Factors Influencing Trade Patterns of South Africa's Fresh Apple Exports, with a Focus on Non-Tariff Barriers

by
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DECLARATION

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ABSTRACT

The South African fresh apple industry is continuously faced with international trade barriers which decrease the competitiveness of the industry in this ever changing global market. Fresh apple exporters from developing countries such as South Africa are struggling as more major importers from developed countries such as the European Union (EU) have turned to implementing non-tariff barriers (NTB's) to protect their domestic industry. Keeping the latter in mind, South African fresh apple exports to traditional markets such as the European Union have been declining over the past decade, despite it being South Africa's single biggest market segment. However, exports to non-traditional markets such as Africa, the Far East and Middle East have been increasing. Technical barriers to trade and sanitary and phytosanitary (SPS) measures were identified as major non-tariff barriers, especially that of the stringent Maximum Residue Limits (MRL's) implemented by the EU.

International trade literature indicates that gravity models have been extensively used to examine and predict trade patterns and several individuals have attempted to derive a method which can serve to quantify the effects of NTB's on bilateral and multilateral trade flows. However, none of these methods have been able to be specifically used as an explanatory variable (NTB proxy) within a gravity trade model in order to estimate the impact NTB's have on the trade of a single commodity i.e. fresh apples in this case.

The objective of this study was to determine the main factors that explain the recent trends in South Africa's apple exports. A gravity trade model was estimated using a fixed effect and Ordinary Least Squares (OLS) regression technique. The variables in the model reacted differently to apple exports compared to that of total exports from South Africa. The following variables were found to be statistically significant: the target country's GDP and population, the ad valorem tariff rate equivalent and the distance between South Africa and the target country. The variables that typically explain total trade flows, which were found to be statistically insignificant for apple exports were: South Africa's GDP and population, the nominal exchange rate and the common language dummy variable. It was also evident that there exist statistically significant differences between the EU and non-traditional markets in terms of the volume of apple exported to these regions.

Factors other than tariffs and non-tariff barriers which could contribute to the shift in traditional export patterns of apple South Africa include market prices, consumption patterns, market-

specific requirements and the production of certain niche cultivars, adverse weather patterns and labour availability during harvesting and packing periods.

OPSOMMING

Die Suid-Afrikaanse appel bedryf staar voortdurend verskeie internasionale handelsbeperkings in die gesig, wat die mededingendheid van die industrie binne die groter wêreld mark, negatief beïnvloed. Die uitvoere van vars appels deur ontwikkelende lande soos Suid-Afrika, is gedurig onder druk wanneer invoerders van ontwikkelde lande soos die Europese Unie (EU), nie-tarief handelsbeperkinge instel om hul plaaslike mark te beskerm. Deur laasgenoemde in gedagte te hou, is dit duidelik dat appel uitvoere vanaf Suid-Afrika na die Europese Unie die afgelope dekade drasties afgeneem het, ten spyte daarvan dat dié mark die enkele grootste uitvoermark vir Suid-Afrika is. Nietemin het appel uitvoere na nie-tradisionele uitvoermarkte soos Afrika, die Verre-Ooste en Midde-Ooste toegeneem. Tegniese, sanitêre-en fitosanitêre nie-tarief handelsbeperkinge, veral die maksimum residu limiete (MRL'e) wat deur die EU ingestel word, was geïdentifiseer as die belangrikste handelsbeperkinge van toepassing op die huidige appel bedryf in Suid-Afrika.

Verskeie literatuurstudies het bewys dat gravitasie handelsmodelle gereeld gebruik word om handelspatrone te ondersoek en te voorspel en dat verskeie individue probeer het om 'n metode te vind wat die effek van verskeie nie-tariefbeperkinge op bilaterale en multilaterale handelsvloeie te kwantifiseer. Ongelukkig kan geen een van dié metodes gebruik word om 'n toepaslike onafhanlike veranderlike te skep wat in 'n gravitasie handelsmodel gebruik kan word om die spesifieke effek van nie-tarief handelsbekerkinge op die handel van 'n enkele kommoditeit of produk, in die geval vars appel uitvoere, vas te vang nie.

Die doelwit van die studie was om die hooffaktore wat die onlangse uitvoerpatrone van die Suid-Afrikaanse appelbedryf beïnvloed, te bepaal. 'n Gravitasie handelsmodel is beraam deur die gebruik van 'n vaste effek en gewone kleinste kwadrate (OLS) regressie tegniek. Die veranderlikes wat toegepas was op totale appeluitvoere in die model het anders gereaggeer in vergelyking met totale uitvoere vanaf Suid-Afrika. Die volgende veranderlikes was statisties betekenisvol: die teiken land se bruto binnelandse produk (BBP) en bevolking, die ad valorem tarief ekwivalent en die afstand tussen Suid-Afrika en die teiken land. Die veranderlikes wat tipies totale handelsvloei verduidelik, maar nie statisties betekenisvol bevind is vir vars appel uitvoere vanaf Suid-Afrika nie, was: Suid-Afrika se BBP en bevolking, die nominale wisselkoers en die fopveranderlike vir 'n gemeenskaplike taal. Dit was ook duidelik dat daar statisties betekenisvolle verskille tussen die EU en die nie-tradisionele uitvoermarkte bestaan in terme van die volume appels uitgevoer na hierdie markte.

Faktore behalwe tariewe en nie-tarief beperkings wat ook ‘n beduidende bydrae kan lewer tot die verandering in die uitvoerpattrone van vars appels vanaf Suid-Afrika, sluit in: markpryse, verbruikerspatrone, mark-spesifieke vereistes en voorkeure, die produksie van sekere nismark kultivars, nadelige klimaatspatrone asook die beskikbaarheid van arbeid gedurende die oes en pak periode.

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ABBREVIATIONS

£	British Pound
€	Euro
ADF	Augmented Dickey–Fuller
AVE	Ad Valorem Equivalent
BFAP	Bureau of Food and Agricultural Policy
BLUE	Best Linear Unbiased Estimator
BRC	British Retail Consortium
C.I.F	Cost, Insurance and Freight
CEPII	Centre d'Etudes Prospectives et d'Informations Internationales
CES	Constant Elasticity of Substitution
CET	Constant Elasticity of Transformation
COMTRADE	Commodity Trade Statistics Database
CPI	Consumer Price Index
DAFF	Department of Agriculture, Forestry and Fisheries
DFPT	Deciduous Fruit Producers Trust
DTI	Department of Trade and Industry
ECP	European Crop Protection
EU	The European Union
FDI	Foreign Direct Investment
FE	Far East
FEM	Fixed Effect Model

FTA	Free Trade Agreements
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
HS	Harmonised System
ICTSD	International Centre for Trade and Sustainable Development
INTB	Index of Non-Tariff Barriers
ITC	International Trade Centre
ITRISA	International Trade Institute of Southern Africa
LLC	Levin, Lin and Chu
MAI	Market Attractiveness Index
ME	Middle East
MFN	Most-Favoured-Nation
NAFTA	North American Free Trade Agreement
NTB	Non-Tariff Barrier
NTM	Non-Tariff Measures
OLS	Ordinary Least Squares
PUC	Producer Unit Code
PURT	Panel Unit Root Test
REM	Random Effect Model
SACU	Southern African Customs Union
SARB	South African Reserve Bank
SPS	Sanitary and Phytosanitary
TBT	Technical Barriers to Trade

TDCA	Trade, Development and Co-operation Agreement
TRAINS	Trade Analysis and Information System
U.S.	United States of America
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNNAMA	United Nations National Accounts Main Aggregates
WDI	World Development Indicators
WHO	World Health Organisation
WITS	World Integrated Trade Solution
WTO	World Trade Organisation
ZAR	South African Rand

CHAPTER 1: INTRODUCTION TO THE STUDY

1.1 Background

Over the last 20 years South Africa has undergone immense social and economic changes, with fundamental structural reforms resulting in an open market oriented economy, following the end of apartheid era sanctions in 1994 (WWF, 2010). South Africa is an emerging market economy which has a dual agricultural economy, with both well-developed commercial farming and small scale communal farming (REO, 2013). The South African agricultural sector contributes less than 3% of the total GDP which is a relatively small share of the GDP, but is highly important in providing employment and earning foreign exchange (DAFF, 2012).

It is important to note that even during the worst economic meltdown in 2008, the South African agricultural sector remained resilient, with its contribution to the total value added to GDP remaining virtually unchanged at 2.2%; while other sectors of the economy experienced sharp declines (DAFF, 2012). South Africa is a net exporter of fresh and processed products in terms of both volume and value and is ranked among the top three best performing Sub-Saharan African economies. South Africa is considered as the European Union's (EU's) largest trading partner on the African continent (European Commission, 2013). The EU remains South Africa's largest single export market for apples and pears (DAFF, 2012; Odendaal, 2014). It is for this reason that the EU market segment will serve as a foundation and reference point throughout this study. Furthermore, South Africa's primary exports to the EU are fuels, raw mining materials, machinery, transport equipment, fresh fruit and other semi-manufactured goods. The EU consists of 28 member countries with over 508 million consumers. The free movement of goods within the EU market allows goods to be transported and sold anywhere within the EU's borders and among its member countries, making the EU the largest single market in the world (European Commission, 2013).

South Africa's trade relations and co-operation with the EU are governed by the Trade, Development and Co-operation Agreement (TDCA) (European Commission, 2013)[1]. According to the European Commission (2013) the TDCA established a free trade area which covers 90 per cent of bilateral trade between South Africa and the EU.

[1] A summary of the main trade agreements between South Africa and the rest of the world can be seen in Appendix A (Table A1)

The EU and South Africa signed the TDCA in Pretoria on 11 October 1999. The agreement covers five areas of co-operation, namely: political dialogue, development co-operation, co-operation in trade and trade related areas, economic co-operation and co-operation in other areas. The TDCA establishes preferential trade arrangements between the EU and South Africa, along with the progressive introduction of a free trade area. The TDCA's trade-related articles were provisionally applied since January 2000. The agreement fully entered into force on 1 May 2004 after ratification by all signatory parties (European Commission, 2013).

One recent significant aspect of international trade policy is the levying or lifting of trade tariffs[2]. This enabled countries to develop and implement Non-Tariff Measures (NTM's) and Non-Tariff Barriers (NTB's) which may be used in tandem with tariffs to protect their domestic industry. It is important to note that the implementation of non-tariff measures and non-tariff barriers is not solely used to replace the effect of tariffs.

According to Sandrey *et al*. (2008:2) Non-Tariff Measures and Non-Tariff Barriers can be broadly defined as any measures, interventions or prevailing conditions, other than tariffs, which distort or restrict the trade in goods, services and factors of production. However, one must make a distinction between NTM's and NTB's. NTB's arise from different NTM's imposed by governments and authorities in the form of government laws, regulations, policies, conditions, restrictions or specific requirements and private sector business practices, or prohibitions that protect the domestic industries from foreign competition. Therefore, NTB's are generally used to describe NTM's which are discriminating, protectionist and trade restrictive (Gourdon and Nicita, 2013).

Despite the preferential trade arrangements between the EU and South Africa, the EU still has seasonal tariff structures. These seasonal tariff structures act as a price entry system, which are at their highest during the European peak harvesting seasons. The EU also imposes quotas, specific tariffs, and various policies that allow, amongst other things, government organizations to purchase produce should the supply rise too quickly (thereby maintaining market prices) and then releasing this excess back into the market when supply eventually drops (European Commission, 2013). The immediate implication of these policies for South Africa is that an opportunity exists to supply apples to the EU in the "off season" periods, as the produce will

[2] A trade tariff is a tax or duty which is placed on goods crossing political borders (or custom unions). Import tariffs are the most common, and involve a tax being assessed on products imported from another country (European Commission, 2013).

not compete directly with the European producers and would therefore not be liable to a whole array of tariffs and protective mechanisms (DAFF, 2012). The EU charges the following tariffs (import duty rates[3]) on apple imports which are priced at or above the minimum entry price. These tariffs are applicable during certain periods within a fiscal year, as depicted in table 1.1 below:

Table 1.1: The EU seasonal tariffs on fresh apple imports

Date of arrival	Additional tariff applied
01/01 - 14/02	4.0 %
15/02- 31/03	4.0 %
01/04 – 03/06	free
01/07 – 15/07	free
16/07 – 31/07	free
01/08 – 31/12	8,9 %

(NHC, 2014)

It is clear from table 1.1 above and table 1.2 that the EU operates an entry price system for apples imported during different periods. For example, if South Africa exports fresh apples to the EU during the period between 1 January and 31 March and 1 August to 31 December, an ad valorem tariff of 4 % and 8.9% respectively will be imposed. It is important to note that these rates are subject to change, because countries use multiple tariff rate structures during different periods and for different products. The entry price is calculated by regulatory authorities and is not only based on the current market value, but also on the optimum prices domestic producers need to maintain their profitability and competitiveness (DAFF, 2012).

This mechanism is used by countries to protect their respective agricultural systems and domestic producers; however it is likely to also be discriminating towards those producers and countries attempting to compete with the domestic producers within the specific country (DAFF, 2012). According to the Northwest Horticulture Council (NHC), fresh apple imports valued below the entry price are charged a tariff equivalent in addition to the fixed tariff (NHC, 2014).

The fixed tariff and the full tariff equivalent are levied on imports valued at less than 92 % of the entry price; making imports of lower-priced apples unfeasible (NHC, 2014). It is interesting

[3] Import duty rates are expressed as ad valorem import tariff rate equal to a percentage of the imported product's value (European commission, 2013).

to note that African countries such as Benin, Angola and Ghana also impose tariffs of 20%, 20% and 25% respectively, which are much higher than that of the EU, but they do not have seasonal tariff structures. This can be a major disadvantage for emerging exporters aiming to enter these markets over the short to medium run, *ceteris paribus*[4]. In reality, tariffs are likely to be lower for South Africa in certain countries because of preferential trade agreements such as the TDCA, most favoured nation (MFN) status, free trade agreements (FTA) and custom unions (CU). Table 1.2 below depicts the ad valorem tariff rate implemented by some of South Africa's main fresh apple export destinations, where South Africa also enjoys MFN status.

Table 1.2: Tariffs applied by various export markets to fresh apples originating from South Africa, 2011

COUNTRY	HS CODE	PRODUCT DESCRIPTION	TRADE REGIME	APPLIED TARIFFS	TOTAL AD VALOREM EQUIVALENT
EU	80810100	Fresh cider apples, in bulk, from 1 April to 31 July	MFN duties (Applied)	0.00%	0.00%
	80810801001	Fresh apples (excl. cider apples, in bulk, from 1 January to 2 February): Cider apples. If the declared price is higher than or equal to 0the EUR/100 kg	MFN duties (Applied)	4.00%	4.00%
	80810809006	Fresh apples (excl. cider apples, in bulk, from 16 September to 31 December) Other. If the declared price is higher than or equal to 0the EUR/100 kg	MFN duties (Applied)	6.40% + 30.36 $/Ton	8.90%
Malaysia	8081000	Fresh apples	MFN duties (Applied)	5.00%	5.00%
Benin	808100000	Fresh apples	MFN duties (Applied)	20.00%	20.00%
Angola	8081000	Fresh apples	MFN duties (Applied)	10.00%	10.00%
United Arab Emirates	8081000	Apples, pears and quinces, fresh: Apples	MFN duties (Applied)	0.00%	0.00%
Singapore	8081000	Fresh apples	MFN duties (Applied)	0.00%	0.00%
Ghana	808100000	Fresh apples	MFN duties (Applied)	20.00%	20.00%
Bangladesh	8081020	Fresh apples	MFN duties (Applied)	25.00%	25.00%

Source: International Trade Centre (ITC) Market Access Map, 2014

As international tariffs were imposed over the past decade by various trade unions and gradually declined in importance, the implementation of NTB's has increased, with the effect

[4] The Latin phrase "*ceteris paribus*" translates approximately to "holding other things constant" and is usually rendered in English (and economic jargon) as "all other things being equal".

of impeding trade flows (Ingham, 2010:48; Sandrey *et al.*, 2008:2). According to recent studies, NTB's are considered to be one of the main obstacles to free trade in the international economy and this is also the case for trade between South Africa and the EU and its main trading partners, which will be discussed later. NTB's can be divided into those that are mandatory and laid out in various country-specific legislature and those that are the result of consumers, retailers, importers and other distributors' preferences (DAFF, 2012).

The South African apple industry faces major challenges in staying competitive in the ever changing global apple market, especially in the EU, as the EU applies a complex compound tariff that varies based on the time of year the apples are imported and the average unit value of the product. After the deregulation of the South African fruit export industry in 1997, the industry became fragmented in the distribution and marketing of its fresh fruits (Conradie, 2008). The one-channel export system had inefficiencies that needed serious attention, but the lack of a controlled deregulation process left the industry fragmented and in a weakened condition (Conradie, 2008).

1.2 Research problem

In recent years, much attention has been paid by government institutions and organizations to the liberalization and expansion of the world agricultural trade environment and its contribution to a country's economic growth and development (Henson & Loader, 2001; Kennedy & Koo, 2005 and Johnson, 2014). One of the most important manifestations and objectives of establishing the General Agreement on Tariffs and Trade (GATT) (which was founded in 1947) and its successor the World Trade Organization (WTO), was to reduce tariffs and other NTB's impeding trade in order to secure freer access to markets and in turn the expansion of international trade through economic globalisation (Kennedy & Koo, 2005; Henson & Loader, 2001). However, as bilateral and multilateral trade agreements throughout the world attempt to decrease the use of tariffs especially by developed countries, other forms of trade barriers have emerged. Moreover, concurrently with this trade liberalization episode, NTB's have surged as a mechanism to protect domestic industries; thereby many countries control imports of apples by these means in combination with tariffs.

According to surveys conducted by various independent organizations across the world on a number of industries and businesses, especially exporting companies, NTB's (most of which were technical barriers to trade) and other obstacles e.g. the lack of infrastructure and

application of Sanitary and Phytosanitary requirements (SPS) constrain their ability to access foreign potential markets (RTFP, 2007; ITC, 2013). The product standards required by consumers in developed countries such as the EU play a major role in the problem(s) faced by producers and exporters in developing countries such as South Africa. These developing countries do not always have the available knowledge and resources to comply with these trade restrictive standards, especially for fresh apple exports (Bellanawithana *et al*., 2004).

It is now widely acknowledged that NTB's to trade have become more important, as these trade barriers may have a greater economic impact on the international trade scene than that of tariff barriers. The economic effect of NTB's has been receiving a great deal of attention in the literature. However, there are few studies (which will be discussed later) which contain quantitative estimations on the impact of certain NTB's on the volume of bilateral trade in fresh apples per se. Most of the previous studies conducted tend to focus more on general agricultural trade (Henson & Loader, 2001; Beghin & Bureau, 2001; Bora *et al*., 2002; Mellado *et al*., 2008 and Trabelsi, 2013).

In fact, the analyses related to NTB's have not kept pace with their increasing complexity, resulting in a gap in our knowledge. Another problem related to NTB's is that, despite their widespread use, their effect on international trade of specific agricultural products is still quite understudied. Therefore, it is of interest to conduct a study which identifies and measures the economic effect of various important factors which may impede bilateral trade and ultimately the export potential of South African apples and in so doing try and fill the knowledge gap that exists in international trade literature. The aim of this study is to determine factors that explain the shift in fresh apple exports away from the EU to other regions such as the Far East (FE), Middle East (ME) and African (AF) countries, respectively. Although NTB's are expected to play an important role in explaining this shift, it is however recognised that NTB's are not the only factors that cause trade patterns to change, so traditional factors such as tariffs, distance from markets and market requirements in terms of consumer preferences are also explored.

The research questions which need to be addressed by this study are therefore:

- Which are the main NTB's impeding trade of fresh apples between South Africa and the Far East, Middle East, Africa and the European Union?
- Which other factors potentially have impact on the decisions of export destinations in South Africa's fresh apple industry?

- What recommendations can be provided to South African export promotion organisations, producers and potential exporters in terms of the findings of the study?
- What recommendations can be provided for future research in this topic and on the gravity trade model in terms of the findings of this study?

1.3 Objectives of the study

The main objective:

- To determine the main factors which explain the recent trends in South Africa's apple exports with a special focus on non-tariff barriers.

Sub-objectives:

- To identify various factors that impact on apple exports;
- To quantify this impact of these factors via the gravity trade model, where possible.

1.4 Method

The basic gravity trade model, which is based on Newton's law of gravitation, is represented in the form of international trade between countries with the basic forces which might help explain the extent of trade between two trading countries. The gravity trade model serves as a powerful analytical tool which can be used to estimate the effect(s) various explanatory variables have on bilateral trade. This basic theoretical trade model possesses several basic features and has proven to be successful in explaining multilateral and bilateral trade flows between countries. Furthermore gravity trade models can easily be adapted in order to investigate specific factors that might have an impact on international trade, which makes this model the ideal framework to meet objectives of this study. The method is as follows:

- Identify and discuss the most important NTB's acknowledged in various trade literature that impede trade and indicate its relevance to exports of fresh apples from South Africa to the European Union, Middle East, Far East and Africa;
- Investigate the South African fresh apple export industry in order to identify the market-specific requirements of South Africa's main export destinations;
- Construct a gravity trade model to investigate and measure the economic effect of various trade variables in terms of the volume of fresh apples exported from South Africa;

- Determine whether the shift in exports away from the European Union to other regions such as the Middle East, Far East and Africa is statistically significant.
- Review the empirical results of the estimations and disentangle possible implications thereof, in order to provide realistic recommendations according to the empirical findings on the status and economic effects of various factors and in particular NTB's on South African apple exports that could be taken into account by various industry associations and policy makers in the future.

1.5 Scope and delimitation of the study

The lack of trade data over time for certain countries limits the ability to include these countries from a modelling perspective. The top twenty importing countries were identified and grouped in terms of the average volume exported from South Africa to each respective country during the period from 2001 to 2013. However, the Russian Federation was excluded from the top twenty selected countries due to the lack of adequate trade data. The remaining 19 countries were then grouped in export regions as: the Far East, Middle East, Africa and the European Union respectively. The countries which were used to represent the respective regions are depicted in table 4.1. Unfortunately unfavourable weather conditions, which included severe hailstorms, struck South Africa's main apple-producing regions in 2014. This had a severe negative impact on the 2014 harvest and exports volumes. It is for this reason that only data up until the end of 2013 will be analysed in this study.

It is important to note that apple production and exports from South Africa are treated as a national aggregate and no distinction is made at provincial or regional level.

1.6 Outline of the chapters

This thesis comprises six chapters. In Chapter 1 an introduction to this study is provided by defining the background of South Africa and its agricultural sector, as well as its changing trade relations with the EU, which provides the rationale for analysing the cause of these changes in international trade. Moreover, Chapter 1 also discusses the research problem statement, objectives, contributions, research design and methodology used, as well as the outline of the chapters. The first part of the literature review in Chapter 2 provides an overview of trade theories to explain international trade and the different types of trade barriers with special focus on Sanitary and Phytosanitary regulations (especially that of Maximum Residue Limits

(MRL's)). The second part of chapter 2 provides a detailed introduction and overview on the gravity trade model history and theoretical basis of the model(s) which have been used, as well as a detailed review on possible methods which can be used examine factors influencing trade. Chapter 3 provides a detailed overview of the South African apple industry profile, the export destinations of fresh apples, domestic and international consumption patterns, cultivar specific information, as well as a special section on the current opportunities and challenges of doing business in Africa. Chapter 4 discusses the methodology of the gravity trade model as used in this study. Chapter 5 presents the empirical results coupled with a detailed interpretation of this research. Chapter 6 concludes the study by providing a comprehensive summary, recommendations for further research and concluding remarks.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

As previously mentioned, the primary objective of this study is to identify the main factors that explain the recent trends in South Africa's apple exports to the Far East (FE), Middle East (ME), Africa (AF) and the European Union (EU). The first part of this chapter provides the history of GATT and discusses its counteraction on the expansion of various NTB's. Furthermore, a brief overview of the theories of international trade will be provided. These theories aid in explaining international trade as well as provide a possible theoretical underpinning for the gravity trade model. This chapter also investigates NTB's and attempts to identify[5] numerous NTB's implemented by developed countries such as the EU, which in turn may have a significant effect on South Africa's apple exports to these markets. The second part of this chapter will discuss the methods used to measure the effects of NTB's as well as the history and theoretical basis of the gravity trade model.

The next sub-section will briefly discuss the General Agreement on Tariffs and Trade (GATT) and the main objective of this trade organization.

2.2 General Agreement on Tariffs and Trade (GATT)

In the year of 1947 the proposed International Trade Organisation (ITO) was replaced by the General Agreement on Tariffs and Trade (GATT). The objective of this replacement was to prevent the return of protectionist measures which damaged world trade in the 1930's (Ingham, 2010:76). Member countries of GATT were to meet from time to time to jointly discuss and negotiate on matters of trade policy. These meetings were termed rounds and altogether there were eight negotiating rounds between 1947 and 1995. The aim of the establishment of GATT was to reduce barriers to trade by removing tariffs, quotas, taxes, subsidies and administrative procedures which could impede international trade and have adverse welfare effects (Coughlin & Wood, 1989:40; Ingham, 2010:76).

GATT also acquired the role of the so-called "trade watchdog" by monitoring the day-to-day trading policies of member countries. According to Ingham (2010:76), GATT was essentially

[5] It is important to note that identifying certain non-tariff barriers can be very subjective and there is no homogeneous method to indicate various non-tariff barriers' importance to each other or the relative scale in which they could be measured.

only a series of international agreements between member countries in order to negotiate on matters of trade policy (Ingham, 2010:76). Keeping that in mind, GATT succeeded in resolving a number of trade disputes[6] between various member countries (Ingham, 2010:76). The Uruguay Round of Multilateral Trade Negotiations that commenced in 1986 and finished in April 1994 was the final round of GATT negotiations and this round was generally agreed to be the "most comprehensive and ambitious" of all. Furthermore, this final round was also the first round to actively and formally promote the participation of developing countries such as South Africa.

The Final Act (a very complex document) which embodied the results of all of these trade negotiations was formally signed in April 1994 in Marrakesh, Morocco (World Trade Report, 2012:2). One of the highlights in this Final Act was the inclusion of agriculture (which was previously effectively excluded), leading to progressive liberalisation of trade in agricultural products (Ingham, 2010:76). This Act also established a formal organisation called the World Trade Organisation (WTO) to replace GATT. The WTO, like its GATT predecessor has surveillance mechanisms in place to oversee members' trade policies and intends to remove or reduce tariff peaks and NTB's in order to promote free trade. An important question remains, however, as to why GATT primarily focused on the reduction (removing) of tariffs rather than NTB's which have become one of the main trade restriction measures (Coughlin & Wood, 1989:40; Ingham, 2010:76). The next subsection will provide an overview of trade theories which might explain international trade patterns as well as to provide some sort of theoretical explanation of the gravity trade model.

2.3 Trade theories which may explain international trade patterns

In the literature it has been argued that the classical and modern theories of international trade are not always empirically verifiable. This does not mean that these theories should be disregarded altogether, since they do provide analytical rigour and useful information about the basic forces at work in international trade. Inevitably, any long-run view of international trade faces the notion that trade patterns can be driven by different reasons. The challenge for a long-run view is therefore to find a unifying framework that accommodates a variety of divergent explanations for international trade.

[6] It is important to note that examples of specific trade disputes which were indeed resolved by GATT fall beyond the scope of this thesis.

David (2007:3-4) argued that trade liberalisation affects economic growth according to the conventional theory of international trade,[7] often referred to as the standard trade theory which suggests three possible channels through which *economic gains* can happen:

i) Firstly, there are *economic gains from exchange,* when trade barriers such as NTB's are removed. By removing or reducing such trade barriers, consumers and producers benefit directly from lower import prices. This also encourages producers to direct their resources away from protected sectors towards the markets where maximum profits can be realised, which in turn stimulates economic growth;

ii) Secondly, *gains form specialization,* where industries such as the South African apple industry can expand their output in terms of increasing the volume available of certain cultivars through the establishment of more hectares under production if they have a comparative advantage in the production of these cultivars in the international market;

iii) Finally, gains from *economies of scale* (also known as increasing returns to scale). This is where a country such South Africa and its producers can develop their apple industry to produce apples in great quantities at a lower total average unit cost; because as individual producers expand, their production cost can be spread over and across more units, which in turn lowers the total average unit cost of producing a ton of apples. Moreover, South Africa can then trade these low-cost apples to other countries which have a higher unit cost. Thus, economies of scale provide additional cost incentives for domestic producers (or countries) to specialize in the production of certain products (in this case apples) and in turn use this comparative advantage to gain from international trade if trade barriers are removed, which if not, can impede that trade effect.

Trade barriers create price distortions that shift production between countries. Thus, if trade barriers can be restricted or ultimately be removed, price distortions will decrease, which in turn may lead to a more efficient allocation of resources and making domestic markets more competitive. This could also encourage production of goods and services in which a country has a comparative advantage (David, 2007).

The gravity equation of trade predicts that the volume of trade between two countries is proportional to their GDP and inversely related to trade barriers between them, which will be

[7] See Linder (1961), and Helpman and Krugman (1985) for further information.

discussed in greater detail in the last section of this chapter (UNCTAD, 2012). Empirical research has found that various versions of the gravity equation can account for the variation in the volume of trade across country pairs and over time. Major insights into the causes of international trade might be gained if it could be determined which theory actually accounted for the success of the gravity equation in a given sample of data. The next few sub-sections focus on various trade theories in international trade from where possible micro-foundations of the gravity trade model can be derived.

2.3.1 Developments in the theory of trade

The theory of trade is the basis of the doctrine of free trade. To start off, Mercantilist economic thinking was the characteristic of the EU up to the seventeenth century. It featured wide-ranging domestic regulations and restrictions on imports and exports (Gouws, 2005:56; Ingham, 2010:9). Then Adam Smith, founder of modern economics, presented a critique of Mercantilism together with the case for free trade based on the principles of absolute advantage (Pugel, 2012:34). He argued that countries specialize in the production of commodities on the basis of absolute advantage and exchange part of their output for commodities produced in other countries. Each country can produce and consume more, indicating that trade is mutually beneficial. However, the principle of absolute advantage cannot be generalized to explain all trade between countries (Kennedy & Koo, 2005:27).

David Ricardo introduced the principle of comparative advantage, which in turn leads to mutually beneficial trade. Ricardo's writings in the early 19th century demonstrated the principle of comparative advantage: "*a country will export the goods and services that it can produce at a low opportunity cost and import the goods and services that it would otherwise produce at a high opportunity cost*" (Pugel, 2012:37; Costinot & Donaldson, 2012). Thus, comparative advantage applies whenever there are productivity differences between countries.

Furthermore, the Heckscher-Ohlin theory showed that the source of comparative advantage is differences in relative factor endowments between countries (Pugel, 2012). Countries export commodities which embody the relatively abundant factor, and import commodities which embody the relative scarce factor (Pugel, 2012:37). Thus, it can be concluded that although theoretically sound, it was proven that the Heckscher-Ohlin theory had serious limitations in an empirical sense, and that the theoretical model performed poorly when applied to real-world data; however it remains vital for understanding the effects of trade.

Since the emergence of the classical theory of trade, the character of international trade has changed dramatically (Ingham, 2010:29). Ingham (2010:29) argued that modern day trade analysis needs to move away from simple comparative advantage, based on productivity differences of factor endowments, towards a more complex analysis based on the advantage which occurs within firms and markets. Ingham (2010:30) identified these factors as:

- Access to markets
- Access to technology
- Scale economies, and
- Organisational advantages

The famous international economist Paul Krugman (1979) has been the leading figure in the revolution of the modern trade theory. He argued and pointed out in his paper "*Increasing returns, monopolistic competition and international trade"* in 1979, that the type of market structure which gives rise to advantages within firms and markets is unlikely to be that of perfect competition. Krugman (1979:473) said:" …we need to focus less on the endowments of nations, and more on the behaviour of firms in different market situations."

Furthermore, traditional-and modern trade theory as a rule explain why countries may trade in different products, but do not explain why some countries' trade links are stronger than others and why the level of trade between countries tends to increase over time. This emphasizes the limited applicability of trade theory in explaining the size of trade flows (Paas, 2000:14). Therefore, while trade theory can explain why trade occurs, it cannot explain the extent of trade, whereas the gravity model allows for more factors to be taken into account to explain the extent of trade as an aspect of international trade flows.

Although comparative advantage is a generally accepted theory of trade, it has suffered empirical problems. Investigations into real world trading patterns have produced a number of results that do not match the expectations of comparative advantage theories. Elhanan Helpman (1981) and Paul Krugman (1980) asserted that the theory behind comparative advantage does not predict the relationships in the gravity model.

2.3.2 New trade theory and agriculture

Agriculture has traditionally been characterized as a purely competitive market. A large number of farmers produce and sell a commodity, thus individual farmers are price takers and

have no influence on the market and this is evident in the deciduous fruit industry (Kennedy & Koo, 2005:58; Hurndall, 2005). Given this industry structure, the traditional trade theories discussed in the previous section assumed pure competition and constant returns to scale. As agriculture has developed, structural changes have occurred in the industry that makes many of the traditional trade theories' assumptions unrealistic and questionable. Agribusiness now plays a much larger role in the industry. As a result, assumptions regarding pure competition may be too restrictive (Kennedy & Koo, 2005:59).

There has been a recent move to relax several of these traditional trade theory assumptions, allowing for imperfect competition, economies of scale and other characteristics that are more consistent with real world trade patterns (Grossman & Rogoff, 1995). Furthermore, it was economist Paul Krugman who pioneered the field known as *New Trade Theory* (Kennedy & Koo, 2005:58). Neoclassical trade theory considers differences such as resource endowments, technology and preferences as the reason for countries to trade. These differences determine the comparative advantage between countries.

In addition, the role of distance in determining the pattern and direction of trade is essentially a topic of economic geography models (the gravity trade model(s)), which incorporates some of the assumptions of the new trade theories (Paas, 2000). These models are concerned with issues of localization of firms and industrial concentration as Krugman (1979 and 1980) explained. According to Krugman's new trade theory, there are two fundamental forces guiding the location of the firm: 1) economies of scale at the factory level and 2) trade costs.

Pugel (2012:133) describes his view of international trade as follows: "As international trade is increasingly liberalized, industries of comparative advantage are expected to expand, while those of comparative disadvantage are expected to shrink, leading to an uneven spatial distribution of the corresponding economic activities".

In other words, within the very same industry, some firms are not able to cope with international competition while others thrive. This can also be true for agricultural producers from developing and least developing countries (LDC's) that are in the same industry, who cannot cope with competition from developed countries for the same product in the same market.

Melitz (2003:1720) argued that the resulting intra-industry reallocations of market shares and productive resources are much more pronounced than inter-industry reallocations driven by comparative advantage. Following the revolution of the new trade theory, the home market

effect, as well as the Linder hypothesis, also plays an important role in international trade. This will be explained in the following sub-sections.

2.3.3 The home market effect

A key aspect of the economies of scale or increasing returns trade theory is the so-called home market effect, which, according to Carbaugh (2008:85), is that "countries will specialize in products that have a large domestic demand". The home market effect was first proposed by Corden (1970) in his paper "*A note on economies of scale, the size of the domestic market and the pattern of trade*" and was later developed by Paul Krugman in 1980 in his article "*Scale economies, product differentiation, and the pattern of trade"*, Krugman sought to provide an alternative to the Linder hypothesis[8] and he found that the home market effect confirms Linder's sentiment i.e. that a nation's demand is a base for its exports, but does not support Linder's claim that differences in countries' preferences inhibit trade.

Grossman and Rogoff (1995) stated that the home market effect is a hypothesized concentration of certain industries in large markets and so it became part of the New Trade Theory. Through trade theory, the home market effect is derived from models with returns to scale and transportation costs. In other words, when it is cheaper for an industry to operate in a single country because of returns to scale and transportation cost, an industry will base itself in the country or close to its largest market where most of its products are consumed in order to minimize transportation costs while still taking advantage of economies of scale (Grossman & Rogoff, 1995; Carbaugh, 2008). This implies that the home market effect, to some extent, can explain the distance variable in gravity trade models because transportation cost is directly associated with the distance between the trading partners.

According to Hanson and Xiang (2002), the home-market effect is "the tendency for large countries to be net exporters of goods with high transport costs and strong scale economies". Siliverstovs and Schumacher (2007) stated that the home market effect is an important common feature of economic geography models (i.e. gravity trade models), as Hanson and Xiang (2002) also mentioned. There are potential challenges in using a gravity trade model to identify home-market effects, but these difficulties are beyond the scope of this paper. Since both the Ricardian and Heckscher-Ohlin theories are supply-side explanations of trade, the next section

[8] The Linder hypothesis (patterns of demand) will be discussed in more detail in sub-section 2.3.4.

consider the Linder hypothesis, according to which demand conditions are the more important determinants of trade flows.

2.3.4 Patterns of demand

The Swedish economist Staffan Burenstam Linder was the first economist of modern times to stress the importance of demand as opposed to supply conditions in determining the pattern of trade between countries (Haq & Meilke, 2011; Ingham, 2010).

The Linder hypothesis presents a demand-based theory of trade in contrast to the usual supply-based theories involving factor endowments (Ingham, 2010). Linder hypothesized that nations with similar demands would develop similar industries. These nations would then trade with each other in similar, but differentiated goods. Thus, the more similar the demand structures of countries are, the more they will trade with one another. According to Jian (2011) and Ingham (2010:32) the Linder hypothesis has been criticised and is referred to as an "economic conjecture" about international trade patterns.

Haq and Meilke (2011) further argued that international trade will still occur between two countries having identical preferences and factor endowments (relying on specialization to create a comparative advantage in the production of differentiated goods between the two nations). However, Haq and Meilke (2011) also retained the factor proportions approach to explain trade in primary products, but stressed that manufacturing goods is a different matter altogether. The implication of the Linder model is that international trade in manufacturing goods will be much stronger between countries with similar per capita income levels. This is because the per capita income level of the country will yield a particular pattern of taste and, therefore demands (Ingham, 2010:58). Here, according to Linder (1960), domestic demand is the key explanatory variable. In other words, a farmer is encouraged to produce a particular commodity because it perceives a significant domestic market. The same holds for apple producers in South Africa producing specific cultivars because of the significant domestic and international demand thereof.

According to Fajgelbaum *et al.* (2011), the Linder model was not expressed in formal terms, but instead just a compelling story about which goods enter into a country's trade and with whom the goods are traded. Fajgelbaum *et al.* (2011) tested the informal Linder model and found that the model tended to follow the hypothesis that differences in per capita incomes will lower the intensity of trade. This is, of course, the opposite of the famous Heckcher-Ohlin

model which implies that different per capita incomes are likely to have different resource endowments and offer a different basket of goods to their trading partners.

