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# Trade reform and trade flows in South Africa: a product level analysis

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**Trade Reform and Trade Flows in South Africa: A product level analysis**

Dissertation Submitted for the Degree of Doctor of Philosophy in Economics,
School of Economic and Business Sciences
University of the Witwatersrand

by

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**AUGUST 2015**

**ABSTRACT**

This thesis investigates the impact of tariff liberalisation on South African trade flows and product quality. The thesis addresses four objectives. First, various measures of trade margins (extensive and intensive) are discussed and calculated for exports and imports. Second, focusing on the European Union-South African Free Trade Agreement, the study investigates the impact of tariff liberalisation on South Africa's export intensive and extensive trade margins. Third, the impact of tariff liberalisation on the intensive and extensive import margins is investigated focusing on South Africa major trading partners. Lastly, the study examines the impact of tariff liberalisation on product quality of South African exports. In addressing these objectives, the study uses panel data exploiting variations across product, time and countries.

The results (in Chapter 2) show that South Africa generally exports more varieties to developed countries and trade more at the intensive margin with China. For imports, the results show that South Africa imported more varieties from developed than developing countries. These results are consistent across different measures of trade margins. In general, the results shows that trade agreements have been important in shaping South Africa's trade patterns. The study also finds differential impacts of tariff reduction across product groups exported (Chapter 3). Disaggregated results largely confirm that tariff reductions are associated with an increase in the number of destinations of South African exports, except for consumer goods. Homogenous products show a weaker relationship with tariff reduction suggesting that homogeneous products are not easily traded even if there is tariff reduction. This implies the need for South African exporters to differentiate their products to increase trade with the European Union. The results also show differential impacts of tariff reduction across different product groups imported (Chapter 4). Capital, intermediate and consumer products show greater responsiveness to changes in tariffs suggesting that trade policy should be targeted, especially to those sectors that aid production.

Finally, results show a positive relationship between tariff changes and product quality (Chapter 5). The results suggest that tariff declines are associated with a decline in quality upgrading.

## ACKNOWLEDGEMENTS

First I thank the Lord, Jesus Christ who gave me continual strength and protection throughout the period of this study

I express my deepest gratitude to my supervisors Professor Neil Rankin and Dr Prudence Kwenda-Magejo. Their immense expertise, excellent guidance, motivation, patience and encouragement made the completion of this thesis possible. I also greatly thank Professor Lawrence Edwards, his guidance and great comments on the various stages of the thesis are forever cherished.

The comments received from Wits Departmental seminars, ERSA Trade workshop and AERC biannual presentation contributed greatly to the completion of this thesis.

I sincerely thank AERC for the financial support that enables the completion of the thesis possible.

Last, I also thank my wife; Princess, my three children; Jim, Daron and Darlene, family members and friends for the support during the period of this study.

**Declaration**

I declare that the work in this thesis is my own, except where acknowledged. The thesis has not been previously submitted for the award of a degree at any university

Marko Kwaramba …….

Date: 25 August 2015

# Table of Contents

ABSTRACT ..... ii

ACKNOWLEDGEMENTS ..... iii

List of Figures ..... 8

List of Tables ..... 9

Chapter 1: Introduction ..... 11

1.0 Overview of study ..... 11

1.1 Research problem ..... 13

1.2 Overall objectives ..... 13

1.3 Justification ..... 15

1.4 Contribution of the study ..... 15

1.5 Limitations of the study ..... 15

Reference ..... 16

Chapter 2: Measurement of Extensive and Intensive Trade Margins: Case of South Africa ..... 19

2.1 Introduction ..... 19

2.2 Background: South Africa's trade agreements ..... 20

2.3 The trade margins literature ..... 23

2.3.1 Theoretical Models ..... 23

2.3.2 The empirical evidence ..... 28

2.4 Methodology of measuring trade margins ..... 31

2.4.1 Simple count measure ..... 31

2.4.2 Dummy variable measure ..... 33

2.4.3 Hummels and Klenow (2002; 2005) measure ..... 33

2.4.4 Kehoe and Ruhl (2003; 2009; 2013) measure ..... 41

2.5 Data issues using hs6 digit level ..... 42

2.6 Results ..... 43

2.6.1 Export extensive margins ..... 43

2.6.2 Export intensive margins ..... 55
2.6.3 Import extensive margins ..... 56
2.6.4 Import intensive margins ..... 63
2.7 Conclusion ..... 64
Chapter 3: Tariff liberalisation and export trade margins in South Africa ..... 74
3.0 Introduction ..... 74
3.1 Background and Overview of EU-SA FTA ..... 77
3.2 Responses to trade liberalisation ..... 82
3.3 Methodology ..... 89
3.3.1 Product-level estimations ..... 90
3.3.2 Country-level estimations ..... 94
3.3.3 Product–country-level estimations ..... 95
3.4 Data Sources and Descriptive Statistics ..... 96
3.4.1 Descriptive statistics ..... 97
3.5 Results ..... 99
3.6 Conclusion ..... 105
References ..... 106
Chapter 4: Tariff liberalisation and import trade margins: The case of South Africa ..... 119
4.0 Introduction ..... 119
4.1 Background ..... 121
4.2 Theoretical and empirical response to tariff changes ..... 123
4.3 Empirical specification ..... 124
4.3.1 Product level ..... 125
4.4 Data definition and sources ..... 126
4.5 Empirical results ..... 128
4.5.1 Destination count measure results: Extensive trade margins ..... 128
4.5.2 Sensitivity analysis ..... 131

4.5.3 Results from Hummels and Klenow Method: Extensive trade margins ..... 135
4.5.4 Results from the Hummels and Klenow method: Intensive trade margins ..... 136
4.6 Conclusion ..... 138
References ..... 138
Chapter 5: Trade Reform and Quality Upgrading in South Africa: A Product-Level Analysis ..... 147
5.0 Introduction ..... 147
5.1 Liberalisation in South Africa ..... 150
5.2 Literature Review ..... 153
5.2.1 Theoretical models ..... 153
5.2.2 Empirical Evidence ..... 159
5.3 Empirical Specification ..... 162
5.4 Data sources ..... 168
5.5 Empirical results ..... 169
5.5.1 Results at the HS8-digit level ..... 169
5.2.2 Robustness checks ..... 174
5.7 Conclusion ..... 178
References ..... 179
Chapter 6: Conclusion and Policy implications ..... 192
6.1 Summary of Findings ..... 192
6.2 Implications of findings ..... 193

# List of Figures

Figure 1: Illustration of trade margins ..... 12

Figure 2: Trade volume by trade agreements ..... 21

Figure 3: Export extensive margin using H&K measure for EU countries ..... 44

Figure 4: Export extensive margin using H&K measure for EFTA countries ..... 45

Figure 5: Export extensive margin using H&K measure for NAFTA countries ..... 46

Figure 6: Export extensive margin using the H&K measure for East Asian countries ..... 47

Figure 7: Export extensive margin using the H&K measure for SADC countries ..... 48

Figure 8: Geographical export extensive margin for the most traded products ..... 51

Figure 9: Trade margin using the Kehoe and Ruhl measure for the UK and US ..... 52

Figure 10: Trade margin using the Kehoe and Ruhl measure for Zimbabwe and China ..... 53

Figure 11: Evolution of least traded goods over time ..... 54

Figure 12: Export intensive margin using the H&K measure for EU and EFTA countries ..... 55

Figure 13: Export intensive margin using H& K measure for East Asian and SADC countries ..... 56

Figure 14: Import extensive margin using the H&K measure for EU countries ..... 57

Figure 15: Import extensive margin using the H&K measure for EFTA countries ..... 57

Figure 16: Import extensive margin using the H&K measure for NAFTA countries ..... 58

Figure 17: Import extensive margin using the H&K measure for SADC countries ..... 60

Figure 18: Import extensive margin using the H&K measure for East Asian countries ..... 60

Figure 19: Import geographical extensive margin ..... 63

Figure 20: Import intensive margin using the H& K measure for EU and EFTA countries ..... 63

Figure 21: Import intensive margin using the H&K measure for SADC and East Asian countries ..... 64

Figure 22: Exports volume ..... 79

Figure 23: Export extensive trade margin ..... 81

Figure 24: How exporters respond to change in trade costs ..... 84

Figure 25: Extensive margin and tariffs ..... 97

Figure 26: intensive margin ..... 98

Figure 27: Unit values of South African exports (averaged at the 8-digit HS level ..... 152

## List of Tables

Table 1: Trade models explanations of trade margins response to changes in trade cost ..... 28

Table 2: Export studies focusing on trade margins ..... 29

Table 3: Import Trade margin studies focusing on trade margins ..... 30

Table 4: Simple count measure: Illustration ..... 32

Table 5: Different ways to calculate export extensive margins using the H&K measure ..... 38

Table 6: Calculation of trade margins: Hummels and Klenow illustration ..... 40

Table 7: Export extensive margin - simple count measure for SA's major trading partners ..... 50

Table 8: Import extensive margin - simple count measure for SA's major trading partners ..... 61

Table 9: EU tariff phase-down: 2000-2009 ..... 77

Table 10: Summary of empirical evidence on tariff and export trade margin ..... 87

Table 11: Product Level Base line results ..... 99

Table 12: Different Product Level results ..... 101

Table 13: OLS regression: Trading partner level ..... 103

Table 14: Extensive margin – marginal effects: Product-trading partner level ..... 104

Table 12: Full sample Poisson results – Destination count (1988–2009): Manufacturing sector ..... 129

Table 13: Full sample Poisson results – Product count: All products classified ..... 130

Table 14: Subsample Poisson results – Destination count (1988–2000): Manufacturing sectors ..... 131

Table 15: Subsample Poisson results – Destination count (2001–2009): Manufacturing sectors ..... 132

Table 16: Subsample Poisson results – Product count (2001–2009): All products classified ..... 134

Table 17: Results of the full sample – H&K (1988–2009): Manufacturing sector ..... 135

Table 18: Subsample results – H&K (1988–2000): Manufacturing sectors ..... 136

Table 19: Results of the full sample – H&K (1988–2009): Manufacturing sectors ..... 137

Table 20: Results of the sub full sample – H&K (1988–2009): Manufacturing sectors ..... 137

Table 21: Different Theoretical Models' Prediction for Key Variables: ..... 155

Table 22: Trade Models Incorporating Quality ..... 158

Table 23: Data Sources ..... 169

Table 24: Full Sample Results (1988-2009): Using HS8 Data, Product Level..... 172

Table 25: Subsample Results (1988-2000); Using HS8 Data (Product Level)..... 175

Table 26: Sub-Sample Results (2001-2009): Using HS8 Data (Product Level Data) ..... 176

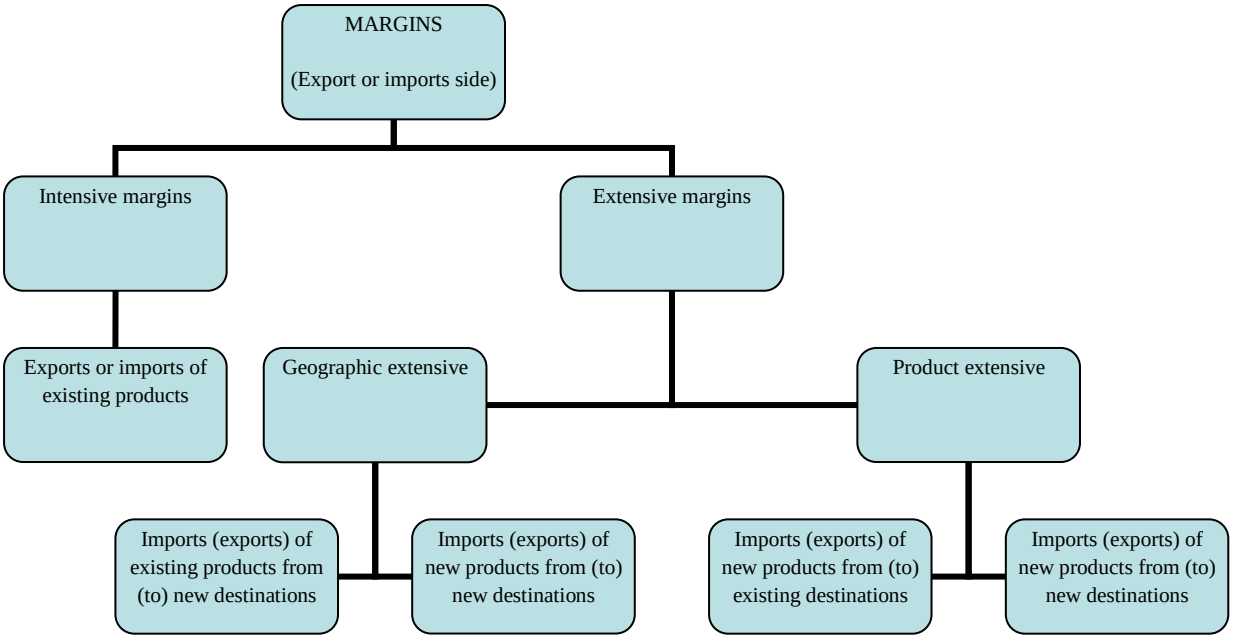
# Chapter 1: Introduction

## 1.0 Overview of study

There is no empirically established consensus on the impact of trade reform, particularly tariff liberalisation, on exports (Caporale *et al*., 2009; Martinez-Zarzoso *et al*., 2009); imports (Debaere and Motshashari, 2010) and product quality upgrading (Amit & Khandelwal, 2013). There is shift in the literature from focusing on aggregate trade data to more disaggregated trade data with emphasis on measuring trade at the extensive and intensive margin. Recently, there has been an increase in studies that look at these margins (Dutt, Mihov & Van Zandt, 2013; Debaere & Mostahari, 2010; Feenstra & Kee, 2007; Felbermayr & Kohler, 2007; Bernard et al., 2007; Baldwin & Nino, 2006; Kohoe & Ruhl, 2003). There is a growing set of studies that specifically focus on the impact of tariff liberalisation on trade margin (see Debaere and Motshashari, 2010, Frensch, 2010). Despite this, there is limited research in South Africa on how South Africa's trade responded to tariff liberalisation at the intensive and extensive margins.

Figure 1 shows the different perspectives from which trade margins have been empirically analysed, as adapted from Amurgo-Pacheco & Pierola (2008) and Reis & Farole (2012) . The illustration applies to either exports or imports. The intensive margin involves the trading of existing products to an existing destination (products already traded by the country pair). The extensive margin can be analysed from a geographical or product perspective. The geographic extensive margin is trading with new trading partners, be it with existing or new products. It examines the change in the number of destinations from or to which a country is shipping its products. The product extensive margin involves trading new products, be it with new or existing trading partners. It focuses on products not previously traded by a country pair.

**Figure 1: Illustration of trade margins**




Source: Author compilation, adapted from Amurgo-Pacheco & Pierola (2008) and Reis & Farole (2012)

South Africa underwent a set of trade reforms in the 1990s and early 2000s and trade volumes responded positively (see Edwards &Lawrence, 2008). As a result of the trade reforms that began in the 1990s South Africa's average tariff has fallen from around 23% in the early 1990s to 8.2% in 2010 (Department of Trade and Industry (DTI), 2010). This shows that significant progress has been made in simplifying South Africa's tariff structure and reducing tariff protection (Edwards, 2005). However, there is still need for further progress on tariff reform for example, in removing tariff peaks and reducing tariff dispersion.

The debate about tariff reform in South Africa is far from over, as tariffs are identified as an instrument of industrial policy which has implications for employment, investment, technology and productivity growth[1] (DTI, 2010). The South African existing studies concentrate more on investigating the determinants of exports and imports (see Edwards & Lawrence, 2008; Edwards & Alves, 2006; Kusi, 2002; Rankin, 2001; Naude, 2000) at either an aggregate national, sector or firm level, without specifically decomposing trade into intensive and extensive margins. The thesis adds to this literature by examining how tariff liberalisation determines change in export and import trade margins using highly

[1] There has been debate on whether South Africa liberalised its trade in the 1990s (see Fedderke and Vaze, (2001) , Rangasamy and Harmse (2003), Holden (2005) and Edwards (2005)

disaggregated product level data. It further links the effects of this tariff liberalisation to product quality. Tariffs may impact on product quality as reduction in tariffs may increase domestic competition which may lead domestic firms to be more innovative and improve their product quality (Aghion & Howitt, 2005). Existing studies in South Africa for example Rangasamy and Harmse (2005) indicate that tariff liberalisation has not been successful in securing improved manufacturing competitiveness. This thesis adds another dimension by investigating if tariff liberalisation has an effect on manufacturing product quality.

### 1.1 Research problem

Tariff liberalisation has proved to be a crucial driver of not only imports and exports volumes (Rodrik, 1999; Edwards & Lawrence, 2008) but also of product quality upgrading in different economies (Amiti & Khandelwal, 2013). Tariff liberalisation is still ongoing in South Africa (DTI, 2010), bringing the need for a comprehensive study that focus on trade margins. Though it has been found that in aggregate, trade liberalisation increases trade flows in South Africa (Edwards & Lawrence, 2008), an analysis that focuses on product level extensive and intensive margin of trade is missing. For the South Africa economy it stems from evidence that tariff reductions have not induced the necessary structural changes to significantly alter the export basket beyond the range of products that reflect South Africa's static comparative advantage (DTI, 2010). This seems contrary to new micro theoretical trade models that predict that changes in tariff have an effect on the trade margin (see Chaney, 2008).

Tariff liberalisation may have heterogeneous effects at the product level for both exports and imports. These differences may be due to difference in product elasticity to tariff changes. The main question that the study answers is whether tariff liberalisation has an effect on the intensive or extensive margins of trade focusing on import and export side. Further the thesis investigates the impact of tariff reduction on product quality, which has not been empirical done for South Africa.

### 1.2 Overall objectives

The main objective of the thesis is to ascertain the impact of tariff liberalisation on South African trade flows and the potential impact on product quality. Specifically the thesis:

1. Characterises South Africa's trade margins. For this objective, the secondary objectives are to ;

- Discuss and analyse different methods used to measure trade margins
- Calculate trade margins using various methods
- Explain and compare the trends of trade flows based on the different measures of trade margins

2. Investigate the impact of tariff liberalisation on the intensive and extensive margin of South Africa's exports. The secondary objectives are to;
    - Investigate the effect of foreign tariff reduction due to Euro European Union-South Africa Free Trade Agreement (EU-SA FTA) on export trade margins for South Africa.
    - Investigate if the change in tariffs has differential impacts on different product groups in South Africa.
3. Assess the impact of tariff liberalisation on the intensive and extensive margin of South Africa's imports. Under this objective, the secondary objectives are to;
    - Assess if lower tariff lead to an increase in imports trade margins for the manufacturing sector.
    - Investigate if South Africa's trade agreements promote export extensive or intensive margins.

      Investigate the impact of tariff reductions over different time periods.
4. Ascertain the impact of tariff liberalisation on product quality of South Africa's exports. Secondary objectives are to;
    - Examine whether trade reform is associated with an increase in product quality for South Africa's manufactured products.
    - Investigate if tariff reduction is associated with discouragement or escape competition effects.

## 1.3 Justification

There are few empirical studies in South Africa that examine the impact of tariff liberalisation on product level trade flows and quality upgrading. Existing studies in South Africa do not distinguish the effects of tariff liberalisation on the extensive and intensive margins of trade (see Edwards & Lawrence, 2008; Edwards & Alves, 2006; Kusi, 2002). Empirical studies on developing countries mostly conduct country cross sectional level analysis without focusing on South Africa trade dynamics per se (Amurgo-Pacheso & Pierola, 2007; Nguyen, 2010; Feenstra & Kee, 2007). This study contributes to the extant literature by using highly disaggregated trade data to assess the impact of tariff liberalisation on trade flows. Further, this study gives new insights on product-level trade patterns in South Africa which is important from a policy perspective.

## 1.4 Contribution of the study

The contribution of the thesis is threefold. Firstly, in chapter 2, it provides an assessment of how South Africa's trade at product-level has been evolving both at the intensive and extensive margins using various measures. It builds on the extensive margin literature which is still a new frontier of international trade research (Debaere & Mostahari, 2010). This has never been done in existing South African studies. Further this generates by means of different methods of measuring trade margin a new understanding of South Africa's trade flows. Secondly, chapter 3 adds to existing literature on how tariff reform affects the volume of existing products traded (intensive margin) and new products traded or emergence of new trading partners (extensive margins) for exports. Chapter 4 analyse the imports. This study departs from existing studies by using a finer measure of trade reform (that is tariff) at product level. In these chapters this study employs panel data methodology in a gravity equation set up. Thirdly, the thesis contributes through assessing the impact of tariff liberalisation on export product upgrading (Chapter 5). There is dearth of empirical studies on the impact of tariff liberalisation on quality upgrading of South African exports. This is the first study in South Africa that links quality of exports and tariff liberalisation.

## 1.5 Limitations of the study

The study has a number of limitations due to data constraints. In the export chapter; the analysis is at the product level rather than the more disaggregated product-firm level. Further, it would be more interesting also to compare regional trade agreement effects on export trade margins. In the import chapter further analysis could be done focusing on the impact of tariff liberalisation on import trade margin focusing only on one trade agreement and particular products. On the product quality chapter, the study could not compute input tariffs relying on Input-Output tables due to data limitation. In addition the other constraint is the lack of demand based data that can be used to measure alternative quality measures. The study relies on unit values which have some limitations, despite its extensive use in the literature.

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# Chapter 2: Measurement of Extensive and Intensive Trade Margins: Case of South Africa

## 2.1 Introduction

In the 1990s, South Africa embarked on a course of tariff liberalisation. Existing empirical evidence for South Africa shows that these trade reforms largely increased trade volumes (Edwards & Lawrence, 2008; Jordaan & Kanda, 2011). However, the analysis of trade policy using only trade volumes neglects heterogeneous responses across products This is because trade reform, and particularly tariff liberalisation impactis not uniform across products and, as a result, responses in trade flows differ across products. Recent empirical studies extend the traditional approach by splitting the aggregated trade data into extensive and intensive trade margins (see Amurgo-Pacheco & Pierola, 2008; Debaere & Mostashari, 2010; Feenstra & Kee, 2007; Felbermayr & Kohler, 2007; Nguyen & Parsons, 2009). This chapter therefore extends this new emerging literature by calculating and providing trends of trade margins over time for South Africa. The first question that this chapter answers is: what are the broad trends of the extensive and intensive margins of imports and exports for South Africa? The second related question is: are these trends broadly associated with changes in trade policy? Tracking the trends of the trade margins helps us to know which products continued, started or ceased to be traded as a result of tariff policy changes. This knowledge is important, as it provides an evaluation of previous and existing trade policy.

The extensive margin of trade is the trading of new products with old/new trading partners or the trading of old products with new trading partners (new trade in products not previously traded by a country pair). The intensive margin entails the trading of old products with old destinations (products already traded by country pair) – see Figure 1 in chapter 1. Measuring trade margins is not a straightforward exercise. Trade margins can be measured using different methods, such as simple count, dummy variable, and the Kehoe and Ruhl (2003; 2009; 2013) and Hummels and Klenow (H&K) (2002; 2005) measures. There are a few existing studies elsewhere (not for South Africa) that compare methods in one study (Dutt, Mihov & Van Zandt, 2013; Kehoe & Ruhl, 2003; Nguyen, 2010). For each specific approach,

existing studies use different formulas, suggesting various possible modifications to existing approaches. This might indicate no consensus on the best method to use to calculate the trade margins. This chapter therefore uses various measures to answer a third main question: do different ways of measuring trade margins give similar results in the case of South Africa? The focus of this chapter therefore is on measuring the trade margins for both South African exports and imports, and explaining any observed trends thereof. Further analysis of measured trade margins, for example in regressions, follows in the subsequent chapters.

The contributions of this chapter are threefold. Firstly, it surveys and compares different methods that are used to measure trade margins. Secondly, this study modifies the existing trade margin measurement methods in order to construct specific measures for the case of South Africa. Lastly, the study provides trends of trade flows using the different methods used in measuring trade margins. The study evaluates whether these trends broadly follow changes in trade policy. This on its own is a new contribution in the case of South Africa.

This chapter is organised as follows: section 1.2 provides a brief background to South African trade agreements, and section 1.3 gives a brief literature review. Section 1.4 focuses on the methodology, which briefly describes each measure and demonstrates how each is calculated, while section 1.5 discusses data issues related to measuring trade margins. Section 1.6 presents the findings from the data on trade margins trends at both the export and import side. Finally, section 1.7 concludes.

### 2.2 Background: South Africa's trade agreements

South Africa's trade and industrialisation strategy before the democratic transition in 1994 was based on protectionism and import substitution (Draper & Alves, 2009). This changed after 1994, when South Africa became engaged in trade liberalisation with various countries and regions (multi-lateral liberalisation)

Trade policy in the democratic era started with the accession of South Africa to the World Trade Organization (WTO) in January 1995. Upon its accession to the WTO, South Africa immediately undertook a commitment to rationalise over 12 000 tariff lines (Draper & Alves, 2009). South Africa committed itself to the tariff liberalisation of its Most Favoured Nation (MFN) applied rates until the year 2000 as it integrated into the world economy. From 2000, regional trade agreements became more important for liberalising trade tariffs.

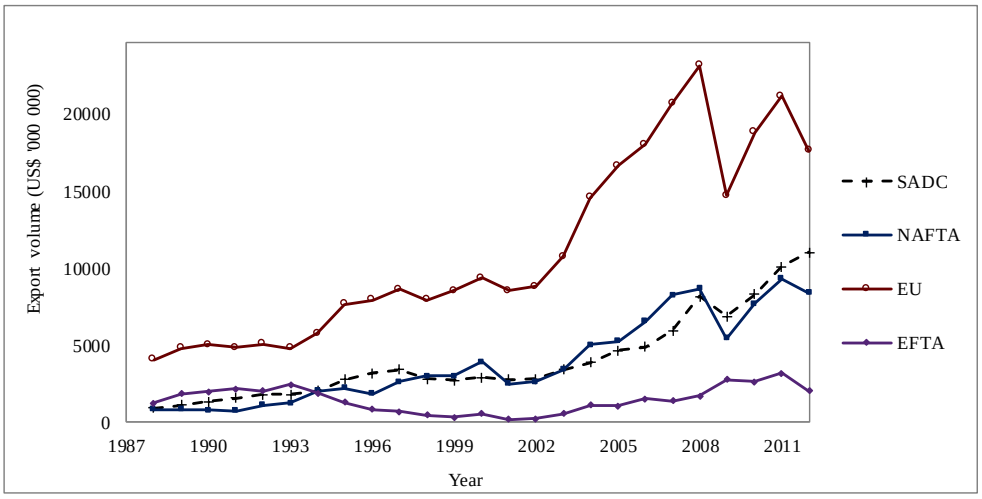
In 2000, the Southern Africa Development Community (SADC) Protocol on Trade was implemented, which included an agreement to establish a SADC free trade area by 2008, a customs union by 2010, a common market by 2015, a monetary union by 2016 and a single currency by 2018. SADC successfully launched its Free Trade Area in 2008, with 85% of trade being duty free, of which the remaining 15% was expected to be fully liberalised by 2012 (Draper & Alves, 2009).

South Africa also signed a free trade agreement with the European Union (EU) in 1999. The FTA agreement, which is also known as the Trade, Development and Co-operation Agreement (TDCA), came into full implementation on 1 May 2004. This agreement stipulates liberalisation of 95% of the European Community's imports from South Africa within ten years, and 86% of South Africa's imports from the EU in twelve years. The protection of sensitive sectors has been granted to both parties, and this has resulted in some sectors being excluded and others being partially liberalised. The current state is that South Africa has liberalised a total of 4 205 tariff lines, which is 82% of its tariff lines with the EU.

In 2006 South Africa and its Southern African Customs Union (SACU) partners also signed a free trade agreement with the European Union Free Trade Area (EFTA)(Iceland, Liechtenstein, Norway and Switzerland), which became effective from May 2008. There also are three separate bilateral agricultural agreements between SACU and Iceland, Norway and Switzerland/Liechtenstein. Due to the wide disparities in levels of economic development between SACU and EU countries, the agreement has asymmetrical commitments. The EFTA undertook to immediately liberalise all trade in Harmonised System (HS) chapters 25 to 99 (that is all non-agricultural trade). South Africa and its SACU partners undertook a commitment to progressively reduce their tariffs with the EU until 2014.

**Figure 2: Trade volume by trade agreements**

Panel A:Export volume by trade agreements




Panel B:Import volume by trade agreements

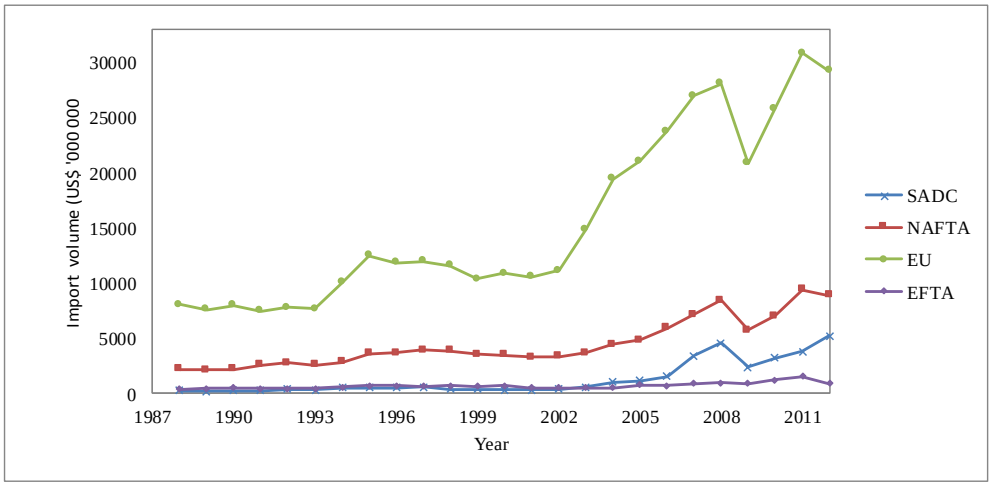



Figure 2 shows trade volume by trade agreement from 1988 to 2012[2]. The pattern in Figure 2 shows that the European Union and NAFTA are the groups South Africa trades most with. EU trade is the largest followed by NAFTA. There is a broad upwards trend interrupted by the Global Financial Crisis in 2008. Figure two only focuses on trade agreement, without country focus. Despite these trade agreements there is also increase in trade between South Africa and China, with China almost overtaking traditional partners in trade volumes. Trade volumes are increasing around the same time when these agreements were signed, for example for EU a sharp increase is seen from early 2000.

[2] The analysis starts in 1988, because the harmonised system, which uniformly codes trade data across countries was introduced in 1988..

South Africa also benefited from the United States (US)'s Africa Growth Opportunity Act (AGOA), which was signed into law on 18 May 2000. Though, AGOA is not a trade agreement, it offers unilateral tariff reduction assistance by the United States to sub-Saharan countries. This implies that there has been a general decline in tariff in the United States South Africa, through SACU also concluded a Preferential Trade Agreement (PTA) with MERCOSUR, which was signed in December 2008. The countries involved are Brazil, Argentina, Paraguay and Uruguay. However, the agreement is not yet in implementation, since all the members have not yet ratified (endorsed) the agreement. This chapter uses simple descriptive analysis to show the trends in the intensive and extensive trade margins and to assess whether these broad trends, and changes in the trends, are associated with the changes in trade policy discussed above. Subsequent chapters analyse the change in trade policy using econometric methods.

## 2.3 The trade margins literature

### 2.3.1 Theoretical Models

The analysis of trade margins is embedded in the development of trade theory. These models start from the new trade models initiated by Krugman (1979, 1980), and finally to "new new", or firm trade models such as Melitz (2003) and Chaney (2008). This section reviews these models in respect to their explanation of trade margins and the implications of tariff changes on these margins.

The model developed Krugman (1979, 1980) was the first to introduce product variety in trade theory. Krugman (1980) adapted the Dixit and Stiglitz (1977)'s monopolistic competition model with constant elasticity of substitution. The model assumes that all firms are identical, and that trade costs (transportation costs) are variable. These assumptions implies that all product varieties are traded and changes in variable trade costs have an impact only the intensive margin of trade. Krugman (1980) predicts that trade will occur despite the presence of trade barriers because consumers have a preference for variety. Trade barriers have a strong impact on trade flows when the elasticity of substitution between goods is high. This is because competition is fierce when the elasticity of substitution is high, and any cost disadvantage translates into large losses of market share. This means that if goods are less substitutable, consumers are willing to buy foreign varieties even at a higher cost, and trade

barriers have little impact on bilateral trade flows. So, the response of traders will depend on the elasticity of substitution.

The model of Melitz (2003) extends the monopolistic competition model by incorporating firm heterogeneity (firm level productivity differences) unlike Krugman's (1980) model that assumes that firms are identical. Melitz (2003) allows the total range of product varieties produced to vary with the exposure to trade. This exposure to trade happens as tariff liberalisation (trade costs) changes. The model assumes symmetric countries and constant elasticity utility function and only one factor of production (labour). The innovation of Melitz (2003) lies in the introduction of the dynamic forward looking entry decision of firms facing sunk market entry costs. In addition to these fixed costs, firms that wish to export also face per-unit costs such as transport costs and tariffs. Export decision occurs after firms know their productivity. If the firms realise their productivity, they choose whether to export in a certain market or not. Those firms that have low productivity will not operate in the market and only high productive firms enter the market. The firms that are highly productive can operate in different markets. This, in general generates the extensive and intensive margin.

Melitz (2003) answers the question: why does trade force the least productivity firms to exit? He posits two channels. The first, (though it may not operate because of the restrictive property of monopolistic competition under constant elasticity of substation preferences) is the increase in product market competition associated with trade. As the country liberalise firms face an increasing number of competitors and the new foreign firms might be more productive than domestic firms. This force the less productivity firms to exit the market. The second channel (which applies in this model) is through the domestic factor market where firms compete for a common source of labour. The increased labour demand by the more productive firms and new entrants bids up the real wage and forces the least productive firms to exit.

The implication is that tariff liberalisation's effects on firms operate through three mechanisms. The decrease in tariffs will lead to increase in the number of available trading partners, reduces variable and fixed trade cost. The implication of these mechanisms is that tariff changes may induce the exit of low-productivity domestic firms, while inducing some relatively productive firms to enter external markets. The increase in number of trading

partners and decrease in trade costs, will force less productive firms to exit. This reason is that this shift up the zero cut-off profit condition and therefore induces an increase in the cut off productivity level, which will be beyond the reach of less productive firms. In general Melitz (2003) introduces the general idea that firms either exit the market or enter new market (extensive margin) and also that firms increase the existing exports (the intensive margin).

Chaney (2008) expands the Melitz (2003) model by considering a world with many asymmetric countries, separated by asymmetric trade barriers. For Chaney (2008), the presence of fixed costs associated with entering foreign markets provides a simple foundation for the extensive margin of trade. The main contribution of Chaney (2008) was to explicitly introduce the extensive margin of trade in a simple and tractable model with multiple countries and asymmetric trade barriers. For Chaney ( 2008), when the distribution of productivity across firms is Pareto the predictions of the Krugman model with representative firms are overturned. The impact of trade barriers on trade flows is dampened by the elasticity of substitution, and not magnified as in Krugman (1980) model.

The Chaney (2008) model predicts that if trade costs (transportation costs) changes, it changes the intensive margin (size of exports) and extensive margin. The main finding from the model is that the elasticity of substitution has opposite effects on each margin. A higher elasticity makes the intensive margin more sensitive to changes in trade barriers, whereas it makes the extensive margin less sensitive. This result implies that as in the Krugman (1980) model, the impact of variable trade costs on the intensive margin of exports still increases with the elasticity of substitution. The reason for this result is that when trade barriers decrease, new and less productive firms enter the export market. When the elasticity of substitution is high, a low productivity is a severe disadvantage. These less productive firms can capture only a small market share. The impact of those new entrants on aggregate trade is small. On the other hand, when the elasticity is low, each firm is sheltered from competition. The new entrants capture a large market share. The impact of those new entrants on aggregate trade is large. So a higher elasticity of substitution magnifies the sensitivity of the intensive margin to changes in trade barriers, whereas it dampens the sensitivity of the extensive margin. In general he concludes that if the distribution of productivity across firms is Pareto,

the effect on the extensive margin dominates. Chaney (2008) proves that the elasticity of intensive margin with respect to fixed cost is zero, but with variable cost not zero. Further in general he also shows that the elasticity of extensive margin to fixed and variable cost is not zero, through it is different between these two costs.

Although Chaney (2008) is purely a model on the export side, it applies equally to the import side. This implies that, from the import side, we cannot observe firm behaviour, but rather observe if there is positive trade at the product or given sector level (see Yi and Biesebroeck, 2012).

We now show key equations from Chaney (2008) and how they help in explaining the key results of the model (for step by step derivation see Chaney (2008)). In the Chaney (2008) model, consumers strive to maximise utility while firms maximise profits. This means that firms will only export if profits exceed the fixed cost of exporting to a destination or have reached a certain productivity threshold. There are two types of trade cost, the iceberg variable trade cost or *ad valorem* tariff ( $\tau^{v}{}_{ij}$ ), and the fixed cost ( $f^{v}{}_{ij}$ ) of exporting in sector *v* ( *v* can be dropped since it just defines a sector). This implies that the cost of producing *q* units of a product in country *i* and exporting it to country *j* is

$$c^{v}{}_{ij}(q) = \frac{\omega_i \tau^{v}{}_{ij}}{\varphi} q + f^{v}{}_{ij} \tag{1}$$

where $\omega$ is wage rate, $\varphi$ is productivity and it is Pareto distributed. Chaney shows that total exports $(X_{ij})$ are given by; (as consumers maximise utility and firms maximise profits),

$$X^{v}{}_{ij} = \lambda \left(\frac{Y_i Y_j}{Y}\right)\left(\frac{\omega_i \tau^{v}{}_{ij}}{\theta_j}\right)^{-\gamma} \left(f^{v}{}_{ij}\right)^{-\left(\frac{\gamma}{\sigma-1}\right)}, if\ \varphi > \bar{\varphi}_{ij} \tag{2}$$

This shows that the productivity threshold guides the exports, and it is only when $\varphi > \bar{\varphi}_{ij}$ that a firm will export.Before splitting equation 5 into the extensive and intensive margin, the equation shows key variables that can determine exports. These determinants, from equation 5 are; output/country sizes, workers' productivity, variable cost (for example tariff) and fixed costs. Chaney also derive productivity threshold $\bar{\varphi}_{ij}$ with firm *i* exporting to *j* as:

$$\bar{\varphi}_{ij} = \lambda(\frac{Y}{Y_j})^{\frac{1}{\gamma}}(\frac{\omega_i \tau_{ij}}{\theta_j})(f^{v}{}_{ij})^{\frac{1}{\sigma-1}} \quad (3)$$

where $\bar{\varphi}$ is equilibrium threshold, implying that only firms that surpass this threshold are able to export, $\sigma$ is the elasticity of substitution, $\lambda$ is a constant, $Y$ is world output and $Y_j$ is output of country j, $\gamma$ is the Pareto parameter to measure the degree of firm heterogeneity, $\omega_i$ is the wage in county i and $\theta_j$ is the index of the country's remoteness.

Following the monopolistic completion model export by individual firms will therefore depend on variable constant the elasticity

Equation 3 can be used to derive one of the crucial implications of Chaney's model. This is the elasticity of the productivity threshold with respect to changes in either fixed cost or variable cost, as:

$$\frac{\partial In \bar{\varphi}_{ij}}{\partial In f_{ij}} = \frac{1}{\sigma - 1} \text{ (for fixed cost)} \quad (4)$$

$$\frac{\partial In \bar{\varphi}_{ij}}{\partial In \tau_{ij}} = 1 \text{ (for variable costs)} \quad (5)$$

The key point is that the impact of fixed cost on the trade is negatively related to a sector's substitution elasticity, while the impact of variable costs on trade is unrelated to the sector's substitution elasticity.

Chaney proves the above observation by introducing formal the intensive and extensive margin of trade. His derivation proves that the impact of trade barriers, both variable and fixed can be decomposed into these margins. His definition of the intensive margin is simply tracks by how much the exporter changes the size of its exports and extensive margin is defined as by how much new entrant's exports. He differentiated the expression for aggregate exports $X_{ij} = \omega_i L_i \int_{\bar{\varphi}_{ij}}^{\infty} X_{ij}(\varphi) dG(\varphi)$ and get the each margin as:

$$dX_{ij} = \left( w_i L_i \int_{\varphi_{ij}}^{\infty} \frac{\partial x_{ij}(\varphi_{ij})}{\partial \tau_{ij}} dG(\varphi) \right) d\tau_{ij} - \left( w_i L_i x(\varphi_{ij}) G'(\varphi_{ij}) \frac{\partial \varphi_{ij}}{\partial \tau_{ij}} \right) d\tau_{ij}$$
$$+ \underbrace{\left( w_i L_i \int_{\varphi_{ij}}^{\infty} \frac{\partial x_{ij}(\varphi_{ij})}{\partial f_{ij}} dG(\varphi) \right) df_{ij}}_{Intensive} - \underbrace{\left( w_i L_i x(\varphi_{ij}) G'(\varphi_{ij}) \frac{\partial \varphi_{ij}}{\partial \tau_{ij}} \right) df_{ij}}_{Extensive} \quad (6)$$

In elasticity notation, this shows that when the variable cost changes and elasticity of substitution increases, this will magnifies the intensive margin, where it dampens the extensive margin, while the fixed cost has no impact on intensive margin and dampens the impact on extensive margin.

Table 1 summarise the how the different model explain how trade cost changes affect the extensive and intensive margin.

**Table 1: Trade models explanations of trade margins response to changes in trade cost**

| **Trade model** | **Explanation on trade** | **Response of extensive margin to tariff liberalization** | **Response of extensive margin to tariff liberalization** |
|---|---|---|---|
| Krugman(1979, 1980) | Product differentiation (love of variety) | Not explicit on extensive margin | Elasticity of substitution dominates. High substation amplifies tariff effects on intensive margin |
| Melitz(2003) | Heterogeneous firms- | Tariff reduction induces exit of firm and entry (extensive margin) | Already exporting increases volumes (intensive margin) |
| Chaney(2008) | Heterogeneous firms- with many asymmetric countries, separated by asymmetric trade barriers. | Elasticity of substation-high elasticity dampens the extensive margin. High tariff reduces trade depending on elasticity. | Elasticity of substation-high elasticity amplifies the extensive margin |

### 2.3.2 The empirical evidence

The central focus of this thesis is to investigate the influence of trade policy, particularly tariff liberalisation, on the extensive and intensive margins for both imports and exports. However, existing studies' use of the measured trade margins varies. Some studies show interest in trade margin determinants such as tariffs (Debaere & Mostashari, 2010; Dennis &

Shepherd, 2011) or trade facilitation initiatives (Dennis & Shepherd, 2011), some in the effects of trade margins on productivity (Nguyen & Parsons, 2009), others in intra-industry trade (Türkcan & Yoshida, 2010), or others in whether the trade margins carry information on the state of technology (Frensch & Gaucaite Wittich, 2009). This study's focus is on the determinants of trade margins in South Africa, particularly the effect of tariff changes.

Existing empirical studies focus separately on either the export or import trade margins. For example, for exports see Hummels and Klenow (2002), Feenstra and Kee (2007), Türkcan and Yoshida (2010) and Yoshida (2011). Table 2 shows different studies that investigate the determinants of export trade margins. It summaries the studies in terms of country, the measure of trade reform used, method used to measure trade margins, estimation technique and the results.

**Table 2: Export studies focusing on trade margins**

| Author | Country | Trade reform measure | Method used to measure extensive margin | Estimation technique | Results |
|---|---|---|---|---|---|
| Dutt, Mihov & Zandt (2011) | WTO members 148 countries | WTO membership | Count measure & H&K | OLS | WTO membership increases the extensive margin of exports by 31% but negligible impact on intensive |
| Feenstra and kee(2007) | Mexico | Tariffs | H&K | OLS and IV | Positive impact of USA tariff reductions on extensive margins |
| Foster,Poschl and Stehrer(2010) | 174 exporters | PTA dummy from WTO | H&K | OLS and Probit (propensity score matching) | Extensive margins respond positively to the formation of a PTA |
| Amurgo and Pacheco (2008) | 24 Developing and developed countries | FTA dummy | Count measure-product and geographical | Tobit estimation technique | Signing FTAs and helps to boost diversification |
| Baier, Bergstrand and Feng (2011)- | -72 countries | Types of Economic integration agreement | H&K | Panel techniques | EIAs lead to increase in trade at both margins |
| Kalaba and Seventer (2005) | South Africa | Tariffs | Kohoe &Ruhl | Descriptive statistics | Decrease in tariff associated with trade widening |
| Disdier et.al(2013) | Emerging countries | Tariff | Dummy variable | Linear Probability model and Probit | No significant impact |
| Persson (2013) | 130 Developing countries | Number of days to export | Count measure | Poisson | Decline in trade cost increase the number exported products |
| Dennis and Shepherd (2011) | EU | Trade facilitation and tariff | Count measure | Poisson | Decline in trade cost increase the number exports and preferential access impact is less robust. |

Table 2 shows that different studies use different methods in estimating the determinants of export trade margin. The most common method used to measure export trade margins is the Hummels and Klenow measure. The results general shows a positive impact of tariff reduction on trade margin when this measure is used. The next common measure is the count measure with most studies using either Poisson or OLS to estimate the impact of tariff reduction on trade margins.

For the imports side, the examples include Arkolakis *et al*. (2008), Goldberg *et al*. (2009), Debaere and Mostashari (2010) and Moncarz (2010). Table 3 also shows the import studies that focus on import trade margin. The table contain same columns as in Table 2

**Table 3: Import Trade margin studies focusing on trade margins**

| Author | Country | Trade reform measure | Method used to measure extensive margin | Estimation technique | Results |
|---|---|---|---|---|---|
| Moncarz (2010) | Argentina | Tariff | Hummels & Klenow (H&K) and Dummy variable | Probit model | Tariff reduction leads to an increase in the probability of Argentina imports from trading partners |
| Mukerji (2009) | India | Trade liberalisation | Kehoe & Ruhl | Descriptive statistics | Liberalisation in 1990s affected trade margins |
| Frensch (2010) | 36 countries | Institutional trade liberalisation | Count measure and H&K | Seemingly unrelated regression and OLS | Stronger extensive import margin effects of liberalization for intermediate and capital goods compared to consumer goods |
| Debaere and Mostashari (2010) | US | Tariffs and tariff preferences | Dummy variable | Probit model | Tariff reduction led to new goods traded |
| Nguyen (2010)[3] | Developing countries | Import duties and trade liberalisation dummy | H&K | Fixed effects and GMM | Trade liberalisation leads to increase in trade margins |

Table 3 shows that Hummels and Klenow measure still dominates. Also studies tend to use the dummy variable measure, which mostly employ the Probit estimator. In general, the results show that reduction in trade costs lead to increase in import trade margins.

