Western Cape Government

Department of Agriculture

African Continental Free Trade Area (AfCFTA): Implications of a Full Tariff Liberalisation on SA's Top Agricultural Products

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Abstract

South Africa is among the African Union member states that have successfully rectified the African Continental Free Trade Area (AfCFTA), a new African agenda that seeks to promote duty-free market access amongst African countries. The adoption of the AfCFTA is anticipated to bring forth several economic prospects in South Africa and its economic sectors. This report provides insights on the potential implications of AfCFTA full tariff liberalisation for South African agriculture in terms of trade creation, revenue and welfare effects. Applying the WITS-Smart simulation on 2023 disaggregated trade data, the trade total effect on the South African market is anticipated to increase by US$13, 85 million, while consumer welfare will improve by US$1.2 million. The simulation also revealed that the free trade area is projected to reduce South African's tariff revenue by an amount of US$5.74 million. The top South African agricultural products vulnerable to the agreement include pasta, vegetables, eggs, ginger, bananas and tobacco amongst the top 15 agricultural products. In light of these findings, the study recommends that the South African government should add all vulnerable products under its sensitive list during trade negotiations. This will ensure that infant industries are safeguarded and provided sufficient time to develop and enhance their market competitiveness.

Keywords: AfCFTA, agricultural exports, revenue, SMART PE model

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1. Introduction

The agricultural sector continues to play a significant role in the economic development of Africa, this is owed to its contribution to gross domestic product, food security and employment creation amongst different economies. The negotiations of the World Trade Organisation (WTO) in the mid-1990s shaped global trade for agricultural food products, in particular; tariffs were progressively reduced, resulting in a significant drop in food prices, expansions in agricultural production and increased formation of trade agreements (Santeramo et al., 2019; Sandrey & Vink, 2009).Africa is home to a number of regional economic communities and trade arrangements, each presenting its unique challenges and successes (Abrego, et al., 2020). The two of the oldest prominent regional economic trade blocks in Africa include the Southern African Customs Union (SACU), formed in 1910, and the East African Community (EAC), established in 1919. The main objective of the latter trade arrangements is to promote free access and flow of goods and services between countries, drive faster economic growth and reduce poverty levels while fostering inclusion in Africa (World Bank, 2020).

Africa's participation in international trade is dominated by export of raw materials and as such, past integration concerted efforts are in developing global value chain and promoting agro-processing to benefit from high profit margins. The study conducted by Bagci, Diallo, & Terai (2023) concurs with the latter expression that exports of African economies are highly dependent on raw and primary products Trade integration in Africa has long been regarded by policymakers as a mechanism to achieve economic prosperity and better human welfare. The current Africa Continental Free Trade Area (AfCFTA) is set to support the realisation of the continent's economic potential, improve the continent's productivity and investment opportunities, and thereof, increase income levels and reduce poverty levels in Africa. Arguably, the proponents of the agreement claim the AfCFTA has the potential to boost intra-African trade, enhance food security and support the ongoing investment diversification efforts (Gonzalez et al., 2019).

Moreover, AfCFTA is critically important in the recovery of Africa from the 2020 Covid-19 pandemic induced economic and financial crises, embedded trade restrictions and exacerbated the US$ 120 billion trade finance gap of this continent (Bagci, Diallo, & Terai, 2023). Therefore, the establishment and operationalization of the AfCFTA promises to drive Africa's response to revive its economic growth, attract new investment, and promote commercial activities in the post-pandemic period of this region. The ambitious goal of the AfCFTA is to fully (100%) liberalise or eliminate all tariff barriers between African member states. According to the AfCFTA tariff schedule, 90 percent of the tariff lines will be eliminated after entry into force of the agreement with about 7 percent of the tariff lines regarded as the sensitive list, and the 3 percent is the exclusion list. Different concessions and time frames will apply for each tariff schedule for different countries.

South Africa is expected benefit and to play a crucial role in progressing the success of AfCFTA's implementation. South Africa has a market-oriented and competitive agriculture sector that include grains, oilseeds, fruits, vegetables and livestock production. This sector (agriculture and agro-processing) averaged 7 per cent of the country's total exports in 2023 (Quantec, 2024) with citrus, wine, table grapes corn and wool accounting for the largest share of the total export values. Primary agriculture is a crucial sector in South Africa as it contributes enormously to rural employment, food security and rural development (Mpundu, 2022).