Using the gravity model, countries with similar levels of income have been shown to trade more. Helpman (1981) and Krugman (1980) see this as evidence that these countries are trading in differentiated goods because of their similarities. Alan Deardorff (1998) adds the possibility that, while not immediately apparent, the basic gravity model can be derived from the Heckscher-Ohlin, as well as the Linder and Helpman-Krugman hypotheses (1985). Deardorff (1998) concludes that, "*considering how many models can be tied to the gravity model equation, it is not useful for evaluating the empirical validity of theories*."

To conclude the Linder model, it seems that trade may be very intensive between countries with similar levels of per capita incomes, but according to Ingham (2010:33), international trade can often be explained simply by the fact that the countries are near neighbours and hence have lower transport cost, or that they are members of the same trade bloc, both of which can be responsible for the growth of trade between them. Therefore, it can be very difficult to disentangle the effects of demand on the patterns of trade. The next section will highlight the theoretical definitions of NTB's.

2.4 Non-tariff measures versus Non-tariff barriers (NTB's)

There are various robust definitions for tariffs and NTB's in a wide spectrum of literature. Non-Tariff Measures (NTM's) and Non-Tariff Barriers (NTB's) can generally be understood as any measures, interventions or prevailing conditions, other than tariffs, which distort or restrict the trade in goods, services and factors of production (Sandrey *et al*., 2008:2). According to Beghin and Bureau (2001:3), it is important to distinguish between an NTB and NTM because their primary intention and effect on international trade differ and are sometimes misleading. Gourdon and Nicita (2013) found that NTM's are incorrectly referred to as NTB's and reasoned that the cause of this confusion might be that most NTM's (in the past) were in the form of quota or voluntary export restraints and these measures are restrictive and protectionist by design.

Furthermore, according to Gourdon and Nicita (2013) NTB's are now generally used to describe NTM's which are discriminating, protectionist and trade restrictive. NTB's arise from different NTM's imposed by governments and authorities in the form of government laws, regulations, policies, conditions, restrictions or specific requirements and private sector

business practices, or prohibitions that protect the domestic industries from foreign competition.

The United Nations Conference on Trade and Development (UNCTAD) provides a type of classification and definition of NTM's. According to this definition, NTM's are generally defined as "policy measures other than ordinary customs tariffs that can potentially have an economic effect on international trade in goods, changing quantities traded, or prices or both." (UNCTAD, 2012:1). According to Van Tongeren *et al*. (2009), it is evident that the primary intention of imposing NTM's is to protect humans, animals and plants within the importing country from disease and chemicals entering via the imported products and ensuring national welfare by correcting market failures and imperfections affecting consumers and producers. These market failures and imperfections refer to imperfect information[9] and negative externalities[10] related to food safety and disease outbreaks (Van Tongeren *et al*., 2009). Many technical measures may restrict trade but improve welfare through the reduction of negative externalities, for example through reducing the risk of importing pests or diseases or informational asymmetries through packaging and labelling of fruit which provide certain details to the consumers about the imported product (Van Tongeren *et al*., 2009). Thus, non-protectionist NTM's can enhance, facilitate and expand trade as consumers receive important product information which can also enhance the characteristics of these products in the market and in turn create increasing demand thereof. However, the excessive usage of NTM's can significantly restrict trade and turn into NTB's.

2.4.1 Possible non-tariff barriers inhibiting exports

As mentioned before NTM's are regulations imposed by governments of different countries to protect their domestic industries. When these measures are trade restricting they become known as trade barriers i.e. NTB's. NTM's include all measures other than tariffs; the effect of which is to significantly alter trade. The impact of NTM's on trade has become a burning issue in international trade, acquiring vast attention among trade researchers in the recent past who attempted to quantify the effect of NTB's on international trade.

[9] Imperfect information is a situation in which the parties to a transaction have different information, for example the sellers (exporter) of fresh apples have more information about its quality, size, cultivar and source of origin than the buyer of the fruit.
[10] Negative externality in this case refers to the external cost incurred by the third party.

It is important to note that various NTB's comprise a wide range of specific measures, many of whose direct effects are not easily measured (Coughlin & Wood, 1989). Beghin and Li (2012:57) highlighted that the quantification, aggregation and delineation of NTB's are very complex and an important issue in the analysis of the potential effect of NTB's on international trade. It is evident in various empirical studies of NTB's that many of these studies involve the quantification and aggregation of several policies implemented by countries and/or regions (Beghin & Marette, 2010; Beghin & Li, 2012; Beghin & Xiong, 2012; DeMaria & Drogué, 2010 and Wilson & Otsuki, 2004).

Beghin and Li (2012:57) refer to an example of the Multi-Agency Support Team (MAST) of international organizations established by the Secretary General of UNCTAD in 2006 who proposed a type of classification methodology or nomenclature for NTB's. According to Kirsten and Kalaba (2012:7-8) this nomenclature has the same logical structure and is almost similar to harmonised system (HS) codes which were defined by the World Customs Organisation (WCO) for the classification of products.

Table 2.1 depicts the hierarchical structure of the UNCTAD (2013) classification of NTM's which is categorized into chapters, each depending on their respective scope of design. The classification of 16 aggregated groups (chapters A to P) is labelled in alphabetical order. The chapters are then further differentiated into several subgroups to allow a finer classification of the regulations affecting trade (UNCTAD, 2013:2).

Furthermore, these NTM's can be qualitative or quantitative in nature which makes the analysis thereof very complex (Beghin & Li, 2012). For example, qualitative requirements and standards such as the labelling and packaging of fruit have no numerical value which can be used in analysing the potential impact of imposing these standards on international trade. Beghin and Li (2012:57) stated that "qualitative policies (NTB's) affect different components of cost of production and marketing and cannot be easily aggregated into a single price equivalent." Thus, the Achilles heel of NTB analysis is that the majority of them are of a qualitative nature.

Various empirical studies use independent dummy variables in econometric models such as that of the gravity trade model to indicate the existence of NTB's, but the interpretation of the coefficients can be biased in some cases (Begin & Bureau, 2001; Trabelsi, 2013; Van Bergeijk & Brakman, 2010; Xiong, 2012; Beghin & Chengyan, 2009; Sirisupluxana & Singhapreecha, 2012 and Johnson, 2014).

Table 2.1 Non-tariff measure classification

Imports	Technical measures	**A** SANITARY AND PHYTOSANITARY MEASURES **B** TECHNICAL BARRIERS TO TRADE **C** PRE-SHIPMENT INSPECTION AND OTHER FORMALITIES
	Non technical measures	**D** CONTINGENT TRADE-PROTECTIVE MEASURES **E** NON-AUTOMATIC LICENSING, QUOTAS, PROHIBITIONS AND QUANTITY-CONTROL MEASURES OTHER THAN FOR SPS OR TBT REASONS **F** PRICE-CONTROL MEASURES, INCLUDING ADDITIONAL TAXES AND CHARGES **G** FINANCE MEASURES **H** MEASURES AFFECTING COMPETITION **I** TRADE-RELATED INVESTMENT MEASURES **J** DISTRIBUTION RESTRICTIONS **K** RESTRICTIONS ON POST-SALES SERVICES **L** SUBSIDIES (EXCLUDING EXPORT SUBSIDIES UNDER P7) **M** GOVERNMENT PROCUREMENT RESTRICTIONS **N** INTELLECTUAL PROPERTY **O** RULES OF ORIGIN
	Exports	**P** EXPORT-RELATED MEASURES

Source: UNCTAD, 2013

Beghin and Li (2012:58) highlighted that a single disaggregated NTB or NTM has a limited application as in real life a myriad of NTB's or NTM's together will have a robust effect on a specific product or market. Thus, using only a single NTB or NTM may lead to a selection bias and mischaracterization of a set of NTB's or NTM's on the regulation of a specific market of interest. In addition, Beghin and Li (2012:58) argued that a single NTB or NTM will not and is not exhaustive and may not be representative, even if there is no subjective selection bias. New NTB's are being erected to replace the role of tariffs in protecting markets thus, NTBs are significant as they are restricting trade flows and increasing transaction cost[11] (Deardorff, 2012).

[11] Transaction cost is a cost incurred in making an economic exchange. A number of different kinds of transaction costs exist.

Deardorff (2012) identified three categories of NTB's:

- Protectionist Policies

  These NTB's are used by countries to protect their domestic producers and industries at the expense of those in other countries. NTB's that serve this purpose include: import quotas, local content requirements, public requirements, domestic subsidies to exporters and administrative barriers which has a very similar economic effect compared to tariffs.

- Assistance Policies

  The aim is to help domestic producers and industries, but not explicitly at the expense or foreign counterparts. Domestic subsidies to exporters and anti-dumping tariffs fit this description.

- Non-protectionist Policies

  These NTB's are not meant to help or protect domestic producers or industries, instead they have distinct purposes, such as Sanitary and Phytosanitary (SPS) measures e.g. maximum residue limits (MRL's) allowed on apples from the use of certain pesticides and herbicides by producers. This category also includes technical barriers to trade (TBT) e.g. packaging requirements for fresh apples and for certain cultivars, which in turn affects foreign exporters (in this case South Africa). In terms of international fruit trade, non-protectionist policies are seen as the most widely implemented NTB's (Deardorff, 2012). The next two sub-sections will focus on TBT and SPS requirements from an apple industry perspective.

As previously mentioned, NTM's which ultimately result in NTB's vary considerably in terms of the implementation by country to country and on the product which is being traded. It is also observed that NTB's tend to change over time and that several types of NTB's for the same product are being implemented by countries. Therefore, it is very difficult to pinpoint which specific NTB's are implemented on one particular commodity or product (in this case fresh apples). If the characteristic of a certain non-tariff barrier implemented by a country covers a wide range of products in a so-called *blanket manner* (Tralac, 2010), it is very difficult to argue the effect it will have on fresh apples *per se*. Table 2.2 below depicts a wide range of possible NTB's that have a trade-restricting effect on fresh apples traded.

Table 2.2: Non-tariff barriers with a potential effect on apple trade

• Import bans • General or product-specific quotas • Complex/discriminatory Rules of Origin • Quality conditions imposed by the importing country on the exporting countries • Unjustified Sanitary and Phyto-sanitary conditions • Unreasonable/unjustified packaging, labelling, product standards • Complex regulatory environment • Determination of eligibility of an exporting country by the importing country • Determination of eligibility of an exporting establishment (firm, company) by the importing country. • Additional trade documents such as Certificate of Origin, Certificate of Authenticity etc.	• Occupational safety and health regulation • Import licenses • State subsidies, procurement, trading, state ownership • Export subsidies • Fixation of a minimum import price • Product classification • Quota shares • Multiplicity and Controls of Foreign exchange market • Inadequate infrastructure • "Buy national" policy • Over-valued currency • Restrictive licenses • Seasonal import regimes • Corrupt and/or lengthy customs procedures • Producer and company audits like; *Global Gap, British Retail Consortium (BRC), Natures' Choice*

Source: Trade Mark Southern Africa (TMSA), 2014

Information about the numerous NTM's or NTB's implemented by the specific countries used in this study tends to not be readily available. More specific NTM's implemented by the United Kingdom, Hong Kong (China), Malaysia and Singapore respectively on fresh apple imports, can be seen in Appendix A. From the afore-mentioned tables (A3 –A5) it is evident that the United Kingdom, which represents the EU, imposes far more SPS measures and TBT compared to the Far East i.e. Hong Kong, Malaysia and Singapore.

2.4.2 Technical Barriers to Trade (TBT)

In recent years technical barriers to trade (TBT) have become increasingly significant because the implementation thereof is trade-restrictive. TBT comprise of technical regulations and standards to be met by products before these products can be exported to a specific country or region (Sandrey *et al.*, 2008). TBT measures are aimed to address technical characteristics of

products. Examples of TBT include: SPS measures, health and safety regulations relating to human, animal and plant welfare, quality standards, technical regulations, packaging requirements, inspection procedures and other marketing and labelling requirements (Sandrey *et al*., 2008). TBT imposed by a country (e.g. the EU) depend on the nature of the product exported by a country (e.g. South Africa into the EU).

For example, South African apple producers and exporters generally export to retailers and demand-specific consumers, especially within the EU, where labelling, product standards, SPS measures (specifically MRL's), as well as barriers related to certifications[12], registrations and testing procedures, are considered as the most crucial restrictions to trade. Overall, SPS and TBT measures comprise of a vast collection of divergent standards and requirements which countries use to regulate markets, correct market failures and protect their domestic consumers and animals. These measures also act to preserve natural resources. However they are often used by developed countries such as the EU to discriminate against imports in favour of domestic products from domestic producers (Johnson, 2014; Tralac, 2010).

In the case of using these measures as NTB's, it will definitely result in additional costs to importers and exporters. According to Bao and Qiu (2009), TBT are considered to be one of the most difficult NTB's imaginable to quantify, due to the theoretical complexity and data paucity. Furthermore, it can be very difficult to assess the economic impact of these negative externalities which can arise from unregulated trade, because the imposed measure can be a form of protectionism if its aim is to address and correct such externality (Tralac, 2010). According to Tralac (2010:13), a method to determine if a specific measure is a form of protectionism, is to examine if the standards and regulations of imported products are indeed the same as those to which the domestic products need to adhere. Beghin and Bureau (2001) suggested using a cost-benefit[13] analysis to establish whether or not regulations (NTB's) are indeed legitimate. Thus, if it is found that the imposed measures are not discriminating against imported products, the presumption is then made that these measures are not imposed for protectionism and will not restrict trade.

[12] GLOBALGAP (formerly known as the EUREPGAP) is a private sector body that sets voluntary certification standards and procedures for good agricultural practices. It was originally created by a group of the European Supermarket chains. Producers need this certification in order to export their produce.
[13] Authors Beghin and Bureau (2001) suggested this method which was developed by Neven (2000). For details about the methodology please refer to Neven (2000).

Moreover, the effect of these "new" generation NTB's such as SPS and TBT on the exports from developing and least developed countries (LDC)[14] such as South Africa, other African countries, the FE and ME, is of great concern (Tralac, 2010). These LDC and developing countries are relatively poor and rely heavily on exports of a limited range of commodities. Such unregulated NTB's hamper these countries' ability to export, which in turn has a severe negative impact on their economies, as well as competiveness within the market (Tralac, 2010; Johnson, 2014). Gourdon and Nicita (2013) indicated that the compliance costs of SPS measures and TBT are often higher for low-income and developing countries because their infrastructure, knowledge and export services are more expensive and, in practice, these compliance costs may erode and alter the competitive advantage which these countries have in terms of labour cost and preferential market access. Steele (2012), the Secretary-General for the International Organization for Standardization, stated in his article that: "Considering the growing emphasis on trade as a means to underpin economic development, especially in developing and least developing countries, there is an urgent and crucial need to address the issue of standards and technical regulations to allow countries to participate effectively in the multilateral trading system".

According to the Tralac report (2010) developing countries often find it difficult to comply with stringent TBT and other regulations and standards, especially in agricultural-food products, in which many developing countries have a comparative advantage. One main reason for this is the lack of resources and capabilities these type of countries face. It is too costly for some developing countries to investigate and challenge the imposed NTB's which do not comply with the WTO rules on these measures (Tralac, 2010).

The Tralac report (2010) came to the conclusion that the economic impact of NTB's still needs a lot of attention as the current empirical and conceptual knowledge thereof remains somewhat "sketchy". The lack of common methodologies, adequate data and up-to-date information (especially on per country per product level), still hampers the complete knowledge and impact investigations on these country-and-product-specific NTB's. Unlike tariffs, NTM's and NTB's are often regulatory; with no immediate number attached to them that captures their economic significance on trade or welfare.

[14] According to the United Nations (UN), a Least Developed Country (LDC) is a country that exhibits the lowest indicators of socio-economic development and human development index ratings of all the countries in the world (UN, 2014)

Furthermore, according to the World Trade Report (2012:136) economic theory offers a mixed picture (both negative and positive) on how TBT affect the volume and direction of trade which is the rationale for focusing on these NTB's, independent of their policy objectives. Putting this into perspective, consider for example, TBT such as labelling requirements and SPS measures i.e. Maximum Residue Limits (MRL's) can raise producer costs because the compliance cost is now more expensive for the producer of fresh apples. This reduces consumer cost because product quality information is more readily available. Thus, trade is expected to increase or decrease depending on whether the positive effect on demand is greater than the negative effect on supply (World Trade Report, 2012:136).

It is important to note that there is a difference between technical regulations and technical standards. Producers and exporters need to be aware of this difference, as it has a significant and different effect on the trade of products to various countries and will also lower the compliance cost for future trade. According to WTO (2014c) "compliance" is the main difference between technical regulations and technical standards. Moreover, technical regulations by their nature are mandatory, while technical standards are voluntary (WTO, 2014c).

To put this difference into perspective, suppose apples exported by South Africa to e.g. the EU are not 'complying' with the *technical standards* of various supermarkets, it will still be able to enter the EU market, but it will not be according to consumer preferences. These consumer preferences such as the fruit size, shape, packaging or cosmetic appearance will in turn result in a decreasing demand for South African apples and thus a decrease in the EU market share. Moreover, if apples exported from South Africa do not comply with the *technical regulations* set by the European Commission such as that of Maximum Residue Limits (MRL's), specific labelling or certification of origin, the apples will not be able to enter the EU or even leave the pack house in South Africa. This will result in major losses faced by producers and exporters.

2.4.3 Sanitary and Phytosanitary measures (SPS) as a non-tariff barrier

Traditionally, fruit quality has been the accepted norm and one of the main concerns in international trade. However, food safety has become an increasingly important public health and consumer safety issue and also a critical priority for governments on a global scale, especially within the fresh produce industry (Hurndall, 2005). Therefore governments world-wide are intensifying their regulations to improve food safety control (WHO, 2014).

Furthermore, Hurndall (2005:113) stated that "the importance of food safety requirements within the South African fruit industry and the demand for the production of safe fresh fruit products of high quality, satisfying consumer expectations and meeting local and international market requirements, is more critical today than ever before."

According to the WTO (2014a) traded agricultural products need to be safe, and should not pose a risk to human, plant and animal health, as this is one of the fundamental requirements for international trade. In order to ensure food safety and to protect the environment, countries world-wide impose *sanitary measures* to protect human and animal health and *phytosanitary measures* to protect plant health (WTO, 2014a). The basic rules for food safety and animal and plant health standards, as well as the application thereof, is set out in the "*Agreement on the Application of Sanitary and Phytosanitary Measures*" (the "SPS Agreement") with its commencement after the establishment of the WTO on 1 January 1995 (WTO, 2014a).

According to the Annex A[15] definition of the WTO (2014a) a sanitary or phytosanitary measure (SPS) is any measure applied within the territory of the member of the WTO to protect animal or plant life or health from:

i) risks arising from the entry, establishment or spread of pests, diseases, disease-carrying organisms or disease-causing organisms;
ii) risks arising from additives, contaminants, toxins or disease-causing organisms in foods, beverages or feedstuffs;
iii) damages to a country, resulting from the entry, establishment or spread of pests and also to prevent or limit these damages.

In other words, SPS measures are any laws, regulations, procedures or standards which government bodies use to protect human, animal or plant life or health from the spread of pests, disease or disease carrying and - causing organisms resulting from the trade in agricultural products (Johnson, 2014;WTO, 2014a). Furthermore, Johnson (2014:1-2) provides examples of SPS measures which include:

- Mandating a specific postharvest treatment and mitigation requirements e.g. chemical, fumigation and quarantine treatments;

[15] For more detailed information on Annex A please see WTO Agreement on Sanitary and Phytosanitary measures from the WTO (2014a).
website:http://www.wto.org/english/tratop_e/sps_e/sps_agreement_cbt_e/c1s3p1_e.htm

- Maximum Residue Limits (MRL's) for pesticide, herbicide and insecticide residues allowable on fruit;
- Product and processing specifications and restrictions on the use of certain chemicals and materials;
- Various overlapping technical requirements e.g. labelling standards directly related to food safety, land-use practices and the use of third-party private standard auditors' certifications such as GlobalGap, Natures Choice, Field to Fork, British Retail Consortium (BRC) and Supplier Ethical Data Exchange (Sedex) to name a few.

It is evident in the literature that SPS- and TBT measures are being widely implemented by governments around the world and these measures are seen by their nature to restrict international trade and protect domestic producers from economic competition. Thus it is of utmost importance for exporters and producers to clearly understand the impact these measures have on their industry and also to clearly identify if a measure is a SPS or TBT. The WTO (2014a) provided a framework (see figure 2.1 below) to try and identify and establish which agreement the imposed measure is related to, in order to clarify the possible reason(s) of its implementation. Producers and exporters are often kindly forced to make costly changes to their production practices or marketing in order to comply with SPS measures and TBT regulations and standards (Johnson, 2014:33). The cost of compliance can in some cases be rather contradicting.

On the one hand, this compliance cost could result in higher production cost per unit which can result in the loss of economies of scale for small to medium production units or ultimately in total economic loss of a potential exporting market, especially in the case of developing countries (Henson and Loader, 2001; Johnson, 2014). On the other hand, this cost of compliance can be seen as a positive cost in order to protect the safety and integrity of domestic and imported food supplies worldwide (Johnson, 2014).

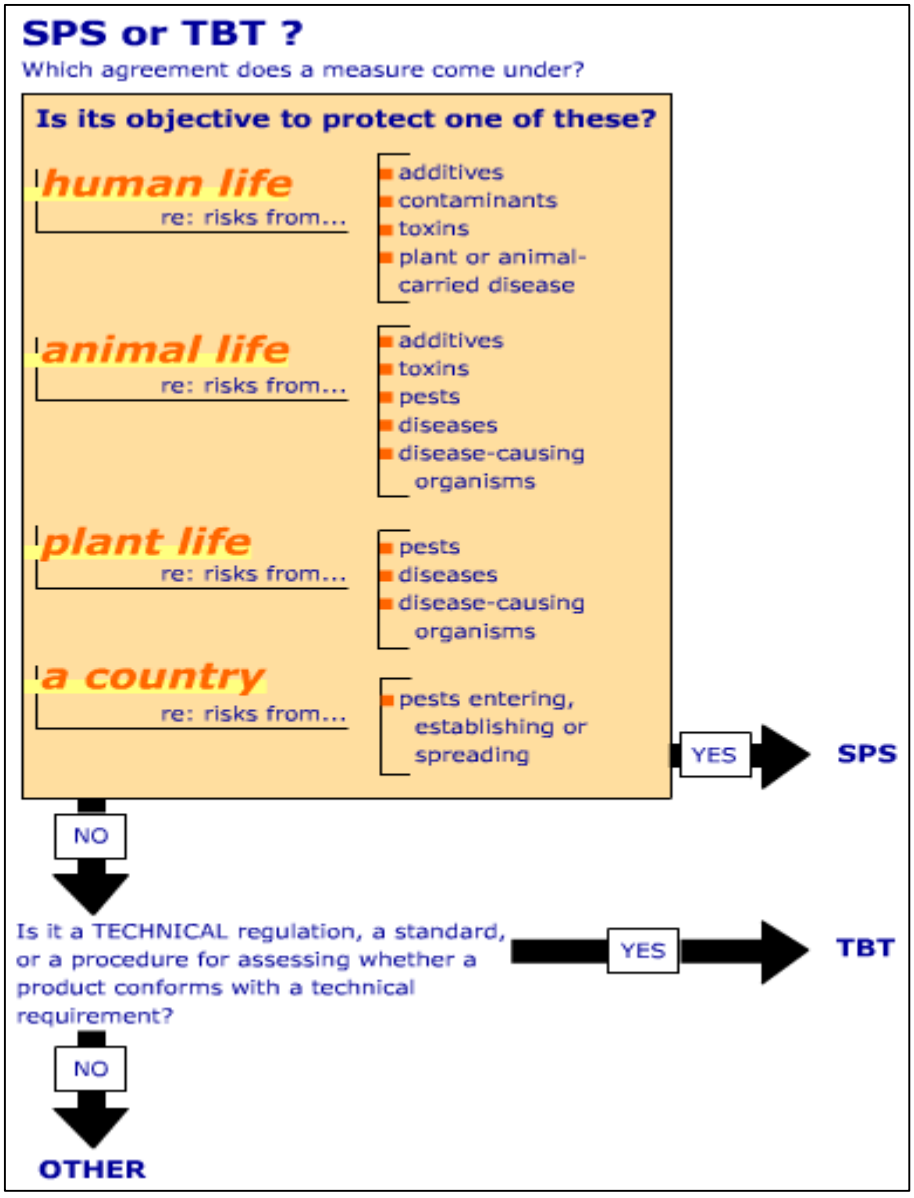


Figure 2.1: Identification of the type of measure used

Source: World Trade Organization (WTO), 2014

Moreover, according to a study done by the Disdier *et al*. (2008), from the International Centre for Trade and Sustainable Development (ICTSD), the cost of compliance to SPS and TBT measures can help improve domestic producer's competitiveness in international markets and they found that "practices and inputs demanded by certifiers created safer working conditions and also increased productivity and company discipline."

Disdier *et al*. (2008:101) also came to the conclusion that the potential positive effects of SPS and TBT measures and the cost associated with the compliance thereof, could partly explain why producers in exporting countries try to fulfil these standards and regulations, also

suggesting that national governments and international organizations should encourage farmers and exporters to implement public and private standards such as SPS and TBT measures. The next section will discuss the Maximum Residue Limits (MRL's) as a possible NTB, which are considered one of the main SPS measures in the apple industry.

2.4.4 Maximum Residue Limits (MRL's) as a non-tariff barrier

Maximum Residue Limits[16] (MRL's) are used on a global scale to regulate the application of pesticides in plant products such as fresh fruit and veterinary drugs in animal products (Beghin & Xiong, 2012:2). Various studies have been and are still being conducted in order to establish how global food safety standards affect international trade (DeMaria & Drogué, 2010:2; Beghin & Xiong, 2012; Farnsworth, 2012; Wilson & Otsuki, 2004; Moenius, 2006). Wilson and Otsuki (2004) defined a MRL as "an index which represents the maximum concentration of a pesticide residue (expressed as mg/kg) legally permitted in food commodities and animal feeds." Farnsworth (2012) also defines MRL's as "the maximum amount of pesticide residue in parts per million (ppm) which a country or region permits on a specific agricultural commodity." Furthermore, MRL's are based on Good Agricultural Practice (GAP[17]) in the use of pesticides. Foods derived from commodities that comply with the respective MRL's are intended to be toxicologically acceptable (Codex, 2014).

Farnsworth (2012:3) stated in his article that: "in practice, the Codex acts merely as a guide and most countries have set up their own specific MRL's and are indeed citing scientific evidence." According to the study done by Farnsworth (2012), only 25 out of the 73 countries in his study had MRL's identical to that of the Codex guideline. This is a good indication that various countries typically set their respective MRL's much stricter (higher) than that of the

[16] The maximum residue tolerances or limits for commodities being exported to other countries were established by the Codex Alimentarius Commission (CAC). Since 1st September 2008, MRLs are now established by an independent scientific authority at the EU level.(Codex, 2014)

[17] "GAP" includes the nationally authorised safe use of pesticides under actual conditions necessary for effective and reliable pest control. It encompasses a range of levels of pesticide applications up to the highest authorised use, applied in a manner which leaves a residue which is the smallest amount practicable. Authorised safe uses are determined at the national level and include nationally registered or recommended uses, which take into account public and occupational health and environmental safety considerations. Actual conditions include any stage in the production, storage, transport, distribution and processing of food commodities and animal feed. For more detailed information go to http://www.codexalimentarius.net (Codex, 2014).

Codex guideline from which the EU is an example. According to the European Commission (EC) since 2 February 2014 the EU significantly reduced the MRL for a pesticide *diphenylamine* (commonly known as DPA) which is used to prevent *superficial scalding*[18] of deciduous fruit held in cold storage (Agritrade, 2014). DPA is a plant regulator which is applied to apples and pears after harvest to manage *superficial scalding*, which is the most important postharvest chilling injury affecting the quality of the main pome fruits. It develops in the fruit after a prolonged storage period at low temperatures, thus limiting the time the fruit can be conserved (Agri-pulse, 2013; Freshplaza, 2014). The DPA residue limit for the EU was reduced from 5 milligrams per kilogram for apples to 0.1 milligram per kilogram as a traditional measure. From July 2015 DPA will no longer be allowed through the EU borders (Agritrade, 2014).

This MRL restriction will lead to severe economic losses to apple exporters in South Africa as the EU was South Africa's largest traditional apple market up until 2010. Exporters and producers are already bolstering exports to the FE, ME and African markets because of these strict MRL regulations. Berghin and Marette (2010:180) argued that the limited access to capital in terms of proper refrigeration for food safety, pesticide management tools, demanding certification processes, as well as absence of qualified labour lead to producers from developing countries not being able to meet the strict standards and requirements which producers from developed countries are able to meet.

The president of the New York Apple Association, Jim Allen, said that "a lot of the MRL levels in the EU are very difficult to meet and even if growers and packers do not use DPA, the risk of cross-contamination in areas where the apples have been treated is too great and poses an even greater risk of potential claims and losses resulting in even more financial losses." According to the European Crop Protection (ECP) (2014) an 18 kg boy would have to eat 534 apples every day of his life to exceed the DPA residue level that is not even dangerous to laboratory animals. Ward Dobbins, who owns U.S. Apple Sales in New York said that " it seem

[18] *Superficial scald* is a very common postharvest disorder especially in apples. The appearance and severity depends on the susceptibility of the variety, with Granny Smith and Red Delicious apple cultivars (Early Red One, Starking and Top Red) being among the worst affected. The skin of the affected fruit turns brown in patches, especially on the shaded side, and may become rough. Only the surface of the fruit is affected, with the flesh remaining firm and of eating quality. Browning develops rapidly once the fruit is moved from cold storage to room temperature. For more detailed information on this disorder please refer to the Washington State University website: http://entomology.tfrec.wsu.edu/Cullage_Site/Physiol_Sus.html

like every couple of years the EU come up with new MRL restrictions and not just by lowering them, but they are willing to pay a high premium for certain apples."

This is why, according to Agritrade (2014), there is continuous research underway into alternative methods of controlling superficial scald in apples and pears. One method according to Freshplaza (2014) is to "include the application of 1-methylcyclopropene or storing the fruit with low oxygen levels, or the combination of both technologies." Furthermore, Freshplaza (2014) stated none of these methods have been evaluated to eliminate DPA residues thus far. This poses some questions as to why some MRL's in the EU, such as that of DPA are so strict. Or is it the case that some countries, especially the EU, are using this MRL standard to protect their agricultural industries, discriminating against potential exporters of deciduous fruits?

According to the Northwestern Horticultural Council (NHC, 2014), another important chemical (MRL) imposed specifically by the EU is that of antimicrobials/cleaning agents namely disinfectants such as benzalkonium chloride (BAC) and didecylmethylammonium chloride (DDAC) which are commonly known as quaternary ammonium compounds (or quats) (NHC, 2014). According to the European Commission's Standing Committee of the Food Chain and Animal Health (ECSCoFCAH), the EU found traces of quats on fruits and vegetables from various origins, which the deciduous fruit industry uses to disinfect their packing lines in their pack houses and also determined that "the residues of BAC and DDAC would be allowed at an enforcement level of 0.5 ppm (NHC, 2014).

DeMaria and Drogué (2010) argued that producers would cope with the cost of complying and maintaining low and acceptable residue levels, given that the specific country already imposes strict domestic tolerance levels on pesticides, herbicides and fungicides, which in turn enable them to comply with the stringent requisites of importers. However, this is not always possible if producers struggle to manage adverse pest and diseases before harvest.

2.4.4.1 Maximum Residue Limits (MRL's) within international trade

The issue of stringent MRL's on agricultural foodstuff and the possible impact it has on trade has been investigated in various international trade literature (Beghin & Li, 2012; Beghin & Xiong, 2012; Beghin & Marette, 2010; Moenius, 2006; Otsuki *et al*., 2001; Otsuki & Wilson, 2001). Wilson and Otsuki (2004) have examined the trade impact of MRL's especially the

aflatoxin B1[19] MRL for 31 exporting and 15 importing countries, respectively. They used a fixed effects gravity trade model in their analysis, which estimates the elasticity of bilateral trade flows for cereals and nuts. They came to the conclusion that specific MRL's, such as the MRL of aflatoxin B1 imposed by importing countries, is trade restrictive and that harmonization and relaxation of such MRL's could most probably increase the value of trade in cereals and nuts by US$ 6.1 billion.

Wilson and Otsuki (2004) conducted another study on the impact of harmonization of the Chlorpyrifos-Methyl[20] (Chlorpyrifos) MRL on banana trade between 21 exporting countries and 11 importing countries, respectively. They also applied a gravity trade model with fixed effects and found that a 10% increase in the stringency of the Chlorpyrifos MRL between the respective countries would cause a 1.48% decrease in banana imports. This confirms that specific MRL's imposed by trading countries could have a negative impact on trade in the affected product (i.e. cereals, nuts and bananas in this case).

Furthermore, DeMaria and Drogué (2010) investigated the influence of MRL's of pesticides on the trade flow between 7 importers and 7 exporters of fresh apples and pears. They also assessed the impact of non-harmonization in regulations (MRL's) and how this will affect the trade in fresh apples and pears. The also made use of a gravity trade model and a similarity index based on the MRL of pesticides set by each country. They found that restrictive MRL's for apples and pears are trade diverting and that the impact is more significant than the impact of tariffs. Their results also suggest that harmonizing MRL regulations impacts trade differently depending on the exporter.

Farnsworth (2012:5) argued that many empirical studies rely on the theoretical model used by Fischer and Serra (2000) which basically states that "tighter regulations imply greater cost, but can be used to restrict foreign access to the market." Fischer and Serra (2000) argue that small domestic industries will most likely benefit from tighter regulations because larger exporters will be more likely to avoid small markets with expensive compliance costs. The findings of the theoretical model used by Fischer and Serra (2000) indicate that countries with a relatively

[19] Aflatoxin B1 is a fungus which is most commonly found in foodstuff originating especially in areas with hot and humid climates. It can also occur in foods, such as groundnuts, tree-nuts, maize, rice, figs and other dried foods, spices and crude vegetable oils, and cocoa beans, as a result of fungal contamination before and after harvest (EFSA. 2014).
[20] Chlorpyrifos Methyl is an active substance in common agricultural insecticides for the treatment of sucking and chewing pests (EFSA, 2014).

small domestic industry and demand for a specific agricultural commodity, should receive substantial political pressure to impose restrictive MRL's.

2.4.5 Logistics and cold chain management as a non-tariff barrier

South African exporters are faced with logistical problems when exporting fresh apples to the EU, FE, ME and African markets. Problems such as long shipping times, port congestion, and costly cold chain[21] management may be seen as a major barrier to trade for South African fresh apple exporters. Furthermore, the exporter is faced with the risk of losing a potential shipment order to the market before it is even loaded (Sandrey *et al*., 2008). South African officials from institutions such as the Perishable Products Export Control Board (PPECB), which operate under a zero-tolerance approach, must certify all products and containers before they can be exported to e.g. the EU. They can reject the fruit (apples) after it has been packed or transported to the harbour even prior to loading (Sandrey *et al*., 2008:34).

Cold chain management ensures that perishable products such as apples are safe and of high quality at the point of consumption. Failure to maintain product quality leads to consumer dissatisfaction and in turn leads to lower demand, as well as excessive claims payable in foreign currency for specific cultivars in specific markets, especially supermarket chains within the EU. These claims usually occur when fruit arrives at the export destination in various forms and via various modes of transport, if there is for example a lack in quality, cosmetic defects (visual defects), bacterial infections e.g. fusi, and internal defects such as internal browning or the presence of insects e.g. the fruit fly or coddling moth.

The buyer of the fruit has two weeks or less to provide specific details on the reasons for their dissatisfaction and a technical report with should include pictures as proof to support the claim. The seller or exporter then has to reimburse the buyer. However, if the seller is not fully satisfied with the reason(s) for the claim, they can hire an independent surveyor on their behalf to conduct a proper study in order to establish legitimate reasons as to why such a claim is issued and who was responsible for the submission of the claim (Odendaal, 2014). These claims[22] are of major concern and have significant financial implications for producers and export companies in South Africa. In order for sellers (exporters) to insure themselves against

[21] Cold chain is referred to as the maintenance of the optimum storage temperature during the handling, transport and marketing of perishable produce i.e. fresh apples (Hurndall, 2005).
[22] The claims referred to here is that of buyers of fresh apples who want their money reimbursed because the specific shipment/order cannot be sold to consumers due to defects resulting from poor cold chain management.

such claims (which may often be unfair), they can sell their products *ex-works*[23] which places the maximum obligation on the buyer and minimum obligations on the seller. This can cover the exporter if, for some reason, the cold chain was not correctly maintained, or cross-contamination, handling errors or possible sabotage occurred.

According to Sandrey *et al*. (2008:34), "the South African deciduous fruit industry has faced increased globalisation of markets, trade liberalisation, deregulation, advances in technology, changes in consumer preferences, over-supply of deciduous fruit in South Africa's traditional markets (like the EU), and increased global competition."

Therefore, with global deciduous fruit markets becoming more competitive and the local industry being largely deregulated, producers and processors of apples are constantly challenged to position themselves as capable competitors in the global free trading market environment (Mashabela &Vink, 2008). It is important to note that a chain is only as strong as its weakest link. Interruptions in the cold chain management may occur as a result of the producers and pack houses who do not comply with the fruit harvesting and packing protocol, or as a result of the supermarkets' respective distribution centres' lack of basic cold chain management (Sandrey *et al*., 2008).

2.5 Methods to measure the effect of non-tariff barriers

As mentioned, tariff barriers have been substantially reduced in the recent past and according to Stern and Deardorff (2006:2): "There has been an increasing interest in the ways that certain non-tariff barriers may distort and restrict international trade especially trade in agricultural goods."

This does not come as a surprise; nevertheless, the political and economic forces that give rise to high tariffs do not disappear once tariffs are reduced (Carbaugh, 2008:148). Instead, countries and governments seek protection at their borders through additional channels other than tariffs of which NTB's play the main role (Carbaugh, 2008:148). The objective of this study is to determine the main factors, including NTB's, that explain the recent trends in South Africa's apple exports to the EU, Africa, FE and ME over a period of 13 years (2001-2013). Beghin and Bureau (2001:3) stated in their article that: "a comprehensive assessment on the

[23] *Ex-works* means that a buyer incurs the risks for transporting the goods to their final destination and is an incoterm rule or International Commercial Term (ICT), which is a series of pre-defined commercial terms used in international commercial transactions or procurement processes (OECD, 2014).

actual impact of these regulations (NTB's) is necessary to address the role to be given to non-tariff instruments and barriers in a future trade agreement."

