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Abstract

This paper analyses the effects of the COMESA-EAC-SADC Tripartite Free Trade Agreement (TFTA) on the South African economy using a global Computable General Equilibrium (CGE) model. Simulation results show that South Africa's economy gains from the implementation of the trade agreement with GDP rising by more than 1 per cent relative to the baseline. This win in overall economic activity occurs on the back of a terms of trade increase and a surge in regional trade, which allows for higher levels of both exports and imports. The boost to exports stimulates local industries, whilst relatively cheaper imports lead to welfare gains for local consumers. Increased trade and industry activity causes higher demand for endowments, including skilled and unskilled labour, capital and land, pushing up wages and capital rentals.

JEL Codes: C68, F13, O55

Keywords: Computable General Equilibrium (CGE) Modelling, Free Trade Agreement, South Africa

1 Introduction

The National Development Plan for 2030 clearly states the importance of increased international relations and trade for South Africa's economic future. "...its policies on African integration must be based on positioning South Africa as one of the continent's powerhouses that would lead African development and influence world affairs" (NPC, 2011). The COMESA-EAC-SADC Tripartite Free Trade Agreement (TFTA) adds to this vision for increased global participation, superficially relating to economic cooperation between South Africa and the rest of the TFTA participants. To attain sustainable economic growth, it is important to set comprehensive trade agreements in place.

In this study, we investigate the implications of the TFTA on the South African economy using a global Computable General Equilibrium (CGE) model. We analyse the impact of this policy using the standard Global Trade Analysis Project (GTAP) model alongside version 8.1 of the GTAP database. The

implementation of any new trade policy has a direct and indirect effect on the economy, and for South Africa to reap the full benefits of such an agreement, it is essential to estimate and understand these effects. The GTAP CGE model's multi-country and multi-sector specification allows us to capture the effects of complicated interactions among economic actors and determine who the winners and losers are likely to be.

Our simulation results show that South Africa's Gross Domestic Product (GDP) and welfare increases in the short-run after the implementation of the TFTA. South African trade shifts away ever slightly from other trading regions such as North America and the European Union (EU), towards other countries participating in the TFTA. With overall economic activity in South Africa expanding, interesting changes in the local market structure emerge. Firstly, the increase in demand for South African exports boosts local industries. However, flowing from this boost in demand is a rise in local prices, and the terms of trade, which causes substitution away from locally produced goods towards now relatively cheaper imports. Depending on the structure of each individual industry, in particular their exposure to these trade outcomes, winners and losers emerge. Overall, the TFTA brings about positive economic effects for South Africa's economy.¹

The structure of the paper is as follows: Section 2 provides a brief background on the TFTA, South African trade and trade between South Africa and other participating countries. Section 3 reviews the relevant trade literature. Section 4 discusses the CGE methodology and looks at the GTAP database, model and model closure. Section 5 provides a small back-of-the-envelope model to assist in the interpretation of results. Section 6 reports selected macroeconomic and industry results. Finally, Section 7 concludes the study and suggests possible policy implications.

2 Background and Trade Profile

The TFTA is a proposed trade alliance between three of the eight Regional Economic Communities (RECs) recognised by the African Union. The TFTA is an umbrella organisation consisting of the Common Market for Eastern and Southern Africa (COMESA), the East Africa Community (EAC) and the Southern African Development Community (SADC). The TFTA constitutes of 26 countries and started negotiations in 2005, which is expected to be implemented in 2016.²

¹This study does not take into consideration non-tariff barriers, services trade and other trade facilitation components of the TFTA. These additional components are likely to have an impact on the actual outcome of the TFTA, decrease the measured losses and create gains for participating countries.

²The 26 member countries are: Angola, Botswana, Democratic Republic of the Congo (DRC), Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia, Zimbabwe, Burundi, Kenya, Rwanda, Uganda, Comoros, Djibouti, Egypt, Eritrea, Ethiopia, Libya and Sudan (now two countries).

The aim of the TFTA is to coordinate and improve regional trading arrangements and programmes - ultimately leading to an African Economic Community realisation. This includes the improvement of trade facilitation to improve the flow of goods, the joint preparation and execution of infrastructure programmes, as well as the free movement of businesspersons within the region (COMESA-EAC-SADC-Tripartite). In addition, the TFTA addresses the issue of overlapping membership between the three RECs. With 26 countries included and a combined GDP of \$860 billion and population of 590 million people (dti, 2014b); the TFTA is expected to generate significant growth in Africa and specifically, South Africa. Section 2.1 considers South African trade, where after Section 2.2 provides a trade profile on South Africa's trade with other participating TFTA countries.

2.1 South African Trade

South Africa has a rich and complex international trade history. The economic sanctions set in place against South Africa during the latter part of Apartheid restricted exports and imports, as well as economic growth depending on trade. After the new democratic regime took power in 1994 and South Africa joined the World Trade Organisation in 1995, South Africa experienced an expansion in foreign trade. The further moving away from protectionism and the participation in Preferential Trade Agreements (PTAs) with the EU in 1999 and SADC in 2000 contributed to South Africa's openness and increased trade (Jordaan, 2011). Figure 1 depicts South African trade as a percentage of GDP over the period between 1960 and 2013.

Between 2008 and 2009, South African imports and exports decreased with 17.4 percent and 19.5 percent, respectively, due to the financial crisis (SARB, 2014). According to the Minister of the Department of Trade and Industry, Rob Davies, exports to the EU decreased from €22 billion (2008) to €20 billion (2012), whilst imports from this region increased over the same period from €20 billion to €25 billion (Ensor, 2014). As the EU was one of South Africa's main trading partners, the economic shock of the financial crisis was significant on foreign trade and would still be evident afterwards.

South Africa's exports increased by 12.7 percent in 2013, because of higher demand from countries such as China, Botswana, Namibia, Germany and the United States (US). Similarly, trade with BRIC countries³ increased notably over the last five years with China as a main driver. South Africa experienced an increase in imports from China, which widened the trade deficit to R70 billion in 2013 (dti, 2014a). The Annual Report for 2013/2014 by the Department of Trade and Industry states that South Africa continues to increase trade, not only with traditional partners but also with other emerging markets. To give some background on South Africa's trade and trade agreements, Table 1 provides a list of the main trading agreements South Africa participates in.

³BRIC countries include Brazil, Russia, India and China. These countries are considered as emerging markets.

2.2 Trade Profile

This section provides a brief profile on South African imports, exports and the tariff structure between South Africa and other TFTA countries.⁴ Figure 2 illustrates the composition of goods imported from other TFTA countries into South Africa and Figure 3 shows the composition of South African goods exported to other TFTA countries.⁵

Overall, only 6.236 percent of total South African imports originate from other TFTA countries, whereas 35.133 percent of all imports are from the EU. Light and heavy manufactured goods make up 63.225 percent of imported goods from all trading partners, whereas oil and gas extraction represent 10.251 percent (GTAP database). South Africa mainly imports manufactured goods as well as oil and gas extraction goods from other TFTA countries, illustrated in Figure 2.

South Africa exports most of its tradable goods to the EU (31.649 percent of all exports), North America (12.918 percent) and other TFTA countries (15.409 percent). Overall, 61.406 percent of exports are that of manufactured goods, 9.093 percent other extractions, followed by transport and communication which equals 6.296 percent. Exports to other TFTA countries are mainly manufactured goods (69.742 percent), as shown in Figure 3. Additional goods exported to other TFTA countries, include processed food as well as petroleum and coal products (GTAP database).

Table 2 illustrates (i) the tax (tariff) on imports of goods from South Africa into other TFTA countries and (ii) the tax on imports of goods from other TFTA countries into South Africa. Grains and crops and other secondary industry products such as light and heavy manufactured commodities, textiles and clothing, as well as petroleum and coal products are highly taxed relative to other goods. Tariffs imposed on imports from other TFTA countries⁷ are lower than tariffs levied on South African traded commodities. Tariffs on grains and crops, processed foods, as well as textiles and clothing are relatively high in comparison with tariffs levied on other traded goods from the other countries participating in the TFTA.

It is important to keep the trade profile in mind when discussing simulation results in Section 6. The following section considers relevant literature on Free Trade Agreements (FTAs), the TFTA and methodologies used to analyse the impacts thereof on economies.

3 Literature Review

The argument for FTAs date back to the mercantilist era when economists believed that the world drew from a limited “pot” of resources and that the wealth of a nation depended on a favourable balance of trade. Conversely, Adam Smith

⁴Other TFTA countries refer to other 25 countries participating in the TFTA, excluding South Africa.

⁵Data obtained from GTAP version 8.1 database. The aggregation of regions and goods is discussed in Section 4.2.

stated in *The Wealth of Nations* that the “pot” is not limited and can grow over time, provided trade between countries is unobstructed (Kishtainy et al., 2012). Many studies that analyse trade agreements use different methodologies such as partial and general equilibrium analysis, as well as econometric approaches. Econometric techniques, including the gravity model, are suitable for *ex-post* analysis, whereas CGE models are more appropriate for *ex-ante* analysis (Cernat, 2003). This section examines various econometric and CGE approaches used in FTA studies.