Existing literature suggests that there are mixed views regarding the implications of trade liberalisation through the regional economic communities (RECs). It is still not clear how the South African agricultural sector will benefit from the AfCFTA, therefore, the focus of this study is to simulate the conversation around potential impact of a full tariff liberalisation on the South African agricultural products. In the context of Western Cape Province, which contributes approximately 55% to the national agricultural export basket, the AfCFTA trade liberalisation and thereof, trade facilitation, is likely to drive the Province's agricultural export grow, offer more agricultural trade market and opportunities whilst pushing farmers in particular those will have to face high competition due to reduced import tariffs to strive to be competitive at the continental level.

2. Literature Review

Several studies have revealed mixed findings of the impact of trade liberalization in Africa. In South Africa, an empirical evaluation of the implication of a free trade area on agricultural products is minimal even though the country has already deposited its instruments and ratified the AfCFTA. This study attempts to draw lessons from existing literature pertaining to the impact of trade openness on the agricultural sector through the AfCFTA. The inception of trade liberalization can be traced back to Adam Smith's theory of absolute advantage, and David Ricardo's theory of competitive advantage in the 18th century. Smith (1776) "*Wealth of nations*" explained that countries could generate wealth from trade liberalization and specialize on production of specific goods and services based on their absolute advantage derived from labour productivity. Following Smith's assertion, trade liberalization became a common practice after David Ricardo introduced a competitive advantage model to illustrate how trade supports economies with variations in opportunity costs of output. However, following this, the impact of trade liberalization on growth has been a topic of controversy for decades (Abbott et al., 2007; Chang et al., 2009). Classical economics assumes that free trade is the driver of prosperity and that trade restrictions contribute to wasteful resources, negatively affecting economic development (Balassa, 1978; Chandran & Munusamy, 2009; Chang et al., 2005; Krugman & Obstfeld, 2006).

Contrary, critics of trade liberalization claim that trade openness is risky to rural livelihoods, benefits are evenly distributed and may even be harmful to economic

growth (Chang et al., 2009; Rodriguez & Rodrik, 2001; Stiglitz & Charlton, 2005). Additionally, trade liberalization does not improve the economic condition of rural households or the middle class but instead, it leaves them in the worst state. It is clear from traditional theories that the effect of trade openness is not clear, or at least it has been contest with different views and consensus of results. However, AfCFTA is primarily anticipated to facilitate, harmonise and efficiently coordinate the Africa's trade regimes, and eliminate any existing challenges in relation with overlapping trade agreement in the continent.

Empirically, Mesut et al, 2018 conducted a study examining the potential adjustment costs and potential benefits of the AfCFTA tariff reductions. The study applied a computable general equilibrium and revealed that a full tariff reduction will result to an estimated increase in GDP and employment by 0.97 per cent and 1.17 percent respectively. The study concluded thelong-run welfare gains of the AfCFTA will surpass tariff revenue losses significantly. A study undergone by Abrego et al, 2019 investigated the welfare gains of the African continental free Trade Area (AfCFTA) using a General Equilibrium Model. The study results concluded that the welfare effects from tariff elimination alone are very small, with an increase in welfare of 0.05 percent for the continent (0.07 percent for SSA). This is consistent with the low levels of effectively applied tariffs on intra-Africa trade, and with the fact that intra-regional trade accounts for a relatively small fraction of overall trade in the continent. Under a full tariff liberalisation, all AU member states will enjoy an increase in welfare, total trade and a reduction in revenue.

Oyelami, 2021 conducted a study exploring the revenue, welfare, and trade implications of African Continental Free Trade Agreement (AfCFTA) on Nigerian economy. The study simulated a 100% tariff cut using the WITS-SMART equilibrium model. A full tariff liberalization to all products originating from African countries at the HS-6 level for the year 2016 was adopted. The results of the study revealed that Nigeria will enjoy the total trade effect of about by about US$ 145 million and US$ 582 million for the rest of Africa. Wonyra and Bayale, 2022, also simulated the trade, revenue and welfare effect of a full tariff cut using a partial equilibrium model with disaggregated trade for Togo. Evidence from the results of the model revealed that trade effects in Togo are likely to surge by US$ 8.83 million while promoting consumers' welfare by US$ 1.09 million. However, Togo is expected to experience a tariff revenue loss following the removal of tariffs. The study concluded that vulnerable products to the agreement include coal, paper and paperboard, sacks and bags of paper, aluminium, vehicles, odoriferous substances, and food preparations.

