrease in prices of these products may positively affect poor household as this will afford relief to their budgets.

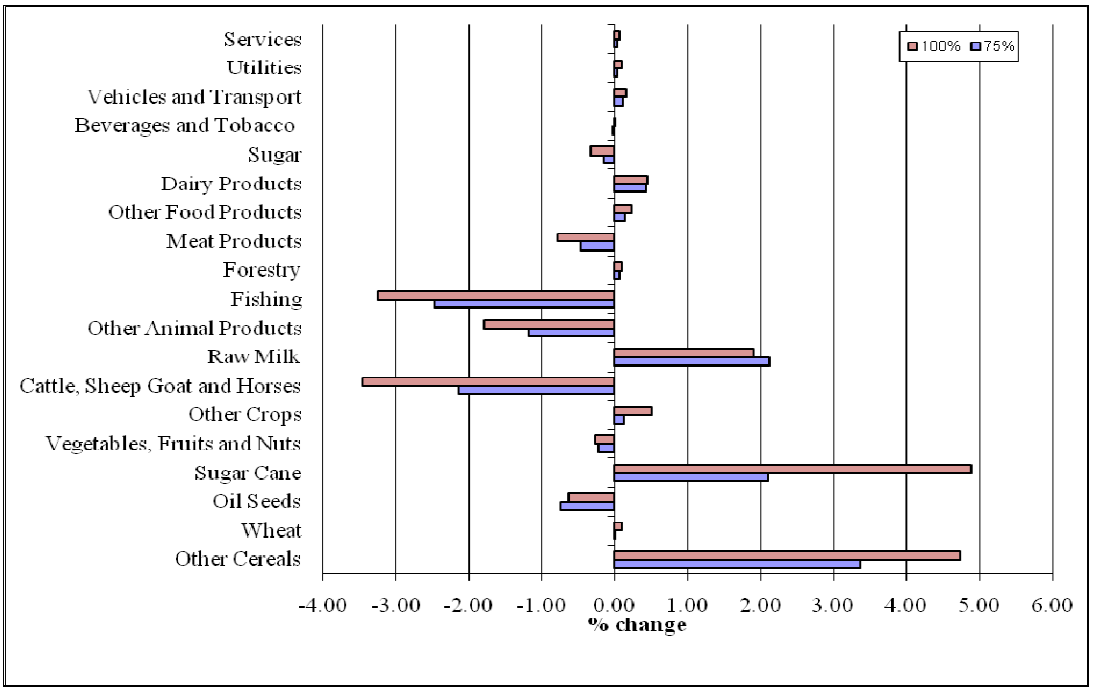

Figure 5.4: Commodity price effects at 75% and 100% liberalization

5.2.5 Factor relocation

In the long term, scarce factors of production are fully employed and are able to relocate to sectors with high returns. The relative change in factor relocation over all the activities is zero, which is justified by the fact that the total factor stock for scarce resources is fixed. The relocation of scarce factors would result in a loss to the sector from which the resources have relocated. This means that scarce factors will move to where there are higher returns.

5.2.6 Household income and expenditure

Changes in nominal income, nominal consumption expenditure and real consumption expenditure are presented in Figure 5.5 to show their linkages to total income returns, as shown in the previous sections, taking into account the effects of taxes, savings and price changes. In provinces where all households either lose out or gain, it is evident that the extent to which they do so varies. White households in six provinces show an increase, which captures the combined effects of increased wages (due to factor relocation), capital and income accrued from land ownership. In the Northern and Eastern Cape, for example, all households are negatively affected while white households are less negatively affected, compared to the other groups. In KwaZulu-Natal, the Free State, Mpumalanga and North-West Province all households are positively affected.