Factors such as the distance between countries, the similarity of economies, the remoteness to the rest of the world and the comparative advantages of trading partners determine the establishment of an FTA (Baier & Bergstrand, 2004). Moreover, countries consider the economic benefits that participation will bring about.⁶ Unilateral and multilateral liberalisation has beneficial impacts on the steady-state growth of all trading countries (Ben-David & Loewy, 1998). Other studies condoning the influence of FTAs on economic growth and international trade include research by Baier and Bergstrand (2007), as well as Wacziarg and Welch (2008).

Authors analyse economic effects of trade agreements similar to the TFTA, using various models and techniques.

Abedini and Peridy (2014) analyse the trade effects from the Greater Arab Free Trade Area (GAFTA) between fourteen Arab countries using the new gravity model accompanied by supply-demand export equations in an imperfect competition environment. To control for the problem of endogeneity, the authors utilise instrumental Generalised Methods of Moments (GMM) panel estimation. The findings of this paper conclude that GAFTA countries could benefit from deeper regional trade integration due to the limited benefits of GAFTA.

Other econometric methods include the Michigan Model of World Production and Trade employed by Brown, Kiyota and Stern (2008) to determine the welfare and economic effects of a bilateral FTA between the United States and South African Customs Union (SACU). Similarly, Jordaan (2011) uses panel data estimation, the gravity model, to determine the effects of the EU-SA and SADC trade agreement.

As CGE methodology takes the intricate interaction between and within sectors into account, other studies analyse the impact of trade liberalisation using various CGE models and databases (Gilbert and Scollay (2000) and O’Ryan et al. (2011)). To analyse the economic effects of four East Asian FTA options, Kitwiwattanachai, Nelson and Reed (2010) consider unemployment, to investigate the changes in real wage and subsequently unemployment due to trade liberalisation. The FTA contributes to higher economic welfare gains compared to any of the other bilateral trade agreements (Kitwiwattanachai, Nelson & Reed, 2010).

Several studies conduct research into the proposed TFTA by means of CGE methodology. In a research report, Minor and Mureverwi (2013) evaluate the

⁶Some trade agreements exist due to political motivation and not necessarily because of economic benefits that might arise for the participating country (Baier, Bergstrand & Clance, 2014).

effects of African trade liberalisation (the TFTA and finally, the customs union) on Mozambique, focussing on the vulnerability of poor households. The authors employ the MyGTAP model and database, developed by Peter Minor and Terrie Walmsley, which allows for the deconstruction of GTAP regional households. The basis of the MyGTAP model is the standard, static GTAP model. Increased trade contribute to higher real income for poor rural households, however, the same is not true for poor urban households. Government revenues are expected to increase and could be applied to compensate for the loss of poor urban households (Minor & Mureverwi, 2013).

Similarly, Mukwaya and Mold (2014) analyse the effect of TFTA on the East African region using the GTAP model and database, to analyse the static effects of the proposed TFTA. The results indicate a net welfare gain of \$10.7 billion. The distribution of gains mainly goes to Egypt, South Africa and Zimbabwe. Increased exports and imports are expected, due to amplified industrial production across the East African region (as new firms enter the market space).

Using the standard comparative, static pre-release version 8 GTAP model, Jensen and Sandrey (2011) simulate a 2 percent reduction in assumed non-tariff barriers to both merchandise goods and services barriers. Results indicate that South Africa and Mozambique gain most favourably from the TFTA. South Africa's exchange rate appreciates when the demand for exports increase. Industries in South Africa that may experience improvement include the agricultural sugar sector, manufacturing and services output (Jensen & Sandrey, 2011).

Likewise, using an ex-ante general equilibrium approach, Willenbockel (2013) uses a GLOBE model and considers eight simulation scenarios. GLOBE is a multi-country CGE model, developed by McDonald, Thierfelder and Robinson (2007) for the investigation of trade negotiations. Commensurate to Jensen and Sandrey (2011), Willenbockel finds that South Africa enjoys the largest income gains from the TFTA under full Intra-Free Trade Area tariff liberalisation. In this study Swaziland, Lesotho and Namibia are expected to gain the largest relative to the baseline (Willenbockel, 2013).

As determined by other studies, South Africa is expected to gain considerably from the TFTA relative to other participating countries. The aim of this study is to conduct a general equilibrium analysis of the effects of the TFTA on South Africa and the different participants within the economy. In order for policy makers to effectively implement the agreement and manage subsequent challenges that may arise, it is of essence to determine the players in the economy who will either benefit or lose from such an agreement.

4 Methodology

In this study, we use a CGE model to analyse the economic effects of the TFTA. Four basic tasks distinguish CGE based analysis: The first task is the derivation of the model's theoretical structure. The second task is calibration, which integrates the construction of the database, as well as the evaluation of coefficients and parameters for the base year. The third task is the simulation design,

which includes the choice of an appropriate model closure for the given exogenous shock. The fourth and final task is the interpretation of the simulation results, considering only the underlying database values, theory and assumptions incorporated in the simulation design (Adams, 2005).

This method of modelling makes use of real world data, taking into account the inter-linkages between different sectors and agents whilst comparing the effects of a certain change, relative to the baseline. CGE models simultaneously consider all the sectors of the economy and take account of economy-wide spillover effects. To solve for a set of prices and quantities where demand and supply are in equilibrium, consumer and producer behaviour with market clearing constraints are imposed (Burfisher, 2011).

A CGE model is a system of equations, which describes the economy and the interaction amongst the different sectors and participants. The foundation of a CGE model is directly derived from economic theory and includes exogenous and endogenous variables, in conjunction with market clearing constraints. Equations are solved simultaneously to obtain equilibrium of the economy. Static CGE models provide a before and after comparison of an economic shock or policy implementation (Burfisher, 2011).⁷ The given CGE database refers to a given time period (the base, business-as-usual, reference or benchmark year), which through simulation, will then take the database from the initial or current time-period to the next (Ianchovichina & McDougall, 2000).

A wide variety of CGE models exist for different applications. The GTAP model, employed in this study, is a static multi-country CGE model that is able to assess economic shocks and policy changes in a global trade framework. In addition to the GTAP model, we utilise the GTAP version 8.1 database. A benefit of using a multi-country CGE model is the endogenous consideration of the foreign market, which recognises that policies implemented in certain countries affect other countries as in the real world.

This section further considers the tasks that distinguish CGE based analysis. Section 4.1 considers the first task and discusses the GTAP model; Section 4.2 evaluates the GTAP database. Hereafter Section 4.3 addresses the third task, which is the simulation design and model closure. Section 6 provides the interpretation of the results of the simulation, which is the final task.

4.1 Global Trade Analysis Project (GTAP) Model Overview

The GTAP was established in 1992 to develop a global model and database in order to quantitatively analyse international economics within an economy-wide framework. The GTAP model is a comparative-static multi-country applied model of the world economy to use in conjunction with the multi-country database – the GTAP database. This multi-country model was created in order to analyse bilateral and multilateral trade agreements, immigration, climate change and international financial imbalances (Hertel, 2013).

⁷Conversely, dynamic CGE models are solved recursively, to take into account the adjustment of variables and factors at each time-period and provides results that are more realistic.

The design of the GTAP model entails the symmetric handling of utility and production functions across different regions. In each region, the representative household maximises a Cobb-Douglas utility function by allocating income between private and public consumption, as well as savings.⁸ Households invest their savings locally or abroad in the global trust, also referred to as the global bank. Private consumption behaviour is modelled using a constant difference of elasticity (CDE) function, where the demand elasticity differs in response to changes in expenditure and prices. Correspondingly, government expenditure is also represented by a Cobb-Douglas utility function. Although utility and production functions are treated symmetrically, differences in regional behaviour are captured in the differences of economic flows, model parameters and the model closure.

Figure 4 is an illustration of the economic relationships in the model. Regional households or consumers earn income through rent of capital, labour, land and natural resources (primary factors) that they own (VOA endowments) and provide to producers. Another form of remuneration includes taxes (TAXES) and tariffs on imports, as well as exports (MTAX and XTAX respectively). The regional household allocates expenditure between private expenditure (PRIV-EXP), government expenditure (GOVEXP) and savings (SAVE). This includes consumption of domestic goods (VDPA and VDGA) and imported goods (VIPA and BEAM), which is included in import tariffs (MTAX), consumer tax (TAXES) and savings (SAVE).⁹

Producers provide goods and services to international and domestic economic participants and obtain revenue from these different sources. Revenue for the producer constitutes out of the total value of government and private sector at market prices (VDGA and VDPA respectively), as well as intermediate consumption between producers (VDFA) and exports to international participants (VXMD). Producers buy inputs and primary resources from private households (VDPA), which is included in taxes paid (TAXES) and imports (VIFA) (Hertel & Tsigas, 1997).

Profit-maximising producers base output decisions on a constant elasticity of substitution (CES) function, represented in the nested production structure illustrated in Figure 5. At each level of production, the demand for commodities depends on the elasticity of substitution and relative prices of inputs. Commodities are produced with CES between primary factors and intermediate inputs. Intermediate inputs may originate from domestic or foreign resources, based on the Armington assumption.

We use the GTAP version 3.6 model to study the impact of the TFTA on the South African economy. Together with the GTAP model and database, we use the GEMPACK suite of economic-modelling software that includes RunGTAP, developed by the Centre of Policy Studies (Pearson & Horridge, 2003). In Section 4.2, we present the GTAP database, which involves the third task of CGE analysis.