Stern and Deardorff (2006) stated in their study that: "the calculation of a tariff equivalent of a given NTB for a given economic indicator is complex and requires a great deal of information." Furthermore, they found that measures that are equivalent for one indicator will not be so for others (Deardorff & Stern, 2006:2). In order to address the issues involving the use and impact of NTBs, Stern and Deardorff (2006:2) said that "it is self-evident that accurate and reliable measures are needed."

From the discussion in this chapter, it is clear that there are numerous factors that impede the trade of fresh apples. It is important to note that some NTB's are quantifiable with trade data and others are not. This chapter investigates some of these measures and certain NTB's such as sanitary, phytosanitary and technical barriers to trade with the gravity trade model. According to Beghin and Chengyan (2009:930), "a number of countries implement drastic measures to restrict trade products associated with a perceived or actual risk of transferring a pest or disease into their geography", such as with fresh fruits (i.e. apples in this case).

Economists and various international trade-related authors attempted to quantify the effect of different NTB's through the use of various methods (Calvin & Krishoff, 1997; Deardorff & Stern, 1998; Beghin & Bureau, 2001; Beghin, 2006; Mellado *et al.*, 2010; Kennedy & Koo, 2005; Van Bergeijk & Brakman, 2010; Trabelsi, 2013 and Johnson, 2014).

The trade effects of NTB's such as Sanitary and Phytosanitary (SPS) measures can be illustrated by figure 2.2 (below), a simple supply and demand graph for a two-country model with the assumption that the impact of the NTB can be quantified as a tariff equivalent that has an impact on price.

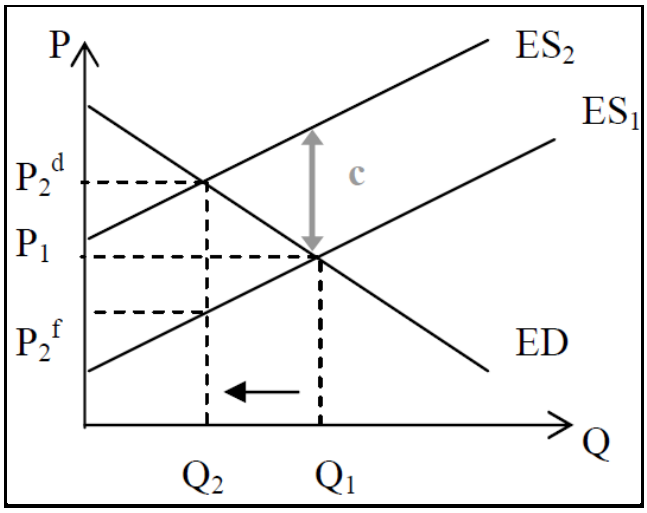


Figure 2.2: The impact of NTB's on price and quantity demanded

Source: Graph from Korinek *et al*., 2008.

It is important to note that the assumption is made that the EU (importing country) has the ability to influence the world market price of a ton of apples and is depicted by a negatively sloped import demand curve *ED*. The exporting country, in this case South Africa, takes up a positively sloped export supply curve *ES*. The free trade equilibrium occurs where the export supply curve, *ES* of South Africa and the import demand curve, *ED* of the EU, intersect where quantity Q_1 is traded at price P_1.

If the importing country such as the EU imposes a SPS regulation which is seen as a form of NTB that results in high compliance costs, *c*, for South African apple producers, the *ES* export supply curve shifts upwards from ES_1 to ES_2. Moreover, the compliance cost of this NTB imposed by the EU on South African apples would increase the exporters and producers' domestic cost and hence reduce the quantity supplied (traded) Q_1 *to* Q_2 by South Africa to the EU, *ceteris paribus*. According to Korinek *et al*. (2008:18) the compliance costs of the imposed SPS measure also constitute a "*price wedge*" between domestic and foreign apple prices P_{2^d} and P_{2^f} respectively. Furthermore this *price wedge* can be seen as a tariff equivalent of the imposed NTB. In other words the difference between P_{2^d} and P_{2^f}, which in turn results in a lower quantity of fresh apples traded between South Africa and the EU (Q_2) at a higher South African domestic price per ton of apples. This could also influence the competitiveness of South African apples in the EU market, because the compliance cost *c* in turn results in higher production cost. This increases the price per ton of apples traded, which gives the EU domestic economies competitive advantage relative to South Africa, because they do not need to incur

the same compliance cost as South Africa. This could also reduce South Africa's market share over the short and medium run, *ceteris paribus*.

Korinek *et al*. (2008) also highlighted that the size and influence of the tariff equivalent of the imposed NTB, is dependent on the elasticities of supply and demand curves, respectively. It is important to note that Deardorff and Stern (1998), as cited by Korinek *et al*. (2008:18), argue that the alternative way of measuring the tariff equivalent of an imposed NTB is calculated by estimating the difference between P_1 (equilibrium price or price without imposed NTB) and P_{2^d} (price resulting from the compliance of a NTB or presence of NTB's). However, Korinek *et al*. (2008) criticised Deardorff and Stern's (1998) method, because price P_1 is typically not observed in the real world and that data is not readily available. The calculation of such a price wedge is seen as biased and do not accurately capture the individual effect of certain NTB's.

Despite the critique by Korinek *et al*. (2008) on the method of calculating a price wedge, it is evident that overly stringent SPS regulations implemented by an importing country of fresh apples (which are seen as NTB's) do indeed result in higher compliance cost to producers and exporters of apples and in turn could result in restricting bilateral trade with South Africa or any other potential trading country.

Beghin and Bureau (2001:6) investigated various additional methods which have been and can still be used in the empirical estimation of the effect of NTB's on bilateral trade. However, they found that there is still a large "gap" between ambitious analytical frameworks and the applied estimates and most of the time the results are rather questionable (Beghin & Bureau, 2001). The following sections will discuss some of the methodologies which are widely used in the literature to measure the effect of NTB's on the trade of products.

2.5.1 The price wedge method

The first additional method investigated by Beghin and Bureau (2001:6) was the *"Price Wedge Method";* also referred to as the "quantity wedge method" (Mellado *et al*., 2010). The price wedge method is based on the estimation of the "quantities" or differences between the domestic and import prices caused by NTB's. In principle this method tries to measure the impact of NTB's on the domestic price of traded goods, in comparison to a reference price, which in turn is considered as the tariff rate equivalent of the NTB's imposed. In order to effectively use this method, one needs to provide a tariff equivalent of the specific NTB evaluated (Beghin & Bureau, 2001; Mellado *et al*., 2010). It was found that the estimate of the

price wedge, or in other words the tariff equivalent, can also be used as an input variable in a gravity trade model or even general equilibrium models, which in turn focus more on the welfare effects of various NTB's (Beghin & Bureau, 2001; Mellado *et al*., 2010).

According to Deardorff and Stern (1998) the tariff equivalent can be estimated by calculating the price wedge which is the difference between the price of the imported good and the price of a comparable product in the domestic market. In other words, one needs to compare the price prevailed without NTB's to the domestic price of a specific trade good in the presence of NTB's (if the price paid to the suppliers remains unchanged) (Deardorff & Stern, 1998). However, these prices are not likely to be measured or perceived, but according to Laird and Yeats (1990), adjustments can apparently be made by using trade quantities, as well as supply and demand elasticities of domestic and imported goods to retrieve prices without NTB's.

The unknown authors of the EU Commission (2001) study were a bit pessimistic about the practical validity of this method, especially because of the data limitations. They highlighted that export prices show considerable variations over time and across various origins and that quality issues cannot explain these variations. Thus quality differences will affect the measurement of this specific non-tariff barrier tariff equivalent as a price wedge residual (EU Commission, 2001; Beghin & Bureau, 2001). Therefore the price wedge method is not used in this study to measure the effect of NTB's on fresh apple exports from South Africa. For additional information regarding the price wedge method see Appendix C.

2.5.2 The survey-based approach

The second method investigated by Beghin and Bureau (2001:10) was the "*Survey-Based Approach*". This method makes it possible to identify various regulations in terms of NTB's which may have a significant trade restriction effect on exported goods. It is indeed a qualitative approach based upon specially constructed surveys coupled with in-depth interviews aimed at export-and-import practitioners to narrow the scope and identify the most important NTB's to trade (Beghin & Bureau, 2001; Kennedy & Koo, 2005; Mellado *et al.*, 2010). This enables one to extract valuable information from completed surveys and rank the various NTB's according to a scale or index which can be used in econometric analysis as valuable explanatory variables (Thornsbury, 1998; Beghin & Bureau, 2001).

However, this method has several drawbacks and is therefore not used in this study to measure the effects of NTB's on South African fresh apple trade. Some of these drawbacks mentioned

by Beghin and Bureau (2001) and Mellado *et al.* (2010) was the high cost involved (which Mellando *et al*. (2010) considered as the main disadvantage). The method is also very time intensive and presents questionable results in terms of responses received and the validity of the results obtained when converting the information to quantitative indices for econometric or statistical analysis is also considered to be debatable. For additional information regarding the survey-based approach see Appendix C.

2.5.3 The inventory-based approach and frequency measures

According to Beghin and Bureau, (2001); Bora *et al*. (2002); Kennedy and Koo (2005) and Beghin, (2006), the inventory-based frequency measure approach can be used in qualitative and quantitative assessments of the importance of regulations as trade barriers. This approach measures the frequency of regulations and barriers present in a given market (Beghin, 2006). In contrast, the survey-based approach normally is used to measure the effectiveness of trade barriers, rather than the frequency or count of identified NTB's (Beghin, 2006).

Beghin and Bureau (2001) and Beghin (2006) found that the number of regulations and policies, frequency of trade detentions at country borders, number of complaints reported by exporters for perceived discriminatory regulatory practices, as well as the frequency of occurrence of NTB's are the inventory-based frequency measures most commonly used. In the case of using the inventory-based frequency measures approach for quantitative assessments, the United Nations Conference on Trade and Development (UNCTAD) database, which is called Trade Analysis and Information System (TRAINS[24]) database, can be used in association with the World Integrated Trade Solution (WITS[25]) software (Beghin, 2006:7; Bora *et al*., 2002:6). The TRAINS database which includes an inventory of importing measures used by importing countries, can according to Bora *et al.* (2002), also be used in the computation of a Trade Restrictiveness Index (TRI) such as the trade coverage ratio (TCR) or a frequency index. However, the frequency index cannot give an overall indication on the importance of NTB's on selected products because this index does not reflect the relative value of the affected products (Bora *et al*., 2002:6). 2.5.3 The inventory-based approach and frequency measures

[24] TRAINS is a comprehensive database covering tariff and non-tariff measures as well as import flows by origin for more than 150 countries.
[25] WITS is an application software which offers a user-friendly data view interface that provides access to the databases like TRAINS, covering imports, exports and protection data (tariff and non-tariff measures) over time. For more information on TRAINS database and WITS software visit http://www.unctad.info/en/Trade-Analysis-Branch/Key-Areas/TRAINSWITS/.

are not suitable for analysis of single products such as apples and therefore this method is not used in this study. For additional information regarding the inventory-based approach and frequency measures see Appendix C.

2.5.4 The augmented index of non-tariff barriers (INTB)

Eremenko and Movchan (2003:5) proposed a methodology for the calculation of a compound NTB index or an augmented index of NTB's (INTB) to differentiate the intensity of different types of NTB's, as well as to include several NTB's into one measure. More specifically, according to Eremenko and Movchan (2003:5), the proposed INTB is a "compound additive index that incorporates a spectrum of NTB's applied in a country, weighted on the value of its imports".

However, given the similarity and nature of such an index to the frequency measure (discussed previously), it could be used as a NTB proxy variable in a gravity trade model, but will also face the same critique as that of the frequency measures (as previously mentioned). Just as the inventory-based approach and frequency measures, this index is not suitable for the analysis of single products such as apples in the case of this study. Therefore, this method is not used in this study. Additionally the INTB was never used as a proxy in a gravity model to simulate the impact of certain NTB's on trade flows by Eremenko and Movchan. For additional information regarding the augmented index of non-tariff barriers (INTB) see Appendix C.

2.6 The gravity trade model

2.6.1 The history of gravity and its micro-foundations

There are various methods in the literature which could be used for a comprehensive assessment on the quantitative impact of NTB's on international trade and welfare (Beghin & Bureau, 2001). It is important to note that the effect of NTB's can be trade-orientated or welfare-orientated (Beghin & Bureau, 2001). The two conceptions have a direct consequence in terms of the impact on bilateral trade and lead to different approaches to the empirical measurement thereof (Beghin & Bureau, 2001). On the one hand, if certain trade orientated NTB's are identified, the possible methods to measure the trade impacts are e.g. methods based on price-wedge estimation, surveys and gravity trade models. On the other hand if the

measurement is welfare-orientated, non-tariff barrier methods such as cost-benefit analysis and general equilibrium analysis could be used.

However, the aim of this study was to determine the main factors that explain the recent trends in South Africa's apple exports with a special focus on NTB's. According to Beghin and Bureau (2001) it is important to note that when trying to quantify the impact of NTB's a possible technique is to consider the foregone trade that cannot be explained by implied tariffs (Beghin & Bureau, 2001).

Furthermore, according to Beghin and Bureau (2001) a typical approach when trying to quantify NTB's is to analyse the coefficients and residuals of economic regression models of trade flows on the various determinants of trade. Thus, the gravity trade model is of particular interest to various trade economists, since these models have long been used as a way to estimate the "border effect" in trade, a part of it reflecting NTB's that impede international trade (Beghin & Bureau, 2001). Anderson and Van Wincoop (2001) developed their own theoretically grounded approach[26] to compute the impact of borders both on intra-national trade (within a country) and international trade and refer to it as "the border effect", which is commonly used in international trade literature. Interestingly, Anderson and Van Wincoop (2001) used their border effect theory and applied it to 1993 trade data between the US and Canada. Their findings confirmed that borders reduce trade between the US and Canada by 44%, while reducing trade among other industrialized countries by 29%, respectively. Moreover, Anderson and Van Wincoop (2001) stated that "while not negligible, we consider these to be plausibly moderate impacts of borders on international trade."

The gravity trade model fell into some disrepute in the 1970s and 1980s, for example Deardorff (1985:503) referred to the gravity model as having "somewhat dubious theoretical underpinnings". Baldwin and Taglioni (2006) further stated that the "gravity model is not a model in the usual sense – it is the regression of endogenous variables on endogenous variables". Keeping the previous statement in mind, the following sub section will focus on the historical development of the gravity trade model and its possible micro-foundations.

The first mathematical formulation and empirical application of a gravity equation was by a group of Dutch economists in the early 1960's (Tinbergen, 1962). Tinbergen was the first to actually publish a gravity model with an empirical application thereof. Furthermore, Tinbergen

[26] The detailed exploration of this approach falls beyond the scope and purpose of this thesis. For more information see Anderson and van Wincoop (2001).

supervised the Ph.D. thesis of Linnemann (1966) titled "*An Econometric Study of International Trade Flows"*, which became a standard reference to the early version of the gravity equation. Although the model itself can be applied to most economic phenomena, most applications involve bilateral trade flows. Despite the popularity of the gravity equation in the early days, the theoretical foundation of the model was missing (Van Bergeijk & Brakman, 2010:5).

Leamer and Stern (1970:169) stated that "the significance of such theoretical fundamental research must be found in context of seeking a broader understanding of the empirical base of the pure theory of international trade flows". This is what a number of studies failed to clarify. According to Van Bergeijk and Brakman (2010:6), the gravity model is able to identify extreme cases of artificial barriers to trade, the role of distance and the effects of membership in various custom and trade unions. Deardorff (1998) investigated the micro-foundations of the gravity model and was also critical with respect to the claimed theories behind it. Jeffery Bergstrand (1985) stated in his comment on the article of Alan Deardorff (1998) that he witnessed over thirty years, a frustrating fascination of trade economists with the gravity equation. Bergstrand (1985) stated that "the fascination stems from the consistently strong empirical explanatory power of the gravity trade model, with R^2[27] values ranging from 65 to 95 percent, depending upon the sample, which has been a persuasive motivation for its usage"

Linnemann (1966) pointed out that, when considering the theoretical aspects of a gravity model for trade, there are three main factors to be considered:

1) the total potential supply (or exports) of a country to the world market;
2) the total potential demand (or imports) of a country from the world market;
3) the factors that create a resistance to trade and thus affect the degree of trade intensity (i.e. tariffs, NTB's and transportation costs).

According to Anderson (2010), past research using the gravity model has sought to evaluate the impact of various variables in addition to the basic gravity equation. Among these, price level and exchange rate variables have been shown to have a relationship in the gravity model that accounts for a significant amount of the variance not explained by the basic gravity equation. The model clearly has a relationship with a geographic view of trade, but other theoretical justifications for the model have also been proposed. After conducting a robust

[27]The coefficient of determination R^2 is used in the context of statistical models. It provides a measure of the proportion of variation in the dependent variable that is explained by variation in the independent variables as well as to give an indication of how well the data fits the statistical model.

literature review it was found that the list of empirical applications of and studies on the gravity trade model is somewhat extensive.

Jacks *et al.* (2011) explained in their article that technical details might differ across models, but many micro-founded trade models produce a gravity equation of bilateral trade (Jacks *et al.*, 2011:186). It is important to note that the determinants of bilateral trade frictions are still poorly understood. This is problematic, since trade costs in terms of NTB's may be as important as the traditional determinants of trade, if not more important.

The general consensus of various literature reviews is that the lack of robust and sound theoretical foundation for the gravity trade model significantly weakens the credibility thereof and has led to a dubious reputation among academics, as this introduces a degree of subjectivity in the interpretation of the estimated coefficients of the model. Thus, although the model has a great empirical performance and is widely used, at this stage in time the search for a sound micro-foundation for the gravity trade model continues.

2.6.2 The gravity equation: theoretical basis

This section will formally introduce the gravity trade equation, known by various trade economists, as a work-horse of international trade analysis and quantification of the effects of NTB's and other trade variables.

Jan Tinbergen (1962), founder of the gravity equation, tried to explain the size of bilateral trade flows between any two countries which he found can be approximated by the Newtonian theory of gravitation (Chaney, 2011). The Newtonian theory states that: "any two bodies in the universe attract each other with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between them." Expressed more clearly by Beghin and Bureau (2001) with equation 2.1:

$$F_{ij} = \mathrm{G} \times \frac{[M_i \times M_j]}{D_{ij}^2} \qquad (2.1)$$

Where,

F_{ij} is the attractive force between objects *i* and *j*,

G is the gravitational constant,

M_i and M_j is the masses of the respective 'objects' and

D_{ij} is the distance between the objects.

This established the basis upon which economists such as Tinbergen (1962) found that this equation performed well in explaining bilateral trade flows (Tinbergen, 1962; Chaney, 2011; Beghin and Bureau, 2001). This Newtonian equation can be used in an economic context by explaining trade flows (forming the basis of the gravity trade model) where F_{ij} represents the trade flow between the country of origin *i* and the country of destination *j*. G represents a constant economic form. M_i and M_j are the respective economic sizes (in terms of GDP) of the two countries or locations and D_{ij} the distance between the two countries (Tinbergen, 1962; Hillman, 1978; Beghin and Bureau, 2001).

According to this principle, the gravity trade equation can be a representation of an empirically stable relationship between the amount of their bilateral trade on the one hand and the size of economies in terms of their respective GDP's and their distance apart on the other hand (Chaney, 2011; Novy, 2012:101). The model was first used by Jan Tinbergen in 1962. He was the first to publish a mathematical formulation and an empirical application of the gravity model in international trade. Moreover, in "*Shaping the World Economy: Suggestions for an International Economic Policy*" Tinbergen (1962) displayed the basic gravity equation which he introduced into the literature of international trade. This gravity trade equation formulated by Tinbergen (1962) is represented by equation 2.2 below:

$$T_{ij} = \alpha_0 \frac{X_i^{\alpha_1} X_j^{\alpha_2}}{D_{ij}^{\alpha_3}} \qquad (2.2)$$

Where;

T_{ij} = Exports of country *i* to country *j*

$X_i^{\alpha_1}$ = Gross Domestic Product (GDP) of country *i*

$X_j^{\alpha_2}$ = Gross Domestic Product (GDP) of country *j*

$D_{ij}^{\alpha_3}$ = Distance between country *i* and country *j*

α_0 = is the general constant.

Tinbergen (1962) stated that the main factors determining the size of the trade flows between any pair of countries are the economic size of the exporting country (in terms of GDP), the economic size of the importing country and the distance between them. Typically, a gravity model is generally expressed as a log-linear relationship in which trade between two countries is expressed as a function of:

- Two countries' income levels of economic size in terms of Gross Domestic Product;
- Two countries' population size;
- The distance between two countries;
- Factors of trade distortion.

Furthermore, Paas (2000:13) explained the basic form of the gravity model for examination of international trade flow as the following:

$$X_{ij} = \alpha\, Y_i^{b1}\, Y_j^{b2} N_i^{b3} N_j^{b4} D_{ij}^{b5} P_{ij}^{b6} \qquad (2.3)$$

Where,

X_{ij} – is the value of trade flowing from country *i* to country *j*

α – a constant

$b_1, b_2, b_3, b_4, b_5, b_6$– Coefficients which are weighted geometric averages

Y_i and Y_j – are the gross domestic products (GDP's) of countries *i* and *j*;

N_i and N_j – populations in countries *i* and *j;*

D_{ij} – the distance between countries *i* and *j*;

P_{ij} – dummy variable to take into account a trade factor (e.g. common language) between countries *i* and *j*.

More sophisticated gravity models include tariffs, non-tariff barrier proxies, transport cost and dummy variables to account for language, cultural differences, consumer preferences and various other explanatory variables (Ingham, 2010:40-41).

Mellado *et al.* (2008) and Beghin and Bureau (2001) presented another basic gravity trade model in a log-linearized form, which can be used to analyse bilateral trade flows. It is important to note that the fact that the gravity trade model is assumed to be in a log-linearized form; the coefficients can in turn be interpreted as elasticities. The common interpretation of such coefficient elasticities suggested is e.g. that a 1 percent (%) increase in say the distance between two trading countries would *ceteris paribus,* lead to a *x* % decrease in trade between them, given that the sign of the distance coefficient is negative in relation to trade.

This model is represented by equation 3.4 below:

(2.4) $\ln(\text{trade\_ flow}_{ij}) = \propto_0 + \sum \beta_n \ln(C_i) + \sum \chi_n \ln(C_j) + \ln\text{distance}_{ij} + \sum \delta_{ij} \ln(\text{NTB}_{ij}) + \varepsilon_{ij}$

Where:

- $(\text{trade\_ flow}_{ij})$ represents the absolute values (or volume) of the trade flow between country *i* and *j*;
- $C_i \; and \; C_j$ represent characteristics considered in the study for country *i* and *j;*
- NTB_{ij} represents NTB's faced in trade of commodities between countries *i* and *j;*
- $\propto_0$ is the constant or specific intercept;
- β_n, χ_n and δ_{ij} are the specific parameters of the characteristics and NTB's of countries *i* and *j*, respectively;
- distance_{ij} represents the actual distance between the respective countries main trading cities in kilometre or miles;
- and finally, ε_{ij} is the error term or residual from the econometric regression

There is no distinct difference in the basic gravity trade model presented by Tinbergen in 1962 from that of Paas (2000), Mellado *et al*. (2008) or Beghin and Bureau (2001). The basic gravity trade model is based on Newton's law of gravitation but just represented in the form of international trade between countries with the basic forces which might help explain the extent of trade between them. As mentioned before, aside from the gravity trade model's functional form, bilateral trade should be positively related to the two economies' incomes or size of the economy in terms of their respective Gross Domestic Product (GDP) and negatively related to the distance between them. Transportation costs which logically correspond with the geographic distance between the two countries and can also be seen as a major trade barrier.

It is clear from the literature review that the gravity trade model serves as a powerful analytical tool which can be used to estimate the effect(s) of various explanatory variables have on bilateral trade.

2.7 Chapter summary

The General Agreement on Tariffs and Trade, as well as the World Trade Organization have surveillance mechanisms in place to oversee members' trade policies and intend to remove or reduce tariffs and non-tariff barriers in order to promote free trade. It is evident in trade literature that there are various classical and modern theories on international trade. It is important to review the development of these theories of trade, since these theories provide useful information about the basic forces at work in international trade. Since there is no clear theoretical foundation upon which the basic gravity trade model is built, some of these trade theories such as the new trade theory, Heckscher-Ohlin theory, home market effect and the Linder hypothesis help to explain the economic intuition behind the gravity trade model.

It is important to note that various NTB's comprehend a wide range of specific measures, many of whose direct effects are not easily measured. It is therefore very difficult to pinpoint which specific NTB's are implemented on one specific commodity or product by specific countries, in this case on South African fresh apple exports. However SPS and TBT, with emphasis on Maximum Residue Limits, imposed by the EU are considered to be the most trade restrictive. The effect of these implemented MRL's by the EU has a major impact on the profitability and development of producers and exporters from developing countries such as South Africa. It is therefore of importance to try and quantify and ultimately measure the effect NTB's have on the exports of agricultural commodities such as that of fresh apples. This chapter therefore reviewed methods used by various trade researchers in order to try and quantify the effect these qualitative trade barriers or non-tariff barriers have on international trade. Interestingly, the results of all these methods basically suffer from the same critique, which is that none of these methods can accurately capture the net-effect of one single non-tariff barrier on the bilateral trade of a single commodity. In addition, the interpretation of these coefficients is generally also seen as being biased because these index variables only account for the presence or absence of NTB's and do not indicate the extent or effect that NTB's have on the trade of a single commodity and ultimately on bilateral trade flows.

The last part of this chapter critically reviewed the theoretical foundations of the gravity trade model, its functional form and general applications thereof. It is of importance to comprehend the basic model and its purpose in order to use the gravity trade model in legitimate empirical applications. The application of the model in this study is discussed in Chapter 5.

CHAPTER 3: SOUTH AFRICAN APPLE INDUSTRY OVERVIEW

3.1 Introduction

South Africa as a leading apple producing country sets the pace in the development of a robust export-orientated fruit industry, despite the rapidly changing world trade dynamics (Hurndall, 2005). The South African apple industry operates in a constantly changing and uncertain business environment where prices, volumes exported and consumption of fresh apples are determined by the market forces of supply and demand. This unpredictable and often unstable business milieu includes policy changes, weather conditions and other market variations and as a result role players and producers in this type of deciduous fruit industry have virtually no influence on the magnitude or direction of change of these factors (Lombard & Reynolds, 2012:17-19). It is important to note that rapidly increasing urbanisation, coupled with a continuously growing population (especially the rise in middle income class consumer) translates into an ever-increasing demand for fresh fruit, not only in South Africa but also in the rest of the world.

This chapter will provide a brief overview of the South African fresh apple industry with a special focus on the characteristics of its top apple export destinations i.e. the European Union, Far East, Middle East and Africa. Due to the shift in South Africa's traditional export market i.e. the EU to other countries in the African continent, there is a special section (sections 3.4.1 and 3.4.2) in this chapter that discusses the trade opportunities and characteristic challenges one faces when doing business in Africa. The world per capita consumption of apples is also briefly investigated in order to establish the fresh apple demand side patterns which could also serve as an indication of future potential export markets.

3.2 Brief overview on South Africa's fresh apple export industry

The deregulation of the South African deciduous fruit industry took place at the end of 1997. This transformed it from a single-channel marketing organization called the Deciduous Fruit Board (D.F.B.), who used one national trademark called "South African Fruit", into a free enterprise marketing era (Hurndall, 2005). The Deciduous Fruit Producers Trust (DFPT) was also formed during 1997 (after deregulation) to protect the interests of fruit producers within the South African borders and to also act as the 'mouthpiece' of the industry. Furthermore, the Fresh Produce Exporters Forum was established in 1998 as a voluntary, non-profit organisation

with 118 members, which account for about 90% of fresh fruit exported from South Africa today. The main purpose for its establishment was to address issues of common concern amongst export agents within the fruit industry, but especially for improving the industry's image and also finding new potential export markets through funding various international trade shows and marketing campaigns (Hurndall, 2005). It is clear that the South African fruit industry, especially the apple industry, would not have been as well established among its competitors without the support from these industry organisations.

South Africa is a net exporter of fresh apples with an average of 42.3% of all apples produced from 2003/2004 season to 2012/2013 season (see table 3.1 below) being exported to the global market, with only 28.2% locally consumed, 29.3% processed and a mere 0.2% dried. In addition to the common municipal markets, retail stores, greengrocers and café's, thousands of independent hawkers, stallholders and street vendors distribute fruit to consumers throughout the country. This is the main reason why the local market has always been and still is very important to the South African fruit industry.

Table 3.1: South African apple production distribution 2003/2004 – 2012/2013 season

Year Jan - Dec	Total Production (ton)	Local Market* (ton)	Exports (ton)	Processed (ton)	Dried (ton)	Change in total production %
2003/2004	822 047	239 827	335 412	245 948	860	4%
2004/2005	698 710	235 517	270 651	191 632	910	-15%
2005/2006	627 091	204 123	269 715	153 003	250	-10%
2006/2007	709 868	223 552	296 471	188 624	1 220	13%
2007/2008	757 679	180 480	338 647	236 833	1 720	7%
2008/2009	800 804	205 808	332 684	261 191	1 120	6%
2009/2010	753 152	221 131	298 559	232 473	990	-6%
2010/2011	768 125	231 285	318 993	216 257	1 590	2%
2011/2012**	813 192	209 198	358 457	244 427	1 110	6%
2012/2013**	882 413	203 173	410 249	266 031	2 960	9%
Average crop distribution (%)		**28.2%**	**42.3%**	**29.3%**	**0.2%**	

* Market sales and direct sales to various supermarkets

Source: Hortgro key deciduous fruit statistics, 2013

The exchange rate is an erratic and robust driver for the exports of fresh apples, especially in South Africa. Imports of South African agricultural products as well as various input costs such as pesticides, herbicides, machinery and transport cost are all linked to the exchange rate. Thus as the South African Rand depreciates against major currencies, these costs also increase, which puts downward pressure on the profit margin of producers and exporters. In other words, in a weak Rand environment the exchange rate effect increases South Africa's competitiveness in terms of exports; however it also tends to create an upside risk for the domestic inflation

outlook which in turn increases the production cost per hectare for the average producer in South Africa.

According to the Bureau of Food and Agricultural Policy (BFAP, 2013:67), rising input costs not only restrict the establishment of new orchards through its negative impact on cash flow, but the violent strikes experienced at the end of 2012 in the Western Cape (which is the largest apple producing region in South Africa), political instability and weak economic outlook for South Africa created a negative investor sentiment, discouraging new investments in commercial farming entities, as well as foreign direct investments (FDI). All of the afore-mentioned factors could influence the demand for South African apples (Lombard and Reynolds, 2012:18). Furthermore, global economic growth is projected to strengthen to 3.6 percent in 2015 (from 3.1 percent in 2014) and is then projected to further increase to 3.9% in 2016 (WEO, 2014:19). While South Africa's projected economic growth rate for 2014 is a mere 2.3% compared to the average emerging and developing market economies of 4.9% (WEO, 2014:19). Thus, as the projected economic growth rates are to improve only marginally over the next few years, the fruit industry may experience difficulties in terms of volumes of fresh fruit exports to certain key markets.

According to Hurndall (2005), despite these poor economic conditions and indicators, the horticultural industry has the largest economic multiplier of all the other agricultural industries in South Africa. The fruit industry, or in this case the apple industry, contributes significantly to various linkages within the entire supply and value chain. These linkages include inputs to supply industries and service providers such as chemical, fertiliser and packaging material suppliers, as well as forward linkages to wholesalers, retailers, hawkers and many other role-players in the supply chain, which in turn also contribute to economic growth, Gross Domestic Product (GDP) and competitiveness of the fruit industry (Hurndall, 2005).

Input costs are expected to continue to rise, in many instances above the average inflation rate of 5.9% (Headline Consumer Price Index); which is considered to be at the high end of the South African Reserve Bank's inflation target ceiling of 6% during 2013, thus further discouraging expansion and intensifying the area under production (StatsSA, 2014). The domestic petrol price increased by 39 cents per litre in February 2014 resulting in a 2.9% monthly increase in the petrol index (StatsSA, 2014). This takes annual petrol inflation to 14% for the past 12 months, which by itself, is the biggest contributor to increased input cost and

increased food inflation. This general increase flows from the 20.4% increase in the oil price and a 23.7% depreciation in the Rand over this 12 month period (StatsSA, 2014).

According to the Hortgro Deciduous Fruit Statistics (2013) and BFAP (2013:68), although the carry-over stock of apples in the United States were higher than in 2012, the European apple stock was about 20% lower in the 2013 season. This relatively empty market, coupled with the relatively weak Rand exchange rate exerting upward pressure on prices, meant returns to producers were favourable for the 2013 season (BFAP, 2013:67). Furthermore, the European carry-over apple stock level is up by 51% year-on-year, which, according to BFAP (2014:88), implies a relatively full European market, which in turn exerts downward pressure on these key export market prices.

It is important to note that, according to the BFAP baseline outlook (2014) report, the impact of Northern Hemisphere (European) apple stock levels on export prices realized by South Africa, is expected to weaken over the next decade given that South Africa continues its extensive expansion into the African, the Far East and Middle East markets. Moreover, other Southern Hemisphere exporters such as Chile, New Zeeland, Argentina and Australia are also expanding into new potential markets, away from South Africa's main export destinations (BFAP, 2014:88).

South Africa's exports represent 4.46% (388 835 tons) of world exports for fresh apples and is ranked 7th in the world in terms of value (thousands of U.S. dollars) and volume (tons) exported in 2013, as one can see from table 3.2 below (Trademap, 2013). Interestingly, five out of the top ten exporters of apples are European countries (Poland, Italy, France, Netherlands, and Belgium) which may indicate intra-industry trade because their market concentration is moderately low compared to other countries outside of the EU. Poland is considered to be South Africa's biggest competitor in the EU. This country experienced a 14% growth in quantity exported over the period of 2008 to 2013 compared to South Africa's 1%. Interestingly, one of the main reasons is that the average distance of importing countries from Poland is 1434 kilometres compared to that of South Africa which is 7315 kilometres.

Table 3.2: Top ten exporters of fresh apples (HS 080810)

Ranking in Quantity (tons) exported	Ranking in value (USD '1000)	Top 10 Exporters	Value exported in 2013 (USD thousand)	Quantity exported in 2013	Annual growth in value between 2008-2013 (%)	Annual growth in quantity between 2008-2013 (%)	Annual growth in value between 2011-2013 (%)	Share in world exports (%)	Average distance of importing countries (km)
1	**2**	**China**	959 913	975 878	9	-4	5	13.5	3 909
2	**6**	**Poland**	431 873	941 678	18	14	59	6.1	1 434
3	**3**	**Italy**	937 177	933 711	7	9	-6	13.2	1 505
4	**1**	**United States of America**	1 083 975	870 185	10	4	14	15.2	6 854
5	**4**	**Chile**	719 217	761 725	4	1	6	10.1	9 769
6	**5**	**France**	691 135	625 943	0	-1	-6	9.7	1 762
7	**7**	**South Africa**	**316 785**	**388 835**	**8**	**1**	**10**	**4.5**	**7 315**
8	**8**	**Netherlands**	313 832	318 587	-6	-3	-14	4.4	652
9	9	New Zealand	293 380	309 464	5	2	3	4.1	12 972
10	**10**	**Belgium**	161 663	180 608	-9	-7	-23	2.3	745

Source: Trademap, 2013

It is clear from table 3.3 below that the United Kingdom (UK) still remains the single biggest importer of South African apples, by ranking 1st in the list of top twenty importing countries in terms of both value and quantity in 2013 with a share of 26.8% of South Africa's total apple exports. Furthermore, there has been a major shift from South Africa's traditional export destinations and importing countries, i.e. the European Union, to African countries, over the last decade.

Table 3.3: List of top 20 importing markets for fresh apples (HS6:080810) exported by South Africa in 2013

Ranking in quantity (tons)	Ranking in value (USD'000)	Region	Importers	Exported value 2013 (USD thousand)	Share in South Africa's exports (%)	Exported quantity 2013 (Tons)	Exported growth in quantity between 2008-2013 (%, p.a.)	Average distance between partner countries and all their supplying markets (km)
1	**1**	EU	United Kingdom	85 037	26.8	98 050	-6	6 042
2	**2**	FE	Malaysia	37 789	11.9	41 043	4	8 236
3	**3**	AF	Benin	21 633	6.8	29 771	12	5 011
4	**4**	AF	Angola	18 015	5.7	21 929	38	2 824
5	**5**	ME	United Arab Emirates	16 049	5.1	19 263	-1	8 888
6	**6**	EU	Netherlands	12 650	4	16 438	-11	7 210
7	**8**	AF	Ghana	10 096	3.2	13 551	31	5 062
8	**16**	AF	Zimbabwe	4 378	1.4	13 449	98	1 101
9	**7**	FE	Singapore	10 470	3.3	11 575	-1	7 841
10	**9**	FE	Bangladesh	8 507	2.7	10 789	31	4 607
11	**12**	AF	Senegal	6 581	2.1	8 779	18	5 739
12	**19**	AF	Zambia	3 494	1.1	8 195	1	1 587
13	**11**	AF	Kenya	7 298	2.3	7 881	9	4 021
14	**10**	AF	Nigeria	7 416	2.3	7 857	328	5 224
15	**13**	RS	Russian Federation	6 140	1.9	7 432	-11	3 304
16	**14**	AF	Cameroon	5 196	1.6	6 579	15	4 242
17	**15**	EU	France	4 740	1.5	5 480	-8	3 893
18	**17**	IS	Mauritius	3 930	1.2	5 314	-2	3 330
19	**22**	ME	Saudi Arabia	2 737	0.9	5 065	3	7 828
20	**23**	EU	Ireland	2 614	0.8	3 810	-20	3 874

Source: Trademap, 2014; ITC calculations based on UN COMTRADE statistics

As one can clearly see from the combination of figure 3.2 and table 3.3, the European countries only consist of 20% of the top 20 importing countries and the African continent 45%. This is no surprise as (one can see from table 3.3 above) the annual export growth in quantity between 2008 and 2013 for the United Kingdom, Netherlands, France and Ireland was -6%, -11%, -8% and -20%, respectively. All of the African countries experienced positive growth over the same period with Nigeria being the top African country that solely realised a robust annual export growth in quantity between 2008 and 2013 of 328%. Africa is the new "buzz word" in international trade and also in the fruit export arena, especially in the case of fresh apples (BFAP, 2013). The excellent shelf life of apples makes it a suitable crop for export to countries where infrastructure is often lacking and port congestions are a common problem (BFAP, 2013).

On the demand side of the African continent (figure 3.1 below), the sweet taste of Golden Delicious (GDL) and Panorama Golden (PNG) apple cultivars (accounting for 67% of the total volume exported to the African continent in 2013), as well as red apple cultivars, such as Top Red (TOP), Starking (SKI) and Early Red One (ERO) (accounting for 7% of the total volume exported) pleases the pallet of the African nations.