Bayale et al 2022, the potential trade, welfare and revenue implications of the African Continental Free Trade Area (AfCFTA) in Ghana. The study simulated a full tariff liberalisation using the SMART partial equilibrium model. It was revealed that Ghana will experience a revenue loss following the full removal of tariffs, exports and imports to African trading partner are expected to increase by 12.9 and 0.7%, respectively.

Seti and Daw, 2022 adopted the SMART partial equilibrium model to simulate the impact of a full tariff liberalization as proposed under the African Continental Free Trade Area (AfCFTA) on South African agriculture trade. The findings of their study revealed that South Africa will gain a total trade value of about US$199 million, and the total trade diversion from third parties will stand at US$42 million. The study results concluded that South Africa should protect infant industries from increased imports to hamper job losses and invest in infrastructure.

The reviewed literature indicates that the theoretical underpinnings of trade openness have been evolving over time as one theory seeks to fill what is missing and strengthen the previous theories. The literature also indicates that two common empirical methodologies have been used to study the effects of trade liberalisation in Africa. From the list of studies reviewed, it is clear that the two common econometric models utilised include the CGE model and the SMART partial equilibrium model. This identification is crucial for the current study in selecting the relevant methods used to examine and measure the impact of trade liberalisation. A number of studies have examined the potential effects of the AfCFTA on participating countries. However, there is limited work examining the impact of the AfCFTA on strategic sectors like the agricultural sector. Therefore, this study focuses on the potential effects of the AfCFTA on agricultural exports from South Africa.

3. Research Methodology

This study adopts the WITS-SMART partial equilibrium (PE) model to simulate the impact of a full tariff liberalization as proposed under the AfCFTA. The analysis is undertaken to better understand the potential implications of a full tariff reduction on South Africa's top agricultural products. The United Nations Conference on Trade and Development (UNCTAD), together with the World Bank, developed the SMART PE model as a methodology for quantifying the impact of changes in trade policy to international trade, particularly, trade liberalisation. The PE models have several known limitations that inter-sectoral implication (second-round effects) on trade policy change that not considered, and the interregional implications within a REC that are also ignored in partial equilibrium structured framework (Lang, 2005). However, partial equilibrium models are continuously used to analyse trade policy effects on trade creation and diversion, welfare and this impact on tariff government revenues (Lang, 2005)

WITS-SMART model enables users to evaluate and analyse the impact of a given trade policy change (measured in tariff) on the following selected trade variables:

-Trade creation effects,

-Trade diversion effects,

-Net trade effect (aggregating trade creation and trade diversion effects)

-Tariff revenue variation, and

-Change in consumer surplus

The behavioural response of the trade market under the WITS-SMART model to a tariff change or liberalisation is illustrated by applying a set of elasticities (supply elasticity, import substitution, and import demand elasticity), which vary at HS-4 to HS-6 level. The term 'partial equilibrium' refers to an analysis that only evaluates the consequences of a policy change in the single market that is directly impacted. In other words, the SMART PE framework ignores the macroeconomic relationship that exists between different markets in a single economy. This is contrary to a general equilibrium model framework of analysis, in which all markets are modelled concurrently, and the relationship that exists between the markets (i.e. economy-wide analysis) is considered. A theoretical derivation of the PE model is explained on the appendix page.

3.1. Simulation scenario and date requirements

In the WITS-Smart simulation scenario created for this study, a case of a 100% tariff liberalization to agricultural products originating from African countries at the HS-6 level for the year 2022 was adopted. The scenario schedule is in line with the AfCFTA modalities in which trading member states starting in 2020 are expected to eliminate 100 percent of tariff lines over five-years (10-year period for the least developed countries, or LDCs). The trade data used in this article is embedded and already exists within the WITS-SMART framework. The WITS-SMART model sources trade data from the United Nations Conference on Trade and Development (UNCTAD), Trade Analysis Information System (TRAINS), International Trade Center (ITC), United Nations Statistical Division (UNSD) and World Trade Organization (WTO) through the Integrated Data Base (IDB). This data has an advantage as it uses harmonized schedule nomenclature. These are real import figures reported by countries (in US$) at customs points at different product levels.