⁸A special case of Stone-Geary utility function is employed, due to all subsistence shares equaling zero, the function reduces to the Cobb-Douglas function.

⁹Households save through the net investment (NETINV) of their capital in producers.

4.2 Global Trade Analysis Database

A CGE database portrays the circular flow of income and expenditure in an economy at a specific time-period. A CGE database reports the aggregated values of all goods and services that the economy produces and the corresponding income generated. We employ version 8.1 of the GTAP database with 2007 as the reference year.¹⁰

The GTAP database records the annual flows of goods and services for the global economy in the benchmark year. With linkages between industries of each regional economy already in place in the database, each economy is consolidated with private and government consumption, investment, exports and imports (James & McDougall, 1993). To model the global economy accurately, the GTAP database considers and incorporates bilateral trade preferences, tariff rate quotas (ad valorem and specific tariffs individually), export subsidies and agricultural support (Hertel, 2013).

The full GTAP database contains 134 regions for all 57 GTAP commodities and is documented in Aguiar, Narayanan and Walmsley (2012). For this study, we aggregate the 134 regions into seven regions: The Republic of South Africa (ZAF), the rest of countries participating in the TFTA (Other TFTA), the rest of Africa (RoA), the North American Free Trade Area (NAFTA), the EU (EU25), the BRIC countries (BRIC) and the Rest of the World (RoW).¹¹ We aggregate the 57 commodities (inflow and outflow) into fourteen sectors (tabulated in Table 3) in order to investigate the micro economic impact of the TFTA.¹²

To produce a consistent economic model, the GTAP database has to adhere to certain requirements. Exports of a certain economy are imported by other economies. Regional economies function on their respective budget constraints. Sectors earn zero profit. Global savings should equal global net investment. Furthermore, exports of global transport services from an individual country must be equal to the demand for the same services (Hertel, 2013). In Section 4.3 we discuss the model closure and simulation design.

4.3 Model Closure and Simulation Design

Similar to other CGE models, the GTAP model contains more variables than equations. In order to solve the model, it is necessary to specify variables to be determined endogenously within the model and variables to be determined exogenously. The model closure is therefore the assumptions regarding the choice and specification of endogenous and exogenous variables. The model closure portrays the desired economic environment in which the simulation is to be run (Dixon et al., 2013).

The standard GTAP closure is a short-run closure. The economic environment is characterised by:

¹⁰The GTAP version 8.1 database was developed; maintained and is available from Purdue University, USA.

¹¹The detailed aggregation of regions is available in Appendix A, Table A1.

¹²The detailed aggregation of commodities is available in Appendix A, Table A2.

- Level of activity in endowment sectors is exogenously determined.¹³
- Aggregate employment of labour (skilled and unskilled) and capital is fixed.
- Government budget balances are slack.¹⁴
- Sluggish endowment commodities such as land and natural resources are dynamically defined.
- Investment and capital in each region move together.
- Global rate of return adjust to ensure each region's investment equals the change in global savings.
- All factor technical efficiency (technological change) is exogenous and held constant indicating that the policy shock will not cause evolution of technology and productivity¹⁵ (Hertel & Tsigas, 1997).

The GTAP policy simulation is the removal of all ad valorem import tariffs between South Africa and other TFTA countries. Tariffs and other import protection between the TFTA, South Africa and other regions remain unchanged.

The shock therefore has two separate elements: Firstly, the elimination of tariffs levied on South African goods imported into the TFTA. Secondly, the elimination of tariffs levied on TFTA goods imported into South Africa.

When analysing the impact of the TFTA on the South African economy, it is important to keep the model closure and simulation design in mind. The following section presents a small back-of-the-envelope model to assist in the interpretation of results, which follows in Section 6.

5 Back-of-the-Envelope Model

A simple back-of-the-envelope (BOTE) model assists with the interpretation and understanding of simulation results. This stylised model of economic relationships supports the evaluation of economic effects that occur because of the elimination of tariffs between South Africa and other TFTA countries.

The BOTE model identifies the primary theoretical mechanisms that motivate the projection and results of the full model. The model also emphasises central elements of the database (Adams, 2005). The stylised model developed

¹³Capital stock is assumed to be constant as capital is immobile in the short-run. The rate of return is therefore determined endogenously in order for the capital market to clear. The real rate of return of all primary factors is determined endogenously.

¹⁴The GTAP model does not link government expenditure to government revenue. Government expenditure depends on regional income, which is allocated between private consumption expenditure, public consumption expenditure and savings.

¹⁵If it is believed that the policy shock will affect technology evolution and the productivity of a country, an additional shock can be implemented to take this into account.

by Adams (2005) has a multi-country dimension, which is simplified in this paper to evaluate only the main economic variables of interest. The BOTE model is depicted in Table 4.

Equation (1) defines the real GDP of region r ($GDP(r)$), which is equal to the sum of real private consumption ($C(r)$), real investment ($I(r)$), real government consumption ($G(r)$) and the net volume of exports (which is the volume of exports ($X(r)$) less the volume of imports ($M(r)$)). The volume of imports is determined by real GDP, the terms of trade ($TOT(r)$) and the average power of the average rate of tariffs (T) in equation (2). Equation (3) depicts the volume of exports, which is determined by the general level of economic activity (GDP) and inversely affected by the terms of trade. South Africa faces a downward sloping curve for export-demand due to the assumption of Armington elasticities. In this analysis, the increase in the export demand for South African goods will shift this downward sloping curve to the right.

Terms of trade is equal to the price of exports ($P(r)_x$) relative to the price of imports ($P(r)_M$). This, we show in equation (4). The rate of return ($ROR(r)$) of the various endowments in the economy is depicted in equation (5) as the function of the capital to labour ratio in the region ($\frac{K}{L}(r)$), the terms of trade in that region and the exogenous level of technology (A), which is assumed exogenous. The various economic relationships discussed in this section aid to elucidate how the shock enters the market, ripples through the economy and create numerous economic consequences.

The following section presents the macroeconomic results, South African specific macroeconomic results and industry results.

6 Simulation Results

This section presents the final task of CGE analysis - the interpretation of simulation results. Simulation results represent percentage deviations from the baseline. For instance, if it were forecasted that South Africa's real GDP will increase by 5 percent in the coming year, from its current level of R3.5 trillion to R3.675 trillion, in a business-as-usual scenario¹⁶, this would be considered as the baseline. If the model predicts that the impact of the exogenous policy shock would increase real GDP growth in the short run by 1 percent, this would be equivalent to predicting that real GDP increase to R3.712 trillion instead of R3.675 trillion, because of the policy change.

With technological change held constant in the closure, the percentage change in technical efficiency variables are zero. That is, we do not allow for the implementation of the TFTA in the policy simulation to change the path productivity growth, relative to the baseline. The same is true for other variables held constant in the closure. In order to incorporate the possible changes that might take place as a because of say, technical efficiency improving as a result of the

¹⁶This is the baseline situation and does not include the exogenous shock under consideration.

policy change, a separate shock to the relevant exogenous variable would have to be implemented.

This section considers the impact of the policy shock and is structured as follows: Section 6.1 discusses macroeconomic and welfare results for the respective regions; Section 6.2 interrogates South Africa specific macroeconomic results and Section 6.3 looks at selected South African industry results.

6.1 Overview of Macroeconomic and Welfare Results

South African GDP increases due to the establishment of the TFTA, whilst other TFTA countries experience a relatively large decrease in value of GDP compared to other regions not participating in the TFTA.¹⁷ Certain countries participating in the TFTA, may enjoy increased value of GDP and welfare, however due to the aggregation of the full GTAP database, we do not evaluate the effects on individual countries.¹⁸ As expected, the impact of the TFTA on other regions not participating in the TFTA is negative, yet negligible. As technical efficiency is assumed constant, the model does not allow for technological spillovers between countries. If the model did allow for such spillovers, we may observe an increase in the value of GDP in other TFTA countries and regions not participating in the trade agreement.

The increase of South Africa's value of GDP by 1.023 percent may be due to the change in patterns of imports and exports, illustrated in Appendix B.¹⁹ The volume of merchandise exports in South Africa and other TFTA countries increase significantly by 0.685 percent and 0.547 percent, respectively. The volume of merchandise imports increase in South Africa and other TFTA countries, however decrease in all other regions not participating in the TFTA. As South Africa's terms of trade improve by 0.698 percent, imports become relatively less expensive, whereas exports become relatively more expensive. Then again, other TFTA countries can now import at lower cost from South Africa, contributing to the overall increase in the region's imports.²⁰

Output of the capital goods sector increases in South Africa and other TFTA countries by 1.155 percent and 0.357 percent, respectively. We can attribute

¹⁷Countries participate in trade agreements due to various reasons such as economic and/or political benefits, or due to pressures from other countries to take part. All countries participating in a trade agreement, will therefore not necessarily gain in terms of GDP and welfare.

¹⁸The aim of the paper is to investigate the impact of the TFTA on the South African economy, therefore for simplicity all other participants in the TFTA were aggregated into one single region as discussed in Section 4.2 and Appendix A.