This empirical review shows that existing studies use various methods to measure trade margins, such as the simple count, dummy variable, the Kehoe and Ruhl (2003; 2009; 2013) and the Hummels and Klenow (2002; 2005) measures. The use of these different approaches

[3] This study also study the export side

depends on the applicability to the study at hand and also how the margins match with other important variables in the regression analysis, such as tariff, distance and trade facilitation variables. Some studies use different approaches as robust checks, while others argue for simple measures such as the product count approach. For example, Dutt, Mihov & Zandt (2011 uses both the simple count measure and the Hummels and Klenow method.

### 2.4 Methodology of measuring trade margins

As the empirical review shows, trade margins can be measured in many different ways. In this section, the study discusses the specifics of these measurements and the different ways to calculate these measures.

#### 2.4.1 Simple count measure

The simple count measure involves counting the number of products a country exports or imports. A simple count measure of the extensive margin is a count of the number of products exported/imported from country *i* to country *j* at time *t*. This is different from the intensive margin, which is defined as the average export/import value per product. The intensive margin tracks the increase in the value of trade of an existing product (Nguyen, 2010).

The existing literature uses the count measure for both imports and exports. For imports, Frensch (2010), following Frensch and Gaucaite Wittich (2009), uses a simple measure in which the extensive margin is the number of imported Standard Industry Trade Classification (SITC) items multiplied by the respective number of source countries. The intensive import margin is the average value of each imported product. Dennis and Shepherd (2011) use a simple measure of counting the number of products imported by the EU from developing countries. Nguyen and Parsons (2009) also use a simple count measure at the industry level for Japan. This is an unweighted measure, which differs from the approach of Hummels and Klenow.

For exports, Persson (2013) measures the extensive margin by counting the number of HS8 digit products that were exported from developing countries to EU countries. Dutt *et al*. (2013) uses both the simple count and the Hummels and Klenow measure in their study on the effect of WTO/GATT membership on the extensive and intensive margins of trade.

The advantage of the count measure is that it is easy to implement, but a major weakness is that it assumes that varieties/goods have equal prices and quantities. It gives the same weight to each variety, irrespective of the value or the market. For example, a trade value of US$ 500 is not treated differently to a trade value of US$ 20 000. The weighted extensive margin (Hummels and Klenow) measure corrects this weakness by allowing varieties to be traded in unequal prices and quantities (Ardelean & Lugovskyy, 2010; Nguyen, 2009). Nguyen (2009), however, finds that this simple count measure provides more statistically significant results than the Hummels and Klenow/Feenstra measure for Japanese imports. This shows that there are merits to using different methods in a study than just one.

***Simple illustration - product count measure***

Table 4 illustrates how trade margins are calculated using the simple count measure. The study assumes country C imported four different products from countries A and B over the years 1995 to 1997. The simple illustration shows the product count, both at the trading partner level and at the across product level. For example, measuring the extensive margin at the destination (trading partner) level using the simple count measure shows that country C imported one product from country A in 1995, two products from country B in 1995, and four products and three products from Country A and Country B respectively in 1997. Another perspective is to use the simple count measure across product space. For example, a simple count measure across products shows that, in 1995, country C imported only one product of product variety 1 from all countries and, in 1997, it imported two products of product variety 1. This means that country C imported from both countries in 1997 for the case of product variety 1. It shows that the simple count method is concerned about how many products have been imported, and not the value of the imports. This, however, becomes data intensive with an increase in the number of products and countries.

Table 4: Simple count measure: Illustration

Country C's trading partners (A and B) (illustrative trade data)

| | Country A | | | Country B | | |
|---|---|---|---|---|---|---|
| product | 1995 | 1996 | 1997 | 1995 | 1996 | 1997 |
| 1 | 0 | 53 | 70 | 45 | 26 | 50 |
| 2 | 0 | 33 | 59 | 0 | 0 | 0 |
| 3 | 0 | 0 | 10 | 67 | 87 | 90 |
| 4 | 94 | 89 | 98 | 0 | 34 | 56 |

Country C simple count measures

Trading partner level

| | A | B |
|---|---|---|
| 1995 | 1 | 2 |
| 1996 | 3 | 3 |
| 1997 | 4 | 3 |

Across product level

| Year | 1995 | 1996 | 1997 |
|---|---|---|---|
| prdct 1 | 1 | 2 | 2 |
| prdct 2 | 0 | 1 | 1 |
| prdct 3 | 1 | 1 | 2 |
| prdct 4 | 1 | 2 | 2 |

### 2.4.2 Dummy variable measure

This approach involves using a dummy variable. The dummy variable takes a value of 1 or 0 for product *i* for certain selected years. The variable is 0 if the product was not imported or 1 if it was imported. The approach usually relies on selecting two different years that are far apart, and tracking changes in product space in these two years by using a dummy variable. For example, if the years are 1995 and 2005, then the procedure involves checking each product line to see whether it was traded in 1995 or 2005. If it was not traded in 1995, a 0 is assigned; if it was traded in 2005, a 1 is assigned, and in this case it is a new product. Moncarz (2010) and Debaere and Mostashari (2010) use this measure for Argentina and the United States, respectively. The resultant trends from the measure are not shown in this chapter, since it is a dummy variable, but we use this measure in the export chapter.

### 2.4.3 Hummels and Klenow (2002; 2005) measure

This measure was initially proposed by Feenstra (1994) and further developed by Hummels and Klenow (2002; 2005) and Feenstra and Kee (2008). It is a theoretically founded decomposition of trade derived within a Melitz/Chaney model (see Feenstra, 1994 for the derivation).

The Hummels and Klenow extensive margin is defined as a weighted count of products a country exports/imports relative to the products exported/imported by/from the rest of the world. The reference economy in this case is the world. However, it varies in the empirical literature. The intensive margin is defined as a country's nominal exports relative to the world's nominal exports in a set of categories in which the country also exports. It is measured in either the products or geographical (markets) intensive margin. It basically captures the changes in trade that take place within surviving trade relationships.

The Hummels and Klenow measure is very similar to a count measure, except that it is a weighted measure. The weighting is by comparison with other reference countries, such as the rest of the world or the world as a whole. The weight/reference economy varies from one study to another. Some use world total trade in each product as weights, while others use national total trade for the country being studied. For example, the (weight) reference

economy in Hummels and Klenow (2002; 2005) is total world trade of the respective trading partner. For example, measuring the export trade margin between South Africa and Zambia, the reference economy is Zambia's total world products exported to Zambia. In other words, the reference economy is the set of products exported by the world to Zambia.

The disadvantage of using this reference economy is that it requires world exports trade to each respective trading partner, which is data intense when analysing the many trading partners of a certain country. To circumvent this weakness, some existing studies choose the total world exports of the country from which the margins are measured. For example, in the above case it will be South Africa's total world exports. Existing studies that use this modification are Türkcan and Yoshida (2010), who chose the United States total trade as a reference economy, while Ardelean and Lugovskyy (2010) exploits the total number of varieties imported by the US from the world. Moncarz's (2010) on Argentina's import patterns, uses Argentina's worldwide imports from all source countries as reference economy. Similarly, in this study we use total world South Africa's exports for the export study, and total world South Africa's imports for the import study as weights/reference economy.

The use of South Africa's world exports/imports as weights is fundamental to this study. This study is interested in comparing the different trade margins South Africa has with other countries or across products. Our study focuses only on South Africa, in a similar way that Türkcan and Yoshida (2010) focus on the United States and Moncarz (2010) focuses on Argentina. To conclude, the majority of the existing studies that focus on one country use their respective country's set of all goods imported/exported from/to all source countries (world) as the reference economy. This study tracks the importance of different export or import destinations or products of South Africa, hence this is the opposite to those studies that use world total trade as reference economy as their studies are more focused on cross country comparison (see Hummels and Klenow, 2005; Dutt and Mihov, 2013). Weighting by South Africa as a nation helps reveal the influence and importance of different trade policy and trade agreements on product trade for South Africa in different destinations. This use of the domestic country as the reference economy is similar to Frensch (2010) who uses the total set of items imported by the virtual country of all OECD economies from the rest of the world as reference economy.

The advantage of using the Hummels and Klenow method is its ability to be modified to suit different conditions without losing its methodological technical details. For example, it can be modified by using different reference economies. Also, it can be modified to suit cross-section, panel and time-series data. Further, the Hummels and Klenow (2002; 2005) methodology has an advantage in that changing nomenclature does not affect the results of trade margins if it is based on a cross-sectional analysis. However, changing nomenclature becomes a concern if the calculation of trade margins is done over time. However, this is addressed by only tracking consistently defined goods from the base year.

The other advantage of the Hummels and Klenow approach is that it takes into account the differences in the importance of product groups (in terms of market shares), unlike the count measure. The existing empirical literature modifies the original Hummels and Klenow measure. Yoshida (2011), for example, applies the trade margins to cross-section regressions for three different sample years. Other studies modify it to apply to panel data or to time series.

The possible weakness of the Hummels and Klenow method is the definition of a non-traded good (Kehoe & Ruhl, 2013). Different methods of measuring the trade margin define differently what a non-tradable good is. Hummels and Klenow (2005) define a non-tradable good as one with zero values (US$ 0), while Evenett and Venables (2003) use a cut-off value of US$ 50 000 (goods below this value are defined as non-tradable) and Kehoe and Ruhl (2003) use the cut-off value implied by their definition of least traded goods. For them, 10% of least traded goods are referred to as non-tradable. The weakness of the fixed cut-off point, as pointed out by Kehoe and Ruhl (2003), is that zero value might indicate that the value traded is too small to be reported. This means it might not necessarily mean that the good was not traded, but rather that customs officials do not force firms to record small-value shipments. Further, according to Dalton (2014), this means that applying the same cut-off across countries does not account for differences in the relative importance of a good in a country's trade. It means that the fixed cut-off will bias the extensive margin measure for large countries, leading them to seem as they are trading many products than small countries.

***Mathematical formula of the Hummels and Klenow trade margin measure***

The initial step in calculating the trade margins is to define the reference economy, *m*. The reference economy, *m*, is South Africa as a nation, which is total world South Africa imports or exports.

For imports, denote South Africa total import value of product *i* from country j at time t as $M_{ijt}$. The extensive import margin ( $EIM$ ) between South Africa and its trading partner j for product *i* in year t therefore is defined as

$$EIM_{jt} = \frac{\sum_{i \in I_{jt}} M_{mijt}}{\sum_{i \in I} M_{mijt}}$$

where $M_{mijt}$ is the South African import total world value of product *i*, where m is the reference economy, which is South Africa as a nation (total world imports). $I_{jt}$ is the set of observable categories in which SA has positive imports from country j in year t, that is $M_{ijt} > 0$, and $I$ is the set of all product categories imported by South Africa from the world. The import extensive margin therefore is a ratio of the set of products in which South Africa has positive imports from a trading partner to the set of total world import products of South Africa. It is weighting a certain trading partner's value of products in relation to the South African total world import value. More specifically, import extensive margins are South Africa's imports from j in products $I_{jt}$ relative to South African imports in all $I$ product categories. This measure is at the trading partner level.

The import intensive margin is measured by comparing the import value from trading country j with the value of South Africa's total world imports in similar products. The intensive import margin (IIM) of South Africa from country j is as follows:

$$IIM_{jt} = \frac{\sum_{i \in I_{jt}} M_{ijt}}{\sum_{i \in I_{jt}} M_{mijt}}$$

The numerator of $IEM_{jt}$ is the denominator of $\boldsymbol{IIM}_{jt}$.

Following Hummels and Klenow (2002; 2005), the overall share (OS) of South African imports from country j is defined as the product of the extensive and intensive margin:

$$OS_{jt} = IIM_{jt} xEIM_{jt}$$

The illustration above also applies to the export side. This is shown as follows; denote the value of exports of product *i* from South Africa to country *j* at time *t* as $X_{ijt}$. The extensive export margin (EXM) between South Africa with its trading partner *j* in year *t* therefore is defined as:

$$EXM_{jt} = \frac{\sum_{i \in I_{jt}} X_{mijt}}{\sum_{i \in I} X_{mijt}}$$

where $X_{mijt}$ is South Africa's total world value of exports of good i to country *j*. $I_{jt}$ is the set of observable categories in which SA has positive exports to country *j* in year *t*, that is $X_{ijt} \succ 0$. $I$ is the set of all product categories exported by South Africa to the world. The export extensive margin is the ratio of the value of South Africa's exports to a trading partner to the total world value of South African exports. More specifically, the export extensive margin is South Africa's export to *j* in products $I_{jt}$ relative to South Africa's exports to *j* in all $I$ categories. It is a weighted count of South Africa's exports to *j* relative to total world South Africa's categories. It is positive and is between 0 and 1.

The intensive margin measures the overall market share SA has within the set of categories in which it exports to country *j*. The intensive export margin (IXM) of South Africa to country *j* in year t is as follows:

$$IXM_{jt} = \frac{\sum_{i \in I_{jt}} X_{ijt}}{\sum_{i \in I_{jt}} X^{w}_{ijt}}$$

The numerator of $EXM_{jt}$ is the denominator of $IXM_{jt}$. The intensive margin equals SA's nominal exports relative to the world's nominal exports in those categories in which SA exports to country *j*. This formula also is modified to apply at the industry level/sector level, as in Türkcan and Yoshida (2010). Moreover, following Hummels and Klenow (2005), the overall share of total exports to country *j* in a given year is the product of the two margins.

The trade weights are likely to vary from year to year. In order to see whether our results are affected by this variation, the study also estimate the margins using fixed year trade share

weights. The reference economy is South Africa's total world export value averaged across time.

***Different ways to measure extensive margins using the Hummels and Klenow measure***

This study uses the value of total world South Africa imports/exports as reference economy, hence the use of $m$ subscript instead of world ($w$), as in Hummels and Klenow (2005) and Baier, Bergstrand and Feng (2014). Table 5 shows the different ways in which the export trade margins are measured. These formulas can also be applied to imports.

Table 5: Different ways to calculate export extensive margins using the H&K measure

| | **XEM by trading partner level at time t** | **XEM by trading partner level at sector v at time t** | **XEM aggregated by product level across countries at time t** |
|---|---|---|---|
| Specification | $EXM_{jt}$ | $EXM^{v}{}_{jt}$ | $EXM_{it}$ |
| Formula | $\frac{\sum_{i \in I_{jt}} X_{mijt}}{\sum_{i \in I} X_{mijt}}$ | $\frac{\sum_{i \in I^{v}{}_{jt}} X^{v}{}_{mijt}}{\sum_{i \in I} X^{v}{}_{mijt}}$ | $\frac{\sum_{i \in I_{jt}} X_{mit}}{\sum_{i \in I} X_{mit}}$ |
| Applicability to this South African study | Yes | yes | Yes |
| Definition | $I_{jt}$ is the set of products in which SA has strictly positive exports to country j | $I^{v}{}_{jt}$ is the set of products of sector v that SA has strictly positive exports to country j | $I_{jt}$ is the set of products in which SA has strictly positive exports to country j. $X_{mit}$ is total world value of South Africa's exports of product i. |
| Reasons | This is only possible if we weight the tariff by trade data so that is varies by trading partner. We need the weighted average tariff of country j. It also is possible for post-2000 in an import study, since import tariff varies by trading partner. | It is possible in the export chapter, since the study estimates margins at the sector level. | This is done for the import chapter, since import tariff data pre-2000 is at product level, not at country level. |
| Existing studies | Dutt *et al*., 2013; Baier *et al*., 2014; Frensch, 2010; Nguyen, 2010; Yoshida, 2011; Funke & Ruhwedel, 2008 | Similar studies to this are Ardelean & Lugovskyy, 2010; Türkcan & Yoshida, 2010; Moncarz, 2010 | A similar study is that of Jaud, Cadot & Suwa-Eisenmann, 2013 |

This study defines the extensive margin as the share of the number of varieties imported/exported by South Africa from any importer/exporter *j* in the total number of varieties/products imported/exported by South Africa from/to the world. Basically, the import extensive margin is a weighted count of the products imported by South Africa from exporter j relative to the weighted count of products imported by South Africa from all exporters (as in Ardelean and Lugovskyy, 2010). This means that the change in trade margins varies as South Africa imports or exports more varieties from a trading partner.

***Simple illustrations – Hummels and Klenow measure***

The study uses hypothetical countries and one year of data to give examples of the ways in which trade margins are measured using the Hummels and Klenow method. This, however, can be extended to a scenario of many countries and years and become more technically demanding. Firstly, the study (Table 6) shows how Funke and Ruhwedel (2008) calculate the import margins assuming three products (1, 2, 3) imported by three economies. Their reference economy is total world imports of the three products. The second illustration is from Nguyen (2010), who assumes four products (s1, s2, s3, s4) and three countries (two exporters, A and B, and one importer country, C). His reference economy is total world exports of the two economies A and B. The third illustration is from Yoshida (2011), using regional exports of regions A, B, C, and D using four products (1, 2, 3, 4). The reference economy is national exports. The last illustration is innovative in calculating the product extensive margin. It shows four countries, with country D importing from countries A, B and C. The reference economy for Yoshida is total national world imports. The current study differs from these studies by using total world imports or exports of South Africa as the reference economy.

Table 6: Calculation of trade margins: Hummels and Klenow illustration

Funke and Ruhwedel (2008) - Import margins - assumes three products imported by three economies, A, B, C.

Layout of trade

| | Country A | Country B | Country C |
|---|---|---|---|
| Product 1 | 0/100/100 | 50/0/50 | 33/33/0 |
| Product 2 | 0/0/0 | 50/0/50 | 33/33/0 |
| Product 3 | 0/0/0 | 0/0/0 | 34/34/0 |
| $m_i$ | 200 | 200 | 200 |

Formula

Extensive

$$\frac{\sum_{j \neq SA} \sum_{i \in I_{SAjt}} M^{W}_{ijt}}{M^{W}}$$

intensive

$$\frac{m_i}{\sum_{j \neq SA} \sum_{i \in I_{SAjt}} M^{W}_{ijt}}$$

Margin calculation for all three economies

| | Country A | Country B | Country C |
|---|---|---|---|
| EIM | 166/600=0.3 | 332/600=0.6 | 400/600=0.7 |
| IIM | 200/166=1.2 | 200/132=0.5 | 400/600=0.5 |

Matrix element 0/100/100 indicates, for e.g. that imports of product 1 by country A from country B and C are equal to 100, 100 respectively

Nguyen (2010): import margins

| | Exporters, world exports | | Importer |
|---|---|---|---|
| Products | Country A | Country B | Country C |
| s1 | 2 | | s1=1 |
| s2 | 4 | | s2=3 |
| s3 | 6 | | |
| s4 | | 5 | s4=2 |
| s5 | | 8 | |
| Total | 12 | 13 | |

Total imports of world = 2+4+6+5+8= $M_t^{W}$

Extensive

$$\frac{\sum_i \sum_{s \in I_{ijt}} M_{ist}^{W}}{M_t^{W}}$$

s=product

Intensive

$$\frac{M_{jt}^{W}}{\sum_i \sum_{s \in I_{ijt}} M_{ist}^{W}}$$

| | Country C import margin calculation |
|---|---|
| $EIM_{ct}$ | 2+4+5/2+4+6+5+8=0.44 |
| $IIM_{ct}$ | 1+3+2/2+4+5=0.55 |

Weights are world trade in each category. Nguyen (2010) modified the formula to denote averages over T. General formula for the case of panel data is the same as that of Funke and Ruhwedel (2008): $\frac{\sum_{j \neq SA} \sum_{i \in I_{SAjt}} M^{W}_{ijt}}{M^{W}}$

Yoshida (2011), Regional exports margins

| | Region | | | | |
|---|---|---|---|---|---|
| Product | A | B | C | D | Nat Sum |
| 1 | 15 | 15 | | | 30 |
| 2 | 15 | 15 | | | 30 |
| 3 | | | 15 | 15 | 30 |
| 4 | | | 15 | 15 | 30 |
| Regional Sum | 30 | 30 | 30 | 30 | |

Extensive

$$\frac{\sum_{i \in I_{jm}} p_{kmi} x_{kmi}}{\sum_{i \in I} p_{kmi} x_{kmi}}$$

intensive

$$\frac{\sum_{i \in I_{jm}} p_{jmi} x_{jmi}}{\sum_{i \in I_{jm}} p_{kmi} x_{kmi}}$$

| | Region A export margin calculation |
|---|---|
| $EXM_{jm}$ | (30+30+0+0)/(30+30+30+30)=0.5 |
| $IXM_{jm}$ | (15+15+0+0)/(30+30+0+0)=0.5 |

Each region has its own export margins. The study can also organise our data in a similar manner and. instead of each region having its export margin, we have each product line having its margin. J is exporter and m importer, i product and k = reference economy.

MODIFICATIONS 1: For product import margin

| | Product extensive margin – country D importing | | | |
|---|---|---|---|---|
| Country | 1 | 2 | 3 | National sum |
| A | 2 | 2 | | 4 |
| B | | 2 | 2 | 4 |
| C | 2 | | 2 | 4 |
| Product sum | 4 | 4 | 4 | |

Extensive

$$\frac{\sum_{i \in I_{jt}} M_{it}^{SA}}{\sum_{i \in I} M_{it}^{SA}}$$

intensive

$$\frac{\sum_{i \in I_{jt}} M_{it}}{\sum_{i \in I_{jt}} M_{it}^{SA}}$$

| | D's product extensive margin calculation |
|---|---|
| EXM | (4+0+4)/(4+4+4)=0.67 |
| $IIM_{it}$ | (2+0+2)/(4+0+4)=0.33 |

Here SA is importing different products from different countries, so we want the margins to be at product level across countries. We can also use world trade as reference economy.

Source: Adopted from Funke and Ruhwedel, 2008; Nguyen, 2009; Yoshida, 2011

### 2.4.4 Kehoe and Ruhl (2003; 2009; 2013) measure

Kehoe and Ruhl (2003; 2009; 2013) developed another approach to measure trade margins that is a modification of the Hummels and Klenow method. This approach measures the extensive margin by taking into account the relative importance of a traded good/product in a country's trade share. The definition of good is an HS6 code. It tracks the growth of least traded goods over time. This divides the codes into one tenths of the export/import value cumulatively. The procedure is to order the codes from smallest to largest value, and then cumulate the codes, with the first bin of codes representing the set of least traded goods. The ordering of the codes is based on the average of the first three years of the sample period – for our study the first three years of the sample are 1988 to 1990. The averaging minimises the ordering's dependence on the choice of the base year. It is constructed by calculating the share of total exports/imports for each of the ten sets of codes in the last year of the sample period. If the growth in trade is driven only by proportional increase in the value of goods already traded, each set of codes would retain its one-tenth share in trade. This is the intensive margin. On the other hand, for the growth in extensive margin, trade liberalisation would lead only to the trade of goods previously untraded, which means that the first set of codes would gain trade share, while the share of the other sets would decline. Sandrey and Van Seventer (2004), Mukerji (2009) and Foster, Poeschl and Stehrer (2011) use this method.

The ultimate measures of the new goods margin can be shown in two ways. The first computes the change in each set's trade over a sample period. As already explained above, the extensive margin is an increase in the trade share of the first set of least traded codes. It shows the change in each bin's trade share from the initial period to the last period of the sample.

The second measure tracks the evolution of the least traded set of codes to summarise the timing of the growth in these goods. According to Kehoe and Ruhl (2013), if there is growth in the extensive margin there is an increase in the share of trade accounted for by this set of goods, as in the first measure. This is a time series measure, which helps to show the impact of trade policy or any other shocks over time. It is a descriptive approach to the distribution; hence it is not used in regression analysis.

The advantage of Kehoe and Ruhl's method over that of Hummels and Klenow is the cut-off point used to define untraded goods. Hummels and Klenow use a fixed cut-off using trade value of $0 as non-traded good, and the weakness of this has been discussed above. Kehoe

and Ruhl (2013) therefore allow the cut-off to vary across countries by defining non-traded goods by their relative importance in a country's trade (Dalton, 2014). Their evolution of least traded goods defines whether new goods are being traded over time.

All the four ways of measuring trade margins are interrelated. The simple count measure is linked to Hummels and Klenow measure in that it just count the number of products, without weighting them. It is widely used due to its simplicity. The Kehoe and Ruhl is a modification of Hummels and Klenow, by incorporating the evolution of least traded goods. The dummy variable approach can be loosely be taken as a count measure since it just assigns 1 for traded commodities and 0 otherwise in a particular year. There is no method therefore that has superiority over the other, rather each model fits to different trade data arrangement

### 2.5 Data issues using hs6 digit level

This study uses HS6 digit-level data. Appendix 1 provides a sample of the data. In subsequent chapters more variables are be added to this data. This chapter defines a product/variety as a six-digit HS category. The use of HS6 as a product line is necessitated by the fact that this is the highest level of product disaggregation that contains products that are standardised across countries. The Harmonized System is an international nomenclature for the classification of products and it is only at HS6 where participating countries classify traded goods on a common basis for customs purposes. HS8 classification and upwards contains products that may be/are different across trading partners. The data is from Quantec for the period 1988 to 2010. This is South African Revenue Services (SARS) trade data and thus the most reliable available. Trade data recorded by customs officials (SARS) is likely to be reliable, since they are the main primary recorders of international transactions for duty purposes. The harmonised system was introduced in 1988 (and this is the reason why the study period start from 1988) and was adopted by most of the countries worldwide. It was revised four times up to 2012 (in 1996, 2002, 2007 and 2012) (World Customs Organisation, 2014). This causes changes to the classification of products. The reasons for modifications or revisions at each product line vary. They may be due to the fact that a product has a low trade volume, hence it is combined with another product line; or it might be that its trade volumes increased significantly, hence its tariff line might be split into various codes. Another reason might be that the product is no longer being traded, for example typewriters; hence the tariff

line is dropped altogether. This all poses a challenge of estimating extensive margins, since these revisions might reflect false changes in trade margins driven by the revisions of the HS6 classification over years. In order to minimise this problem, this study bases the analysis on only consistently defined products since 1988.[4]

### 2.6 Results

This section provides the results from calculations of the extensive and intensive margins for both exports and imports. In this analysis, the study selects the major trading partners of South Africa from different regions and trading blocs. This provides a global picture of how South African exporters or importers are responding to differential trade policies in different regions. The countries chosen are the most important trading partners of South Africa. They account for more than 75% of South African trade flows. The section firstly presents the results from the exports, and then from the imports. For each section, the study starts with the extensive margin.

#### 2.6.1 Export extensive margins

In this section, the study tracks changes in the extensive margin using the three measures, Hummels and Klenow (H&K), simple count and the Kehoe and Ruhl measure.

***Hummels and Klenow (2002; 2005) measure***

This sections shows trade margins calculated using the Hummels and Klenow measure for different regions. The first region is the European Union (EU). The European Union and South Africa Free Trade Agreement (Trade Development and Cooperation Agreement) was signed in October 1999 and implemented in 2000. It has resulted in tariffs being reduced gradually over a period of 12 years. Figure 3 shows that, from around 1998, South Africa's export extensive margin to the selected EU trading partners showed an upward trend. This indicates that South African exporters increased the number of products they export to the EU as the trade agreement came into effect. This might be explained as an anticipation effect, driven by positive expectation from the trade agreement. Another year that shows an upward trend is 2005, when South Africa joined the SADC-EU Economic Partnership Agreement.

[4] Cebeci *et al*. (2012) instead consolidate the different HS classifications. This involves identifying the HS codes related to each other (those that were split or merged) and replacing them with a single code for the entire period. This study does not pursue this route; rather, the number of lines left if the classification ends in 2010 is 4216, and it is 4079 if the classification ends in 2012. In this study we map to 2012 HS classification.

From the extensive margin it is clear that there is an upward trend in varieties exported around this period to most of the EU countries, except for France. This suggests the possible role played by tariff reduction in expanding trade relations between EU countries and SA. The graphical results support Amurgo-Pacheco's (2006) findings on the Euro Mediterranean Free Trade Area, namely that FTA results in the expansion of the range of products traded among member countries. He shows graphically that the average number of zeros between EU and its Mediterranean partners decreased sharply around the beginning of the Barcelona process.

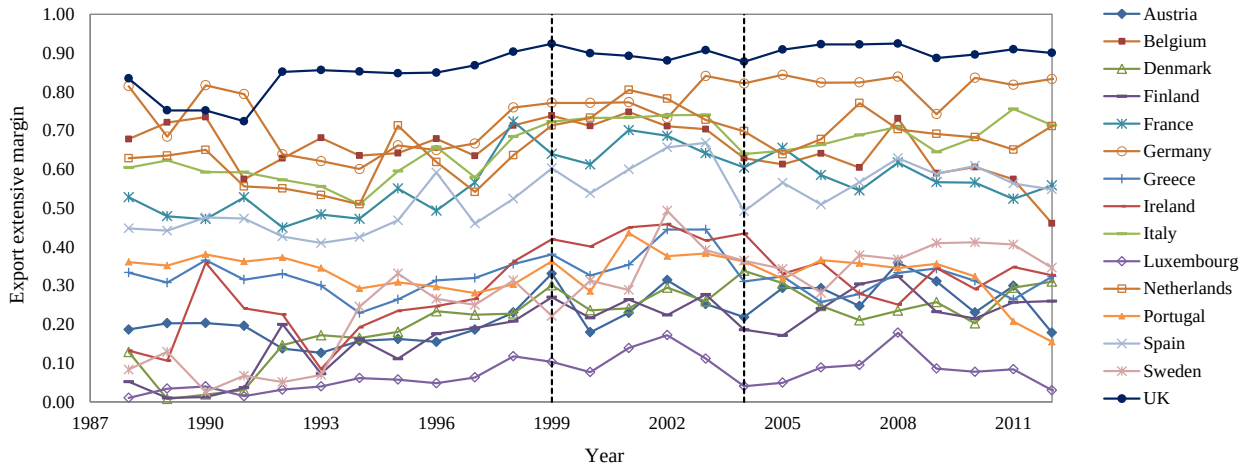
South Africa also benefited from the European Union's (EU) Generalised System of Preferences (GSP), which is the system of preferential trading arrangements through which EU countries extend preferential access to their markets to developing countries. It offers developing countries a lower tariff on their exports into the EU. South Africa was among the top 20 GSP beneficiary countries that recorded higher GSP utilisation rates for 2007, at 18,6%[5] (European Community, Notification, 2009)

The results are in line with the findings of Hummels and Klenow (2005) and Amurgo-Pacheco and Pierola (2008) that export extensive margins seem to be influenced by the size of the destination market. Graphical results show that countries with a higher gross domestic product, like the United Kingdom, Germany and the United States, have high extensive margins.

Despite notable humps for the above mentioned years, the results indicate that, in general, there were no major upward or downward changes in the trade margin across years. For example, UK extensive margins largely remained in the 0.8 to 0.9 band throughout the years. This shows that the EU has already opened its economy to some extent, even before the EU-SA FTA agreement. These results support Bauer's (2004) assertion that South Africa's liberalisation process was faster than the EU's, since the EU had already opened its market before the trade agreement.

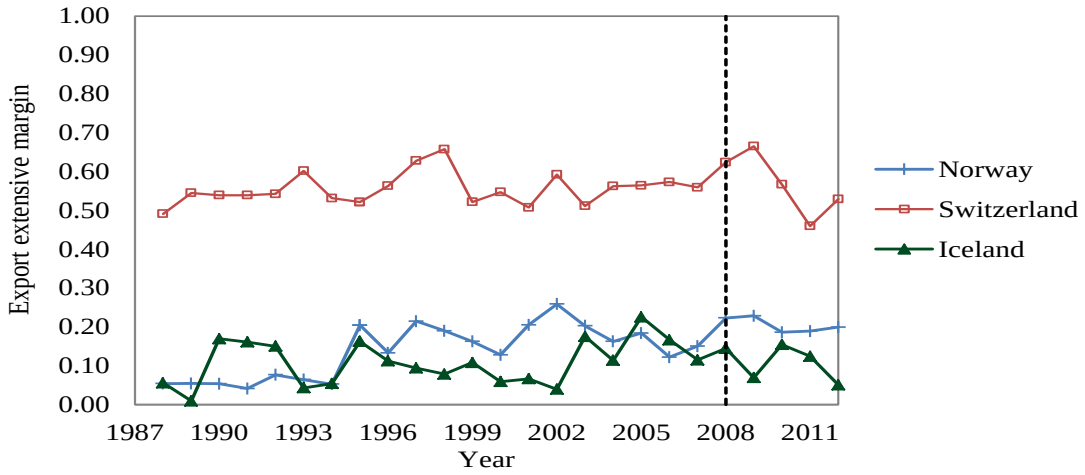
Figure 3: Export extensive margin using H&K measure for EU countries

[5] http://trade.ec.europa.eu/doclib/docs/2009/april/tradoc_143051.pdf




The Southern African Customs Union (SACU) and the European Free Trade Association (EFTA) signed a trade agreement in 2006 and it started operating in 2008. Figure 4 suggests that the tariff reduction from this trade agreement increased the extensive export trade margins, as seen by the surge in export variety from Norway and Switzerland.

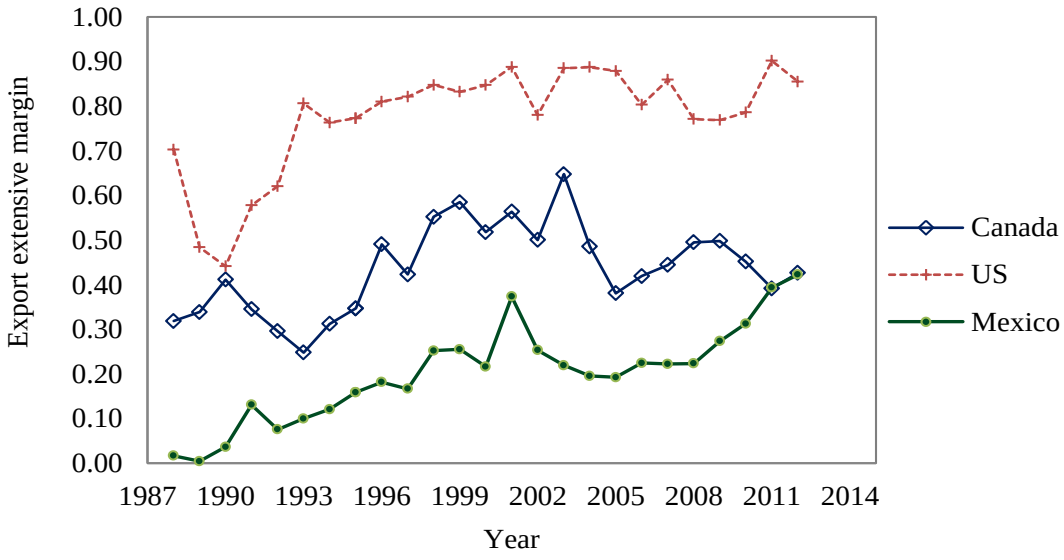
Figure 4: Export extensive margin using H&K measure for EFTA countries




For the North American Free Trade Agreement (NAFTA), Figure 5 shows an increase in South Africa's export varieties to the United States (US), save for a slump in 2001 and 2008. This might be reflecting a decline in economic activity in the United States due to the September 11 terrorist attack and global financial crisis. South Africa benefited from tariff reduction initiatives by the United States, such as the Africa Growth Opportunity Act (AGOA), which was signed into law on 18 May 2000, and GSP and Most Favoured Nation

(MNF) preferences. The DTI (2012) analysis show that about 99.59% of South Africa's exports entered the US market duty free through AGOA, GSP and zero-rated tariff duties that apply under Most Favoured Nation. The results for the export extensive margin suggest the importance of these US tariff reduction initiatives, as the extensive export margins are generally high and increasing compared to other NAFTA countries. This might be in line with Feenstra and Kee's (2008) results, which find significant effects of US tariff reductions on the export variety of Mexico to the US. These authors find that tariff liberalisation due to NAFTA has increased export variety from Mexico to the US. The results that show that GSP preferences possibly lead to a larger amount of products exported is in line with what Gamberoni (2007) who shows that beneficiaries of the GSP programmes export a larger number of products compared to African Caribbean and Pacific trade preferences.

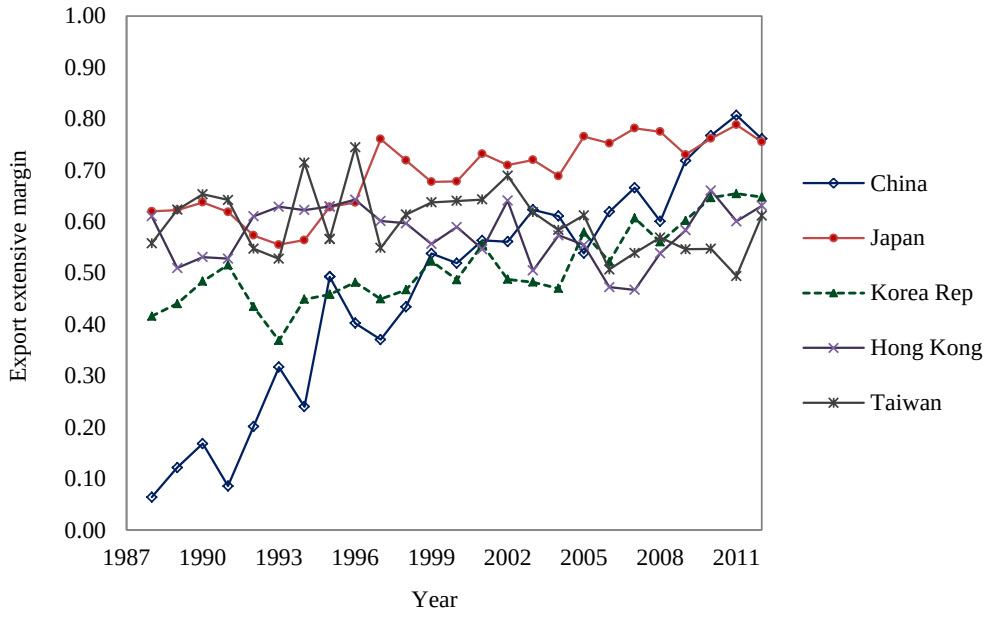
Figure 5: Export extensive margin using H&K measure for NAFTA countries




There had been no specific trade agreement between South Africa and East Asian countries, except the one recently initiated between South Africa and China. Of the East Asian countries, Figure 6 shows that South Africa exports more varieties to China. South Africa's extensive margin with China experiences a large increase over time. This shows how important China has become in the global economy. It also shows that, since China entered the WTO in 2001, its trade expansion has continued. These graphical results suggest that South Africa exporters did take advantage of China's entry into the WTO by increasing the

varieties they export to China over time. These preliminary results suggest that Rose's (2005) results, which indicate that joining the World Trade Organisation does not increase trade among countries, might not hold for the case of China. The results also show that South Africa's trade with Japan is increasing in terms of the new goods margin while South Africa's exports of varieties to Taiwan and Hong Kong have been stable over the years. This might indicate that these countries have already established nearly all export relationships with South Africa and thus show little room for an export extensive margin expansion.

Figure 6: Export extensive margin using the H&K measure for East Asian countries

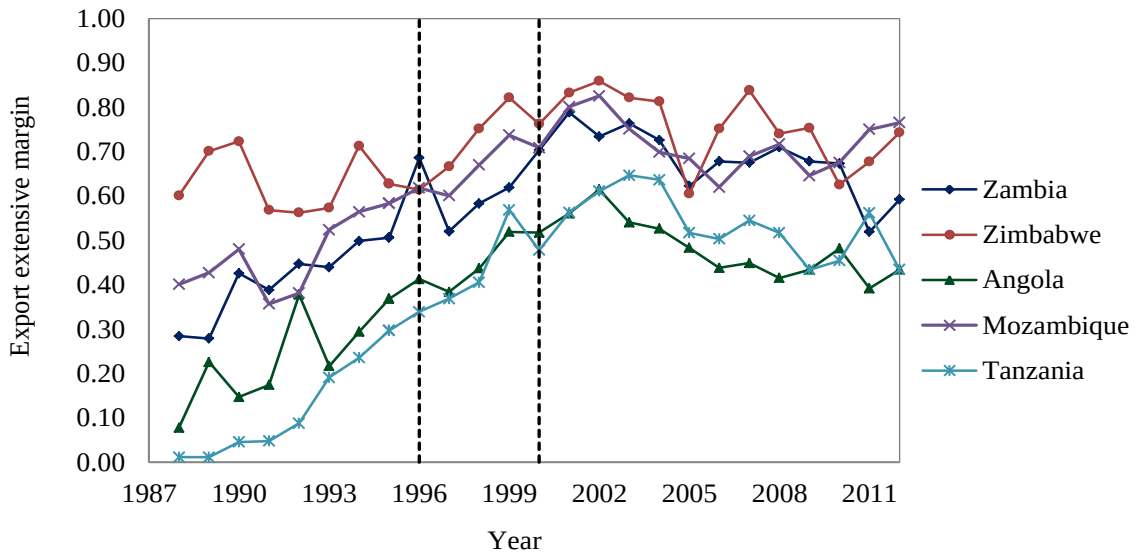



The SADC Trade Protocol was signed in 1996 and implemented from 2000 (shown by dotted lines in Figure 7), leading to significant tariff liberalisation among SADC countries. Figure 7 shows a major upward trend in the export extensive margins of almost all selected SADC countries around the years when the trade agreement was signed. It shows that growth in exported varieties coincides with a period of trade liberalisation. Specifically, the pick of exports by South Africa for all countries can be witnessed after 1999, showing the possible impact of SADC trade. It is clear that the increase in exported varieties started just prior to the signing of the trade agreement in 1998, showing greater anticipation among members. These results concur with McGowan (2001), who says that prior to the introduction of the Euro, trade volumes increased in anticipation of the single currency's introduction. It shows

that major SADC trading partners of South Africa have witnessed huge gains in extensive margins over time, possibly driven by tariff reductions among member countries.

The other possible reason for the observed trend might be distance. This supports results from gravity studies, namely that proximity to the destination market is a driver of the export extensive margin (Moncarz, 2010; Pacheco & Pierola, 2008). The theory of gravity establishes that the shorter the distance between the markets of two trading nations, the higher the trade relations. Countries closer together have lower transaction costs, mainly due to lower transport costs; hence they trade heavily with each other. Further results may be showing that South Africa produces goods that are demanded by SADC countries, indicating the greater industrialisation of South Africa than other African countries. It shows how diversified the South African economy has become over the years.

Figure 7: Export extensive margin using the H&K measure for SADC countries




Taking the average of the extensive margin 3 years prior to 2000 and 3 years after the agreement shows that for Zambia the average extensive margin was 0.67 prior and 0.74 after agreement while for Zimbabwe prior was 0.77 and 0.83 after. This generally shows that trade increased after the implementation of the trade agreement.

*Product count measure*

The product count measure shows the number of HS6 codes exported to South Africa's trading partners. Table 7 show major percentage changes in the number of products between 1988 and 2010 for Tanzania, Mexico, Norway and China. The change might be as a result of tariff reductions. For example, SACU member countries are beneficiaries of the Norwegian and Swiss General System of Preferences (GSP), which allows them to export their products duty-free to these countries for 100% of the (HS) lines, although for many of these countries trade started from a low base. Econometric regressions (in subsequent chapters) will be able to show the actual driver. Comparing across the region, the table shows that South Africa exports a greater number of products to SADC countries than all selected regions. The possible reasons might be due to extensive tariff liberalisation among SADC countries. The preliminary results support the finding of Bensassi, Márquez-Ramos and Martínez-Zarzoso (2011) that North African countries increased the number of exported products to the EU as a result of the Euro Mediterranean Trade Agreement. In a similar finding, Wilhelmsson and Persson (2009) find that ACP preferences result in a positive impact on the extensive margin.

It also shows that, in the 1990s, South Africa was exporting few products to SADC/African countries, and as it developed, industrialised and diversified, the number of exports to African countries increased. The other possible reason as explained above might be due to proximity, as supported by gravity theory.

Both the Hummels and Klenow and the product count measure results suggest that South Africa's extensive margin increased after tariff liberalisation in those countries with which it had not yet established extensive trade relations. The results indicate that, out of 5 014 possible products, South Africa exports the highest number of products to Zimbabwe, at 3 418. Among the developed countries, those that received the highest number of exported products are the United Kingdom, the United States and Germany. As the study compares across countries or regions, the table shows that the extensive margins are higher for SADC countries.

These results also support what has been shown by Edwards and Lawrence (2012), namely that tariff barriers on South African exports to developing countries far exceed those to developed countries. This means that, as developing countries reduce tariffs on South African products, it tends to increase the South Africa export varieties to those countries. The average applied tariff imposed on South African exports to BRICs ranges from 8.37% in China to

12.4% in Brazil, yet it is substantially lower for developed economies – 0.26% in EU countries, 1.66% in the US and 3.62% in Japan.