Interestingly, one cultivar experiencing an increasing demand from the African market segment because of its unique storing capability, eating quality and low defect status is that of Sundowner® (SDN) apples. Pink Lady® apples are also high on the demand list for the average African consumer. The apple's pinkish colour, conical shape, sweet tasting flavour and great eating quality are some of the main reasons the African consumer is willing to pay a premium for it (Odendaal, 2014). The rise in the middle income working class, increasing per capita consumption, coupled with the continuous change in young African consumer preferences are the main driving forces for the increasing demand for good quality and high value cultivars such as Granny Smith, Sundowner, Pink Lady and Golden Delicious apples (Odendaal, 2014).

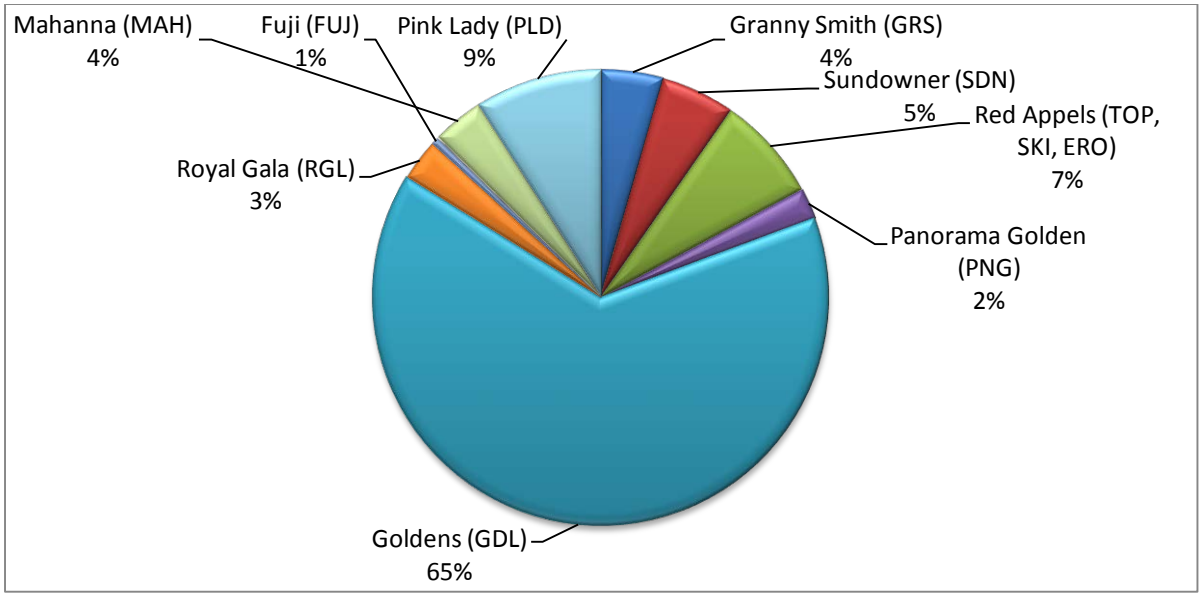


Figure 3.1: Total cartons exported per cultivar to Africa[28] (2013)

Source: Ceres Fruit Growers, 2013

As depicted in figure 3.2 (below), it is clear that in 2013 Africa accounted for 23% of SA export shipments from a low 6% in 2001, which is an increase of 301% in quantity exported from South Africa. It is important to note that South Africa did not report its trade with Southern African Customs Union (SACU[29]) partners prior to 2010 (BFAP, 2015:11). However, SACU countries always reported their trade with South Africa. Therefore, the increase in quantity exported to the African continent is not as great as depicted in the data (figure 3.2 below). Essentially, the increase in the quantity of exports from South Africa to the African continent from 2010 to 2013 is 135%. It is important to note that these figure(s) are however a gross underestimation of total exports to Africa as they do not include apples crossing our borders by trucks (or bicycles). It is believed that exports by truck to our neighbouring countries are noteworthy, but due to insufficient border controls the extent thereof is unknown (BFAP, 2013).

[28] The data used in the calculation in order to arrive at the percentage of each cultivar exported to the European Union, Far East, Middle East and African market segments, is representative of the total of South African fresh apple exports to these respective markets. The data on cartons exported is strictly confidential and may not be disclosed.

[29] Please refer to footnote in section 3.5.1 for more detail on SACU.

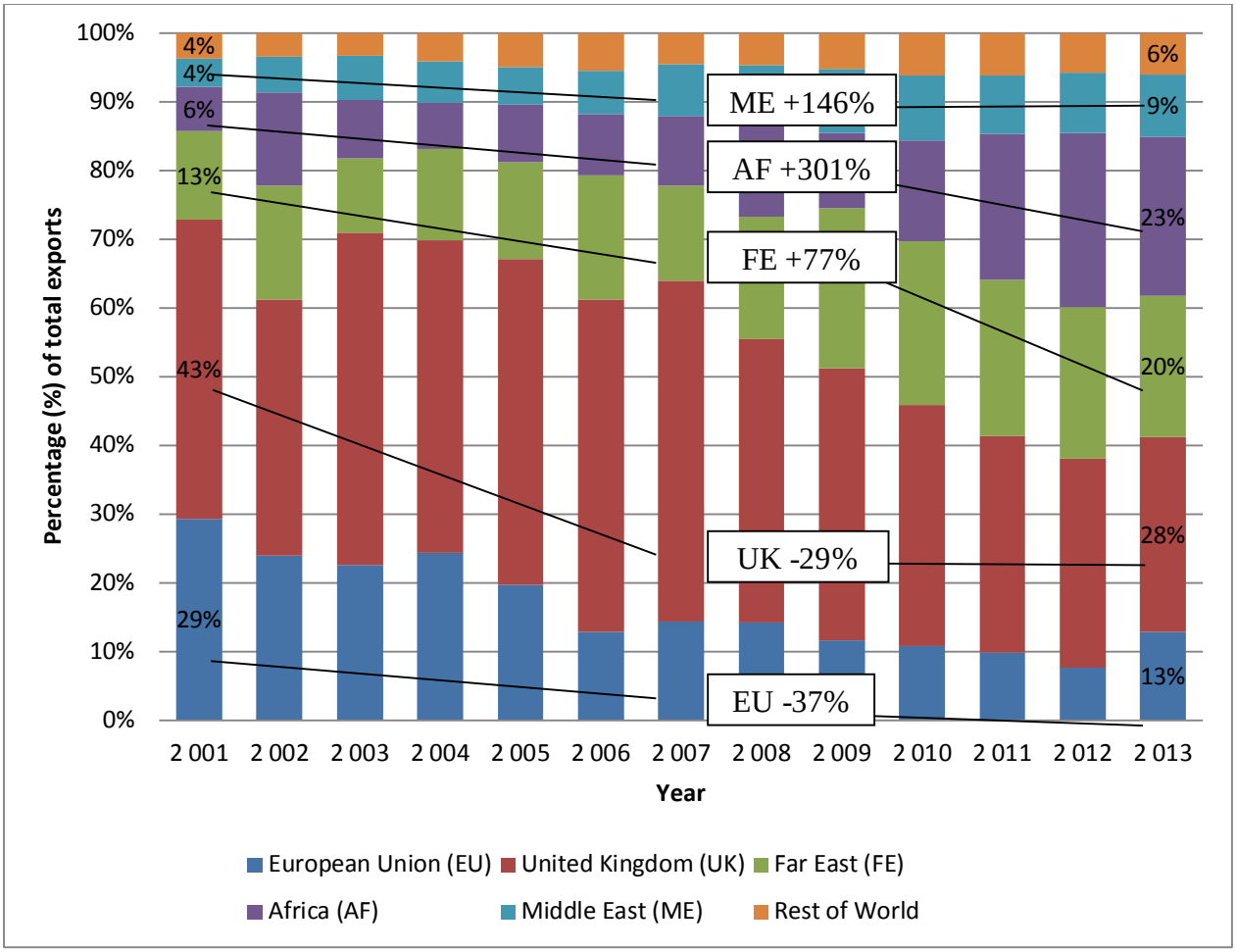


Figure 3.2: Trends in shifting apple export markets[30] (2001-2013)

Source: Trademap, 2013

As depicted in figure 3.2 (above), the quantity of fresh apples exported to that of the EU[31] and UK over the period from 2001 to 2013 decreased significantly by 37% and 29%, respectively. The United Kingdom is still South Africa's biggest apple importer in terms of the average volume over the same period. One might argue that the UK imports more of certain cultivars such as Pink Lady, Granny Smith and Golden Delicious, because the country is not a major apple producer and only accounts for 1.2 % or 5 396 hectares of apple trees planted within the EU (see figure 3.3).

[30] It is important to note that the data depicted in figure 3.2 represents all the countries situated in the respective regions i.e. all the countries that South Africa exports fresh apples to and not just the pre-selected 19 countries used in this study. The countries that do not fall under the categories: European Union, Africa, Far East and Middle East respectively, fall under the category "Rest of World".

[31] It is important to note that the EU data used to represent the EU in figure 3.2 above, excludes the UK.

Furthermore, an increase in the quantity exported to the FE and ME (Asia) of 77% and 146 %, respectively, over the same period (2001 to 2013), is another robust indication of the shift in export markets. There are various factors which contribute to these shifts in the fresh apple export market. The rising gross domestic product per capita and population in developing countries within the FE, ME and African regions, create a high demand for fruits and vegetables.

As one can see from figure 3.3, apple producing countries within the EU such as Poland, continue to produce high volumes of apples as various new plantings reach full bearing stage. This creates a decreasing demand for certain apple cultivar imports from South Africa as the EU is self-sufficient in these cultivars such as red and bi-colour apple cultivars e.g. Idared, Jonagold and Golden Delicious. One could also argue that the fact that tariffs implemented especially by the EU are decreasing, the use of NTB's is increasing and in turn may also cause South Africa and other apple producing countries to export less to the EU.

It is important to note that apples are the most common fruit kind planted within the EU, covering almost 450 000 hectares compared to South Africa's 22 925 hectares. As depicted by figure 3.3 below, Poland is by far the biggest apple producing (growing) country within the EU (28) considering that 31.8 % (143 113 hectares) of the apple trees planted in the EU are in Poland. Italy (11.6%) and Romania (11.4%) follow each with a share of over 11 %, respectively. France (8.2%), Germany (7.1%), Spain (6.0%) and Hungary (5.6%) are also major apple producing countries within the EU. Together these seven EU (28) Member States cover more than 81 % of the total EU area under apple trees which translates to approximately 367 347 hectares. With the most recent EU enlargements, the apple tree area more than doubled.

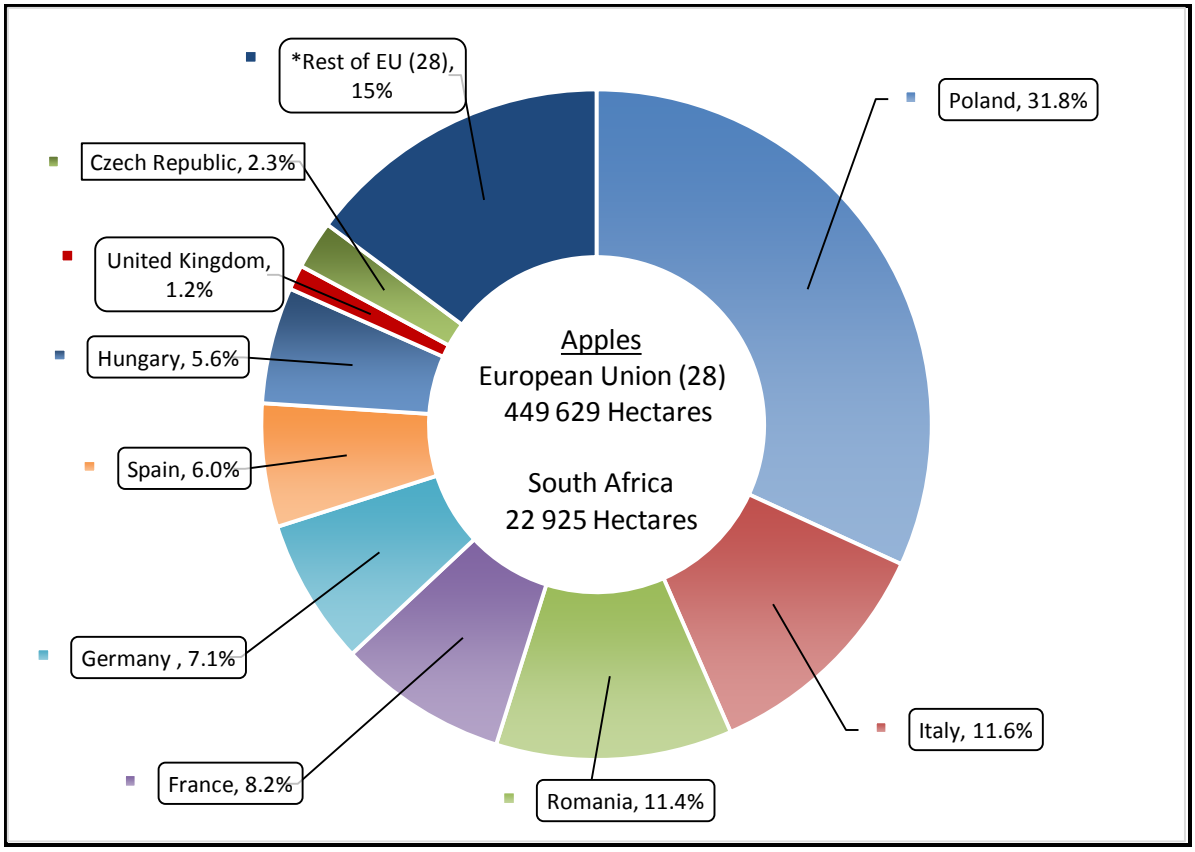


Figure 3.3: European Union (28) Apple hectares

*Rest of EU (28) consist of the following countries: Hungary, Portugal, Greece, Netherlands, Austria, Belgium, Bulgaria, Croatia, Slovakia, Slovenia, Latvia, Sweden, Lithuania, Denmark, Finland, Ireland, Estonia, Cyprus, Luxembourg and Malta.

Source: EuroStat, 2014.

Malaysia is the second largest importer of fresh South African apples and is ranked 2nd in both value (USD) and quantity (tons) which represents an 11.9% share in South Africa's exports, coupled with a 4% growth in quantity per annum between the period of 2008 to 2013 (see table 4.3). Malaysia is the single leading importer of all the Far Eastern countries with a market concentration of 0.28, which is considered relatively concentrated according to the Herfindahl index methodology used by the ITC (Trademap, 2014). Malaysia, Singapore and Bangladesh represent a combined market share in South Africa's fresh apple exports of 17.9%, as well as a combined exported growth in quantity (tons) of 34% per annum of which South Africa exported 63 407 tons of fresh apples during 2013. This translates to 4 973 098 million MK6[32] equivalent cartons exported to these three Far Eastern countries alone (Trademap, 2013).

[32] A MK6 equivalent carton is referring to a 12.5kg M12T Telescopic Carton (MK6) (Hortgro, 2014). For more information on the apple carton specifications and counts see table A7 in appendix A.

Another interesting phenomenon is that of the Middle and Far East countries which also continue to import more and more premium quality apples and high value cultivars during the recent past. In addition, it is clear from figure 3.4 that these cultivars in demand and imported by the ME and Indian market are high value Royal Gala (40%), Granny Smith (25%), Royal Beaut (16%) and Golden Delicious (9%) respectively.

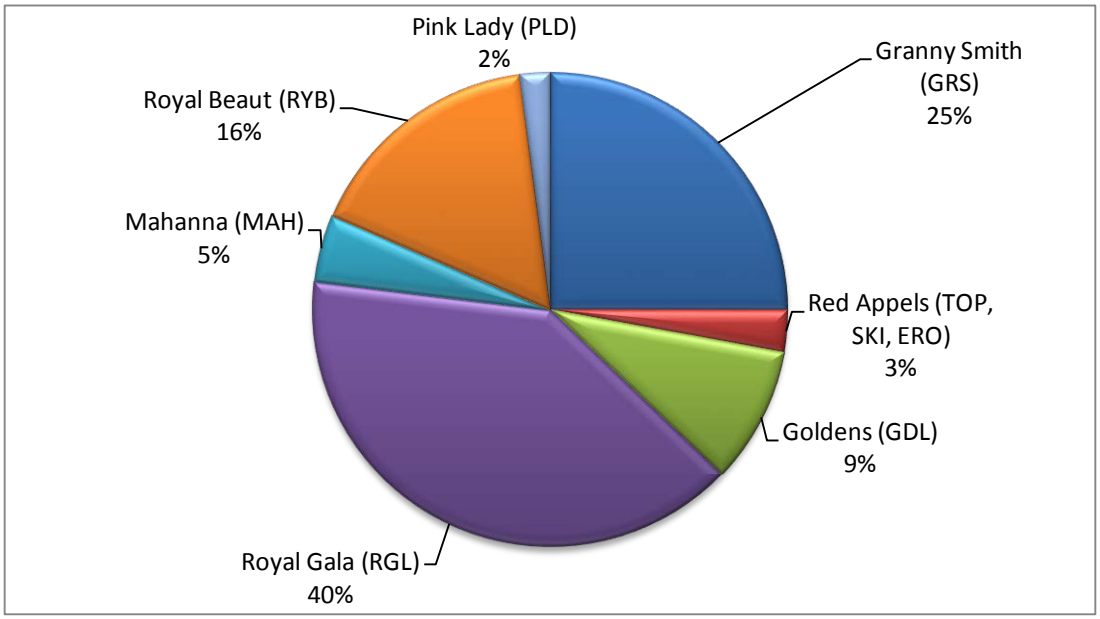


Figure 3.4: Middle East & India (ME) 2013 (Total MK6 carton quantity exported)

Source: Ceres Fruit Growers, 2013

The Far East market's cultivar selection, as well as fruit size and packing requirements, on the other hand, differ quite considerably from that of the ME. Figure 3.5 depicts the percentage (%) of MK6 equivalent cartons exported to the FE from South Africa during 2013. The FE market also imports high value cultivars such as Fuji (32%), Granny Smith (31%), Royal Gala (10%), Golden Delicious (10%) and Royal Beaut (6%), as depicted in figure 3.5 below. Interestingly, the Granny Smith cultivar is commonly also known in export language and often referred to as "Green Gold" because of its high value and premium paid by importers (Odendaal, 2014).

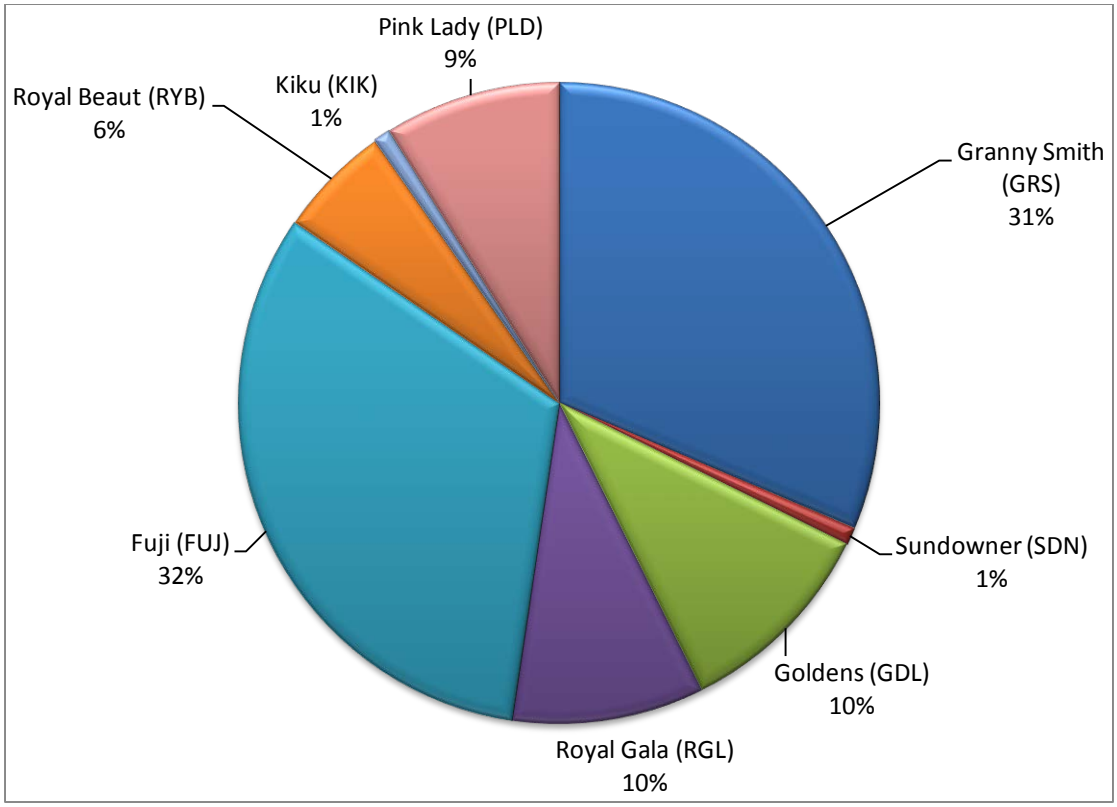


Figure 3.5: Far East (FE) 2013 (Total MK6 carton quantity exported)

Source: Ceres Fruit Growers, 2013

It is evident that there is a new shift in South Africa's traditional export markets, such as the United Kingdom, in terms of fresh apple exports to other, more rewarding export market destinations. This indicates that South African producers and marketers are becoming more focused on exploring these "new" African, Middle and Far East markets and trying to build a strong relationship with existing and potential clients in these countries in order to enable them to continue to benefit from the opportunities and higher export prices.

It is clear from Figure 3.6 that South African exports of fresh apples (in tons) to the EU (28) has drastically declined from 2007, with only a marginal increase from 2011 onwards. This slight increase could be attributed to various economic factors such as a depreciation of the Rand against the Euro (€) and British pound (£), low stock levels in the northern hemisphere (especially in 2013 when the European Union experienced a 20% decline in domestic production levels) (BFAP, 2013).

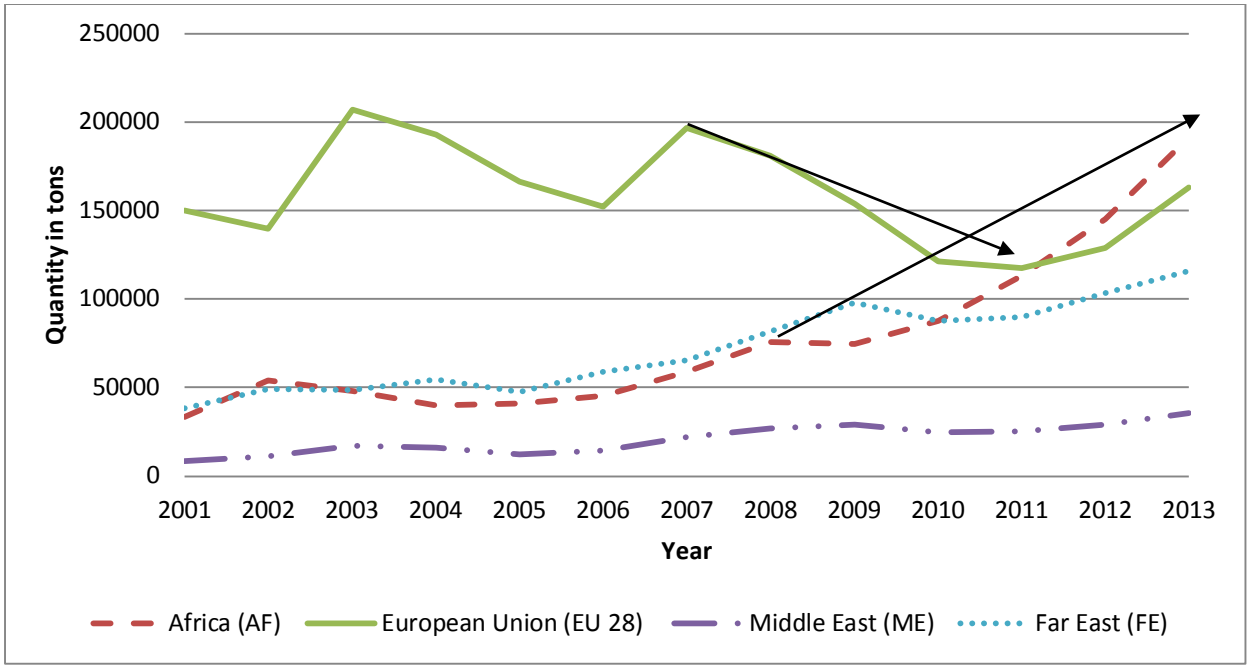


Figure 3.6: South African apple exports to AF, the EU (28), ME and FE form 2001 to 2013

Source: Trademap 2013, own calculations

The EU especially the UK, was considered South Africa's most important traditional export destination during the past. This trading picture has been changing considerably over the last seven years. For some industries, especially that of fresh apples, this shift is happening rather quickly, while the process for pears is rather slower (Kotze, 2013). The new strategic markets are the FE and ME and AF as depicted in figure 3.6.

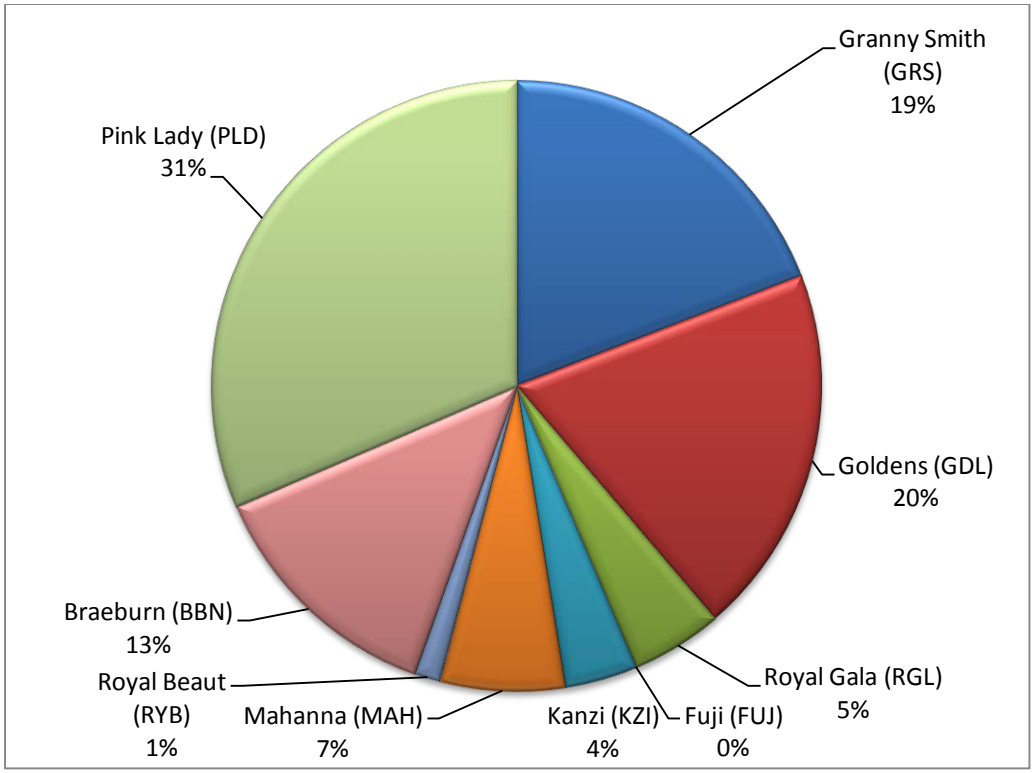


Figure 3.7: European Union (28), 2013 (Total MK6 carton quantity exported)

Source: Ceres Fruit Growers, 2013

The EU consumer demand for various apple cultivars differs considerably from that of the African, Far Eastern and Middle Eastern consumer. As one can see from figure 3.7 above, the cultivars mainly exported to the EU are those of Pink Lady (31%), Golden Delicious (20%) and Granny Smith (19%) followed by Braeburn (13%). South Africa has the competitive advantage in the production of Pink Lady apples. The cold nights coupled with warm, sunny days contribute to the great colour enhancement of these apples, which is a major requirement for the European consumer. Golden Delicious apples are by far the biggest export-orientated apple cultivar for South Africa.

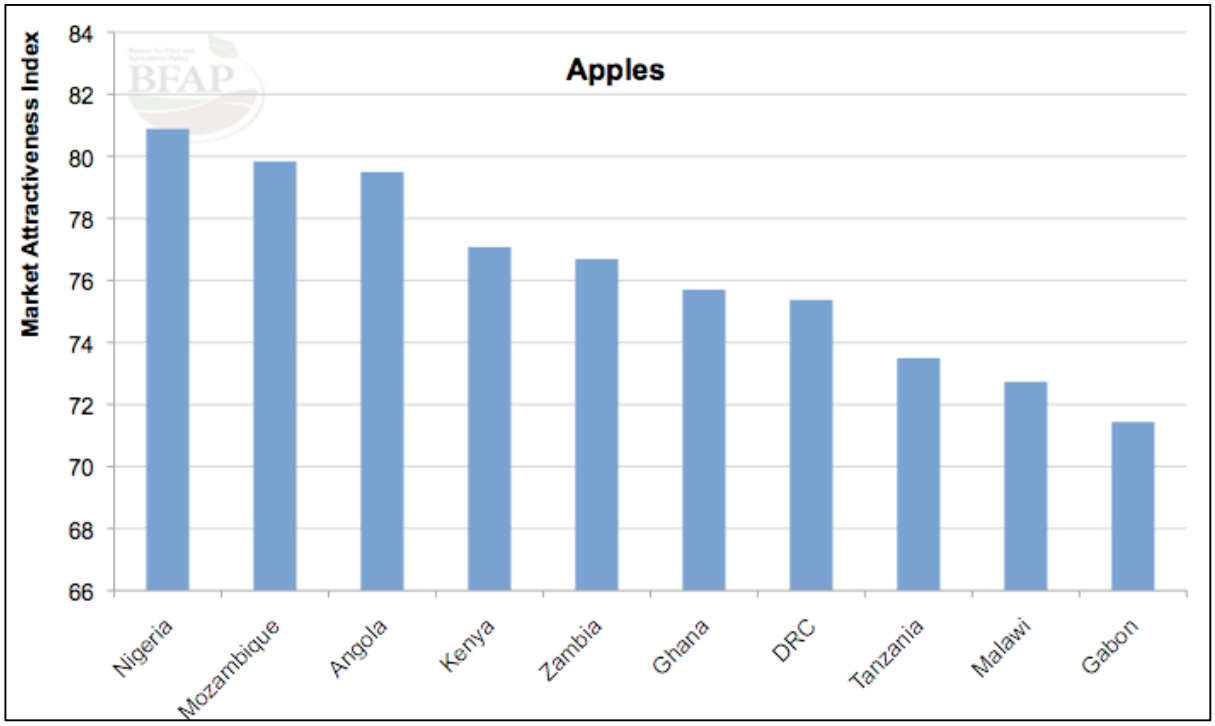


Figure 3.8: Top 10 most attractive export markets for fresh apples (HS 080810) for 2013

Source: BFAP, 2014

During 2013, South Africa supplied 26.5% of total imports of fresh apples to the African continent, making it the largest exporter of fresh apples to this continent (BFAP, 2014:86). Moreover, 85.8% of the total fresh apple imports into the Sub-Saharan African region originated from South Africa (BFAP, 2014:86). According to the Market Attractiveness Index (MAI), developed especially for fresh apples by BFAP (2014) and depicted in figure 3.8 above, Nigeria, Mozambique and Angola are considered the most attractive African export market destinations for fresh apples. A strong consumer demand coupled with less barriers to entry compared to the EU are considered as a robust reason for the findings. Moreover, as these non-traditional and lucrative export markets continue to develop their market access and infrastructure in line with that of internationally accepted standards, exports to these markets will continue to grow and develop.

3.3 Demand side patterns: per capita consumption of fresh apples

The total supply of apples globally produced by nature, determines the volume available for *per capita* consumption. Despite the supply or availability of apples, customer behaviour must also be taken in consideration as this may have a negative effect on the turnover of certain supermarket chains which, in the case of the EU, are the biggest buyers or importers of South

African apples. According to the DFPT (2005:104-105), customers see the produce department of a supermarket as an indicator of total store quality and most fresh fruit purchases are impulse driven. Furthermore, buyers and ultimately the final consumer, are influenced firstly by the freshness of the fruit, secondly by cleanliness, thirdly by price (especially promotions) and finally by appealing appearance, when buying fresh fruit (Hurndall, 2005). This highlights, yet again, the importance of knowing the buyer and customer and ultimately the market, as their characteristics have a great effect on the demand and in turn, the trade flow of certain cultivars.

Chinese apple production for example, is retained for domestic consumption and fewer apples are consumed in processed form, which indicates why Chinese per capita consumption *per se* has been soaring over the past decade (WAR, 2013:87). In contrast, many other major apple producing countries such as South Africa, China and Chile (to mention but a few) have very active processing sectors. In the case of South Africa, the processing sector consists of 29.3% of total production and the fresh exporting sector absorbs a further 28.2%, which is a substantial amount of total production (Hortgro, 2013).

This suggests that further reductions in apple availability in major producing countries are likely to lead to substantial reductions in domestic per capita consumption of fresh apples in major importing countries (WAR, 2013). On the other hand, the factors that influence the country-specific demand for fresh apples, such as economic growth, income per capita, size of the economy, the diversification of the population, population growth, barriers to trade and customer satisfaction determine the total volume of fresh apples a specific country will demand (WAR, 2013:83).

Data on per capita availability of fresh apples which is only made available by the Word Apple Report, simply gives one an indirect indication of the direction of per capita consumption by any given country (WAR, 2013). However, according to the author of the World Apple Review (WAR, 2013), getting precise measures and estimates on per capita consumption per country, is somewhat difficult and sometimes misleading. This forced the WAR team to develop their own series of estimates of per capita consumption of fresh apples in countries where reliable data is available.

According to the WAR, per capita consumption of fresh apples for each country for each consecutive year has been derived from the following relationship:

Fresh Apple Consumption (FAC)[33] = Total apple production (tons) + Fresh apple imports (tons) – Fresh apple exports (tons) – Apples for processing (tons) - Withdrawals (tons) / Population

It is important to note that these estimates made available by the WAR, reflect the retail weight (in kilograms) purchased, rather than the actual volume consumed per capita. Furthermore, according to the WAR (2013), the per capita consumption figures derived from their aforementioned relationship will not create any comparison issues as almost all other official measures of fresh fruit consumption in turn, also refer to the actual retail weight of fruit purchased by consumers thereof.

[33] Estimates of per capita consumption derived in this relationship are referred to as "disappearance" since this estimate includes shrinkage, waste, losses in distribution and natural disasters for which no relevant data is available.

Table 3.4: Estimated per capita consumption of fresh apples for selected EU countries, 1991 - 2012

Country/Region	1991-93	2000-02	2010-12	1991-93 to 2000-02	2000-02 to 2010-12
	(kg)	(kg)	(kg)	(% change)	(% change)
Austria	32.32	24.11	24.37	- 15.4	+ 1.1
Belgium	23.75	18.51	17.78	- 22.1	- 4.0
Denmark	15.50	19.99	19.98	+ 29.0	- 0.0
France	13.98	17.31	13.45	+ 23.8	- 22.3
Germany	23.77	20.70	18.23	- 12.9	- 11.9
Greece	19.68	21.87	23.57	+ 11.1	+ 7.8
Italy	21.20	22.04	16.83	+ 4.0	- 23.6
Netherlands	23.43	20.13	18.60	- 14.1	- 7.6
Spain	17.66	17.91	11.41	+ 1.4	- 36.3
Sweden	16.15	15.55	14.43	- 3.7	- 7.2
United Kingdom	11.23	9.50	9.40	- 15.5	- 1.0
EU-11	18.72	18.07	15.13	- 3.5	- 16.2
Bulgaria	7.08	3.38	4.97	- 52.3	+ 47.0
Hungary	24.51	14.05	15.22	- 42.7	+ 8.3
Norway	15.36	15.10	15.27	- 1.7	+ 1.1
Poland	13.71	16.54	16.21	+ 20.6	- 2.0
Romania	27.65	13.62	18.16	- 50.7	+ 33.3
Serbia	15.89	7.14	4.97	- 55.1	- 30.4
Slovakia	n.a.	10.74	10.89	n.a.	+ 1.4
Other Europe	n.a.	13.19	14.12	n.a.	+ 7.0

Source: World Apple Review (WAR), 2013

It is clear from table 3.4 above that there is a relative decline in per capita consumption of fresh apples in most of the countries within the EU. In total, the EU-11 countries experienced a relatively modest decline in the average per capita consumption of 16.2 percent between the periods of 2000-02 to 2010-12. Austria and Greece were the only two of the eleven countries which over the same period experienced a mere 1.1 and 7.8 percent increase in per capita consumption, respectively. Interestingly, the per capita consumption percentage change of 22.3%, 11.9%, 23.6% and 36.3% for France, Germany, Italy and Spain, respectively, over the same period had double-digit percentage declines.

In contrast, Bulgaria, Hungary, Norway, Romania and the rest of the European countries (not specified) showed a relative increase in per capita consumption over the last decade, but still

experienced a decline in general from 1991-3 to 2010-12. Some of the increases in per capita consumption of fresh apples in certain countries over the last decade may have been due to the wider availability of cheaper domestic apples especially from Poland. It is important to note that there is no single definite explanation for these discrepancies between these countries. Weakened economies, continuously aging populations, high unemployment, skewed per capita income distributions and the availability of fresh apples in Europe may contribute to the change in per capita consumption levels of fresh apples in these traditional South African apple export destinations (WAR, 2013). These trends should be of great concern to apple producers and marketers especially in South Africa and in the rest of the world.