¹⁹Change in volume of total exports from region r to destination s is provided in Appendix B, Table B1. The volume of total exports from South Africa to all regions except other TFTA countries decrease relative to the baseline, indicating that South Africa diverts trade away from other regions. Other TFTA countries export more to global trading partners, however less to other countries participating in the TFTA. On the other hand, the rest of Africa decreases its exports to all regions, except South Africa and other African countries not included in the TFTA. South Africa also resorts in importing more from other African countries due to the terms of trade improvement.

²⁰Other TFTA countries now substitute goods imported from BRIC countries with imports from South Africa, explaining the decrease in the exports of the BRIC region 0.002 percent.

this to the increase in production and GDP in certain secondary industries. The market price for primary factors increase in South Africa by 1.004 percent, whilst other regions experience a decrease. As the terms of trade improve in South Africa and tariffs decrease, the real price of labour, capital and other endowments increase, escalating the market price index for all primary factors.²¹ We examine this further in Section 6.2 and Section 6.3.

Furthermore, the establishment of the TFTA affects welfare in the different regions specified in the model. The decomposition of welfare effects allows for the identification of the welfare contributions by commodity, factor and tax type (Huff & Hertel, 2000). Global welfare increases with US\$ 0.805 million, as illustrated in Table 6. South Africa is the only region that experience welfare gains, whereas other TFTA countries bear a net welfare loss. The welfare gain of US\$ 815.985 million for South Africa is primarily driven by the terms of trade effect. The terms of trade effect contributes to decreased welfare for all regions, except for South Africa, where the terms of trade effect contributes US\$ 602.899 million.²² The total investment-savings effect contributes US\$ 19.930 million to increased welfare. Furthermore, South Africa experiences a welfare gain through the allocative efficiency effect, whilst this effect decreases for other TFTA countries, as a region, relative to the baseline.

The BRIC countries and the rest of the world also lose, relative to the baseline, in this regard. The net welfare losses in rest of Africa and BRIC are driven by the loss of the total investment-savings effect. Although the total terms of trade effect is globally negative, the total loss of global welfare is primarily driven by the negative impact of the trade tax effect of US\$ 13.760 million and the total investment-savings effect of US\$ 0.060 million.

Considering the welfare decomposition, the TFTA has a negative impact on the welfare of other countries participating in the TFTA as a single region. In addition, the rest of Africa not included in the TFTA loses in terms of welfare. The TFTA would thus prove to be more beneficial for South Africa than to other TFTA countries (as a region) participating. Section 6.2 investigates and interprets South African macroeconomic results.

6.2 South African Macroeconomic Results

To reiterate, the model is shocked with the elimination of import tariffs between South Africa and other TFTA countries. The trade profile presented in Section 2.2 and the BOTE model discussed in Section 5 assist in the interpretation of results, presented in Table 7. The first round impact of the elimination of import

²¹The positive shift in the demand for South African goods causes increased pressures on endowments used in production. Due to the assumption of exogenous technical efficiency, prices of endowments increase to show the increased demand and supply.

²²Again, note that some countries participating in the TFTA can gain, however the overall effect is observed in this paper. Some countries may gain significantly, however the loss experienced by others outweighs the benefits for others. In the paper by Jensen and Sandrey (2011), the authors find that only South Africa and Mozambique gain in terms of welfare. Mukwaya and Mold (2014) find that net welfare gains procure to Egypt, South Africa and Zimbabwe.

tariffs is expected to increase the demand for imports (in South Africa and other TFTA countries) at the expense of demand for domestic products. As the agreement eliminates tariffs between South Africa and other TFTA countries, trade increases and positively affect the South African economy.

The selected macroeconomic variables presented in Table 7 show an improvement after the shock of the elimination of tariffs is applied. South Africa's economy grows at a relative higher rate, as a result of the implementation of the TFTA. The GDP quantity index increases by 0.068 percent and the value of GDP increases by 1.023 percent relative to the baseline. Moreover, the increased GDP²³ contributes to higher levels of private consumption (1.082 percent) and government consumption expenditure (1.120 percent).²⁴

The elimination of tariffs between South Africa and other TFTA countries directly decreases the price of imports for South Africa by 0.012 percent. Concomitantly, the price of imports from South Africa into other TFTA countries decrease, leading to increased demand for South African exports. The positive shift in the downward sloping demand for South African exports (more so than for other TFTA countries as a region), bring about an increase the price of exports of 0.686 percent and contribute to improved terms of trade.²⁵ With an increase in the price of exports and a decrease in the price of imports, South Africa's terms of trade improve by 0.689 percent.²⁶ Increased GDP, improved terms of trade and reduced ad valorem import tariffs contribute to the increase in South African imports, as seen theoretically in equation (2). From the simulation results, we observe the increase in volume of exports and imports increasing by 0.685 percent and 2.003 percent, respectively. The relatively higher increase in imports than exports contributes to the deterioration of the trade balance by US\$ 596.769 million.

The increase of South Africa's terms of trade positively affects the rate of return to endowments, contributing to an increase in the prices of endowments. Equation (5) depicts the rate of return as a function of the ratio of capital and labour, technology (both of which are assumed exogenous in the model closure) and the terms of trade. The current rate of return on capital stock increase of 0.685 percent is thus due to the terms of trade improvement. The rate of return to capital contributes to the increase in the real price of capital of 0.291 percent. The market price index for primary factors increase by 1.004 percent, relative to the baseline. Moreover, the real price of unskilled and skilled labour increase

²³Increased GDP signifies increased regional expenditure, which is equal to increased regional income.

²⁴Government budget balance deteriorates due to the loss of tariff revenue. This does not imply that government expenditure decreases or increases in other taxes. As reductions in taxes and tariffs lead to reduced excess burden, regional real income increases contribute to increased government (public consumption) expenditure (Hertel & Tsigas, 1997). Most published GTAP applications assume this (Adams, 2005).

²⁵From the simulation results, it is observed that South Africa shifts exports away from other regions not included in the TFTA, toward other countries participating in the TFTA. The overall supply of exports to all regions thus decreases. From basic international trade background, it is known that with decreased supply of South African exports (the shift of the supply curve to the left) – the price of exports also increases.

²⁶Refer to equation (4) in the BOTE model.

by 0.314 and 0.338 percent, respectively.²⁷

With the real price for labour (unskilled and skilled) increasing relatively more than capital, it is expected that output of capital goods sector rise, due to increased demand for capital goods. An increase in output in the capital goods sector of 1.155 percent represents an increase in investment.

Overall, the improvement in trade, investment and expenditure contributes to the increase of GDP viewed from the expenditure side, as in equation (1). Although the overall South African economy benefits from the implementation of the TFTA, certain industries may lose as a result of macroeconomic changes. Section 6.3 presents the various impacts of the TFTA on the different industries of South Africa. This section also investigates the demand for the respective endowments in various industries.

6.3 Industry Results

Due to the increase in imports in all industries, industries substitute domestically produced goods with imports. This is true for industries with negligible exports to other TFTA countries. Output (value added) in most industries decrease, however, secondary industries such as processed food, textiles and clothing, petroleum and coal products, as well as construction experience an increase in output. From Section 2.2, we observe that processed food as well as petroleum and coal products contribute 20 percent of exports to other TFTA countries. As processed foods and petroleum and coal products were highly taxed by other TFTA countries - the elimination of tariffs motivates the production and consequently, the export of these goods to other TFTA countries. Output, imports, exports and selected price indices for respective industries are tabulated in Table 8.

The percentage change in private and government demand for domestic and imported goods may provide us with insight into output changes within industries.²⁸ Private and government demand for imported primary industry goods such as grain and crops, livestock and meat products, as well as secondary industry goods such as textile and clothing increase most notably compared to other goods.

Conversely, the domestic demand for grains and crops, textiles and clothing as well as manufactured goods decrease relative to the baseline. This is indicative of the substitution of domestic goods with imported goods. This substitution of domestic goods with imported goods, explains the decrease in output of particular industries.

In all industries the terms of trade effect is observable as the increase in private and government demand for imported goods, exceed that of domestically produced goods. Due to the decreased price of imports, it becomes more affordable to import certain goods than to produce domestically. This is the case for all goods, except for coal extraction, where an increase of 0.021 percent

²⁷This is measured as the ratio of return of endowment to inflation (CPI).

²⁸See Figure 6.

occurs in the price of imports. As a result, South Africa experiences an increase in overall imports in the all industries. Demand for goods imported mainly from other TFTA countries into South Africa such as oil and gas extraction and manufactured goods, increases.²⁹

The ratio of domestic to import prices is positive in all industries, implying that domestically produced goods are more expensive than imported goods.³⁰ The ratio of domestic to import prices for grains and crops increases significantly by 1.182 percent, relative to that of other goods. Therefore, it is economically sensible for industries to substitute locally produced goods with less expensive imported grains and crops. As South Africa's terms of trade improve and the currency appreciates, imports become cheaper and replace expensive domestically produced goods.