Table 7: Export extensive margin - simple count measure for SA's major trading partners

| Years | 1988 | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | Absolute change (1988 &2010) | % change (1988 &2010) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SADC countries** | | | | | | | | | | | | |
| Angola | 419 | 588 | 1944 | 2371 | 2773 | 2754 | 2527 | 2537 | 2399 | 2436 | 2017 | 4.81 |
| Zambia | 1912 | 2230 | 3196 | 3416 | 3286 | 3406 | 3133 | 3096 | 3108 | 3173 | 1261 | 0.66 |
| Zimbabwe | 2688 | 2888 | 3759 | 3504 | 3458 | 3583 | 3421 | 3389 | 3478 | 3418 | 730 | 0.27 |
| Mozambique | 2190 | 2483 | 3173 | 3502 | 3230 | 3283 | 3098 | 3119 | 3098 | 3157 | 967 | 0.44 |
| Tanzania | 48 | 81 | 1164 | 1911 | 2487 | 2551 | 2307 | 2306 | 2299 | 2242 | 2194 | 45.71 |
| **EU countries** | | | | | | | | | | | | |
| Germany | 1294 | 1423 | 1684 | 1843 | 1788 | 1811 | 1846 | 1696 | 1578 | 1514 | 220 | 0.17 |
| UK | 1673 | 1789 | 2203 | 2443 | 2336 | 2403 | 2251 | 2114 | 1898 | 1816 | 143 | 0.09 |
| Netherlands | 593 | 724 | 973 | 1152 | 1228 | 1211 | 1150 | 1160 | 1085 | 1056 | 463 | 0.78 |
| Italy | 538 | 603 | 825 | 997 | 999 | 1018 | 1018 | 899 | 830 | 844 | 306 | 0.57 |
| France | 534 | 623 | 881 | 1070 | 1219 | 1197 | 1157 | 1100 | 1057 | 1120 | 586 | 1.10 |
| **NAFTA countries** | | | | | | | | | | | | |
| Canada | 385 | 359 | 693 | 863 | 1031 | 988 | 993 | 931 | 937 | 872 | 487 | 1.26 |
| US | 1017 | 1083 | 1809 | 2166 | 2142 | 2068 | 1970 | 1910 | 1765 | 1762 | 745 | 0.73 |
| Mexico | 15 | 30 | 128 | 186 | 223 | 248 | 237 | 228 | 242 | 263 | 248 | 16.53 |
| **EFTA countries** | | | | | | | | | | | | |
| Norway | 25 | 27 | 169 | 240 | 323 | 324 | 380 | 338 | 355 | 307 | 282 | 11.28 |
| Switzerland | 508 | 537 | 673 | 798 | 841 | 807 | 787 | 762 | 763 | 682 | 174 | 0.34 |
| Iceland | 14 | 44 | 85 | 51 | 70 | 110 | 76 | 66 | 42 | 48 | 34 | 2.43 |
| **East Asian countries** | | | | | | | | | | | | |
| Taiwan | 533 | 614 | 705 | 626 | 576 | 566 | 474 | 460 | 407 | 395 | -138 | -0.26 |
| Japan | 540 | 507 | 693 | 766 | 852 | 727 | 775 | 595 | 584 | 574 | 34 | 0.06 |
| Korea-Rep | 170 | 250 | 342 | 448 | 456 | 437 | 456 | 428 | 384 | 400 | 230 | 1.35 |
| Hong Kong | 511 | 618 | 803 | 908 | 938 | 873 | 804 | 823 | 826 | 744 | 233 | 0.46 |
| China | 33 | 56 | 225 | 417 | 809 | 877 | 922 | 849 | 937 | 894 | 861 | 26.09 |

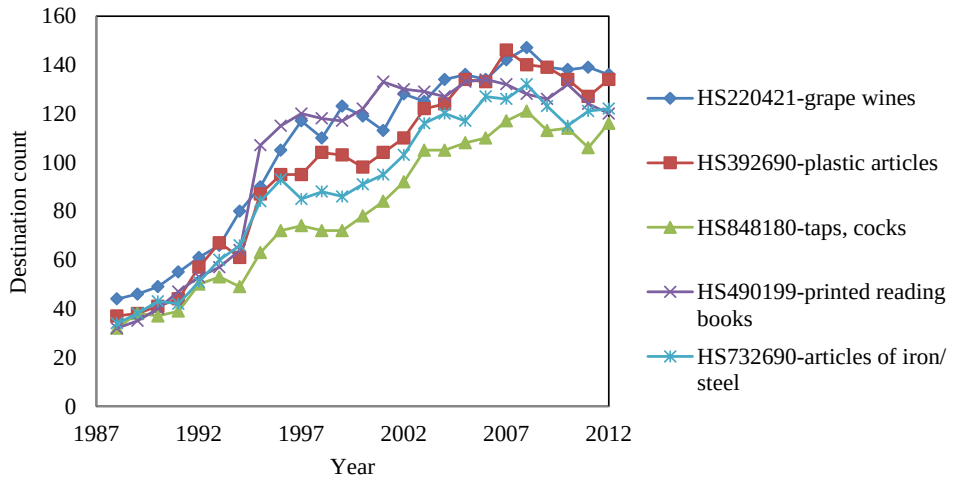
**Geographical export extensive margins – product count measure**

Geographical diversification/margins show the number of countries to which South Africa exports a particular product (HS6 digit code). Figure 8 shows the few selected products that are mostly traded across countries by South Africa. It shows that wines from grapes, plastic articles and iron and steel articles have increasingly been exported to many countries. The graphs support the comparative advantage trade theories that a country always exports more of the products for which it has a comparative advantage. This is shown by the continual dominance of wine and resource-based manufactured items such as plastic articles and books.

Another possible reason might be that the exports of these commodities have increased because they used to be subject to high tariffs before the trade agreement.

Appendix 2 tracks the geographical extensive margins of different product groups. It shows that South Africa has exported many products to different countries over the years. The products shown are for HS84, which is nuclear reactors, boilers and machinery products, HS63, which is textile products, and HS22, which is beverages and spirit and vinegar products. Of these, South Africa exports more HS22 products than HS84 lines to many countries.

Figure 8: Geographical export extensive margin for the most traded products




*Kehoe and Ruhl measure*

The study illustrate trade margin calculated using Kehoe and Ruhl measure on only selected South Africa trading partners. The basis for choosing these countries for example United Kingdom, Zimbabwe and China is mainly driven by huge trade flows with South Africa. These countries are among the top countries South Africa trade with from different trading blocs.

Figure 9 shows the change (from 1988 to 2010) in the distribution of products exported by South Africa to the United Kingdom and the United States. The set of least traded goods is the first bin in each graph. The horizontal black line at 0.10 shows the height of each bar had there been no changes to the distribution of goods from 1988 to 2010. The number above each bar shows the number of goods in each bin. If, for example, trade liberalisation leads only to the trade of goods previously untraded, the first set of codes (in the first bin) would gain trade share, while the share of the other set would decline. This is the extensive margin in trade growth. If the other bins' (not the first bin) trade share changes, it shows growth at the intensive margin.

Figure 9 shows that the set of least traded goods increased from 10% of South African exports to the United Kingdom to 58% of trade share in 2010. This shows that the once untraded goods are now being traded as the least traded gain trade share. This includes 3 853 HS6 codes. These results concur with Kalaba, Sandrey and Van Seventer's (2005) findings in their study on the preliminary attempt to examine the impact of the EU-SA FTA. They find that trade widening takes place as the HS6 product lines represented by the bottom 10% of the value of trade in 2000 accounted for more than 20% in 2003. They point out that these results coincide with the tariff phase-down by the EU for South African products.

Furthermore, Figure 9 shows that the growth in least traded goods is higher for the United States, in relation to which least traded goods grew to about 79%, covering about 3 983 products of the 4 079 possible products. This is in line with the findings of Kehoe and Ruhl (2013), namely that the least traded goods gained the share for trade between Mexico and Canada after the formation of NAFTA. It shows that South African exporters have taken full advantage of the United States trade preferences. These results concur with the findings of the study using the Hummels and Klenow and the product count measures. The intensive margin can be seen in the third bin of the UK. These products grew from 10% of South African exports to the UK in 1988 to 19% in 2010.

Figure 9: Trade margin using the Kehoe and Ruhl measure for the UK and US

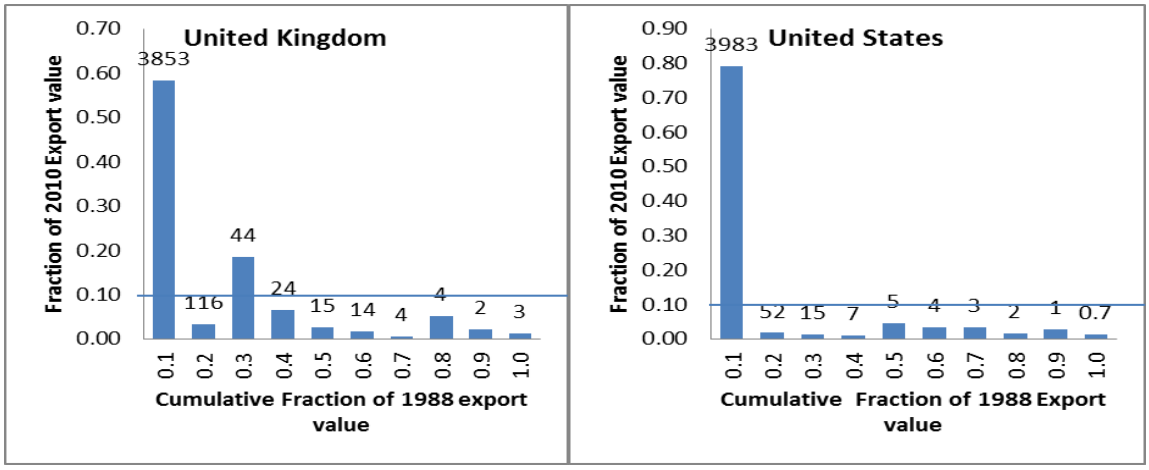
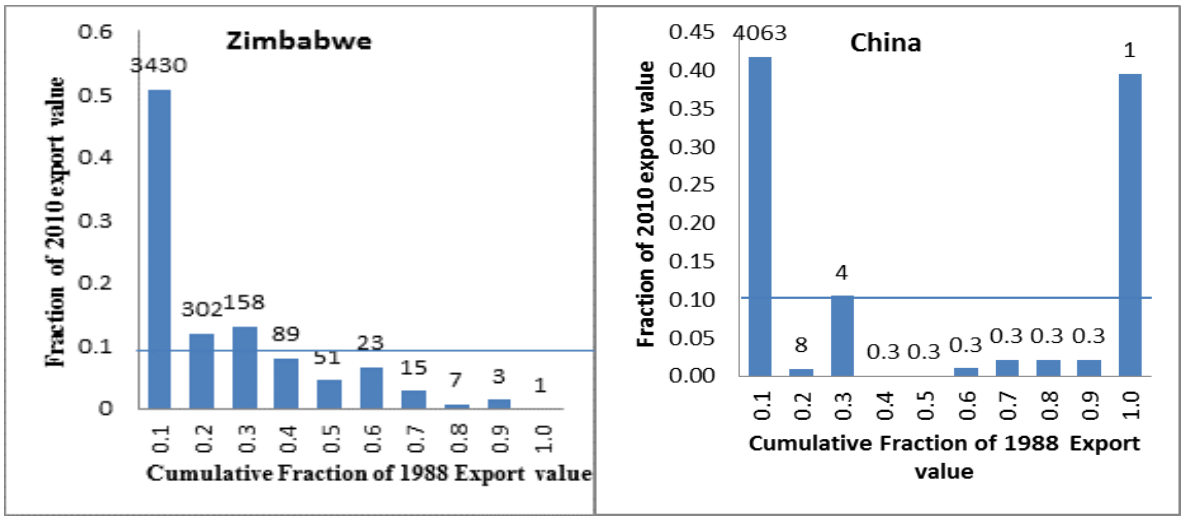



Figure 10 shows the trade share of least traded goods exported by South Africa to Zimbabwe and China. For Zimbabwe, the trade share of least traded goods increased to 51%, while for China it increased to 42% in 2010. It shows that China's least traded share did not increase when compared to other countries. For Zimbabwe, the growth in the intensive margin is seen in the second and third bins. The last bin for China shows high growth in the intensive margin, with growth similar to the extensive margin of about 41%. This means that South Africa's exports to China did not only witness excessive growth in the new varieties, but also in the old varieties.

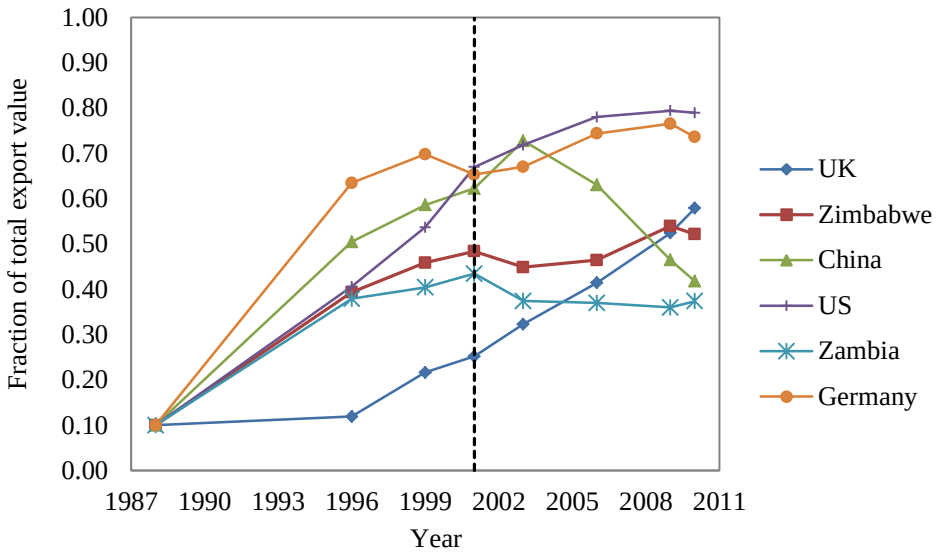
Figure 10: Trade margin using the Kehoe and Ruhl measure for Zimbabwe and China




The study uses the Kehoe and Ruhl second measure to track the evolution of least traded goods over time. For illustration, this section selects the major trading partners of South Africa from each region or trade agreement group. The interpretation is that, if the least

traded share is increasing over the years, there is growth in the extensive margin. The figure starts with the share of least traded goods, which was 10% in 1988. Figure 11 shows the countries that experienced the highest growth in the extensive margin from 1988 to 1996 were Germany and China, with growth of 63% and 50% respectively. Furthermore, the figure shows what happens around 2001, when many of the trade agreements were implemented. The time of this trade policy shift is indicated by a dotted vertical line. As can be observed, South Africa's export of varieties to China increased drastically, suggesting that China's trade increased as it joined the WTO. These results seems to contradict what Dalton (2014) finds for Japanese exports to China, but are in line with China's exports to Japan after China's entrance into the WTO. The results also concur with what the study finds when using the Hummels and Klenow measure and the product count measure. However, South Africa's export extensive margin to China seems to decline in later years. The UK represents EU countries and the figure shows a growth in the extensive margin round about the time of the liberalisation period. This supports the results from the majority of existing studies, using the same methodology developed by Kehoe and Ruhl (2013), who finds that growth in the new goods margin (extensive margins) coincided with a period of trade liberalisation. For example, Mukerji (2009) finds an increase in new goods margins after India's unilateral trade liberalisation. Further, Sandrey and Van Seventer (2004) find that the New Zealand export extensive margin to Australia increased after trade liberalisation. This is not, however, observed in the case of Germany and Zimbabwe.

Figure 11: Evolution of least traded goods over time



### 2.6.2 Export intensive margins

This section presents the intensive margins obtained from the Hummels and Klenow measure, showing the results from the regional level on the basis of the extensive margin. Figure 12 shows that, unlike the trend for the extensive margin, the intensive margin of exports has been falling over time. However, it is noticeable in the EU countries that import intensive margins increased around 2000, for example for the UK, the Netherlands and France. This might suggest an influence from the EU-SA FTA. For the EFTA countries, especially Norway and Switzerland, import intensive margins declined until 1999, when they started to increase. As the trade agreement effectively started in 2008, we also witness an increase in the same varieties exported. Comparing the extensive and intensive margins shows that the extensive margin was greater than the intensive. This might support the results of Dutt *et al*. (2013), who find that WTO membership increases the extensive margin while decreases the intensive margin. Foster *et al*. (2011) also find that a reduction in tariff as a result of joining the Preferential Trade Agreements led to an increase in extensive margin but find no impact on the intensive margin. The intensive margin is not stable over the sample period, which is the opposite of the extensive margins for EU, EFTA and NAFTA countries. This suggests that South African exporters are broadening exports instead of narrowing them, and deepening already traded goods.

Figure 12: Export intensive margin using the H&K measure for EU and EFTA countries

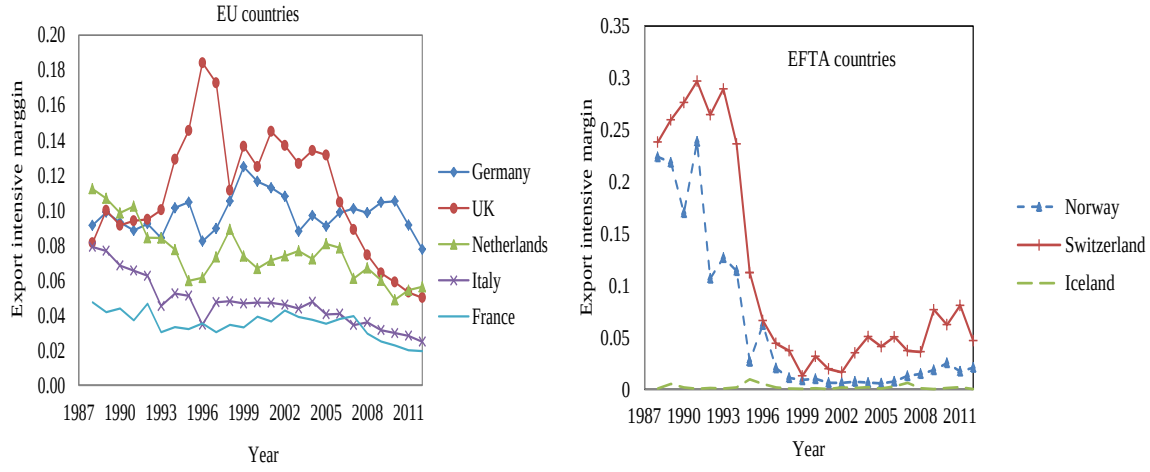
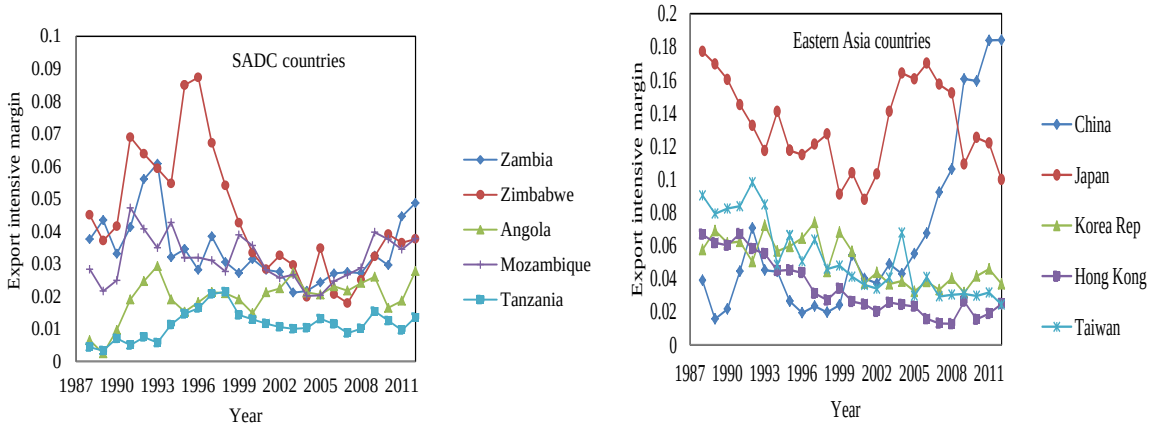


Figure 13 shows that South Africa exports higher volumes of old products to China in comparison to other East Asian countries and SADC countries. China joined the WTO in 2001, and the figure shows a major upward trend from that year. It shows the possible influence of tariff reduction in China as it liberalised its trade. South Africa's export of similar goods across years is high to Japan. For the SADC countries, the most notable trend is the decline in intensive margins across almost all selected countries, save only for Angola from 2000. This suggests that, as the SADC liberalised trade, South Africa exported less of already traded goods from SADC countries.

Figure 13: Export intensive margin using H& K measure for East Asian and SADC countries




The general observation is that the export extensive margin has been increasing, while the intensive margin has been falling.

### 2.6.3 Import extensive margins

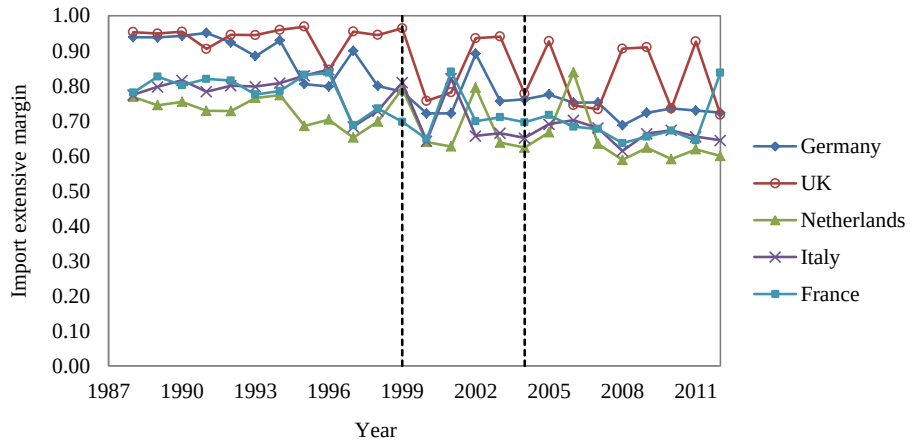
This section presents the import margins of South Africa and uses the H&K measure and a simple count measure. The dotted line on some of the graphs shows when trade agreement was signed or implemented.

*Hummels and Klenow measure*

Figure 14 indicates that South Africa has imported more varieties from major EU trading partners over the years. There was a surge of imports in 2000, indicating a possible impact of the EU-SA trade agreement. Although it is not yet an econometric analysis, the graphical

results are in line with Klenow and Rodriguez-Clare (1997), who show that trade reform in Costa Rica between 1986 and 1992 was accompanied by a surge in import variety. It may suggest that the initial tariff reduction rescued a possible decline in the import extensive margin. However, the increase was not prolonged over the years, as the subsequent years show fluctuations. Hence, South Africa's import extensive margins were high from 1988, varying between 0.7 and 1 for the selected countries. There are no significant gains over years in the extensive margins of the EU countries, suggesting that trade relations were already established historically.

Figure 14: Import extensive margin using the H&K measure for EU countries




The results shown in Figure 15 suggest the possible impact of the trade agreement, since the import varieties increase from 2008, the year the trade agreement between the SACU and EFTA countries came into effect. This might suggest that tariff reductions are crucial in enhancing the importation of more varieties from trading partners. Norway shows an upward trend from 2006, a year after the agreement was signed. These preliminary graphical results concur with the econometric findings of Goldberg *et al*. (2009), who find that trade reform in India increased import varieties. In Costa Rica, for example, Arkolakis *et al*. (2008) find that growth in imported varieties coincides with the period of trade liberalisation.

Figure 15: Import extensive margin using the H&K measure for EFTA countries

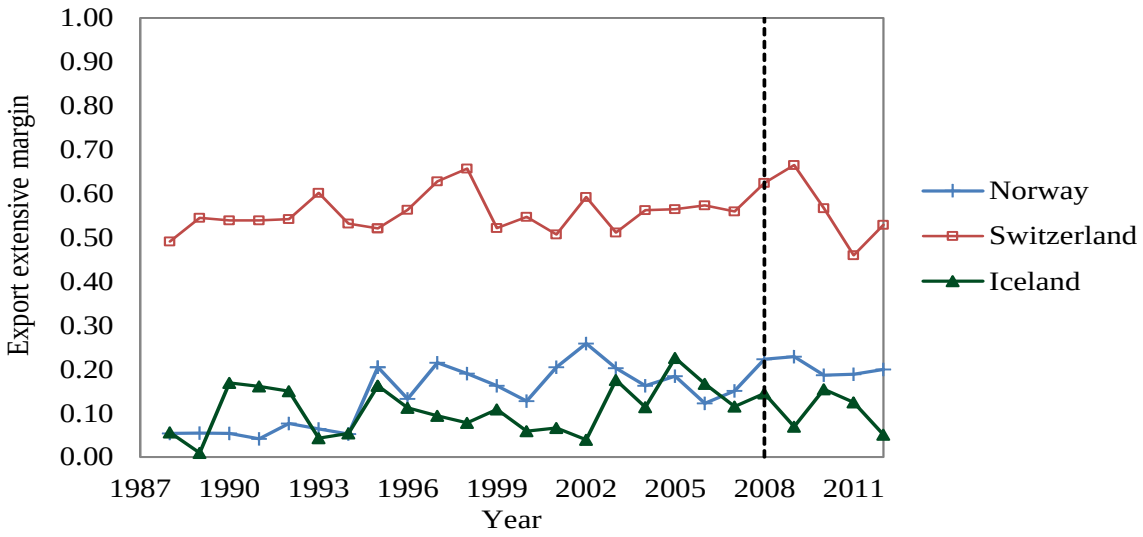



Figure 16 shows the results for South Africa's imports from NAFTA countries. South Africa imports more varieties from the United States than the other countries. The margin fluctuates within the 0.8 and 0.1 bands, indicating less fluctuation over years, and potentially indicating a long-established trade relationship with the US. The results accord with Debaere and Mostashari's (2010) findings which show that tariffs and tariff preferences have affected trade margins statistically significantly, but had a small impact on the variety of products imported from the US over the period 1989 to 2000. These results graphically show possible similar results, since the extensive margin is very high but does not show major trends over time. A significant gain in the extensive margins is from Mexico. South Africa maintained almost the same trade relations with Canada over the years.

Figure 16: Import extensive margin using the H&K measure for NAFTA countries

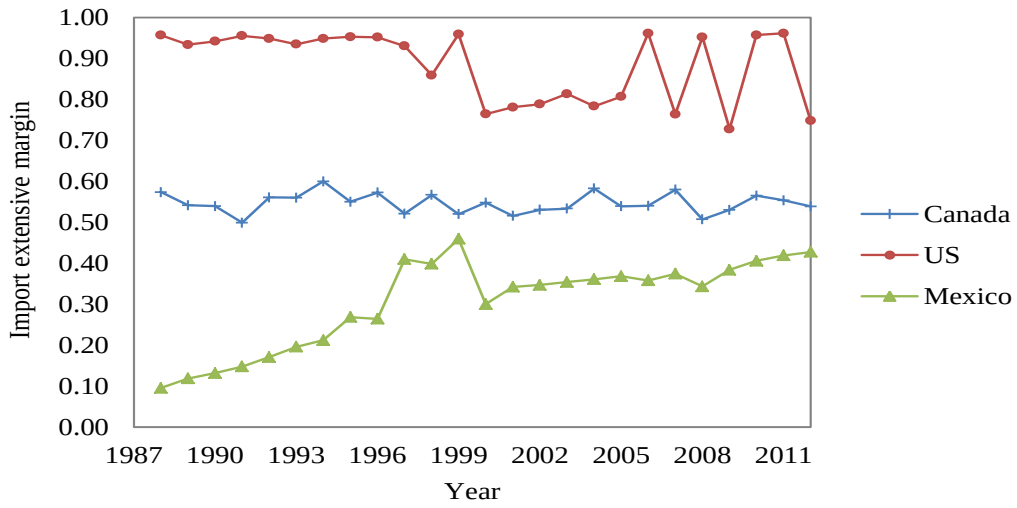


Figure 17 shows the increase in imported varieties by South Africa from most of the selected SADC countries, possibly suggesting the influence of tariff reduction due to the 2000 SADC trade agreement. South Africa has high import extensive margins with Zimbabwe, although these have declined consistently over the years. This is possibly due to the economic crisis faced by Zimbabwe from 2000 to 2009. It shows that economic shocks led Zimbabwe to produce fewer products that could be exported to South Africa. However, trade relations between South Africa and Zimbabwe increased sharply from 2000, possibly suggesting the impact of tariff liberalisation due to the SADC Trade Protocol. Major extensive margin gains are from Angola, Mozambique and Tanzania.

Compared with the extensive margin of high-income countries, South Africa imports fewer varieties in general from SADC countries. The import extensive margins across SADC countries are largely less than 0.6, while for the EU countries and the US they are above 0.6. This shows that, despite extensive tariff liberalisation and proximity, South Africa still imports most of its commodities from advanced countries. These low import extensive margins might indicate that South Africa produces similar resource-based products to these African countries, which points to low complementarity in trade across products – they produce similar goods.

The other possible reason why South Africa's import extensive margin from SADC countries/African countries is low might be their economic structure, which concentrates on just a few products – mainly commodities. This reason is in line with Amurgo-Pacheco and Pierola (2008), who show that African countries lack capacity to innovate and diversify. This might also suggest that their (African countries) national production does not meet the standards to export many products. Another possible reason is what was predicted by Tekere (2001), namely that South Africa imports from SADC countries might decline as they are replaced by commodities from the European Union.

Figure 17: Import extensive margin using the H&K measure for SADC countries

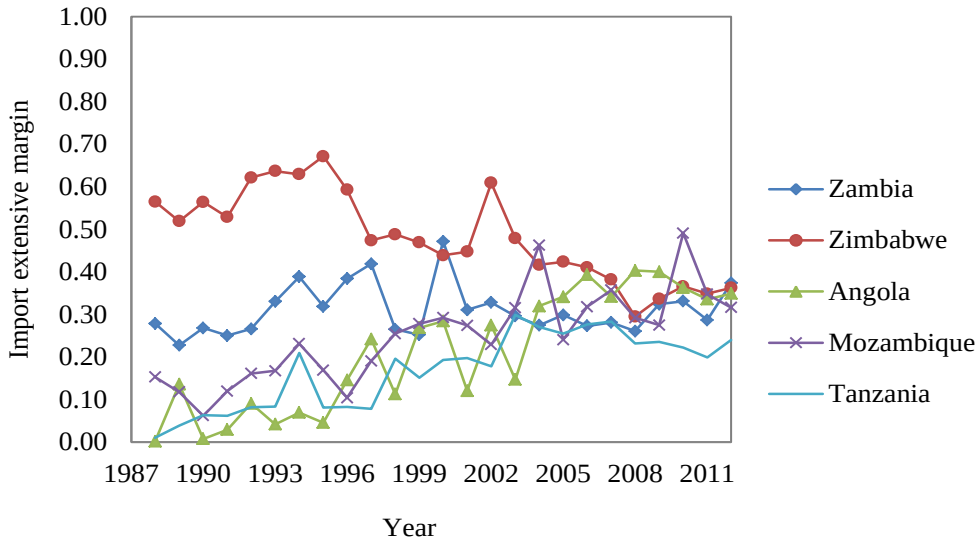
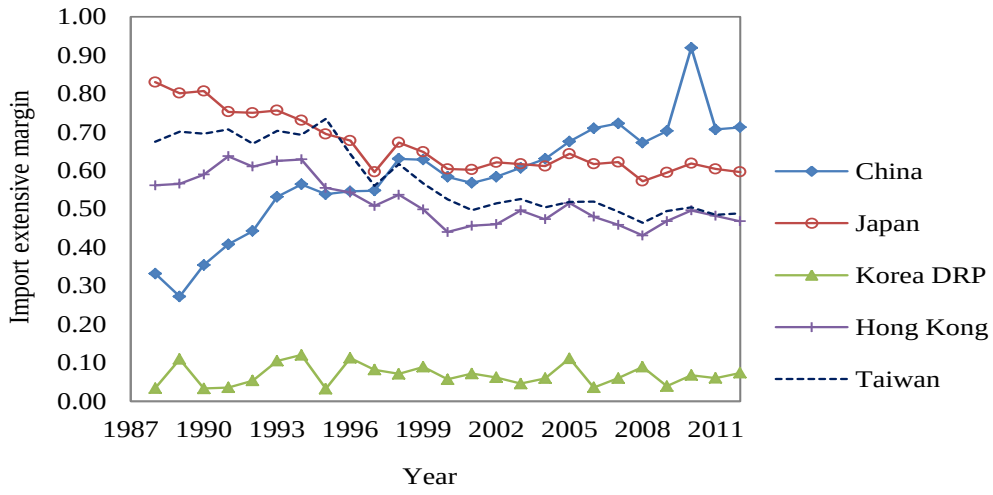



Figure 18 shows that South Africa has higher extensive margins with Japan, Taiwan and China than with the SADC countries. A significant gain in the extensive margins is from China. This shows that South Africa has continuously increased its trade relations with China over the years. The possible reason for the high import varieties is due to China's growth as a major economy in the world. It might also suggest the tariff reduction that China applied as a result of joining the WTO in 2001. The trade in new goods shows a marginal decline for other Asian countries over the years.

Figure 18: Import extensive margin using the H&K measure for East Asian countries




*Trading partner product count measure*

Table 8 shows that the countries that experienced changes in the extensive margin of greater than 1% are Angola, Tanzania, Mexico, Norway and China. This shows that SA has expanded the number of products it imports from these countries. It might also suggest that trade from these countries started from a low base. This means that South Africa did not benefit much from trade liberalisation over the years from most EU, SADC and NAFTA countries, since they have already established nearly all import trade relationships and thus have little room to gain from the extensive margin. These trends are consistent with the findings of Mayda and Steinberg (2009) that COMESA's preferential tariff liberalisation did not considerably increase Uganda's trade with COMESA countries. Some of the countries, like Zimbabwe, Germany, the UK, the US and Japan, witnessed a decline in absolute products imported by South Africa. The major loss in percentage terms is from Zimbabwe, at -0.56%. This shows that South Africa imported less than half of the products it used to import from Zimbabwe by 2010. This, however, is not a surprise, given the economic crisis that Zimbabwe experienced from 2000 to 2009.

South Africa imported the highest number of products from China in 2010; out of the possible 5 014 tracked products, it imported 3 385. This shows the emergence of China as a major global trader. It also shows that China's joining of the WTO in 2001 enabled the expansion of its trading with other countries. This supports Dalton's (2014) findings on the importance of China after entering the WTO, showing that the new goods margin in Chinese exports to Japan coincides with Chinese entry into the WTO.

The Free Trade Agreement between the EFTA states and the SACU started on 1 May 2008. As Table 8 shows, there has been an increase in the number of products imported from Norway and Iceland, save by Switzerland in 2008. The other possible scenario shown in Table 8 is that countries with a higher GDP export more varieties. This fact is evident from the fact that South Africa imports a greater number of products from countries with a higher GDP, such as the United States, Germany and the United Kingdom. This supports the results of Hummels and Klenow (2005) and Moncarz (2010), namely that large economies are more diversified than small economies.

Table 8: Import extensive margin - simple count measure for SA's major trading partners

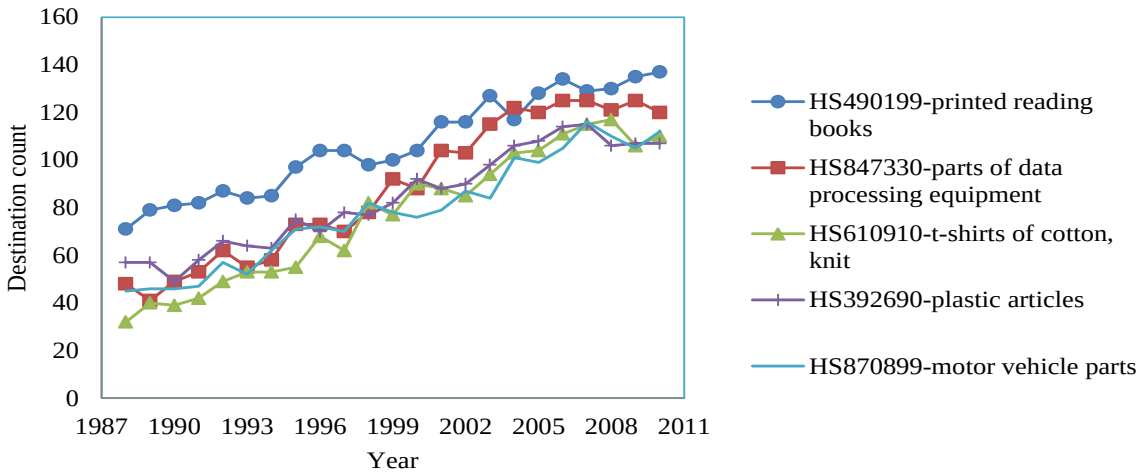
| | 1988 | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | Absolute change (1988-2010) | % change (1988 - 2010) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SADC countries** | | | | | | | | | | | | |
| Angola | 4 | 6 | 29 | 110 | 198 | 219 | 245 | 258 | 192 | 251 | 247 | 61.75 |
| Zambia | 336 | 290 | 416 | 486 | 360 | 467 | 446 | 454 | 631 | 500 | 164 | 0.49 |
| Zimbabwe | 1540 | 1658 | 1822 | 1276 | 934 | 892 | 885 | 726 | 721 | 683 | -857 | -0.56 |
| Mozambique | 67 | 83 | 211 | 735 | 398 | 502 | 686 | 606 | 515 | 473 | 406 | 6.06 |
| Tanzania | 26 | 20 | 84 | 250 | 396 | 373 | 427 | 355 | 349 | 341 | 315 | 12.12 |
| **EU countries** | | | | | | | | | | | | |
| Germany | 3689 | 3671 | 3732 | 3588 | 3517 | 3560 | 3322 | 3242 | 3251 | 3250 | -439 | -0.12 |
| UK | 3676 | 3680 | 3886 | 3668 | 3432 | 3385 | 3164 | 3160 | 3093 | 3166 | -510 | -0.14 |
| Netherlands | 2069 | 2144 | 2373 | 2397 | 2427 | 2466 | 2376 | 2298 | 2288 | 2306 | 237 | 0.11 |
| Italy | 2535 | 2554 | 2824 | 2848 | 2866 | 2899 | 2747 | 2744 | 2668 | 2695 | 160 | 0.06 |
| France | 2503 | 2560 | 2747 | 2739 | 2655 | 2699 | 2599 | 2589 | 2553 | 2552 | 49 | 0.02 |
| **NAFTA countries** | | | | | | | | | | | | |
| Canada | 1001 | 956 | 1374 | 1428 | 1536 | 1649 | 1624 | 1632 | 1558 | 1610 | 609 | 0.61 |
| US | 3339 | 3414 | 3754 | 3587 | 3437 | 3498 | 3300 | 3319 | 3256 | 3312 | -27 | -0.01 |
| Mexico | 129 | 123 | 339 | 697 | 859 | 885 | 912 | 905 | 902 | 968 | 839 | 6.50 |
| **EFTA countries** | | | | | | | | | | | | |
| Norway | 210 | 214 | 482 | 549 | 595 | 595 | 530 | 577 | 492 | 502 | 292 | 1.39 |
| Switzerland | 2250 | 2367 | 2324 | 2127 | 1900 | 1912 | 1841 | 1797 | 1705 | 1731 | -519 | -0.23 |
| Iceland | 110 | 79 | 189 | 150 | 115 | 159 | 149 | 124 | 148 | 150 | 40 | 0.36 |
| **Eastern Asian Countries** | | | | | | | | | | | | |
| Taiwan | 2185 | 2248 | 2330 | 2256 | 2379 | 2352 | 2202 | 2146 | 2091 | 2145 | -40 | -0.02 |
| Japan | 2393 | 2311 | 2131 | 2140 | 2111 | 2111 | 2023 | 2001 | 1924 | 1973 | -420 | -0.18 |
| Korea-Rep | 1112 | 1232 | 1398 | 1650 | 1804 | 1802 | 1770 | 1805 | 1754 | 1775 | 663 | 0.60 |
| Hong Kong | 1827 | 1911 | 2085 | 1871 | 1965 | 2010 | 1851 | 1795 | 1747 | 1809 | -18 | -0.01 |
| China | 982 | 1081 | 1959 | 2539 | 3351 | 3451 | 3250 | 3307 | 3298 | 3385 | 2403 | 2.45 |

*Product count – geographical extensive margin*

We selected the most traded commodities to illustrate the destination extensive margin. This is the geographical product count measure, counting the number of countries with which South Africa has positive trade relations with a specific HS 6-digit line. Tracking products over all of South Africa's trading partners shows that South Africa imports printed books and parts of data-processing equipment from most of the countries (see Figure 19). By 2010 it imported printed articles (HS392690) from 137 countries as compared to 71 in 1988, and parts and accessories for data-processing equipment (HS847330) from 120 countries compared to 48 in 1988. This shows that, as the world liberalised its trade, trade across countries increased.

Appendix 3 shows the geographical extensive margins for HS49, which is books, newspapers and pictures, HS84, which is machinery and mechanical products, and lastly HS62, which are textile products. South Africa imports HS84 and HS62 products from almost a similar number of countries.

Figure 19: Import geographical extensive margin




### 2.6.4 Import intensive margins

The intensive margins are obtained using the H&K measure. Figure 20 shows that South Africa imported a bigger volume of goods (intensive margins) from Germany, an EU country. However, the trend is declining, being replaced by rising trends from Eastern Asia and China. Switzerland is the major EFTA country with which South Africa has high intensive import margins, although these have been declining over the years. There is a sign of recovery around 2008, however, and this suggests the importance of tariff liberalisation. The figure shows an upward trend in imports from Norway.

Figure 20: Import intensive margin using the H& K measure for EU and EFTA countries

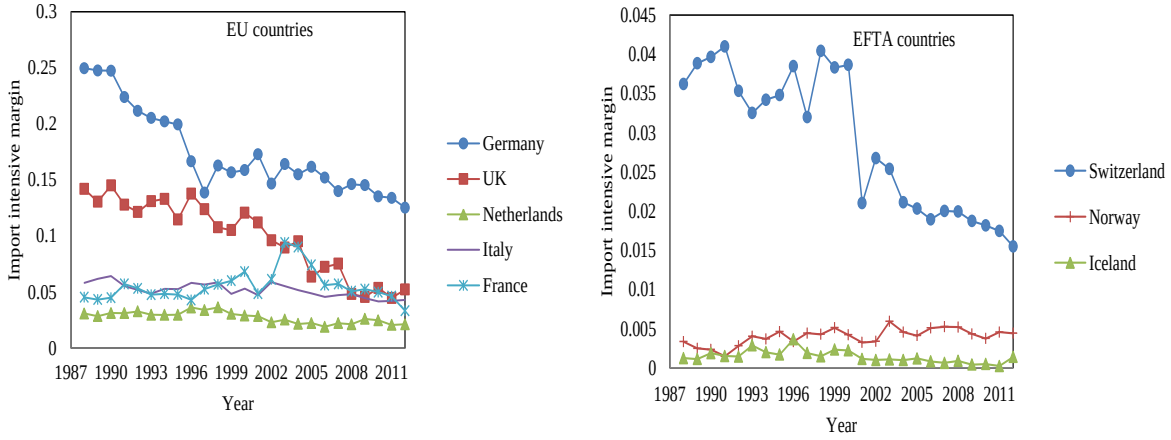
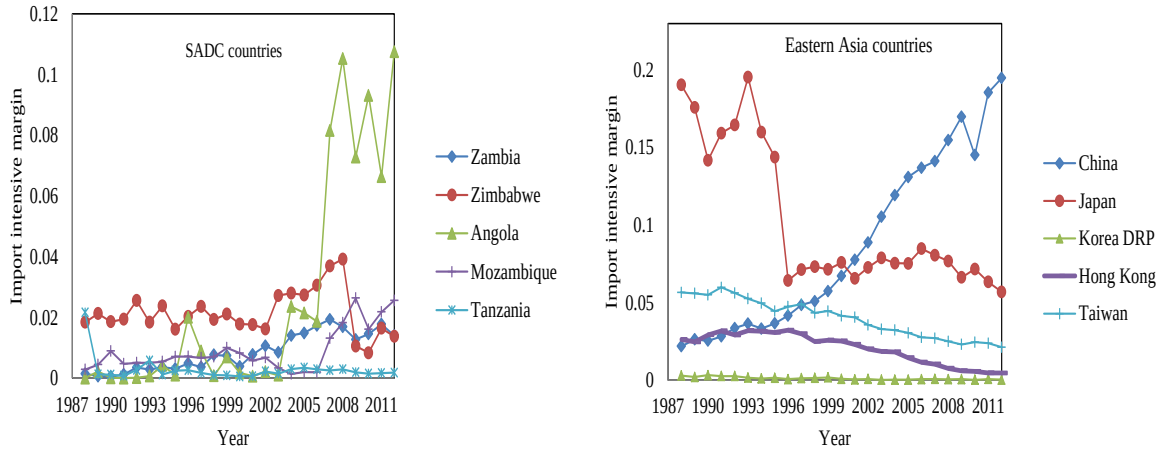



Figure 21 shows South Africa's import intensive margins from East Asia and the SADC. It shows that South Africa imports more volumes of the same products from China. South

Africa's import volume from Japan declined up to the mid-1990s, thereafter it remains almost constant. Zimbabwe was the top country from which South Africa imported the same volume of goods over years, save from 2006, when Angola took the position. South Africa's imports from Angola are increasing and show a spike, suggesting the importance of the oil trade.

Figure 21: Import intensive margin using the H&K measure for SADC and East Asian countries




## 2.7 Conclusion

This chapter focusses on explaining various methods used to measure trade margins, such as the simple count, Kehoe and Ruhl, (2003; 2009; 2013) and Hummels and Klenow (2002; 2005) measures. The chapter further exploits these measures to come up with broad trends of trade margins for South Africa. We compare if the different measures of trade margins produce the same trends, and also if the trends broadly conform to changes in trade policy

Firstly, on the export side, the results show that export extensive margins had larger values than export intensive margins as South Africa and its trading partners liberalised. It shows that South Africa exports more varieties, rather than a greater volume of old products, to most of the trading partners, save for China. The results also show that the composition of South Africa's exports is moving away from 'traditional' partners towards China. The results further reveal that South Africa exports consistently more varieties to developed countries. The trends reveal that the extensive margin is high for those countries with which South Africa has trade agreement, such as the EU and SADC countries. The extensive margins

show an increase of exports from South Africa to SADC countries, especially from 2000, the year when the SADC trade agreement was implemented. These results are consistent across all the three measures used: Hummels and Klenow, simple count and the Kehoe and Ruhl measure. However, the major difference is with South Africa's exports to China. The results show a decline in the new product margin in later years when using the Kehoe and Ruhl method. This is the opposite of the trends we find when using the Hummels and Klenow and simple count measures. This is expected, since South Africa's exports to China grew sharply on the intensive margins, as depicted by the Hummels and Klenow and Kehoe and Ruhl measures. The export intensive margins for the majority of the countries have generally been decreasing over the years. However China, Germany, the EFTA countries and the SADC countries show some increases from 2006.

Secondly, on the import side, the results show that South Africa imports more varieties from developed countries. This is consistent with the established fact that the richer the country is, the higher the number of products it will produce. The results also reveal a surge in the import extensive margin, coinciding with changes in the major trade policies for the majority of countries in the EU and EFTA. The results show that South Africa imports few varieties from the SADC countries, despite the favourable trade policy, possibly pointing to the incapacity of most SADC countries to produce many varieties of products. The import extensive margin is generally below the 0.6 mark. The results of the import extensive margins are consistent across the different measures.

The import intensive margins exhibit the same trend as the export intensive margins. The importance of importing the same old products seems to decline, despite the tariff reductions associated with different trade policies. However, South African imports from countries like China and Angola show a major spike (increase) in the value of old products (intensive margins). The possible reason for China is its emergence as a major global trader, and for Angola it might show the importance of trade in oil-related products from Angola.

The broad conclusion is that the major trends exhibited by the export and import extensive trade margins show that they are broadly associated with changes in trade policy. This might indicate the importance of tariffs in driving trade margins, a case that is investigated in subsequent chapters. Further, the results are consistent across all the different measures.