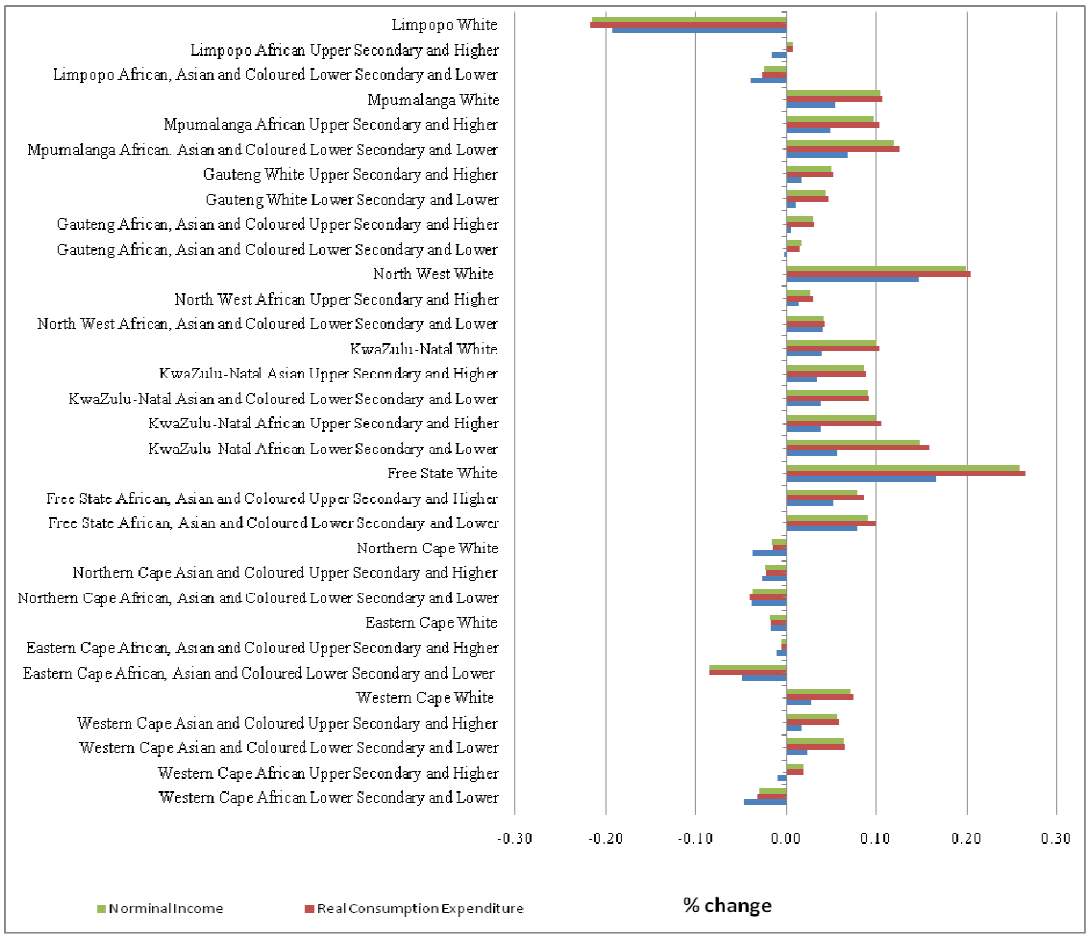

Figure 5.5: Changes in per capita household income and consumption

The difference between real and nominal consumption expenditure is minimal. This indicates that the net impact on the price of goods consumed by each household is small. On average, the low reaction implies that the households concerned do not experience significant changes in either their real consumption or their nominal income, even though there is a relatively large increase in nominal income. In terms of income and price increases, it is evident that poorer households are affected positively.

5.2.7 Employment and wage effects

Activities that provide employment to various labour groups determine the extent to which they are affected. Unskilled and semi-skilled labour are assumed to be not fully employed, meaning that there is sufficient supply of activities to satisfy demand, which justifies wage rates remaining unchanged. The employment effects of liberalisation on unskilled labour are shown in Figure 5.6. There is a decrease in employment with regard to unskilled and semi-skilled labour at 75% for Africans, Asians and Colourers (0.10%) residing in the Limpopo

Province; for Africans, Asians and Coloureds (0.06%) residing in the Northern Cape; for Africans, Asians and Coloureds (0.11%) residing in the Eastern Cape; and for Africans (0.05%) residing in the Western Cape. The Eastern Cape shows the largest employment decrease compared with other provinces.

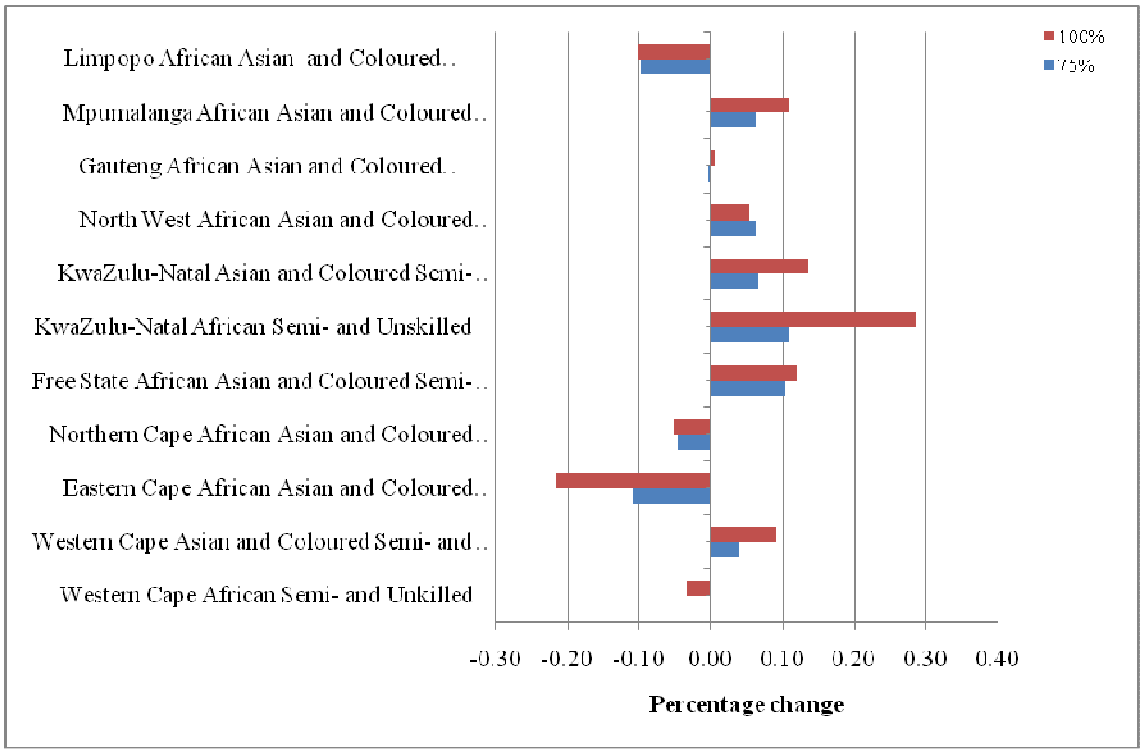

Figure 5.6: Employment (FS) effect at 75% and 100% liberalisation

Employment increases for unskilled and semi-skilled workers in other provinces are as follows. The three labour groups that are affected substantially (at 75%) are the KwaZulu-Natal African semi- and unskilled workers (0.12%) and the Free State African, Asian and Coloured (0.14%) workers. As full employment of White and all skilled labour groups is assumed, an increase in demand for these labour groups will push wage rates upward. The big wage increases (not shown here) at 75% liberalisation occur for the Free State (0.24%) and North-West Province White labour groups (0.25%). All other skilled labour groups are affected positively, except for the Limpopo White (-0.26%), Northern Cape White (-0.08%) and Eastern Cape White labour groups (-0.02%). At 75% liberalisation, the total number of people employed would increase by 2 973. The Eastern Cape would experience an employment loss of 752 persons at 75% while employment increases of 794 and 1 192 persons respectively are expected for KwaZulu-Natal and the Free State.