Imports and exports determine domestic production in industries. The elimination of tariffs most favourably affects high exporting industries and in specific, industries where exports to other TFTA countries are high. Secondary industry goods such as processed food, petroleum and coal products, textiles and clothing and, to a lesser extent, manufactured (light and heavy) goods exports increase respectively by 9.771 percent, 10.272 percent, 7.940 percent and 0.694 percent.³¹ As other TFTA countries highly taxed processed foods imports from South Africa, it sheds light on the sharp increase in exports to other TFTA countries.³²

Exports to other TFTA countries increase considerably, yet at the same time decrease to other trading partners, relative to the baseline, as depicted in Figure 7. Oil and gas extraction exports to other TFTA countries increase by 35.200 percent, whilst exports to other countries such as North America and the European Union decrease by 3.433 and 3.599 percent. Other industries that experience increase in exports sales to other TFTA countries are processed food (31.863 percent), textiles and clothing (32.030 percent), as well as light and manufactured goods (27.466 percent).³³

The TFTA as a trade agreement has a noteworthy impact on trade in all industries, affecting the level of production. The changes in production levels cause fluctuations in the demand for endowments in industries. In order to benefit from potential improvements or address possible challenges, we consider the changes in demand for endowments. Table 9 reports the percentage change in the demand for the five primary factors by the different industries. In this model, we consider the activity (expansion or contraction) of endowment sectors as exogenous.

²⁹See Figure 2.

³⁰The ratio of domestic to import prices compares the price of domestically produced goods to that of imported goods.

³¹Although a substantial increase in exports of petroleum and coal products is experienced, total exports of this product are small and equal only 4.235 percent of all exports (GTAP Database).

³²37.055 percent of processed foods are exported to other TFTA countries and 26.579 percent to the European Union.

³³Manufactured goods make up 69.742 percent of all exports to the TFTA, while processed food and textiles and clothing also being of the high exported goods to this region.

The overall demand for endowments by industries increases, relative to the baseline. Total South African demand for endowments increases by 10.104 percent.³⁴ Demand for unskilled and skilled labour increase by 2.842 and 2.502 percent, respectively.³⁵ The grains and crops industry demands less labour, land and capital endowments, because of the decreased output resulting from import substitution. With production in industries contracting, we do not expect an expansion in the demand for endowments that these industries cannot optimally employ.

The demand for labour in primary industries concerned with mining activities, as well as electricity and gas, decrease considerably. As skilled labour is comparatively more expensive than unskilled labour, the decrease in demand for skilled labour decreases by a higher margin. Demand for employment by extraction industries decrease significantly relative to other industries. Demand for unskilled and skilled labour by the other extraction industry decrease by 0.785 percent and 0.789 percent, in the coal extraction industry by 0.586 percent and 0.591 percent and in the oil and gas extraction industry by 0.517 percent and 0.521 percent, respectively. Conversely, industries such as processed food, petroleum and coal products, water, construction and other services demand more unskilled and skilled labour. Industries that experience an increase in demand for labour, also experience increase in demand for all other primary factors.

Furthermore, the increases in the use and demand of capital denote the investment expenditure in industries and the economy. Demand for capital increases considerably in the petroleum and coal (1.995 percent), processed food (1.226 percent) and construction (0.993 percent) industries. The increase in demand for capital in these secondary industries signifies the expansion and growth because of the TFTA and explains the overall increase in the demand for capital of 3.172 percent, relative to the baseline. In a growing economy, we expect the increase in the demand for all primary factors, as well as improvement and increased investments in infrastructure and accompanying services.

From the analysis of the results, it is apparent that secondary industries benefit from the TFTA, whilst primary industries lose. Although overall demand for labour increases; structural unemployment may possibly arise as the demand in agricultural and mining industries decrease. Industry specific economic effects are of importance to consider when developing policies. Section 7 provides concluding remarks and discusses possible considerations when evaluating the effects of the TFTA on the South African economy.

³⁴This result may seem high relative to other macroeconomic results however; the percentage change represents the aggregated demand for endowments of all industries. The percentage change in the total demand for all endowments is thus calculated by considering the change in demand for a certain endowment relative to the share of that endowment employed in the industry.

³⁵The percentage deviation in the demand for natural resources is positive overall, yet relatively small.

7 Conclusion and Policy Implications

With the South African National Planning Commission emphasising the importance of increased trade between South Africa and other African countries, the effects of the TFTA is of great significance to policymakers. In this paper, we use a global CGE model to analyse the impact of the TFTA on the South African economy.

Simulation results indicate that South Africa gains relative to other TFTA countries, as a region. South Africa's value of GDP increases by 1.023 percent, relative to the baseline. The boom in South African exports contributes to the improvement of the terms of trade of 0.698 percent. As South Africa increase exports to other TFTA countries, exports to other non-participating regions decrease. Although trade diversion is expected, South Africa should guard against the neglect of existing trade relationships with major trading partners. With overall imports and exports increasing because of the increase in demand, South Africa's industries are affected differently. The TFTA brings about increased output in secondary industries such as processed food, petroleum and coal products.

Increased outputs in these industries consequently contribute to increased demand for endowments, such as skilled and unskilled labour, capital and land. Other industries experience substitution of domestically produced goods with that of now relatively less expensive imported goods. Private and government demand for grains and crops, livestock and meat products, as well as textile and clothing industries increase notably with the demand for domestically produced goods decreasing relative to the baseline.

In contrast to the boom created on the export side, the substitution of domestically produced goods with imported goods by some users slightly reduces output again, and subsequently, the demand for endowments. Although overall demand for employment increases by 2.842 percent for unskilled and 2.502 percent for skilled labour, primary industries such as coal extraction, oil and gas extraction and other extractions demand less labour, which may give rise to structural unemployment for these type of workers.

In order to take advantage of the benefits and minimise negative repercussions, government should adapt economic policies accordingly. To compensate for possible increased structural unemployment, policymakers can react by reducing restrictive labour laws that will encourage employment of both skilled and unskilled labour in the particular industries where demand for labour decreases. As unemployment is a macroeconomic concern for South Africa, such an intervention is well worth investigating for all industries. To motivate economic activity in industries where production decreases, government could ease the tax burden and red tape on companies operating in these industries, which may result in increased production activity.

The overall impact of the policy change on the South African economy is positive and South Africa can draw obvious benefits from the establishment of this agreement. We expect the TFTA to increase economic growth, trade,

consumption and government expenditure³⁶, investment and employment in South Africa. The economic effects of the TFTA on South Africa add to the NDP vision to increase global participation and economic cooperation, in an effort to advance the South African economy for all.

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³⁶As a result of increased economic growth and activity.

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Table 1: South Africa's Main Trade Agreements

<i>Agreement</i>	<i>Participants</i>
<i>Free Trade Agreements (FTAs)</i>	
Southern African Development Community (SADC)	12 SADC member states
Trade, Development and Cooperation Agreement (TDCA)	South Africa and the European Union (EU)
EFTA-SACU	European Free Trade Association (EFTA) and SACU
<i>Customs Union</i>	
Southern African Customs Union	South Africa, Botswana, Lesotho, Namibia and Swaziland
<i>Preferential Trade Agreements (PTAs)</i>	
SACU-Southern Common Market (MERCOSUR)	Argentina, Brazil, Paraguay, Uruguay and SACU
Zimbabwe-South Africa	South Africa and Zimbabwe
SACU-India	India and SACU (still under negotiations)
<i>Non-reciprocal Trade Agreements</i>	
Africa Growth and Opportunity Act	Unilateral assistance measure granted by US to 39 Sub-Saharan African countries
Generalised System of Preference (GSP)	Unilateral Preferences offered to South Africa by the EU, Norway, Switzerland, Russia, Turkey, US, Canada and Japan
<i>Other Trade Agreements</i>	
Trade and Investment Framework Agreement (TIFA)	Bilateral agreement between US and South Africa
Trade, Investment and Development Cooperation Agreement (TIDCA)	Cooperative agreement between SACU and US

(Source: the dti, 2014b)

Table 2: Percentage Ad Valorem Rate, Import Taxes

	South Africa (i)	Other TFTA countries (ii)
Grains and Crops	4.178	2.340
Livestock and Meat Products	2.887	0.006
Coal Extraction	0.934	0.000
Oil and Gas Extraction	2.523	0.000
Other Extraction	0.797	0.002
Processed Food	8.561	1.173
Textiles and Clothing	5.000	0.816
Light and Heavy Manufacturing	4.752	0.173
Petroleum and Coal Products	5.077	0.611
Electricity and Gas	0.459	0.000
Total	35.168	5.121

(Source: GTAP database)

Table 3: Aggregated Commodities

Grains and Crops	Light and Heavy Manufacturing
Livestock and Meat Products	Petroleum and Coal Products
Coal Extraction	Electricity and Gas
Oil and Gas Extraction	Water
Other Extraction	Construction
Processed Food	Transport and Communication
Textiles and Clothing	Other services

Table 4: Back-of-the-Envelope Model

$$GDP(r) = C(r) + I(r) + G(r) + (X(r) - M(r)) \quad (1)$$

$$M(r) = F_M(GDP(r), TOT(r), \frac{1}{1+T}) \quad (2)$$

$$X(r) = F_X(-TOT(r) * GDP) \quad (3)$$

$$TOT(r) = \frac{P(r)_X}{P(r)_M} \quad (4)$$

$$ROR(r) = F_{ROR}(\frac{K}{L}(r), TOT(r), A) \quad (5)$$

Table 5: Macroeconomic Results

	Percentage change					
	Value of GDP	Volume of merchandise exports	Volume of merchandise imports	Terms of trade	Output of capital goods sector	Market price index for primary factors
NAFTA	-0.005	0.005	-0.006	-0.002	-0.007	-0.005
EU25	-0.005	0.003	-0.005	-0.002	-0.009	-0.005
BRIC	-0.008	-0.002	-0.011	-0.004	-0.006	-0.007
ZAF	1.023	0.685	2.003	0.698	1.155	1.004
Other TFTA	-0.291	0.547	0.603	-0.162	0.357	-0.023
RoA	-0.006	0.008	-0.007	-0.007	-0.015	-0.006
RoW	-0.006	0.001	-0.007	-0.003	-0.009	-0.005