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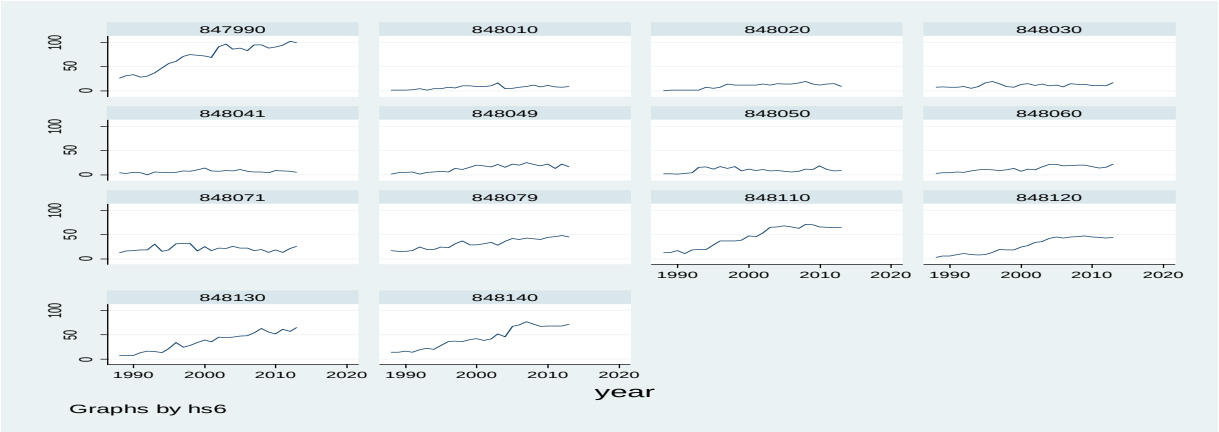
## Appendix 1: Sample of randomly selected data set

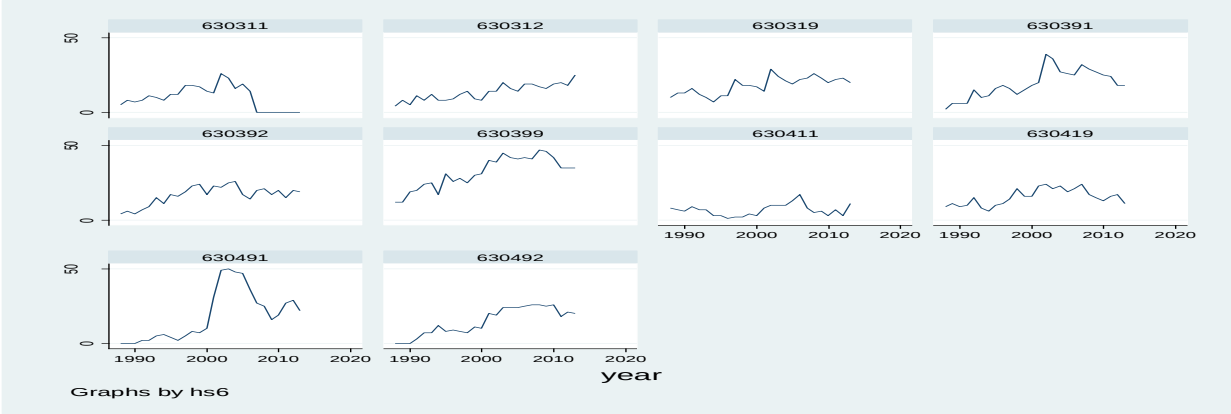
| HS6 | COUNTRY | YEAR | EXPORT VALUE |
|---|---|---|---|
| 10290 | Morocco | 1999 | 0 |
| 10290 | Mozambique | 1996 | 366556 |
| 10290 | Netherlands | 1997 | 0 |
| 10290 | Nigeria | 2003 | 474314 |
| 80610 | Netherlands | 2008 | 139388383 |
| 150100 | Guatemala | 2002 | 0 |
| 200880 | United Arab Emirates | 2000 | 91916033 |
| 260112 | Germany | 2005 | 68413698 |
| 260112 | China | 1997 | 75822057 |
| 260200 | Japan | 1990 | 90475540 |
| 260200 | India | 2011 | 119344287 |
| 270112 | Netherlands | 1994 | 134157127 |
| 271011 | Nigeria | 2005 | 74526180 |
| 271011 | Malaysia | 2011 | 90906514 |
| 271011 | Zimbabwe | 2007 | 179141637 |
| 280920 | India | 2007 | 200185025 |
| 380590 | Venezuela | 2003 | 0 |
| 390210 | China | 2008 | 70006885 |
| 390319 | Djibouti | 2004 | 0 |
| 391190 | Venezuela | 1999 | 0 |
| 392114 | Marshall Islands | 2005 | 0 |
| 470200 | Indonesia | 2006 | 119774821 |
| 510111 | China | 2013 | 197001494 |
| 520210 | Yugoslavia | 2012 | 0 |
| 550610 | Armenia | 1992 | 0 |
| 700210 | Jordan | 1991 | 0 |
| 710210 | Switzerland | 1995 | 139940887 |
| 710221 | Switzerland | 1992 | 136908177 |
| 710231 | United Kingdom | 2004 | 908808701 |
| 710231 | Switzerland | 1994 | 1577960270 |
| 710239 | Belgium | 2005 | 110395165 |
| 710239 | United States | 2001 | 117624758 |
| 710239 | Switzerland | 2003 | 167932304 |
| 711011 | Germany | 1997 | 111150127 |
| 711019 | Japan | 2005 | 970355106 |
| 711019 | Switzerland | 2013 | 1312426053 |
| 711021 | United Kingdom | 2007 | 75322541 |
| 711021 | Japan | 2012 | 231400812 |
| 711021 | United States | 2012 | 385729010 |
| 711029 | United Kingdom | 2013 | 167288388 |
| 711029 | Japan | 2009 | 171513771 |

## Appendix 2: Export geographical extensive margin – Product count

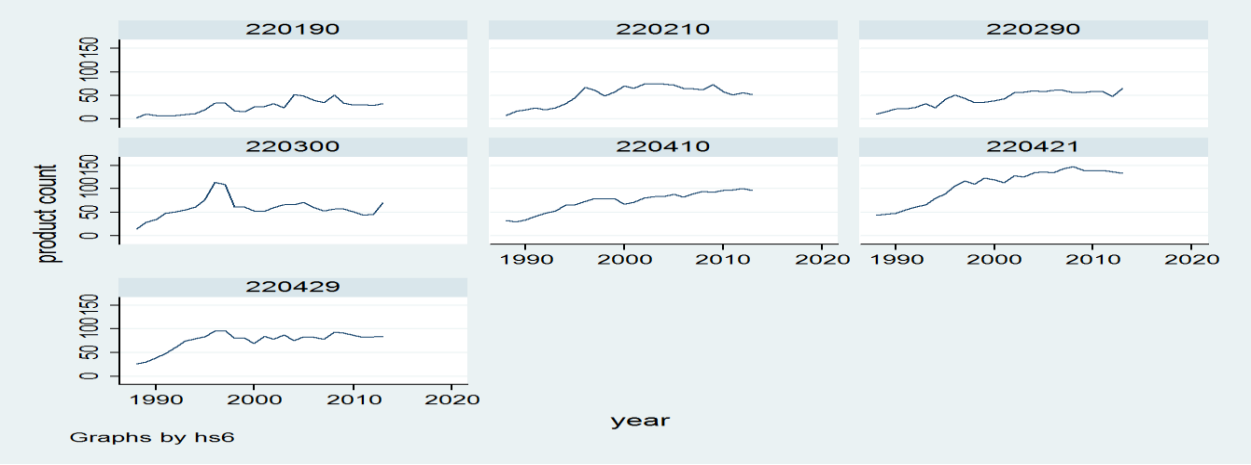
*Machinery and mechanical appliances: Nuclear reactors, boilers and machinery products*



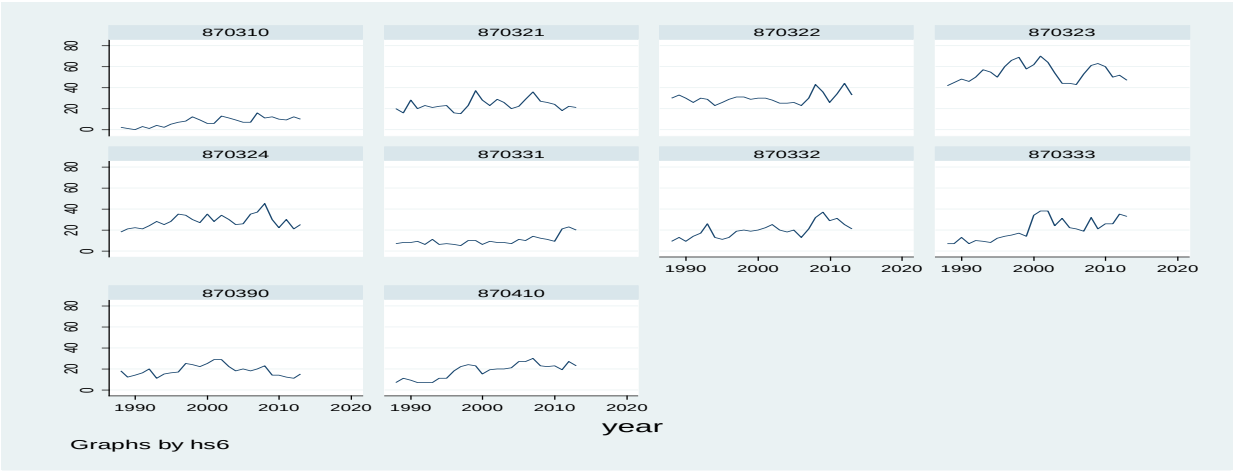

*Textile and textile articles: Other-made textiles articles*




*Prepared foodstuff, beverages, spirits and vinegar: Beverages, spirits and vinegar*

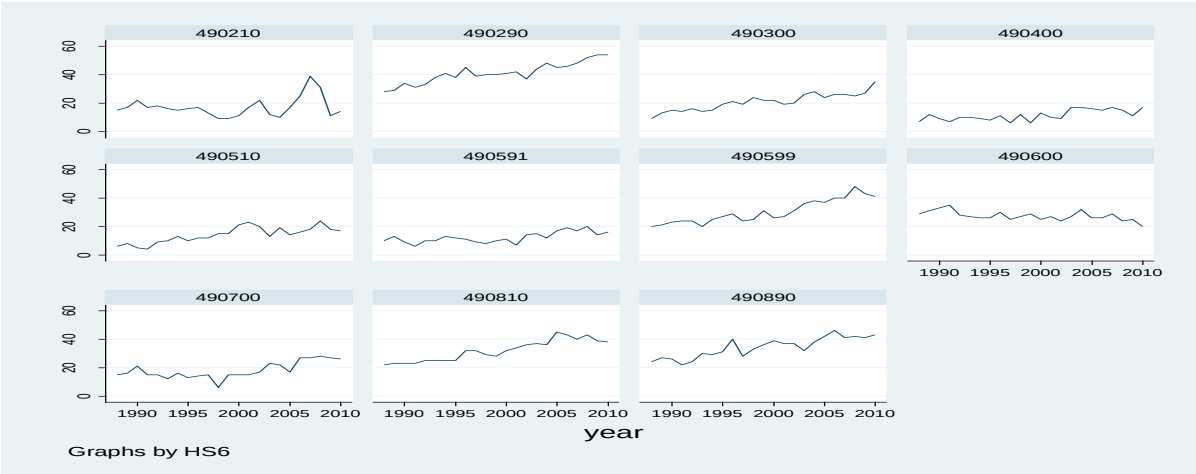



*Vehicles, aircraft, vessels and associated transport equipment: Vehicles other than railway*

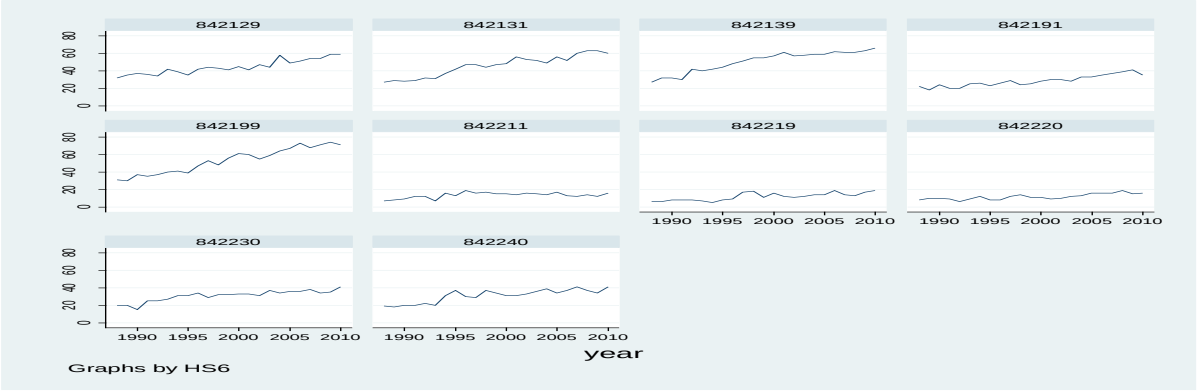



## Appendix 3: Import extensive geographical margin – Product count

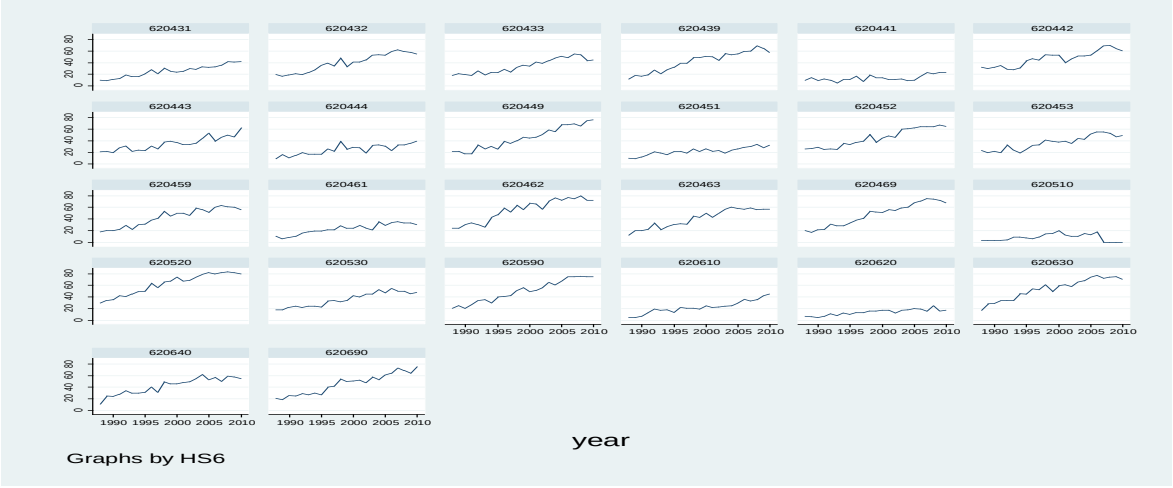
*Pulp of wood: Printed books, newspapers and pictures*



*Machinery and mechanical: nuclear reactors, boilers and machinery*




*Textiles and textile articles: Articles of apparel, accessories*



# Chapter 3: Tariff liberalisation and export trade margins in South Africa

## 3.0 Introduction

In October 1999 South Africa and its largest trade partner, the European Union (EU), signed the Trade, Development and Cooperation Agreement (TDCA). This agreement, implemented in 2000, aimed to establish a free trade area covering 90% of bilateral trade between the partners. The reduction in trade restrictions which is the core of the agreement was staggered – agricultural and industrial products gradually entered each market duty-free until 2012. The agreement is also asymmetric in terms of the time frame – South Africa had a period of twelve years to fully implement the agreement and the European Union had ten years. This agreement meant that the EU offered to liberalise 95% of its duties on South African-originating products by 2010, while South Africa offered to liberalise 86% of its duties by 2012 (see Department of Trade and Industry, 2014).

Existing empirical evidence on the impact of preferential trade agreements, particularly tariff impacts, on trade flows is mixed (Cipollina et al., 2013), showing positive (Bensassi et al., 2011; Caporale et al., 2009), negative (Francois et al., 2006; Martinez-Zarzoso and Gradeva, 2009) or inconclusive (Ghosh and Yamarik, 2004) effects of trade agreements on trade flows. Disaggregate analysis which examines the impact on the extensive margin (exports of new products to old destinations or old products to new destinations) and intensive margin (exports of old products to old destinations), also show mixed results (Bensassi et al., 2011; Gamberoni, 2007). Demaria and Aiello (2009) and Persson and Wilhelmsson (2013) find that some European Union (EU) preference regimes for developing countries have a positive effect on the developing countries' exports, while Martínez-Zarzoso and Gradeva (2009) find that some preference regimes, such as Everything But Arms (EBA), appear to have insignificant or even negative effects on developing countries' exports. McQueen (2007) also finds that preferences, especially unilateral preferences, have little or no trade-stimulating effect.

The focus of this study is helpful to South Africa. The fact that European Union-South Africa Free Trade Agreement (EU-SA FTA) is reciprocal means that each government has its own expectations of the benefits and costs of the agreement. For the South African government, the agreement was extremely important, as it was expected to spearhead South Africa's further integration into the world economy. Further, due to the resultant greater market

openness, productivity was expected to be enhanced and exports stimulated, resulting in economic growth (Lee, 2002). This chapter focuses on exports. It does not only focus on aggregate exports, but rather applies new trade concepts, namely extensive and intensive margin, to evaluate the impact of the agreement.

As discussed in Chapter 2, the existing literature sometimes argues that preferential tariff liberalisation contributes much less than expected to the extensive margins (exports of new products to old destinations or old products to new destinations), but rather more to the intensive margin (exports of old products to old destinations). The reason is that exporters tend to concentrate on the few highly preferred tariff lines rather than diversifying into many products (Brenton, 2003). However, another strand of the literature argues that a decrease in tariffs motivates firms to enter into export, since they now face less trade cost, especially from tariff reduction (see Melitz, 2003; Chaney, 2008; Tokarick, 2007). In this regard, trade preferences make the export industry more attractive, which leads to entry.

This chapter investigates the relationship between foreign tariff reduction, focusing particularly on the European Union-South Africa Free Trade Agreement (EU-SA FTA) tariff rate changes and export trade margins for South Africa. There are various transmission channels through which tariff reductions may influence exports trade margins. Following Melitz's (2003) model, the first channel, investigated in this study, suggests that reduced trade costs (reduced tariff) leads to more firms exporting (extensive margin) and also to an increase in existing exports (intensive margin). The fall in tariff increases demand for South African products in the foreign market as they will be cheaper. This is a market demand shock, as in the Bernard *et al*. (2011) and Cherkashin *et al*. (2010) models. Related to the first, the second channel is through domestic competition. Changes in foreign (in this case EU) tariffs may lead to increased competition in the South African market as more firms will be willing to export. Increased competition induces exporters to innovate in order to remain competitive on the foreign market. This is defensive exporting, where increased competition in the domestic market forces firms to export so as to maintain scale and remain competitive Melitz (2003). A third channel, which this study does not investigate in depth, is through the reduction of import tariffs by South Africa as reciprocity; part of the requirements of the trade agreement. In this context, the decrease in import tariffs should lower costs of imported intermediate products which in turn makes firms that use these imports (some exporters) more competitive. This channel is supported by existing empirical evidence for South Africa

which shows that many South African exporters are importers too (see Edwards, Rankin & Schoer, 2008).

Related to the aforementioned first and second channels, this chapter answers the following questions: what is the effect of foreign tariff reduction on the extensive and intensive margin of exports? Does the change in tariffs have differential impacts on different product groups in South Africa?

The contributions of this study are threefold. First, departing from existing studies[6] which rely on dummy variables as a measure of trade preferences, the present study exploits tariff data - a measure that tracks changes on specific product lines. Although there are other studies applying this measure for instance Emlinger *et al*., (2008), Cipollina, Laborde and Salvatici (2014), this is the first study on South Africa (to the best of my knowledge). In addition, this study is unique as it uses foreign tariff data - other studies use import tariffs of the respective country under study.

Second, most existing studies (Edwards & Lawrence, 2008; Edwards & Alves, 2006; Jordan & Kanda, 2011) use aggregated data which masks important information. In addition, these studies largely focus on the effects of trade preferences on the intensive trade margin ignoring the extensive margin. Yet, emerging research shows that the extensive margin is an important component of trade (Bernard *et al*., 2009; Hummels & Klenow, 2002) and thus ignoring this aspect is a significant omission. In light of this, the present study investigates the impact of EU tariffs on South African export trade (intensive and extensive) margins using highly disaggregated data. The use of highly disaggregated data makes it feasible to investigate the impact of tariffs focusing on specific product groups like homogenous versus differentiated products. This provides insight into which products South Africa should focus future tariff liberalisation on.

Third, existing international studies do not provide a comprehensive analysis of trade margins at different levels in one study. For example, some focus on the product level (Kehoe & Ruhl, 2003); country level (Hummels & Klenow, 2002; Felbermayr & Kohler, 2006; Dutt, Mihov & Van Zandt, 2013), product-country level (Besedeš & Prusa, 2011) and firm-product level (Bernard *et al*., 2009; Berthou & Fontagné, 2008). This chapter is unique in that it focuses on

[6] See Cardamone, 2007 for a detailed survey of existing studies.

all these levels except the firm level (due to data constraints). This provides a first comprehensive and robust analysis for South Africa. The final contribution of this study stems from its primary focus on South Africa. Most existing studies use cross-country level data and often focus on multilateral agreements (Dutt, Mihov & Van Zandt, 2013) which masks important within-country information. Thus, focusing only on South Africa and a single trade agreement (EU-SA-FTA) is much more informative as it provides comprehensive analysis taking into account the peculiarities of the country.

The rest of this chapter is structured as follows: section 3.1 focuses on the background section and overview of EU-SA FTA, section 3.2 on the theoretical models and conceptual framework, while 3.3 is on methodology, data source and descriptive statistics in 3.4. Section 3.5 focuses on the results and 3.6 conclude the study.

### 3.1 Background and Overview of EU-SA FTA

The TDCA was the first reciprocal free trade agreement to be signed in Southern Africa (Tsolo et al., 2010). It was concluded after 24 rounds of negotiation and was provisionally implemented on 1 January 2000 and fully implemented in 2004. The liberalisation schedules were asymmetric across products, particularly between agricultural and industrial products. As Table 1 shows 99% of the tariff lines for industrial products were to be free from tariffs, compared to only 48% for agriculture over the period from six to nine years after implementation.

Table 9: EU tariff phase-down: 2000-2009

| | | Base rate | Year 0-2 | Year 3-5 | Year 6-9 |
|---|---|---|---|---|---|
| All tariffs | Number of free tariffs | 587 | 2 916 | 4 167 | 4 711 |
| | Number of tariffs | 5 113 | 5 113 | 5 113 | 5 113 |
| | Share | 11% | 57% | 81% | 92% |
| Agriculture tariffs | Number of free tariffs | 166 | 254 | 341 | 341 |
| | Number of tariffs | 704 | 704 | 704 | 704 |
| | Share | 24% | 36% | 48% | 48% |
| Industrial tariffs | Number of free tariffs | 421 | 2 662 | 3 826 | 4 370 |
| | Number of tariffs | 4 409 | 4 409 | 4 409 | 4 409 |
| | Share | 10% | 60% | 87% | 99% |

Source: Trade and Industrial Policy Strategies (TIPS), 2010

Some studies that evaluated the potential impacts of the trade agreement before its implementation showed potential positive impacts on South Africa (Lewis, Robinson & Thierfelder, 1999) whilst others suggested a potential negative impact (Eurostep, 2000). .

**South Africa–EU trade overview**

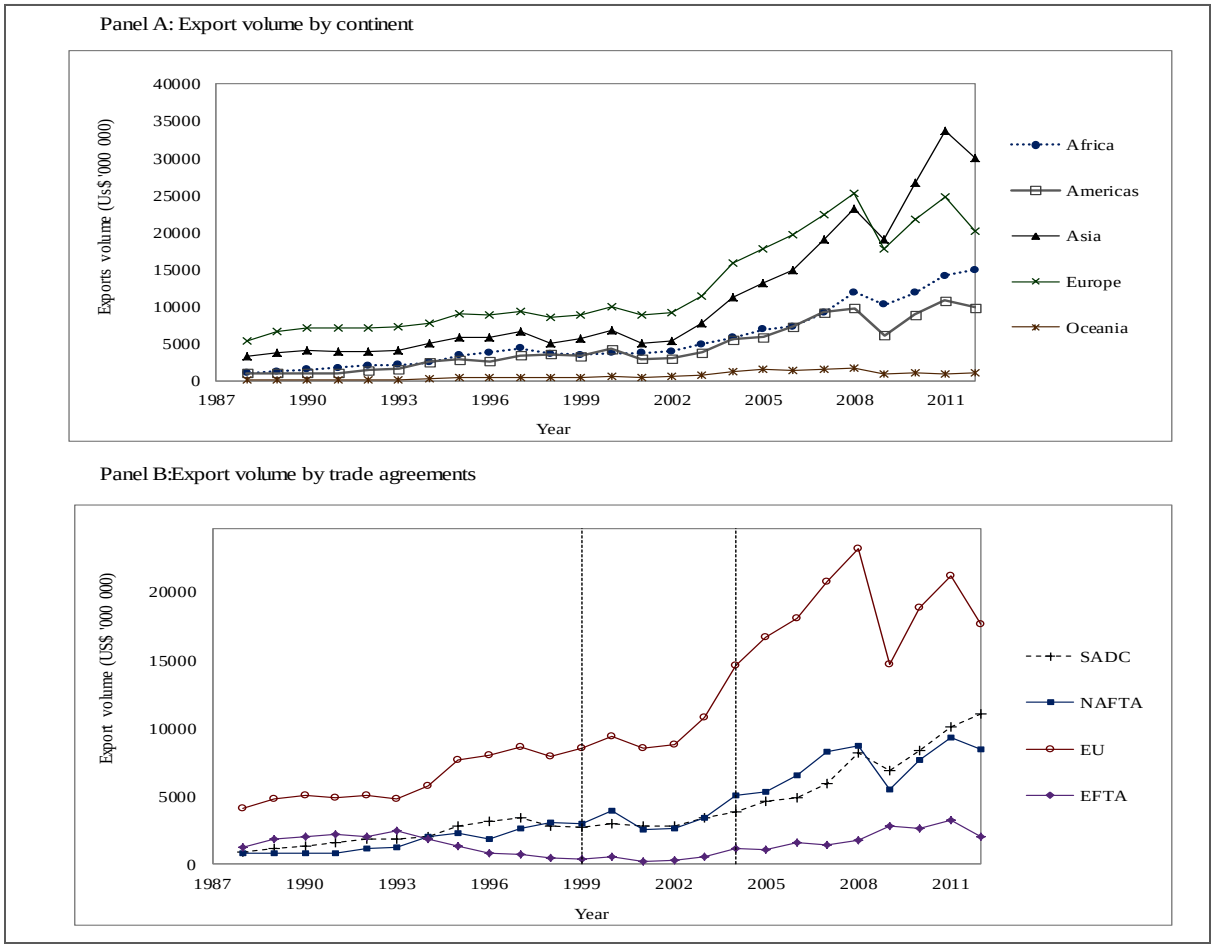
This section provides a brief overview of the intensive and extensive margins between South Africa and European Union (See Chapter 2 for a detailed discussion of these trade margins in comparison to other regions).

*Intensive margin – volume of exports*

Figure 22 shows the graphs for export volume at the level of continental and trade agreements. The dotted line at 1999 (in Panel B) shows the time when the trade agreement was signed, and that at 2004 when the trade agreement was fully implemented.

Panel A in Figure 22 shows that Europe was the dominant export destination for South Africa until 2009, when it was overtaken by Asia, driven largely by increases to China. Panel B shows that EU is South Africa's major export destination if specific trade agreements are considered. Panel B also shows a major rise in volume soon after the signing of the trade agreement. There also is a major rise from 2003, a year before the full implementation of the EU-SA FTA. This suggests that the trade agreement might have been driving South African export flows

Figure 22: Exports volume




*Source: Author's compilation based on Quantec, 2013*

*The extensive margin of exports*

The extensive margin of exports at a product level varies across sectors. Figure 23 comprises three panels: Panel A shows the number of products exported per sector; Panel B shows the product count per country; and Panel C shows the number of export destination for the vehicles sector level, focusing only on Harmonised System (HS) lines from 870790 to 870893. The dotted lines at 1999 show the year the trade agreement was signed and dotted line on 2004 represents the year when the trade agreement was fully implemented.

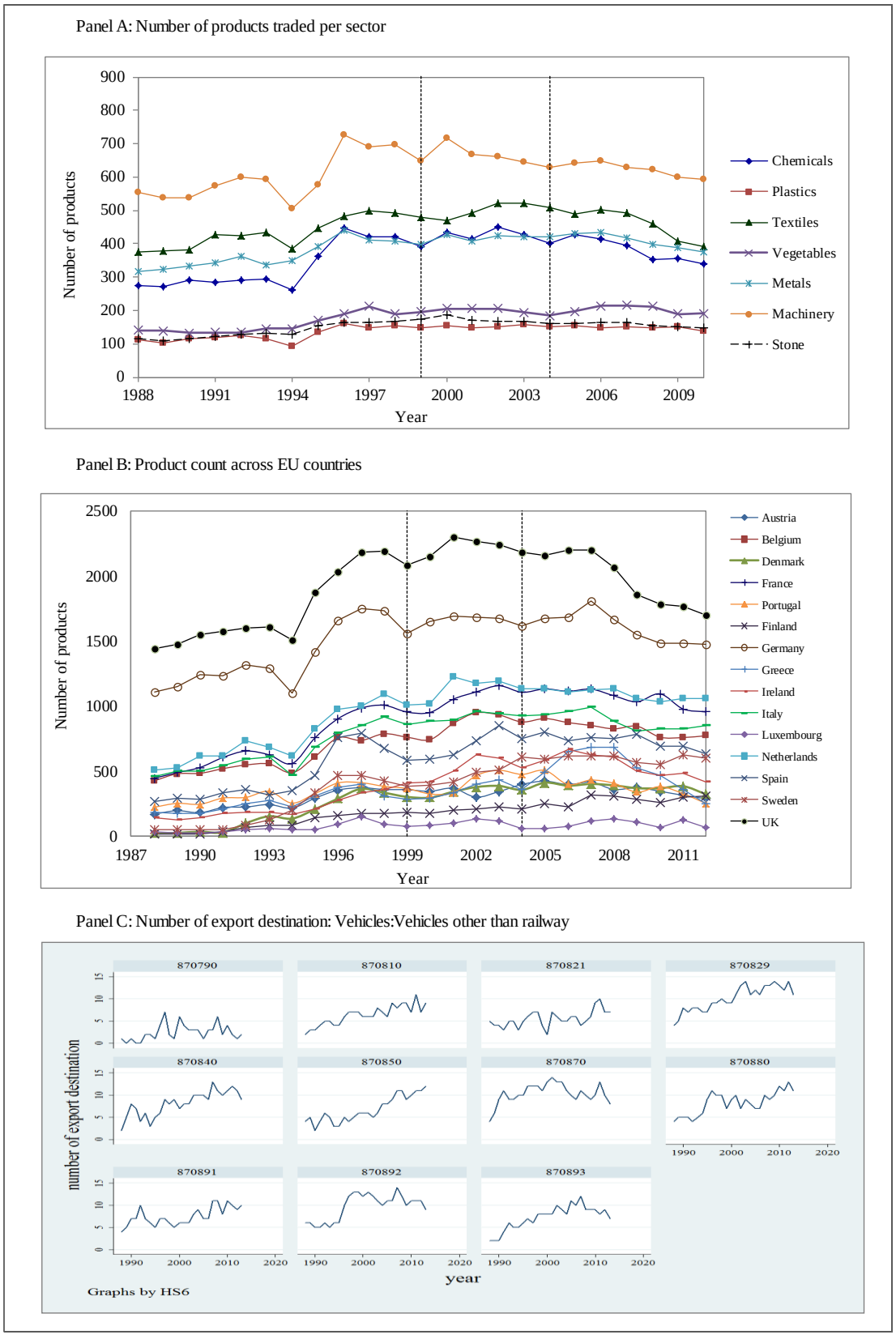
Panel A in Figure 23 shows that South Africa exports the highest number of products in machinery, textiles and chemicals respectively, while the lowest number of product exports is in footwear, hides and minerals (though not reported in the graph). The observed trends

suggest that products that received greater tariff reduction enabled South Africa to export more product lines. There is a clear increase in number of products from 1999 for most of the selected products. The trend also suggests that South African exporters export the products in which they have a comparative advantage. Most of the exported product groups show an increase from 1999, the year the agreement was signed.

Panel B which focuses on the 15 initial EU countries shows that South Africa exports a large number of products to the United Kingdom, followed by Germany, while Luxemburg receives the least number of South African products. The possible reason for the higher exports to the United Kingdom and Germany might be the higher gross domestic product of these two countries as Hummels and Klenow (2005) find that countries with higher GDP trade more varieties.

Panel C shows the general increase in most of the HS tariff lines from 1999. This suggests that the trade agreement had an impact on the number of EU countries South Africa exported to. The HS 870850 (drive axles with differential for motor vehicles) displays an upward trend since 2000 – the year the trade agreement was implemented provisionally. The vehicles are picked for illustrative purposes. Further, Appendix 1 shows the geographical extensive margins only, focusing on the initial 15 EU countries. It shows that South Africa was increasing exports of beverages and spirits to the EU.

Figure 23: Export extensive trade margin




*Source: Author's compilation based on Quantec, 2013*

### 3.2 Responses to trade liberalisation

As shown in Chapter 2, the 'micro' trade theories such as Chaney(2008), Melitz (2003) provide a theoretical framework for understanding how trade liberalisation may impact exports at the intensive and extensive margins. Although the Melitz model uses firms as the unit of analysis similar mechanisms can be used to understand entry and exit at a product and country level. Melitz (2003) clearly explains the impact of trade liberalisation through the increase in the number of trading partners and decrease in variable and fixed trade costs. Basing on his assumption of demand and production (see Melitz for the model derivation), the key message is that there are differences in firm productivity which makes some firms to exit and others to enter the market if trade liberalisation occurs. Increased exposure to trade forces the least productivity firms to exit, but also generates entry of new firms into the export market

Bernard et al., (2011) and Arkolakis and Muendler, (2009) extend Melitz, (2003) to explain new product-level trade facts. In the multiproduct firm model of Bernard et al., (2011) varieties are reinterpreted as products rather than firms. The key components of these models are firm-level productivity, costs of entry into each market and 'iceberg' transport costs. The response to changes in trade cost depends on whether the exporter is a high or low productivity exporter. A reduction is tariffs makes entry into the export market easier and makes domestic firms more competitive abroad since the per-unit cost in foreign markets fall. This would suggest that existing exporters expand – an increase at the intensive margin, and new exporters enter – an increase at extensive margin. Both low and high productivity exporters are able to intensify exporting of existing products (intensive margin) that witness tariff reduction. However, these Melitz-style models are focused only on finished products and do not consider the impact on intermediate inputs that may be imported.

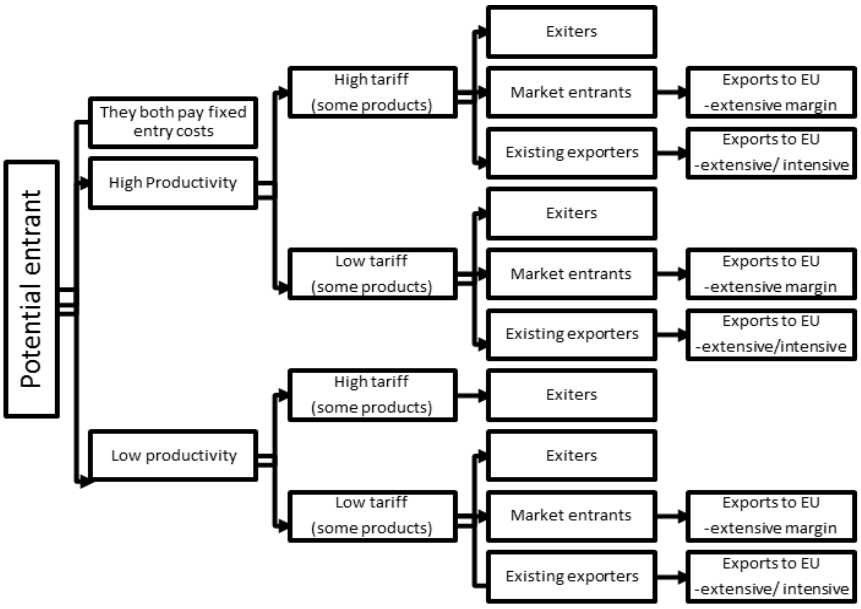
In the domestic market, the entry of more productive foreign firms may drive out low productivity firms producing for the domestic market through competition. Changes in foreign (in this case EU) tariffs may lead to increased competition in the South African market as more firms will be willing to export to the EU market. Also as SA tariffs falls, as part of the reciprocal agreement, this will lead to increased entry of EU firms into the SA

market. Increased competition induces exporters to innovate in order to remain competitive on the foreign market. This is defensive exporting, where increased competition in the domestic market forces firms to export so as to maintain scale and remain competitive (Melitz, 2003).

The availability of lower cost imported intermediate inputs as a result of the FTA may also improve the productivity of local firms. This could increase existing exports, if these benefit from these lower cost inputs, and/or lead to the entry of new exporters. Edwards and Lawrence, (2008) argue that the reduction in anti-export bias as a result of the trade liberalisation in the 1990s was a key mechanism that stimulated South African export growth as well as the diversification of exports away from commodities. It shows that even some low-productivity exporters are able to export due to low tariffs (Bernard *et al*., 2011). In this way, trade liberalisation (declining trade cost) raises their productivity by causing low productivity firms to drop their least attractive products (see Bernard *et al*., 2011, for the firm explanation).

The other model, explained in Chapter 2 that suits this study is that of Chaney (2008) which gives a gravity equation in the Melitz framework with many countries and asymmetric trade costs. The intuition derived from Chaney's model is that a reduction in variable trade barriers (such as tariffs) implies that each existing exporter exports more, hence the intensive margin. At the same time, higher potential profits attract new entrants – the extensive margin. His explanation is strongly governed by elasticity of substitution. From the model it is clear that when goods are highly differentiated (elasticity of substitution is low), the demand for variety is relatively insensitive to changes in trade costs, and hence trade barriers will have little impact on the intensive margin of trade. This shows that the impact of tariff changes on trade margins is not theoretically straightforward.

Figure 24: How exporters respond to change in trade costs




*Source: Author's compilation*

As figure 24 shows, exporters are categorised into high- and low-productivity exporters. The initial condition is that both types of pay fixed entry costs (as in Melitz-style models). The fixed entry cost may include making contact with foreign buyers and non-tariff barriers. These costs are constant. The second cost is the variable costs. This study's variable costs are tariffs. As tariffs and other costs are reduced, the study expects more products to be exported, more firms to export and an increase in the number of countries exported to.

Those exporters who are able to overcome the entry cost will face further shocks. These are individual, firm-specific shocks and shocks as a result of market-specific demand characteristics. Individual specific characteristics are not very important in this study, since the study is not dealing with specific firm-level data (as in Bernard *et al*., 2011; Cherkashin *et al*., 2010; Melitz, 2003). Market-specific demand shocks are crucial in this study, such as tariff reductions on some products in the EU market. Figure 24 shows that both high-productivity and low-productivity exporters face low and high tariff on products from the EU. This is because the tariff phase-down was not symmetrical across all products, with some products still attracting high tariff while other products face very low tariffs. There also are other market demand shocks, such as the national income of the EU, which are included in the regression analysis.

After exporters face the differential tariff across products they may exit, enter or continue exporting to the EU market. As Figure 24 shows, for high-productivity exporters there is a big chance that existing exporters may intensify exporting those products that witnessed a reduction in tariff. This is the intensive margin effect. Furthermore, the existing exporters may expand their exports to EU countries (geographical extensive margins) to which they did not export previously, or they may export new products either to the already existing EU countries or to new EU trade partners (product extensive margin). The same applies to new entrants, as trade preferences given by the EU to South African exporters make the industry more attractive and create entry (see Cherkashin *et al*. (2010) for the firm-specific argument). These market entrants create new trade relations, either through geographical or product-extensive margins. There also is some chance that, even among the high-productivity exporters, some will exit the market. They will not be able to compete, hence they will exit. The above characterisation is seen in both high-tariff and low-tariff products.

For low-productivity entrants, those who face high tariffs will exit the market since they are not able to compete. However, those who face low tariffs will either be exiters, market entrants or existing exporters. The existing exporters will either continue exporting previously exported products (intensive margins) or new products (extensive margins). The market entrants' exports will create new trade relationships (extensive margins). This shows that some low-productivity exporters are able to export due to low tariffs. In this way, trade liberalisation (declining trade cost) raises their productivity by causing them to drop their least attractive products (see Bernard *et al*. (2011) for the firm explanation). This enables exporters to make profit and hence be able to sustain exporting to the favourable EU market simply due to lower tariffs. Bernard *et al*. (2011) explain that a reduction in variable trade costs induces some low-productivity (ability) firms that previously served the domestic market to enter the export market.

So, in general, both fixed costs (for example cost of market research, or cost of conforming to foreign regulatory standard or rules of origin) and variable costs (for example tariffs, transportation costs) determine whether or not exporters will supply a foreign market. This is also shaped by whether it is a low-productivity or high-productivity exporter. It is expected that high-productivity exporters have larger total exports than low-productivity exporters. This is because high-productivity entrants export more of a given product to a given country, and also export to a larger number of countries (geographic extensive margin) than low-

productivity firms. The reason provided by Bernard *et al*. (2011) is that high-ability/productivity firms will charge lower prices for their products, hence increase the volumes and number of countries to which they export. The clear policy on tariffs from the EU-SA FTA reduces uncertainty and is expected to have a positive impact on the extensive margin of trade (see Francois & Martin (2004) for the argument). In Figure 23 the mechanism goes from tariff to both the extensive and intensive margin of trade.

There are a relatively large number of studies that investigate the impact of tariffs on export trade margins (see Table 8). For example, Disdier, Fontagne and Mimouni (2013) examine the extent to which tariff reduction influences the extensive and intensive margin for emerging markets (South Africa included) for the period 1996 to 2006. This period covers the full implementation of the Uruguay Round agreement, and the complete episodes of multilateral liberalisation and free trade areas. Using highly disaggregated trade data (at the HS6 digit level), the authors find a limited impact of tariff cuts on emerging countries' extensive margins. However, at the intensive margin, tariff reduction had a significant impact only on exports of differentiated goods.

Buono and Lalanne (2012) investigate the impact of the Uruguay round on trade using firm-level data from France for a time period ranging from 1993 to 2002. Their interest is tracking the impact of a worldwide reduction in tariffs implemented within the framework of the Uruguay round. They consider exports of French firms for 57 sectors to 147 destinations. They find a positive effect of tariff reduction on the intensive margin, but find no evidence of an impact on the extensive margin when they considered the panel dimension. However, for the pooled OLS estimation, tariffs had a significant impact on both margins. The results of Buono and Lalanne (2012) indicate that the tariff cuts, partly due to the Uruguay round, leads to an increase in aggregate French exports, ranging from 2.3% to 3.6% between 1993 and 2002. From their preferred specification, tariff reductions are responsible for a growth rate of French manufacturing exports of 3%, which can be split into a growth rate of 2.5% for the intensive margin, and 0.5% for the extensive margin. Feenstra and Kee (2007) investigate the impact of US tariff reduction due to NAFTA on exports to Mexico. Using OLS and instrumental variable estimation methods, they find statistical evidence linking US tariff liberalisation due to NAFTA to increased export variety from Mexico.

Table 10: Summary of empirical evidence on tariff and export trade margin

| **Study** | **Tariff variable** | **Result of extensive margin (tariff coefficient)** | **Result of intensive margin (tariff coefficient)** |
|---|---|---|---|
| Feenstra and Kee (2007) | US import tariff data computed from US import data and WITS data from World Bank | Negative and statistically significant | – |
| Buono and Lalanne (2012) | TRAINS tariff data | Negative and significant with OLS pooled cross-section estimation<br>Panel estimation – not significant | Negative and significant with OLS pooled cross-section estimation<br>Panel estimation – not significant |
| Yi and Van Biesebroeck (2012) | Chinese import tariff – Chinese National Bureau of Statistics | Highly negative and significant for differentiated products, low for homogenous products | – |
| Disdier *et al*. (2013) | Emerging country tariff data from TRAINS, MAcMap | Not a significant impact | Significant impact on differentiated goods |

There also is a large amount of research on the relationship between preferential trade agreements and trade margins. Cardamone (2009) and Cipollina and Salvatici (2010) provide a comprehensive survey of the impact of preferential trade agreements (PTAs) on trade. Cipollina *et al*. (2013) estimated the trade preferences effect for developing countries' trade flows comparing EU and US trade preferences. Using cross-sectional trade data at the HS8 digit level for 2004 they find that the gains are stronger for the EU (25 countries) on the intensive margins than US preferences, while they were more effective at the extensive margin for US schemes than for EU schemes. They also find that preferential schemes have a significant and positive impact on the intensive margin of trade, while the impact on the extensive margin varies across sectors, both in terms of the sign and the magnitude of the estimated coefficients. The positive impact on the extensive margin means that preferences help to reach product diversification, while a negative sign confirms the traditional criticism that preferences lead to excessive export specialisation. This study differs from these existing studies by considering only one exporter, South Africa. Further, previous studies use import

data of the US and EU, instead of export data from the exporter perspective, as in this chapter.

There are several studies that investigate the determinants of South African exports (Rankin, 2001; Naude, Oostendorp & Serumaga-Zake, 2005; Edwards & Alves, 2006; Edwards & Lawrence, 2008). However, these studies do not focus on trade margins per se, but on general trade volumes. There are also various existing studies for South Africa that focus on EU-SA FTA (see Akinkugbe, 2000; Assarsson, 2006); Jordaan & Kanda, 2011). For example Assarsson (2006) find, using descriptive statistics, that the EU-SA FTA led to an increase in exports from 1999 to 2003. Their methodology is based on comparing trade statistics between the years 1999 and 2004. Using the gravity model, Jordaan and Kanda (2011) find out that the EU-SA preferential trade agreement led to a significant trade expansion effect using data from 1994 to 2008. Lewis *et al*. (1999), in their study before the implementation of the EU-SA FTA agreement, find that the sectors that experience the largest gains are those that have been protected previously, such as fruits and vegetables (agriculture) and food processing. The aforementioned existing South African studies differ from this study in several ways. Firstly, this study adds the dimension of trade margins, which is missing from existing studies. Secondly, this study uses foreign tariffs that South African products face in the EU. The majority of the studies use dummy variables that tend to blanket specific issues. Third, the present study is at the product level, while the majority use aggregate trade flows.