5.2.8 Total factor income

Variations in world price changes, employment levels, wages and factor allocations in South Africa, in turn, result in changes in the total income accumulated by these factors. Table 5.1 shows that variations in total factor incomes illustrate a substantial change in returns to land because of the land specificity found in each province. Provinces experience mixed responses with regard to the income accrued. Of the nine provinces, four show increases in returns on land: the Free State (3.03%), North-West Province (2.01%), Mpumalanga (1.64%) and KwaZulu-Natal (0.90%). Gauteng (-3.15%), the Eastern Cape (-1.64%), Limpopo (-1.24%), the Western Cape (-1.13%) and the Northern Cape (0.13%) show decreasing returns on land.

Table 5.1: Changes in factor income (at 75% liberalisation)

	Labour				
		African, Asian and Coloured			
Province	**White**	**Skilled**	**Unskilled**	**Land**	**Capital**
Western Cape	0.02	0.06	0.02%	-1.13	
Northern Cape	-0.02	0.02	0.01%	-0.13	
North-West	0.15	0.04	0.06%	2.01	
Free State	0.19	0.04	1.06%	3.03	
Eastern Cape	-0.04	0.03	-0.11%	-1.64	
KwaZulu-Natal	0.08	0.10	0.15%	0.90	
Mpumalanga	0.07	0.05	0.10%	1.64	
Limpopo	-0.13	0.02	-0.01%	-1.24	
Gauteng	0.03	0.01	0.01%	-3.15	
All					**0.01**

Overall, the economy experiences an increase of 0.01% in returns on capital. The White labour force's returns increase by 0.36% while the African, Asian and Coloured unskilled and skilled labour force's returns increase by 0.36%. Even though the total income accrued by all the factors appears to increase, it is evident that the increase in the total returns on income for unskilled labour is small, suggesting that unskilled labour may not benefit to the same extent that skilled labour does.

5.2.9 Macroeconomic and government effects

The effects of OECD liberalisation (at 75%), expressed in world price changes on a number of government and macroeconomic variables, are shown in figures 5.7 and 5.8. The GDP from the value added increases by 0.003% while government consumption and investment consumption decrease by (-) 0.07% and (-) 0.02% respectively.