Table 3.5: Estimated per capita consumption of fresh apples for other major apple producing countries, 1991-2012

Country/Region	1991-93	2000-02	2010-12	1991-93 to 2000-02	2000-02 to 2010-12
	(kg)	(kg)	(kg)	(% change)	(% change)
Argentina	8.06	9.62	7.53	+ 19.3	- 21.7
Australia	9.72	6.95	11.19	- 28.5	+ 61.0
Brazil	2.85	4.61	5.21	+ 61.8	+ 13.1
Chile	6.00	6.77	11.14	+ 12.8	+ 64.6
New Zealand	14.70	17.05	13.81	+ 16.0	- 19.0
South Africa	5.12	3.62	4.37	- 29.3	+ 20.8
S Hemisphere	4.64	5.51	6.20	+ 18.8	+ 12.5
China	5.41	13.39	21.64	+147.5	+ 61.6
Japan	5.59	5.81	5.43	+ 3.9	- 6.5
Taiwan	5.73	5.71	5.79	- 0.4	- 0.1
Turkey	32.32	32.03	30.15	- 0.9	- 5.9
Asia Selected	6.74	13.44	20.52	+ 99.4	+ 52.7
Canada	12.03	11.67	10.66	- 3.0	- 8.7
Mexico	4.40	5.31	5.83	+ 20.7	+ 9.9
United States	8.62	7.43	6.83	- 13.8	- 8.1
North America	8.13	7.23	6.87	- 11.1	- 5.0
Russian Federation	4.86	6.36	10.60	+ 30.9	+ 66.7
All 32 Countries	n.a.	11.89	15.50	n.a.	+ 30.3
(Excluding China)	n.a.	10.64	10.32	n.a.	- 3.0

Source: World Apple Review (WAR), 2013

Table 3.5 above, depicts the estimates of per capita consumption (in kilograms) for selected major apple producing countries in four different regions: the Southern hemisphere, North America, Asia and the Russian Federation, respectively. It is clear that the general per capita consumption in all of these producing countries (except China and Turkey) is considerably lower than the average of the EU-11 countries (table 3.4) of 15.13 kg for the period 2010-12.

Most interestingly, despite the fact that the Southern hemisphere producing countries are major exporters of fresh apples, their average domestic consumption is relatively low over the last decade, but the overall trend for the region is still positive. Japan, Taiwan and Turkey were

relatively stable over the last two decades, but have been slowly declining; whilst China's domestic consumption has been and is still booming. This does not come as a surprise, as China has a population of 1,364,340,000 people which is 19.1% of the world population and is currently ranked first in the world in terms of its population size (WEO, 2014). However, other apple exporting countries have shared little in this powerful upswing as China's fresh apple consumption is being dominated by domestic supplies (WAR, 2013:91).

Table 3.6: Estimated per capita consumption of fresh apples (grams) for non-producing regions, 1990-2010

Region	1990	1995	2000	2005	2007	2008	2009	2010
Eastern Africa	17	43	70	49	61	68	106	101
Middle Africa	24	31	47	87	93	127	92	151
Western Africa	38	20	66	83	130	152	142	146
Central America	175	806	1,649	1,652	1,854	1,602	1,794	1,816
Caribbean	299	343	428	593	556	626	555	635
Southeastern Asia	247	540	665	892	876	1,011	1,126	1,136

Source: World Apple Review (WAR), 2013

As depicted in table 3.6 above, it is clear that there is also a wide disparity in the per capita consumption of these six sub-regions which do not commercially produce apples (WAR, 2013:92). Interestingly, the African sub-regions had a relatively low per capita consumption over the period of 1990 and 2010 of less than 151 grams (which is only one apple with the average size of 72 millimetres in diameter, which is a medium sized apple). In contrast, Central America and South-eastern Asia sub-regions consume more than 10 times more on average over the same period. However, there is still a relatively robust positive growth trend in the per capita consumption of fresh apples in these sub-regions, especially in the African and Asian countries, which in turn confirm and back the significant growth in exports of fresh apples to these regions as also depicted in figure 3.2.

Overall, these per capita consumption figures give one a good indication of the general trends of not only fresh apple consumption, but that of fresh fruit produce in different producing and non-producing countries and regions all over the world. These demand side patterns are very important for producers and exporters, in this case of fresh apples, to identify possible new potential export markets and adapt their cultivar selection and production according to these markets in order to benefit in the growth in the near future. It is important to note that many lower income (developing) countries have a tendency to increase their per capita consumption

and among these countries many appear to have a considerable capacity for further increases in the future. One would also predict that further increases in the per capita incomes of developing and developed countries will not result in increased per capita consumption of fresh apples, as consumers tend to experiment and include other traditional and exotic fruits for new and exciting taste experiences (WAR, 2013:97).

Furthermore, the results of the per capita and export figures discussed in this chapter show that there is a dramatic shift in the per capita consumption and export from the traditional markets such as that of the European countries, to the new and robust African, FE and ME markets. Thus, is it of utmost importance that South African producers and exporters of apples identify these trends and prepare themselves to enter these markets as soon as possible to maximize the gain in these growing fresh apple markets, before the rest of the other major southern hemisphere producers.

According to the World Apple Review (2013:100), producers and marketing agents need to stimulate fresh apple consumption in the African, FE and ME countries, especially in those countries that are experiencing rapid economic growth which may appear to be more promising. Moreover, while the per capita consumption of fresh apples in the non-producing countries, especially that of Africa, the FE and ME appears to be more responsive to increasing per capita incomes as a result of their booming economies; now and in the coming decade, fresh apples still face challenging competition from a wide range of domestic fruits, as well as those imported and sometimes cheaper fruits. All of the other producers of fresh fruit fight for the same market opportunities over the same period of time, therefore current South African apple marketing and promotion efforts need be of sufficient scale and very adaptive to new market trends in order to stay competitive.

There is some confidence in the pome fruit sector at the moment, especially in South Africa. The South African apple sector has had a profitable year in 2013 (as mentioned earlier) and most growers, packers, and exporters can see a sustainable future in Africa, the ME and FE markets, that is if they can provide the right product and volume to these markets at the right time, price and place. The main factors which contribute to providing the right product are definitely fruit size, colour and quality (Odendaal, 2014). Producers (growers) are likely to accentuate management to support fruit size and colour in order to maintain the high price premiums they have achieved in various export markets over the last few years (Odendaal, 2014).

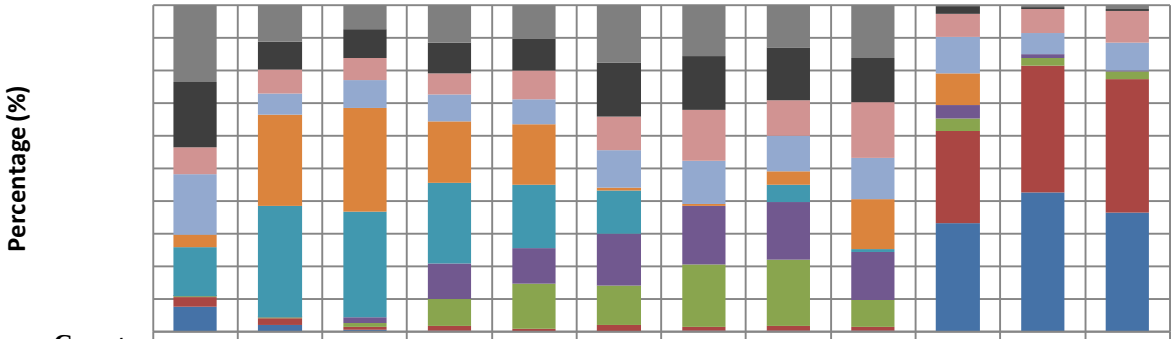
As depicted by table 3.7 below in conjunction with figure 3.7, certain apple cultivars and specific apple size(s) are exported to specific markets. The European continent's markets demand larger apples (count of 70 to 110) in an MK4[34] equivalent carton with an average weight of 261 grams to 166 grams respectively, as well as an average fruit diameter of between 86 mm to 74 mm. According to Odendaal (2014) and expert exporters to this market, the main reason for this trend is that the average European consumers prefer bigger loose apples, especially pre-packed in plastic bags. This, coupled with the above average income per capita, enables the traditional European consumer to buy a 1.5 kilogram bag of apples (at a premium for certain high value cultivars) to share with his or her family (Odendaal, 2014).

In contrast, the African markets demand a much smaller apple with an MK4 equivalent size of 180 to 216, which has an average weight of 101 grams to 84 grams per apple and a minimum diameter of 59 mm tot 55 mm, respectively in this specific count per equivalent carton. Interestingly, the main reason for this specific market requirement is that the average African consumer is relatively poor and prefers quantity at a lower affordable price. Thus, from an informal buyer perspective, they are also regulated by higher authority as to how many apples per bag and at what price they may sell to the consumers in their informal street markets. In other words, South African apple exporters export relatively smaller fruit by local standards in loose cartons in order to allow the African buyer to resell according to their traditional consumer preferences at a lower price (Odendaal, 2014).

Furthermore, according to Kotze (2013), various factors e.g. location and climatic conditions (not enough chilling units) are most probably the two factors which have the greatest influence on why South Africa is generally not a perfect region for producing large fruit. This poses as another robust indication that South Africa has an ideal opportunity to dominate the African market, as Africa, as mentioned earlier, is generally a small fruit market which also accepts South African Class 1L[35] local apple standard, as well as the major cultivars which are traditionally domestically grown. The FE and ME markets differ to a great extent in terms of general apple size(s) and cultivars, from one another.

[34] A MK4 equivalent carton refers to an 18.25 kilogram M18T Telescopic carton, see table A6 and table A7 (Appendix A).
[35] Class 1L refers to a fruit quality standard specially packed for the domestic supermarkets such as that of Spar, Checkers and Pick 'n Pay.

Table 3.7: Fruit size distribution per target market (2012 & 2013)



Count	70	80	90	100	110	120	135	150	165	180	198	216
ME_2012	1.7%	4.3%	5.0%	11.2%	12.1%	15.3%	23.4%	14.4%	10.6%	0.6%	0.5%	0.7%
ME_2013	1.5%	3.2%	5.9%	9.4%	11.2%	14.2%	24.9%	17.6%	8.8%	2.5%	0.5%	0.3%
FE_2012	0.6%	2.7%	4.6%	6.3%	10.0%	8.8%	23.5%	12.1%	11.0%	8.2%	6.6%	5.6%
FE_2013	1.4%	2.4%	5.6%	7.8%	8.8%	9.8%	19.9%	12.1%	8.4%	13.4%	5.6%	4.8%
EU_2012	0.3%	10.6%	21.5%	18.4%	21.6%	0.8%	1.0%	4.4%	10.0%	11.4%	0.0%	0.0%
EU_2013	1.1%	12.8%	21.9%	24.1%	22.4%	11.5%	0.0%	5.7%	0.4%	0.0%	0.0%	0.0%
UK_2012	0.0%	0.0%	1.2%	10.5%	12.7%	13.6%	26.8%	19.5%	9.6%	4.6%	1.2%	0.3%
UK_2013	0.0%	0.1%	0.8%	8.3%	15.9%	10.4%	28.9%	22.3%	5.5%	4.7%	2.0%	1.2%
AF_2012	0.2%	0.8%	0.5%	1.3%	0.9%	1.7%	1.6%	1.5%	0.7%	33.1%	34.6%	23.2%
AF_2013	0.5%	0.8%	0.4%	0.2%	0.0%	0.0%	0.5%	0.3%	0.2%	38.8%	37.5%	20.7%

Source: Ceres Fruit Growers, 2013

On the one hand, world apple production is expected to increase further on the back of higher demand from developing countries within Africa, the Middle East and Far East. It is clear from the per capita consumption and importing figures that the largest demand for fresh apples is from regions where the per capita consumption is still significantly lower than that of developed countries. These low demand patterns will change as more consumers become health-conscious, as well as the income per capita of these developing countries increases during the next decade. However, on the other hand, the global- and country-specific economic downturn could result in a significant decrease in demand of fresh apples as it is considered as a luxury product in the general fruit basket. Thus, in difficult economic times, apples will not be considered to be high on the priority list of the average individual or family (WAR, 2013). As mentioned, Africa is the new “buzz word” in international trade and also in the fruit export arena, especially apples. The following two sections will focus on Africa with special attention to the opportunities and risk associated by doing business in this continent.

3.4 South Africa's growing opportunities in Africa in terms of apple exports

Since the deregulation of 1997, the South African pome fruit industry started developing new markets within the ME, FE and Africa respectively (Pretorius, 2014). The Latin phrase "*Ex Africa semper aliquid novi*", which is translated to "Something new always comes out of Africa", gains new meaning as the African continent is continually establishing itself as a global hub for doing business (Niemann *et al*., 2014). According to Niemann *et al*. (2014), Africa is still remaining relatively resilient through the recent contraction (economic downturn) in global economic conditions and activity from 2008. South Africa is rebounding rather quickly and outpacing most of the remaining world in terms of an average real GDP growth rate of 4.5% over the period from 2008 to 2013 (Niemann *et al*., 2014; AEO, 2014; Van den Berg, 2014).

South Africa is geographically ideally situated to supply fresh apples and other fruits to Africa with an average distance of 3267 km to major African cities and business hubs (Trademap, 2014). According to Kotze (2013), the majority of South African apple exports are destined for West Africa, with the exception of Kenya (which is situated in East Africa). The numerous South African supermarket stores such as Checkers, Pick 'n Pay, Shoprite, Spar, OK Foods, Fruit & Veg and Woolworths (to name just a few) are constantly investing and diversifying into Africa and, in turn, contribute to better market penetration, as well as increasing demand for fruit in general (Kotze, 2013). Interestingly, exports to African markets started to gain momentum after the global financial crisis in 2008. The African market share grew from 6% in 2001 to 24% in 2013[36]. According to Pretorius (2014), rapid growth will relieve the pressure from the traditional markets such as the UK, and enable South African producers to remain profitable.

3.4.1 Africa: a continent of opportunity

Across the 54 countries within the African continent endless business opportunities are presented (Niemann *et al*., 2014). Moreover, Africa as a strategic export market is becoming increasingly important for exporters across multiple industries, especially and more specifically for players in the consumer goods and fresh produce markets (Van den Berg, 2014). The vast growth in mobile technology, especially in mobile banking, the discovery of

[36] See figure 3.2

oil and gas resources, under-developed tourism potential, increasing young population growth and countless reports show that the African continent is on a robust growth trajectory (Niemann *et al.*, 2014: Kotze, 2013).

The economic fundamentals of certain countries in Africa seem promising over the last couple of years. According to Niemann *et al.* (2014), Africa countries have a relatively stable exchange rate, increased private and foreign direct capital investments, resilient commodity prices, increasing per capita income (especially the rising middle income group) and modest inflation. Furthermore, these favourable economic conditions have given rise to extensive urbanisation and thus opened a healthy new consumer market with unprecedented higher disposable incomes (Niemann *et al*., 2014).

It is important to note that the Free Trade Agreement (FTA) within the Southern Africa Customs Union (SACU) [37] manifests easy access to some of the key African markets, such as Namibia and Botswana, without import tariffs (on certain goods) and custom duties applicable on exports from South Africa (Kotze, 2013; SACU, 2014). New free trade agreements such as the Southern African Development Community (SADC), Free Trade Area (FTA) and the Tripartite FTA between SADC, East African Community (EAC) and the Common Market for Eastern and Southern Africa (COMESA) have also created new opportunities, particularly for South African apples (USDAFAS, 2012).

Moreover, according to Van den Berg (2014) and Niemann *et al.* (2014), although the African continent offers a lucrative and sustainable long term growth opportunity and is an increasingly critical export market that cannot be ignored by international businesses, with expected economic growth rates being higher than the world norm, coupled with growth in the middle income class consumer numbers, these opportunities comes with many challenges. These challenges or risks can easily turn seemingly profitable ventures into an exporter's worst nightmare. Keeping the exceptional business opportunities of the African continent in mind, it is of utmost importance to clearly understand the challenges in this ever growing market. The following sub-section will briefly put some of these challenges into perspective.

[37] The Southern African Customs Union (SACU) consists of Botswana, Lesotho, Namibia, South Africa, and Swaziland. The SACU Secretariat is located in Windhoek, Namibia. SACU was established in 1910, making it the world's oldest Customs Union (SACU, 2014).
The Member States form a single customs territory in which tariffs and other barriers are eliminated on all the trade between the member states for products originating in these countries and there is a common external tariff that applies to non-members of SACU (SACU, 2014). See table A1 (Appendix A) for a summary of the main trade agreements between South Africa and the rest of the world.

3.4.2 Doing business in Africa: Challenges

Despite the enormous opportunities and the abundance of economic data, there is however, according to Games (2004:1), "very little qualitative information available on the structural challenges facing business in Africa."

> *"Africa is changing and the risk of doing business has already begun to decline and is expected to continue its decline. However, it is still vital to have the right partners when dealing with the continent as vast experience and understanding is needed to be able to successfully negotiate in this unusual environment" (Nelson & Papier, n.d.).*

It comes as no surprise that Africa's operating environment remains one of the most difficult in the world, when considering the historical context, political divisions, income inequality, culture differences and external interference with many other African countries (Niemann *et al*., 2014). The following highlights some of the key challenges of doing business on the African continent, according to various sources:

- Poor Infrastructure (roads, ports, information systems)
- On-going electricity crises
- Unreliable supply chain
- Limited or inadequate distribution and cold chain facilities
- Bureaucratic import procedures, corruption and graft
- "Stop & go" policies
- A lack of reliable communication and institutional capability
- Political, legal and regulatory instability
- Opaque procurement processes
- Shortage of skilled workers
- Weak fiscal and monetary policies
- High taxes and inflation
- Nationalisation issues
- Volatile currencies and commodity markets i.e. low oil price.

These key challenges are by no means exclusive to Africa, but are the main reason(s) as to why the African continent still dominates the lower reaches of the World Bank's "doing business[38]" rankings (EIU, 2012:9; Niemann *et al*., 2014). Several of these "key challenges" will take a generation, if not more, to correct. Niemann *et al.* (2014,) argues that it is the concentration, combined with the inherent complexity of these challenges, that hampers the African continent's development and as education and skills improve, so will this development process.

According to Van den Berg (2014), these "key challenges" will force companies to adjust their strategies and expectations when entering the African market by understanding and taking cognisance of these challenges to, in turn, unlock maximum long term value from the opportunities on the African continent. Van den Berg (2014) furthermore stressed that it is of utmost importance to study and understand specific local market dynamics, cultural aspects, consumer behaviour, patterns of preference and demand and most importantly, mitigate financial risks by selecting the right business partners and customers.

Nelson and Papier (n.d.) stated that "doing business in Africa is no harder than anywhere else, but rather requires a different set of skills and understanding and often a large dose of patience and tenacity." They stressed the importance of connecting with people by stating that "sitting down, having a meal together is the African way of building relationships", which other countries do not necessarily understand as a way of doing business.

As one would expect, stronger property rights, financial market sophistication and better infrastructure in Africa are all associated with higher exports from South Africa to those countries within the African continent. Similarly higher levels of corruption and more burdensome customs procedures in South African trading partners are associated with lower exports from South Africa to those countries, especially non-traditional export markets. The effect of NTB's in African countries is pushing up the cost of doing business in this region (TMEA, 2014). NTB's implemented by East African countries still have a great impact on free trade among the African countries. Furthermore, according to a report by the East African Community Secretariat, the lack of eliminating NTB's and more African countries

[38] The World Bank's Doing Business Indicators are updated on an annual basis, providing a quantitative measure of a particular aspect relevant to competitiveness: business regulations relevant to the operation of domestic small- to medium-sized enterprises (SMEs) throughout their life cycle (WEF, 2014). These indicators specifically cover the following topics: starting a business, dealing with construction permits, registering property, getting credit, protecting investors, and paying taxes, trading across borders, enforcing contracts, and closing a business (WEF, 2014).

continuously introducing new NTB's, in turn denies this region from larger potential markets, economies of scale and promotion of local, regional, and global trade (TMEA, 2014).

This means exporters to African countries, especially East Africa, will experience higher cost of doing business arising from existing and "new" NTB's, of which weighbridges, roadblocks, poor infrastructure, unnecessary delays at border posts and corrupt officials are the most general NTB's encountered. These are also coupled by the lack of harmonised import and export standards, procedures and documentation, according to the Secretariat's report findings (TMEA, 2014). It is clear from a potential apple exporter/producer's point of view that the African continent has unlimited opportunities which could benefit the South African apple industry greatly; however these opportunities do not come without challenges. The afore-mentioned challenges, which could translate into NTB's, need to be taken into account when smaller producers and exporting agencies consider penetrating this continent; otherwise these suppliers may incur huge financial losses.

3.5 Characteristics of South Africa's top apple export destinations

It is of utmost importance for producers and exporters of any good or service to know the challenges, opportunities and characteristics of traditional and potential export destinations or markets. The lack of market and, ultimately the end consumer or client knowledge, may contribute to unforeseen and unnecessary cost of doing business which may lead to a loss and/or higher transaction cost over the short- to medium run, *ceteris paribus*. The South African apple industry has the ability to adapt to the continuously changing market conditions and consumer demand patterns, despite being considered a developing country coupled with poor economic indicators such as high unemployment, a volatile exchange rate, political instability and low economic growth. The following section provides a brief summary on the most important characteristics of the FE, ME, EU and African markets according to interviewed specialised fruit exporters combined with personal industry knowledge.

3.5.1 Africa (AF)

- Benin is the main import "hub" for goods being exported into West Africa, especially into Nigeria, as Benin has quick and easy clearance procedures at its borders and did not have any major trade impeding barriers until 2011 (Coetzee, 2014);

- Benin also impose a relatively low import tariffs of 20% on fresh apples exported from SA, compared to Nigeria's import tariff of 90% upon till 2011 (ITC, 2014);
- As of 2011 Nigeria granted import permits and lowered their import tariffs to 20%, which opened up their borders, making more economic sense to export directly to Nigeria, which contributed greatly to why South Africa's exports to Nigeria increased by almost 330% in recent years;
- Import tariffs imposed by African countries generally do not exceed 20%, but still has an effect on the volume of exports to certain countries, especially in West Africa (Coetzee, 2014);
- The market is not very sophisticated, as fruit is usually sold on the informal markets such as by street vendors and hawkers (Odendaal, 2014);
- Buyers of apples in this market are dedicated to pay a high premium for good quality fruit (Odendaal, 2014);
- Western and Eastern African market segment also prefer smaller sized fruit (count[39] 180 to 216) because the buyer wants quantity to resell (Odendaal, 2014);
- Golden Delicious, Pink Lady®, Sundowner® (also known as Cripps Red) and Granny Smith are the main apple cultivars being exported to West Africa. Top Red, Starking, and Early Red One, which are red apple cultivars, are preferred in East Africa, thus there are robust differences between African market segments (Coetzee, 2014);
- Africa does not have the ideal climatic conditions, infrastructure and knowledge to produce their own apples and South Africa has an ideal physical position and adequate climatic conditions, as well as the knowledge to produce and supply the African continent with apples. This creates the increasing demand for South African fruit (apples) and also encourages producers and exporters to penetrate into Africa and establish good relationships in order to dominate foreign competition (Kotze, 2013);
- The Ebola virus has a negative impact on trade, especially on the shipping of products to Nigeria, because the Nigerian authorities prohibit any shipment from the virus-infected countries or areas in order to protect their population (Coetzee, 2014);
- The Political instability, corruption, lack of infrastructure, lack of credit insurance, availability of physical currency (hard cash), lack of property rights, language and

[39] Please see tables A6, A7 and A8 in appendix A for specific details regarding the technical specifications of various packaging of apples and the size specifications which were supplied by Hortgro (2014) and Ceres Fruit Growers (2013).

cultural differences and sterilization requirements (especially in Nigeria) of fruit, are seen as the major barriers to trade in this market segment (Coetzee, 2014; Odendaal, 2014);

- In order to protect South African producers and exporters from potential losses as a result of border congestion, corruption or lack of efficient cold chain management for this highly perishable product, apples are usually sold "ex-works[40]" to the potential buyer in this market segment (Coetzee, 2014; Odendaal, 2014);
- France, Italy and the United States of America are South Africa's main competitors in the Eastern and Western Africa market. They dump large quantities of apples at very low prices into these markets, which in turn results in downward pressure on market prices and ultimately the demand for certain apple cultivars (Coetzee, 2014);
- African economies are a very dependent on the oil price which generates many of the economies' main sources of income. There are concerns that low oil prices will also have a negative effect on countries such as Nigeria (which has the second largest oil reserves in Africa and accounts for 95% of all Nigerian exports) and Angola, which indicates how tepid and volatile West African economies are to commodity price fluctuations (AEO, 2014);
- The Chinese private sector is continuously increasing investments in new road, port and other transport facilities in African countries such as Nigeria, Angola, Kenya, Zambia and Tanzania, which is easing infrastructural hurdles for exporting into Africa (Viviers *et al*., 2014:195).

3.5.2 Middle East (ME)

- Import tariffs are major barriers to trade as they result in lower fruit prices, as South African exporters still need to absorb the tariff effect and still be profitable (i.e. India's import duty on apples is 40 per cent) (Meiring, 2014);
- Apple exports from South Africa entering Dubai, the United Arab Emirates, Saudi Arabia, Oman and Kuwait are free of import tariffs (Meiring, 2014);
- Dubai is the main import hub for the ME markets and ±60% of the South African volume exported to the ME is being distributed from Dubai throughout the ME (Meiring, 2014);

[40] See footnote in subsection 2.4.5 for the "ex-works" terminology.

- Golden delicious and Gala type (i.e. Royal Gala, Royal Gala Red, Royal Beaut) apple cultivars are on high demand because of their respective taste profile (sweet taste) and colour spectrum (Meiring, 2014);
- The ME market as a whole also prefers medium size fruit, but interestingly, not as small as the African market (usually a count 110 to 165) (Odendaal, 2014);
- Oman and the United Arab Emirates (UAE) can be seen as one market segment within the ME and they usually prefer smaller apples (count 150-165) and a small percentage of this specific market prefers a carton count of 180. This market segment also has a high demand for Royal Gala and Golden Delicious cultivars (Meiring, 2014);
- The ME is a market which will buy less coloured fruit which is very convenient for producers of these cultivars as they can utilise all of their produce (Meiring, 2014);
- The high volumes from USA and Southern Hemisphere countries such as Chile, Argentina, New Zealand and Australia (which are major competitors in this market segment) can be seen as a trade barrier for South African apple producers and exporters (Meiring, 2014);
- There is also a kind of a culture present in this market where the general consumer thinks that "everything that comes from the USA is better" and they are willing to pay a higher premium for apples of USA origin, which in turn can also have a negative influence on the demand for South African fruit or any other product from a country other than the USA (Meiring, 2014; Odendaal, 2014);
- The director of G.F. Marketing David Pearce, stated in is interview for the article in the FreshFruitPortal (2014) that "The Middle East is a market that can absorb only so much before it is upset with too much apples and that the main concern with the Middle Eastern markets is that we will see 'every man and his dog' trying out these new markets causing flooded markets and poor returns (FreshFruitPortal, 2014)."

3.5.3 Far East (FE)

- There is a 5% import tariff present in Malaysia and no import tariffs imposed by Singapore and Hong Kong, respectively (ITC, 2014);
- Bangladesh and Indonesia impose a 25% import tariff, but the high prices received from this market outweighs the negative impact thereof (Meiring, 2014);
- Taiwan also imposes an import duty of 20% on South African apples. The orchards of a specific cultivar of a South African producer, as well as the specific pack-house where

the fruit has been packaged, needs to be registered in order to export to this market. It is important to note that South Africa's main competitors in the Taiwanese market are Chile, New Zealand and the USA which can enter this market duty free. This in turn gives them the competitive advantage in this specific market segment (Meiring, 2014);

- Indonesia also imposes import licences (permits) and import quotas which are not easy to acquire. South Africa also needs a SPS certificate, as well as "heavy metal" tests for the presence of traces of metals on fruit. This must be done for each and every Producer Unit Code (PUC) at a cost of approximately R2000 per PUC. This is generally seen as major NTB's in this market (Meiring, 2014);
- Malaysia is by far South Africa's biggest market segment within the FE as it absorbed almost 70% of the FE export volume in 2013 alone (Meiring, 2014);
- South Africa may not use Jakarta (which is the capital city and main harbour) for exports into Indonesia and may only use Surabaya, where the roads and infrastructure are relatively poor. This in turn limits the volume that can be exported to this market;
- The FE is a more sophisticated market segment in terms of quality requirements, as well as the cosmetic appearance and packaging of fruit (Meiring, 2014);
- Per capita income is generally very high, so are the consumers' demands, as they are willing to pay high premiums for good quality fruit, but there is still a large part of the population which is considered to be poor, which creates a demand for the lower quality fruit as well (Meiring, 2014);
- Cultural characteristics (tradition) are very important, as the FE population offer the highest quality fruit as gifts to visitors. They also offer fruit when they pray to Allah during the month of Ramadan, which in turn creates a higher demand for spotless (no defect) and good coloured and quality fruit (especially during these "cultural periods") (Meiring, 2014; Coetzee, 2014);
- There is also an opportunity to export lower quality apples, which are usually being sold by informal markets, but this opportunity has been exhausted by other competitors, which in turn puts downward pressure on the price of good quality fruit (Odendaal, 2014);
- Fuji, Granny Smith, Royal Gala, Royal Beaut and Pink Lady® apple cultivars are on high demand within the FE because of their taste profile and unique quality appearance;

- SmartFresh™[41] eliminates the potential export window to this market as this enables the Northern and Southern competitors to supply specific apple cultivars to this market all year round which can be trade restrictive, but in the same sense also promotes sound market competitiveness;
- The USA is very pro-active and supplies their surplus volume (which is very high) to this market;
- Singapore is a very sophisticated market segment and demands a very high standard of apples with reference to quality, such as that of Fuji, Royal Gala, Granny Smith and Pink Lady® cultivars and also generally prefer a medium sized fruit i.e. count (size) 110 to 165 (Meiring, 2014);
- Taiwan is very specific in terms of fruit size and cultivars i.e. bigger sized apples such as a count 70 to 120 and only Fuji apples are currently exported to this market because of its unique sweet taste profile (Meiring, 2014);
- South Africa supplies Hong Kong (China) with medium to large sized apples, which are usually a count 90 to 135 specifically for cultivars such as Royal Gala and Granny Smith apples. The apples need to be free of any kind of cosmetic damage coupled with an excellent colour profile (Meiring, 2014);
- All the competitors such as Chile, New Zeeland and USA export ("dump") a large volume of apples into this market between April and July. This forces South Africa out during this period; therefore this market is only profitable before April and after the end of July each season (Meiring, 2014);
- South Africa does not produce large apples, which may be a problem to supply the increasing demand in this market with large volumes. This market is considered to be very important to sell bigger sized Fuji apples to which some producers might harvest during a season (Odendaal, 2014);
- Hong Kong was previously used as a "grey area" in order to enter China, but this marketing channel was closed in the recent past by the Chinese authorities (Meiring, 2014).
- After eight years of negotiations between the respective government authorities, the Chinese market opened up for South African fresh apple exports in 2015 (Odendaal, 2014).

[41] According to Agrofresh (2015) the SmartFresh™ Quality System is an important tool used for fruit quality management as it manipulates the ripening of fruit and vegetables by controlling naturally occurring ethylene during storage and transport. Ethylene causes ripening and spoiling of fruits and vegetables.

- A major trade barrier in Hong Kong is the large volumes of apples entering this market which puts downward pressure on market prices, which is undesirable for exporters (Meiring, 2014);
- Cultural differences are very important and, in order to be successful in this market, one needs to know the different cultures and how to show respect to the clients according to their cultural norms (Meiring, 2014);

3.5.4 European Union (EU)

- It is important to note that South Africa can export apples to the EU between 1 April and 31 July each year, free of any additional tariffs other that of the seasonal import duty on fruit being exported outside their given seasonal window of between 5 % to 9% (on the total value of the apples exported) (see table 1.1);
- The EU is no longer South Africa's biggest target market, because of the availability of fruit within the European market throughout the year. This is thanks to new cooling and storage technology such as SmartFresh®, as well as the foreign competition from Poland and the southern hemisphere countries e.g. Chile, Argentina and New Zealand. Thus the supply for fresh apples is very high in this market segment, resulting in lower net price per ton/carton being offered by buyers (Coetzee, 2014; Odendaal, 2014);
- SPS measures such as Maximum Residue Limits (MRL's) are seen as the biggest NTB imposed by this market segment, which in turn has a great effect on the bilateral trade of fresh fruit between South Africa and the EU (Coetzee, 2014);
- The United Kingdom runs campaigns to establish a "pro-British" culture in order to encourage domestic consumers to buy local produce which may result in lower demand for foreign products, in this case a lower demand for South African apples and certain cultivars (Coetzee, 2014; Odendaal, 2014);
- Specific audit requirements such as GlobalGap, Natures Choice (Tesco), Field to Fork (Waitrose) and SIZA, which are very costly and time consuming, increase South African apple producers' production cost (compliance cost). South African apple producers need to undergo these types of sustainability and ethical trade audits on an annual basis in order to comply with the supermarkets' specific requirements, otherwise they cannot export any fruit to the EU. This is also seen as a major NTB in this market segment;

- European apple producers such as Poland, Germany and the Netherlands are being subsidised by the European government to establish new orchards and expand their current production units. This lowers their production cost per unit, which in turn decreases South Africa's competitive advantage in this market as we cannot compete with their low market prices (Coetzee, 2014);
- The European Commission also subsidises their agricultural sector in order to counter or decease urbanisation, as the average European city is overpopulated with its associated problems. This serves as a type of incentive for the European farmers to stay on their farms and also to increase their contribution to GDP and the increasing demand for foodstuff within the urban areas. This allows the EU to not have to import foreign products which may pose a risk to the environment and/or to the population (Coetzee, 2014);
- Europe produces their own apples throughout the continent, but their late season for apples still creates a demand for South African apples to be exported to the European Union, thus the window of opportunity in this market segment is of great importance to receive a higher price (Coetzee, 2014);
- Europe prefers bigger sized fruit (i.e. count 70 to 100) which is pre-packed in specific packaging (cartons and bags) (Coetzee, 2014);
- Braebrun and Pink Lady® cultivars are on high demand throughout the European continent because of their unique taste profiles and because these cultivars have a good general appearance (Coetzee, 2014);
- The exchange rate effect is very important for South Africa's export opportunities, especially in this market segment with two high value currencies (i.e. Pound (£), Euro (€)) (Odendaal, 2014).

3.6 Chapter summary

The purpose of this chapter was to review the South African apple industry and its main export market segments. It is clear that the per capita consumption of fresh apples is under pressure from other fruits in the traditional middle income consumer's fruit basket. The African continent is continually becoming more important in terms of the growing opportunity for doing business, but this opportunity does come with its risks and cost of doing business.

The African, the Middle East and the Far East regions have displayed resilient demand patterns despite difficult global conditions. It is clear that each of the established, as well as the potential export market destinations for South African apples, is very unique and coupled with their own set of trade barriers. South African apple producers will continually face pressure to penetrate and stay competitive in this highly competitive industry which is totally dependent on good weather conditions and volatile exchange rate conditions in order to stay profitable in the long run.

Another important aspect in international trade is to try and quantify the economic effect of NTB's on the export of specific commodities, in this case the export of fresh apples. As mentioned in chapter 2, there are various methods evident in trade literature; however, these methods cannot be successfully applied to single commodities. Unfortunately not all factors that influence export volumes can be quantified and included in the model, notably NTB's and consumer preferences. The following chapter will provide more specific detail on the methodology used in this study and specification of the data used in the gravity trade model.

CHAPTER 4: MODEL AND DATA SPECIFICATION

4.1 Introduction

Gravity trade models possess several basic features and have proven to be successful in explaining multilateral and bilateral trade flows between countries. Gravity trade models can easily be adapted in order to investigate specific factors that affect international trade, which makes these models the ideal framework to meet objectives of this study. The first section of this chapter discusses the data specification and variables used in the basic gravity trade model applied in this study. The last section of this chapter will focus on the methodological aspects of the regression techniques used as well as testing the panel data and variables for stationarity using a panel unit root test.

4.2 The variables and data description

This study used primary, as well as secondary data. The primary data consisted of various informal interviews conducted with fruit exporters. Secondary data was obtained using databases which are accessible online and contain various trade indicators from various international trade organizations. Trademap of the International Trade Centre (ITC) based on the United Nations Commodity Trade Statistics Database (COMTRADE), which is maintained by the United Nations Statistical Division (UNSD), were used for all trade-related data queries.

The trade data in terms of the volume (tons) of fresh apples exported from South Africa to the country groupings (see table 4.1 below) was sourced online from the Trademap database as mentioned. Trademap was the only source that had accurate data for all the relevant countries extending over the entire period being considered in this study. The Harmonized System (HS), which is an international nomenclature defined by the World Customs Organisation (WCO) for the classification of products, was used at a (HS) six-digit level (080810) for fresh apples for the purpose of this study (ITC, 2013). The United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) (2012) have published a gravity trade model user guide in which they indicate that GDP and exchange rate data used in a gravity trade model should be expressed in nominal terms. The reason is that trade data, such as the GDP and exchange rate data, should not be deflated by unobserved price indices such as the consumer price index (CPI) of GDP deflator. This is because real GDP and exchange rate data is adjusted

for inflation and therefore do not adequately capture the price effect and can consequently produce misleading results (UNESCAP, 2012).

Data on GDP[42], population and the official nominal exchange rate used in this study was obtained from the World Bank's World Development Indicators (WDI) database as well as the United Nations National Accounts Main Aggregates Database (UNNAMAD). The nominal exchange rate data retrieved from the WDI refers to the exchange rate determined by national authorities or the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (local currency units relative to the U.S. dollar). Then each country's local currency (relative to the U.S. dollar) is converted by using the average South African Rand (ZAR) relative to the U.S. dollar exchange rate for each year, which is sourced and calculated using the South African Reserve Bank's (ZAR per U.S. dollar) historical exchange rates database. The converted exchange rate variable for each country is expressed in nominal terms.

The French research centre for international economics (CEPII) gravity distance database is the data source used for the geographical bilateral distance (in kilometres) between South Africa[43] and the selected trading partners. The dummy variable (which indicates the common language spoken by the respective countries used in the model) was also sourced by using the CEPII gravity database. Trade data was extracted from these sources to ensure a unified set of data to calibrate the model.