In sum, existing studies that assess the impact of trade preferences differ in the samples they use, how they measure extensive and intensive margins,[7] the proxies used for trade policy, and the type of empirical model and estimator utilised. For example, in relation to trade policy the most frequently used is a dummy variable that will equal to one if the country is a member of a free trade area. Few studies use tariffs (Dennis & Shepherd, 2011; Feenstra & Kee, 2007; Persson & Wilhelmsson, 2013) or preference margins (Cipollina & Salvatici, 2010). In estimating, some studies employ the gravity model (Cipollina & Salvatici, 2011; Dutt *et al*., 2011; Foster, Poeschl & Stehrer, 2011; Wilhelmsson & Persson, 2009;), while others follow different empirical strategies (Cherkashin *et al*., 2010; Dennis & Shepherd, 2011; Feenstra & Kee, 2007; Gamberoni, 2007).

[7] Three indices are basically used (as shown in Chapter 2): the count measure – number of products with positive trade flows. Kehoe and Ruhl (2003) measure and the theoretically found indexes from Feenstra (1994) which were developed further by Hummels and Klenow (2005) and Feenstra and Kee (2007).

## 3.3 Methodology

This study uses various methods to investigate the impact of SA-EU FTA on export trade margins depending on the measure of the extensive margin. The study uses panel data to exploit variations across products, countries and product-country over time.

*Choice of the Estimators*

The choice of estimator is influenced by existing studies and how the trade margin has been measured. Existing studies, for example Berthou and Fontagné (2008) and Persson and Wilhelmsson (2013) use Poisson regression; Bernard *et al*. (2011) use ordinary least squares (OLS); Debaere and Mostashari, (2010) and Moncarz, (2010) use Probit, and Persson and Wilhelmsson (2013) use the negative binomial maximum likelihood. Consequently, this study applies diverse models depending on how the extensive and intensive margin variable is measured. Our study uses Probit model (binary model) when the dummy variable approach is used to measure trade margin. The Probit estimator is used for product level and product country level estimations. Poisson estimator (a count data models) are used when the measure of extensive margin is through destination count. This is the case for product level estimation. We use Probit model because of the binary nature of dependent variable. We use the Poisson estimator because our dependent variable is a discrete (count data), and we assume that the number of countries exported to by South Africa follows a Poisson distribution with mean and variance equal to each other. Further, the study uses OLS estimator, if the extensive margin or intensive margin is measured by count outcome variable which is log- transformed. This is used for country level estimations. Under this setting the use of OLS is used for robustness checks purpose. This enables to adopt a large amount of fixed effects.

The estimations include product-fixed effects that control for unobserved heterogeneity in the determinants of the number of products exported, and time dummies that control for common macroeconomic shocks. Using a country-specific fixed effect, this study controls for country-level characteristics that may jointly determine a country's choice of tariffs and its level of trade with South Africa. This treats the endogeneity bias in time-invariant characteristics in the panel setting (see Baier & Bergstrand, 2007). Different measures of the extensive margin, such as geographical extensive margin, dummy variable approach and the Hummels and Klenow (2002; 2005) measure, are used for robustness checks.

**Econometric Specification**

***3.3.1 Product-level estimations***

This section presents the econometric specification at product level. There are two specifications, the first using the count measure – geographical count, and the second using the dummy variable approach.

**Geographical count measure – Intensive and extensive margin**

This section firstly specifies the general OLS equation exploiting margins calculated using the geographical extensive margin. This measure of extensive margin is the number of South African export destinations (countries) by HS6 product line. The study considers the founding 15 EU countries, hence the dependent variable has an upper bound of 15.

***For extensive margins,***

$$\ln(em_{it}) = \beta_0 + \beta_1 \ln(tariff_{it}^{eu}) + Z'_t\varsigma + \lambda_i + \theta_t + \varepsilon_{it} \quad (1)$$

where *i* represents the product, *t* time and ln is the natural logarithm; $em_{it}$ is the export-extensive margin of product *i* with the EU at time t, and $\ln(tariff_{it}^{eu})$ is the natural log of tariff that South African exporters face in the EU market. The tariff variable is treated as $1+tariff_{it}^{eu}$ to enable us to take the logs. This is the tariff charged for South African exporters in the EU market. $Z_t$ is a vector of control variables that varies over time but not at the product level, for example real effective exchange rate, gross domestic product and foreign direct investment. $\lambda_i$ is a product fixed effect. Some of the estimations have product fixed effects, which implies that the study is looking at effects within products, and coefficients are being identified by changes in tariffs. The product fixed effects also address the problem of some variables that do not have data that varies at the tariff line or product level. $\theta_t$ is time-fixed effects. In equation (1) the coefficient of interest is $\beta_1$. A priori, $\beta_1$ should be negative – as a tariff reduction leads to an increase in trade margins.

Due to the way this section measures the extensive margin, it is not easy to find the corresponding measure of the intensive margin. As a result, the proxy for the intensive

margin[8] is the volume of export in US$ for product *i* (see Baier & Bergstrand, 2001; Disdier *et al*., 2013)

***For intensive margins,***

$$\ln(im_{it}) = \alpha_0 + \alpha_1 \ln(tariff_{it}^{eu}) + Z'_t\varsigma + \lambda_i + \theta_t + \varepsilon_{it} \quad (2)$$

$im_{it}$ is the export-intensive margin, - the value of the export of product *i*. The coefficient of interest is $\alpha_1$ and a priori has a negative relationship with the volume of exports.

The study controlled for omitted variable bias by including other control variables, which are captured by *Z*.

$$Z_t = f(\ln(reer_t), \ln(sagdp_t), \ln(eugdp_t), \ln(fdi_t)) \quad (3)$$

The other control variables are defined as follows: $\ln(sagdp_t)$ is the natural log of South African Gross Domestic Product (GDP) per capita at time *t*, $\ln(eugdp_t)$ is the natural log of EU GDP per capita at time *t*, $Lfdi_t$ is the natural log of foreign direct investment into SA at time t, $\ln(reer_t)$ is the natural log of the real effective exchange rate of South Africa at time *t*, $\theta_t$ represents time-fixed effects and $\varepsilon_{it}$ is the error term.

Since the dependent variable in the above models is a count variable, it means that a model for count data is more appropriate. The above OLS-specified equation model can be represented by the Poisson estimation methodology (see Dennis & Shepherd, 2011; Persson & Wilhelmsson, 2013). The density of the Poisson distribution is given as

$$f(em_i | tariff_i^{eu}, Z, \lambda_i, \theta_t) = \frac{\exp^{-\mu_i} \mu_i^{em_i}}{em_i!} \quad (4)$$

where $\mu_i$ is the intensity parameter and $Z$ represents other control variables as specified in Equation 3 above. The Poisson distribution is characterised by equidispersion, that is the mean [$E(em_i) = \mu_i$] is equal to the variance [$V(em_i) = \mu_i$]. This is not always the case; hence

[8] This measure is no longer common, as new measures by Hummels and Klenow are used. We use the new measures at country level regressions.

others have estimated alternative models, such as the negative binomial model. The regression model specifies the respective parameters of the Poisson to vary across products according to a specific function of the regressors, with usual Poisson distribution specified as

$$\mu_i = \exp\left(\beta_0 \ln(tariff_i^{eu}) + \lambda_i + \theta_t + X\beta\right) \quad (5)$$

$\beta$ denotes a matrix of coefficients of the control variables to be estimated.

In OLS regression the dependent variable is in logs, while it is in levels in the Poisson regressions. The independent variables are the same for both OLS and Poisson regressions.

For robustness checks the study estimated the above models using different harmonised system (HS) standard product group classifications. These first two classifications are from the WITS data base.[9] The first classification is the UNCTAD stages of processing (SoP), which groups products along the production chain. Stage 1 has raw material products, stage 2 intermediate products, stage 3 has consumer products and stage 4 has capital products. The second classification uses the World Trade Organization Harmonised System Classification, which categorises products into agricultural versus industrial. The third classification is from Rauch (1999). This classification groups goods into those traded on an organised exchange (homogeneous goods), reference priced and differentiated products.[10] Rauch (1999) has two versions: the liberal and the conservative classification. The conservative minimises the number of products classified as reference priced, while the liberal maximises them.

**Dummy variable approach – Intensive and extensive margin**

The study measured the export-extensive margin exploiting dummy variable 0 or 1, with 1 showing that the product was traded in a certain year. The definition of a new product/good is as follows: a product *i*, exported to the EU, is considered new if exports in 2005 were positive and they were zero in 1995; 1995 is taken as the benchmark year. This is important since it represents years before the implementation of SA-EU FTA. The year 2005 is chosen specifically since it represents the period of implementation of the FTA. A product *i*, exported to the EU, is considered disappearing if exports in 2005 were zero but were positive in 1995. To check for robustness, the study used different years as the start and end period, for example considering 1995 and 2010. Only products that have been consistently defined

[9] http://wits.worldbank.org/referencedata.html

[10] http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/TradeData.html#Rauch

from 1988 to 2012 are used. The estimation methodology is similar to that of Debaere and Mostashari (2010) and uses a Probit estimator.

***For extensive margins***

Let $x_{it}$ be an indicator variable that is 1 when South Africa exported product *i* to EU in 2005 and 0 otherwise. This is stated as

$$x_{it} = 1[x_{it}^{*} > 0]$$

$$x^{*}_{it} = \psi_0 + \psi_1 \Delta \ln(1 + tariff_{it}^{eu}) + \psi_2 status95_{it} + \psi_3 \Delta \ln(1 + tariff_{it}^{sa}) + \phi_i + \theta_t + \varepsilon_{it} \quad (6)$$

where $x^{*}_{it}$ is a latent variable whose values determine whether or not a product will be exported in 2005. This dependent variable is a probability of recording a new trade flow in 2005. $\ln$ is the natural logarithm, and $\Delta \ln(1 + tariff_{it}^{eu})$ is the change in natural log of the tariff imposed by the EU on South African product *i*. $status95_{it}$ is a dummy variable that is 1 if product *i* was exported by South Africa to the EU in 1995. This variable means that, if the trade relation already existed in 1995, it should continue to exist in 2005, as the fixed cost associated with starting a new trade relation would already have been incurred. $tariff_{it}^{sa}$ is South Africa's average import tariff of product *i* – this may affect SA's ability and competitiveness to acquire intermediate goods. $\phi_i$ is the product-specific fixed effects (that capture product characteristics that are constant over time and not observable) and $\theta_t$ is time-fixed effects. The South African imports tariff data is obtained from Edwards (2005). This data is disaggregated according to the EU, SADC, MFN and EFTA and has been updated yearly up to 2010. This study can carry out robustness checks using both MFN alone and the EU preference tariff merged with MFN that exist pre-2000. Other robustness checks that can be done include splitting the sample according to those products that have not been traded in the base year (1995) or those traded in 1995 (see Debaere & Mostashari, 2010).

On the above equation, the coefficient of interest is $\psi_1$ and is expected to have a negative sign.

***For the intensive margin***

The intensive margin (using the dummy variable approach) differs from the extensive margin on the dependent variable. In this case the intensive margin is defined as products that are exported both in 1995 and 2005. The existing literature provides show the dependent variable to be the change in the logarithm of the value of bilateral exports of good *i* from South Africa to the EU between 1995 and 2005 ($\Delta \ln(X_{it})$). The focus is only on those trade flows that are strictly positive in both 1995 and 2005 (Disdier *et al*., 2013). The same independent variables are used for the extensive and intensive margin:

$$\Delta \ln(X_{it}) = \gamma_0 + \gamma_1 \Delta \ln(1 + tariff_{it}^{eu}) + \gamma_2 status95_{it} + \gamma_3 \Delta \ln(1 + tariff_{it}^{sa}) + \varepsilon_{it} \quad (7)$$

The intensive margin equation (7) is estimated using OLS. The coefficient of interest is $\gamma_1$, which is expected to be negative a priori. For a robustness check on both the extensive and intensive margin it is possible to change the base year, for example from 1995 to 1990, and the reference year from 2005 to 2010.

### *3.3.2 Country-level estimations*

This section presents the econometric specification at country level. At this level the study used the extensive and intensive margin calculated using the Hummels and Klenow measure. The Hummels and Klenow extensive margin is defined as a weighted count of products that South Africa exports to a trading partner relative to the products exported by South Africa to the rest of the world.

To estimate the model for the country-level export **extensive margins of trade**, the study used the following equation:

$$\ln(em_{jt}) = \vartheta_0 + \vartheta_1 \ln(wtariff_{jt}) + \vartheta_2 fta_{jt} + \vartheta_3 Z_{jt} + \lambda_j + \theta_t + \varepsilon_{jt} \quad (8)$$

***For the intensive margins:***

$$\ln(im_{jt}) = \varpi_0 + \varpi_1 \ln(wtariff_{jt}) + \varpi_2 fta_{jt} + \varpi_3 Z_{jt} + \lambda_j + \theta_t + \varepsilon_{jt} \quad (9)$$

where ln is the natural logarithm, $em_{jt}$ is the export-extensive margin of South Africa with trading partner *j* at time *t*, as calculated from the methods of Hummels and Klenow (2002).

$\vartheta_1$ and $\varpi_1$ are the coefficient of interest and were expected to be negative; $fta_{jt}$ is the dummy variable equal to 1 for countries in the EU and 0 if not in the EU bloc, and $wtariff_{jt}$ is the weighted average tariff on all products of trading partner *j* (overall tariff faced by South African exporters in trading partner j). $Z_{jt}$ is a vector of control variables like distance, common language, border, colonial relationship and GDP per capita of other countries. $\lambda_j$ is the country fixed effects and $\theta_t$ is the time-fixed effects. Using a dummy variable captures all other aspects related to FTA, such as fixed cost and variable cost. These costs are due to the rules of origin or changes in traders' costs due to a modification of non-tariff barriers under FTA (Feenstra & Kee, 2007; Scoppola, Raimondi & Olper, 2013). The study also interact dummy variables and tariffs to capture the effect of tariff on trade margins during the trade liberalisation period (see Scoppola *et al*., 2013). The study considered the original 15 EU countries.

### *3.3.3 Product–country-level estimations*

This section presents the estimation exploiting the trade margins from the dummy variable approach at the country-product level. The study used the Probit estimation approach, following Debaere and Mostashari (2010) and Moncarz (2010) when using the dummy variable as the dependent variable. The definition of a new product (extensive margin) is as follows: A product *i*, exported to country *j*, is considered new if exports in 2005 were positive and in 1995 were zero. A product *i*, exported to country *j*, is considered disappearing if exports in 2005 were zero and in 1995 were positive. Similarly, the intensive margin is defined as products that are exported in 1995 and 2005.

Let $x_{ijt}$ be an indicator variable that is 1 when South Africa export product *i* to trading partner *j* in 2005, and 0 otherwise. This is stated as

$$x_{ijt} = 1[x_{ijt}^{*} > 0] \tag{10}$$

$$x^{*}_{ijt} = \kappa_0 + \kappa_1 status95_{ijt} + \kappa_2 \Delta \ln(1 + tariff_{ijt}^{tp}) + \kappa_3 \Delta In(1 + tariff_{ijt}^{sa}) + Z_{ijt}\kappa_z + \gamma_j + \phi_i + \theta_t + \varepsilon_{ijt}$$

where $x^{*}_{ijt}$ is the latent variable whose values determine whether or not a product will be exported to country *j* in a selected year, for example 2005. $\Delta \ln(1 + tariff_{ijt}^{tp})$ is the change in natural log of the tariff imposed by trading partner j on South African exports of product i.

$tariff_{ijt}^{tp}$ is the tariff of product i faced by South African exporters when exporting to a trading partner j (foreign tariff). The tariff at the HS6 digit level is different from the one used in the country regression in Equations 8 and 9, but similar to the one used under product-level estimation, as in Equations 1 to 7. The only difference is that, unlike the one used in Equation 1, the focus now is on individual trading partners, including EU countries. $status95_{ijt}$ is a dummy variable that is equal to 1 if product *i* was exported by South Africa to a trading partner in 1995. $Z_{ijt}$ is the vector of country-specific explanatory variables. For example, the change in natural log of GDP per capita between the selected period, $tariff_{ijt}^{sa}$, is South Africa's import average tariff of product *i* – this may affect SA's ability and competitiveness to acquire intermediate goods. $\gamma_j$ is country-specific effects, $\phi_i$ is product-specific effects, and $\theta_t$ is time-fixed effects.

The coefficient of interest in Equation 10 is $\kappa_2$ and it is expected to have a negative relationship with the extensive margin.

### 3.4 Data Sources and Descriptive Statistics

The most important combined datasets are the tariffs and trade data at the HS6 digit level; the main source of tariff data is World Integrated Solution (WITS), the World Bank statistics portal.[11] The study uses tariff data from Trade Analysis and Information System (TRAINS) database. The advantage of this data is that it covers 165 countries, including the European Union as a trading block. It makes it easy to use the data since the study also focuses on the EU as a block in some of the regression analysis at product level. The study effectively uses applied rates rather than bound tariffs. At trading partner (country) level, the study uses the applied import tariff rate, which is the weighted mean of all products from the World Bank. This gives a tariff that is not disaggregated at product level. At the product-trading level the study used the TRAINS data, utilising the tariff imposed on South Africa exports by different trading partners. This is at the HS6 digit level. The trade data used to calculate the trade margin is from COMTRADE and SARS. The other control variables, for example Gross

[11] WITS comprise data from the WTO Integrated Database (IDB), the WTO Consolidated Tariff Schedules (CTS) and the Trade Analysis and Information System (TRAINS).

Domestic Product (GDP) per capita, GDP growth rate, foreign direct investment and real effective exchange rate, are from the World Bank Development Indicators. Gravity model variables like distance, contiguity, common language and colony ties are from Centre d'études prospectives et d'informations internationals (CEPII), 2014. Appendix 2.1 shows the definition of the variables and where they were used in the regression. The study period is from 1988 to 2012.

### *3.4.1 Descriptive statistics*

The descriptive statistics of the data at both product and country level are in Appendixes 2.2 and 2.3. Appendix 2.2 shows the descriptive statistics for data at the product level. The extensive margin measure is bounded from below by zero and at the upper end by the number of the original 15 EU countries. The graphical representation for the selected HS6 product line is in Appendix 1. The log tariff ranges from 0 to 0.64. All the variables presented are in logs, except for extensive margin (*em*) and the EU GDP growth. Appendix 2.2 shows the variables used in the trading partner regression level. For trading partner level regression, the dependent variables were measured using the Hummels and Klenow measure. This showed that the extensive margins ranged from 0 to 0.92. Of the 159 trading partners selected, at some point South Africa exported most of its products to one of the countries, as 0.92 is close to 1. The intensive margin is smaller than the extensive margin as it ranges from 0 to 0.37. Figure 25 shows the graphical representation of the average extensive margin both a product and trading partner level and average tariff rates over years.

**Figure 25: Extensive margin and tariffs**

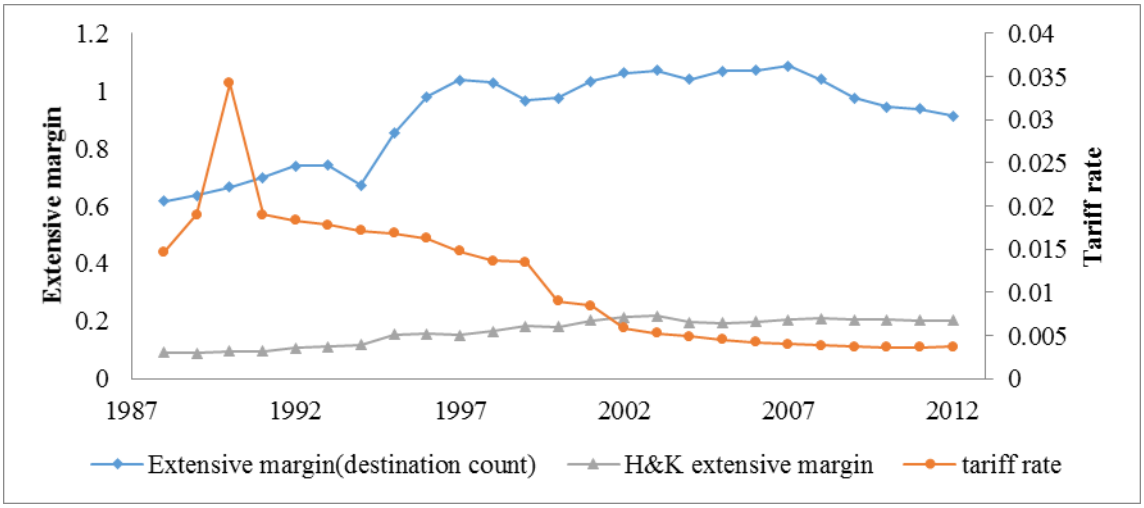
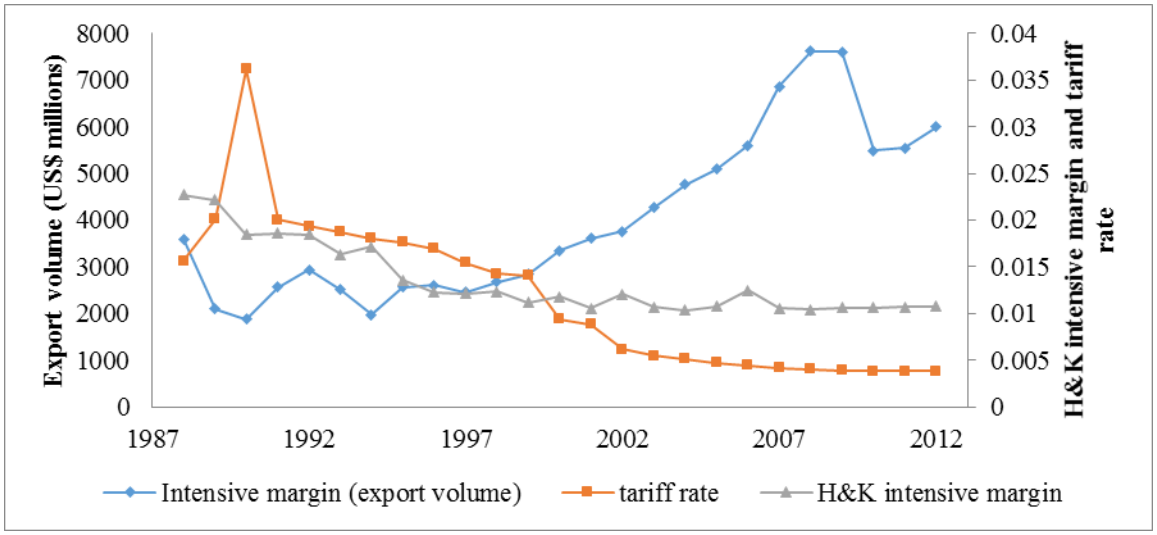


Figure 25 shows a decline tariff rates over time while the extensive margin as measured by destination count has been increasing although the beginning of this increase predates the FTA. This trend is similarly observed for the extensive margins at trading partner calculated when using the Hummels and Klenow (2005) measure. The trend is also present when using the average tariff from trading partner (not reported here).

For the intensive margin Figure 26 shows the relationship between the Hummels and Klenow extensive margin measure, trade volume (intensive margin) and tariff.

**Figure 26: intensive margin**




There is negative correlation between trade volume and tariff, for example the increase in tariff in 1990 corresponds to a drop in trade volume. This pattern is not observed for the intensive margin calculated using Hummels and Klenow method. Rather the intensive margin has been decreasing until around 1997, and then it fluctuates thereafter. This trend is the same when we use the average tariff from trading partners (graph not shown here).

### 3.5 Results

3.5.1. Product level- Base results

Table 11 shows baseline results at both the extensive, using Poisson and OLS estimators, and intensive margins. The way in which the extensive margins is measured, by counting the number of destinations, means that it is not easy to obtain the corresponding intensive margins measure. Instead, the study presents the intensive margins results using trade volumes, as in the existing literature (Baier and Bergstrand, 2001; Disdier et al., 2013; Dutt et al., 2013). Since the dependent variable is not bounded, the study uses only the OLS estimation for the intensive margin. The table also shows results obtained when using dummy variable as dependent variable; the coefficients are interpreted from given independent variables in the fifth column.

Table 11: Product Level Base line results

| | Extensive margin | | Intensive margin | Dummy variable Results- marginal effects | | |
|---|---|---|---|---|---|---|
| | Poisson | OLS | OLS | | Extensive-Probit | Intensive-OLS |
| ln(tariff) | -0.59*** | -0.60*** | -0.24*** | $\Delta$ ln(tariff) | -0.46*** | -2.73 |
| | (0.100) | (0.074) | (0.022) | | (0.041) | (2.396) |
| ln(real effective exchange rate) | -1.03*** | -0.71*** | -0.56*** | ln(South Africa tariff | 0.15*** | -2.36** |
| | (0.018) | (0.014) | (0.111) | | (0.013) | (1.085) |
| Foreign direct investment | 0.017*** | 0.015*** | 0.021** | status_95 | 0.13*** | 0.94*** |
| | (0.002) | (0.001) | (0.009) | | (0.003) | (0.228) |
| EU Gross Domestic Product | 0.010*** | 0.0065*** | 0.00043 | | | |
| | (0.001) | (0.001) | (0.008) | | | |
| SA Gross Domestic Product | 0.43*** | 0.059*** | -1.38*** | | | |
| | (0.025) | (0.018) | (0.171) | | | |
| Constant | | 3.68*** | 17.3*** | | | 4.90*** |
| | | (0.183) | (1.685) | | | (0.221) |
| *N* | 96150 | 97 250 | 18140 | | 41 513 | 1 223 |
| $R^2$ | | 0.065 | 0.020 | | | 0.022 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11 shows that a reduction in tariffs is associated with an increase in the number of destinations to which South Africa exports. The impact of tariff is negative for both the extensive and intensive margin using both destination count and dummy variable as a dependent variables. However it is not significant for the intensive margin when using the dummy variable. This is similar to Feenstra and Kee, (2007) which finds that tariff reduction associated with NAFTA led to an increase in Mexican export variety. For the dummy

variable results, the marginal effects on tariff variable shows that it is negative, as expected. It shows that a 1% change in tariff ( $\Delta \ln(tariff)$ ) is associated with a 0.46% increase in exports for all products at the extensive margin. However this is insignificant for the intensive margin. The variable that controls for whether good i was or was not exported in 1995 is always positive and statistically significant, as expected. The coefficients for the marginal effects imply that, on average, the fact that good *i* was exported in 1995 increases the probability of it being exported in 2005, for example, by 0.13% for extensive margin. These results are in line with what Debaere and Mostashari (2010) find, namely that already traded goods would have succeeded in overcoming fixed costs, hence their ability to continue being traded after tariff changes. The import tariff coefficient is positive for the extensive margin; it shows that a reduction in import tariff by South Africa led to less exports both at the extensive margin. This however, is the opposite for intensive margin.

### 3.5.2. Products level results- Different Product classification

To investigate the effects across products with different characteristics Table 12 shows the results using two different product classifications; the UNCTAD SoP (for Panel A) and the conservative Rauch, (1999) classification (for panel B). The smaller number of observations shown under the Rauch classification is because some products do not appear in Rauch's classification.

Panel A shows that a reduction in tariff is associated with an increase in the number of destinations to which South Africa exports across all products groups of the UNCTAD classification. The results show consistency of significance on coefficients for different products on the intensive margin than extensive margin. For example, under extensive margin the impact of changes in tariff on consumer products is insignificant. These results suggest that consumer products did not benefit much from the tariff cuts that came about as a result of the SA-EU FTA. These results are in line with Cipollina *et al*. (2013), who find that preference schemes have differentiated impacts on different products. The products in which South Africa has a high comparative advantage (abundance in) are significant, for the effect on capital goods is 1.73 and on raw material is 0.96 all under extensive margin. The other control variables, has the expected sign. For example, the exchange rate has the expected negative sign, as expected from the theory. As the exchange rate appreciates, exports trade

margins decrease. Largely, the study finds that tariff reduction is associated with an increase in both the extensive and intensive margin of export. This is in contrast to the findings of Disdier *et al*. (2013), who find that most of the coefficients were not significant across the respective products groups.

The results from using the Rauch classification (Panel B) confirm the negative effect of tariffs on the two export margins. This is in line with the findings obtained using the UNCTAD SoP classification. It shows that tariff cuts are associated with an increase in the number of countries to which South Africa exports and the volume of already traded goods.. However, for the extensive margin the impact is not uniform across products. It is significant for differentiated commodities, but not for homogenous and reference priced products. The results support (Van Biesebroeck and Yi, 2012) findings, which show that differentiated goods have the most sensitive tariff-extensive margin elasticity, followed by reference-priced goods and then homogenous goods. Further, this finding, which shows different tariff responsiveness between homogeneous and differentiated goods, is consistent with a variety of models, ranging from the "new" trade theory of Krugman (1979) to the "new new" trade theory of Melitz (2003). These models show that consumers and firms react more to trade incentives for differentiated goods than for homogenous goods.

**Table 12: Different Product Level results**

Panel A: Extensive margin (Destination count measure) and Intensive (Volume of Exports) – UNCTAD SoP classification

| | Extensive margin- Poisson coefficient | | | | Intensive margin-OLS | | | |
|---|---|---|---|---|---|---|---|---|
| | Capital | Consumer | Intermediate | Raw material | Capital | Consumer | Intermediate | Raw material |
| In(tariff) | -1.73*** | -0.15 | -0.58** | -0.96*** | -0.61*** | -0.14*** | -0.17*** | -0.25*** |
| | (0.407) | (0.127) | (0.251) | (0.269) | (0.070) | (0.035) | (0.038) | (0.055) |
| In(real effective exchange rate) | -0.86*** | -1.22*** | -1.07*** | -0.57*** | -2.15*** | -0.79*** | 0.064 | -0.75*** |
| | (0.035) | (0.028) | (0.038) | (0.060) | (0.442) | (0.187) | (0.165) | (0.252) |
| Foreign direct investment | 0.021*** | 0.016*** | 0.013*** | 0.019*** | 0.059* | 0.020 | 0.0045 | 0.0080 |
| | (0.003) | (0.003) | (0.004) | (0.005) | (0.031) | (0.015) | (0.015) | (0.023) |
| EU Gross Domestic Product | 0.0063*** | 0.0079*** | 0.019*** | 0.019*** | 0.030 | -0.020 | -0.00043 | 0.045*** |
| | (0.002) | (0.002) | (0.003) | (0.004) | (0.035) | (0.014) | (0.011) | (0.017) |
| SA Gross Domestic Product | 0.33*** | 0.87*** | 0.11** | 0.44*** | -4.86*** | -1.86*** | -0.57** | -0.84** |
| | (0.048) | (0.039) | (0.053) | (0.085) | (0.874) | (0.335) | (0.242) | (0.350) |
| Constant | | | | | 52.9*** | 22.9*** | 2.73*** | 14.0*** |
| | | | | | (8.013) | (3.167) | (0.812) | (3.481) |
| *N* | 19625 | 31200 | 36425 | 8900 | 2202 | 6990 | 6712 | 2236 |
| $R^2$ | | | | | 0.171 | 0.016 | 0.004 | 0.028 |

Panel A: Extensive margin (Destination count measure) and Intensive (Volume of Exports) – Rauch (1999) classification

| | Extensive margin- Poisson coefficient | | | Intensive margin- OLS | | |
|---|---|---|---|---|---|---|
| | Differentiated | Reference | Homogenous | Differentiated | Reference | Homogenous |
| In(tariff) | -0.91*** | -0.41 | -1.15 | -0.35*** | -0.16*** | -0.28* |
| | (0.254) | (0.268) | (1.462) | (0.066) | (0.057) | (0.156) |
| In(real effective exchange rate) | -1.09*** | -0.81*** | -0.52*** | -1.49*** | -0.93*** | -0.26 |
| | (0.041) | (0.080) | (0.158) | (0.380) | (0.229) | (0.670) |
| Foreign direct investment | 0.015*** | 0.019*** | 0.020 | 0.051* | -0.011 | 0.12* |
| | (0.004) | (0.007) | (0.015) | (0.030) | (0.021) | (0.063) |
| EU Gross Domestic Product | 0.010*** | 0.012** | 0.025** | 0.030 | 0.0051 | 0.071* |
| | (0.003) | (0.006) | (0.011) | (0.028) | (0.015) | (0.041) |
| SA Gross Domestic Product | 0.88*** | 0.11 | 0.41* | -3.09*** | 0.21 | 2.32*** |
| | (0.056) | (0.113) | (0.210) | (0.609) | (0.307) | (0.865) |
| Constant | | | | 36.1*** | 6.21** | -15.5* |
| | | | | (5.864) | (3.103) | (8.979) |
| *N* | 13100 | 6125 | 1475 | 2102 | 2173 | 273 |
| $R^2$ | | | | 0.065 | 0.023 | 0.092 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

*Robustness checks*

The study further estimates the extensive margin regression equation using OLS as in Appendix 3 and Appendix 4. The results largely confirm the results the study finds using the Poisson estimation. The results still show a negative sign on the tariff coefficient across products. For example, consumer goods still turn out to be insignificant. Appendix 4 results confirm that the response of homogenous products to tariff reduction is insignificant. Appendix 5 shows the other robust checks for verifying if the results hold for another different product classification, namely the WTO HS classification. This disaggregates products into agricultural and industrial. The same procedure is followed, estimating the same regression using both OLS and Poisson. The results are in line with the findings when using the UNCTAD SoP and Rauch product classifications. The results show a negative relationship between tariff reduction and the export-extensive trade margin for both industrial and agricultural products. However, the coefficient for industrial products is insignificant. This supports the prediction by Lewis *et al*. (1999 that the sectors that will tend to benefit most are those that initially are highly protected, in this case the agriculture sector with a coefficient of -1.73, which is significant, versus the industrial sector with a coefficient of -0.15, which is not significant. All other control variables have the expected sign and are

significant. The study also estimated the same regression using OLS, and the results did not differ from the ones obtained using Poisson estimation.

For the intensive margin, the study estimated export volumes using the WTO HS classification, which disaggregates products into agricultural and industrial goods (as in Appendix 6). The same description of columns holds, that number 2 indicates regression with added control variables. The results confirm that tariff cuts have benefited South African exporters across products. They show that a decrease in tariff is associated with an increase in volume of exports of industrial products and agricultural products to many EU countries.

3.5.3. Trading partner (country) level results

Table 13 shows the OLS results from estimating Equation 8 and 9 at trading partner level Column 1 shows the regression with tariff and other controls variables as independent variables, Column 2 introduce the free trade area dummy variable. The exclusion of tariffs under Column 2 is to observe the effect of the FTA dummy on its own. Column 3 introduces the interaction between the FTA dummy and the tariff. This is the same for both extensive and intensive margin. This estimation uses a different tariff dataset, since it exploits the average import tariff of each trading partner of South Africa from the World Bank, rather than from the TRAINS, dataset.

Table 13: OLS regression: Trading partner level

| | Extensive margin | | | Intensive margin | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 1 | 2 | 3 |
| ln(wtariff) | -0.12** | | -0.26*** | -0.23*** | | -0.38*** |
| | (0.055) | | (0.033) | (0.054) | | (0.036) |
| ln(distance) | -1.32*** | -1.94*** | -1.67*** | -0.69*** | -0.86*** | -0.69*** |
| | (0.108) | (0.057) | (0.086) | (0.087) | (0.070) | (0.082) |
| Language | 0.28*** | -0.11* | 0.15* | 0.072 | -0.074 | -0.063 |
| | (0.089) | (0.054) | (0.081) | (0.086) | (0.048) | (0.093) |
| Colony | 1.19*** | 1.22*** | 1.38*** | 2.01*** | 2.05*** | 2.23*** |
| | (0.057) | (0.077) | (0.061) | (0.082) | (0.060) | (0.086) |
| ln(GDP) | 0.42*** | 0.67*** | 0.48*** | 0.32*** | 0.53*** | 0.37*** |
| | (0.045) | (0.025) | (0.050) | (0.032) | (0.019) | (0.034) |
| Free trade area dummy | | -0.0029 | | | -0.20*** | |
| | | (0.042) | | | (0.049) | |
| ln(real eff. exchange rate) | | -0.044 | | | 0.072 | |
| | | (0.272) | | | (0.201) | |
| Contiguity | | -9.57*** | -1.96*** | | -2.20** | 0.68 |
| | | (0.585) | (0.617) | | (0.844) | (0.538) |
| fta*ln(tariff) | | | 0.16*** | | | 0.16*** |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | (0.033) | | | (0.028) |
| Constant | 5.86*** | 9.69*** | 8.29*** | -2.38*** | -1.98 | -2.93*** |
| | (0.851) | (1.395) | (0.668) | (0.711) | (1.214) | (0.751) |
| *N* | 1 530 | 1 588 | 1 530 | 1 530 | 1 588 | 1 530 |
| $R^2$ | 0.278 | 0.387 | 0.301 | 0.213 | 0.239 | 0.231 |
| *Year Fixed Effects* | yes | yes | yes | yes | yes | yes |
| *Country Fixed Effects* | yes | yes | yes | yes | yes | yes |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The results in Table 13 shows that a reduction in tariff – lwtariff (weighted mean tariff) – is associated with an increase in varieties traded and is robust to different econometric specifications. This shows that a tariff reduction in South Africa's EU trading partner countries results in increases in the varieties exported by South Africa. For example, Column 3 shows that a 1% decline in tariff results in a 0.26% increase in exported varieties while it lead to 0.38% for already traded varieties (intensive margin). This is similar to existing empirical evidence (see Buono and Lalanne, 2012 results under OLS) The FTA dummy is not significant for the extensive margin. This finding contradicts what Foster *et al*. (2011) found, namely that PTAs are trade-creating, especially for the extensive margin.

3.5.4. Product- Country results

Table 15 shows the results obtained from estimating Equation 10. The three broad columns show estimations firstly for the full sample period, while the second column considers only products traded in 1995. This tested persistence in trade. The third column estimated for those goods not traded in 1995.

**Table 14: Extensive margin – marginal effects: Product-trading partner level**

| | **Full sample** | | | **Traded in 1995** | | | **Not traded in 1995** | | |
|---|---|---|---|---|---|---|---|---|---|
| | Poisson | Probit | OLS | Poisson | Probit | OLS | Poisson | Probit | OLS |
| **Δ ln(tariff)** | -0.059*** | -0.079*** | -0.094*** | -0.084* | -0.091* | -0.088* | -0.077*** | -0.083*** | -0.10*** |
| | -0.015 | -0.018 | -0.021 | -0.048 | -0.054 | -0.051 | -0.015 | -0.018 | -0.023 |
| **status_95** | 0.34*** | 0.36*** | 0.52*** | - | - | - | - | - | - |
| | -0.008 | -0.007 | -0.013 | - | - | - | - | - | - |
| **ln(distance)** | -0.055*** | -0.056*** | -0.060*** | -0.042* | -0.040* | -0.041* | -0.063*** | -0.060*** | -0.065*** |
| | -0.009 | -0.008 | -0.009 | -0.025 | -0.024 | -0.024 | -0.009 | -0.009 | -0.009 |
| **N** | 9 615 | 9 615 | 9 615 | 1 548 | 1 548 | 1 548 | 8 067 | 8 067 | 8 067 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The results show that a change in tariff and status of products in 1995 (status_95) has the expected sign and is significant. The coefficient for change in tariff variable ( $\Delta \ln(\text{tariff})$) has the expected negative sign, as confirmed from the product-level analysis. The coefficient of the 1995 status is positive. This shows that the probability that the product that was initially traded before the trade agreement will continue being exported after the trade agreement is high. The distance coefficient carries the expected sign and is significant. Further, the estimation only for products traded in 1995 shows the expected sign, but is significant at the 10% level. It shows persistence in trade. The last column, which shows products not traded in 1995, also displays the expected sign for tariff coefficient across the estimation methods. It shows that there were new products that were largely traded. The results of this section are robust to different estimation techniques.

## 3.6 Conclusion

This chapter investigates the impact of tariff reduction due to the SA-EU FTA on the extensive and intensive export margins, exploiting different ways of measuring trade margins. The paper estimates the impact of tariff reduction at the product, country-level and product-country level. The results largely show that foreign tariff reduction leads to an increase in both the extensive and the intensive margin.

The results at the product level are disaggregated into various product groups according to the UNCTAD SoP, and Rauch (1999) classifications. The results show that a decrease in tariff is not associated with an increase in the number of countries exported for all product types. However for intensive margin it shows that reduction in tariff led to increase in volume of all traded products. This shows that South African exporters have been expanding exports of already traded (intensive margins) as compared to extensive margin.

The results disaggregated according to capital, consumer, intermediate and raw materials show the importance of tariff reductions in driving trade among these product categories. The results show that it is only consumer goods that do not respond significantly to tariff reduction. This suggests that South Africa does not export much of these categories, as they may be easily manufactured in the EU market. These results are confirmed under the Rauch

classification, since homogenous products show a weaker relationship with tariff reduction. This shows that similar products are less responsive to a tariff reduction.

The importance of tariff reduction is also shown on the results at country level, for both the intensive and extensive margins. These results show that tariff changes lead largely to an increase in the number of varieties traded and volumes of already traded goods and are robust to different specifications. The importance of tariff reduction is also observed at the product-country level. The results are robust to the use of different estimators. Also, the impact of tariff liberalisation is enhanced if the commodity was traded before the trade agreement. This implies that the SA-EU FTA was largely beneficial where there were pre-existing trade flows.

This chapter focuses largely on tariffs from a trade agreement perspective; further research should focus on comparing the differential impacts of tariff reductions across regional trade agreements. This will help to discover if the tariff reductions have different impacts from one region to the other. Other future research could be to carry out a study of the impact of tariff on trade margins without necessarily focusing on the trade agreement perspective.