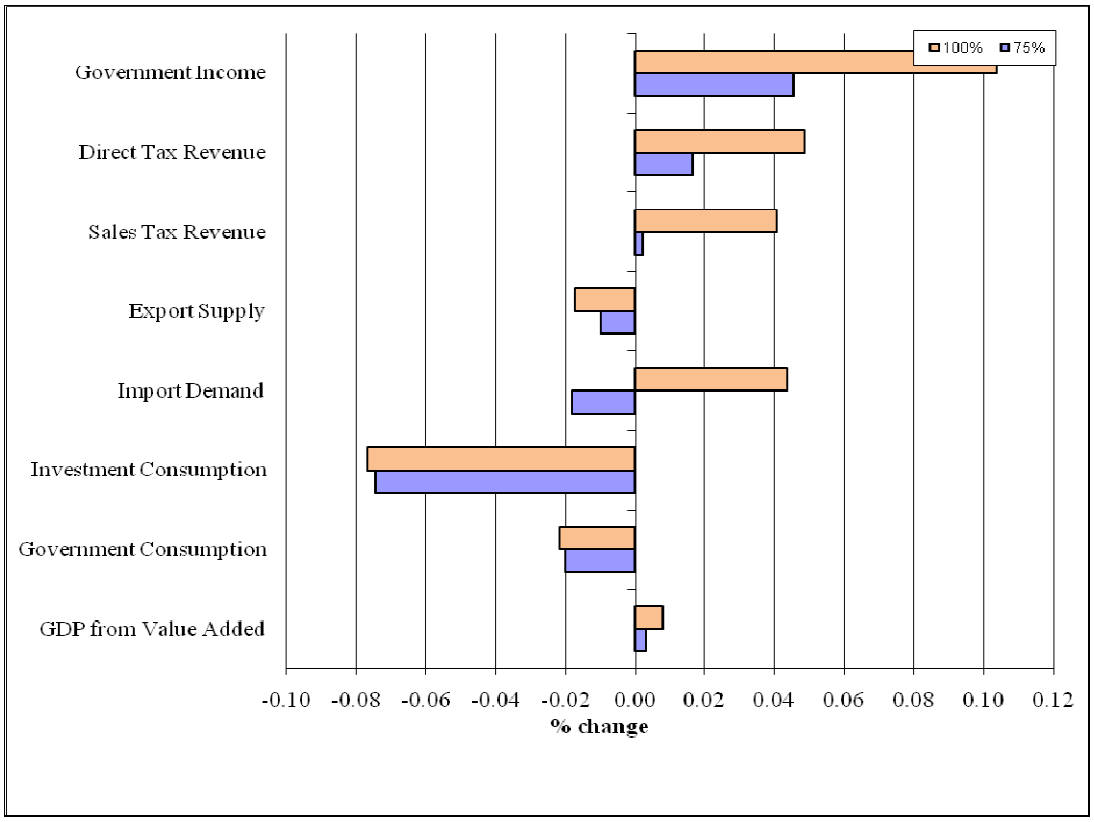

Figure 5.7: Government and macroeconomic effects at 75% liberalisation

The government income increase of 0.05% is justified by an increase in direct tax and sales tax revenues. Furthermore, changes in the (real) value of both imports and exports exceed the changes in GDP. The value of the local currency (the rand) appreciated by 0.03% at 75%. Investment and government consumption expenditures decrease with investment consumption, by a substantial margin compared to government consumption. Finally, it can be argued that government and macroeconomic variable changes are small (< 0. 12%) but positive.

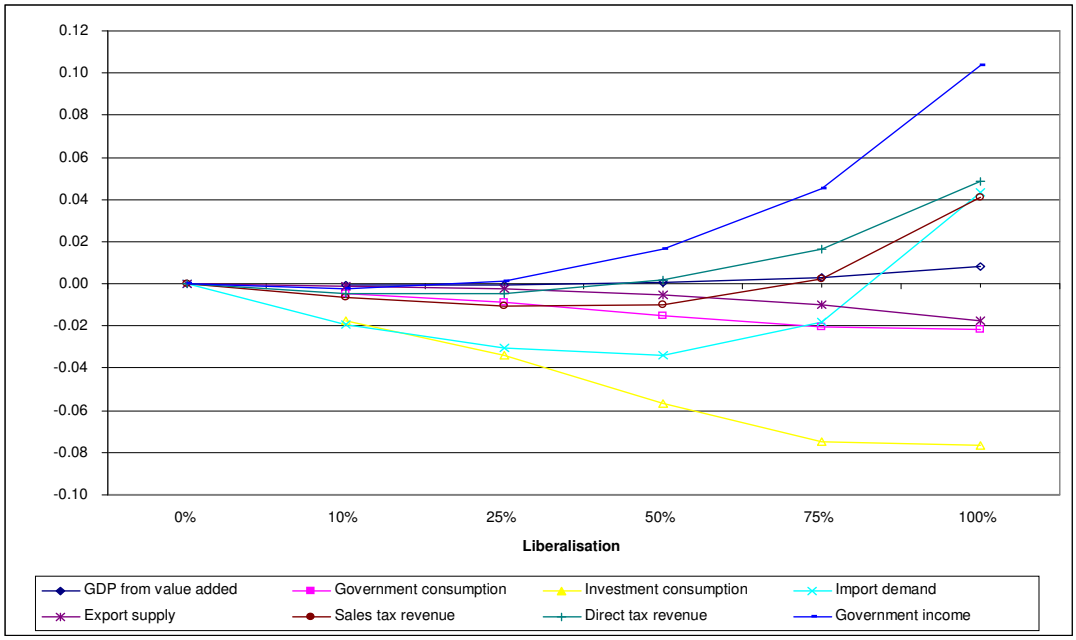

Figure 5.8: Government and macroeconomic effects of agricultural liberalisation

CHAPTER 6: CONCLUDING REMARKS AND RECOMMENDATIONS

6.1 Introduction

The detailed analysis provided in Chapter 5 clearly indicates the way in which the South African economy is likely to respond to liberalisation of agricultural trade in the OECD countries. The fundamental question that this study addresses is what the impact of the DDA of the WTO's agricultural negotiations is likely to be on the economy of South Africa. In addressing this question, the conclusions drawn from the findings of chapters 1, 2 and 3 are worth highlighting.

- It is demonstrated in Chapter 2 that trade liberalisation is the recommended path to follow, considering the role played by agriculture in the South African economy. A number of issues, however, need to be considered, such as the adjustment cost associated with liberalisation.
- It is concluded that agricultural trade perceptions changed in the wake of the UR. The agricultural support provided by developed countries is still occurring, and developed countries want to continue with it (in Chapter 3).
- The conclusion that the CGE model is the best analytical tool for addressing the questions posed in this study was reached. The GLOBE model was used in order to arrive at world prices while the PROVIDE model was used to arrive at the distributional impact of liberalisation (in Chapter 4).

These conclusions, together with the answers to the research questions provided in Chapter 5 (repeated in Section 6.2 below), inform the final conclusions reached in Section 6.3 and the recommendations made in Section 6.4.

6.2 Answers to the research questions

6.2.1 The impact on world prices of agricultural commodities

Reducing import tariffs, factor use taxes and export subsidies by 75% on agricultural and food commodities in OECD countries, changes in the world price of exports (PWE) range from -3% to +29.7% while changes in the world price of imports (PMR) range from -19.6% to +3.8%. However, when the three most highly affected commodity prices are excluded, the price changes are more modest, ranging from -3% to +3% for exports and from -0.2% to

+1.5% for imports. The increases in world export prices of the three most affected commodities at 75% liberalisation are as follows:

- Wheat: 29.7%
- Other cereals: 8.4%
- Sugar: 10%

On the other hand, the changes in world import prices of the three most affected commodities at 75% liberalisation are as follows:

- Other cereals: 3.8%
- Dairy products: 2.6%
- Sugar: -19.6%

The weighted world prices of exports and imports for all the commodities were used to shock the PROVIDE model. The results from the PROVIDE model are discussed below.

In short, the world prices of exports and imports of agricultural commodities will increase because of the liberalisation of agricultural and food commodities in the OECD countries.