4. Results and discussion

In this section, we present findings of the study. The WITS-SMART partial equilibrium model was used to simulate the potential impact of the AfCFTA on South Africa's agricultural products. The analyses reveal the impact of full tariff liberalisation on trade creation, trade diversion, net trade, tariff revenue and welfare effects.

4.1 Impact of the tariff reduction on agricultural exports

According to trade theories, countries that fully open their economies to allow free movement of goods and services prosper faster than autarky economies. In other words, trade liberalisation results in an increase in exports into the domestic economy, which then reduces prices as the result of improved product availability or increased

supply, and this eventually improves consumer welfare. Table 1 confirms the reliability and the assertion under which trade theories are based on. The simulation model results identified African markets that will increase their agricultural exports to South Africa market. Table 1, identified the top 20 countries or markets to increase their agricultural exports to South Africa are led by Seychelles (67%), Angola (62.9%), Burkina Faso (62.2%), Senegal (54.9%) and Papua New Guinea (51.2%). All the top Five countries will see an increase of more than 50% on their agricultural exports to the South Africa South Africa market trading under the AfCFTA agreement when the tariff lines are reduced by 90% when the trade has kick-started in the continent.

Table 1: Expected increase in exports of individual countries after AfCFTA (US$000**)**

Rank	Partner Name	Exports Before AfCFTA US$'000	Exports After AfCFTA US$'000	Export Change US$'000	Export Change (%)
1	Seychelles	2 577,15	4 314,17	1 737,03	**67,4**
2	Angola	363,05	591,41	228,36	**62,9**
3	Burkina Faso	3,11	5,05	1,94	**62,2**
4	Senegal	2,55	3,95	1,40	**54,9**
5	Papua New Guinea	39,73	60,07	20,35	**51,2**
6	Eritrea	1,41	2,08	0,67	47,5
7	Algeria	44,74	62,97	18,22	40,7
8	Tunisia	478,07	654,87	176,80	37,0
9	Egypt	33 505,78	45 498,68	11 992,90	35,8
10	Kenya	6 807,77	8 967,20	2 159,43	31,7
11	Nigeria	4 741,31	6 226,86	1 485,55	31,3
12	Cameroon	4,31	5,28	0,97	22,4
13	Benin	1 301,37	1 576,94	275,57	21,2
14	DRC	10,34	11,73	1,39	13,4
15	Ethiopia	5 219,81	5 701,89	482,07	9,2
16	Ghana	5 338,66	5 504,80	166,14	3,1
17	Rwanda	452,79	460,14	7,35	1,6
18	Morocco	41 145,08	41 555,48	410,40	1,0
19	Uganda	5 112,07	5 128,26	16,20	0,3

20	Cote d'Ivoire	12 151,58	12 178,22	26,64	0,2

Source: Output from WITS-Smart Model, 2023

4.2 Impact of the tariff reduction on tariff Revenue

The trade revenue effect is determined as the difference between the product of the initial tariff and initial import value, and the product of the new tariff and new import value (Mashuri, 2020). This change in revenue is equivalent to the sum of the change in imports and the change in price. International trade revenue plays a significant role in government local revenue mobilisation and collection through the applied tariffs (Ngaba, Bayela, & Dobah, 2023).The proposed full tariff reduction under the AfCFTA agreement has a potential to harm the South African agricultural sector revenue collection. The impact of revenue loses however, will vary across countries depending on the tariff phase-down approach, concessions and rate as provided in the FTA. Table 2 below illustrates the top 20 largest potential losses of tariff revenue in South African agricultural products against other African countries after the AfCFTA tariff removal.