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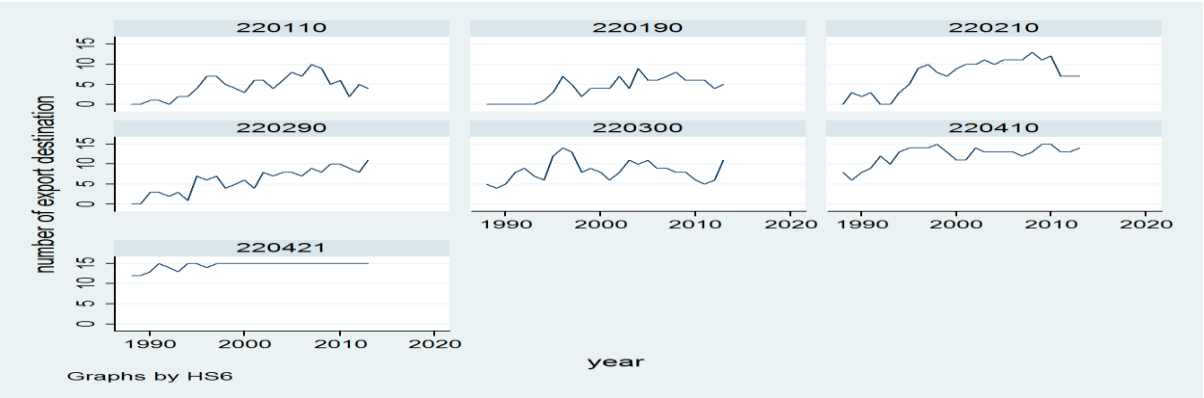
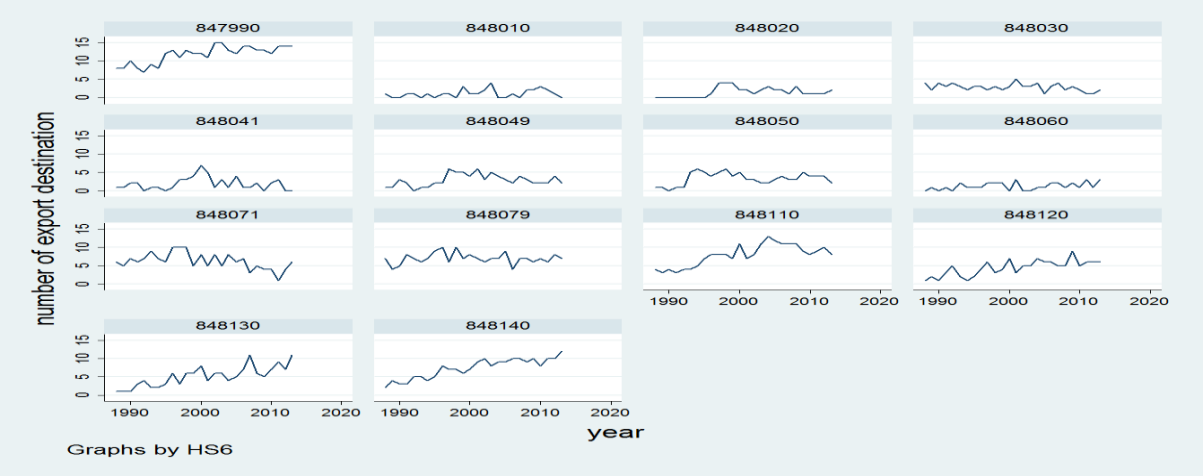
**Appendix 1: Geographical extensive margin, focusing on 15 EU member countries**

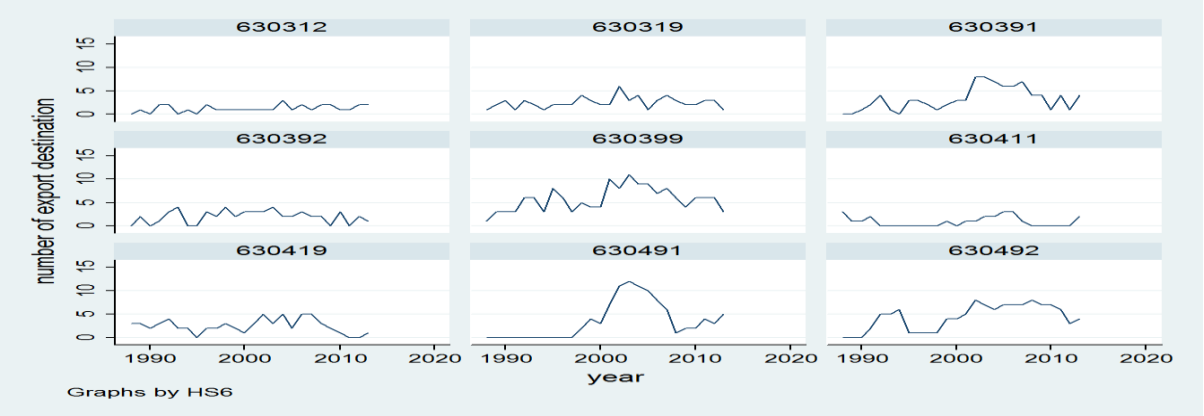
*Prepared foodstuff, beverages, spirits and vinegar: Beverages, spirits and vinegar*




*Machinery and parts*




*Textile and textile articles: Other made textiles articles*




## Appendix 2.1: Definitions of variables

| Variable | Definition | Regression level |
|---|---|---|
| Tariff (at HS6) | Tariff at HS6 digit code. It is effective applied rate. The same dataset also contains preferential rates | Product level |
| Extensive margin (em) – geographic | Number of destinations to which South Africa exports | Product level |
| Intensive margin (im) | Change in value (US$ millions) of HS6 products exported by South Africa from 1995 to 2005 | Product level |
| Tariff-(wtariff)-trading partner level | Simple mean applied tariff is unweighted average of effectively applied rates for all products subject to tariffs calculated for all traded goods | Trading partner |

| | | |
|---|---|---|
| Extensive margin (em) – trading partner | This is as calculated in Chapter 1 using the Hummels and Klenow approach | Trading partner |
| Intensive margin (im) – trading partner | This is as calculated in Chapter 1 using the Hummels and Klenow approach | Trading partner |
| Real exchange rate (reer) | This is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs | Trading partner and product level |
| GDP per capita (US$) | The gross domestic product (final value of all goods and services produced in the country) divided by midyear population | Trading partner and product level |
| Foreign direct investment (FDI) | Net inflows of investment to acquire a lasting management interest in an enterprise operating in an economy other than that of the investor | Trading partner and product level |
| Distance | Distance between major capital cities between countries – calculated following the great circle formula, which uses latitudes and longitudes of the most important cities | |
| Free trade area (fta) | Dummy variable equal to one after EU-SA trade agreement | Trading partner and product level |
| Contiguity | Dummy variables indicating whether the two countries are contiguous (neighbours) | Trading partner |

**Appendix 2.2: Descriptive statistics: Product-level regressions**

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| ln (extensive margin) | 97250 | .9147358 | .8027761 | 0 | 2.772589 |
| Extensive margin | 97250 | 2.473018 | 3.021525 | 0 | 15 |
| ln(tariff) | 97250 | .0112053 | .0308278 | 0 | .6418539 |
| ln(real effective exchange rate) | 97250 | 4.602368 | .1399344 | 4.240811 | 4.815431 |
| ln(foreign Direct investment) | 89470 | 20.74092 | 1.958275 | 15.02686 | 23.01428 |
| SA GDP per capita | 97250 | 8.51255 | .0904586 | 8.405700 | 8.680199 |
| EU GDP per capita | 97250 | 10.15952 | .1283685 | 9.935317 | 10.32692 |
| EU GDP growth | 97250 | 1.952867 | 1.738284 | -4.414166 | 4.403027 |

**Appendix 2.3 Descriptive statistics: Country-level regression**

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Extensive margin (em) | 3532 | .160758 | .2149438 | 0 | .9240727 |
| Intensive margin (im) | 3197 | .0135771 | .026172 | 0.00000201 | .356216 |
| In(wtariff) | 3532 | .0338511 | .0625074 | 0 | .754101 |
| In(distance) | 3532 | 8.855813 | .7164191 | 5.546152 | 9.654922 |
| In(GDP per capita) | 3264 | 7.678776 | 1.607906 | 3.998296 | 11.12069 |

## Appendix 3: Product-level pooled OLS regression: Different products

| | All 1 | All 2 | Capital 1 | Capital 2 | Consumer 1 | Consumer 2 | Intermediate 1 | Intermediate 2 | Raw material 1 | Raw material 2 |
|---|---|---|---|---|---|---|---|---|---|---|
| In(tariff) | -1.99*** | -0.60*** | -3.57*** | -1.59*** | -2.06*** | -0.029 | -1.66*** | -0.51*** | -1.70*** | -1.26*** |
| | (0.073) | (0.074) | (0.323) | (0.320) | (0.102) | (0.102) | (0.137) | (0.141) | (0.228) | (0.234) |
| In(real effective exchange rate) | | -0.71*** | | -0.65*** | | -1.05*** | | -0.54*** | | -0.47*** |
| | | (0.014) | | (0.029) | | (0.025) | | (0.022) | | (0.044) |
| Foreign direct investment | | 0.015*** | | 0.019*** | | 0.020*** | | 0.0090*** | | 0.016*** |
| | | (0.001) | | (0.003) | | (0.002) | | (0.002) | | (0.004) |
| EU Gross Domestic Product | | 0.0065*** | | 0.0031* | | 0.0038** | | 0.0088*** | | 0.014*** |
| | | (0.001) | | (0.002) | | (0.002) | | (0.001) | | (0.003) |
| SA Gross Domestic Product | | 0.059*** | | 0.011 | | 0.41*** | | -0.086*** | | -0.37*** |
| | | (0.018) | | (0.038) | | (0.034) | | (0.029) | | (0.059) |
| Constant | 0.94*** | 3.68*** | 1.15*** | 4.02*** | 1.18*** | 2.41*** | 0.62*** | 3.82*** | 0.92*** | 6.13*** |
| | (0.002) | (0.183) | (0.003) | (0.382) | (0.003) | (0.338) | (0.003) | (0.290) | (0.006) | (0.589) |
| *N* | 97 250 | 97 250 | 19 650 | 19 650 | 31 250 | 31 250 | 37 275 | 37 275 | 9 075 | 9 075 |
| $R^2$ | 0.008 | 0.065 | 0.006 | 0.067 | 0.013 | 0.131 | 0.004 | 0.034 | 0.006 | 0.035 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

## Appendix 4: Product-level OLS regression: Using Rauch's (1999) classification

| | All 1 | All 2 | Differentiated 1 | Differentiated 2 | Reference 1 | Reference 2 | Homogenous 1 | Homogenous 2 |
|---|---|---|---|---|---|---|---|---|
| In(tariff) | -2.28*** | -0.92*** | -2.99*** | -1.16*** | -1.44*** | -0.86*** | -1.66 | 0.12 |
| | (0.156) | (0.154) | (0.215) | (0.208) | (0.229) | (0.233) | (1.030) | (1.046) |
| In(real effective exchange rate) | | -0.76*** | | -0.91*** | | -0.49*** | | -0.53*** |
| | | (0.029) | | (0.037) | | (0.053) | | (0.114) |
| Foreign direct investment | | 0.016*** | | 0.016*** | | 0.016*** | | 0.013 |
| | | (0.003) | | (0.003) | | (0.005) | | (0.011) |
| EU Gross Domestic Product | | 0.0064*** | | 0.0044* | | 0.0091*** | | 0.013* |
| | | (0.002) | | (0.002) | | (0.004) | | (0.008) |
| SA Gross Domestic Product | | 0.27*** | | 0.45*** | | -0.11 | | 0.21 |
| | | (0.039) | | (0.049) | | (0.071) | | (0.150) |
| Constant | 1.06*** | 2.25*** | 1.22*** | 1.56*** | 0.76*** | 3.94*** | 0.86*** | 1.46 |
| | (0.004) | (0.391) | (0.005) | (0.489) | (0.009) | (0.712) | (0.014) | (1.515) |
| *N* | 20 900 | 20 900 | 13 125 | 13 125 | 6 300 | 6 300 | 1 475 | 1 475 |
| $R^2$ | 0.011 | 0.085 | 0.015 | 0.126 | 0.007 | 0.037 | 0.002 | 0.039 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

## Appendix 5: Extensive margin – Poisson product-level regression: Agriculture versus industry

| | All 2 | Agriculture | Industry |
|---|---|---|---|
| In(tariff) | -0.59*** | -1.73*** | -0.15 |
| | (0.100) | (0.407) | (0.127) |
| In(real effective exchange rate) | -1.03*** | -0.86*** | -1.22*** |
| | (0.018) | (0.035) | (0.028) |
| Foreign direct investment | 0.017*** | 0.021*** | 0.016*** |
| | (0.002) | (0.003) | (0.003) |
| EU Gross Domestic Product | 0.010*** | 0.0063*** | 0.0079*** |
| | (0.001) | (0.002) | (0.002) |
| SA Gross Domestic Product | 0.43*** | 0.33*** | 0.87*** |
| | (0.025) | (0.048) | (0.039) |
| *N* | 96 150 | 19 625 | 31 200 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

## Appendix 6: Intensive margin – Volume of exports – OLS regression: Agriculture versus industry

| | All 1 | All 2 | Agriculture 1 | Agriculture 2 | Industry 1 | Industry 2 |
|---|---|---|---|---|---|---|
| In(tariff) | -0.30*** | -0.24*** | -0.21*** | -0.61*** | -0.32*** | -0.14*** |
| | (0.020) | (0.022) | (0.041) | (0.068) | (0.022) | (0.034) |
| In(real effective exchange rate) | | -0.55*** | | -2.05*** | | -0.81*** |
| | | (0.109) | | (0.430) | | (0.183) |
| Foreign direct investment | | 0.021** | | 0.060** | | 0.019 |
| | | (0.009) | | (0.030) | | (0.015) |
| EU Gross Domestic Product | | 0.0016 | | 0.039 | | -0.020 |
| | | (0.008) | | (0.035) | | (0.014) |
| SA Gross Domestic Product | | -1.48*** | | -5.20*** | | -2.04*** |
| | | (0.175) | | (0.885) | | (0.342) |
| Constant | 2.92*** | 18.2*** | 3.61*** | 55.3*** | 2.75*** | 24.5*** |
| | (0.062) | (1.707) | (0.115) | (8.051) | (0.072) | (3.209) |
| *N* | 18 616 | 18 616 | 3 312 | 2 286 | 15 304 | 7 208 |
| $R^2$ | 0.014 | 0.021 | 0.008 | 0.172 | 0.016 | 0.017 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

# Chapter 4: Tariff liberalisation and import trade margins: The case of South Africa

## 4.0 Introduction

A goal of trade liberalisation in the form of tariff reductions or trade preferences is to stimulate trade. However, existing empirical studies suggest that the impact of tariff reduction on trade volumes is ambiguous (Debaere & Mostashari, 2010; Tang, 2006). Further, the emergence of "new new" trade theory, emphasising the extensive and intensive margins of trade, brings a new dimension to analysing the impacts of tariff liberalisation. The extensive margin involves importing new goods that were not previously traded, while the intensive trade margin is the trading of already existing products to old trading partners (Amurgo-Pacheco & Pierola, 2008; Choi, Hummels & Xiang, 2006; Hummels & Klenow, 2002; 2005). The mechanism/channel through which tariffs affect imports differs from export, hence the need for this separate chapter on imports. For example the focus on export chapter was more on foreign tariff while the focus on imports is entirely on import tariff at the South African border. The analysis of exports and imports therefore needs different approaches. The impact of tariff liberalisation can differ across the import extensive and intensive trade margins and across products. For example, Frensch (2010) finds stronger extensive import margin effects of liberalisation for intermediate and capital goods compared to consumer goods for the European emerging economies. He however finds that trade liberalisation effects are considerably higher for the intensive than for the extensive margin.

Further the mechanism through which tariffs affect the import intensive and extensive margin is theoretically grounded. Krugman (1980), and heterogeneous firm models like those of Melitz (2003) and Chaney (2008), provide theoretical insights into how tariffs affect imports. Krugman (1980) shows that, due to the appetite for variety, consumers might demand imports even if the prices are high for the sake of satisfying variety needs. This theory therefore does not see tariff as an inhibiting factor in the demand for import variety. The most probable way in which tariffs affect imports is through the price effect. A tariff is a cost, so it leads to a decrease in the price of imports, which in turn leads to an increase in demand for imports.

Analysing the impacts of tariff liberalisation, focusing on import trade margins and tracking different products is important for the South African economy. South Africa's tariff liberalisation has not been uniform across countries and products. For example, some countries with trade agreements with South Africa, such as the countries of the South African Development Community (SADC), the European Union (EU) and the European Free Trade Association (EFTA) face preferential tariffs, while other countries face Most Favoured Nation (MFN) rates[12]. In the pre-trade agreements era (pre-2001), South Africa used MFN Principles as dictated by the World Trade Organization (WTO) tariff decrease. On a much broader note, South Africa's average tariff was approximately 23% in the early 1990s and by 2010 it stood at 8.2% (Department of industry and Trade, 2010). Furthermore, tariffs vary across products, giving differential effects across products and hence economy-wide differential effects. For example, in theory, more variety in consumer goods is associated with an increase in welfare effects (Brander & Krugman, 1983), while more intermediate inputs may aid production and improve product quality (Amiti & Konings, 2007), more capital goods may enhance the country's technology and change the country's production (Frensch & Gaucaite Wittich, 2009). Further, more manufacturing varieties may also enhance domestic competition and hence force firms to innovate and produce high-quality products (Fernandes & Paunov, 2013). On the flip side, if there are excessive imports, this may force domestic firms to close business. For example, Bernard, Redding and Schott (2011) established that excessive imports can push out of business low productivity firms and hence leading to an increase in overall productivity in the economy (see also Melitz, 2003).

Overall, the existing evidence suggests that tariff liberalisation effects on trade flows are not uniform across countries, trade margins and products. This study examines these potentially heterogeneous impacts and answers the following questions for the case of South Africa: do lower tariffs increase import volumes by raising imports from existing countries or already existing traded products? Do lower tariffs lead to an increase in imports from new countries or imports of new products not previously imported? Do South Africa's trade agreements promote extensive or intensive import margins? Although existing research has examined the

[12] MFN tariff rates is the tariff imposed by a country on members of the WTO (MFN rates are the highest that WTO members charge one another). This is in contrast to preferential rates, the rates imposed by a country on those countries that it has same trade agreement with (it is lower than MFN rates)

impact of trade liberalisation in South Africa on aggregate trade (Edwards & Lawrence, 2008), its impact on extensive and intensive import trade margins is not known.

This study contributes to three strands of the trade literature. Firstly, by tracking whether imports tariffs have an influence on trade margins, the study contributes to the broad literature investigating the determinants of import extensive and intensive trade margins. Many of the existing studies that investigate the relationship between tariffs and trade margins are cross-sectional and do not focus specifically on South Africa imports (Frensch, 2010; Karlsson, 2011; Nguyen, 2009). Secondly, by focusing only on South Africa, this study provides empirical evidence for an emerging market in Africa on how import varieties are changing as a response to tariff policy changes. This contribution is important, since the majority of existing studies focus on developed countries, and for those that focus on developing countries, few focus on Africa, and none have been on South Africa (Goldberg *et al*., 2008; Klenow & Rodriguez-Clare, 1997; Moncarz, 2010). Lastly, the study provides the basis for assessing the impact of trade liberalisation and whether trade liberalisation should be continued, reversed or targeted as a policy options. It provides an opportunity to better understand the responses to trade liberalisation in a specific country.

The rest of the chapter is organised as follows; section 4.1 gives the background of the study, section 4.2 on theoretical framework and empirical evidence while section 4.3 is empirical specification. Data definition and sources is section 4.4, empirical results in section 4.5 and section 4.6 concludes.

## 4.1 Background

Imports are central to any economy. Imported products may come either as intermediate inputs, which aid in production, or as a final good, which might increase competition. The increase in competition may reduce prices, or add to the variety of goods available to consumers and increase consumer welfare (Krugman, 1980). South Africa has engaged extensively in liberalisation since 1994. The democratic transition in 1994 was followed by the accession of South Africa to the World Trade Organization in January 1995. Upon accession to the WTO, South Africa immediately undertook a commitment to rationalise over 12 000 tariff lines, to reduce the number of tariff bands to six and to increase the number of

tariff bindings for industrial products from 55% to 98%, among others (Draper & Alves, 2009). In 1990 there were 13 609 tariff lines and, by 2006, these had been reduced to 6 420. About 6 228 lines at the HS8 digit level apply to simple *ad valorem* tariffs, and 192 agriculture lines apply to non-*ad valorem* duties (Department of industry and Trade, 2010). Further, trade liberalisation entailed the replacement of quantitative restrictions with *ad valorem* tariff lines, fostering a simplification of the tariff regime. There also has been phasing out of a substantial export subsidisation scheme. This saw the simple average tariff on manufacturing goods reduced from 21.0% in 1992 to 15.6% in 1997 and about 11.5% in 2002. All quantitative restrictions were eliminated by 1998 (Department of industry and Trade, 2010).

On top of the multilateral trade liberalisation, South Africa also negotiated a number of bilateral or regional trade agreements. South Africa signed a Free Trade Area (FTA) with the European Union (EU) in 2000. Regionally, it signed the SADC Trade Protocol in 1996. The SA-EU Trade, Development and Cooperation Agreement (TDCA) and the SADC Trade Protocol have contributed to tariff changes. In general, the SADC Trade Protocol made 99% of tariff lines duty free by 2005, with 97% of imports from the SADC qualifying for duty-free access to South Africa (South Africa Trade Policy and Strategic Framework, 2010). Figure 1 in Appendix illustrates the change in import tariffs for the manufacturing sector.

***Tariff and Import relationship***

Figure 1 in Appendix 1, Panel A shows that the average import tariffs of manufacturing products have been decreasing since the late 1990s. This shows the influence of tariff liberalisation negotiations both at multilateral and regional level. Panel B shows a sharp increase in import values from 2002 to 2007, which suggests that trade liberalisation might have a major influence on import patterns. Panel C shows the sharp increase in the destinations from which South Africa imports, which also increased during the liberalisation period of 2001 to 2009. This is the geographical import extensive margin. Lastly, Panel D shows the relationship between the number of import destinations per HS6 product line and tariff. This shows a negative relationship. It shows that tariff declines are associated with the number of countries South Africa imports from.

This chapter focuses on imports of manufactured goods. The reason for considering manufacturing goods is that most of South African imports come from developed countries (see Figure 1 in Chapter 1 that shows that EU, NAFTA and EFTA countries dominates in supplying imports). Since these countries are developed it is most likely they export manufacturing products into South Africa for example capital, consumer or intermediate goods. Besides mineral fuels and oil, South Africa largely imports machinery and mechanical appliances, electrical machinery/equipment and vehicles which constitute 14.5%, 10.6% and 8.6% of total import in 2010, respectively. All these are manufacturing products (SACU, 2010).

### 4.2 Theoretical and empirical response to tariff changes

Chapter 2 explains in detail the theoretical response of trade margins to trade liberalisation. Krugman's (1980) love of variety model forms the theoretical foundation of this research. The implication of this model is that, if goods are less substitutable, consumers are willing to buy (import) foreign varieties even at a higher cost, indicating that trade barriers pose limited restrictions on trade volumes. Melitz (2003) developed the Krugman model further by introducing explicitly the extensive and intensive margin and adding heterogeneous firms. The model that equally fits the import side is Chaney (2008) and as explained in Chapter 2, decrease in trade costs will affect the two import margins differently. This model implies that *ad valorem* tariffs affect the extensive margin in the same way that iceberg transport costs do.

*Chapter 2 also* provides several empirical studies that concentrate on the effects of tariff liberalisation on the extensive margin of imports (Broda & Weinstein, 2004; Feenstra, 1994; Frensch, 2010; Mukerji, 2009). These studies base their empirical estimations on different methods developed to measure the trade margin, such as the Hummels and Klenow (2002; 2005) and simple count measure discussed in Chapter 2.

There are South African studies that investigate the determination of tariff liberalisation on aggregate imports. For example, Edwards and Lawrence, (2008) provide the baseline study for import volumes. They estimated a conventional import demand equation over the period 1962 to 2004 using quarterly data, and find that trade policy is an important determinant of import trade flows. The major departure of this paper from their study is the focus on

extensive and intensive margins using highly disaggregated data. Edwards (2005) provides detailed tariff data constructed to re-evaluate changes in the nominal and effective protection of South African industries from the late 1980s. The study uses the tariff rates calculated by Edwards. Most of the previous studies on the impact of preference trade area (PTA) on trade flows, for example Bayoumi and Eichengreen (1997), employ gravity-type models, using dummy variables to capture countries' joint membership of PTA on bilateral aggregate trade. The major weaknesses of these studies are their reliance on aggregate trade data and their use of dummy variables to capture the effect of trade liberalisation.

Santos-Paulino (2002) and Wu and Zeng (2008) also used the liberalisation dummy. The weakness of using aggregate trade data is that it does not reveal different product trade flows. Studies utilising aggregate country-level data miss important information, since tariff reductions are likely to vary across products, and it seems realistic to assume that the effects of tariff liberalisation on imports varies across products. Also, the use of dummy variables is too simplistic, as the variables inadvertently may capture other factors that are difficult to separate from the pure trade effects of trade liberalisation. Moreover, the use of dummy variables may be a poor indicator of the actual changes in tariffs (Jones & Morrissey, 2008). Exploiting variations in tariff rates at the detailed commodity level may address the aforementioned weaknesses (see Jones & Morrissey, 2008; Krueger, 2000; Romalis, 2007; Santos-Paulino, 2002). Mehta and Parikh (2005) estimated the import demand function for 20 broad commodities for India and find that price elasticity tends to rise with increase in liberalisation when tariff rates decrease. This study provides insight into this study regarding the use of commodity groups.

### 4.3 Empirical specification

The estimation approach is based on existing studies (Frensch, 2010; Goldberg *et al*., 2008; Moncarz, 2010), whilst Chaney (2008) provides the theoretical basis of this study. This study follows Debaere and Mostashari (2010), in tracking separately the impact of tariff reduction on the manufacturing sector. The study also disaggregates products according to their stages in the production process, just like Frensch (2010), who differentiates goods by categories of intermediate, capital and consumer goods. Other existing studies that focus on certain products are Türkcan and Yoshida, (2010), who focus on the US auto industry, and Liapis

(2011) who focuses on extensive margins in agriculture. The study uses both Poisson and ordinary least squares as the baseline estimation. The least squares method has an advantage in that it allows the inclusion of extremely flexible controls for demand and supply effects (see Yi & Van Biesebroeck, 2012). The Poisson is suitable for the bounded dependent variable, either South Africa may not import a product at all at certain HS line or it may import to all included 135 destinations/countries in the sample. When the dependent variable is defined as a count variable, the study uses count data estimation techniques, such as Poisson. In general, the estimation technique is shaped by how the extensive and intensive margins are defined.

The empirical specification allows for robustness checks of our results. We include fixed effects in the regressions. For example, the product year fixed effects cater for other global demand and supply factors that may affect product trade, such as improved quality or price changes that affect every trading partner in the same way. The regressions also include year fixed effects to capture unobserved aggregate shocks, for example macroeconomic variables. The study uses the logarithm of tariff so as to interpret tariff variables as elasticities.

### 4.3.1 Product level[13]

The product level tracks the variation at product level. It aims to see if different products are affected differently by changes in tariffs. This study focuses separately on manufacturing sector[14] products and all other products, as classified by the UNCTAD Stages of Processing (SoP). Manufacturing product codes were obtained after concordance between HS and International Standard Industrial Classification (ISIC) Revision 3. Concordance tables are obtained from World Integrated Trade Solution (WITS), while the manufacturing classification are obtained from ISIC – All Economic Activities, Revision 3, and Chapter 15 to 36.

Equation 6 presents the extensive trade margin equation at product level. This is similar to that in Goldberg *et al*. (2008).

[13] Chapter 2 provides the methodology and trends for measuring trade margins at different levels.
[14] According to ISIC Rev. 3, mmanufacturing is defined as the physical or chemical transformation of materials or components into new products, whether the work is performed by power-driven machines or by hand, whether it is done in a factory or in the worker's home, and whether the products are sold at wholesale or retail.

$$\ln(em_{it}) = \beta_0 + \beta_1 \ln(tariff_{it}) + x_t\beta + \gamma_i + \theta_t + \varepsilon_{it} \quad (6)$$

The coefficient of interest and expected sign is $\beta_1 < 0$ , where *i* represents product and *t* time. $\ln(em_{it})$ is the natural logarithm of import extensive margin of product *i* at time *t*[15]. The extensive margin at this level is measured by two methods as the number of countries (destinations) South Africa import from and by Hummels and Klenow (2002, 2005 measure). The study defines product as an HS6-digit product. $\ln(tariff_{it})$ is the natural logarithm of tariff of product *i* at time *t* $x_t$ is vector of control variables such as exchange rate, South Africa gross domestic product (GDP) per capita, world GDP growth rates $\gamma_i$ is product fixed effects and $\theta_t$ is year fixed effects, and $\varepsilon_{it}$ is the error term.

For the intensive margin:

$$\ln(im_{it}) = \varpi_0 + \varpi_1 \ln(tariff_{it}) + x_t\varpi + \gamma_i + \theta_t + \varepsilon_{it} \quad (7)$$

Where $\ln(im_{it})$ is the import intensive margin of product *i* at time *t* and the coefficient of interest is $\varpi_1$ and should be negative. The measure of intensive margin here is only by Hummels and Klenow method. However, there is no clear corresponding intensive margin measure from using the count measure, hence we don't estimate intensive margin using this measure. The other variables are as defined in equation 6.

### 4.4 Data definition and sources

*Tariff liberalisation*

Unlike other studies that use dummy variables as a measure of trade liberalisation (see (Dutt, Mihov & Van Zandt, 2011; Nguyen, 2009), this study relies on tariff levels per product (following studies like Moncarz, 2010). The tariff used is average import tariff per product. The data is from Edwards (2005), calculated at HS8 and updated yearly up to 2009. The tariff data pre-2001 was only at MFN level. However after 2000 there were different preferential treatment tariffs to different regional blocs such SADC, EU and EFTA. This is the main reason why this study conducts sub-sample analysis to test if this structural change

[15] In calculating the extensive margin the study relies on the original 1988 HS classification

in tariff affects trade margins differently. After 2000, we therefore calculate the average tariff that envelops the effect of different trade agreements using trade weights. This does not change the interpretation of the tariff coefficient.

*Import margins – intensive and extensive margins*

The study uses trade data at HS6-digit codes from Quantec, which sources the data from the South Africa Revenue Services (SARS) to calculate import trade margins. The study calculates the import margins at product level as in Chapter 2. At product level we use trade margins calculated by counting the number of destinations from which South Africa imports (geographical extensive margin). This involves estimating equation 6. This measure does not have a corresponding straightforward intensive margin formula. The other measure used to estimate trade margin is from the Hummels & Klenow (2005) method. The Hummels and Klenow method was used for both the extensive margin estimation (equation 6) and intensive margin estimation (equation 7). The measure of import trade margin using the H&K is from the modified formula as in Table 2 in chapter 2, column four (last column). This shows the trade margins measured at product level across countries. This is a modification of the original measure that calculates the margins at country level.

*Market size*

GDP determines the importer and exporter demand size (Baldwin & Harrigan, 2007). The study uses GDP per capita (constant 2000 US$). Dutt and Mihov (2011) and Melitz (2003) found that country size increases the extensive margins of trade for the case of exports. According to Hummels and Klenow (2002; 2005), countries with higher GDP trade both higher volumes of goods (intensive margins) and wider varieties of goods (extensive margin). Nguyen (2010) also finds a positive relationship. In the case of South Africa, this study expects that, as income rises, there is high chance that imports will increase; hence there is a direct connection between economic growth and imports. GDP per capita data is taken from the World Bank Development Indicators.

*Real effective exchange rate*

Real effective exchange rate is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs. If the effective rate increases it will lead to a decrease in trade.

Nguyen (2010) found a negative relationship between trade margins and real effective exchange rate in his study. This data is from World Bank Development Indicators.

**Descriptive statistics**

The descriptive statistics are shown in Appendix 2. This shows descriptive results for regression using the dependent variable of counting the number of countries from which South Africa imports per product line. The minimum for log (tariff) is 0 and the maximum is 0.68. The study adds one to HS lines that have zero tariffs. This is done to enable to take logs. Descriptive statistics also show the minimum of zero and maximum of 5 for logarithm of destination count variable. It shows that there are some product lines from which South Africa imported nothing. The standard deviations for all the variables are low, indicating the data is not largely dispersed.

### 4.5 Empirical results

This section presents the results at product level using the destination count by HS6 digit level and Hummels and Klenow (2002; 2005). The simple destination count method counts the number of destinations from which South Africa imports, at each HS6 digit line.

#### 4.5.1 Destination count measure results: Extensive trade margins[16]

***Full sample results 1988–2009***

Table 12 shows the Poisson regression results using the full sample period. The table has five columns: Column 1 shows tariff as the only determinant of the import extensive margin with product fixed effects (reduced form regression); column 2 adds year fixed effects; column 3 adds other variables but with no fixed effects; while column 4 includes both product and year fixed effects. The results are also compared to OLS regression results in the Appendix, Table 3, panel A. The results are consistent when using the OLS method (see Appendix Table 3, Panel A). It shows that results are robust to estimation technique. The results also show that

[16] The study does not estimate intensive margin using this measure

tariff coefficient carries the expected sign and is significant across different model specifications[17]. It shows that a decrease in tariffs is associated with an increased number of destinations from which South Africa imports.

Table 15: Full sample Poisson results – Destination count (1988–2009): Manufacturing sector

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| ln(tariff) | -2.02*** | -0.37*** | -0.67*** | -0.71*** |
| | (0.017) | (0.040) | (0.018) | (0.048) |
| ln(GDP SA) | | | 0.49*** | 0.48*** |
| | | | (0.012) | (0.019) |
| World GDP growth | | | 0.049*** | 0.049*** |
| | | | (0.001) | (0.001) |
| ln(real effective exchange rate) | | | -1.01*** | -1.01*** |
| | | | (0.007) | (0.011) |
| constant | | | 3.47*** | |
| | | | (0.110) | |
| Year fixed effects | no | yes | no | yes |
| Product fixed effects | Yes | yes | no | yes |
| *N* | 77467 | 77467 | 77467 | 77467 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

These results can be interpreted as elasticity. A one percentage decrease in tariff results in a 0.37% (see column 2) increase in the number of destinations from which South Africa imports. If we add other variables, a one percentage decrease in tariff results in a 0.67% (see column 3) increase in the number of destinations from which South Africa imports. The results are robust to different estimation specifications. These results are consistent with the findings in Goldberg *et al*. (2008) and Arkolakis *et al*. (2008), who found that the range of imported varieties expanded as a result of the tariff declines in Costa Rica and India, respectively. The study also uses world exports growth and foreign direct investments for robustness checks and the results (not reported) remain qualitatively similar.

The coefficient of GDP per capita is significant and has the expected sign. This shows that, as South Africans become richer; they demand greater varieties of goods. The results support the findings in several existing studies that the richer a country becomes; the higher the import and export extensive margins (Baldwin & Harrigan, 2007; Hummels & Klenow, 2002; 2005).The real effective exchange rate (*reer*) carries the expected sign. It shows that an

[17] All estimations for this Table has product fixed effects

increase in the exchange rate is associated with a decrease in demand for new varieties. This is in line with Nguyen's (2010) findings.

The study also investigates whether the impact of tariff reduction is similar across products. The study uses stages of the production process to classify products into capital, consumer and intermediate goods and raw materials. Table 13 shows the Poisson estimation results which are comparable to OLS results presented in Appendix 4, Panel A.

**Table 16: Full sample Poisson results – Product count: All products classified**

| | All 1 | All 2 | Capital 1 | Capital 2 | Consumer 1 | Consumer 2 | Intermediate 1 | Intermediate 2 | Raw material 1 | Raw material 2 |
|---|---|---|---|---|---|---|---|---|---|---|
| ln(tariff) | -1.99*** | -0.69*** | -4.01*** | -1.80*** | -1.77*** | -0.52*** | -1.69*** | -0.64*** | -0.61* | 0.17 |
| | (0.064) | (0.047) | (0.223) | (0.166) | (0.075) | (0.058) | (0.109) | (0.088) | (0.354) | (0.289) |
| ln(GDP SA) | | 0.49*** | | 0.45*** | | 0.75*** | | 0.083** | | 0.77*** |
| | | (0.019) | | (0.028) | | (0.033) | | (0.035) | | (0.116) |
| World GDP growth | | 0.049*** | | 0.046*** | | 0.051*** | | 0.046*** | | 0.047*** |
| | | (0.001) | | (0.001) | | (0.001) | | (0.001) | | (0.004) |
| ln(real effective exchange rate) | | -1.00*** | | -0.97*** | | -1.11*** | | -0.80*** | | -0.91*** |
| | | (0.011) | | (0.022) | | (0.017) | | (0.020) | | (0.058) |
| N | 85164 | 85164 | 16832 | 16832 | 26489 | 26489 | 33509 | 33509 | 8334 | 8334 |

All columns with a number 1 show only tariff as determinants of the extensive margin, while those with a 2 show added independent variables such as gross domestic product and real effective exchange rate. Table 13 shows that the tariff coefficient maintains the expected sign except for raw materials. The greatest impact of tariff declines is on capital. This shows that trade liberalisation promotes imports of capital goods by South Africa. This is similar to intermediate goods. This supports Edwards and Lawrence's (2008) findings and they conclude that these products in turn lead to an increase in exports. The results are also in line with Goldberg *et al*. (2010), who find that the impact of tariff reduction is more pronounced for intermediate products for India. Also, Frensch (2010) finds stronger extensive import margin effects of liberalisation for intermediate and capital goods compared to consumer goods for the emerging European economies. The consumer products coefficient carries the expected negative sign. The raw materials products show the wrong sign once we add other control variables. Thus, the results for raw material products are not robust to different econometric specification. This is expected, since tariff reductions might not lead to higher imports of raw materials. South Africa is largely endowed with raw materials, hence fewer imports of them. Other control variables, GDP and the real effective exchange rate carry the expected sign.

### 4.5.2 Sensitivity analysis

The study uses various ways to test the sensitivity of results to different subsample periods. The study splits the time period into two to cater for structural shifts in tariff policy. The first subsample is from 1988 to 2000, when tariff policy is not based on the preferential tariff basis but rather based largely on the Most Favoured Nation (MFN) basis, which is largely a WTO principle. This is the period before the major trade agreements came into force. The other subsample covers the period of preferential tariff for SADC, EU and EFTA countries. For example, tariffs for SADC countries were different to those for EU members. Further, the tariffs for countries without a trade agreement with South Africa were largely on an MFN basis.

***Subsample results: 1988-2000***

Table 14 shows the results covering the years 1988 to 2000 for manufacturing products only. Columns 1 to 4 are as explained in Table 13.

Table 17: Subsample Poisson results – Destination count (1988–2000): Manufacturing sectors

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| ln(tariff) | -1.30*** | -0.029 | -0.12*** | -0.16*** |
| | (0.022) | (0.038) | (0.024) | (0.037) |
| ln(GDP SA) | | | -4.47*** | -4.48*** |
| | | | (0.058) | (0.056) |
| World GDP growth | | | 0.11*** | 0.11*** |
| | | | (0.002) | (0.001) |
| ln(real effective exchange rate) | | | -2.44*** | -2.44*** |
| | | | (0.016) | (0.022) |
| Constant | | | 49.7*** | |
| | | | (0.442) | |
| Year fixed effects | no | yes | no | yes |
| Product fixed effects | Yes | yes | no | yes |
| *N* | 44164 | 44164 | 44185 | 44164 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 14 shows that the impact of tariff on import extensive margins is consistent with the findings of the full sample period. This suggests that the results are robust to changes in the sample period. It shows that, as the tariff is reduced, South Africa increases the number of

destination from which it imports products. A one percentage decline in tariff results in a 0.16% (see column 4) increase in the number of destinations from which South Africa imports. World GDP growth and real effective exchange rate coefficients carry the expected sign and are significant. GDP per capita for South Africa now has a negative relationship with extensive margin; this seems logical given the time period. It suggests that, during this period, an increase in GDP per capita has led South Africa not to concentrate more on increasing import varieties.

***Subsample: 2001–2009***

Table 15 shows the results for the last subsample period, for the years 2001 to 2009. This is for manufacturing products and the columns are as explained under Table 9. The sample period 2001 to 2009 (Table 13) shows that tariff effects on extensive import margin are robust to the subsample, except for column 3, which has the wrong sign and is insignificant. These results also confirm that a reduction in tariff leads to an increase in varieties and the results are robust to changes in the sample period. The coefficients of GDP for South Africa and world GDP growth have the expected positive sign.

Table 18: Subsample Poisson results – Destination count (2001–2009): Manufacturing sectors

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| ln(tariff) | -2.09*** | -0.58*** | -0.11* | -0.58*** |
| | (0.068) | (0.089) | (0.064) | (0.089) |
| ln(GDP SA) | | | 0.90*** | 0.86*** |
| | | | (0.018) | (0.018) |
| World GDP growth | | | 0.0043*** | 0.0044*** |
| | | | (0.001) | (0.000) |
| ln(real effective exchange rate) | | | 0.21*** | 0.20*** |
| | | | (0.014) | (0.009) |
| constant | | | -5.28*** | |
| | | | (0.145) | |
| Year fixed effects | no | yes | no | yes |
| Product fixed effects | Yes | yes | no | yes |
| *N* | 33129 | 33129 | 33282 | 33129 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table 3 Panel B and C show the sub sample estimations using OLS and it shows that the results are largely consistent from the ones under Poisson Estimation.

Table 16 show both subsamples for all products. It further validates the analysis by using different product classifications for the subsample periods. The results maintain that the tariff reduction effects are consistent on capital products. The consumer products carry the expected sign. However, for intermediate products the tariff coefficient is not robust to additions of control variables. The impact on raw materials still reports the inconsistent results.

Appendix 4, panel B and C show sub sample estimations using OLS. The results still show a weak response of raw material goods to tariff reduction. The OLS results largely carry the same sign as those under Poisson estimations.

## Table 19: Subsample Poisson results – Product count (2001–2009): All products classified

| | Sub sample 1988-2000 | | | | | Sub sample 2001-2009 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | All 2 | Capital 2 | Consumer 2 | Intermediate 2 | Raw material 2 | All 2 | Capital 2 | Consumer 2 | Intermediate 2 | Raw material 2 |
| ln(tariff) | -0.16*** | -0.18 | -0.17*** | -0.30*** | 0.23 | -0.51*** | -0.089 | -0.64*** | 0.0027 | 0.56 |
| | (0.03) | (0.125) | (0.046) | (0.079) | (0.252) | (0.090) | (0.298) | (0.111) | (0.164) | (0.358) |
| ln(GDP SA) | -4.46*** | -4.88*** | -4.75*** | -3.72*** | -4.03*** | 0.88*** | 0.90*** | 1.01*** | 0.60*** | 1.12*** |
| | (0.057) | (0.104) | (0.089) | (0.105) | (0.404) | (0.018) | (0.029) | (0.029) | (0.037) | (0.112) |
| World GDP growth | 0.11*** | 0.13*** | 0.11*** | 0.10*** | 0.14*** | 0.0042*** | 0.0029*** | 0.0047*** | 0.0054*** | -0.00028 |
| | (0.001) | (0.002) | (0.002) | (0.003) | (0.011) | (0.000) | (0.001) | (0.001) | (0.001) | (0.003) |
| ln(real effective exchange rate) | -2.42*** | -2.45*** | -2.66*** | -2.02*** | -2.09*** | 0.20*** | 0.11*** | 0.29*** | 0.15*** | 0.28*** |
| | (0.021) | (0.039) | (0.034) | (0.040) | (0.116) | (0.009) | (0.014) | (0.014) | (0.017) | (0.054) |
| N | 48511 | 9602 | 15121 | 19097 | 4691 | 36419 | 7182 | 11305 | 14377 | 3555 |

Standard errors in parentheses, $^{*}$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$

### 4.5.3 Results from Hummels and Klenow Method: Extensive trade margins

The study validates the results by using a different measure of import extensive margins, the Hummels and Klenow (2005) measure. The study repeats the same specification; however, the analysis is not disaggregated by product type but studies the manufacturing sector as a whole, over the full and subsample periods defined previously.

Table 17 shows the results of the full sample regression using different definitions of the import extensive margin. The columns are as explained in Table 9 and are for the manufacturing sectors.

Table 20: Results of the full sample – H&K (1988–2009): Manufacturing sector

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| ln(tariff) | -0.79*** | -0.13*** | 0.12*** | -0.054* |
| | (0.039) | (0.039) | (0.036) | (0.032) |
| ln(GDP SA) | | | 0.86*** | 0.89*** |
| | | | (0.026) | (0.027) |
| World GDP growth | | | 0.0067*** | 0.0067*** |
| | | | (0.001) | (0.001) |
| ln(real effective exchange rate) | | | -0.73*** | -0.72*** |
| | | | (0.016) | (0.016) |
| Constant | 1.67*** | 1.30*** | -2.10*** | -2.27*** |
| | (0.004) | (0.008) | (0.217) | (0.222) |
| Year fixed effects | no | yes | no | no |
| Product fixed effects | Yes | yes | no | yes |
| *N* | 90251 | 90251 | 90251 | 90250 |
| $R^2$ | 0.015 | 0.233 | | 0.142 |

Table 17 shows that the results are qualitatively similar to those obtained when using the count measure. It is reassuring that the results are robust to different measures of the dependent variable. For example, a one percentage decrease in tariff results in a 0.13% (see column 2) increase in varieties of products imported, which is similar to what we find under the count measure. All the control variables carry the expected sign.

Table 18 repeats the estimation for the two subsample periods. The column is as previously defined under Table 9.

Table 21: Subsample results – H&K (1988–2000): Manufacturing sectors

| | Sub sample 1988-2000 | | | | Sub sample 2001-2009 | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| ln(tariff) | 0.13*** | 0.018 | 0.026 | -0.0030 | -1.25*** | -0.24* | 0.19* | -0.22* |
| | (0.037) | (0.040) | (0.034) | (0.035) | (0.138) | (0.132) | (0.108) | (0.132) |
| ln(GDP SA) | | | -2.74*** | -2.77*** | | | 0.80*** | 0.76*** |
| | | | (0.070) | (0.070) | | | (0.029) | (0.029) |
| World GDP growth | | | 0.026*** | 0.026*** | | | 0.0049*** | 0.0049*** |
| | | | (0.002) | (0.002) | | | (0.001) | (0.001) |
| ln(real effective exchange rate) | | | -0.97*** | -0.97*** | | | 0.22*** | 0.22*** |
| | | | (0.028) | (0.028) | | | (0.016) | (0.016) |
| Constant | 1.46*** | 1.28*** | 27.9*** | 28.2*** | 1.89*** | 1.73*** | -5.79*** | -5.33*** |
| | (0.004) | (0.008) | (0.584) | (0.583) | (0.010) | (0.012) | (0.241) | (0.245) |
| Year fixed effects | no | yes | no | no | no | yes | no | no |
| Product fixed effects | Yes | yes | no | yes | Yes | yes | no | yes |
| *N* | 54854 | 54854 | 54854 | 54854 | 35397 | 35397 | 35397 | 35397 |
| $R^2$ | 0.001 | 0.143 | | 0.130 | 0.009 | 0.070 | | 0.069 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The results in Table 18 show that the tariff coefficient carries the expected sign as per the results of the Table 17 largely for the second subsample. The impact of tariff reduction is more visible in the second sub sample period (2001-2009). This shows that the implementation of trade agreement is accompanied by increases in trade. However the results are not consistent on the first sub sample. To test the sensitivity of the results to different specifications, the specification in column 3 has no year and product fixed effects. Results show that the coefficient on tariff switches sign and is significant in the second subsample for the extensive margin. However, for the intensive margin (see Table 17 and 18), the coefficient on tariff remain negative and is significant. This shows that in general the impact of tariff is not sensitive to changes in specifications. The study further re-estimates column 3 specifications with only year fixed effects and the results remain the same in terms of sign and significance.

### 4.5.4 Results from the Hummels and Klenow method: Intensive trade margins

This section presents the intensive margins results for the manufacturing sectors based on the Hummels and Klenow measure (Table 19). The columns are as defined in Table 13.

Table 22: Results of the full sample – H&K (1988–2009): Manufacturing sectors

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| ln(tariff) | -0.87*** | -0.85*** | -1.07*** | -0.84*** |
| | (0.110) | (0.128) | (0.103) | (0.109) |
| ln(GDP SA) | | | -1.60*** | -1.56*** |
| | | | (0.084) | (0.084) |
| World GDP growth | | | -0.026*** | -0.025*** |
| | | | (0.002) | (0.002) |
| ln(real effective exchange rate) | | | 1.49*** | 1.47*** |
| | | | (0.049) | (0.049) |
| Constant | -8.60*** | -7.96*** | -2.43*** | -2.60*** |
| | (0.010) | (0.025) | (0.729) | (0.730) |
| Year fixed effects | no | yes | no | no |
| Product fixed effects | Yes | yes | no | yes |
| *N* | 90251 | 90251 | 90251 | 90251 |
| $R^2$ | 0.002 | 0.083 | | 0.061 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The results indicate a largely a negative relationship between tariff and intensive margin and are significant. This confirms the results found under the extensive margin. The results for other variables, however, carry the opposite sign. However they have the expected sign for GDP under subsample 1988-2000 (see Table 20 for sub sample periods)

**Table 23: Results of the sub full sample – H&K (1988–2009): Manufacturing sectors**

| | Sub sample 1988-2000 | | | | Sub sample 2001-2009 | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| ln(tariff) | -0.18* | -0.43*** | -0.61*** | -0.26** | -0.35 | -1.44*** | -2.41*** | -1.44*** |
| | (0.097) | (0.120) | (0.097) | (0.104) | (0.400) | (0.429) | (0.279) | (0.427) |
| ln(GDP SA) | | | 2.49*** | 2.74*** | | | -1.45*** | -1.41*** |
| | | | (0.234) | (0.235) | | | (0.096) | (0.099) |
| World GDP growth | | | -0.027*** | -0.031*** | | | -0.010*** | -0.010*** |
| | | | (0.007) | (0.007) | | | (0.003) | (0.003) |
| ln(real effective exchange rate) | | | 1.93*** | 1.86*** | | | -0.18*** | -0.18*** |
| | | | (0.084) | (0.085) | | | (0.050) | (0.049) |
| Constant | -8.29*** | -8.02*** | -37.3*** | -38.9*** | -8.87*** | -8.54*** | 3.88*** | 3.55*** |
| | (0.010) | (0.022) | (1.913) | (1.926) | (0.029) | (0.038) | (0.794) | (0.831) |
| Year fixed effects | no | yes | no | no | no | yes | no | no |
| Product fixed effects | Yes | yes | no | yes | Yes | yes | no | yes |
| *N* | 54854 | 54854 | 54854 | 54854 | 35397 | 35397 | 35397 | 35397 |
| $R^2$ | 0.000 | 0.039 | | 0.036 | 0.000 | 0.019 | | 0.018 |

Table 20 shows that results at subsample carry the expected sign. Tariff reductions are accompanied by increase in imports and the results are robust to different specification. Still the impact is more pronounced from 2001 onwards. This is a sub sample period where largely trade agreements were in operation. It shows South African importers responded to change in tariff positively.