6.2.2 The effect on agricultural production

Agricultural production will exhibit varying reactions. First, the domestic prices of wheat, other cereals and sugar cane will show strong increases, resulting in an increase in the quantity produced. Production will increase due to the increased incentives granted to stimulate such production.

6.2.3 The degree to which households stand to benefit from such change and factor returns

At 75% liberalisation, the total labour income increase for skilled labour will be 0.72%, resulting in a total labour increase of 0.37%. Returns to capital will increase by 0.01%. In short, returns to the factors of production will increase.

6.2.4 The likelihood of growth in the economy due to the liberalisation of agricultural trade

The study reveals that the liberalisation of agricultural trade in the OECD countries will have a small though positive effect on macroeconomic variables. While it seems logical that the liberalisation of agricultural trade in the OECD countries would benefit the whole economy, results show that at 75%, only 0.003 increases will occur in the GDP from value adding, with

0.05 increases (75%) occurring in government income. The changes in government and macroeconomic variables are likely to be small (less than 0.12%).

6.2.5 The likely responses of the South African labour market

At 75% of the OECD countries' agricultural trade, the skilled labour wage will increase. An increase in the world prices of exports and imports, due to the liberalisation of the food and agricultural commodity trade of the OECD countries, will likely benefit the South African unskilled labour force, even though the number of jobs created is likely to be small. The total number of unskilled persons employed in South Africa will increase by 2 973 at 75%. The province that is likely to experience the largest employment loss – of 752 and 1 272 jobs at 75% and full liberalisation respectively – is the Eastern Cape.

6.3 Conclusions

The analyses reported in this study evaluate the effects of liberalisation of the OECD countries' trade on the world export and import prices. This study reports the likely effects of a 75% liberalisation of the OECD countries' food and agricultural trade. Chapter 2, after acknowledging the adjustment cost of liberalisation, concludes that agricultural liberalisation is the path that will benefit South Africa. Chapter 3 concludes that agricultural trade support has not decreased worldwide, though it may have changed from one form to another. Perceptions regarding agricultural trade have also changed since the UR. Chapter 4 concludes that the CGE model is the most suitable tool for answering the research questions posed in this study. As world prices could only be derived from a global model, the GLOBE model was developed. The detailed distributional effect of world price changes for South Africa could, however, be derived from the PROVIDE model.

In conclusion, the outcome of the DDA of WTO negotiations on agriculture, expressed through liberalisation of the OECD countries' trade, is likely to cause the world prices of exports to change within a range of between -4% and 46%. The world prices of imports stand to vary, within a range of between -29% and 5%, because of the liberalisation of agricultural trade in the OECD countries. The domestic prices of agricultural commodities will vary (some will increase while others will decrease). Such price increases/decreases are likely to cause increases/decreases in the quantities produced. The value of production will increase, and the employment effect, both in terms of wage increases and the number of people employed, will increase. Household consumption expenditure will increase, and the

macroeconomic variables will increase, even though minimally. Overall, world price changes resulting from the liberalisation of the OECD countries' trade stand to benefit the South African economy.

6.4 Recommendations for further research

The following recommendations are made based on the results from this study:

- The effects of the WTO negotiations on the South African economy can be viewed on a per commodity basis.
- An issue worth investigating is the opportunity cost of ceding the preferential access that the EU and USA markets currently give to South Africa in exchange for reduced support in those economies.
- Another important issue worth in-depth investigation is the adjustment cost that South Africa is likely to incur.

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APPENDICES

Appendix 1

Appendix 1 tabulates the world prices of import (PMR) percentage changes due to the liberalisation of trade in the OECD. PMR increases range from 0% to 5%, with 5% being encountered at full liberalisation of food and agricultural trade (Sim06). At 75% liberalisation of food and agricultural trade, there is a 4% increase in PMR. The higher price increases are for other cereals.