Table2: Top 20 largest potential losses in RSA Agricultural Products revenue after the AfCFTA agreement with Africa (US$ 000)

Rank	HS6-code	Product description	Revenue Effect U$'000	% Share of Total Loss
1	190230	Pasta, cooked or otherwise prepared	-1030,26	17,9%
2	170410	Chewing Gum, whether or not sugar-coated	-474,91	8,3%
3	091011	Ginger, neither crushed nor ground	-437,32	7,6%
4	180632	Chocolate & other preparation containing Cocoa	-358,72	6,2%
5	180631	Cocoa powder, sweetened	-317,02	5,5%
6	190219	Uncooked past, not stuffed or otherwise prepared	-282,23	4,9%
7	071290	Dried vegetables and mixtures of vegetables	-269,29	4,7%
8	240311	Water pipe tobacco-free	-259,56	4,5%
9	080610	Fresh Grapes	-178,64	3,1%
10	081110	Frozen Strawberries	-176,21	3,1%
11	060311	Fresh cut roses & buds	-171,30	3,0%

12	071333	Dried, shelled kidney beans	-159,88	2,8%
13	080390	Fresh or dried bananas	-141,36	2,5%
14	151790	Edible mixtures or prep animal or veg fats or oil	-122,81	2,1%
15	070810	Fresh or chilled peas	-112,32	2,0%
16	121190	Plants, parts of plants, incl.seeds & fruits	-108,46	1,9%
17	190531	Sweet biscuits	-103,69	1,8%
18	091012	Ginger , crushed or ground	-102,64	1,8%
19	081010	Fresh strawberries	-91,87	1,6%
20	120242	Groundnuts, shelled whether or not broken	-71,96	1,3%
21	Others	Agricultural Products not specified above	-779,13	13,6%
22	**Total**	**Total Agricultural Products**	**-5749,55**	**100%**

Source: Output from WITS-SMART model, 2023

Evidently from the Table above, the major revenue losses in terms of RSA agricultural products were observed in pasta cooked or otherwise (17.9%), chewing gum sugar coated or not (8.3%), ginger (7.6%), chocolate & other preparation that contain cocoa (6.2%), cocoa powder, sweetened (5.5%), dried & mixed vegetables (4.7%) also fresh grapes (3.1%), frozen strawberries (1.6%), and fresh cut of roses & buds(3.1%), amongst the top twenty affected products.

4.3 Impact of the tariff reduction on trade creation and trade diversion

Trade liberalisation is expected to change the trade patterns of African economies with the implementation and operationalisation of the AfCFTA. For example, some industries or firms in Africa are protected with relatively higher tariff rates, therefore, distorting their trade flows and liberalising these tariffs across the region may change the demand for imports of certain agricultural products within the continent. Trade creation arises from the elimination of tariffs, which changes the pricing of imported goods. This leads to the substitution of less efficient domestic companies with imports from members of the new Free Trade Agreement (FTA) whose products become more affordable due to the removal of tariffs. On the other hand, trade diversion occurs when is diverted from a more efficient producer that is outside the FTA to a less efficient member of the FTA (Guei et al., 2017; Milner, Morrissey, & McKay, 2005).

Table 3 presents South Africa's top 15 agricultural products with the highest trade creation potential. Trade creation is distributed unevenly throughout tariff lines due to the varying extent of product disaggregation. The top five products that contribute

the most to trade creation are diverse and encompass tobacco to the value of $3.3 million, onions ($3.2 million), banana ($1,6 million), pasta ($371 000), roses ($559 000) and. These findings align not only with the research conducted by Guei et al. (2017), but also with the study conducted by Seti and Daw (2021) on the effects of the AfCFTA on the South African economy.

Table 3: Top 17 products with highest trade creation effects in South Africa

HS code - 6	Product Description	Trade Creation ($'000)	Trade Diversion ($'000)
All	**Agriculture, Forestry and Fisheries**	**8,336,170**	**5,516,830**
240311	Tobacco	3309	164
070310	Onions and shallots	3227	27
080390	Bananas	1557	168
190230	Other Pasta	371	816
060311	Roses	559	43
190410	Cereal products	514	58
180632	Cocoa	164	391
070810	Peas	463	38
180631	Cocoa Powder	44	386
091011	Ginger	111	315
190219	Containing eggs	104	317
070310	Onions and shallots	379	3
071290	mixtures of vegetables	112	260
071333	Kidney beans	110	167
121190	Perfume Plants	227	35
230610	Cotton Seeds	168	78
070810	Peas	211	18

Source: Output from WITS-SMART model, 2023

Regarding the trade diversion effect, the study presents the top 15 most vulnerable products to trade diversion in Table 3. We realized that the most sensitive products to trade diversion include pasta, vegetables, eggs, ginger, peas, bananas, and tobacco amongst the top 15 agricultural products. This information is of great importance to South Africa in their trade negotiation process and to shield infant industries from collapse. As trade berries such as tariffs are removed, the price of imports falls, resulting to increased number of imports to meet the domestic demand. Additionally,

some firms may find it more profitable to export within African than exporting outside the continent, leading to more trade diversion and trade creation effects (Bagci, Diallo, & Terai, 2023). This might have implications on employment and on agricultural production in the long-run, particularly in African countries characterised by high trade barriers.