## 4.6 Conclusion

The chapter investigates the relationship between tariff reduction and import trade margins. Emerging from the results is that reductions in tariffs are associated with increases in the import extensive trade margin at product level. The results are robust to different measures of trade margin, model specifications and different subsamples. For the intensive margin, the impact of a reduction in tariff results in more volume being imported.

The results show different impacts of tariff reduction across different product groups. Capital, intermediate and consumer products show greater responsiveness to changes in tariff. This suggests that trade policy should be targeted, especially in those sectors that aid production. Further the results show differential impacts across sub sample periods. The results reveal there is an increase for both the intensive and extensive margin during the period where trade agreements are in operation. The results imply that trade agreements or tariff liberalisation increased import trade flows.

The study tracks the influence of tariff changes on import trade margins. Future studies may focus on one specific product group and tracking it to one trade agreement. Further, future studies can focus on the influence of non-tariff barriers on the import trade margins.

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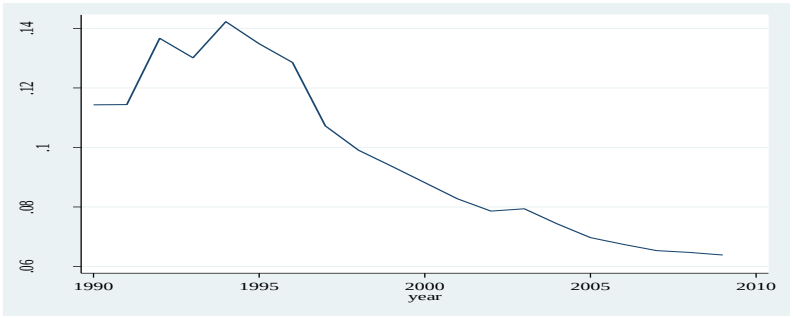
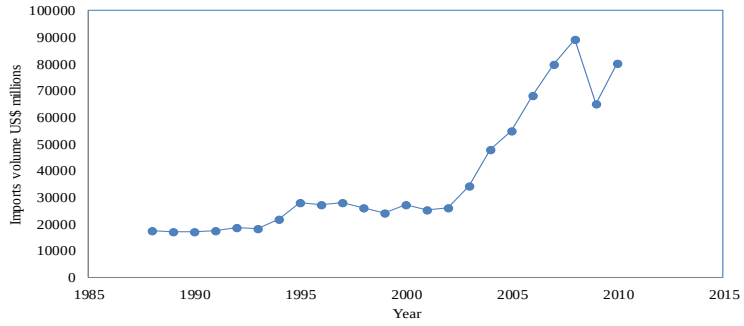
Appendix 1: Trend in average tariff and imports

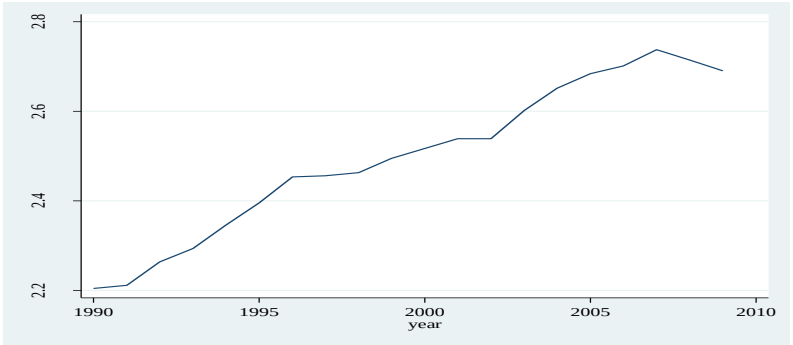
Panel A: Trend in average tariffs of the manufacturing sector



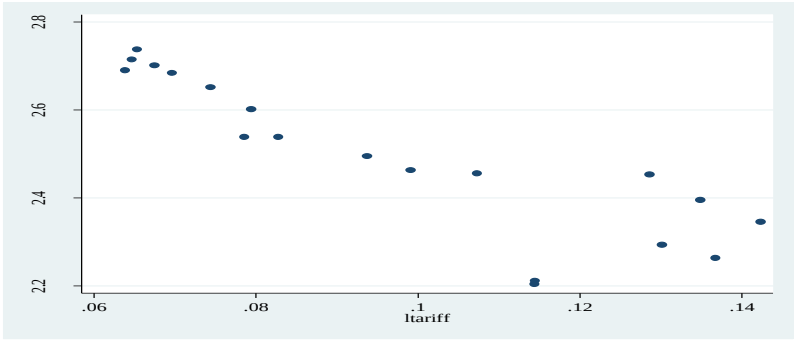

Panel B: Imports volume – all commodities




Panel C: Number of destinations imported from per HS6 product code




Panel D: Scatter plot on destination count and average manufacturing tariff



**Appendix 2: Descriptive statistics**

| Variable | Observations | Mean | Stand. deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| ln(destination count) | 78517 | 2.503 | 0.923 | 0 | 5.337 |
| ln(tariff) | 77290 | 0.097 | 0.120 | 0 | 0.687 |
| ln (GDP SA) | 81203 | 8.063 | 0.080 | 7.973 | 8.241 |
| World GDP growth | 81203 | 2.773 | 1.443 | -2.245 | 4.720 |
| ln(real eff. exchange rate) | 81203 | 4.616 | 0.148 | 4.255 | 4.829 |

**Appendix 3 : OLS regression: Destination Count at Prod HS6 digit level: Manufacturing sector**

A. Results of full sample – Product count (1988–2009)

| | 1 | 2 | 3 | 5 |
|---|---|---|---|---|
| ln(tariff) | -1.75*** | -0.38*** | -0.57*** | -0.64*** |
| | (0.025) | (0.046) | (0.047) | (0.049) |
| ln(GDP SA) | | | 0.47*** | 0.45*** |
| | | | (0.026) | (0.026) |
| World GDP growth | | | 0.038*** | 0.038*** |
| | | | (0.001) | (0.001) |
| ln(real effective exchange rate) | | | -0.91*** | -0.91*** |
| | | | (0.016) | (0.016) |
| constant | 2.69*** | 2.18*** | 2.88*** | 2.99*** |
| | (0.003) | (0.009) | (0.211) | (0.210) |
| Year fixed effects | no | yes | no | yes |
| Product fixed effects | Yes | yes | no | yes |
| *N* | 75141 | 75141 | 75141 | 75141 |
| $R^2$ | 0.063 | 0.387 | | 0.186 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

B. Results of subsample – Product count (1988–2000)

| | 1 | 2 | 3 | 5 |
|---|---|---|---|---|
| ln(tariff) | -0.97*** | -0.12*** | -0.15*** | -0.21*** |
| | (0.035) | (0.045) | (0.043) | (0.046) |
| ln(GDP SA) | | | -3.63*** | -3.65*** |
| | | | (0.076) | (0.076) |
| World GDP growth | | | 0.070*** | 0.071*** |
| | | | (0.002) | (0.002) |
| ln(real effective exchange rate) | | | -2.07*** | -2.06*** |
| | | | (0.029) | (0.029) |

| | | | | |
|---|---|---|---|---|
| constant | 2.53*** | 2.15*** | 41.0*** | 41.2*** |
| | (0.005) | (0.009) | (0.632) | (0.631) |
| Year fixed effects | no | yes | no | yes |
| Product fixed effects | Yes | yes | no | yes |
| *N* | 42647 | 42647 | 42647 | 42647 |
| $R^2$ | 0.020 | 0.479 | | 0.337 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

C. Results of subsample – Product count (2001–2009)

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| ln(tariff) | -1.44*** | -0.33*** | 0.064 | -0.33*** |
| | (0.073) | (0.119) | (0.102) | (0.119) |
| ln(GDP SA) | | | 0.85*** | |
| | | | (0.029) | |
| World GDP growth | | | 0.0063*** | -0.038*** |
| | | | (0.001) | (0.002) |
| ln(real effective exchange rate) | | | | |
| | | | 0.20*** | |
| constant | | | (0.015) | |
| | 2.75*** | 2.56*** | -5.20*** | 2.62*** |
| | (0.005) | (0.011) | (0.241) | (0.009) |
| Year fixed effects | no | yes | no | yes |
| Product fixed effects | Yes | yes | no | yes |
| *N* | 32494 | 32494 | 32494 | 32494 |
| $R^2$ | 0.013 | 0.088 | | 0.088 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**Appendix 4: OLS regression**: All products classified

## A. Results of full sample – Product count (1988–2009)

| | All 1 | All 2 | Capital 1 | Capital 2 | Consumer 1 | Consumer 2 | Intermediate 1 | Intermediate 2 | Raw material 1 | Raw material 2 |
|---|---|---|---|---|---|---|---|---|---|---|
| ln(tariff) | -1.70*** | -0.61*** | -3.58*** | -1.73*** | -1.79*** | -0.49*** | -1.39*** | -0.59*** | -0.48* | 0.025 |
| | (0.062) | (0.048) | (0.240) | (0.183) | (0.072) | (0.061) | (0.102) | (0.083) | (0.257) | (0.217) |
| ln(GDP SA) | | 0.47*** | | 0.55*** | | 0.83*** | | 0.11** | | 0.67*** |
| | | (0.026) | | (0.042) | | (0.041) | | (0.044) | | (0.112) |
| World GDP growth | | 0.038*** | | 0.039*** | | 0.042*** | | 0.034*** | | 0.034*** |
| | | (0.001) | | (0.001) | | (0.001) | | (0.001) | | (0.004) |
| ln(real effective exchange rate) | | -0.89*** | | -0.88*** | | -1.14*** | | -0.68*** | | -0.72*** |
| | | (0.015) | | (0.030) | | (0.025) | | (0.025) | | (0.068) |
| constant | 2.61*** | 2.71*** | 2.95*** | 2.39*** | 3.16*** | 1.41*** | 2.23*** | 4.35*** | 1.52*** | -0.71 |
| | (0.006) | (0.212) | (0.008) | (0.367) | (0.012) | (0.319) | (0.008) | (0.370) | (0.011) | (1.008) |
| N | 81762 | 81762 | 16435 | 16435 | 26086 | 26086 | 32191 | 32191 | 7050 | 7050 |
| R2 | 0.055 | 0.172 | 0.117 | 0.261 | 0.085 | 0.294 | 0.039 | 0.098 | 0.002 | 0.076 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

## B. Results of sub sample – Product count (1988–2000)

| | All 1 | All 2 | Capital 1 | Capital 2 | Consumer 1 | Consumer 2 | Intermediate 1 | Intermediate 2 | Raw material 1 | Raw material 2 |
|---|---|---|---|---|---|---|---|---|---|---|
| ln(tariff) | -0.92*** | -0.19*** | -3.17*** | -0.54*** | -0.36*** | -0.13** | -1.27*** | -0.35*** | -0.023 | 0.12 |
| | (0.068) | (0.045) | (0.272) | (0.180) | (0.083) | (0.057) | (0.127) | (0.082) | (0.269) | (0.205) |
| ln(GDP SA) | | -3.58*** | | -4.20*** | | -4.02*** | | -2.94*** | | -3.07*** |
| | | (0.075) | | (0.151) | | (0.112) | | (0.125) | | (0.390) |
| World GDP growth | | 0.071*** | | 0.090*** | | 0.060*** | | 0.066*** | | 0.095*** |
| | | (0.002) | | (0.004) | | (0.003) | | (0.004) | | (0.011) |
| ln(real effective exchange rate) | | -2.04*** | | -2.05*** | | -2.50*** | | -1.67*** | | -1.70*** |
| | | (0.028) | | (0.053) | | (0.045) | | (0.047) | | (0.122) |
| constant | 2.46*** | 40.4*** | 2.86*** | 45.8*** | 2.78*** | 46.6*** | 2.19*** | 33.3*** | 1.42*** | 33.7*** |
| | (0.008) | (0.628) | (0.012) | (1.280) | (0.016) | (0.947) | (0.013) | (1.015) | (0.013) | (3.267) |
| *N* | 46357 | 46357 | 9348 | 9348 | 14862 | 14862 | 18210 | 18210 | 3937 | 3937 |
| $R^2$ | 0.017 | 0.320 | 0.091 | 0.426 | 0.004 | 0.440 | 0.032 | 0.238 | 0.000 | 0.174 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

C. Results of full sample – Product count (2001–2009)

| | All 1 | All 2 | Capital 1 | Capital 2 | Consumer 1 | Consumer 2 | Intermediate 1 | Intermediate 2 | Raw material 1 | Raw material 2 |
|---|---|---|---|---|---|---|---|---|---|---|
| ln(tariff) | -1.36*** | -0.25** | -2.87*** | -0.21 | -2.04*** | -0.64*** | -0.55** | 0.24 | -0.32 | 0.21 |
| | (0.126) | (0.116) | (0.535) | (0.526) | (0.176) | (0.133) | (0.217) | (0.227) | (0.453) | (0.413) |
| ln(GDP SA) | | 0.84*** | | 1.04*** | | 1.04*** | | 0.55*** | | 0.92*** |
| | | (0.029) | | (0.053) | | (0.043) | | (0.050) | | (0.131) |
| World GDP growth | | 0.0055*** | | 0.0079*** | | 0.0068*** | | 0.0060*** | | -0.0065 |
| | | (0.001) | | (0.002) | | (0.001) | | (0.001) | | (0.004) |
| ln(real effective exchange rate) | | 0.20*** | | 0.13*** | | 0.32*** | | 0.11*** | | 0.38*** |
| | | (0.015) | | (0.027) | | (0.019) | | (0.026) | | (0.074) |
| constant | 2.67*** | -5.13*** | 3.03*** | -6.03*** | 3.34*** | -6.74*** | 2.22*** | -2.85*** | 1.62*** | -7.55*** |
| | (0.008) | (0.244) | (0.009) | (0.438) | (0.023) | (0.369) | (0.011) | (0.420) | (0.015) | (1.074) |
| *N* | 35405 | 35405 | 7087 | 7087 | 11224 | 11224 | 13981 | 13981 | 3113 | 3113 |
| $R^2$ | 0.011 | 0.082 | 0.009 | 0.146 | 0.058 | 0.222 | 0.001 | 0.028 | 0.000 | 0.053 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

# Chapter 5: Trade Reform and Quality Upgrading in South Africa: A Product-Level Analysis

## 5.0 Introduction

The link between trade liberalisation and product quality is both empirically and theoretically ambiguous. Existing empirical studies show mixed results (Hummels & Skiba, 2002; Amiti & Konings, 2007; Fan, Li & Yeaple, 2014) with Amiti and Khandelwal (2013) showing that product quality upgrading depends on how far the product is from the technological frontier. However, little research on the relationship between tariff reduction and product quality upgrading has been done on developing countries. Trade reform and tariff policies in particular, play a central role not only in determining trade performance but also in driving economic growth. For a country to remain competitive in the global market, it can either decrease the price of its products or increase the quality of its products. The latter strategy seems most viable for developing and emerging economies given that a decrease in prices might squeeze profit margins, which are already low, even further (see Rodrik, 2008- for case of South Africa). This study empirically examines the relationship between trade reform, particularly tariff reform, and product quality upgrading of South African export products.

South Africa's average tariff has fallen from around 23% in the early 1990s to 8.2% in 2011 (DTI, 2010), and the continued importance of tariff reform in South Africa's industrial development is evidenced by the government's call for continuing trade policy debate (DTI, 2010). Yet there has been very little research on how this tariff reform has impacted on product quality in South Africa. Most previous studies on product quality in South Africa have been descriptive (see Petersson, 2005). More detailed studies have been conducted by Edwards and Van de Winkel (2005) and Aghion, Braun and Fedderke (2008). However, these studies focus on domestic markets and productivity rather than exports. Distance-to-the-frontier models find that tariff reductions are associated with quality upgrading for products closer to the world quality frontier, whereas lower tariffs discourage quality upgrading for products more distant from the frontier (Amiti & Khandelwal, 2013). Trade liberalisation may result in fiercer competition in product marketing; hence, product quality enhancement becomes central for competiveness.

This chapter is motivated by the current limited empirical evidence regarding how product quality is influenced by trade liberalisation (see Hallak & Schott, 2011; Fan, Li & Yeaple, 2014). The few studies that have explored this relationship focus mainly on developed countries. The studies that examine developing countries have not included African countries (see Bandyopadhyay & Acharyya, 2004; Fernandes & Paunov, 2009; Ma & Dei, 2009; Amiti & Khandelwal, 2013). The focus of this study is on manufacturing goods at the trade flow product level (Harmonised System (HS) 8-digit level) and the study analyses the impact of the removal of tariff barriers on South African imports on the quality of South African exports. The assumption in this study is unilateral tariff liberalisation in which tariffs on imports are reduced without a parallel change in export conditions as assumed by Aghion, Braun and Fedderke (2008).

Trade liberalisation can affect product quality upgrading in two ways: through competition (Lileeva & Trefler, 2007; Bustos, 2011; Lacovone & Smarzynska Javorcik, 2012) or through the import of better quality inputs (Coe & Helpman, 1995; Keller, 2001). The competition effect works through the final product/output channel; this raises the issue of horizontal product differentiation, which is a key input in models showing that trade liberalisation induces welfare gains due to an increase in products variety available to consumers (Krugman, 1979, 1990). The increase in product variety can either lead to an increase in product quality, as firms will try to innovate to outdo competition, or lead to a decline in product quality, as firms fail to compete. This is referred to in the literature as the variety effect[18], a horizontal differentiation-driven phenomenon. Further models such as Melitz (2003) predict that tariff reduction raises aggregate productivity as less productive firms exit and the remaining firms increase production.

The other way in which tariff liberalisation can affect product quality is through the input channel. As a country liberalises, it should be able to import higher quality inputs and thus produce higher quality products. This is in line with the vertical linkage or product differentiation models, which show that richer countries will produce and export higher quality products/inputs (Flam & Helpman, 1987; Hummels & Klenow, 2005; Kugler &

[18] This variety effect is seen not only in final outputs but even in imported intermediate inputs, as firms might improve efficiency through access to a broader range of imported intermediates (or new product variety) – "the variety effect" as per Goldberg *et al*. (2008).

Verhoogen, 2012; Schott, 2008). The idea is that trade liberalisation increases access to foreign intermediate inputs and capital goods, and this access promotes international knowledge spillovers and product quality upgrading. Firms respond to trade liberalisation, by increasing their imported inputs and capital goods from more advanced countries and "learning" from foreign technology incorporated in the imported intermediates – "the learning effect" (Coe & Helpman, 1995; Keller, 2001; Mendoza, 2010). This is also referred to as the quality effect[19] (Grossman & Helpman, 1991; Halpern, Koren & Szeidl, 2009; Fan, Li & Yeaple, 2013, 2014).

The position of this chapter in the current literature is quite clear. Firstly, it uses highly disaggregated trade data at the product level, which has not been used previously in such an analysis in an African context. Secondly, the chapter is among the few studies that track the effects of the current wave of trade liberalisation on export quality with a focus on product-level trade data using an African data set. Understanding the sensitivity of product quality to tariff liberalisation can help fine-tune trade policy in order to bring greater benefits to the South African economy. Further, understanding how tariff reform might help emerging and developing countries sell higher priced products is important to these countries' own development. South Africa represents an emerging country which could provide lessons for other developing African countries in their quest for product quality upgrading. This focus on an emerging country in Africa gives insight into how other African countries are responding to global competition, and the effects that producers in South Africa face as a result of tariff liberation could signal the growth path of the entire African continent.

This chapter's other main contribution relates to the methodology, dimension, and variables used in the analysis. A majority of recent studies focus on firm-level data (Amiti & Konings, 2007; Fernandes & Paunov, 2009; Bastos & Silva, 2010; Topalova & Khandelwal, 2011; Lacovone & Smarzynska Javorcik, 2012; Martin & Mejean, 2014) and only a small number on product level analysis (Baldwin & Harrigan, 2011; Fontagné, Gaulier & Zignago, 2008; Amiti & Khandelwal, 2013). The focus of this study is on product-level data. This product-level view is necessitated by a lack of firm-level data that can be exploited to match the tariff

[19] Existing literature supporting the idea that imported input quality is higher than the quality of domestic inputs include Schott, 2004; Amiti and Konings ,2007; Kasahara and Rodrigue, 2008 and Muendler, 2004)

data available in South Africa. This study follows Baldwin and Harrigan (2011); Johnson, (2012) but exploits variations in quality at the product level as tariffs change. This dimension has not been extensively exploited in the literature, let alone in the context of South Africa.

The main objective of this study is to ascertain the impact of trade liberalisation on product quality upgrading in South African exports. Specifically, the study assesses the impact of tariff liberalisation on product quality and investigates whether tariff reform is associated with an increase in product quality for South Africa's manufactured products. The study seeks to determine whether lower import tariffs on HS8 products raises the export unit values of such products. The hypothesis is that tariff reduction in South Africa is associated with the escape-competition effect, a situation in which firms will try to innovate to out-compete other firms. This is the opposite of the discouragement effect, in which firms will not innovate if they believe that they cannot keep up with their competition.

The rest of the chapter is organised as follows. Section 5.2 briefly describes the liberalisation landscape of South Africa. Section 5.3 gives a literature review and section 5.4 outlines the empirical model. Section 5.5 presents the results and section 5.6 concludes.

### 5.1 Liberalisation in South Africa

Recent trade liberalisation in South Africa can be characterised by two periods: the pre-democratic era and the post-democratic era. In the pre-democratic era, South Africa's trade and industrialisation strategy was based on protectionism and import substitution (Draper, Kalaba & Alves, 2006) and depended on a wide range of trade instruments inclined more toward quantitative restrictions than tariffs (Edwards, 2005; Draper, Alves & Sally, 2009). Another important event during this period was the establishment of the Southern Africa Customs Union (SACU) in 1910.

Post-democratic era trade policy was marked by one important event: the accession of South Africa to the World Trade Organization (WTO) in January 1995. Upon its accession into the WTO, South Africa immediately committed to rationalise over 12, 000 tariff lines, reduce the number of tariff bands to six, and increase the number of tariff bindings for industrial products from 55% to 98% (Draper & Alves, 2009). The country also committed itself to tariff liberalisation of its Most Favoured Nation (MFN) applied rates until the year 2000 as it

integrated into the world economy. Since 2000, regional trade agreements have become more important for liberalising trade tariffs; in 2000, the Southern Africa Development Community (SADC) Protocol on Trade was implemented, which included an agreement to establish a SADC Free Trade Area by 2008, a Customs Union by 2010, Common Market by 2015, a Monetary Union by 2016, and a single currency by 2018. SADC successfully launched its Free Trade Area in 2008 with 85% of trade being duty-free; the remaining 15% was expected to be fully liberalised by 2012, but due to the global financial crisis, some of the member states (Tanzania and Zimbabwe) have since applied for derogation, which has derailed the attainment of a fully-fledged Free Trade Area.

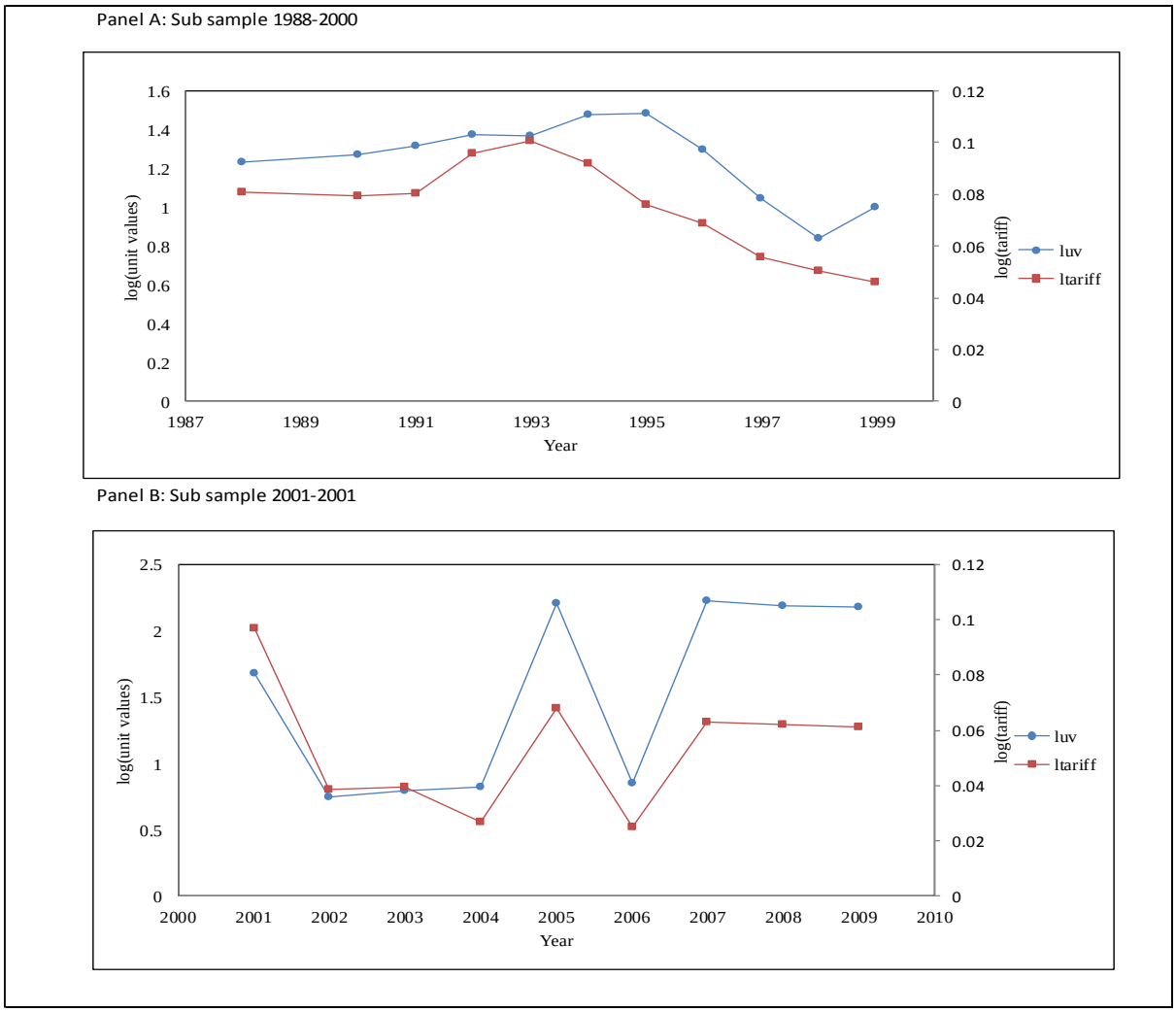
South Africa signed a Free Trade agreement with the European Union (EU) in 1999. The FTA agreement, also known as the Trade, Development and Co-operation Agreement (TDCA), came into force on May 1, 2004. This agreement stipulates differential liberalisation schedules for EU and South Africa. There is also protection of sensitive sectors, which has resulted in some sectors being excluded and others being partially liberalised.

South Africa and its SACU partners have also signed a free trade agreement with the European Union Free Trade Area (EFTA), consisting of Iceland, Liechtenstein, Norway, and Switzerland. The agreement includes a Free Trade Agreement (effective from May, 2008) between the two sides and three separate bilateral agricultural agreements between SACU and Iceland, Norway, and Switzerland/Liechtenstein. Due to the wide disparities in levels of economic development between SACU and EU countries, the agreement has asymmetrical commitments. The EFTA undertook to immediately liberalise all trade in HS chapters 25 to 99 (i.e. all non-agricultural trade) (Kalaba, Sandrey & van Seventer, 2005); the SACU is completely liberalising the majority of its non-agricultural trade with EFTA, although in certain cases tariffs are being reduced over an extended nine-year period (Kalaba, Sandrey & van Seventer, 2005; Draper, Kalaba & Alves, 2006;). Thus, South Africa and its SACU partners undertook a commitment to progressively reduce their tariffs with the EU until 2014. It can be concluded that majority of trade agreements started full operating since 2000.

As a result of these liberalisation episodes, there has been a marked decline in tariffs at the South African border. The average manufacturing tariff has decreased since the late 1990s (see Figure 1 in Appendix in chapter 4- imports chapter). Figure 27 shows averaged unit

values per year for two subsample period 1988 to 2000 and subsample 2001-2009. This is for all the manufacturing products.

Figure 27: Unit values of South African exports (averaged at the 8-digit HS level




Source: Author's calculation from data in Quantec (2013) and Edward (2005)

Figure 27 Panel A shows that unit values and tariff have been decreasing since 1995 while tariff started decreasing in 1993. There is a clear positive relationship between tariff and unit values during the pre-trade agreements period. Before 2001 most imports tariff was largely the World Trade Organisation Most favoured Nation rates. However, after 2000, the tariff was varying across regional trade agreements. During the period 2001-2009 the tariff and unit values are oscillating. These fluctuations in tariff reflect the need for further tariff reform. Edwards and Lawrence (2008) points that the current tariff structure remains complex

relative to other middle-income economies as measured by the coefficient of variation, the number of tariff bands and the number of domestic spikes.

Rangasamy and Harmse (2005) provide a detailed analysis on the extent of tariff liberalisation during the 1990s using effective rate of protection (ERP). They compare the percentage change in the ERP between two periods; average of ERP for period 1988 to 1993 and the average for the period 1994 to 1998. Sectors are classified into three categories, that is, liberalised, protected and medium protected sectors. Liberalised sectors are defined as those with a tariff reduction of greater than 10%. These include paper and paper products; glass and glass products; TV radio and equipment; plastic products; footwear; motor vehicle parts and electrical machinery just to mention a few. Protected sectors are those that had an increase in ERP of 10%. These included beverages; food; textiles and tobacco. Lastly, the medium protected sector is composed of all the remaining sectors which include printing, publishing and recording media; rubber, leather and non-metallic minerals. The general conclusion is that tariff liberalisation in the 1990s did not succeed in improving manufacturing sector competitiveness.

Appendix Figure 1 shows also a clear positive relationship between average unit values and gross domestic product (GDP) per capita. This support that as GDP per capita improves quality of products also gradually increases. As GDP per capita increased consumers have higher buying capacity to buy higher quality goods.

## 5.2 Literature Review

### *5.2.1 Theoretical models*

Many trade models (theories) do not explicitly incorporate product quality. These include traditional trade theories such as the modified comparative advantage theory by Eaton, Kortum (2002), to new trade theories such as the monopolistic competition theory of Dixit & Stiglitz (1977), to "new new" trade theories specifically the heterogeneous firms trade model of Melitz (2003). These models do not introduce quality component, although they include some predictions regarding export prices. The introduction of quality in heterogeneous trade models is a recent phenomenon (see Kugler & Verhoogen, 2012; Verhoogen, 2008; Johnson, 2012). These studies expanded the Melitz (2003) model of heterogeneous firms and constant mark-ups by considering how firms optimally choose quality and by producing quality

sorting across firms. Firms endowed with low marginal costs (higher productivity) produce high quality goods, while firms endowed with high costs (low productivity) produce low quality goods (Antoniades, 2014).

We only review the earlier models because they give general guidelines regarding how other variables affect export prices. For example Eaton and Kortum (2002) theory is a multi-country Ricardian model with trade cost. According to this theory, exporter countries should face competition in their destination markets. The more competitive a country is, the higher its chances of exporting a wide range of goods. This theory predicts that most costly products are less likely to be exported over longer distances. Export prices decreases over bilateral distance, increase in the destination country's price index (remoteness), and are unrelated to size (Baldwin & Harrigan, 2011). Eaton and Kortum (2002) also predict that the bigger the market of the importing country, the smaller the probability that the exporter will successfully ship its commodity to that market.

Models of monopolistic competition were introduced in the 1980s to explain intra- industry trade; consumers can buy some of every good with a finite price, and goods are exported to all nations. Basic tenets of these models include imperfect competition, increasing returns, and homogenous firms. The Dixit and Stiglitz (1977) monopolistic competition model utilises optimal mill pricing[20], implying that firms charge free on board (f.o.b) export prices regardless of the export's destination. Trade costs are passed fully to consumers. Due to the assumption that products are sold in all markets, this model implies that f.o.b prices are identical for all destinations and that export prices are unrelated to distance, market size, or remoteness. Remoteness is defined by Baldwin and Harrigan (2011) as the relative location effect that the destination market will have if it faces high average trade costs. In this scenario, the destination market will experience high local prices and will thus be relatively easy for an exporting market to penetrate for any given bilateral trade cost. Unlike Eaton & Kortum (2002) model, in this model, export price prediction with linear demand is driven by the reduction in mark-ups with distance.

Melitz's (2003) heterogeneous firms' trade model explains trade at the firm level; however, it works with symmetric countries and thus requires modification to allow for the use of asymmetric countries and bilateral trade costs. It embraces all features of the baseline

[20] Firms set a single price at the plant, and consumers bear the cost of transport.

monopolistic competition model and adds elements of heterogeneous firm level marginal cost and beachhead costs (overhead fixed costs). Firms with lower marginal cost produce and export profitably. In general, the model directs that firms sell more in large countries than in small countries. After some manipulation, the model implies that the average price for any destination should decrease by markets distance, and increase by size and remoteness[21] of the destination market (Baldwin & Harrigan, 2011). Just like the monopolistic competition model, its basic tenets also include imperfect competition and increasing returns; however, it adds beachhead costs and heterogeneous marginal costs. This model may vary with market structure, source of scale economies, and source of heterogeneity. These models suggest that gross domestic product, trade costs such as distance and tariffs are all important factors associated with trade at the product level and must be accounted for by any empirical approach. In general, these models provide some prediction about the relationship between unit values and other variables, as shown in Table 21.

Table 24: Different Theoretical Models' Prediction for Key Variables:

| Models | Variables' Effect on Unit Prices | | |
|---|---|---|---|
| | Distance[22] | Importer size | Remoteness |
| Eaton and Kortum | - | 0 | + |
| Monopolistic competition, linear demand | - | 0 | + |
| Heterogeneous firms, linear demand | - | - | + |
| Heterogeneous firms, CES, quality competition[23] | + | - | - |
| Heterogeneous firms, CES | - | + | + |

There are a number of models that examine the relationship between product innovation and the product's distance from the world technological frontier (Aghion *et al*., 2005; 2009).

[21] Remoteness generally points to the average price of goods sold in the destination market.

[22] This is a proxy for trade cost, which is similar to tariffs

[23] This is a modification to Melitz model by Baldwin and Harrigan (2011) which accounts for spatial aspects on prices. Firms will compete on the basis of quality as well as prices. Their modification assumes that consumers care about quality and that firms produces different varieties of quality.

These models show that theoretically, the relationship between the resultant competition from tariff liberalisation and product quality is ambiguous and the relationship between competition and innovation is not linear. As in Schumpeter's ( 2013) argument, the lower the competition, the more innovation is expected. This is because firms will have higher chances of getting higher returns/profits due to possibility of higher mark-ups. His argument is that for example, monopoly practices are health in that they facilitate expenses on innovative research. But as firms approach the technological frontier; the higher the competition, the higher the innovation. These models show that intense competition is good for quality improving innovation (Aghion *et al*., 2005; Thoenig & Verdier, 2003) because firms will try to innovate in order to escape from competition. Along the same lines, Melitz (2003) suggests that average export quality could rise in response to trade liberalisation because less productive firms are driven out of the market.

These models show two effects: firms either face discouragement (appropriability effect) or escape the competition effect. The discouragement effect entails that if firms see that they cannot match their competition due to trade liberalisation, they will not innovate because they know that their products will not be able to compete with existing products that are close to or on technological frontier already. The escape competition effect entails that firms that are closer to the technological frontier will innovate as competition intensifies; the idea behind this is that firms will continue to innovate in order to maintain their leadership position. These firms view quality upgrading as a way to survive competition from potential new entrants. Therefore, product quality is influenced by competition or by the product's proximity to the technological frontier.

Product-cycle models (see Wells, 1968) assume that developing countries will imitate the products of the developed countries. This imitation implies that developing countries will not be the initial producers of high quality commodities. In the same vein Grossman and Helpman (1991) model of quality ladders fit in this discussion. The model assumes that improvement in intermediate inputs will lead to higher quality of final goods. They explain that each new product enjoys a limited time at the technological frontier, since it will be absolute by being replaced by new products. Product innovation is seen as a process of generating an ever-expanding range of horizontally differentiated products. Therefore almost

every product exists on the quality ladder. This combined by the product- cycle model imply that trade facilitate quality improvement of traded products.

Various models have later introduced quality choice into heterogeneous firm models (Baldwin & Harrigan, 2011; Kugler & Verhoogen, 2012; Bastos & Silva, 2010; Johnson, 2012; Fan, Li & Yeaple, 2013; Antoniades, 2014). Table 22 provides a summary of trade models that modify Melitz's (2003) model of heterogeneous firms and constant marks to consider quality choices.

Table 25: Trade Models Incorporating Quality

| | Baldwin and Harrigan (2011) | Johnson(2012) | Bastos and Silva (2010) | Verhoogen (2008) | Kugler and Verhoogen (2012) | Khandelwal[24] (2010) | Antoniadse (2014)[25] | Fan and Li(2013) |
|---|---|---|---|---|---|---|---|---|
| Melitz (2003) modification | QHFT- n-country version- consumers and producer care about quality | n-country version- consumers and producer care about quality | Tries to exploit unchartered- within firm product unit values | Features vertical product differentiation and differences in income across countries | Include endogenous choice of input and output quality. Added perfectly competitive but quality differentiated intermediate sector | Make explicit distinction between vertical and horizontal product differentiation | Full general equilibrium model- incorporates quality competition in Melitz- Ottaviaono model | Introduces endogenous quality[26] and number of imported varieties and fixed cost of importing |
| Unit value calculation level | Product country level | Product country level | Firm-product-country and product country level | Plant level | Plant-product level | Product level (exports to US) | Modelling- firm level. | Firm-product-country level |

[24] This focuses on US imports, similar to Hallak (2006) and Schott (2004). Other studies that rely on the use of CES specification and rely on demand effects to identify quality include: Hallak and Schott, 2011; Feenstra and Romalis, 2012; and Baldwin and Ito, 2008.

[25] This is a modification of Melitz- Ottaviano's (2008) model of linear demands systems and endogenous mark-ups that introduces endogenous quality.

[26] Assumption of exogenous quality invalidates their findings

These models show that if firm production raises marginal costs substantially, there is a positive correlation between prices and productivity, as well as firm size and prices. The models produce quality sorting along the productivity axis, showing the positive correlation between prices and quality. This relationship shows that price is a good proxy for quality (Baldwin & Harrigan, 2011; Antoniades, 2014).

All of these models introduce the quality component at both the demand side and the supply side. The demand side shows the utility function, in which a consumer maximises consumption of products of various quality levels. The consumer therefore prefers to maximise consumption of high quality products, and therefore quality in this case might be treated as exogenous (Foster, Haltiwanger & Syverson, 2005). On the supply side, the firm maximises profit by producing high quality goods; thus, quality is modelled as an endogenous sunk cost that firms have to pay (Shaked & Sutton, 1987, 1990; Kugler & Verhoogen, 2008, 2012; Fan, Li & Yeaple, 2013; Antoniades, 2014). As this study contributes to the empirical side, it does not track the various equations involved in these models.

### 5.2.2 Empirical Evidence

The measurement of product quality is a major challenge in current literature investigating the impact of trade reform on product quality (Hallak & Schott, 2011; Hallak, 2006; Amiti & Khandelwal, 2013)

Most empirical trade literature uses the unit value[27] (prices) of products as a measure of product quality (see Fontagné, Gaulier & Zignago, 2008; Hallak & Schott, 2011; Schott, 2008; Fernandes & Paunov, 2009, 2013a; Bastos & Silva, 2010; Hallak, 2006; Kiyota, 2010; Kugler & Verhoogen, 2012; Lacovone & Smarzynska Javorcik, 2012). For example Fontagné, Gaulier and Zignago (2008) use unit prices of HS6-digit products for 200

[27] Unit values are easily calculated as the export/import value of a certain product divided by the exported/imported quantities of the respective product.

countries. They find that the South is not competing with the North in terms of market share of high quality products. Hummels and Skiba (2002) show that export prices vary negatively with tariffs and positively with shipping costs, confirming the Alchian-Allen hypothesis. Hummels and Klenow (2002; 2005) and Hummels and Skiba, (2002), like Schott (2008), find a positive relationship between exporter GDP per capita and product quality. Baldwin and Harrigan (2011) use bilateral product-level export data to show that the determinants of unit prices postulated by various leading trade theories fail to explain actual trade prices. They therefore suggest a quality-augmented Melitz model, which confirms their findings that export unit values are positively related to distance; however, they fail to find a negative relationship between exporter GDP and unit values.

Fernandes and Paunov (2009, 2013), building upon the measure used by Bernard, Redding and Schott, (2011), make use of transport costs as a measure of import competition, as this measure can be exogenous to quality upgrading. They measure product quality using product unit values. They estimate a product quality equation using plant level data and point out that the usual measure of trade barriers (that is, tariffs) is not informative in the Chilean context due to the uniform tariff structure across industries that have been in place since the 1980s. They find a positive and robust effect of import competition on product quality in line with escape competition hypothesis of innovation. Our study differs by focusing on product level data and use tariff as a trade barrier measure.

There are however other studies that use alternative measures of product quality (see Ardelean & Lugovskyy, 2013; Amiti & Konings, 2007; Khandelwal, 2010; Hallak & Schott, 2011; Amiti & Khandelwal, 2013). For example, Ardelean and Lugovskyy (2013) implement a methodology developed by Bils and Klenow, (2001) and consequently estimates product quality for 66 durable consumer goods. They use household-level data Consumer Expenditure Survey. Ardelean and Lugovskyy's (2013) study determines whether trade liberalisation explains the variation in product quality in the case of the U.S. Their paper identifies and estimates quality Engel curves using household-level data on purchases of durable goods. They finds that trade liberalisation led to consumption of low quality goods in the US, if it imports lows quality goods initially but as the developing country closes the technological gap, US will import quality goods from developing countries. This study differs

from Ardelean and Lugovskyy (2013) both in the data used and in the focus; our study differs further by focusing not on goods consumed by South Africa, but rather on goods exported.

Amiti and Khandelwal (2013) use import tariffs to analyse the effect of import competition on quality upgrading using highly disaggregated export data (10 000 products) for the United States from 56 countries. They employ a nested logit demand framework based on Berry (1994) to estimate the quality variable and find that lower tariffs increase quality upgrading for products closer to the world quality frontier but discourage quality upgrading for products that are distant from the frontier. Their study defines a variety's proximity to the frontier as the ratio of its quality to the highest quality within each HS product. They rely on models by Aghion *et al*., (2005; 2009)[28], which argue that the degree of innovation resulting from import competition will depend on the distance of the product to the world technological frontier.[29] Our study differs from Amit and Khandelwal's study in that they focus on exports only to the US, while this study's focus is on South African exports to other countries. As in their study, however, we make use of tariffs as a measure of import competition and utilise their other product quality measure – unit prices.

Antoniades (2014), using a theoretical model, shows that an increase in competition raises the scope for quality differentiation and causes the quality ladder to pivot around some point. His study shows that for firms above the pivot point, the more productive firms escape competition by raising quality, mark-ups, and prices; firms below the point either lower quality, mark-ups, and prices or exit the market. The model predicts that average prices and mark-ups exhibit a U-shape response to competition (imports from developed countries are of higher quality and cost more than imports from developing countries). Hallak and Schott (2011) introduce a new method of measuring countries' product quality that involves decomposing observed export prices into quality- versus quality-adjusted-price components

[28]Aghion *et al*. (2005) demonstrate the discouragement or appropriability effect and escape entry/competition effect.

[29] Amable, Demmou and Ledezma (2008) use labor productivity (value added per hour worked) as the measure of efficiency, thus allowing them to identify the technological frontier. The latter is defined as the most productive available technology for each industry in a given time period. The individual (country-industry couple) having the maximum labor productivity among all countries in a given year is identified as the technological leader for that year. The closeness to the frontier is measured as the percentage of labour productivity relative to that of the frontier. (The distance to frontier is then the inverted ratio.) In order to smooth the series, they consider a three-year moving average.

using information from countries trade balance. They find that product quality is correlated with an exporter's level of development, but find a weaker relationship for growth rates.

There are also various studies that track product quality at the firm-level (Gorg, Halpern & Murakozy, 2010; Bustos, 2011; Kugler & Verhoogen, 2012; Martin & Mejean, 2014). They compute unit values at the firm-product-country level, which differs from our dimension exploiting the product level alone and/or product- country level variations. Most of these studies find that competition results in firms upgrading the quality of their products. Moreover, the majority of these studies find that within firms, there is a positive correlation between export price and gross domestic product per capita of the destination country: markets that can afford high quality goods are supplied with high quality goods. Bloom, Draca and Van Reenen (2011) find that highly productive firms in the EU were more likely to respond to the increased competition bought by China's entry to the WTO by innovating than less productive firms. Lacovone and Smarzynska Javorcik (2012) also find that liberalisation boosts innovation efforts for more productive firms than it does for less productive firms. Schor, 2004; Lileeva & Trefler (2007) reveal that the impact of liberalisation is heterogeneous across firms, while Bustos (2011; Gutiérrez and Teshima (2011) use highly detailed plant level data from Argentina and Mexico, respectively, and find that firms respond to liberalisation by investing in technology and innovation. Blundell, Griffith and Van Reenen (1999), using a panel of British manufacturing firms, find that increased competition leads to innovation by more dominant firms.

### 5.3 Empirical Specification

The empirical equation follows specifications from existing studies (Baldwin & Harrigan, 2011; Kneller & Yu, 2008; Amiti & Khandelwal, 2013). The chapter estimates a model with unit values calculated at only the product level[30]. Unit values are calculated at the HS8-digit level, and the definition of a product means an HS8 product code. The use of HS8 helps in reducing the aggregation bias resulting from the use of the HS6-digit level. The model

[30] We also tried to estimate with unit values calculated at either country or preference and HS6 product level. The results are consistent.

ignores country-level variations in unit values following existing international trade models, which implies that exporters charge the same free on board (f.o.b) to all destination countries (Krugman, 1990; Melitz, 2003; Eaton & Kortum, 2002); this is in contrast to those models that depict unit values as reduced for more distant countries (Brander & Krugman, 1983). Country-level variations are ignored because the tariff data only varies at the product level. We instead include product-year fixed effects to account for product-specific productivity shocks or changes in consumer demand. The focus is only on manufacturing products.