	Trade liberalization of agricultural commodities						**Trade Liberalization of all commodities**					
	sim01	**sim02**	**sim03**	**sim04**	**sim05**	**sim06**	**sim07**	**sim08**	**sim09**	**sim10**	**sim11**	**sim12**
Wheat	0.0%	-0.2%	-0.5%	-1.1%	-1.9%	-3.1%	0.0%	-0.2%	-0.4%	-0.8%	-1.4%	-2.3%
Other Cereals	0.0%	0.6%	1.4%	2.6%	3.8%	5.0%	0.0%	0.7%	1.6%	3.0%	4.3%	5.7%
Vegetables fruits and nuts	0.0%	0.1%	0.1%	0.3%	0.7%	1.4%	0.0%	0.1%	0.2%	0.6%	1.1%	2.1%
Oil seeds	0.0%	0.0%	0.2%	0.5%	1.0%	2.0%	0.0%	0.1%	0.3%	0.8%	1.6%	2.9%
Sugar cane and beet	0.0%	-0.3%	-0.7%	-1.6%	-2.8%	-4.6%	0.0%	-0.2%	-0.6%	-1.4%	-2.6%	-4.3%
Other crops	0.0%	0.2%	0.4%	0.9%	1.5%	2.5%	0.0%	0.2%	0.5%	1.1%	1.9%	3.3%
Cattle sheep goats horses	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%	0.2%	0.4%
Other animal products	0.0%	-0.2%	-0.3%	-0.4%	-0.3%	-0.2%	0.0%	0.0%	0.1%	0.5%	1.0%	1.7%
Raw milk	0.0%	-0.1%	-0.2%	-0.1%	0.1%	0.5%	0.0%	0.0%	0.1%	0.5%	1.1%	1.8%
Forestry	0.0%	0.1%	0.2%	0.5%	0.9%	1.5%	0.0%	0.1%	0.3%	0.6%	1.1%	1.9%
Fishing	0.0%	0.0%	0.1%	0.3%	0.6%	1.1%	0.0%	0.1%	0.4%	0.9%	1.5%	2.4%
Coal oil and gas	0.0%	0.1%	0.2%	0.5%	0.9%	1.4%	0.0%	0.1%	0.3%	0.6%	1.1%	1.8%
Minerals	0.0%	0.1%	0.3%	0.6%	1.0%	1.6%	0.0%	0.1%	0.3%	0.6%	0.9%	1.5%
Meat products	0.0%	0.0%	0.1%	0.2%	0.4%	0.6%	0.0%	0.1%	0.3%	0.6%	0.9%	1.3%
Dairy products	0.0%	0.2%	0.6%	1.5%	2.6%	3.8%	0.0%	0.4%	1.2%	2.7%	4.4%	6.2%
Sugar	0.0%	-1.9%	-5.2%	-11.7%	-19.6%	-28.5%	0.0%	-2.2%	-5.9%	-13.1%	-21.6%	-30.7%
Other food products	0.0%	0.0%	0.1%	0.2%	0.3%	0.6%	0.0%	0.1%	0.3%	0.7%	1.1%	1.7%
Beverages and tobacco	0.0%	-0.2%	-0.5%	-1.0%	-1.4%	-1.8%	0.0%	0.1%	0.2%	0.5%	1.0%	1.6%
Textiles and apparel	0.0%	0.1%	0.3%	0.6%	1.1%	1.7%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.3%
Wood products	0.0%	0.1%	0.3%	0.6%	1.0%	1.7%	0.0%	0.1%	0.3%	0.6%	1.1%	1.9%
Petroleum chemicals and minerals	0.0%	0.1%	0.3%	0.5%	0.9%	1.3%	0.0%	0.1%	0.2%	0.5%	0.8%	1.2%
Metal products	0.0%	0.1%	0.3%	0.6%	1.0%	1.7%	0.0%	0.1%	0.3%	0.6%	1.1%	1.7%
Vehicles and transport	0.0%	0.1%	0.3%	0.6%	1.0%	1.4%	0.0%	0.0%	0.1%	0.2%	0.3%	0.6%
Other manufactures	0.0%	0.1%	0.3%	0.6%	1.0%	1.5%	0.0%	0.1%	0.2%	0.4%	0.6%	1.0%
Utilities	0.0%	0.1%	0.3%	0.7%	1.4%	2.4%	0.0%	0.1%	0.3%	0.8%	1.5%	2.8%
Construction	0.0%	0.1%	0.3%	0.6%	1.0%	1.4%	0.0%	0.1%	0.2%	0.4%	0.7%	1.1%
Trade and transport	0.0%	0.1%	0.3%	0.5%	0.9%	1.3%	0.0%	0.1%	0.2%	0.5%	0.8%	1.3%
Services	0.0%	0.1%	0.3%	0.5%	0.9%	1.4%	0.0%	0.1%	0.2%	0.5%	0.8%	1.3%

Appendix 2

Appendix 2 clearly shows big changes in PWE changes compared to PMR changes when the liberalisation of OECD trade is simulated, with wheat and sugar showing higher price increases. At 75% and full liberalisation of food and agricultural trade, world wheat prices increase by 30% and 46% respectively, with sugar prices increasing by 10% and 21% respectively. Cattle, sheep, goats, horses, oil seeds, and fishing products show increases of about 4%.