(Source: Simulation Results)

Table 6: Welfare Decomposition

	Million US\$				
	Welfare	Allocative Efficiency Effect	Terms of Trade Effect	Investment-Savings Effect	Trade Tax Effect
NAFTA	-57.781	-1.725	-33.330	-22.728	-7.166
EU25	-126.053	-10.130	-109.545	-6.380	-59.784
BRIC	-127.100	-43.401	-89.747	6.045	-34.419
ZAF	815.985	193.853	602.899	19.930	104.769
Other TFTA	-324.989	-102.814	-221.484	-0.854	15.140
RoA	-24.898	-5.835	-18.437	-0.633	-1.981
RoW	-154.360	-27.181	-131.742	4.560	-30.321
Total	0.805	2.768	-1.386	-0.060	-13.760

(Source: Simulation Results)

Table 7: Selected Macroeconomic Indicators for South Africa¹

	Percentage change
GDP quantity index	0.068
Value of GDP	1.023
Private consumption expenditure	1.082
Government consumption expenditure	1.120
Volume of merchandise imports ²	2.003
Volume of merchandise exports ³	0.685
Change in trade balance, X - M (US\$ million)	-596.769
Terms of trade	0.698
Output of capital goods sector	1.155
GDP price index	0.954
Price index of merchandise imports	-0.012
Price index of merchandise exports	0.686
Rental rate on capital	1.022
Real return to capital	0.291
Real return to unskilled labour	0.314
Real return to skilled labour	0.338
Market price index for primary factors	1.004
Current net rate of return on capital stock	0.685

¹ In line with the standard model's policy closure, the world price index of primary factors is exogenous and acts as a numeraire.

² Value merchandise imports increase with 1.991 percent.

³ Value of merchandise exports increase with 1.375 percent.

(Source: Simulation Results)

Table 8: Selected Industry Results

	Percentage change					
	Value added	Aggregate exports, FOB weights	Aggregate imports, CIF weights	Aggregate exports price index	Aggregate imports price index	Ratio of domestic to imported prices
Grains and Crops	-0.036	-0.418	3.037	0.792	-0.387	1.182
Livestock and Meat Products	-0.045	-1.496	2.565	0.771	-0.035	0.807
Coal Extraction	-0.320	-0.883	0.721	0.207	0.021	0.186
Oil and Gas Extraction	-0.289	-3.314	2.050	0.250	-0.01	0.26
Other Extraction	-0.663	-0.868	0.755	0.491	-0.024	0.515
Processed Food	1.211	9.771	2.044	0.799	-0.056	0.855
Textiles and Clothing	0.218	7.940	2.724	0.784	-0.073	0.857
Light and Heavy Manufacturing	-0.240	0.694	2.087	0.725	-0.016	0.741
Petroleum and Coal Products	1.944	10.272	0.477	0.090	-0.011	0.101
Electricity and Gas	-0.336	-2.230	1.683	0.623	-0.065	0.689
Water	0.097	-4.579	2.512	0.837	-0.007	0.845
Construction	0.976	-2.976	2.543	0.787	-0.008	0.795
Transport and Communication	-0.170	-3.081	1.588	0.833	-0.007	0.839
Other services	0.065	-3.470	1.953	0.925	-0.006	0.930

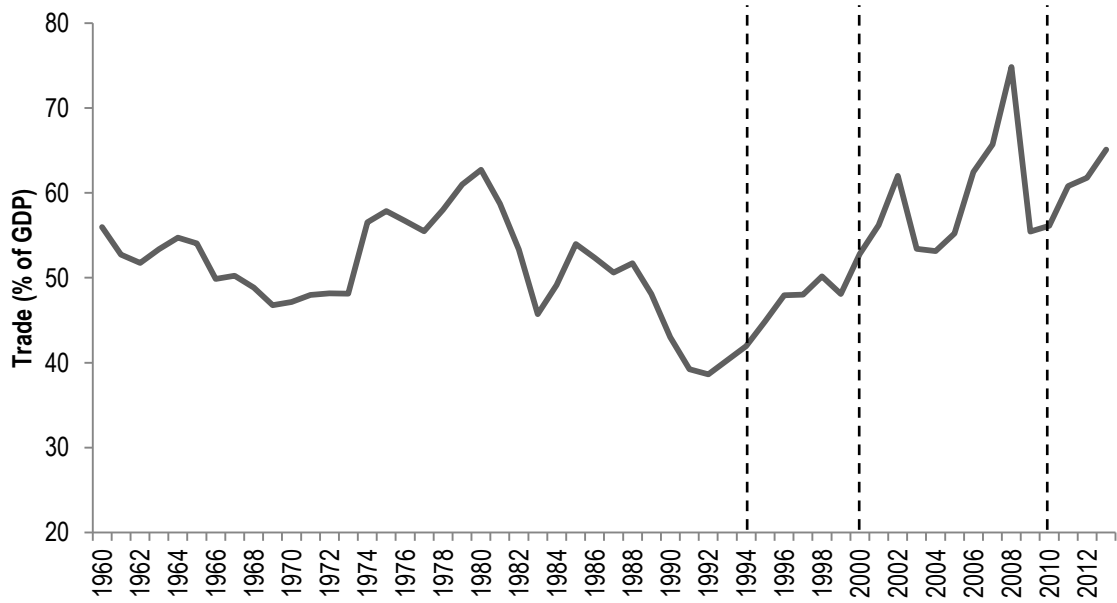
(Source: Simulation Results)

Table 9: Demand for Endowment for Use in Industries

	Percentage change				
	Land	Unskilled labour	Skilled labour	Capital	Natural resources
Grains and Crops	-0.004	-0.045	-0.052	-0.039	0.003
Livestock and Meat Products	0.012	-0.058	-0.07	-0.046	0.003
Coal Extraction	-0.465	-0.586	-0.591	-0.582	0.000
Oil and Gas Extraction	-0.406	-0.517	-0.521	-0.512	0.001
Other Extraction	-0.630	-0.785	-0.789	-0.78	-0.001
Processed Food	0.642	1.200	1.172	1.226	0.004
Textiles and Clothing	0.177	0.215	0.185	0.245	0.003
Light and Heavy Manufacturing	-0.031	-0.254	-0.285	-0.225	0.003
Petroleum and Coal Products	0.931	1.925	1.895	1.955	0.005
Electricity and Gas	-0.074	-0.351	-0.381	-0.321	0.003
Water	0.120	0.088	0.057	0.117	0.003
Construction	0.487	0.965	0.931	0.998	0.004
Transport and Communication	0.020	-0.187	-0.226	-0.149	0.003
Other services	0.108	0.061	0.030	0.090	0.003

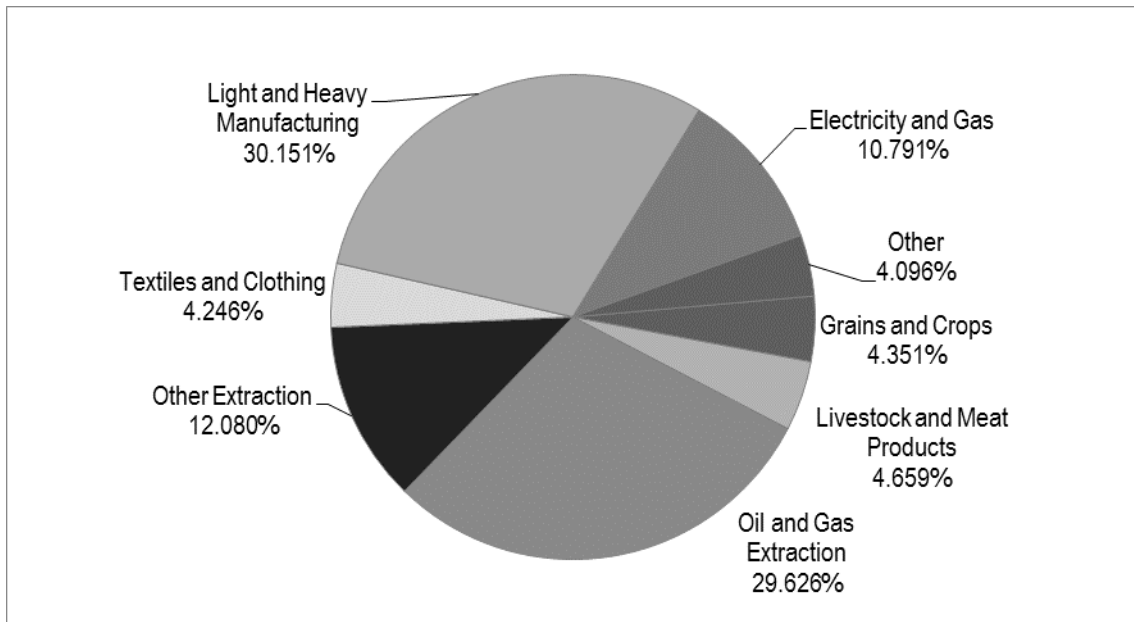
(Source: Simulation Results)