It is important to note that the South African apple industry recorded a remarkable harvest in terms of production volumes, high local and international market prices and excellent overall fruit quality in 2013. Unfortunately, unfavourable climatic conditions, which included severe hailstorms, struck in the Western Cape area (especially the Ceres, Witzenberg Valley and Koue Bokkeveld regions). This impacted negatively on the 2014 harvest and exports. It is for this reason that only data up until the end of 2013 will be analysed in this study. Therefore, the export data used was the volume of fresh apple exports (measured in tons) from South Africa to the grouping of countries which represent the top 19 export destinations for South African apples over the time period of 2001 to 2013 (13 years). The number of countries was limited because of the lack of adequate trade and economic data. The selected countries were grouped

[42] GDP values are expressed in nominal terms and in US$.
[43] Pretoria was used as South Africa's capital city from which the distances (in kilometres) to the selected countries' capital cities, were taken.

as: the Far East, Middle East, Africa and the European Union (which are denoted by the acronyms FE, ME, AF and the EU, respectively). The 19 countries which were used to represent the four respective regions are as follows:

Table 4.1: Country selection and grouping

Region	Country	Abbreviation
Europe (EU)	United Kingdom	UK
	Netherlands	NLD
	France	FRA
	Germany	DEU
Africa (AF)	Benin	BEN
	Angola	AGO
	Ghana	GHA
	Senegal	SEN
	Nigeria	NGA
Far East (FE)	Malaysia	MYS
	Singapore	SGP
	Bangladesh	BAN
	Indonesia	IND
	Hong Kong-China	HKG
	Chinese Taipei-Taiwan	TWN
Middle East (ME)	United Arab Emirates	UAE
	Saudi Arabia	SAU
	Oman	OMN
	Kuwait	KWT

Panel data, or in other words the bilateral trade data over time, was used in the analysis. Panel data ultimately enables one to identify time effects (business cycles), source country effects and target country effects over time. According to Hsiao (2007:3-6); Baltagi (2008); Baltagi *et al*. (2014) and UNCTAD (2012), panel data has several advantages over the use of either cross-sectional or time-series data, which are as follows:

i) Panel data can give more informative data, usually contains more degrees of freedom, has more variability, less collinearity among variables and more accurate inference of model parameters; hence improving the efficiency of econometric estimates;
ii) Panel data is able to control for parameter heterogeneity, whereas cross-section and time-series data do not, thus running the risk of obtaining biased results;
iii) Panel data is able to better identify and measure effects that are simply not possible with cross-section and time-series data;

iv) Models using panel data can enable one to construct and test more complicated behavioural models than models using pure cross-section and time series data.
v) The nature of panel data (which contains components of both cross-section and time-series) allows one to make many observations on an economic relationship within a single time period.

Hsiao (2007:19) highlighted that it is very important to know the limitations[44] of using panel data and also what kind of econometric method is most suitable in analysing such data efficiently.

4.3 Methodological aspects of estimating the gravity trade model

Given the multiplicative nature of the gravity trade model, the traditional method for estimating the coefficients of this model in its log-linear form, is using the Ordinary Least Squares (OLS) regression technique (Kapaptsoglou *et al*., 2010; Van Bergeijk and Brakman, 2010; UNCTAD, 2012). This allows for easy interpretation of the estimated parameters, because these parameters are estimated in natural logarithms, which indicate their respective elasticities.

According to Herrera and Baleix (2010:9), fixed effect models are primarily used if individual country trade effects are the focus of the model estimation. Herrera and Baleix (2010) argued that fixed effect models assume that the unobserved heterogeneous component in a regression is constant over time, which may result in biased estimation results. It is also important to note that any explanatory (independent) variable that does not vary over time (e.g. country distance or common language in this case) needs to be omitted from the first regression if a fixed effect model is used because of perfect multicollinearity of the distance variable and common language (Herrera & Baleix, 2010:10). Thus, the use of a fixed effect model does not allow one to estimate coefficients of some fixed (time-invariant) variables such as distance, common language and dummy variables on bilateral trade, which is one major disadvantage of using a fixed-effects model (Herrera & Baleix, 2010:10; Genç & Law, 2014:19, Greene, 2013 & Martinez-Zarzoso and Nowak-Lehmann, 2003:298-299). This is however a disadvantage that is addressed in this study.

Another common panel data technique is random effects estimation, which requires that the explanatory variables used in a gravity model not to be correlated with country-specific effects

[44] Specific limitations fall beyond the scope of this thesis. For more detailed information on these limitations please see Baltagi (2008) and Hsiao (2007).

(Dinçer, 2014; Genç & Law, 2014:19). Fixed effect estimation is preferred over the random-effects estimation technique when bilateral trade flows between predetermined groups of trading countries is estimated (Greene, 2013:33; Dinçer, 2014; Egger, 2000:26 and Martinez-Zarzoso and Nowak-Lehmann, 2003:299). However, in order to differentiate and verify the most efficient estimation technique (i.e. fixed effect versus random effects), the Durbin–Wu–Hausman test (sometimes also known as simply as the "Hausman specification test") can be used. According to Eita (2008), if the null hypothesis of no correlation between the country-specific effects and the regressors is rejected, then the fixed effect estimation technique is more efficient and consistent than the random effect estimation, given the panel dataset used. Since the primary objective of this study was to determine the main factors that explain the recent trends in South Africa's apple exports to the EU, AF, the FE and ME over a period of 13 years (2001-2013) using the fixed effects specification coupled with the OLS regression technique of the gravity model. Thus, the Hausman test was not needed in order to choose between the two (aforementioned) estimation techniques. As mentioned, the fixed effect allows one to determine the country group-specific effects on trade flows; whereas the random effect assumes that the country-specific effects are random and not directly estimated.

According to Yamano (2009) heteroscedasticity in the dataset can be taken into account by estimating an Ordinary Least Squares (OLS) regression with robust standard errors. This allows one to estimate an OLS regression with standard errors which are Best Linear Unbiased Estimators (BLUE), which in turn results in an error term with constant variance in the presence of heteroscedasticity (Yamano, 2009). The Stata econometric software package used for estimating the gravity model in this study conveniently has an option for estimating an OLS or fixed effect regression with robust standard errors, by simply adding a 'robust' command in the regression (Yamano, 2009). It is clear that there are some important estimation issues one needs to take in consideration before the gravity trade equation can be used.

4.4 The basic gravity trade model framework and specification

As previously stated the purpose of this study was to use the gravity trade model in order determine the potential impact of various factors on the recent trends in South Africa's fresh apple exports as well as whether there are statistically significant differences in terms of the different export regions i.e. the EU, FE, ME and AF. The basic gravity trade model used in this study states that trade of fresh apples (volume in tons), between $country_i$ (i.e. South Africa) and $country_j$ (target country, e.g. United Kingdom) is proportional to the product of GDP_i (in

current value) and GDP_j and is inversely related to the distance (in kilometres) between them. Additionally, other explanatory variables such as the source and target countries' population, nominal exchange rates in terms of South African currency (ZAR) and the ad valorem equivalent (AVE) tariff rate percentage, were added. A dummy variable[45] such as common language[46] was also used in this study. Furthermore, dummy variables for the target (importing) country groupings i.e. the FE, ME, AF and the EU and exporter (source) country (South Africa) were included in the data sample, excluding one target country to avoid perfect collinearity. These dummy variables were included in order to capture the regional effect on South Africa's fresh apple exports to the afore-mentioned target countries. The natural logarithm of all variables was used to obtain a log-linear gravity trade equation that can be estimated by ordinary least squares (OLS) regression.

The basic gravity trade model is represented in the following equation and holds the following functional form:

$$lnX_{ijt} = \beta_0 + \beta_1 lnGDP_{SA,t} + \beta_2 lnGDP_{jt} + \beta_3 lnPOP_{SA,t} + \beta_4 lnPOP_{jt} + \beta_5 lnACTEXCH_{ijt} + \beta_6 lnAVE_{SAjt} + \beta_7 COMMONLANG_{SA,j} + \beta_8 DIST_{SA,j} + \varepsilon_{it} \quad (4.1)$$

Where, the upper-case letters represent the natural logarithm (logs) of the respective explanatory or independent variables (i.e. GDP's, populations (POP), actual exchange rate (ACTEXCH), ad valorem tariff rate equivalents (AVE), common language ($COMMONLANG$) and distance (DIST). β_0 (Beta) depicts the common intercept (coefficient). β_{1-8} (Beta) is the regression-coefficients (parameters) which are also known as the unknown response parameters of the independent variables included in the basic gravity trade equation (Gujarati, 2006). The sub-script *t* represents the time-series i.e. *t* = 2001, 2002… 2013 and *j* = importing country group, also known as the target country group and *SA* = *i* = South Africa (exporting country) which is also referred to as the source country.

The effects of NTB's on the exports (volume) of fresh apples, and other factors not included as variables in the model, were assumed to be captured in the error term ε_{it} of equation (4.1) above. It is important to note that the error term[47](ε_{it}) in a fixed effect OLS regression consists of the following:

[45] A dummy variable is an explanatory variable that takes on only the values 0 or 1
[46] English is used as the world common language.
[47] According to Schmidt (2004:8-9), an error term (ε_{it}) is a random variable that represents all that is not captured by the econometric model.

$$\varepsilon_{it} = \mu_i + \upsilon_{it} \quad (4.2)$$

Where, μ_i = time-invariant country-specific effect

υ_{it} = white noise residual

The white noise residual (υ_{it}) is a variable that has an identical and independent distribution with a mean of zero (Cowpertwait & Metcalfe, 2009:68). Furthermore, white noise residuals are said to be "serially uncorrelated" and thus are very unpredictable. In other words the white noise residuals do not display a predictable time series pattern and previous values cannot be used to help forecast future values. The μ_i component of the residual is however of importance as it captures the time-invariant country-specific effects of the fixed effects model.

According to Gujarati (2006) and Xiong (2012), time-invariant variables such as distance and common language cannot directly be estimated in a FEM as these explanatory variables will be omitted in the regression due to perfect multicollinearity. Elshehawy *et al.* (2014:143) also found that a FEM is inept in estimating time-invariant variables and that these variables need to be excluded from the regression when using fixed effects. According to Elshehawy *et al.* (2014:143), Greene (2013), Eita (2008) and Martinez-Zarzoso and Nowak-Lehmann (2003:298-299), this econometric issue can also be solved by estimating these time-invariant variables through running a second stage regression by using the individual effects of the first stage regression (μ_i) as the dependent variable and time-invariant variables such as distance, common language and FE, ME and AF group dummy variables as independent variables. The two-stage regression technique proposed by Elshehawy *et al.* (2014:143), Greene (2013), Eita (2008) and Martinez-Zarzoso and Nowak-Lehmann (2003:298-299) was used to address the specific econometric issue at hand in this study.

In order to model the regional effect (AF, FE, ME and EU), the econometric issues were addressed by running a fixed effects model (step 1), followed by the OLS regression (step 2) in Stata as discussed above. In order to attain more reliable and informative results another step (Step 3) was added in this study, which will be discussed shortly. It is important to note that the FEM (step1) does not allow one to include time-invariant variables such as the four regional dummy variables in the regression. Therefore, the second regression (step 2) involved running an OLS model by using the residuals from step 1 as the dependent variable and the region dummy variables (i.e. AF, FE, ME, EU) as independent variables. This was done in order to

determine whether there is a statistically significant difference between the four respective regions. The three step regression process was as follows:

Step 1: Fixed effect with robust standard errors (basic gravity trade model)

The first-step in this three-step regression involved running a FEM where the time-invariant variables (i.e. distance and common language) were omitted as independent (explanatory) variables. The residuals (μ_i) from this model were then used as the dependent variable in step 2. The Stata command used to estimate this step 1 FEM is as follows: ". xtreg l_trade_tons l_gdp_s l_gdp_t l_pop_s l_pop_t l_actrexch tariff_ave, fe vce(robust)".

The functional form of the regression in step 1 is as follows:

$$lnX_{ijt} = \beta_0 + \beta_1 lnGDP_{SA,t} + \beta_2 lnGDP_{jt} + \beta_3 lnPOP_{SA,t} + \beta_4 lnPOP_{jt} + \beta_5 lnACTEXCH_{ijt} + \beta_6 lnAVE_{SAjt} \quad (4.3)$$

Step 2: OLS regression (μ_i) versus regional dummy variables (AF, FE, ME and EU)

The second step (regression step 2) involved running a OLS regression with the 'residuals' estimated by step 1 (denoted μ_i in equation (4.4) below) as the dependent variable and the time-invariant variables (i.e. AF_i, FE_i, ME_i) as the independent variables (Elshehawy *et al.*, 2014). The EU country group dummy variable EU_i was used as the basis, as one needs to drop one region from the regression to avoid the dummy variable trap. The distance and common language dummy variables were initially included in this OLS regression (step 2) according to theory in the literature review (chapter 2). The distance variable however depicted an incorrect positive sign when included as an independent variable when the regional dummy variables were also included, thus the distance variable was eventually omitted from step 2. Therefore an additional step (step 3) was done in order to prove that the distance variable is indeed theoretically correct i.e. that it displays a negative relation to apple exports.

The functional form of the second step regression is as follows:

$$\mu_i = \beta_0 + AF_i + FE_i + ME_i + \varepsilon_{it} \quad (4.4)$$

After estimating the regression above using a OLS model, the subsequent effect of the dummy variables (i.e. FE, ME, AF) and also the effect of NTB's (which were assumed to be captured in the error term ε_{it}) on bilateral trade in fresh apples were depicted.

Step 3: OLS regression with each country as a dummy and including distance

As mentioned, the step 1 fixed effect model did not allow one to estimate the effect of time-invariant variables such as distance and common language; therefore a third regression (step 3) was estimated. This is an OLS regression that allows for the estimation of a fixed effect model and the inclusion of time invariant variables while using each individual country as a dummy variable, thereby allowing the distance variable to be included. The Stata command used in this step was proposed by Torres (2007) and is as follows: ".regress l_trade_tons l_gdp_t l_pop_t tariff_ave l_distance i.tradeflow, vce(robust)". The Stata command appears the same as the functional form (below) but generates its own dummy variables (i.e. country-specific dummies indicated by i.tradeflow) and includes these dummies in the regression. It does not allow for the use of the regional dummy variable and could therefore not be used in step 2.

The functional form of the regression in step 3 is as follows:

$$lnX_{ijt} = \beta_0 + \beta_1 lnGDP_{SA,t} + \beta_2 lnGDP_{jt} + \beta_3 lnPOP_{SA,t} + \beta_4 lnPOP_{jt} + \beta_5 lnACTEXCH_{ijt} + \beta_6 lnAVE_{SAjt} + \beta_8 DIST_{SA,j} + \varepsilon_{it}$$

It is important to note that the functional form actually includes the 19 individual country dummy variables, which is automatically generated by Stata.

4.5 A priori expectations of the parameters

It is important to identify and argue the relative signs of the model's parameters before running the gravity trade regression in order to ascertain the economic significance of the explanatory variables, considering the economic intuition thereof. In order to effectively interpret and understand why the independent (explanatory) variables are related after obtaining regression results, relations should be based on economic theory (Schmidt, 2004).

Moreover, a basic regression analysis depicts the mathematical relationship between two variables, but it does not explain why the relationship exists or to what extent the independent variable causes a specific change in the dependant variable (Schmidt, 2004:107). This is why it is of importance to distinguish between the correlation and the causality of two variables. In order to ascertain why a specific independent variable causes an increase or decrease to the dependant variable, a sufficient underlying economic theory or economic model is needed to help explain the relation between the variables (Schmidt, 2004:107).

The following section will provide the *a priori* expectations of the parameters from the first stage regression of the basic gravity trade model used in this thesis.

i) $\beta_1(lnGDP_{SA,t})$ and $\beta_2(lnGDP_{jt})$

The relationship between bilateral trade and both exporter and importer GDP measures are expected to be positive. Kalaba (2014:113) found that the GDP coefficient was positive and consistent with literature on the gravity trade model. Kalaba (2014:113) also concluded that the positive GDP coefficient is a clear indication that as a trading country's economic condition improves; the bilateral trade between the respective countries also increase. Furthermore, Jordaan & Kanda (2011:235) and Kapuya (2014:11) found that the impact of both countries' GDP's on trade flows is two-sided:

1. Supply side effect

   On the one hand, an increase in the South African nominal GDP would result in a higher production capacity which translates into a larger source market for potential exports to the trading partners, which in turn creates a greater capacity to trade. In other words, an increase in South Africa's nominal GDP would have a positive effect on both South Africa's ability to export more and bilateral trade (supply side), *ceteris paribus*.

2. Demand side effect

   On the other hand, an increase in the trading countries' nominal GDP (larger GDP) would indicate a greater absorption capacity, which could result in an increasing demand for specific imported goods such as that of certain high value apple cultivars. In other words, an increase in trading countries' nominal GDP would also increase the importing (trading countries') ability to import more, which in turn will have a positive effect on trade (demand side), *ceteris paribus*.

   It is important to note that in the case of fresh apples (a single commodity); the GDP of the source country and the target country will not provide an accurate representation of the demand and supply of a specific commodity (Scheltema, 2013:63). However, the sign of both South Africa and the target countries' GDP coefficient is expected to be positive.

ii) β_3 ($lnPOP_{SA,t}$) and β_4 ($lnPOP_{jt}$)

According to Jordaan and Kanda (2011:235) there is no clear *a priori* relationship between exports (bilateral trade) and the populations of both the exporting country (South Africa) and importing countries. Jordaan and Kanda (2011:235) argue that the estimated coefficient of the exporter (South Africa) variable can either be positive or negative because the exporter may have a large (increasing) population and export more or may have a large (increasing) population and export less (referring to the absorption effect). Martinez-Zarzoso and Nowak-Lehmann (2003:296) also argue that a negative relationship between exports and population is an indication of an absorption effect. A rise in South Africa's (source or exporting country's) population could also reduce commodity outflows due to the competing domestic consumption for certain commodities i.e. the absorption effect. In this case, the sign of the South African population coefficient is expected to be negative and the sign of the importing (target) country coefficient is expected to be positive in relation to exports of South African apples.

iii) β_5 ($lnACTEXCH_{ijt}$)

The expected sign of the nominal exchange rate (in terms of ZAR) coefficient β_5 is positive in relation to bilateral trade. The impact of the South African exchange rate on trade over the long-run becomes relatively less severe, as producers and exporters, as well as importers will adapt their supply and demand in order to use the exchange rate effect to their own advantage.

According to Herrera and Baleix (2010), the exchange rate impact on trade volumes can be either positive or negative depending on the estimation technique, industry, product traded and countries concerned. The effect of exchange rates is significant and with the expected sign for South Africa (exporter) to be positive with apple volume exports to increase when South Africa's currency (ZAR) depreciates vis-à-vis to the Pound (£) or the Euro (€); the impact of short-run exchange rate volatility on trade flows of fresh apples could be two-sided:

1. On the one hand, if the ZAR depreciates against the major currencies, input cost will be higher, as various inputs i.e. pesticides, machinery and equipment need to be imported. During the process of exporting apples, transport cost (shipment) of containers of fresh apples is normally quoted in U.S. dollar ($) terms, which also increases considerably in a depreciation cycle. This in turn leads to higher production cost per unit and lower competitiveness, because the price per ton of apples produced in South Africa is higher than that of other countries' *ceteris paribus*.

2. On the other hand, the depreciation will lead to higher profitability to producers and exporters of South African apples, which could lead to increasing supply of apples to selected countries over the short run, *ceteris paribus*. According to Jordaan and Kanda (2011:235) in the case of a depreciation of the Rand (ZAR), the demand from the trading country for South African exports will increase because it is cheaper for the trading partner country to source the required amount of ZAR to effect payments for imports, resulting in a higher demand for South African exports. If output prices are more affected than input costs, the expected sign is positive in relation to apple exports.

iv) β_6 $(lnAVE_{SA,jt})$

The expected sign of the ad valorem equivalent import tariff percentage (AVE) is negative. A higher AVE would have a negative effect on bilateral trade in fresh apples because an increasing AVE indicates that the applied tariff per ton of apples contributes to higher transaction costs, which in turn results in a lower profit margin for the exporter and ultimately the producer.

v) β_7 $(COMMONLANG_{SA,j})$

The common language dummy variable's coefficient is expected to be positive. The dummy variable of one indicates that English is spoken in the selected country and zero for otherwise. One would argue that if two trading countries share a common language, trade negotiations will be much easier resulting in lower information cost, which in turn will most likely facilitate bilateral trade.

vi) β_8 $(DIST_{SA,j})$

The spatial theory of trade suggests that the quantity of commodities traded varies inversely with distance. In other words, bilateral trade flow decreases with increasing distance between trading partners (Rossi-Hansberg, 2005). The distance variable acts as an observable proxy for trade cost in terms of transport cost (Deardorff, 1998). Logically one would therefore expect the sign to be negative, because the greater the distance between two trading partners, the higher the transport cost and the more restrictive it will be to trade certain commodities.

A summary of the variables used and their description, as well as the expected signs is depicted in Table 4.2 below.

Table 4.2: Variables used in basic gravity trade model

Variable Name	Description	Expected Sign
lnX_{ijt}	Volume (tons) of fresh apple exports from South Africa to country *i* in year *t* (dependent variable)	
β_0	Common intercept (coefficient)	(+) or (-)
$lnGDP_{SA,t}$	Current (nominal) value (US$) of South African GDP at time *t*	(+)
$lnGDP_{jt}$	Current (nominal) value (US$) of country *j* GDP at time *t*	(+)
$lnPOP_{SA,t}$	Population (billion) of South Africa at time *t*	(-)
$lnPOP_{jt}$	Population (billion) of country *j* at time *t*	(+)
$lnACTEXCH_{ijt}$	The nominal exchange rate[48] of the selected country *j* against the South African Rand (ZAR) at time *t*	(+)
$AVE_{SA,jt}$	Ad valorem equivalent[49] (AVE) tariff percentage (%)of the selected country *j* at time *t*	(-)
$COMMONLANG_{SA,j}$	Dummy variable for whether the selected country *j* shares a common language with South Africa	(+)
$DIST_{SA,j}$	Distance[50] between South Africa and the selected country *j*	(-)
ε_{it}	The country specific one-way error term	

4.6 Testing for unit roots in panel data

According to Levin *et al.* (2002) and Jordaan and Kanda (2011:237), it is of importance to analyse the univariate characteristics of the data used for running a regression model in order to ascertain whether the variables used in the respective regression are stationary, before the actual estimation can be carried out. According to Schmidt (2004:331), it is quite plausible that many macroeconomic variables such as GDP, population statistics and exchange rate data do in fact contain unit roots or are non-stationary. If the data or variables used in the regression model are non-stationary, standard estimation and testing procedures will give incorrect results. Regressions using non-stationary variables are often characterised by high R^2 values, highly autocorrelated residuals and a highly insignificant value for the estimated parameters. This is known as spurious regressions (Verbeek, 2012:342).

[48] The actual exchange rate is expressed in nominal terms.
[49] Data is retrieved from the ITC Market Access Map database.
[50] Distance is expressed in kilometres from Pretoria to the selected countries' capital city.

It is important to note that time-invariant variables such as that of distance and dummy variables do not contain unit roots; therefore a panel unit root test is not needed. In order to determine whether the variables used in the basic gravity model (equation 5.1) are indeed stationary, a Panel Unit Root Tests (PURT) was done. There are various panel unit root tests. The Augmented Dickey–Fuller[51](ADF) and the Levin, Lin and Chu (2002) (LLC) PURT are the most widely reported tests for unit roots using panel data (Schmidt, 2004:33). According to Jordaan and Eita (2007:86) one can assume that the variables used in the data series are indeed stationary if at least one of the available panel unit root tests reject the null hypotheses (pointed out below) which indicates that the variables and data series are stationary. Therefore, this study also used the rejection of unit roots by at least one test to assume a verdict of stationarity.

According to Schmidt (2004), the LLC test suggests the following hypotheses:

H_0 : the panel data series or variable contains a unit root

H_a : the panel data series or variable is stationary

The LLC test was done on the dataset for each variable using Stata econometric analysis software. The selection used in each variable for the LLC unit root test is depicted in table 4.3 below. After testing the panel data for each variable used in the basic model, the LLC test results rejected the null hypothesis (H_0) and concluded that the data series was indeed stationary and that the gravity trade model used in this study could indeed be estimated by using the fixed effect and OLS regression techniques. Thus, differencing would not have to be carried out and the coefficients could be read off as elasticities. The stationary data was then used to estimate the model(s) and the empirical results obtained are presented in the following chapter. All of the variables in table 4.3 are significant on at least the 5% level of significance.

Table 4.3: Levin, Lin and Chu (LLC) unit root test results

Variable	t-statistic	P-value
$\ln X_{it}$	-3.3291	0.0004***
$\ln GDP_{it}$	-1.7365	0.0412**
$\ln GDP_{SA,t}$	-6.5590	0.0000***
$\ln POP_{it}$	-24.5323	0.0000***
$\ln POP_{SA,t}$	-14.5623	0.0000***
$\ln ACTEXCH_{it}$	-11.210	0.0000***

[51] The detailed explanation and calculation of ADF and LLC panel unit root tests fall beyond the scope of this study, as these tests are done automatically when using econometric regression software such as Stata.

***/**/* indicate the rejection of the null hypothesis at 1%, 5% and 10% levels.

Source: Own calculations using Stata econometric software.

4.7 Chapter summary

This chapter focused on the data specifications and the gravity trade model methodology used in this study. The top export destinations for South African apples over the time period of 2001 to 2013 were used and the number of countries was limited because of the lack of adequate trade and economic data. Panel data was used in the analysis because it enables one to identify time effects (business cycles), source country effects and target country effects over time.

As mentioned, the fixed effect estimation technique was used because it allows one to determine the country group-specific effects on trade flows whereas the random effect estimation assumes that the country-specific effects are random and not directly estimated. The traditional method for estimating the coefficients of the gravity trade model is in its log-linear form when using the fixed effects and Ordinary Least Squares (OLS) regression techniques. This allows for easy interpretation of the estimated parameters because these parameters are estimated in natural logarithms which indicate their respective elasticities.

The data was tested for stationarity by using the LLC panel unit root tests. The LLC test rejected the null hypothesis and found that all of the variables used in the model did not contain any significant unit roots; thereby confirming that the variables were stationary and no further co-integration tests were needed. The following chapter will focus on the empirical gravity trade model estimation results obtained and the interpretation thereof.

Heteroscedasticity was corrected by using robust standard errors when running all three steps of the regression. The first step in the three step regression involved running a fixed effect model where time-invariant variables (i.e. distance and common language) were omitted as independent explanatory variables. The second step involved running an OLS regression with the residuals estimated in step 1 as a dependent variable and the regional time-invariant dummy variables as independent variables. The third step involved running an additional OLS regression with each country as a dummy variable, including distance in order to depict that the distance coefficient does indeed have a negative relation to South African fresh apple exports.

CHAPTER 5: MODEL ESTIMATION AND RESULTS

5.1 Introduction

This chapter presents the empirical results estimated by using a specially constructed gravity trade model in order to address the general objectives of this study. As mentioned in chapter 4, the analysis involved running a three-step regression technique using Stata. The first step consisted of estimating a fixed effect regression with robust standard errors in order to address one fundamental concern when using a gravity trade model, which is heteroscedasticity. The statistically insignificant explanatory variables were then excluded from the basic model after running the regression with the original data-set.

The fixed effect panel regression (step 1) does not allow one to include the country-specific dummy variables as well as the distance variable because these variables are characterised by being perfectly collinear to the dependant variable; therefore a second regression needed to be done. The second step (model 1.3) was then completed in order to estimate the effect. This was done by using the regression results (μ_i) from model 1.1 in step 1, as the dependant variable and the country group dummies as explanatory variables. A second regression (step 3) using the OLS technique coupled with robust standard errors was then estimated in order to include the 19 different countries as dummy variables as well as the distance variable, which are all time-invariant variables. Torres (2007) indicates the ability of Stata to handle time invariant variables in a fixed effects model.

The empirical results from the afore-mentioned three-step regression models will be discussed and also compared to findings of similar studies throughout this chapter.

5.2 Empirical results and discussion

Step 1

Variables for the first model were selected based on theory and recent models found in the literature. Results for theoretic model 1.1, the step 1 estimation are reported in Table 5.1.

Table 5.1: Results for theoretic Model 1.1 (fixed effects with robust standard errors)

Explanatory Variables	Sign	Coefficient	Std. Error	t-statistic	P-Value	Significance
ln_GDP_S	-	-4.5745	2.4528	-1.87	0.0790	*
ln_GDP_T	+	1.8420	0.9715	1.9	0.0740	*
ln_POP_S	+	10.2070	5.7169	1.79	0.0910	*
ln_POP_T	+	1.6579	0.7669	2.16	0.0440	*
ln_ACTEXCH	+	0.1915	0.2033	0.94	0.3590	
Tariff (AVE)	-	-0.0500	0.0026	-19.18	0.0000	***
Constant	-	-126.7152	54.2833	-2.33	0.0310	*
R-squared (R^2)	0.4951					

(***/**/*) Statistically significant at the 1%, 5% and 10% levels, as reported in Stata.

South Africa's GDP coefficient (ln_GDP_S) did not display a positive relation to the exports of fresh apples. This is contradicting to the *a priori* expectations, as well as the findings from a study done for South Africa by Jordaan and Kanda (2011), on total trade. However, the GDP of the target countries (importing countries) coefficient (ln_GDP_T) was positive and statistically significant at a 10% level. This corresponded with the *a priori* expectation and was also in line with the findings of Jordaan and Kanda (2011). Moreover, the target countries' GDP was positively related to trade in fresh apples and this would suggest, in the case of a importing country, that the growth in its GDP results in a growth or increase in the absorptive capacity of the relevant economies and in turn, the demand for certain apple cultivars from South Africa. The results obtained indicate that a 1% increase in the size of the target (importing) country's GDP will, on average, lead to a 1.8% increase in the volume of fresh apple imports from the trading partner, *ceteris paribus*.

South Africa's (exporting country) population coefficient (ln_POP_S) did not depict the correct sign and was not statistically significant at a 5% level of significance. There is no clear theoretical explanation as to why the South African population coefficient was positive in relation to the export flows of fresh apples. This result was also contradicting to the findings of Jordaan and Kanda (2011) and basic economic intuition. Furthermore, as mentioned before, a country's population could be a significant indication of the relative market size and absorptive capacity. One could argue that, if the importing country's population increases the domestic demand for certain commodities also increases, as there are more mouths to feed. This in turn would lead to an increase in trade flows, as the importing country could not sufficiently produce and supply the domestic market with certain commodities and thus needs

to import more (enhance trade flows). This will be evident especially in non-apple producing countries with high population rates such as that of AF, the ME and FE countries.

The coefficient for the natural logarithm of the nominal exchange rate (ln_ACTREXCH) between South Africa and the selected trading country groups in terms of ZAR can also be interpreted as an elasticity. Thus a 1% relative depreciation in the ZAR according to the basic model (model 1.1 above), leads (on average) to approximately a 0.19% relative increase in export flows of fresh apples from South Africa, *ceteris paribus*. This suggests that South Africa's export flows are quite sensitive to the exchange rate. However, the nominal exchange rate variable was found to be statistically insignificant and therefore was excluded from the final model (model 1.2) as an explanatory variable.

The sign of the ad valorem equivalent import tariff percentage (Tariff_AVE) coefficient was found to be negative in relation to export flows, coupled with a small negative effect on apple exports. In other words, if the ad valorem equivalent import tariff percentage imposed by the selected countries increases by 1%, exports of fresh apples from South Africa (on average) will potentially decrease with 0.05%, *ceteris paribus*. This is in line with the a priori expectation and the variable was statistically significant at a 1% level. Therefore, a higher or increasing ad valorem equivalent import tariff percentage imposed by importing countries will have a negative effect on bilateral trade in fresh apples. This is because it indicates that the applied tariff on one ton of apples results in higher trade cost, which in turn leads to lower profit margins for the importer and exporter.

Given the unexplained negative sign and statistically insignificant coefficient of South Africa's GDP (ln_GDP_S), the contradicting positive and statistically insignificant South African population coefficient (ln_POP_S) and the (ln_ACTREXCH) variable which displayed a positive sign but was also statistically insignificant, one can argue that these source country explanatory variables and the nominal exchange rate variable did not show any clear correlation or relationship with the variation in the volume of export of fresh apples (bilateral trade).

In order to test the model 1.1 with total exports as a dependent variable the same regression (step 1) was done using total exports from South Africa, expressed in ZAR, but the ad valorem tariff rate percentage (AVE) was excluded, as this specific variable was not available for total exports. The regression results were rather interesting. The signs of South Africa's GDP (ln_GDP_S), South African (ln_POP_S) and the nominal exchange rate (ln_ACTREXCH) corresponded to the findings of Jordaan & Kanda (2011) as well as that of economic theory.

Estimated results are shown in model B1 (Appendix B). The result from the comparison of fresh apple exports to that of total exports using the same data-set and regression technique, in fact, confirmed that the basic explanatory variables used in the traditional gravity trade model do not have the same effect on fresh apple trade as that of total exports.

Due to the fact that apple trade does not behave the same as total trade, it was decided to deviate from this standard theory in terms of which variables should be included in the model. It is for this reason that the South African GDP (ln_GDP_S), South African population (ln_POP_S) and the nominal exchange rate (ln_ACTREXCH) explanatory variables were excluded from the basic model. The results from the simplified (as opposed to theoretic) model 1.2 which excludes these explanatory variables are depicted in table 5.2 below.

Table 5.2 Results for simplified Model 1.2 (fixed effects with robust standard errors excluding ln_GDP_S, ln_POP_S and ln_ACTEXCH variables).

Explanatory Variables	**Sign**	**Coefficient**	**Std. Error**	**t-statistic**	**P-Value**	**Significance**
ln_GDP_T	+	1.3902	0.5465	2.54	0.0200	**
ln_POP_T	+	1.6497	0.7964	2.07	0.0530	*
Tariff (Ave)	-	-0.0514	0.0021	-24.39	0.0000	***
Constant	-	-54.6116	12.1278	-4.5	0.0000	***
R-squared (R^2)	0.4852					

(***/**/*) Statistically significant at the 1%, 5% and 10% level, as reported in Stata.

The R^2 form the fixed effects model (model 1.2 above) indicates only the within country group effects. It is clear that by comparing the R^2 value of 0.4951 from model 1.1 to the R^2 value of 0.4852 of model 1.2, as well as the signs and the coefficients of the remaining variables, the results from model 1.2 (above) indicate that the explanatory power of the model is basically the same as that of model 1.1. It is for these reasons that the time-invariant country-specific effects (μ_i) from model 1.2 were used in step 2 as the dependant variable.

Step 2

The region dummy variables for countries within the Far East, Middle East and Africa were included in the second step using OLS regression, where the EU was used as the base region[52]. As mentioned, the time-invariant country-specific effects (μ_i) from model 1.2 were used as the dependant variable.

[52] As previously mentioned, one dummy variable needs to be excluded from the regression due to perfect multi-collinearity (dummy variable trap) when running the OLS regression; consequently the EU is used as the base and its effect will be captured by the constant coefficient.

Table 5.3 Results for Model 1.3 (OLS with robust standard errors (μ_i versus regions))

Country group	Sign	Coefficient	Std. Error	t-statistic	P-Value	Significance
Constant	-	-3.4542	0.3316	-10.42	0.0000	***
Africa (AF)	+	6.5702	0.5793	11.34	0.0000	***
Far East (FE)	+	2.4757	0.4901	5.05	0.0000	***
Middle East (ME)	+	4.4813	0.4271	10.49	0.0000	***
F(3, 243)	56.68					
R-squared =	0.3854					

*, **, ***: statistically significant at the 10%, 5% & 1% levels respectively, as reported in Stata.

It is clear from the results depicted in table 5.3 above, that although the importing countries' GDP, population and import tariffs (AVE) play the most significant role in the determination of the export of fresh apples over time, the regional effect[53] also has a considerable (statistically significant) effect on fresh apple trade between South Africa and the respective target countries. South Africa has a higher propensity to export to the Far Eastern, Middle Eastern and African regions compared to the EU given that the signs of the FE, ME and AF dummy coefficients were positive. This implies that South Africa is likely to trade more with the FE, ME and AF countries which do not implement as many (as compared to the EU) trade restricting NTB's such as specific technical, sanitary and phytosanitary (SPS) requirements, as well as seasonal tariffs which, in turn, impede the export of fresh apples from South Africa[54]. However; one should note that several factors other than NTB's could also contribute to this trade pattern.

The regional effect could also be attributed to factors other than NTB's, such as consumer preferences, market-specific requirements, the production capacity for certain cultivars within the respective importing countries and per capita consumption patterns as substantiated in chapters 2 and 3. Since the potential impact of all of these factors is captured in the error term of model 1.2, it is evident that import tariffs (AVE) have a small but significant effect on the exports of fresh apples. Therefore one could argue that NTB's implemented by various countries will have a similar effect, although a relevant NTB proxy variable could not be included in the basic model. It is clear that a combination of various other factors attribute to

[53] The regional effect refers to the regions to which South Africa tends to export more fresh apples i.e. Africa (AF), the Far East (FE) and the Middle East (ME) compared to the European Union (EU) in this case.
[54] Please refer to sections 2.4.2; 2.4.3 and 2.4.4 which illustrate that the EU market segment implements more trade barriers compared to the FE, ME and African countries.

the remaining variation in the model, but it can be expected that NTB's may have a significant contribution to the variation in the exports of fresh apples.

Step 3

It is important to note that the distance (which is a time-invariant variable) did not display the expected sign in relation to the export of fresh apples when the region dummy variables were used. Therefore an additional step i.e. step 3 was needed in order to include the individual countries as dummy variables in order to indicate that the distance variable does indeed have a negative relationship to the total export of fresh apples, as theory predicts. The empirical results are presented in table 5.4 below.

Table 5.4 Results for Model 1.4[55] (OLS with each country as a dummy variable with distance included).

Explanatory Variables	Sign	Coefficient	Std. Error	t-statistic	P-Value	Significance
ln_GDP_T	+	1.3902	0.4608	3.02	0.0030	**
ln_POP_T	+	1.6497	0.4168	3.96	0.0000	***
Tariff (Ave)	-	-0.0514	0.0174	-2.96	0.0030	**
ln_Distance	-	-15.9841	4.3588	-3.67	0.0000	***
F-value(21, 225)	214.96					
Adjusted R^2	0.8775					

(***/**) Statistically significant at the 1% and 5% levels, as reported in Stata.

It is important to note that the coefficient results from model 1.4 are exactly the same as that of the fixed effect regression with robust standard errors (model 1.2). Model 1.4 was estimated in step 3 by using the original data, but used the OLS regression technique coupled with robust standard errors. By using this technique and the Stata command proposed by Torres (2007)[56], it enabled one to include the 19 respective countries which represent the four exporting regions (i.e. FE, ME, AF and the EU) and to use the countries as dummy variables. Additionally it allowed one to include the distance (also a time-invariant variable) in the regression. After estimating model 1.3, it was clear that the log of distance had the expected sign and was found to be negative. The p-value of the distance variable was highly significant at a 1% level. It can be projected that, with a 1% increase in distance between South Africa (i) and country j (the

[55] Please note that the common language dummy variable was tested for in step 3 (model 1.3) but it was found that this dummy variable was statistically insignificant and therefore was excluded from the basic model.

[56] Torres (2007) proposed a Stata command which allows one to include the time-invariant variable (distance) in the fixed effects OLS regression model. The Stata command is as follows:.regress l_trade_tons l_gdp_t l_pop_t tariff_ave l_distance i.tradeflow, vce(robust).

importing country), there would (on average) be a corresponding 15.98% decrease in trade of fresh apples between South Africa and country j. This result corresponds to the gravity equation where greater distances detract from the propensity to trade as it results in higher transport costs and thus trade cost. This observation is consistent with the literature, as many empirical studies use bilateral distance as a proxy of trade costs. This is also in agreement with what Jordaan (2011), Jordaan and Kanda (2011) and Cheng (2014) found and with basic economic intuition.