	Trade liberalization of agricultural commodities						**Trade Liberalization of all commodities**					
	sim01	**sim02**	**sim03**	**sim04**	**sim05**	**sim06**	**sim07**	**sim08**	**sim09**	**sim10**	**sim11**	**sim12**
Wheat	0.0%	2.8%	7.9%	17.6%	29.7%	45.7%	0.0%	3.1%	8.2%	18.2%	30.1%	45.7%
Other Cereals	0.0%	0.8%	2.2%	5.0%	8.4%	12.7%	0.0%	1.1%	2.9%	6.4%	10.8%	16.2%
Vegetables fruits and nuts	0.0%	-0.5%	-0.7%	-0.7%	-0.5%	-0.1%	0.0%	-0.2%	0.0%	0.8%	1.9%	3.2%
Oil seeds	0.0%	0.0%	0.2%	0.9%	2.0%	3.6%	0.0%	0.2%	0.7%	2.0%	3.5%	5.6%
Sugar cane and beet	0.0%	-0.8%	-1.5%	-2.2%	-2.7%	-2.8%	0.0%	-0.5%	-0.6%	-0.4%	0.1%	0.8%
Other crops	0.0%	-0.9%	-1.5%	-2.2%	-2.5%	-2.4%	0.0%	-0.6%	-0.7%	-0.6%	-0.1%	0.7%
Cattle sheep goats horses	0.0%	0.1%	0.5%	1.3%	2.6%	4.8%	0.0%	0.2%	0.8%	2.1%	4.0%	6.9%
Other animal products	0.0%	-0.5%	-1.0%	-1.6%	-2.1%	-2.3%	0.0%	-0.2%	-0.3%	-0.2%	0.0%	0.6%
Raw milk	0.0%	-0.8%	-1.5%	-2.3%	-3.0%	-3.5%	0.0%	-0.5%	-0.6%	-0.5%	-0.2%	0.2%
Forestry	0.0%	-0.1%	-0.3%	-0.6%	-0.8%	-0.9%	0.0%	0.1%	0.2%	0.5%	0.8%	1.3%
Fishing	0.0%	0.4%	1.0%	2.0%	3.0%	4.2%	0.0%	0.6%	1.5%	3.0%	4.7%	6.6%
Coal oil and gas	0.0%	0.1%	0.2%	0.4%	0.6%	1.0%	0.0%	0.1%	0.2%	0.4%	0.7%	1.1%
Minerals	0.0%	0.1%	0.2%	0.5%	0.8%	1.3%	0.0%	0.1%	0.3%	0.6%	1.0%	1.5%
Meat products	0.0%	0.2%	0.6%	1.3%	2.0%	2.8%	0.0%	0.4%	1.2%	2.7%	4.3%	6.2%
Dairy products	0.0%	0.1%	0.4%	0.9%	1.5%	2.2%	0.0%	0.2%	0.4%	1.0%	1.7%	2.6%
Sugar	0.0%	0.4%	1.4%	4.2%	10.0%	21.3%	0.0%	0.5%	1.6%	4.9%	11.4%	23.8%
Other food products	0.0%	0.1%	0.3%	0.7%	1.2%	1.8%	0.0%	0.3%	0.7%	1.5%	2.5%	3.7%
Beverages and tobacco	0.0%	0.1%	0.3%	0.7%	1.1%	1.7%	0.0%	0.2%	0.6%	1.3%	2.1%	3.1%
Textiles and apparel	0.0%	0.1%	0.2%	0.5%	0.9%	1.4%	0.0%	0.2%	0.5%	1.0%	1.6%	2.4%
Wood products	0.0%	0.1%	0.2%	0.5%	0.8%	1.2%	0.0%	0.1%	0.2%	0.4%	0.7%	1.2%
Petroleum chemicals and minerals	0.0%	0.1%	0.3%	0.6%	1.1%	1.9%	0.0%	0.1%	0.3%	0.6%	1.1%	2.1%
Metal products	0.0%	0.1%	0.2%	0.5%	0.8%	1.3%	0.0%	0.1%	0.2%	0.5%	0.8%	1.3%
Vehicles and transport	0.0%	0.1%	0.2%	0.5%	0.8%	1.2%	0.0%	0.2%	0.4%	0.7%	1.2%	1.7%
Other manufactures	0.0%	0.1%	0.3%	0.6%	1.0%	1.6%	0.0%	0.1%	0.2%	0.5%	0.8%	1.4%
Utilities	0.0%	0.1%	0.3%	0.6%	1.0%	1.7%	0.0%	0.1%	0.3%	0.6%	1.1%	1.9%
Construction	0.0%	0.1%	0.2%	0.5%	0.8%	1.1%	0.0%	0.1%	0.2%	0.4%	0.7%	1.0%
Trade and transport	0.0%	0.1%	0.2%	0.5%	0.7%	1.1%	0.0%	0.1%	0.2%	0.4%	0.7%	1.0%
Services	0.0%	0.1%	0.2%	0.5%	0.7%	1.0%	0.0%	0.1%	0.2%	0.4%	0.6%	0.9%

Appendix 3

This section provides the complete listing of SAM accounts used in the model for this study. The numbers of commodities, activities, factors, enterprises, government, capital and rest of the world accounts are provided.

Agricultural commodities

GAMS name	Description
1. Ccer	Other cereals
2. Cwht	Wheat
3. Cosd	Oil seeds
4. Cscans	Sugar cane
5. Cvfn	Vegetables, fruit & nuts
6. Cocrp	Other crops
7. Cctl	Cattle, sheep, goats & horses
8. Crmk	Raw milk
9. Coanm	Other animal products
10. Cfsh	Fishing
11. Cfrs	Forestry

Other commodities

GAMS name	Description
12. Ccog	Coal, oil & gas
13. Comn	Minerals
14. Cmeat	Meat products
15. Cofod	Other food products
16. Cmil	Dairy products
17. Csgr	Sugar
18. Cbevt	Beverages & tobacco
19. Ctex	Apparel & textiles
20. Cwood	Wood products
21. Cpchm	Petroleum, chemicals & minerals
22. Cmet	Metal products
23. Coman	Other manufactures
24. Cveh	Vehicles & transport
25. Cutil	Utilities
26. Ccns	Construction
27. Ctrdt	Transport & trade
28. Cserv	Services

Agricultural activities

GAMS name	Description
29. AwcA	Western Cape Agriculture
30. AncA	Northern Cape Agriculture
31. AnwA	North West Agriculture
32. AfsA	Free State Agriculture
33. AecA	Eastern Cape Agriculture
34. AkznA	KwaZulu-Natal Agriculture
35. AmpA	Mpumalanga Agriculture
36. AlpA	Limpopo Agriculture
37. AgpA	Gauteng Agriculture

Other activities

GAMS name	Description
38. Afrs	Forestry
39. Afsh	Fishing
40. Acog	Coal, oil & gas
41. Aomn	Minerals
42. Ameat	Meat
43. Aofod	Other food
44. Amil	Dairy
45. Asgr	Sugar
46. Abevt	Beverages & tobacco
47. Atex	Apparel & textiles
48. Awood	Wood
49. Apchm	Petroleum, chemicals & minerals
50. Amet	Metals
51. Aoman	Other manufacturing
52. Aveh	Vehicles & transport
53. Autil	Utilities
54. Acns	Construction
55. Atrdt	Transport & trade
56. Aserv	Services