Figure 1: South African Trade as a Percentage of GDP (1960-2013)



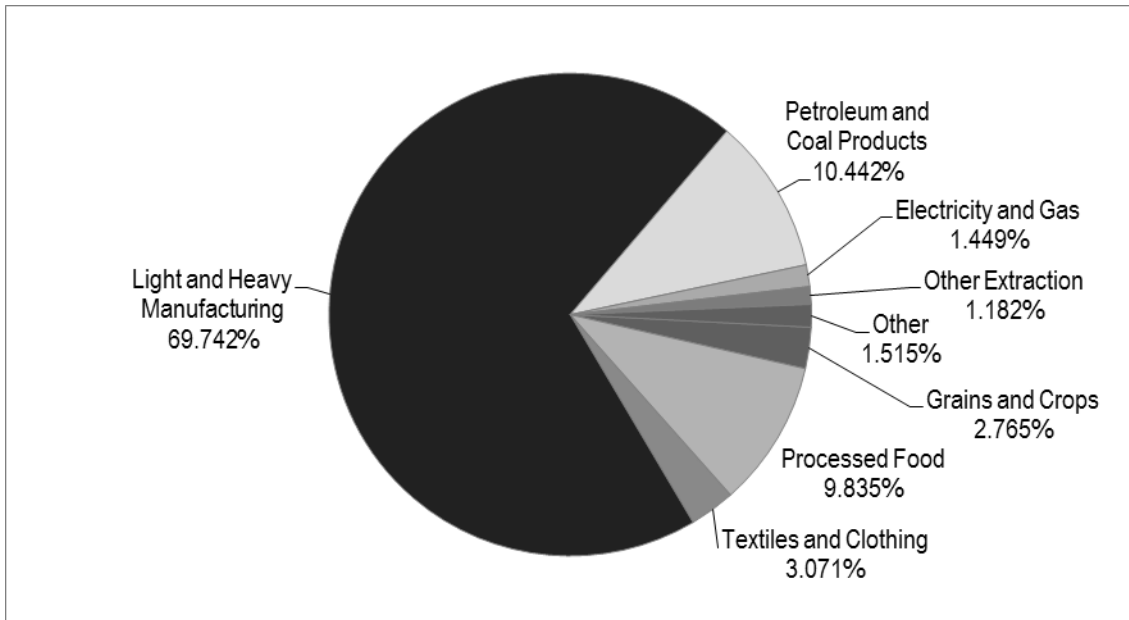
(Source: World Development Indicators)

Figure 2: Goods Imported from Other TFTA Countries into South Africa



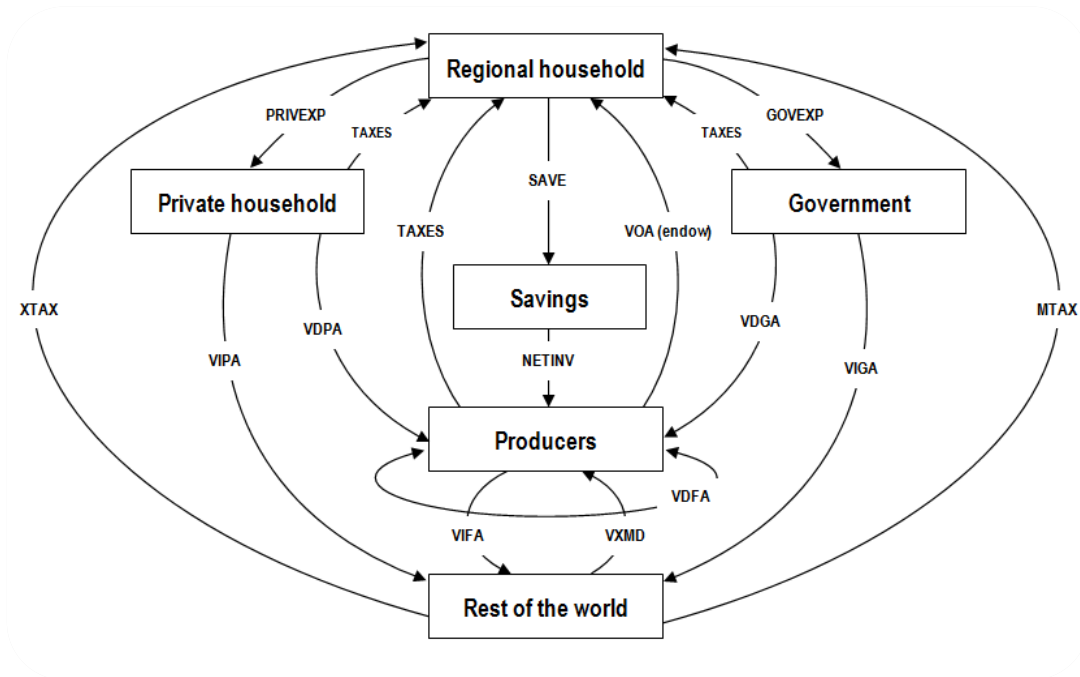
(Source: GTAP database)

Figure 3: South African Goods Exported to Other TFTA Countries



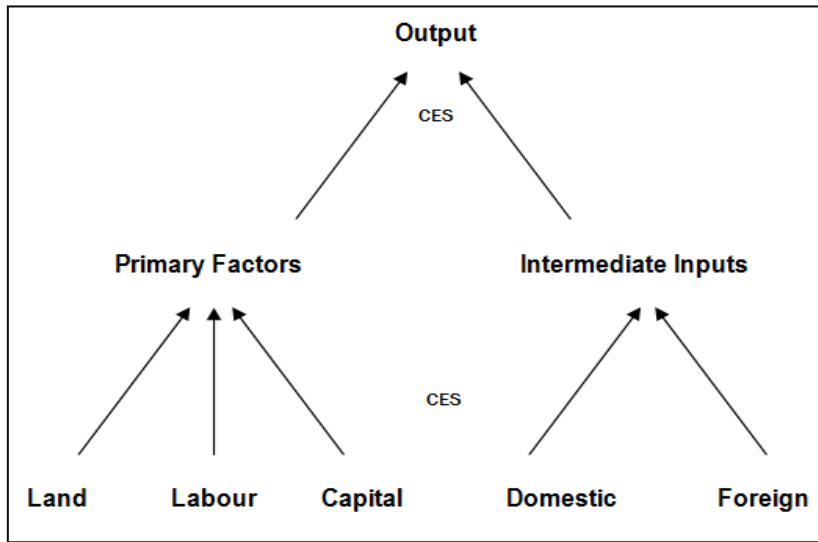
(Source: GTAP database)

Figure 4: Economic Relationships in the GTAP model



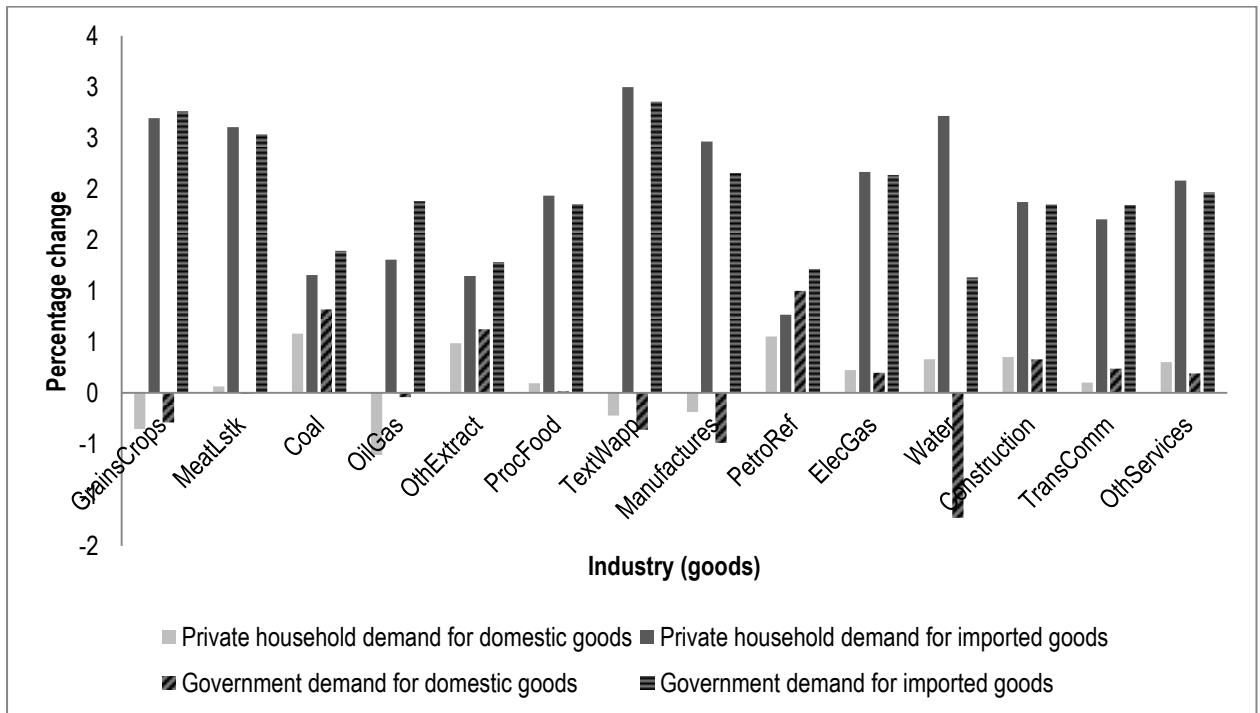
(Source: Hertel & Tsigas, 1997)