Moreover, the fact that fresh apples are highly perishable and sensitive to post-harvest defects such as bruising, internal browning, lenticel and various cosmetic damages resulting from the lack of proper cold chain management, distance to the consumer or market is of critical importance. Although the containers in which the apples are being exported are atmospherically controlled in order to maintain the cold chain, the risk in transportation to especially African, Far Eastern and Middle Eastern countries is much higher than those markets closer to South Africa. Therefore, distance does play a significant role in the bilateral trade of fresh apples.

As mentioned, English was taken as the world's common language and this dummy variable was tested for in model 1.3, but was found to be statistically insignificant and therefore excluded. The insignificance of the common language spoken by trading countries implies that a common language does not have any significant impact on the trade of fresh apples per se. For example, when South African marketing agents of fresh apples receive an order, the order and transaction is normally done in English, even if clients from the importing country do not generally speak English.

The relatively high R^2 [57] value of 0.88 from model 1.4 (table 5.4) indicates that approximately 88% of the variation in the volume of apple trade is explained by this basic gravity trade model, *ceteris paribus*. The relatively high F-statistic of 214.96 also supports the significance of the model under consideration. One can also conclude that the selected independent variables used in the first stage regression account (on average) for 88% of the variation explained by the model. The effect of NTB's implemented by each country on bilateral trade flows has the potential to be captured by the remaining 12% variation in the model, *ceteris paribus*. Moreover, the basic supply and demand forces (which determine the market price), coupled by consumer preferences (which determine the volume of fresh apples exported by South Africa

[57] In this OLS model (model 1.4) the R^2 indicates the total effects.

in any given year), may also be captured in the remaining 12% variation. It is very difficult to pinpoint exactly which trade determinants are captured by the error term (e_{it}) of the model, but one can argue that the basic model displays the effect of tariffs, the Gross Domestic Product as well as the population of the importing country and that the rest of the variation could be considered amongst other the effect of NTB's.

5.3 Chapter summary

This chapter discussed the empirical results estimated by using the gravity trade model approach. This approach used a three-step regression technique. This three step approach consisted of estimating four separate models. Model 1.1 was estimated using the original data-set and by running a fixed effect panel regression coupled with robust standard errors. The results were analysed and the statistically insignificant coefficients such as South African GDP (ln_GDP_S), South African population (ln_POP_S) and the nominal exchange rate in terms of South African Rand (ln_ACTEXCH) were excluded from the model.

The results obtained from the statistically significant explanatory variables such as the GDP of the target (importing country) indicate that a 1% increase in the size of the target country's GDP will, on average, lead to a 1.8% increase in the volume of fresh apple imports from the trading partner, *ceteris paribus*. The population of the target country (ln_POP_S) variable also indicates that a 1% increase in the size of the target country's population will, on average, lead to a 1.6% increase in the volume of fresh apple imports from South Africa, *ceteris paribus*. The results indicate that if the ad valorem equivalent import tariff percentage (Tariff (Ave)) imposed by the selected countries increases by 1%, exports of fresh apples from South Africa (on average) will potentially decrease by 0.05%, *ceteris paribus*. This is in line with the a priori expectation and the variable is statistically significant at a 1% level. Last but not least, the R^2 form the fixed effects model (model 1.1) indicates only the within country group effects. It is clear that by interpreting the R^2 value of 0.4951 from model 1.1 that the explanatory power of this model given the data used is relatively good when using a fixed effect regression technique.

An additional model (Model B1 in appendix B) using total exports from South Africa as a dependant variable, was estimated and the results were rather interesting. The coefficients unveiled the correct signs as per *a priori* expectations. This indicates that the effect of the selected explanatory variables on fresh apple exports from South Africa, differ from that of

total exports. Model 1.2 was estimated after the statistically insignificant variables were excluded.

In the second step Model 1.3 was estimated with an OLS regression to include the region dummy variables for countries within the Far East, Middle East, Africa, with the European Union as base. Results showed a statistically significant difference in exports to EU compared to the other three regions. The distance variable was also initially included, but showed the wrong sign, hence it was excluded. In order to explore this further, a third step was carried out.

Model 1.4 was estimated using an OLS regression technique in order to include the 19 selected countries as dummy variables as well as the distance (time-invariant) variable. The distance variable (ln_Distance) was highly significant at a 1% level and the coefficient indicates that a 1% increase in distance between South Africa (i) and country j (the importing country), there would (on average) be a corresponding 15.98% decrease in trade of fresh apples between South Africa and country j. This result corresponds with the gravity equation where greater distances detract from the propensity to trade as it results in higher transport costs and thus trade cost. This observation is consistent with the literature, as many empirical studies use bilateral distance as a proxy of trade costs. All of the variables retained in the final reported models were found to be highly significant and the signs correlated with the initial economic intuition captured in the a priori expectations of the explanatory variables, as discussed in the previous chapter. Almost 88% of the variance in the data is explained by this model which, in turn, implies that the model fits the data well.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This study investigated the potential trade effect of various basic determinants of trade on South Africa's fresh apple exports for the period of 2001 to 2013 using a gravity trade model approach. The study was motivated by the fact that developed countries, such as the European Union (EU), have turned to implementing NTB's in combination with tariffs (the use of which has been regulated and reduced) to protect their domestic industries. Over the past decade the volumes of fresh apples exported to the European Union have been decreasing. At the same time, exports have been increasing to the Far East, Middle East and African countries. The majority of recent empirical research in this area has similarly focused on the impact of trade barriers such as NTB's on the total volume of trade (Jordaan & Kanda, 2011). This is not surprising, as producers and exporters are ultimately interested in knowing the effect of various trade barriers on trade flows and the potential influence it might have on their future production practices and earnings.

Several studies have shown that given the vast variety of existing NTB's, as well as the implementation of so-called "new" NTB's, that there is no single analytical procedure or methodology in dealing with the entire spectrum of NTB's and the diverse economic effects that they exert on international trade (Deardorff & Stern, 1998; Sandrey *et al*,. 2008). The methods that were researched in order to include a NTB proxy variable in the gravity trade model were not successful. Therefore, in this case it was not possible to quantify the effect NTB's have on the exports of fresh apples from South Africa *per se*. Certain factors that influence trade were included in the model; the effect of NTB's on fresh apple trade however, was only theoretically described. Despite the afore-mentioned, the gravity trade model methodology was identified as the ideal framework to address the general objectives of this study. The basic gravity trade model was used as the primary econometric model in order to analyse the effect that various explanatory variables (which were used in the model) have on the exports of fresh apples from South Africa to the European Union, Far East, Middle East and African country groups. After applying a simplified and modified gravity trade model to South African fresh apple export data, the model was found to be a remarkably good fit for the data.

6.2 Summary and conclusions of the study

In the first chapter, an introduction to the study was provided, discussing the background, research problem, research questions, objectives, scope and delimitation, as well as a brief outline of the chapters. The first part of the literature review (chapter 2) focused on the history and main objectives of the GATT and the establishment of its successor, the WTO. The WTO has surveillance mechanisms in place to oversee its members' trade policies and the intention to remove or reduce tariff peaks and NTB's in order to promote free trade. These surveillance mechanisms are of importance to the smaller developing countries with the objective to trade with developed countries, as well as to promote their competitiveness in the industry in the long run. International trade theories such as the new trade theory, Heckscher-Ohlin theory, home market effect and the Linder hypothesis, which help to explain international trade patterns, were discussed. However, it was found that none of these international trade theories effectively provide a theoretical underpinning for the gravity trade model. These theories are still useful however; as they aid explaining the basic economic intuition behind international trade.

This chapter also focused on defining NTM's and NTB's and to investigate the possible NTB's implemented on fresh apple trade and those which might impede the trade thereof (see section 2.4). Technical barriers to trade and sanitary and phytosanitary (SPS) measures were identified as major non-tariff barriers, especially that of the stringent Maximum Residue Limits (MRL's) implemented by developed countries such as the European Union. The EU significantly reduced the MRL for a pesticide *diphenylamine*, commonly known as DPA, which is used to prevent *superficial scalding*[58] of fresh apples that are held in cold storage (Agritrade, 2014). The DPA residue limit for apples has been reduced from 5 milligrams per kilogram to 0.1 milligram per kilogram as a traditional measure and from July 2015 DPA will no longer even be allowed through the EU's borders (Agritrade, 2014). It is clear that the reduction of this specific MRL will have substantial financial implications for the South African fresh apple export industry. The compliance cost to the small producer and the industry as a whole associated with this reduction, implies that this MRL classifies as a major NTB implemented by the EU and, in fact, is expected to contribute to the decline in fresh apple exports directed to this market.

[58] *Superficial scald* is a very common postharvest disorder especially in apples.

The second half of Chapter 2 provided an overview of the various methods and studies done by trade researchers in order to try and quantify the impact that qualitative trade barriers such as NTB's have on international trade (see section 2.5). However, after reviewing the available methods i.e. the price wedge, survey-based, inventory- and frequency-based as well as the index of non-tariff barriers, none of these methods could be used to develop a specific NTB proxy variable which could be used in conjunction with the gravity trade model, in order to effectively quantify the effect of NTB's on fresh apple exports from South Africa. Despite not having included an NTB proxy variable in the empirical model, the standard gravity model's explanatory variables (e.g. GDP and distance) coupled with additional explanatory variables (e.g. tariffs and nominal exchange rate) could still be used to estimate the effect these variables have on the exports of South African fresh apples.

The final section of chapter 2 focussed on the history, development, functional form and general applications of the traditional gravity trade equation of international trade (see section 2.6). The basic gravity trade model is based on Newton's law of gravitation but is simply represented in the form of international trade between countries with the basic forces which might help explain the extent of trade between them. After conducting an extensive literature review on the gravity trade model, it is clear that there is no sound theoretical underpinning for the explanatory power of this model in terms of bilateral and multilateral trade between countries. Despite the critique of the lack of robust economic theory behind the model, it is still widely used as an econometric tool in order to estimate the impact that various trade-related explanatory variables have on trade between countries.

Chapter 3 provided a brief overview of the South African fresh apple export industry. This included investigating the per capita consumption patterns of producing and non-producing countries as well as that of developing and developed countries as reported in the World Apple Review (2013), in order to establish the consumer preferences or demand side patterns. The per capita consumption patterns of fresh apples are very difficult to accurately measure and the interpretation thereof can be subjective in some cases. However, the data reported by the World Apple Review (2013) indicates that the per capita consumption of fresh apples is much higher for non-producing and in some cases for developing countries than that of producing and developed countries. The consumption patterns for several markets are influenced by various factors such as the GDP per capita, population growth, and average age of the consumers and the availability of apples in these markets. It is evident that apple exports to the African continent have been soaring over the last decade (see figure 3.2). Golden Delicious, Pink Lady

and red apple cultivars such as Early Red One, Top Red and Starking are mainly exported to and on high demand from this continent. It is for this reason that the opportunities and challenges of doing business in Africa (sub-section 3.4.1 and 3.4.2) were investigated. It is clear that this continent comes with great business opportunities as their economic growth increases and ultimately the middle class average GDP per capita. However, these booming business opportunities do not come without their challenges. Many challenges are facing exports to the African continent in which corruption, border congestion, inadequate infrastructure and the availability of cash (U.S. dollars) are considered as the main challenges. These challenges will most likely take a lifetime to improve and overcome. The last section of chapter 3 briefly pointed out the market-specific requirements of the four regions considered in this study. It is of utmost importance for producers and exporters of fresh apples to be aware of the challenges, opportunities and characteristics of traditional and potential export markets. The lack of market and, ultimately end consumer or client knowledge, may contribute to unforeseen and unnecessary cost of doing business, which in turn may lead to higher transaction cost over the short- to medium term.

The data specification and model methodology were discussed in Chapter 4. The top 19 countries to which South Africa exported fresh apples (in terms of average tonnage exported) over the period from 2001 to 2013 were classified in four separate regions namely the FE, ME, AF and the EU respectively. This was done in order to ascertain if there is a statistically significant difference in the volume of trade between South Africa and the four respective regions. A panel database was constructed for each country. Then each variable within the panel database was tested for stationarity among the variables using the LLC unit root test. The LLC test results rejected the null hypothesis (H_0) which confirmed that all the variables were indeed stationary or, in other words, the data did not contain unit roots. The gravity trade model approach was followed using a three-step regression technique.

In Chapter 5 the empirical results of the three-step regression were represented and interpreted. The first step was conducted using a fixed effect panel regression with robust standard errors. The results from the fixed effects model were rather contradicting to the *a priori* expectations of the explanatory variables. The signs of the South African GDP and South African population coefficient were incorrect and statistically insignificant. In order to test these variables, another model was used that contained the same explanatory variables and regression technique, but instead used total exports from South Africa in terms of total value (expressed in ZAR) as the dependant variable in the regression. The results from were rather surprising. The South

African GDP coefficient displayed a positive sign as expected and was statistically significant. The South African population coefficient (in_POP_S) displayed a negative sign (as one would expect) but was statistically insignificant. In both models (the one for apple exports and the one for total trade), the nominal exchange rate coefficient (ln_ACTEXCH) displayed the correct relationship (negative sign), but was statistically insignificant. It was deduced that by comparing the empirical results of total fresh apple export to that of total exports, the fresh apple exports are explained by different factors.

It is important to note (as mentioned) that a depreciation of nominal exchange rate in terms of ZAR appears not to have a statistically significant effect on South African apple exports over the short run. The exchange rate effect from an export orientated perspective is not as significant as one would expect. This is because many of the export prices (contracts) with actual importers or buyers have been agreed upon even before some of the apples have been packed and transported. In these cases the exporter and importer take the risk in terms of the depreciation or appreciation of the exchange rate at the time of delivery. Thus, because of the nature of the transactions involving fresh apple trade, the exchange rate does not have a significant effect on the exports of fresh apples over the short run. After comparing the coefficients of both models it is evident that the South African GDP and population, as well as the nominal exchange rate coefficients do not have a significant effect on the volume of fresh apples exported from South Africa. Therefore, these variables were excluded from the basic model.

A final simplified model was estimated with only target country GDP and target country population and tariff rate equivalents as explanatory variables. It is clear by comparing the R^2 values of (as well as the signs and the coefficients of the remaining variables) the more complex model to that of the simplified model for apple exports, that the explanatory power of the two models is basically the same even though these variables were excluded. The GDP of the target (importing country) as well as the importing country's population is positively related to the volume of fresh apples exported from South Africa to the respective target country, as expected. The ad valorem equivalent import tariff percentage imposed by the importing country is inversely related to the exports of fresh apples from South Africa. In other words the higher the import tariff imposed by the importing country, the average profit margin per carton of apples sold to the respective country will be lower for the exporting country. This will therefore have a negative influence on the total volume of apples exported to this market segment, thereby acting as a trade restricting barrier.

The part of the residual of the fixed effect model that indicates the time-invariant country-specific effect was used in the second step of the model in an OLS with robust standard errors to determine if there is a statistically significant difference between the four identified regions, namely the European Union, Middle East, Far East and Africa. Results indicated that indeed significantly more trade takes place between South Africa and the Middle East, Far East and Africa respectively, compared to the EU, which supports the argument that there has been a recent shift away from EU towards these other markets. When including distance between markets as a dummy variable in this model, the sign is contrary to expectation. In an attempt to explore this further, a third modelling step was carried.

The third model used an OLS regression technique coupled with robust standard errors to run a fixed effect model, using individual countries as dummies (as opposed to regions as in the previous step), as well as the distance variable. In this model, the sign of the distance variable was found to be negative, which corresponds to *a priori* expectations and is consistent with the standard (basic) gravity trade model, where greater distances between trading countries, detract from the propensity to trade as it results in higher transport costs and thus trade cost. The coefficients of the standard gravity trade model's explanatory variables such as the importing countries GDP, population, and tariffs (AVE) depicted the expected signs and are all statistically significant.

Despite not being able to include a specific NTB proxy variable in the gravity trade model and explicitly measuring the specific effect thereof; after conducting this study, one can so much as only expect that NTB's implemented by trading countries (especially by the EU) do indeed have a notable impact on the fresh apple exports from South Africa.

After conducting this study, it is evident that in the recent decade there has been a distinct shift in South Africa's traditional fresh apple export markets. There has been a decline in the volume of fresh apple exports to the EU, while exports to other market segments, namely the FE, ME and other African countries have increased. From the literature review one can draw the conclusion that this shift is most likely due to the high compliance costs in terms of NTB's associated with exporting to the EU. This trend does not come as a surprise as South African export agencies and producers adapted to these market demands in order to penetrate and establish themselves in new and potential export markets away from the EU. However, the long term implications of this shift away from the EU market are rather difficult to accurately predict, because every season differs and presents diverse challenges and market requirements

are also ever changing. It can be argued that the South African apple industry is very capable to adapt to the ever-changing markets and conditions and is in the ideal geographical position to successfully establish a long term trading relationship with the African, Middle Eastern and Far Eastern markets. This in turn is likely to absorb the potential loss in volume of apples traditionally exported to the EU market segment and ultimately create new market opportunities to export future volumes to.

6.3 Recommendations for further study

It is important for South African apple producers to regularly introduce new offerings in response to evolving consumer preferences in the non-traditional export markets. South African apple producers need to invest in disease-resilient fruit varieties that have a superior fruit colour and a higher export-quality yield. New varieties also contribute to a more profitable farming enterprise, offsetting the rising costs of labour, electricity and imported inputs (which are especially acute given the sustained weakness of the South African rand) which also contribute significantly to raising the production cost per hectare.

In order to stay competitive in this global apple industry, South African producers need to diversify their export markets in terms of the cultivar selections in order to keep up with the ever changing consumer preferences and in turn create an increasing demand (per capita consumption). Several African, Far Eastern and Middle Eastern markets are appealing prospects for further expansion. However, competition is rising as these markets' appeal grows and other southern hemisphere markets such as Chile, Argentina, New Zealand and Australia will grab at every opportunity to dominate the market with their produce.

Government institutions such as the Department of Trade and Industry (DTI) and industry mouthpieces such as Hortgro need to address these NTB's during trade negotiations at both regional and international level to ensure that certain NTB's do not continue to impede trade. Industry organisations such as the Perishable Export control Board (PPECB) and Hortgro can also assist exporters and producers in providing them with crucial information on newly implemented NTB's as well as maintaining up-to-date market intelligence databases. Such NTB databases and information can be used by producers and exporters of fresh apples to effectively identify potential trade-impeding NTB's as well as to help to effectively plan how to absorb the specific compliance cost associated with certain NTB's implemented by importing countries. For many exporters, especially small to medium apple producers,

obtaining information on specific NTB's is impractical due to the high costs associated with acquiring such information (i.e. independent consultants) and their lack of knowledge about international trade and the compliance cost associated with certain implemented NTB's. This will in turn contribute to enhancing the competitiveness of the South African apple industry in the ever changing global market.

Furthermore, the crucial role and importance of NTB's in restricting trade is officially recognised in South Africa. Reducing tariff barriers alone will not succeed in providing genuine market access for developing countries such as South Africa. NTB's such as TBT and SPS regulations implemented by developed countries such as the EU, often pose a significant threat to developing countries' exports. The uncertainties surrounding quantitative estimates of these NTM's and NTB's should not preclude a study that as a minimum examines and documents measures impeding trade. This is because a strong qualitative assessment is also able to give policy makers and trade negotiators (exporters) significant information as to where effort should be directed for maximum gain from the elimination or reduction of trade-impeding NTB's.

Considerable work could still be done, particularly in extending and refining the gravity trade model. This could be done by including more country trade data as well as designing an explicit NTB proxy variable which could be used in a gravity trade model in order to capture the specific trade effect of NTB's. Such a NTB proxy should not be biased and suffer from the same critique as that of the price wedge method, survey-based method, frequency index or the augmented index of non-tariff barriers (INTB) developed by Eremenko and Movchan (2003), when used as an explanatory variable in regression models Movchan (2003), when used as an explanatory variable in regression models. Althouhg developing a NTB proxy for apples was one of the initial aims of this study, the attempts were unsuccessful and there was also to the knowledge of the author no NTB proxy previously developed which could capture the effect of specific NTB's on a single commodity (fresh apples in this case). It is recommended that future studies in the apple industry which use the gravity trade model approach, focus on deriving proxies to include other factors in the model. These additional explanatory variables identified in this study which could contribute to explain the shift in South Africa's export markets as well as have a significant impact on the volume exported in a given year are as follows:

- Volatile market prices;
- Production cost
- Consumption patterns;
- Market-specific requirements i.e. TBT and SPS measures;
- A country's production capacity;
- Adverse weather patterns i.e. extreme drought and hail damage;
- Labour availability during harvesting and packing periods;
- Political instability i.e. labour strikes, Land reform
- Trade agreements;

The impact that these variables may have on the exports of South African apples will be interesting. However, it will be extremely challenging to measure the specific impact that these variables have on trade of specific commodities, because most of these variables suffer from the same challenges as those suffered by NTB's i.e. how to measure and quantify their effect on bilateral and multilateral trade.

List of References

African Economic Outlook (AEO). 2014. *Real GDP Growth Rates, 2005-2015*. [Online]. Available: http://www.africaneconomicoutlook.org/en/statistics/ [2014, July 05].

Agri-Pulse. 2013. *U.S. apple industry prepares for the EU restrictions, trade expansion.* [Online]. Available: http://www.agri-pulse.com/US-apple-industry-prepares-for-new-EU-restrictions-trade-expansion-01222014.asp [2014, August 09].

Agritrade. 2014. *New MRLs could heavily affect pear and apple sector*. [Online]. Available: http://agritrade.cta.int/Agriculture/Topics/SPS-Food-safety/New-MRLs-could-heavily-affect-pear-and-apple-sector [2014, August 09].

Agrofresh. 2015. SmartFresh Technology. [Online]. Available: http://www.agrofresh.com/smartfresh-technology [2015, June 24].

Anderson, J.E. & Van Wincoop, E. 2001. *Gravity with Gravitas: A Solution to the Border Puzzle*. NBER working paper series no.8079. 1-37 [Online]. Available: http://www2.bc.edu/-anderson/BorderEffects.pdf [2013, August 09].

Anderson, J.E. 1979. A theoretical foundation for the gravity equation. *American Economic Review*, 69: 106-16.

Anderson, J.E. 2010. The Gravity Model. *Annual Review of Economics*, 3(1): 1-46.

Association of South-Eastern Asian Nations (ASEAN), 2014. *Non-Tariff Measures Database*. [Online]. Available: http://www.asean.org/communities/asean-economic-community/item/non-tariff-measures-database [2014, August 25].

Baldwin, R. & Taglioni, D. 2006. *Gravity for dummies and dummies for gravity equations.* National Bureau of Economic Research Working Paper 12516, NBER [Online]. Available: http://www.nber.org/papers/w12516 [2013, August 10].

Baltagi, B. 2008. *Econometric analysis of panel data*. John Wiley & Sons.

Bao, X. & Qiu, L.D. 2009. *Quantifying the trade effects of technical barriers to trade: Evidence from China* [Online]. Available: http://www.sef.hku.hk/apts2009/paper/A1620-Xiaohua%20Bao.pdf [2014, September 14].

Beghin, J. 2006. *Non-tariff Barriers*. Centre for Agricultural and Rural Development, Iowa State University Ames, Iowa. Working Paper 06-WP 438 [Online]. Available: http://www.aereconference.org/sites/default/files/publications/papers/paper_12703.pdf [2014, August 23].

Beghin, J.C. & Chengyan, Y. 2009. Tariff equivalent and forgone trade effects of prohibitive technical barriers to trade. *American Journal of Agricultural Economics*, 91 (4):930-941.

Beghin, J.C. & Xiong, B. 2012. *Stringent Maximum Residue Limits, Protectionism and Competitiveness: The Cases of the US and Canada*. Working Paper No. 12024. Iowa State University[Online].Available: https://www.econ.iastate.edu/sites/default/files/publications/papers/p15584-2012-10-21.pdf [2013, August 09].

Beghin, J.C., & Li, Y. 2010. *A Meta-Analysis of estimates of the Impact of Technical Barriers to Trade* [Online]. Available: http://www.sciencedirect.com [2014, August 10].

Beghin, J.C. & Bureau, J.C. 2001. *Measurement of Sanitary, Phytosanitary and Technical Barriers to Trade* [Online]. Available: http://www.oecd.org/tad/agricultural-trade/1816774.pdf [2014, February 8].

Beghin, J.C. & Marette, S. 2010. Are Standards Always Protectionist? *Review of InternationalEconomics*,18(1):179-192[Online]. Available:http://web.a.ebscohost.com.ez.sun.ac.za/ehost/pdfviewer/pdfviewer?sid=23317057-ba53-417d-98cd-1cd70df055d1%40sessionmgr4001&vid=1&hid=4209 [2014, August 10].

Bellanawithana, A., Weerahewa, J. & Wijerathne, B. 2004. Impacts of Non-Tariff Measures (NTM) on Agricultural Exports: A Gravity Modeling Approach, Asia-Pacific Trade Economists' Conference. South Asia: 1-37.

Bergstrand, J.H. 1985. The gravity equation in international trade: Some microeconomic foundations and empirical evidence. *Review of Economics and Statistics*, 67 (3):474-488.

Bora, B., Kuwahara, A. & Laird, S. 2002. *Quantification of Non-Tariff Measures*. Policy Issues in International Trade and Commodities Study Series No. 18 [Online]. Available: http://unctad.org/en/Docs/itcdtab19_en.pdf [2013, August 21].

Bureau of Food and Agricultural Policy (BFAP). 2013. *10th Baseline Agricultural Outlook 2013-2022*
[Online].Available:http://www.bfap.co.za/documents/baselines/BFAP_Baseline_2013.pdf [2013, September 21].

Bureau of Food and Agricultural Policy (BFAP). 2014. *Baseline Agricultural Outlook 2014-2023*
[Online].Available:http://www.bfap.co.za/documents/baselines/BFAP_Baseline_2014.pdf [2014, November 15].

Bureau of Food and Agricultural Policy (BFAP). 2015. *Baseline Agricultural Outlook 2015-2024*
[Online].Available:http://www.bfap.co.za/documents/baselines/BFAP_Baseline_2015.pdf [2015, November 01].

Carbaugh, R.J. 2008. *International Economics*. United States of America: South-Western Cengage Learning.

Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). 2015. GeoDist database.[Online].Available:
http://www.cepii.fr/CEPII/En/bdd_modele/presentation.asp?id=6 [2015, July 3].

Ceres Fruit Growers (Pty) Ltd. 2013. Fruit size distribution. Database. Ceres.

Chaney, T. 2011. *The Gravity Equation in International Trade: An Explanation* [Online]. Available: http://home.uchicago.edu/tchaney/research/Distance.pdf [2013, August 09].

Codex Alimentarius. 2014. *Codex Pesticides Residues in Food Online Database* [Online]. Available: http://www.codexalimentarius.net/pestres/data/codex/top_en.jpg [2014, August 10].

Coetzee, H. 2014. Export Manager. Ceres: Telephone interview, January 2014.

Conradie, S. 2008. Crafting a positioning strategy for the South African apple and pear industry to successfully compete against Chile in European supermarket business. Published Masters dissertation. Stellenbosch: University of Stellenbosch

Corden, W.M. 1970. *A Note on Economies of Scale, the Size of the Domestic Market and the Pattern of Trade*. In I.A. McDougall and R.H. Snape (eds.), Studies in International Economics. Amsterdam, North-Holland.

Costinot, A. & Donaldson, D. 2012. *Ricardo's Theory of Comparative Advantage: Old Idea, New Evidence* [Online]. Available: www.cepr.org/pubs/dps/DP8930.asp.asp.asp [2012, September 20].

Coughlin, C.C. & Wood, G.E. 1989. *An Introduction to NTB's to Trade* [Online]. Available:http://research.stlouisfed.org/publications/review/89/01/Trade_Jan_Feb1989.pdf [2014, February 7].

Cowpertwait, P.S.P. & Metcalfe, A.V. 2009. *Introductory Time Series with R. Springer. New York* [Online]. Available: http://www.springer.com/gp/book/9780387886978 [2015, April 25].

David, H.L. 2007. *A Guide to Measures of Trade Openness and Policy* [Online].Available: http://www.cgu.edu/Include/spe/Conf%20Pol%20Econ%20Indicators%202007/A%20Guide%20To%20Measures%20of%20Trade%20Openness%20and%20Policy.pdf [2014, September 14].

Deardorff, A.V. & Stern, R.M. 1998. *Measurement of NTB's. Studies of International Economics*. University of Michigan Press [Online] Available: https://books.google.co.za/ [2013, May 13].

Deardorff, A.V. 1985. *Major recent developments in international trade theory*. Institute of Public Policy Studies, University of Michigan.

Deardorff, A.V. 1998. *Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World?* [Online]. Available: http://www.nber.org/chapters/c7818 [2012, September 14].

Deardorff, A.V. 2012. *Easing the burden of NTB's* [Online]. Available: http://www.intracen.org/easing-the-burden-of-non-tariff-barriers/ [2013, May 13].

DeMaria, F. & Drogué, S. 2010. *Do different in Maximum Residue Levels of pesticides affect trade competitiveness? The case of apples and pears* [Online]. Available: http://www.etsg.org/ETSG2010/papers/Drogue.pdf [2014, August 12].

Department of Agriculture, Forestry and Fisheries (DAFF). 2012. *Apple Market Value Chain Profile* [Online] Available: http://www.nda.agric.za/docs/AMCP/Apple2012.pdf [2013, January 24].

Department of Agriculture, Forestry and Fisheries (DAFF). 2012. *Guideline to contract farming (GLOBALGAP) Horticulture* [Online]. Available: http://www.nda.agric.za/doaDev/sideMenu/Marketing/Marketing%20Requirements%20and%20Guidelines/Guidelines%20on%20contract%20farming%20_%20horticulture%20_GLOBALGAP.pdf [2014, August 09].

Dinçer, G. 2014. *Turkey's Rising Imports from BRICS: A Gravity Model Approach* [Online]. Available:http://mpra.ub.uni-muenchen.de/61979/1/MPRA_paper_61979.pdf [2015, July 25].

Disdier, A., Fekadu, B., Murillo, C. & Wong, S.A. 2008. Trade Effects of SPS and TBT Measures on Tropical and Diversification Products [Online]. Available: http://www.ictsd.org/downloads/2008/05/disdier_issuepaperno12.pdf [2014, June 28].

Economist Intelligent Unit (EIU), 2012. *Africa: open for business. The potential challenges and risks* [Online]. Available: http://www.globalnegotiator.com/blog_en/wpcontent/uploads/2012/12/Africa-New-Opportunities-for-Business-EIU.pdf [2014, July 06].

Egger, P. 2000. A note on the proper econometric specification of the gravity equation. *Economics Letters*, 66(2000):25-31.

Eita, J.H. 2008. *Determinants of Namibian Exports: A Gravity Model Approach* [Online]. Available: http://www.africametrics.org/ [2015, July 25].

Elshehawy, M.A., Shen, H. & Ahmed, R.A. 2014. The Factors Affecting Egypt's Exports: Evidence from the Gravity Model Analysis. *Open Journal of Social Sciences*, 2(11) 138:148 [Online]. Available: http://www.scirp.org/journal/jss [2015, July 25].

Eremenko, I. & Movchan, V. 2003. *Measurement of NTB's: the case of Ukraine, Fifth Annual Conference of the European Trade Study Group (ETSG). Spain: Madrid* [Online]. Available: http://www.etsg.org/ETSG2003/papers/eremenko.pdf [2014, September 14].

European Commission. 2013. *Enterprise and Industry: Free Trade Agreements* [Online]. Available:http://ec.europa.eu/enterprise/policies/international/facilitating-trade/free-trade/index_en.htm [2013, September 01].

European Food Safety Authority (EFSA), 2014. *Aflatoxins in food* [Online]. Available: http://www.efsa.europa.eu/en/topics/topic/aflatoxins.htm [2014, August 17].

EuroStat. 2014. Agriculture, forestry and fishery statistics. [Online]. Available: http://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agricultural_production_-_crops&oldid=263837 [2015, June 15].

Fajgelbaum, P.D., Grossman, G.M. & Helpman, E. 2011. *A Linder Hypothesis for Foreign Direct Investment,* NBER Working Paper No. 17550 [Online]. Available: http://www.nber.org/papers/w17550 [2012, September 14].

Farnsworth, D. 2012. *Maximum Residue Limits: Protectionism or Food safety?* [Online]. Available: http://ageconsearch.umn.edu/bitstream/124931/2/derek_farnsworth_aaea_2012.pdf [2014, August 09].

Fischer, R. & Serra, P. 2000. *Standards and Protection* [Online]. Available: http://www.sciencedirect.com.ez.sun.ac.za/science/article/pii/S0022199699000586 [2014, August 17].

FreshFruitPortal, 2014. *Middle Eastern fruit market shifting to consignment deals.* [Online].Available: http://www.freshfruitportal.com/news/2011/10/04/middle-eastern-fruit-market-shifting-to-consignment-deals/ [2015, May 24].

Freshplaza, 2014. *The European Union to change MRLs on top fruit treatments* [Online]. Available: http://www.freshplaza.com/article/117123/EU-to-change-MRLs-on-top-fruit-treaments [2014, August 10].

Genç, M. & Law, D. 2014. *A Gravity Model of Barriers to Trade in New Zealand* [Online]. Available: http://observgo.uquebec.ca/observgo/fichiers/56231_twp14-05.pdf [2014, September 27].

Gourdon, J. & Nicita, A. 2013. *United Nations Conference on Trade and Development (UNCTAD): A Preliminary analysis on newly collected data on non-tariff measures* [Online]. Available: http://unctad.org/en/PublicationsLibrary/itcdtab54_en.pdf [2014, September 14].

Gouws, A.R. 2005. The determinants of South African exports: Critical policy implications,. Unpublished Doctoral Dissertation. Pretoria: University of Pretoria.

Greene, W. 2013. *Export Potential for US Advanced Technology Goods to India using a Gravity Model Approach*. Office of Economics Working Paper, (2013-03B) [Online].Available: http://www.usitc.gov/publications/332/EC201303B.pdf [2015, July 25].

Grossman, G. & Rogoff, K. 1995. *Handbook of International Economics*. Boston: Elsevier.

Gujurati, D. 2006. Essentials of Econometrics. New York: McGraw-Hill Education.

Gupta, R.K. 1997. *NTB's or Disguised Protectionism* [Online].Available: http://www.cuts-international.org/1997-2.htm#MEANING%20OF%20NON-TARIFF [2014, July 26].

Hanson, G.H. & Xiang, C. 2002. *The home market effect and bilateral trade patterns, American Economic Review,* American Economic Association, 94(4):1108-1129. [Online].Available: http://www.nber.org/papers/w9076 [2015, September 19].

Haq, Z.U. & Meilke, K.D. 2011. Does the Linder effect hold for differentiated agri-food and beverage product trade? *Applied Economics*, 43(27): 4095-4109.

Helpman, E. & Krugman, P.R. 1985. *Market structure and foreign trade: Increasing returns, imperfect competition, and the international economy*. MIT press [Online].Available: https://books.google.co.za/books?hl=en&lr=&id=KB_bO8w4JgoC&oi=fnd&pg=PR11&dq=helpman+and+krugman+1985&ots=dEszxp-OY&sig=yuEbYqXAoTvc9A2Xn6MSef3acfs&redir_esc=y#v=onepage&q=helpman%20and%20krugman%201985&f=false [2015, September 19].

Helpman, E. 1981. International trade in the presence of product differentiation, economies of scale and monopolistic competition: A chamberlin-heckscher-ohlin approach. *Journal of International Economics*, 11(3): 305-340.

Henson, S. & Loader, R. 2001. *Barriers to Agricultural Exports from Developing Countries: The Role of Sanitary and Phytosanitary Requirements.* World Development Journal, 29(1): 85-102. [Online]. Available: http://www.sciencedirect.com.ez.sun.ac.za/science/article/pii/S0305750X00000851# [2013, August 21].

Hillman, J.S. 1978. Nontariff Barriers: Major Problem in Agriculture. *American Journal of Agricultural Economics*, 60(3), August:491-501.

Hortgro, 2013. *Key deciduous fruit statistics.* [Online]. Available: http://www.hortgro.co.za/market-intelligence-statistics/key-deciduous-fruit-statistics/ [2014, April 10]

Hortgro, 2014. *South African pome fruit industry packaging material guidelines*. [Online]. Available:http://www.hortgro.co.za/download/production-technical-information/technical-information/handling-protocols/pome-fruit/5.5.1.pome-fruit-pack-material-guidelines%202012.pdf. [2014, July 10].

Hsiao, C. 2007. *Panel Data analysis advantages and Challenges*. Test, 16 (1):1-22.

Hurndall, R. 2005. *A guide to deciduous fruit of South Africa*. Deciduous Fruit Producer's Trust (DFPT). Paarl.

Ingham, B. 2010. *International Economics: A the European Focus*. London: Pearson Education Limited.

International Trade Centre (ITC). 2013. *Some key results from ITC surveys on Non-Tariff Measures in SVEs.* [Online]. Available: http://www.wto.org/english/tratop_e/devel_e/wkshop_oct13_e/itc_ntm_sve.pdf [2013, September 23].

International Trade Centre (ITC). 2014. *Market Access Map (MACMAP)*. [Online]. Available http://www.macmap.org/QuickSearch/NTM/FindNonTariff.aspx [19, July 2014].

Jacks, D.S., Meissner, C.M. & Novy, D. 2011. Trade booms, trade busts, and trade costs. *Journal of International Economics*, 83(2): 185-201.

Jian, Z. 2011. *Based on Gravity trade model and Linder Hypothesis: An Empirical Application to China-EU Trade Flows*. Paper presented at Business Management and Electronic Information (BMEI) International Conference. 13-15 May 2011, China. [Online]. Available:http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=5920483&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D5920483 [2013, July 05].

Johnson, R. 2014. *Sanitary and Phytosanitary (SPS) and Related NTB's to Agricultural Trade* [Online]. Available: http://nationalaglawcenter.org/wp content/uploads//assets/crs/R43450.pdf [2014, July 26].

Jordaan, A. & Kanda, P. 2011. *Analysing the trade effects of the EU-SA & SADC trading agreements: a Panel data approach*. Department of Economics. University of Pretoria [Online].Available: http://www.sajems.org/index.php/sajems [2015, April 28].

Jordaan, A.C. 2011. Analysing Exports in South Africa's Chemical Sector: A Panel Data Approach. *Studies in Economics and Econometrics*, 35(2): 95-112.

Kapuya, T. 2014. *The trade effects of technical barriers on South Africa's orange exports.* The Agricultural Business Chamber (Agbiz). Pretoria [Online]. Available: http://www.agbiz.co.za/uploads/documents/trade-intelligence/publications/14_05_20_Trade_effects_SA_orange_exports%20.pdf [2015, April 28].