Labour factors: Fully employed

GAMS name	Description
57. FwcW	Western Cape White
58. FlpW	Limpopo White
59. FncW	Northern Cape White
60. FmpW	Mpumalanga White
61. FkznW	KwaZulu-Natal White
62. FfsW	Free State White
63. FecW	Eastern Cape White
64. FnwW	North West White
65. FgpW	Gauteng White
66. FnwAICs	North West African, Asian & Coloured High-skilled & Skilled
67. FncAICs	Northern Cape African, Asian & Coloured High-skilled & Skilled
68. FfsAICs	Free State African, Asian & Coloured High-skilled & Skilled
69. FgpAICs	Gauteng African, Asian & Coloured High-skilled & Skilled
70. FkznAs	KwaZulu-Natal African High-skilled & Skilled
71. FkznICs	KwaZulu-Natal Asian & Coloured High-skilled & Skilled
72. FlpAICs	Limpopo African Asian & Coloured High-skilled & Skilled
73. FmpAICs	Mpumalanga African, Asian & Coloured High-skilled & Skilled
74. FwcAs	Western Cape African High-skilled & Skilled
75. FwcICs	Western Cape Asian & Coloured High-skilled & Skilled
76. FecAICs	Eastern Cape African, Asian & Coloured High-skilled & Skilled

Labour factors: Not fully employed

GAMS name	Description
77. FwcAu	Western Cape African Semi-skilled and Unskilled
78. FwcICu	Western Cape Asian and Coloured Semi-skilled and Unskilled
79. FecAICu	Eastern Cape African, Asian and Coloured Semi-skilled and Unskilled
80. FncAICu	Northern Cape African, Asian and Coloured Semi-skilled and Unskilled
81. FfsAICu	Free State African, Asian and Coloured Semi-skilled and Unskilled
82. FkznAu	KwaZulu-Natal African Semi-skilled and Unskilled
83. FkznICu	KwaZulu-Natal Asian and Coloured Semi-skilled and Unskilled
84. FnwAICu	North West African, Asian and Coloured Semi-skilled and Unskilled
85. FgpAICu	Gauteng African, Asian and Coloured Semi-skilled and Unskilled
86. FmpAICu	Mpumalanga African, Asian and Coloured Semi-skilled and Unskilled
87. FlpAICu	Limpopo African, Asian and Coloured Semi-skilled and Unskilled

Other factors

GAMS name	Description
88. Fgos	Gross operating surplus mixed income
89. FwcL	Western Cape land
90. FncL	Northern Cape land
91. FnwL	North West land
92. FfsL	Free State land
93. FecL	Eastern Cape land
94. FkznL	KwaZulu-Natal land
95. FmpL	Mpumalanga land
96. FlpL	Limpopo land
97. FgpL	Gauteng land

Households

GAMS name	Description
98. HwcAl	Western Cape African lower secondary & lower
99. HwcAh	Western Cape African upper secondary & higher
100. HwcICl	Western Cape Asian & Coloured lower secondary & lower
101. HwcICh	Western Cape Asian & Coloured upper secondary & higher
102. HwcW	Western Cape White
103. HecAICl	Eastern Cape African, Asian & Coloured lower secondary & lower
104. HecAICh	Eastern Cape African, Asian & Coloured upper secondary & higher
105. HecW	Eastern Cape White
106. HncAICl	Northern Cape African, Asian & Coloured lower secondary & lower
107. HncICh	Northern Cape Asian & Coloured upper secondary & higher
108. HncW	Northern Cape White
109. HfsAICl	Free State African, Asian & Coloured lower secondary & lower
110. HfsAICh	Free State African, Asian & Coloured upper secondary & higher
111. HfsW	Free State White
112. HkznAl	KwaZulu-Natal African lower secondary & lower
113. HkznAh	KwaZulu-Natal African upper secondary & higher
114. HkznICl	KwaZulu-Natal Asian & Coloured lower secondary & lower
115. HkznIh	KwaZulu-Natal Asian upper secondary & higher
116. HkznW	KwaZulu-Natal White
117. HnwAICl	North West African, Asian & Coloured lower secondary & lower
118. HnwAh	North West African upper secondary & higher
119. HnwW	North West White
120. HgpAICl	Gauteng African, Asian & Coloured lower secondary & lower
121. HgpAICh	Gauteng African, Asian & Coloured upper secondary & higher
122. HgpWl	Gauteng White lower secondary & lower
123. HgpWh	Gauteng White upper secondary & higher
124. HmpAICl	Mpumalanga African, Asian & Coloured lower secondary & lower
125. HmpAh	Mpumalanga African upper secondary & higher
126. HmpW	Mpumalanga White
127. HlpAICl	Limpopo African, Asian & Coloured lower secondary & lower
128. HlpAh	Limpopo African upper secondary & higher
129. HlpW	Limpopo White

Trade and transport margins

GAMS name	Description
130. M1	Trade margin
131. M2	Transport margin

Tax accounts

GAMS name	Description
132. IMPTAX	Import duties
133. EXPTAX	Export tax
134. FUELTAX	Fuel tax
135. VATM	Value-added tax on imports
136. VATD	Value-added tax on domestic goods
137. ECTAX	Excise duty
138. SALTAX	Sales tax
139. SALSUB	Sales subsidies
140. INDTAX	Production taxes
141. INDREF	Production refunds / VAT
142. INDSUB	Production subsidies
143. FACTTAX	Factor tax
144. DIRTAX	Direct income taxes

Other accounts

GAMS name	Description
145. GOVT	Government
146. ENT	Business enterprises
147. KAP	Savings
148. DSTOC	Stock changes
149. ROW	Rest of world
150. TOTAL	Account totals