Figure 5: Nested Production Structure



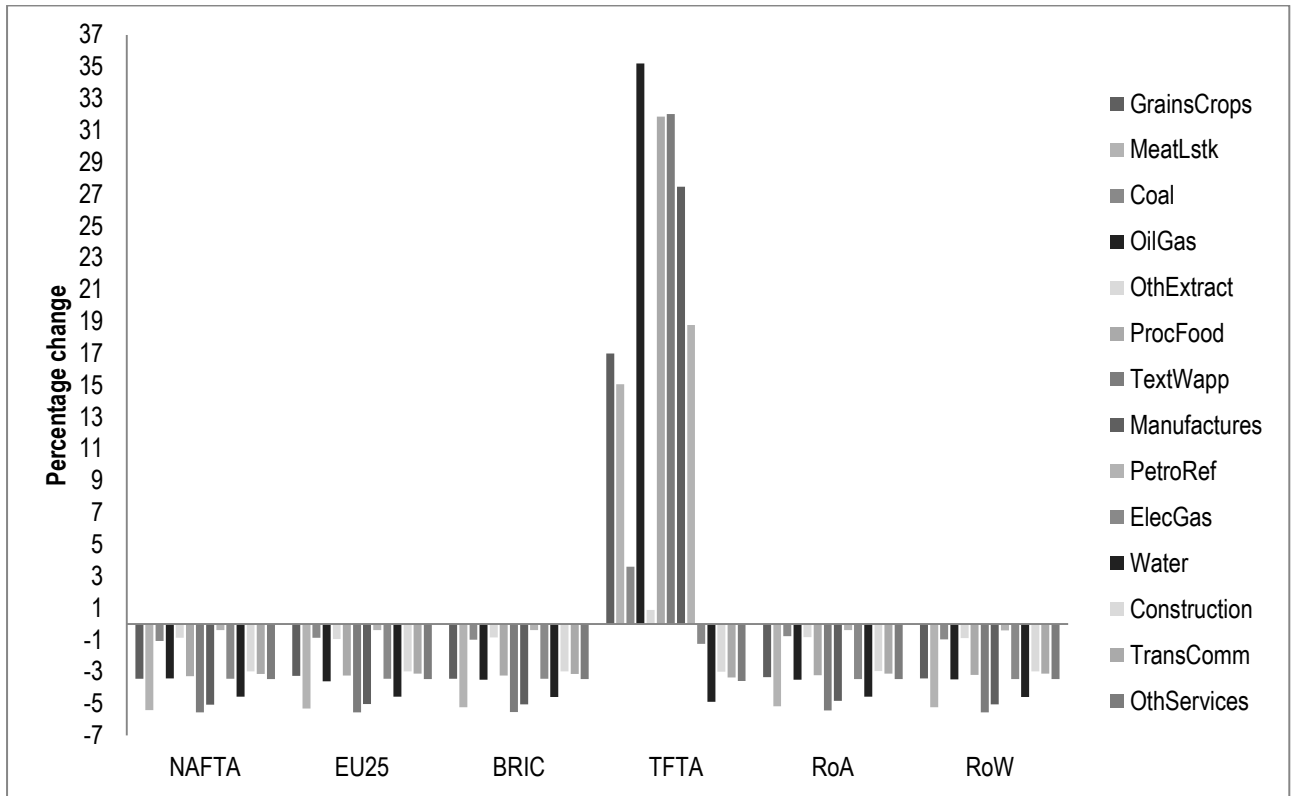
(Source: Hertel & Tsigas, 1997)

Figure 6: Private and Government Demand for Domestic and Imported Goods



(Source: Simulation Results)

Figure 7: South African Export Sales to Other Regions



(Source: Simulation Results)

APPENDIX A: The Data

Table A1: Aggregation of Regions

Model Region		Regions Included
South Africa	ZAF	South Africa
Tripartite Free Trade Area (excluding South Africa)	Other TFTA	Egypt; South Central Africa; Ethiopia; Kenya; Madagascar; Malawi; Mauritius; Mozambique; Rwanda; Tanzania; Uganda; Zambia; Zimbabwe; Botswana; Namibia; Rest of South Africa Customs
European Union	EU25	Austria; Belgium; Cyprus; Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Ireland; Italy; Latvia; Lithuania; Luxembourg; Malta; Netherlands; Poland; Portugal; Slovakia; Slovenia; Spain; Sweden; United Kingdom
Major emerging economies	BRIC	Brazil; Russian Federation; India; China
North America	NAFTA	Canada; United States of America; Mexico; Rest of North America
Rest of Africa	RoA	Rest of Eastern Africa; Morocco; Tunisia; Rest of North Africa; Benin; Burkina Faso; Cameroon; Cote d'Ivoire; Ghana; Guinea; Nigeria; Senegal; Togo; Rest of Western Africa; Central Africa
Rest of World	RoW	Australia; New Zealand; Rest of Oceania; Hong Kong; Japan; Korea; Mongolia; Taiwan; Rest of East Asia; Cambodia; Indonesia; Lao People's Republic Democratic Republic; Malaysia; Philippines; Singapore; Thailand; Vietnam; Rest of Southeast Asia; Bangladesh; Nepal; Pakistan; Sri Lanka; Rest of South Asia; Argentina; Bolivia; Chile; Columbia; Ecuador; Paraguay; Peru, Uruguay; Venezuela; Rest of South America; Costa Rica; Guatemala; Honduras; Nicaragua; Panama; El Salvador; Rest of Central America; Caribbean; Switzerland; Norway; Rest of EFTA; Albania; Bulgaria; Belarus; Croatia; Romania; Ukraine; Rest of Eastern Europe; Rest of Europe; Kazakhstan; Kyrgyzstan; Rest of former Soviet Union; Armenia; Azerbaijan; Georgia; Bahrain; Islamic Republic of Iran; Israel; Kuwait; Oman; Qatar; Saudi Arabia; Turkey; United Arab Emirates; Rest of Western Asia

Table A2: Aggregation of Commodities

Sector Description		Commodities Included in Sector
Primary industries		
GrainsCrops	Grains and Crops	Paddy rice; Wheat; Cereal grains; Vegetable, fruit, nuts; Oil seeds; Sugar cane, sugar beet; Plant-based fibres; Crops; Processed rice
MeatLstk	Livestock and Meat Products	Cattle, sheep, goats, horses; Animal products; Raw milk; Wool, silk-worm cocoons; Meat: cattle, sheep, goats, horse; Meat products
Coal	Coal Extraction	Coal
OilGas	Oil and Gas Extraction	Oil; Gas
OthExtract	Other Extraction	Minerals; Forestry; Fishing
Secondary industries		
ProcFood	Processed Food	Vegetable oils and fats; Dairy products; Sugar; Food products; Beverages and tobacco products
TextWapp	Textiles and Clothing	Textiles ; Wearing apparel
Manufactures	Light and Heavy Manufacturing	Leather products; Wood products; Paper products, publishing; Chemical, rubber, plastic products; Mineral products; Ferrous metals; Metals; Metal products; Motor vehicles and parts; Transport equipment; Electronic equipment; Machinery and equipment; Manufactures
PetroRef	Petroleum and Coal Products	Petroleum, coal products
ElecGas	Electricity and Gas	Electricity; Gas manufacture, distribution
Water	Water	Water
Construction	Construction	Construction
Tertiary industries		
TransComm	Transport and Communication	Trade; Transport; Sea transport; Air transport; Communication
OthServices	Other services	Financial services; Insurance; Business services; Recreation and other services; Public administration, defence, health and education; Dwellings

APPENDIX B: Results

Table B1: Change in Volume of Total Exports from r to s

		(s)							
		NAFTA	EU25	BRIC	ZAF	Other TFTA	RoA	RoW	Total
(r)	NAFTA	87.322	46.352	16.918	140.015	-271.336	5.041	71.529	95.840
	EU25	38.065	276.048	24.770	580.401	-977.473	29.043	110.654	81.508
	BRIC	67.829	85.405	17.715	225.917	-583.407	11.394	133.200	-41.947
	ZAF	-492.885	-986.001	-334.793	0.000	3374.466	-110.658	-921.54	528.588
	Other TFTA	99.055	247.995	55.109	205.419	-94.312	38.148	184.663	736.077
	RoA	-4.255	-2.531	-6.361	69.322	-36.218	0.619	-1.533	19.043
	RoW	33.433	73.027	39.941	475.909	-745.063	13.756	121.953	12.956
	Total	-171.437	-259.705	-186.702	1696.983	666.657	-12.659	-301.075	1432.064

(Source: Simulation Results)