***Estimated equation***

The specification of the model is as follows:-

$$\ln(uv_{it}) = \beta_0 + \beta_1 \ln(tariff_{it}) + \beta_2 \ln(lagtariff_{it}) + \beta_3 mc_{it} + \gamma_i + \lambda_t + \varepsilon_{it} \quad \textbf{(1)}$$

where $\ln(uv_{it})$ is the natural logarithm of unit value of product *i* (here HS8 product code) at time *t*. This study focuses only on manufacturing products. $\ln(tariff_{it})$ is natural logarithm of tariff of product *i* at time t[31]. $\ln(lagtariff_{it})$ is the lag of natural log of tariff. This variable takes into account the fact that a tariff might have a lag in its effect on quality upgrading. This effect of tariff on product quality might not be instantaneous. This is used as a robustness check, as we specify some, not all of the econometric equation with a lag of tariff. $mc_{it}$ is an indicator of whether the product is imported or not at time t. This is a proxy for import variety effect. It is a measure of extensive import trade margin and is a dummy variable with 1 if the product has been imported for a particular year and 0 otherwise. The other variable used to represent this variety effect is the log of the import value $\ln(mv_{it})$ of product i at time t. $\gamma_i$ represents product fixed effects and controls for both products' unit values (for example, values for gold versus values for shirts) and difference in units of measurement (for example, kilograms versus a simple count) across HS8 codes. $\lambda_t$ represents year fixed effects (time trend). This captures macroeconomic disturbances that does not vary at product level and $\varepsilon_{it}$ represents the residuals.

[31] To take logs of tariff we add 1 to tariff percentages such that its $(1 + tariff_{it})$.

In addition, the study adds other variables as control variables in line with the existing literature. The augmented equation therefore is:

$$\ln(uv_{it}) = \beta_0 + \beta_1 \ln(tariff_{it}) + \beta_2 \ln(lagtariff_{it}) + \beta_3 mc_{it} + X_t\beta + \gamma_i + \lambda_t + \varepsilon_{it} \quad \textbf{(2)}$$

Where $X_t$ is a vector of other variables such as gross domestic product per capita, foreign direct investment, world export, growth, and world gross domestic product growth (Hummels & Klenow, 2002; Hummels & Skiba, 2002; Reganati & Pittiglio, 2005; Caetano & Galego, 2006; Amiti & Konings, 2007b; Baldwin & Harrigan, 2011). The inclusion of these variables is justified below and sees Appendix Table 1 for various existing studies that use these different variables. Unit values, gross domestic product per capita measure, foreign direct investment, and import value measure are all in US$ for the same 2000 base year. From this empirical equation, it can be envisaged that the determinants of product quality can be grouped into exporting and importing country characteristics. For example, the larger or more sophisticated the domestic market, the higher the quality of products supplied to the local consumer (as in Motta, Thisse & Cabrales, 1997). This means that there are both demand-side determinants, like the importing country's GDP per capita, and supply-side determinants, like the exporting country's GDP per capita.

The coefficient of interest in equations 1 and 2 is $\beta_1$. A priori, it might be negative or positive; this depends on the channel that holds for South African products.

This study uses HS8-digit data. The tariff data from 2001 has been adjusted using trade weights to make it resemble MFN tariffs pre-2001. We also averaged tariffs without using trade weights; the results are not sensitive to this change. The study conducted several robustness checks as explained under robustness checks section.

***Definition of variables***

The empirical equations estimated are at the product level, and the variables are modified to represent such specifications. For example, for unit value, the study starts with a calculation that assumes that f.o.b. prices for exports are same across countries; this is a calculation at the HS8 level.

*Product Quality Measure - Why Use Unit Value?*

Unit values are the common proxy for quality in international trade (Hallak, 2006; Schott, 2008; Johnson, 2012). In general, higher quality goods are expected to sell at higher prices. The reason for using unit values as an indicator of quality lies in the fact that trade data does not contain information on product characteristics (Faruq, 2011), which makes it hard to draw direct inferences about quality. Higher prices are therefore inferred as a depiction of higher quality (Hallak, 2006; Schott, 2008). Furthermore, this strategy builds on the methodology used in several previous studies on trade and product quality[32] (Baldwin & Harrigan, 2011; Schott, 2008; Khandelwal, 2010; Faruq, 2011). The calculation of product unit values entails first aggregating the trade values and quantity at the product level across the countries to remove variation. We then divide the value by the quantity to obtain the unit value.

The use of HS8-digit level aggregation is intended to reduce composition problems that might be associated with the calculation of unit values. This study relies on the Quantec data set, from South Africa Revenue Authority, which contains both quantity and value for exports at the HS8-digit level; therefore by definition, a product is at the HS8-digit level[33]. The formula used to calculate unit values is as follows:[34]

$$uv_{it} = \frac{\sum_{i \in I_{jt}} hs8v_{ijt}}{\sum_{i \in I_{jt}} hs8q_{ijt}} = \frac{Value_{it}}{Quantity_{it}} \qquad (6)$$

where $uv_{it}$ is the unit value of product i at time t. $hs8v_{ijt}$ is the HS8-digit level value of product i to country j at time t. $hs8q_{ijt}$ is the HS8-digit level quantity of product i to country j at time t. These are summed across countries in order to have a unit value of a product for all

[32] Existing empirical evidence even at the firm level reports a positive correlation between prices, supporting the use of unit values as a proxy for quality (Verhoogen, 2008; Kugler and Verhoogen, 2012; Lacovone and Javorcik, 2012)

[33] This follows literature which has arbitrariness in the definition of a product. Schott (2004) connotes two different headings of the most detailed level of international trade classification as representing two different products at the HS6-digit level.

[34] However, this entails running a regression with products in different measurement units (for example, kgs, barrels, etc.). This is to an extent controlled by $\gamma_i$. Baldwin and Harrigan (2011) restrict their samples to only those in kilograms or only manufacturing products, as per this study.

countries; this process is dictated by trade models that assume that export prices will not differ across countries (free-on-board)[35].

The advantage of this method is that unit values are easy to calculate from trade data. However, unit values might be inadequate proxies for quality if products possess both vertical and horizontal attributes (Amiti & Khandelwal, 2013). This inadequacy does not hold for this study, though, as it only focuses on South African exports with variation across products, not across countries. Using unit values as a proxy for quality is subject to criticism for other reasons as well. Unit values might be determined by factors other than quality, such as market power and production cost. Hallak and Schott (2011) further challenge the strong association of prices to quality, arguing that differences in unit values may reflect not only the quality of a product but also exchange rate misalignment or differences in production costs. For example high production costs due to input cost increases may lead to increases in unit values that are unrelated to quality improve. Another weakness might arise from the fact that price differences could reflect quality perceptions influenced by advertising or reputation rather than intrinsic characteristics of the goods traded. Despite these weaknesses, using unit values as a proxy for quality is a generally accepted practice in existing trade literature. The study also use product and time fixed effects to control for other factors that may not vary with unit values.

*Tariff Liberalisation*

The tariff data used in this study is at the product level and does not vary across countries because import tariff does not vary at country (trade agreement level) level pre-2001. This limits the ability to analyse the impact of tariff liberalisation on product quality using cross-country or trade agreement variation. Due to this limitation, the analysis is carried out using variation across products. After 2000, South African tariffs changed to the regional level, at SADC, EU, and MFN levels. To make the data comparable, we take the trade-weighted average of tariff data after 2001 and then combine the calculated tariff with pre-2001 tariff data.

We construct weighted average tariffs for country j. The simple average is calculated by adding the tariffs on all lines of interest and dividing by the number of those tariff lines; a

[35] We neglect this assumption at theHS6-digit level and see if results hold.

drawback of this process is that it gives the same weight to products that are not imported and to products that are imported in large amounts. Weighted average tariffs, on the other hand, tell us how much protection is applied by a country on average; the difference from a simple average is that weighted averages take into account the volume of imports in each product category. In other words, the weighted average tariff can be defined as the sum of the tariffs in a country's tariff schedule multiplied by a weighting factor that represents that product's importance to the country's trade. The disadvantage to this process is that, unlike simple averages, it tends to understate the degree of protection because high protection levels tend to restrict the volume of imports in a sector, leading to that sector being given a low weight. The formula for a weighted average tariff is:

$$\bar{\tau} = \sum_k w_k \tau_k \qquad (7)$$

where *k* indexes imported goods and $w_k$ is the weight given to tariff on the average. The most common approach is to weight goods with their share in the county's overall imports as shown below.

$$\bar{\tau} = \sum_{iSA} \frac{m_{iSAj}}{\sum_k M_{kSA}} \tau_{iSAj} \qquad (8)$$

where *j* is trading partner country, *i* is the set of products of interest, *k* is the set of source countries, $\tau$ is the tariff of interest, *m* is product-level imports, and *M* is total imports by category. The weight used in this study is trade share in total South African imports for each product of EU, SADC, and MFN countries. The weights differ by year, but for robustness purposes, we also try weights that don't vary by year.

*Foreign Direct Investment (FDI)*

Foreign Direct Investment tries to measure the inflow of technology into the country. Several existing studies posit that FDI plays a role in quality as it provides a conduit for both direct technology transfer and indirect intra- industry knowledge spillovers (Blomstrom, n.d.; Damijan *et al*., 2003; Javorcik, 2004; Reganati & Pittiglio, 2005; Caetano & Galego, 2006). As South Africa receives more FDI, it can upgrade its product quality and hence be expected to export higher quality products. The FDI variable used in this study is net FDI inflows into South Africa as a percentage of GDP. This variable, like world export growth and GDP per

capita, does not vary across products; thus, we also estimate time-specific and product-fixed effects.

*World Export Growth and Import Value/Variety*

World Export Growth represents a proxy for productivity shocks, as used in (Amiti & Khandelwal, 2013); the most appropriate measure for this study is the world export growth for each product. By tracing both the import value and variety, we can trace the impact that these have on product quality. In essence, the higher the quality of the varieties being imported, the higher the quality expected of South African products (the variety effect). This has been seen in existing literature by Fan, Li and Yeaple (2014) and also implies the input effect on product quality since most of the imports are intermediate commodities.

*Market Size/Demand GDP per Capita*

GDP per capita proxies market demand and development. The higher the GDP per capita for the exporting country, the higher the likelihood of that country to export higher quality goods. However, the sign of GDP per capita for importing countries is ambiguous: it might present either a positive or a negative effect on unit values as indicated by the models reviewed previously. This follows Helpman, Melitz and Rubinstein, (2007) framework in which varieties of different qualities were produced at a cost reflected by higher prices for higher qualities. This model was extended by Choi, Hummels and Xiang, (2009) to form a multi-product, multi-country framework that allows for higher income countries buying higher unit value varieties. We use world GDP growth rates to proxy GDP for all other countries since we do not have variation at the country level.

## 5.4 Data sources

The sources of the data are shown in Table 23. Import tariff data is from (Edwards, 2005) that is updated annually up to 2009 and is tariffs on final products. This shapes the time period for the study from 1988-2009, mainly driven by data availability.

Table 26: Data Sources

| Variable | Description | Source |
|---|---|---|
| Unit values at HS8 digit level | Calculated from HS8 digit level trade data | COMTRADE and Quantec. Both data sets start from 1988 |
| Tariff rates | Calculated by Edwards at HS8 digit level | UNCTAD TRAINS Database, Edwards(2005), and South African Revenue Services (SARS), Edwards, 2010 |
| GDP | Gross Domestic product | World Bank |
| World Exports growth | calculated | IMF |
| FDI | Foreign Direct Investment | World Bank |

The descriptive statistics are presented in Appendix Table 2. The mean and standard deviation of the variables are not widely spread except for South Africa GDP and import values. The remaining tariff lines (products) are the result of data cleaning and merging of data sets. The tariff and unit values show that the minimum are zero. This is due to the way we treated zero values for the two variables when taking logs. We add 1 to make logs of number less than 1 to be positive. The maximum values tariff is 0.69 and for unit values 20. The import tariff only focuses on manufactured products. Import extensive margin is a dummy variable 0, 1 as explained earlier. The world export growth and GDP growth have negative minimums as expected.

## 5.5 Empirical results

### 5.5.1 Results at the HS8-digit level

Table 24 shows results for different specifications of equations 1 and 2, Columns 1-5 specifically of equation 1, while columns 6-9 of equation 2 with different control variables. Column 1 controls for the product fixed effects. Column 2 considers only the lagged tariff and product fixed effects. Column 3 controls for both the tariff and lagged tariff, while columns 4 and 5 take into account the two measures of extensive margins (variety). Columns

6-9 considers other variables that might affect product quality, such as GDP, export growth, world GDP growth, and foreign direct investment.

The results consistently show the positive relationship between tariffs and the measure of product quality (unit values). The positive impact of tariffs is robust to the inclusion of different variables[36]. For example, column 9 shows that a 1% increase in tariffs leads to a 0.27% increase in product quality. Further including lag tariff does not change the results. From column 1 and 3 it shows that the sum of the tariff coefficients is not different from when you only have either tariff or lag tariff alone.

Given that tariffs have generally been falling from early 1990s to 2009 in South Africa, these results suggest that a reduction in tariffs is associated with a decline in product quality. This suggests that South African manufacturers may have been concentrating on supplying the domestic market rather than the export market since they could potentially gain increased margins in the domestic economy. As the economy opens up, mark-ups are reduced. These results support the finding from Fedderke, Kularatne and Mariotti (2007) who investigate the extent of the mark-up of the South African manufacturing sector and find significant mark-ups to be present in the manufacturing industry which however get reduced by both import and export penetration. Further, the other explanation to the results is that presumably SA exporters are price takers in the export market hence the decline in export values.

The other possible explanation for the results is the product variety compositional issues within the 8-digit HS level. This may mean that within products there is a shift to lower priced varieties potentially because of a rationalisation of product lines, this is market disciplining explanation (which however is difficult to separately empirically measure). Further, although the study controls for product fixed effects, the estimated coefficients is an average of these across products which might mean large falls in some industries may be driving these results. This study further check this under robustness section where the study separate the sample between sectors which experienced high tariff reductions of more than the median and those which experiences tariff reductions lower than the median tariff.

[36] Foreign Direct Investment is used for sensitivity analysis, and its inclusion in regression has not altered our results. However, an appropriate measure for FDI might be foreign direct investment per sector or product.

Another interpretation is that South African products were not close to the technological frontier during the study period. This concurs with results found by Amiti and Khandelwal, (2013) using the same measure as a proxy for product quality for products far away from the unit value frontier. Goldberg *et al*. (2008, 2009) also find that lower tariffs resulted in lower unit values of existing product lines for India. These results seem logical, as they show that increasing tariffs will result in higher product quality because larger profits will be generated by the lack of competition. These profits will then be used to invest in improved product quality. The results support the discouragement effect as opposed to the escape-competition effect.

One implication of these results is that during the 1990s, South Africa was not competitive enough, and thus protection was the key to producing high quality exports. A more straightforward explanation suggests that a decrease in tariffs leads to decrease in product quality upgrading, meaning that the decrease in tariffs has not brought quality benefits to the South African manufactured products. This can be referred to as the market disciplining effect (Edwards & Van de Winkel, 2005) and shows that due to intense competition, South African exporters have been defensive in decreasing the unit prices of their commodities. This might be particularly the case for exports to other African markets, where South African exporters can decrease the quality of their products in order to sell their commodities.

The results presented in Table 24 have used a weighted tariff from 2001; this weighted tariff at the product level was calculated at the preferential trade data level using SADC, EU, EFTA, and MFN countries. The total imports of a HS product to South Africa were divided by total South African imports of that product from the whole world; this was then multiplied by the product's respective tariff. For sensitivity purposes, the results obtained from such a manipulation are compared to the results obtained using an average of the tariff data after 2000 without weighting; these results are generally in conformity with one another, which shows that the manipulation did not distort the tariff effect on product quality.

Table 27: Full Sample Results (1988-2009): Using HS8 Data, Product Level

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| ln(tariff) | 4.33*** | | 2.62*** | 0.30*** | 0.65*** | 0.11** | 0.43*** | 2.35*** | 0.27*** |
| | (0.037) | | (0.048) | (0.061) | (0.038) | (0.051) | (0.061) | (0.053) | (0.089) |
| ln(lagtariff) | | 4.20*** | 2.58*** | | | | 0.37*** | 2.39*** | 0.37*** |
| | | (0.038) | (0.048) | | | | (0.059) | (0.053) | (0.092) |
| ln(import value) | | | | 0.040*** | | 0.079*** | 0.045*** | | 0.052*** |
| | | | | (0.003) | | (0.002) | (0.003) | | (0.003) |
| Import extensive margin | | | | | 1.62*** | | | | |
| | | | | | (0.007) | | | | |
| ln(SA GDP) | | | | | | 0.17*** | 0.52*** | | 1.26*** |
| | | | | | | (0.057) | (0.060) | | (0.085) |
| World export growth | | | | | | 0.20*** | 0.15** | | -0.43*** |
| | | | | | | (0.061) | (0.062) | | (0.078) |
| World GDP growth | | | | | | -0.017*** | -0.011** | -0.069*** | 0.048*** |
| | | | | | | (0.004) | (0.005) | (0.004) | (0.006) |
| ln(foreign direct investment) | | | | | | | | | -0.061*** |
| | | | | | | | | | (0.006) |
| Constant | 0.98*** | 0.98*** | 0.93*** | 1.55*** | 0.34*** | -0.28 | -2.76*** | 1.32*** | -7.55*** |
| | (0.004) | (0.004) | (0.004) | (0.035) | (0.004) | (0.457) | (0.484) | (0.014) | (0.618) |
| Product Fixed Effect | Yes | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes |
| Year Fixed Effect | No | No | No | Yes | No | No | No | Yes | No |
| *N* | 299992 | 283083 | 283083 | 161029 | 299992 | 161029 | 151679 | 283083 | 111609 |
| $R^2$ | 0.046 | 0.044 | 0.054 | 0.010 | 0.191 | | 0.004 | 0.078 | 0.007 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The lagged tariff also shows a positive sign. The results are robust to the inclusion of the lagged tariff when including other variables. The positive impact of the tariff and the lagged tariff still stand in Columns 7-9 in Table 24. Appendix Table 3 estimates equation 3 without measure of import volume or variety. It shows high coefficients throughout the columns for tariff. Contrasting Table 24 and Table 3 in appendix shows that the impact of tariff on unit values is positive no matter which variables are included. It is robust to variables selection. However the coefficient in Appendix 3 is large which is as expected and gets smaller as other variables are included

The positive relationship between South African GDP per capita and product quality shows that as the country becomes richer, it is able to produce higher quality goods. This points both to the country's ability to produce quality goods and to South Africa's domestic demand for quality products, showing that higher development is associated with shipping higher unit values. World GDP growth rate, however, carries mostly negative signs, which shows that as the world GDP increases, South African product quality decreases. This finding may be supported by the fact that as the world GDP increases, South Africa's competitors are able to produce and supply higher quality goods, dampening the potential quality upgrading of South Africa products. This supports the coefficient on tariff. In other words, as global incomes increase, the world in general will not import more South African products shipped at higher unit values. This is the market size effect as envisaged by the heterogeneous firms linear demand models. This concurs with Baldwin and Harrigan (2011) who postulate that lower quality firms will find it profitable to enter a larger destination market, thereby lowering the average export unit value to that market. This is opposite to Kneller and Yu (2008) who show that a larger market implies fierce competition, resulting in higher export unit values. Bastos and Silva (2010) also finds a positive relationship between market size and unit values, but their results are derived from cross-sectional analysis for 2005 and include income per worker. This suggests that demand-side considerations do play a role in explaining export unit values. Kugler and Verhoogen (2012) find similar results.

World export growth carries a positive sign with the exception of column 9 (in Table 24). This shows that an increase in world exports acts as an increase of productivity, which might carry some spill-over effects to South African commodities. Thus, the increase in world exports is a proxy for productivity, implying that such an increase is good for South African manufacturers.

### 5.2.2 Robustness checks

We estimate sub-sample periods (as robustness checks) from 1988-2000 and 2001-2009 to determine if our methodology does not masks the impact of a break in tariff reform that occurred in 2000.

Another robustness check is estimating the equation after classifying exports by their technology intensity as proposed by Lall (2000). This enables the study to investigate if different products experience different response to tariff reductions. Lall (2000) classifies manufacturing exports into broadly 4 categories; high technology, medium technology, low technology and resource based technology manufactures. According to Lall (2000) resource based manufactures, constitute for example agro/forest based products, prepared meats/fruits, beverages and vegetable oils. Low technology manufactures constitute textile/fashion cluster textile fabrics, clothing, headgear, footwear, leather manufactures, travel goods and other low technology such as pottery, simple metal parts/structures, furniture, jewellery, toys, and plastic products. Medium technology manufactures constitutes automotive products, passenger vehicles and parts, commercial vehicles, motorcycles and parts, medium technology engineering industries such engines, motors, industrial machinery, pumps, switchgear, ships, watches. High technology manufactures constitutes for example electronics and electrical products office/data processing/telecommunications equipment, TVs and other high technology such as pharmaceuticals, aerospace, optical/measuring instruments and cameras. An additional robustness check involves classifying products into those with high, medium and low initial tariff in 1988 and re-estimated the equations. This splitting of products between high tariff reduction and low tariff reduction sectors enables us to see whether results differ by the extent of tariff reduction.

***Sub-sample analysis***

The structural shift that occurred in 2001 in terms of tariff reform warrants sub-sample estimations using the pre-2001 sample and the post-2000 sample to see if our results remain consistent after preferential application of tariffs to some regional blocks. Tables 25 and 26 show the sub-sample estimations for 1988-2000 and 2001-2009, respectively. As Table 25 shows, for the pre-2001 sub-sample, the results are not sensitive to sub-sample analysis. Columns 1-5 show estimates for equation 1, while columns 6-9 estimates are for equation 2.

Table 28: Subsample Results (1988-2000); Using HS8 Data (Product Level)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| ln(tariff) | 2.52*** | | 2.03*** | 0.41** | 1.70*** | 0.47*** | 0.17 | 2.46*** | 0.30 |
| | (0.080) | | (0.094) | (0.200) | (0.083) | (0.135) | (0.217) | (0.095) | (0.228) |
| ln(lagtariff) | | 1.56*** | 0.47*** | | | | 0.42** | 0.68*** | 0.56** |
| | | (0.080) | (0.094) | | | | (0.209) | (0.095) | (0.222) |
| ln(import value) | | | | 0.017*** | | 0.069*** | 0.022*** | | 0.018*** |
| | | | | (0.004) | | (0.003) | (0.004) | | (0.004) |
| Import extensive margin | | | | | 0.43*** | | | | |
| | | | | | (0.014) | | | | |
| ln(SA GDP) | | | | | | 1.40*** | 1.63*** | | 1.08*** |
| | | | | | | (0.065) | (0.068) | | (0.143) |
| World export growth | | | | | | 0.43*** | 0.38*** | | 2.29*** |
| | | | | | | (0.076) | (0.076) | | (0.136) |
| World GDP growth | | | | | | 0.00091 | 0.0035 | -0.091*** | -0.13*** |
| | | | | | | (0.005) | (0.005) | (0.004) | (0.009) |
| ln(foreign direct investment) | | | | | | | | | 0.084*** |
| | | | | | | | | | (0.011) |
| Constant | 1.10*** | 1.15*** | 1.11*** | 1.55*** | 0.91*** | -10.3*** | -11.6*** | 1.05*** | -8.70*** |
| | (0.004) | (0.005) | (0.005) | (0.057) | (0.008) | (0.524) | (0.548) | (0.010) | (0.965) |
| Product Fixed Effect | Yes | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes |
| Year Fixed Effect | No | No | No | Yes | No | No | No | Yes | No |
| *N* | 96016 | 95046 | 95046 | 50819 | 96016 | 50819 | 50763 | 95046 | 45500 |
| $R^2$ | 0.013 | 0.005 | 0.011 | 0.032 | 0.025 | | 0.023 | 0.029 | 0.032 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 29: Sub-Sample Results (2001-2009): Using HS8 Data (Product Level Data)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| ln(tariff) | 3.47*** | | 2.33*** | 0.40*** | 0.70*** | 0.10* | 0.29*** | 2.20*** | 0.026 |
| | (0.046) | | (0.055) | (0.073) | (0.047) | (0.059) | (0.075) | (0.061) | (0.117) |
| ln(lagtariff) | | 3.25*** | 2.06*** | | | | 0.49*** | 1.99*** | 0.58*** |
| | | (0.047) | (0.055) | | | | (0.070) | (0.061) | (0.117) |
| ln(import value) | | | | 0.046*** | | 0.098*** | 0.048*** | | 0.056*** |
| | | | | (0.003) | | (0.003) | (0.004) | | (0.004) |
| Import extensive margin | | | | | 1.50*** | | | | |
| | | | | | (0.010) | | | | |
| ln(SA GDP) | | | | | | 0.81*** | 1.36*** | | 0.79** |
| | | | | | | (0.175) | (0.192) | | (0.358) |
| World export growth | | | | | | -0.054 | -0.012 | | -0.80*** |
| | | | | | | (0.088) | (0.090) | | (0.114) |
| World GDP growth | | | | | | -0.082*** | -0.098*** | 0.076*** | 0.11*** |
| | | | | | | (0.007) | (0.008) | (0.008) | (0.022) |
| ln(foreign direct investment) | | | | | | | | | -0.13*** |
| | | | | | | | | | (0.014) |
| Constant | 1.02*** | 1.03*** | 0.96*** | 1.44*** | 0.40*** | -5.39*** | -9.21*** | 0.87*** | -2.50 |
| | (0.005) | (0.005) | (0.005) | (0.044) | (0.006) | (1.393) | (1.529) | (0.023) | (2.909) |
| Product Fixed Effect | Yes | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes |
| Year Fixed Effect | No | No | No | Yes | No | No | No | Yes | No |
| *N* | 203976 | 187538 | 187538 | 110209 | 203976 | 110209 | 100862 | 187538 | 66054 |
| $R^2$ | 0.030 | 0.027 | 0.037 | 0.007 | 0.141 | | 0.006 | 0.048 | 0.008 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In Table 25, the tariff, GDP, world exports, and world growth all largely carry the same sign as in the full sample results. The results show that there is still a positive relationship between tariffs and product quality. The explanation for these consistent results might be the fact that pre-2001, South African producers were not very competitive. This line of thought supports the idea that high tariffs during this pre-2001 period seem to have been beneficial to manufacturers. The lagged tariff variable still carries a positive and significant sign.

Table 26 shows sub-sample results for the post-2000 period. The positive impact of tariffs on product quality still holds in these results, showing that even after the tariff reform of 2001, tariff reductions remain associated with a decline in product quality. This finding may signify that South African producers have failed to upgrade their products during this period. It may also suggest that South African producers are engaging in a defensive strategy in the domestic market by reducing mark-ups as they face higher competition These results show that the positive impact of tariffs is robust to sub-sample analysis. The measure for extensive margin or product variety carries a positive sign on all these regressions. GDP per capita for South Africa still carries a positive significant sign, as expected.

***Lall (2000) technological intensity classification***

This robustness check classifies exports by their technological intensity as provided by (Lall, 2000). Appendix Table 5, panel A (full sample) and B (sub sample) shows the results. The results indicate that tariff impacts on exports have differential impacts on type of manufactures. The coefficient on high technology manufactures is negative though not significant both on full sample and subsample estimations. This shows that a decrease in tariff (though not significant) is associated with quality improvement on high technology manufactures. The coefficient on other manufactures is positive and significant in the full sample results. This suggests that tariff reductions are associated with decline in product quality. This is in line with (Lall, 2000) findings that show that low technology products have slowest growth and high technology intensive products have the fastest. Our results are largely in contrast to Fan, Li and Yeaple ( 2013, 2014) whose model predicts that a reduction in the import tariff induces an exporter to increase the quality of its exports and to raise

(lower) its export price in industries where the scope for quality differentiation is large (small).

***Comparing Products using initial tariff level***

This last robustness check examines whether there is differential response to tariff reduction for products that face differential initial tariff. The products are divided into those that have high initial tariff, medium and low initial tariff. Results in Appendix Table 5, panel A, B and C show that grouping products in such a way will result in differential magnitude impacts on different products. However, throughout all the subsample period the coefficient on tariff is positive. Those products with initial medium tariff experience greater reduction in product quality than those that have high initial tariff. This result however is not consistent on full sample and subsample period 2001-2009 for low initial tariff products. The coefficient for products with medium tariff is consistent across the three sample period. This shows that the products that have been heavily affected by tariff reduction are products with medium initial tariff. This can be explained since those products that had initial high tariff might have faced not very significant tariff reduction to warrant quality improvement.

## 5.7 Conclusion

This study investigates the impact of tariff liberalisation on export product quality upgrading at the HS8-digit code from 1988 to 2009. The study employs a panel data method that exploits variation across the product level. The results indicate that on average tariff liberalisation is associated with a decline in the quality upgrading of South African export products. These results support the discouragement effect which discourages firms facing higher competition from upgrading the quality of their products. The other potential mechanism is that South Africa's export prices were high pre tariff reform. This suggests that domestic mark-ups in South Africa have been high, so tariff liberalisation brings in competition which leads to lower prices. This shows that as South Africa opens the economy to trade, more products were traded possibly at lower prices hence forcing South African exporters to decrease their prices. This is the market discipline effect. The results further reveal that different product types have responded differently to tariff reduction. High

technology products seem to marginally respond to tariff reduction by showing product quality upgrading signs. This shows some hope to product quality upgrading though it is largely weak. In addition, results from comparing products with high, medium and low initial tariff shows that medium tariff products have a more consistent response to tariff reduction than those products with initial low tariff. This shows that those products with initial high tariff did not response highly to tariff reduction.

While this study has attempted to unravel the impacts of tariff liberalisation, there remains a need for further study to disentangle the competition and variety effects of tariff liberalisation by computing input tariffs relying on Input-Output tables. In addition, while the methodology used in this study relies on unit values to measure product quality, unit values remain imperfect measures of product quality. Future research should therefore try to use alternative quality measures.

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## Appendix

Figure 1: GDP per capita and unit values

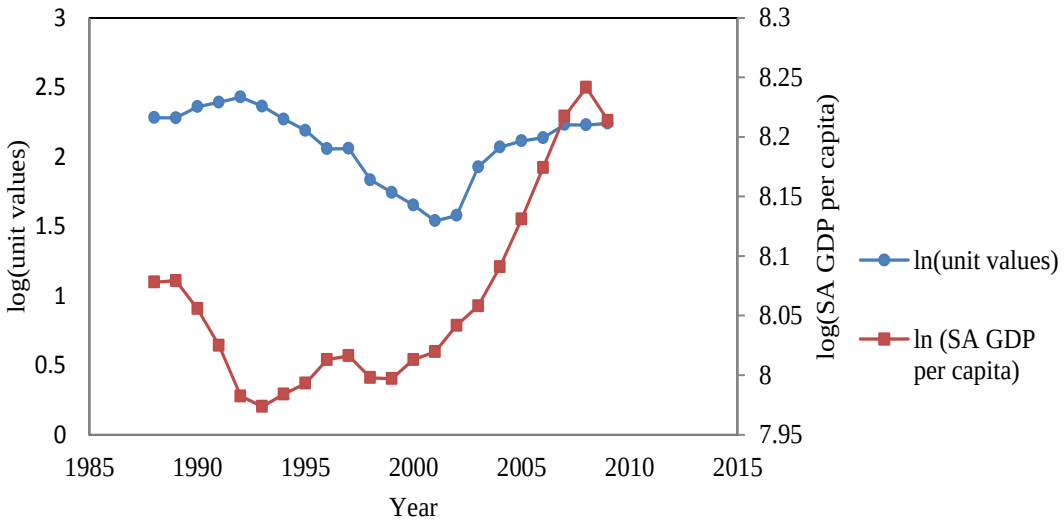


Table 1: Descriptive Statistics

| Variables | Expected sign | Previous Studies |
|---|---|---|
| GDP per Capita | +/- | Falvey and Kierzkowski, 1987; Schott, 2004; Hummels and Klenow, 2005, Baldwin and Harrigan, 2011, Hallak, 2006 |
| Human capital | + | Schott, 2004 |
| Technological innovation | + | Flam and Helpman, 1987, Aw et at. 2008, Faruq, 2011 |
| FDI | + | Harding and Jovircik, 2009); Caetano and Galego, 2006, Reganati and Pittiglio, 2005, Faruq, 2011 |
| Institutions | + | Faruq, 2011, Amiti and Khandelwal, 2012 |
| Distance | +/- | Fontagne *et al*., 2008, Baldwin and Harrigan, 2011, Harrigan and Shlychkov, 2012 |
| Tariffs | +/- | Amiti and Khandelwal, 2012, Hummels and Skiba, 2004 |
| World Wide export growth | +/- | Proxy for productivity shocks. Amiti and Khandelwal, 2012 |

Table 2: Descriptive statistics

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| ln (unit value) | 299992 | 1.247752 | 1.963062 | 0 | 20.00654 |
| ln(tariff) | 299992 | .0616338 | .1087834 | 0 | .6931472 |
| ln(lagtariff) | 282584 | .0639948 | .1105917 | 0 | .6931472 |
| ln(SA GDP per capita) | 299992 | 8.047174 | .066886 | 7.973569 | 8.241478 |
| ln( import value) | 161049 | 12.32066 | 2.91114 | -.2150321 | 21.8179 |
| Import extensive margin | 299992 | .5368443 | .4986415 | 0 | 1 |
| World Export Growth | 299992 | .0876006 | .0841974 | -.2164727 | .2189627 |
| World GDP growth | 299992 | 2.917897 | 1.172482 | -2.245053 | 4.720025 |
| In(foreign Direct investment) | 221416 | 21.68792 | 1.107896 | 19.63573 | 23.25962 |

Table 3**:** Full Sample Results (1988-2009): Using HS8 Data: Product level: No import data

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| ln(tariff) | 4.33*** | | 2.62*** | 4.02*** | 4.33*** | 4.10*** | 4.44*** | 4.02*** | 4.61*** |
| | (0.037) | | (0.048) | (0.039) | (0.037) | (0.036) | (0.038) | (0.039) | (0.045) |
| ln(lagtariff) | | 4.20*** | 2.59*** | | | | | | |
| | | (0.038) | (0.048) | | | | | | |
| In(SA GDP) | | | | | | 1.07*** | 1.05*** | | -0.040 |
| | | | | | | (0.045) | (0.045) | | (0.065) |
| World export growth | | | | | | 0.093** | 0.086* | | 0.58*** |
| | | | | | | (0.047) | (0.047) | | (0.061) |
| World GDP growth | | | | | | -0.045*** | -0.039*** | -0.088*** | -0.078*** |
| | | | | | | (0.003) | (0.003) | (0.003) | (0.005) |
| ln(foreign direct investment) | | | | | | | | | 0.031*** |
| | | | | | | | | | (0.004) |
| Constant | 0.98*** | 0.98*** | 0.93*** | 0.96*** | 0.98*** | -7.58*** | -7.34*** | 1.37*** | 0.76 |
| | (0.004) | (0.004) | (0.004) | (0.012) | (0.004) | (0.361) | (0.364) | (0.014) | (0.471) |
| Product Fixed Effect | Yes | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes |
| Year Fixed Effect | No | No | No | Yes | No | No | No | Yes | No |
| *N* | 299992 | 282584 | 282584 | 299992 | 299992 | 299992 | 299992 | 299992 | 221416 |
| $R^2$ | 0.046 | 0.044 | 0.054 | 0.072 | 0.046 | | 0.048 | 0.072 | 0.053 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Regression using Lall(2000) classification

***Panel A. Full sample***

| | High Technology | Low Technology | Medium Technology | Resource Based |
|---|---|---|---|---|
| ln(tariff) | -0.076 | 0.50*** | 1.04*** | 0.32*** |
| | (0.307) | (0.047) | (0.106) | (0.079) |
| ln(imports value) | 0.11*** | 0.019*** | 0.052*** | 0.011*** |
| | (0.009) | (0.003) | (0.004) | (0.002) |
| ln(SA GDP) | -0.18 | 0.36*** | 0.24** | 0.46*** |
| | (0.194) | (0.059) | (0.094) | (0.057) |
| World export growth | 0.43* | 0.11 | 0.20* | 0.034 |
| | (0.230) | (0.065) | (0.106) | (0.068) |
| World GDP growth | -0.049*** | -0.0037 | -0.022*** | -0.0079* |
| | (0.016) | (0.004) | (0.007) | (0.005) |
| Constant | 3.70** | -1.51*** | 0.10 | -2.58*** |
| | (1.570) | (0.479) | (0.760) | (0.466) |
| *N* | 23129 | 89061 | 87432 | 59298 |
| $R^2$ | 0.009 | 0.003 | 0.004 | 0.005 |

**Panel B: Subsample**

| | Subsample 1988-2000 | | | | Subsample 2001-2009 | | | |
|---|---|---|---|---|---|---|---|---|
| | HT | LT | MT | RB | HT | LT | MT | RB |
| ln(tariff) | -0.37 | 0.35*** | 1.18*** | -0.026 | -0.17 | 0.081 | 1.14* | 0.17 |
| | (0.488) | (0.072) | (0.159) | (0.136) | (1.643) | (0.274) | (0.649) | (0.247) |
| ln(imports value) | 0.14*** | 0.034*** | 0.062*** | 0.010** | 0.038* | 0.021*** | 0.050*** | 0.012** |
| | (0.018) | (0.005) | (0.007) | (0.005) | (0.021) | (0.007) | (0.010) | (0.006) |
| ln(SA GDP) | 2.13** | -0.27 | 2.89*** | 0.69*** | 1.96*** | 0.98*** | 2.38*** | 1.09*** |
| | (0.871) | (0.246) | (0.372) | (0.258) | (0.286) | (0.100) | (0.155) | (0.102) |
| World export growth | -0.21 | -0.21* | -0.21 | 0.049 | 0.83** | 0.28*** | 0.57*** | 0.11 |
| | (0.454) | (0.118) | (0.185) | (0.131) | (0.338) | (0.105) | (0.173) | (0.118) |
| World GDP growth | -0.20*** | -0.0078 | -0.14*** | -0.037*** | -0.020 | 0.013* | -0.0042 | 0.0032 |
| | (0.040) | (0.010) | (0.016) | (0.011) | (0.024) | (0.007) | (0.012) | (0.008) |
| Constant | -14.6** | 3.42* | -21.0*** | -4.27** | -12.9*** | -6.50*** | -17.4*** | -7.81*** |
| | (6.901) | (1.963) | (2.959) | (2.057) | (2.280) | (0.805) | (1.239) | (0.821) |
| *N* | 9215 | 37487 | 37341 | 20698 | 4283 | 16014 | 15667 | 11641 |
| $R^2$ | 0.013 | 0.004 | 0.008 | 0.001 | 0.025 | 0.019 | 0.034 | 0.016 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NB: HT- High technology, LT- low technology, MT- Medium technology, RB- Resource based technology

Table 5: Results using difference in initial tariff on products

***Panel A: Full Sample***

| | High initial tariff | Medium initial tariff | High initial tariff | High initial tariff | Medium initial tariff | Low initial tariff |
|---|---|---|---|---|---|---|
| ln(tariff) | 0.45*** | 0.99*** | 0.54*** | 0.42*** | 0.90*** | 0.53*** |
| | (0.097) | (0.132) | (0.134) | (0.107) | (0.148) | (0.145) |
| ln(imports value) | 0.020*** | 0.023*** | 0.056*** | 0.024*** | 0.034*** | 0.069*** |
| | (0.005) | (0.004) | (0.004) | (0.006) | (0.005) | (0.004) |
| ln(SA GDP) | | | | 0.79*** | 1.18*** | 1.45*** |
| | | | | (0.213) | (0.162) | (0.115) |
| World export growth | | | | -0.052 | -0.39*** | -0.60*** |
| | | | | (0.162) | (0.140) | (0.113) |
| World GDP growth | | | | 0.032** | 0.038*** | 0.061*** |
| | | | | (0.015) | (0.012) | (0.009) |
| ln(foreign direct investment) | | | | 0.017 | -0.039*** | -0.095*** |
| | | | | (0.012) | (0.010) | (0.008) |
| Constant | 1.20*** | 1.37*** | 1.70*** | -5.48*** | -7.49*** | -8.34*** |
| | (0.062) | (0.059) | (0.056) | (1.597) | (1.199) | (0.817) |
| *N* | 28171 | 45262 | 86698 | 17967 | 29098 | 63774 |
| $R^2$ | 0.009 | 0.006 | 0.018 | 0.005 | 0.006 | 0.009 |

***Panel B: Sub sample 1988-2000***

| | High initial tariff | Medium initial tariff | High initial tariff | High initial tariff | Medium initial tariff | Low initial tariff |
|---|---|---|---|---|---|---|
| ln(tariff) | 0.43*** | 1.17*** | 0.58*** | 0.51*** | 0.81*** | 0.26 |
| | (0.108) | (0.151) | (0.180) | (0.147) | (0.202) | (0.212) |
| ln(imports value) | 0.017*** | 0.031*** | 0.069*** | 0.014* | 0.041*** | 0.079*** |
| | (0.006) | (0.005) | (0.006) | (0.008) | (0.007) | (0.007) |
| ln(SA GDP) | | | | 2.73*** | 1.70*** | -0.26 |
| | | | | (0.686) | (0.570) | (0.584) |
| World export growth | | | | 0.0081 | -0.48** | -1.25*** |
| | | | | (0.216) | (0.192) | (0.178) |
| World GDP growth | | | | -0.028 | 0.036 | 0.19*** |
| | | | | (0.042) | (0.039) | (0.032) |
| ln(foreign direct investment) | | | | 0.057** | -0.042 | -0.24*** |
| | | | | (0.027) | (0.026) | (0.021) |
| Constant | 1.21*** | 1.26*** | 1.55*** | -21.7*** | -11.6** | 8.05* |
| | (0.071) | (0.070) | (0.078) | (5.608) | (4.650) | (4.736) |
| *N* | 22507 | 34771 | 52352 | 12782 | 19643 | 33162 |
| $R^2$ | 0.008 | 0.006 | 0.013 | 0.003 | 0.006 | 0.015 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Results using difference in initial tariff on products (continued)

***Panel C: Sub sample 2001-2009***

| | High initial tariff | Medium initial tariff | High initial tariff | High initial tariff | Medium initial tariff | Low initial tariff |
|---|---|---|---|---|---|---|
| ln(tariff) | 0.25 | 0.90** | 0.29 | 0.34 | 1.12*** | 0.36 |
| | (0.326) | (0.413) | (0.290) | (0.340) | (0.431) | (0.310) |
| ln(imports value) | 0.023** | 0.015* | 0.023*** | 0.024** | 0.017* | 0.023*** |
| | (0.010) | (0.008) | (0.005) | (0.011) | (0.009) | (0.006) |
| ln(SA GDP) | | | | 0.36 | 1.32*** | 0.95*** |
| | | | | (0.368) | (0.292) | (0.177) |
| World export growth | | | | 2.74*** | 1.74*** | 2.39*** |
| | | | | (0.351) | (0.275) | (0.170) |
| World GDP growth | | | | -0.15*** | -0.096*** | -0.13*** |
| | | | | (0.024) | (0.019) | (0.012) |
| ln(foreign direct investment) | | | | 0.11*** | 0.038* | 0.10*** |
| | | | | (0.028) | (0.022) | (0.014) |
| Constant | 1.24*** | 1.26*** | 1.60*** | -3.70 | -10.0*** | -7.93*** |
| | (0.141) | (0.111) | (0.073) | (2.496) | (1.972) | (1.189) |
| *N* | 5664 | 10491 | 34346 | 5185 | 9455 | 30612 |
| $R^2$ | 0.044 | 0.026 | 0.033 | 0.045 | 0.027 | 0.033 |

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

# Chapter 6: Conclusion and Policy implications

## 6.1 Summary of Findings

The overall objective of the thesis is to provide a comprehensive analysis at product level of the impact of tariff reforms of trade flows and product quality. This trade flow analysis examines the trade response through the concept of extensive and intensive margins. Analysis of trade patterns in this way is relatively new in the trade literature and very few South African studies have been done using this approach.

In chapter two the thesis calculates trade margins for both exports and imports using different trade margins measures. The results show that for exports, South Africa exports more at the extensive trade margin than on the intensive margin to its trading partners. The results for imports show that South Africa imports more varieties from developed than developing countries. These results are consistent across different measures of trade margins. Further, trend analysis suggest that trade policy matters more at the extensive margin than intensive margin for both imports and exports, with largely the extensive margins showing an upward trend around trade agreements period. The results show that South African traders are transiting from trading with traditional trade partners like European countries to trading more with East Asian countries like China.

Chapter 3 investigates the relationship between tariff liberalisation and export trade margins. The study finds differential impacts of tariff reduction across different product groups. Disaggregated results largely confirm that tariff reductions are associated with an increase in the number of destinations for South African exports, except for consumer goods. Homogenous products show a weaker relationship with tariff reduction which shows that, at least for South Africa, homogeneous products are not easily traded at higher volumes even if there is tariff reduction.

Chapter 4 investigates the relationship between tariff reforms and import trade margins at the HS6 digit level. The results also show differential impacts of tariff reduction across different product groups imported. Capital, intermediate and consumer products show greater responsiveness to changes in tariffs. Tariff reduction has a weaker impact on raw materials.

Finally chapter 5 assesses the impact of trade reform on product quality upgrading. The results show a positive relationship between tariff changes and product quality, with tariff liberalisation associated with a decline in quality upgrading. The results suggest that tariff liberalisation is negatively associated with quality upgrading.

The common thread of these chapters is tariff liberalisation. Chapter 3 investigates the impact of tariff changes on export trade margins, which has similarly been done to the import side in Chapter 4. Lastly Chapter 5 tracks the impact of tariff liberalisation on product quality. This chapter acts as an inference chapter from the other two chapters. It closes the study by investigating whether these changes in tariffs, trade margins and trade volumes have implications on product quality.

## 6.2 Implications of findings

The first implication is that South Africa should continuously monitor the impact of tariff liberalisation at both trade margins. Since results show that tariffs have impact on the trade margins mostly at the extensive margin, it is crucial that South Africa should continue using trade policy to influence desired objectives like industrial growth. In a related argument South Africa should promote South- South trade (so as to be the industrial hub of Southern Africa) through more tariff concessions and other regional marketing initiatives, since analysis of trade margins show more trade with developed countries than with developing countries.

The second implication is that there is need for South African exporters to differentiate their products to increase trade with the European Union countries and more other developed countries. Trading homogenous products is less likely to bring the expected benefits in trade. For industrial growth, tariff policy should therefore be targeted to promote more production of diversified products.

Following from the second implication, the third entails that tariff policy should be targeted to increase imports from sectors that promote industrial growth. The importance of tariff reduction on capital and intermediate goods should be continually promoted. However, these policies should promote quality upgrading such that South Africa competes in the international market. More imports of final capital goods might stifle product quality

upgrading as compared to more intermediate products that are used in the production process. This brings the fourth implication that future tariff reforms need to address the failure of South African exporters to upgrade their products. Thus, there is a need for case-by-case consideration for further tariff liberalisation, with proper consideration of the impact of such liberalisation on international competitiveness. There is need to target growth in high technology manufactures as they show some responsiveness to tariff reduction. This many lead South Africa to export more even to developing countries.