Kee, H., Nicita, A. & Olarreaga, M. 2009. Estimating Trade Restrictiveness Indices. *The Economic Journal*, 119(534) [Online]. Available: https://openknowledge-worldbank-org.ez.sun.ac.za/handle/10986/5903 [2014, September 28].

Kennedy, L.P & Koo, W.W. 2005. *International trade and agriculture*. Oxford: Blackwell Publishing.

Kirsten, J. & Kalaba, M. 2012. *Estimating the quantity effects of non-tariff measures on SADC meat and milk trade* [Online]. Available: http://web.up.ac.za/sitefiles/file/48/2052/2012%20Working%20Papers/NTM%20on%20Intra-Meat%20Trade~2Oct12.pdf [2014, September 27].

Korinek, J., Melatos, M. & Rau, M. 2008. *A Review Of Methods For Quantifyng The Trade Effects Of Standards In The Agri-Food Sector*. OECD Trade Policy Working Paper No. 79 [Online].Available: http://78.41.128.130/dataoecd/35/22/41430327.pdf [2014, September 28].

Kotze, M. 2013. *Opinion: SA's growing apple export opportunities in Africa* [Online]. Available: http://www.freshfruitportal.com/2012/01/31/opinion-sas-growing-apple-export-opportunities-in-africa/?country=south%20africa [2014, April 10].

Krugman, P.R. 1979. Increasing returns, monopolistic competition, and international trade. *Journal of International Economics*, 9(4): 469-479.

Krugman, P.R. 1980, Scale Economies, Product Differentiation, and the Pattern of Trade. *The American Economic Review*, 70(5):950-959.

Laird, S. & Yeats, A. 1990, *Quantitative Methods for Trade Barrier Analysis*. The Macmillan Press. London.

Leamer, E.E. & Stern, R.M. 1970. *Quantitive International Economics*. Chicago: Aldine Publishing Company.

Levin, A., Lin, C. & Chu, C.J. 2002. Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties. *Journal of Econometrics*, 108(1):1-24 [Online]. Available: http://www.sciencedirect.com/science/article/pii/S0304407601000987 [2015, April 30].

Linnemann, H. 1966. *An Economic Study of International Trade Flows*. Amsterdam: North-Holland. [Online]. Available: http://www.jstor.org/stable/2229319?seq=1#page_scan_tab_contents [2013, June 12].

Lombard, J.P. & Reynolds, S. 2012. A long-term view on South Africa's apple and pear industry. *South African Fruit Journal*, 11(1): 17-19.

Martinez-Zarzoso, I. & Nowak-Lehmann, F. 2003. Augmented gravity model: an empirical application to MERCOSUR-EU trade flows. *Journal of Applied Economics*, 6(2):291-316.

Mashabela, T.E. & Vink, N. 2008. *Competitive performance of global deciduous fruit supply chains: South Africa versus Chile*. Agrekon, 47 (3): 240 – 255, June 2008 [Online] Available: http://reference.sabinet.co.za.ez.sun.ac.za/sa_epublication/agrekon [2014, June 30].

MAST (Multi-Agency Support Team). 2008. *First Progress Report to the Group of Eminent Persons on NTB's*. UNCTAD, Manuscript, Geneva. [Online]. Available: http://unctad.org/en/PublicationsLibrary/ditctab20122_en.pdf [2014, June 24].

Melitz, M.J. 2003. The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. *Econometrica* 71:1695–1725.

Meiring, K. 2014. Export Manager Middle East. Ceres: Telephone interview, January 2014.

Mellando, A.G., Gay, S.H., M'arek, R. & Ferrari, E. 2010. *Evaluation of Non-Tariff Measures for African agricultural exports to the EU in a CGE framework* [Online]. Available: https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=3274[2013, August 21].

Moenius, J. 2006. *The good, the bad and the ambiguous: standards and trade in agricultural products*. Paper prepared for the IATRC summer symposium "food regulation and trade: Institutional framework, concepts of analysis and empirical evidence", Bonn, Germany, May 28-30 2006, International Agricultural Trade Research Consortium [Online].Available: http://bulldog2.redlands.edu/fac/johannes_moenius/content/moenius_agriculture_trade.pdf [2014, August 12].

Mutume, G. 2006. *New Barriers hinder African trade* [Online].Available: http://www.un.org/africarenewal/magazine/january-2006/new-barriers-hinder-african-trade 2014, July 26].

Nelson, S. & Papier, T. (n.d). *The challenges and opportunities of doing business in Africa* [Online].Available:http://www.ensafrica.com/Uploads/Images/news/ThechallengesandopportunitiesofdoingbusinessinAfrica.pdf [2014, July 05].

Neven, D. 2000. *Evaluating the Effects of NTB's: The Economic Analysis of Protection in WTO Disputes*. Working Paper, Centre for Economic Policy Research [Online]. Available: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.195.4742&rep=rep1&type=pdf [2014, September 27].

Niemann, E., Shields, A. & Sandham, F. 2014. *Investec: Africa: Continent of Opportunities and Challenges* [Online]. Available:https://www.investec.co.uk/research-and-insights/insights/forward-curve/africa--continent-of-opportunities-and-challenges.html [2014, June 26].

Northwest Horticultural Council (NHC). 2014. *The EU Chemical Maximum Residue Levels (MRL's)*. [Online].Available: http://nwhort.org/export-manual/countries-toc/european-union/ [2014, August 10].

Novy, D. 2012. International trade without CES: Estimating translog gravity. *Journal of International Economics*, working paper series, no.31:1-34.

Odendaal, F.O. 2014. Personal Interview. 1 March, Ceres.

Organization for Economic Cooperation and Development (OECD). 2014. *Glossary of Statistical Terms*. [Online]. Available: http://stats.oecd.org/glossary/detail.asp?ID=332 [2014, February 20].

Otsuki, T., Wilson, J. S. and Sewadeh, M. 2001. Saving two in a billion: quantifying the trade of the European food safety standards on African exports. *Food Policy*, 26(5):495-514.

Otsuki. T. & Wilson, J.S. 2001. *Global Trade and Food Safety: Winners and Losers in a Fragmented System* [Online]. Available: http://books.google.co.za/books?hl=en&lr=&id=JftL8RIAY6sC&oi=fnd&pg=PA20&dq=Winners+Losers+in+a+Wilson,+John&ots=tI5rg

uEbs-&sig=A-GBOB5schOSfekI4cxsnzPmF7c&redir_esc=y#v=onepage&q=Winners%20Losers%20in%20a%20Wilson%2C%20John&f=false [2014, August 09].

Paas, T. 2000. *Gravity approach for modeling trade flows between Estonia and the main trading partners*. Tartu University Press [Online]. Available: http://www.mtk.ut.ee/doc/febawb4.pdf [2012, September 15].

Pretorius, M. 2014. *The potential for exporting South African pome-fruit to other African countries*. Presentation: Hortgro Technical Symposium, Allée Bleue Conference Centre, Groot Drakenstein. [2014, 3-6 June].

Regional Economic Outlook (REO), 2013. *Sub-Saharan Africa: Keeping the Pace.* [Online]. Available: http://www.imf.org/external/pubs/ft/reo/2013/afr/eng/sreo1013.pdf [2013, October 23].

Regional Trade Facilitation Programme (RTFP), 2007. *Survey of NTB's to trade: COMOROS.* Prepared by Imani Development International (Ltd). [Online]. Available: http://www.tradebarriers.org/documents/survey-reports [2013, September 23].

Rossi-Hansberg, E. 2005. A Spatial Theory of Trade. *American Economic Review*, 95(5): 1464-1491. [Online]. Available: https://www.princeton.edu/~erossi/SToTAER.pdf [2015, April 30].

Sandrey, R., Smit, L., Fundira, T. and Edinger, H. 2008.*Non-tariff measures inhibiting South African exports to China and India*. Tralac Working Paper No 6/2008. [Online]. Available: www.tralac.co.za. [2014, March 2].

Scheltema, N. 2013. A Gravity Approach to the Determinants of International Bovine Meat Trade. Published master's thesis. Pretoria: University of Pretoria.

Schmidt, S.J. 2005. *Econometrics*. New York: McGraw-Hill/Irwin.

Siliverstovs, B. & Schumacher, D. 2007. Using the gravity equation to differentiate among alternative theories of trade: Another look. *Applied Economics Letters*, 14(14): 1065-1073.

Sirisupluxana, P. & Singhapreecha, C. 2012. *Impact of NTB's on fruit growers in northern Thailand under FTA with China*. International Conference of Sustainable Land Use and Rural Development in Mountain Areas: Hohenheim, Stuttgart, Germany, 16-18 April 2012. [Online]. Available:https://www.unihohenheim.de/fileadmin/einrichtungen/uplands2012/abstracts/P12b.pdf [2014, July 16].

South African Reserve Bank (SARB), 2014. Historical exchange rates database. [Online]. Available: https://www.resbank.co.za [2014, February 21].

Southern African Customs Union (SACU). 2014. [Online]. Available: http://www.sacu.int/main.php?id=471 [2014, July 05].

Steele, R. 2012. International standards: A key solution to address non-tariff barriers to trade [Online]. Available: http://www.tradeforum.org/article/International-standards-A-key-solution-to-address-non-tariff-barriers-to-trade/ [2014, June 13].

Stern, R.M. & Deardorff, A.V. 2006. Globalization's Bystanders: Does Trade Liberalization Hurt Countries that do Not Participate? *World Development*, 34(8): 1419-1429.

Thornsbury, S. 1998. *Technical Regulations as Barriers to Agricultural Trade*. Unpublished doctoral thesis. Virginia: Virginia Polytechnic Institute.

Tinbergen, J. 1962. *Shaping the World Economy: Suggestions for an International Economic Policy*. New York: The Twentieth Century Fund [Online]. Available: http://onlinelibrary.wiley.com/doi/10.1002/tie.5060050113/pdf [2013, January 27].

Torres, O. 2007. *Panel Data Analysis: Fixed and Random Effects*. Data and Statistical Services, Princeton University [Online]. Available: http://www.princeton.edu/~otorres/Panel101.pdf [2015, November 17].

Trabelsi, I. 2013. Agricultural trade face to NTB's: A gravity model for the Euro-Med area, *Journal of Studies in Social Sciences*, 3(1): 20-32.

Trade Law Centre (Tralac). 2010. *Determining the scope and nature of non-tariff measures prevalent in selected international. markets.* [Online] Available:http://www.namc.co.za/upload/other_trade_publications/Non-Tariff%20Measures%20affecting%20SA%20agric%20exports.pdf [2013, April 26].

Trade Mark East Africa (TMEA), 2014. *Free Trade Still A Pipedream: NTB's Push up Cost of Doing Business in the Region.* [Online]. Available: http://www.trademarkea.com/free-trade-still-a-pipedream-non-tariff-barriers-push-up-cost-of-doing-business-in-the-region/ [2014, July 16].

Trade Mark Southern Africa (TMSA). 2014. *Non-Tariff Barriers.* [Online]. Available: http://www.tradebarriers.org [2014, February 7].

United Nations Conference on Trade and Development (UNCTAD), 2012. *Classification of non-tariff measures.* [Online]. Available: http://unctad.org/en/PublicationsLibrary/ditctab20122_en.pdf [2013, September 23].

United Nations Conference on Trade and Development (UNCTAD), 2012. *Analyzing bilateral trade using the gravity trade equation, Chapter 3.* [Online]. Available: http://vi.unctad.org/tpa/web/ch3.html [2013, September 23].

United Nations Conference on Trade and Development (UNCTAD), 2013. *Non-Tariff Measures To Trade: Economic and Policy Issues for Developing Countries.* [Online]. Available: http://unctad.org/en/PublicationsLibrary/ditctab20121_en.pdf [2013, September 23].

United Nations Conference on Trade and Development (UNCTAD), 2014. *Virtual Institute: Analyzing bilateral trade using the gravity trade model.* [Online]. Available: http://vi.unctad.org/video/gravity/gravity_1/player.html [2014, September 23].

United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP). 2012. *The Gravity Trade Model of International Trade: A User Guide*. [Online].Available: http://www.unescap.org/resources/gravity-model-international-trade-user-guide[2015, October 23].

United Nations National Accounts Main Aggregates Database (UNNAMAD), 2015. [Online].Available: http://unstats.un.org [2015, September 20].

United Nations Statistics Division, 2015. *National Accounts and Population data*. [Online].Available: http://unstats.un.org/unsd/snaama/dnllist.asp [2015, October 30].

United States Department of Foreign Agricultural Services (USDAFAS), 2012. *Gain report: South African Fresh Deciduous Fruit Semi-annual Fresh Apple and Table Grape Exports Expected to Increase.* [Online]. Available: http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Fresh%20Deciduous%20Fruit%20Annual_Pretoria_South%20Africa%20-%20Republic%20of_11-6-2012.pdf [2014, July 05].

Van Bergeijk, P.A.G. & Brakman, S. 2010. *The Gravity Model in International Trade: Advances and Applications.* Cambridge: Cambridge University Press.

Van den Berg, C. 2014. *Key success factors for exporting to African markets*. Presentation: Hortgro Technical Symposium, Allée Bleue Conference Centre, Groot Drakenstein. [2014, 3-6 June].

Van Tongeren, F., J. Beghin and S. Marette. 2009. *A Cost-Benefit Framework for the Assessment of Non-Tariff Measures in Agro-Food Trade*, OECD Food, Agriculture and Fisheries Working Papers, No. 21, OECD Publishing. [Online].Available: http://www.oecd.org/tad/agricultural-trade/45013630.pdf [2014, September 13].

Verbeek, M. 2012. *A Guide to Modern Econometrics*. 4th Edition. Wiley Publishers [Online].Available: http://www.scholartext.com/reader/index/docid/88808446/page/1 [2015, April 28].

Viviers, W., Kühn, M., Steenkamp, E. & Berkman, B. 2014. *Tru-Cape Fruit Marketing, South Africa: Managing the Export Market Diversification Challenge*. International Food and Agribusiness Management Review 17(1B): 193-197. [Online]. Available: http://ageconsearch.umn.edu/handle/179599 [2015, May 24].

Wilson, J. and Otsuki, T.2004. To spray or not to spray: pesticides, banana exports, and food safety. *Food Policy*, 29(2):131-146.

World Apple Review (WAR). 2013. [Online].Available: http://www.e-belrose.com/MonthlyWAReports.html [2014, April 10].

World Development Indicators Database (WDI). 2014. [Online].Available: http://data.worldbank.org/data-catalog/world-development-indicators [2013, July 13].

World Economic Forum (WEF), 2014. *The Africa competiveness report*. [Online].Available: http://wwwwds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2013/05/09/000442464_20130509113504/Rendered/PDF/774520AR0P14310complete0with0covers.pdf [2014, July 06].

World Economic Outlook (WEO). 2014. *Recovery Strengthens, Remains Uneven*. [Online]. Available: http://www.imf.org/external/Pubs/ft/weo/2014/01/pdf/text.pdf [2014, April 12].

World Health Organisation (WHO), 2014. *Sanitary and Phytosanitary Measures: Agreement on the Application*. [Online].Available: http://www.who.int/trade/glossary/story080/en/ . [2014, September 14].

World Trade Organisation (WTO). 2014a. *Introduction to the SPS Agreement: What is an SPS measure?* [Online].Available:http://www.wto.org/english/tratop_e/sps_e/sps_agreement_cbt_e/c1s3p1_e.htm [2014, September 14].

World Trade Organization (WTO). 2014b. *NTB's: Principles of a trading system*. [Online]. Available: http://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm9_e.htm [2014, February 7].

World Trade Organization (WTO). 2014c. *Understanding The WTO: The Agreements on Standards and safety*. [Online]. Available:http://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm4_e.htm [2014, February 28].

World Trade Report. 2012. *The trade effects of non-tariff measures and services measures*. [Online]. Available:https://www.wto.org/english/res_e/publications_e/wtr12_e.htm [2014, February 8].

World Wildlife Fund (WWF), 2010. *Agriculture: Facts & Trends South Africa*. [Online]. Available:http://www.wwf.org.za/downloads/facts_brochure_mockup_04_b.pdf [2013, September 23].

Xiong, B. 2012. Three essays on non-tariff measures and the gravity equation approach to trade. Unpublished doctoral thesis. Iowa State: Iowa State University.

Yamano, T. 2009. *Lecture Notes on Advanced Econometrics: Heteroskedasticity and Robust Estimators* [Online]. Available: http://www3.grips.ac.jp/~yamanota/Lecture_Note_9_Heteroskedasticity.pdf [2015, November 25].

Appendix A

Table A1: Summary of main trade agreements between South Africa and the rest of the world

Summary of Main Trade Agreements between South Africa and the rest of the World				
Main Trade Agreements	**Type of Agreement**	**Countries Involved**	**Main Objective/Terms**	**Products Involved**
Customs Union (CU)				
Southern African Customs Union (SACU)	Customs Union	South Africa, Botswana, Lesotho, Namibia and Swaziland	Duty free movement of goods with a common external tariff on goods entering any of the countries from outside the SACU	All products
Free Trade Agreements (FTAs)				
Southern African Development Community (SADC) FTA	Free Trade Agreement	Between 12 SADC Member States	A FTA, with 85% duty-free trade achieved in 2008. The 15% of trade, constituting the "sensitive list", is expected to be liberalised from 2009 to 2012 when SADC attains the status of a fully-fledged FTA with almost all tariff lines traded duty free.	Most products
Trade, Development and Cooperation Agreement (TDCA)	Free Trade Agreement	South Africa and the European Union (EU)	The EU offered to liberalise 95% of its duties on South African originating products by 2010. In turn, by 2012, South Africa offered to liberalise 86% of its duties on EU originating products.	There is currently a review of the agreement underway, which is aimed at broadening the scope of product coverage. This is taking place under the auspices of the Economic Partnership Agreement (EPA) negotiations between SADC and the EU
EFTA-SACU Free Trade Agreement (FTA)	Free Trade Agreement	SACU and the European Free Trade Association (EFTA) -Iceland, Liechtenstein, Norway and Switzerland	Tariff reductions on selected goods	Industrial goods (including fish and other marine products) and processed agricultural products. Basic agricultural products are covered by bilateral agreements with individual EFTA States
Preferential Trade Agreements (PTAs)				
SACU-Southern Common Market (Mercosur) PTA	Preferential Trade Agreement	SACU and Argentina, Brazil, Paraguay and Uruguay	Tariff reductions on selected goods. It is not expected to enter into force before some time in 2012	About 1,000 product lines on each side of the border
Zimbabwe/South Africa bilateral trade agreement	Bilateral Preferential Trade Agreement	South Africa and Zimbabwe	Preferential rates of duty, rebates and quotas on certain goods traded between the two countries	Selected goods. A most recent version of the agreement was signed in August 1996, which lowers tariffs and quotas on textile imports into South Africa.

Summary of Main Trade Agreements between South Africa and the rest of the World				
Main Trade Agreements	**Type of Agreement**	**Countries Involved**	**Main Objective/Terms**	**Products Involved**
Non-reciprocal Trade Arrangements				
Generalised System of Preferences (GSP)	Unilateral preferences granted under the enabling clause of the WTO that are not contractually binding upon the benefactors	Offered to South Africa as developing country by the EU, Norway, Switzerland, Russia, Turkey, the US, Canada and Japan	Products from developing countries qualify for preferential market access	Specified industrial and agricultural products
Africa Growth and Opportunity Act (AGOA)	Unilateral assistance measure	Granted by the US to 39 Sub-Saharan African (SSA) countries	Preferential access to the US market through lower tariffs or no tariffs on some products	Duty free access to the US market under the combined AGOA/GSP programme stands at approximately 7,000 product tariff lines.
Other Agreements				
Trade, Investment and Development Cooperation Agreement (TIDCA)	Cooperative framework agreement	SACU and US	Makes provision for the parties to negotiate and sign agreements relating to sanitary and phyto-sanitary measures (SPS), customs cooperation and technical barriers to trade (TBT). It also establishes a forum of engagement of any matters of mutual interest, including capacity-building and trade and investment promotion.	None
Trade and Investment Framework Agreement (TIFA)	Bilateral agreement	South Africa and US	Provides a bilateral forum for the two countries to address issues of interest, including AGOA, TIDCA, trade and investment promotion, non-tariff barriers, SPS, infrastructure and others.	None
Current Trade Negotiations				
SACU-India PTA	Preferential Trade Agreement	SACU and India	Tariff reductions on selected goods	SACU and India are in the process of exchanging tariff requests
SADC-EAC-COMESA Tripartite FTA	Free Trade Agreement	26 countries with a combined GDP of US$860 billion and a combined population of approximately 590 million people	The Tripartite Framework derives its basis from the Lagos Plan of Action and the Abuja Treaty establishing the African Economic Community (AEC), which requires rationalisation of the continent's regional economic communities. The FTA will be negotiated over the next three years, with the possibility of an additional two years for completion.	The Tripartite initiative comprises three pillars that will be pursued concurrently, in order to ensure an equitable spread of the benefits of regional integration: market integration, infrastructure development and industrial development. The FTA will, as a first phase, cover only trade in goods; services and other trade-related areas will be covered in a second phase.

Table A2: NTM's imposed by United Kingdom on fresh apples (HS 080810)

Import related non-tariff measures applied by **United Kingdom** Product: **080810 - Fresh apples** Partner: **South Africa** Year: **2010**		
Sanitary and phytosanitary measures (SPS)		
NTM Code	**Measures applied by importing country**	**# of affected NTL products**
A130	Systems Approach	3
A150	Registration requirements for importers	3
A190	Prohibitions or restrictions of products or substances because of SPS reasons n.e.s.	3
A210	Tolerance limits for residues of or contamination by certain substances	3
A220	Restricted use of certain substances in foods and feeds	3
A310	Labelling requirements	3
A410	Microbiological criteria on the final product	3
A420	Hygienic practices during production	3
A630	Food and feed processing	3
A700	Regulation of foods or feeds derived from, or produced using genetically modified organisms (GMO)	3
A830	Certification requirement	3
A840	Inspection requirement	3
A850	Traceability information requirements	3
A851	Origin of materials and parts	3
A852	Processing history	3
A853	Distribution and location of products after delivery	
Technical barriers to trade (TBT)		
NTM Code	**Measures applied by importing country**	**# of affected NTL products**
B140	Authorization requirement for TBT reasons	3
B310	Labelling requirements	3
B320	Marking requirements	2
B700	Product quality or performance requirement	2
Licenses, quotas, prohibition & other quantity control measures		
NTM Code	**Measures applied by importing country**	**# of affected NTL products**
E100	Non-automatic licence	2
Finance measures		
NTM Code	**Measures applied by importing country**	**# of affected NTL products**
G110	Advance import deposit	2

Source: ITC, MACMAP, 2014

Table A3: NTM's imposed by Hong Kong, China on fresh apples (HS 080810)

Import related non-tariff measures applied by **Hong Kong, China** Product: **080810 - Fresh apples** Total national tariff lines (NTL) affected: **1** Partner: **South Africa** Year: **2010** Data source: **ITC (MAcMap)** NTM classification revision: **NTM rev. 2009**		
Sanitary and phytosanitary measures (SPS)		
NTM Code	**Measures applied by importing country**	**Number of affected NTL products**
A140	Special Authorization for SPS reasons	1
A190	Prohibitions or restrictions of products or substances because of SPS reasons n.e.s.	1
A210	Tolerance limits for residues of or contamination by certain substances	1
A220	Restricted use of certain substances in foods and feeds	1
A310	Labelling requirements	1
A820	Testing requirement	1
A830	Certification requirement	1
Technical barriers to trade (TBT)		
NTM Code	**Measures applied by importing country**	**Number of affected NTL products**
B310	Labelling requirements	1
B700	Product quality or performance requirement	1
Charges, taxes and other para-tariff measures		
NTM Code	**Measures applied by importing country**	**Number of affected NTL products**
F200	Service charges	1

Source: ITC, MACMAP, 2014

Table A4: NTM's imposed by Malaysia on fresh apples (HS 080810)

Import related non-tariff measures applied by **Malaysia** Product: **080810 - Fresh apples** Partner: **South Africa** Year: **2014** Data source: http://www.asean.org/communities/asean-economic-community/item/non-tariff-measures-database NTM classification revision: **NTM rev. 2009** National Legislation : Food Act 1983 (Ministry of Health)	
Sanitary and phytosanitary measures (SPS) (Food Safety Requirement)	
NTM Code	**Measures applied by importing country**
6100	Certificate of Approval;
8100	Technical regulations
NTM Description	No description available

Source: ASEAN, 2014

Table A5: NTM's imposed by Singapore on fresh apples (HS 080810)

Import related non-tariff measures applied by **Singapore** Product: **080810 - Fresh apples** Partner: **South Africa** Year: **2014** NTM classification revision: **NTM rev. 2004** **Imports of these fruits are regulated through the automatic licensing for reasons of public health and safety** Data source: http://www.asean.org/communities/asean-economic-community/item/non-tariff-measures-database Control of Plants Act (Chapter 57A) / Agri-Food and Veterinary Authority (AVA)- http://www.ava.gov.sg/Legislation/ListOfLegislation/ Ministry of National Development (MND)- http://www.mnd.gov.sg/handbook/nurt_main.htm	
Sanitary and phytosanitary measures (SPS) (Food Safety Requirement)	
NTM Code	**Measures applied by importing country**
34	Automatic Licensing
NTM Description	Imports of these fruits are regulated through the automatic licensing for reasons of public health and safety

Source: ASEAN, 2014

Considerable confusion exists surrounding the nett and the gross weights of the different packaging. In certain situations it leads to rejections overseas with serious financial implications. The EU may consider underweight packaging as a legal violation. Receivers (importers) overseas usually specify weights, but in the absence thereof, the following guidelines may be followed:

Table A6: General guideline to apple carton and packaging weights

A. Apples

Carton	Carton Dimension	Trays	Bags	Mass	
				Min* (Compulsory)	Max (Recommend)
12.5kg M12T	300x400x227mm	383x281mm	Length- 410mm Width - 310mm Depth - 775mm	12.5kg	13.0kg
12.5kg A12D	600x400x134mm	588x364mm	Length- 610mm Width - 410mm Depth - 800mm	12.5kg	13.0kg
12.5kg B12D	600x400x144mm	588x364mm	Length- 610mm Width - 410mm Depth - 800mm	12.5kg	13.0kg
12.5kg C12D	600x400x154mm	588x364mm	Length- 610mm Width - 410mm Depth - 800mm	12.5kg	13.0kg
6.5kg A06D	600x400x75mm	588x364mm	Length- 410mm Width - 310mm Depth - 775mm	6.5kg	7.0kg
6.5kg B06D	600x400x85mm	588x364mm	Length- 410mm Width - 310mm Depth - 775mm	6.5kg	7.0kg
6.5kg C06D	600x400x95mm	588x364mm	Length- 410mm Width - 310mm Depth - 775mm	6.5kg	7.0kg
7.0kg A07D	600x400x75mm	588x364mm	Length- 410mm Width - 310mm Depth - 775mm	7.0kg	7.5kg
7.0kg B07D	600x400x85mm	588x364mm	Length- 410mm Width - 310mm Depth - 775mm	7.0kg	7.5kg
7.0kg C07D	600x400x95mm	588x364mm	Length- 410mm	7.0kg	7.5kg
18.25kg M18T	500x333x261mm	480x313mm	Length – 550mm Width – 350mm Depth – 875mm	18.25kg	18.75kg

*Minimum weight on arrival in the market

Source: Hortgro, 2014

Table A7: Guideline to apple carton sizes, counts and specifications

Apples

1. **Single layer Display Carton (MK7)**

Carton	Counts					Ctns/Std Pallet	Ctns/Hi-cube pallet
A06D 75mm	32	35	39	40	42	115	130
B06D 85mm	24	28	32	35		100	115
C06D 95mm	18	20	24	28		90	105

2. **Double layer Display carton (MK9)**

Carton	Counts				Ctns/Std Pallet	Ctns/Hi-cube pallet
A12D 134mm	88	96			70	75
B12D 144mm	70	78	80	84	65	70
C12D 154mm	48	56	64		60	65

3. **12.5kg M12T Telescopic Carton (MK6)**

Carton	Counts												Ctns/Std Pallet	Ctns/Hi-cube pallet
M12T	48	56	64	70	80	84	88	100	113	125	138	150	70	80

4. **18.25kg M18T Telescopic Carton (MK4)**

Carton	Counts											Ctns/Std Pallet	Ctns/Hi-cube pallet
M18T	70	80	90	100	110	120	135	150	165	180	198	49	56

5. **21kg M21T Telescopic Carton (Bushel)**

Carton	Counts			Ctns/Std Pallet	Ctns/Hi-cube pallet
M21T	216	231	252	42	42

Source: Hortgro, 2014

Table A8 Apple (MK4 Equivalent carton 18.62 kilograms)

Count	Ave Weight	Min Weight	Size (mm)	
	(g)	(g)	Min	Max
70	261	246		86
80	228	210	84	
90	203	195	81	
100	183	170	78	
110	166	162	74	
120	152	142	72	
135	135	128	68	
150	122	114	65	
160		110	63	
165	111	106	62	
180	101	97	59	
198	92	88	57	
216	84	81	55	

Source: Ceres Fruit Growers Database, 2013

Appendix B

Table B1: Result for Model 2 (fixed effect with robust standard errors for South Africa's total exports excluding ad valorem tariff rate percentage (AVE)).

Explanatory variables	Sign	Coefficient	Std. Error	t-statistic	P-Value	Significance
l_GDP_S	+	2.3331	1.1670	2	0.0610	*
l_GDP_T	+	1.1977	0.5174	2.31	0.0330	*
l_POP_S	-	-1.1702	3.6975	-0.32	0.7550	
l_POP_T	+	0.1048	0.3772	0.28	0.7840	
l_actrexch	+	0.3664	0.1064	3.44	0.0030	**
CONSTANT	-	-58.5436	34.8078	-1.68	0.1100	
R-squared (R^2)	0.4760					

(***/**/*) Statistically significant at the 1%, 5% and 10% level, as reported in Stata.

Source: Own calculations[59] using Stata.

[59] The value of total exports from South Africa in terms of ZAR were used with the same data explanatory variables. However, the ad valorem tariff rate percentage (AVE) was excluded from this model because there is not AVE available for total exports.

Appendix C

The Price wedge method

Beghin and Bureau (2001:7) investigated an existing study on the *"Price Wedge Method"* originally from the article of Calvin and Krishoff (1997) that used this method to estimate the tariff rate equivalents of the technical regulations in the United States of America's (U.S.) apple sector. They compared the *landed prices* which includes freight and insurance costs (c.i.f prices[60]) of fresh U.S. apples in Japan with wholesale prices in this foreign market (Calvin & Krishoff, 1997). The price wedge in this study is the difference between the domestic Japanese price and the price of similar U.S. apples delivered to Japan.

Calvin and Krishoff (1997:361) used monthly price data and assumed that the price gap consists of the tariff and technical barrier tariff rate equivalent. They attempted to focus on the price of similar apples (i.e. same variety, grade, and size) during the same time period and at a similar place in the marketing chain. They also constructed transport costs that correspond to the cost of supplying U.S. apples to various Japanese wholesale markets. Once the difference in price between the U.S. apple delivered in Japan and the wholesale price for a similar apple in this wholesale market was known, the monthly price wedge (in percentage terms) was calculated. The monthly price wedge was then divided into the known tariff rate, as well as the technical barrier tariff rate equivalent, which was the residual (Calvin & Krishoff, 1997).

The EU Commission (2001) also used this kind of approach in their study in which they compared c.i.f prices of U.S. pig and poultry meat, as well as fresh apples in the EU, with the EU wholesale price (Beghin & Bureau, 2001:7). On the one hand empirical studies of the "*price wedge method"* were somewhat contradicting in some sense, because Calvin and Krishoff (1997) stated that "*the price wedge method can provide useful estimates of the tariff equivalent of technical barriers"*. In other words, it can be used to estimate the trade impact of these specific NTB's. On the other hand Beghin and Bureau (2001) found that most of the time, the

[60] According to the OECD's Glossary of Statistical Terms (2014), the c.i.f. price (i.e. cost, insurance and freight price) is the price of a good delivered at the frontier of the importing country, including any insurance and freight charges incurred to that point, or the price of a service delivered to a resident, before the payment of any import duties, other taxes on imports, trade and transport margins within the country.

results when using this method or approach, were rather questionable and do not capture the effect of specific NTB's on bilateral trade flows.

The Survey-based Method

Beghin and Bureau (2001:10) stated in their article that "the ability of a survey-based approach to actually quantify or help quantifying NTB's is rather questionable." They argued that survey respondents are likely to be biased in their feedback in terms of the scoring of certain factors, if they are under the perception that the agency conducting the survey would use the results for policy purposes. They also added by stating that "*the definition of the questionnaire and the way the survey is conducted are likely to affect the non-tariff barrier estimate*."

It is clear from the empirical studies that the survey-based method is only useful if no other sources of information are available and the cost, time and quality of the information in terms of conducting the survey, are considered (Henson & Loader, 2001; Beghin & Bureau, 2001).

Henson and Loader (2001) used the survey-based approach to obtain quantitative information on the relative importance of NTB's. They sent surveys via fax to all low- and middle income countries as classified by the World Bank which were members of the WTO and/or Codex Alimentarius in March 1999. Survey respondents were asked to consider a range of factors that might impede their respective country's ability to export agricultural and food products to the EU and also indicate the significance of each identified factor on a scale from *very significant* (1) at one extreme to *very insignificant* (5) at the other extreme (Henson & Loader, 2001:91). The overall result of the surveys indicated that SPS and other TBT requirements such as labelling regulations or compositional standards, transport and other direct export costs were considered to be the most significant of the factors that impede exports to the EU (Henson & Loader, 2001:91).

The inventory-based approach and frequency measures

The frequency index only accounts for the presence or absence of NTB's and summarises the percentage of products to which one or more NTB's are applied without indicating the value of imports covered. This avoids the problem of endogeneity of the weights used in the calculation of TRC (Bora *et al*., 2002: Gourdon & Nicita, 2013). According to Bora *et al*. (2002:6), the "frequency index indicates the percentage of import transactions covered by a selected group of NTB's for a specific exporting country." The frequency index is calculated using the following formulae:

$$F_{jt} = \left[\frac{\sum(D_{it} . M_i)}{(\sum M_i)}\right] . 100$$

Where,

Dummy variable[61] D_i takes the value of 1 if there are NTB's and 0 if there are no NTB's. M_i (also a dummy variable) indicates whether there are indeed imports form country *j* of product *i*. The *t is* the year of measurement of NTB's. According to Bora *et al.* (2002), it is possible for TCR and frequency ratios to give one an indication of the trade restrictiveness, but within limits of between 0 and 100 percent coverage, despite the weaknesses of these ratios. However, Beghin (2006) argues that frequency ratios can indeed be used in gravity trade model(s) to identify the effects of NTB's on trade flows but they do not identify the trade restrictiveness of the NTB. The TCR provides a type of measure of the importance of NTB's on overall imports, in other words it measures the percentage of trade subject to NTB's for the importing country *j* (Gourdon & Nicita, 2013).

According to Beghin (2006:7) the TCR is based on the "value of imports of products within a category which is subject to an NTB, expressed as a share of the import value of the corresponding category." According Bora *et al*. (2002), the percentage of trade subject to NTB's for an exporting country *j* at a desired level of product aggregation is expressed using the TCR according to the following formulae:

$$C_{jt} = \left[\frac{\sum(D_i . V_i)}{(\sum V_i)}\right] . 100$$

Where,

If a NTB is applied to product *i* the dummy variable D_i takes the value of 1 if there are NTB's and 0 if there are no NTB's. V_i is the value of imports of product *i*.

Bora *et al*. (2002) and Gourdon and Nicita (2013) argued that a considerable problem arises with the interpretation of the TCR because of the endogeneity[62] of the import value weights. They explained that that TCR will be downward biased if an NTB is (at the extreme) so

[61] A dummy variable (also known as an indicator variable or qualitative variable) is a numerical variable used in regression analysis, that takes only two values, 1 or 0 (Schmidt, 2005)

[62] The problem of endogeneity occurs when the independent variable in this case the import value weights is correlated with the error term in a regression model.

restrictive that it precludes all imports of product *i* form country *j* where the weight V will then be zero. Furthermore, Bora *et al*. (2002) and Gourdon and Nicita (2013) also argued that the TCR will not indicate the extent to which NTB's have reduced the value of the effected import product, but instead it will reduce the weight of the restricted products in terms of the total value of a country's imports.

The augmented index of non-tariff barriers (INTB)

Eremenko and Movchan (2003:5) stated that the INTB index can be calculated using the following formula:

$$INTB_j = \frac{\sum_{i=1}^{I} NTB_{ij}\ x\ IM_j}{\sum_{j=1}^{J} IM_j}$$

where;

- $INTB_j$ is the index of NTB's for commodity *j*,
- NTB_{ij} is a weight of NTB *i* to commodity *j*;
- IM_j is the value of import of commodity *j*
- i =1,…,*I*, j = 1,…,*J* where *I* is the number of NTB's incorporated (i.e. the total number of NTB's that could exist for commodity *j*) and *J* is the total number of commodities (group of commodities);

Furthermore the NTB_{ij} is calculated as follows:

$$NTB_{ij} = \begin{cases} 0 \\ 25 \\ 50 \\ 75 \\ 100 \end{cases}$$

Where a weight of zero means the absence of the NTB *i* of commodity *j*, and 100 is a maximum value of severity of NTB i for commodity *j* .Thus, the NTB_{ij} variable could be a value between zero and 100.

Eremenko and Movchan (2003:5) made the assumption in their study that in the case where the severity of a specific NTB is not readily available, the median level of NTB_{ij} = 50 is taken. Eremenko and Movchan (2003:6) argued that the proposed NTB index can be seen as a type of frequency measure as the NTB_{ij} variable works like a dummy variable which is used in

general frequency measures (discussed previously). They also indicated the main characteristics of the proposed NTB index which are as follows:

- the minimum value is zero and maximum value is 100;
- an increase (decrease) in the NTB_{ij} leads to a increase (decrease) in the index value, *certeris paribus*;
- an increase (decrease) in the value of commodity *j* leads to an increase (decrease) in the value of the index, *certeris paribus*;
- a high NTB for commodities that possess a small share in total value of imports/exports has a less significant impact on an index than the same NTB for commodities that possess large share in imports/exports.

Eremenko and Movchan (2003) then applied the proposed INTB to evaluate the intensity of NTB's in the Ukraine on trade data between 1994 and 2001. They recommended that one uses a base year for the index calculations in order to avoid distortions associated with changes in the imports, which allows one to concentrate on the intensity of NTB's *per se*. The authors did not use the INTB as a proxy in a gravity model to simulate the impact of certain NTB's on trade flows.