4.4 Impact of the tariff reduction on consumer welfare

While it is true that the full tariff cut under the AfCFTA will result in a decrease in South African government revenue, it will also bring about cheaper food products, and deaccelerate food prices that would directly benefit individual households. In theory, due to lower food prices, consumers will be provided with diversified agricultural products and able to enhance their consumption, this leading to an anticipated improvement in welfare. Table 4 below reveals the top 15 products with the most potential to benefit consumers in South Africa. The expected consumer surplus in South Africa amounted to approximately US$ 1.23 million. Therefore, South African consumers will have the opportunity to acquire agricultural products from other African nations at more affordable costs, so enhancing their quality of life provided with diversified products to choose from.

Table 4: Products with largest consumer welfare in South Africa

HS Code - 6	Product Name	Welfare ($'000)
All products	**Agriculture, Forestry and Fisheries**	**1,228,619**
240311	Tobacco	849,944
190230	Other pasta	54,020
060311	Roses	51,905
190410	Prepared foods from cereal products	40,741
070810	Peas (Pisum sativum)	33,923
070310	Onions and shallots	24,368
071290	mixtures of vegetables	19,584
091011	Ginger	12,542
071333	Kidney beans	10,042
081110	Strawberries	9,086
080390	Bananas	6,831
180632	Cocoa powder	6,571
190531	Sweet biscuits	6,568
210390	Soya sauce	4,974

120242	In shell seed	4,652
151790	Margarine	4,590
120799	Cotton seeds	3,524
520859	Plain weave	3,201
160416	Salmon	3,171
170410	Chewing gum	3,087

Source: Outcome from WITS-SMIRTS simulation, 2023

Amongst the top 15 products with the greatest potential for increasing consumer welfare in South Africa include tobacco, pasta, roses, cereal, peas, onions, vegetables, ginger, kidney beans, strawberries, and banana. This can be aligned with the study conducted (Stormer & Msweli, 2023) by that the AfCFTA agreement is expected to create an improved overall welfare gain of $17.7 billion by 2035.

5. Conclusion

The purpose of this study was to analyse the impact of the 100% tariff reduction under AfCFTA using the WITS-SMART simulation method. The results of the simulation show that certain agricultural product are sensitive to trade creation and trade diversion. The model's results illustrated that the anticipated FTA's impact on bilateral trade flows are likely to be unequal, suggesting significant economic gains for relative developing countries such as South Africa, and insignificant gains for African small economies. To benefit from the trade preferential access gains presented by the AfCFTA to the African economies, agricultural products like pasta, ginger, cocoa powder, dried vegetables, water pipe tobacco, fresh grapes, frozen strawberries, fresh cuts of roses and buds will have to compete for market with products coming from different African markets such as Seychelles, Angola, Burkina Faso, Senegal and Papua New Guinea amongst other top 15 African countries.

To balance the losses and wins due to implementation of tariff reduction through the AfCFTA, the South African agricultural sector can improve the investment, competitiveness, adopt environment-friendly technologies, and enabling-infrastructure of the later listed products that are most likely to be affected by high export competition from other African countries. On the other hand, the South African government needs to establish a trade-friendly environment with less restrictive regulations and trade policies that encourage the country's farmers to reinvest and upscale to compete in the African whilst providing tax incentives are attractive to the domestic farmers with potential losses to expand. Lastly, the study recommends that further and future research on the impact of the AfCFTA on the South African agricultural sector should be tailored and focused on identifying the overall impact of non-tariff barriers related to agricultural trade.

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7. Annexure

Theoretical framework

The research offers a thorough analysis of the SMART partial equilibrium model contained in the WITS software. The SMART PE model is selected because it incorporates an advanced trade analysis framework that allows for multilateral tariff reforms and preferential trade liberalization. A static partial equilibrium technique is applied, which allows the researcher to analyse the impact of changes in trade policy in a single country. Since the focus of this study is based on a single market (South Africa), the application of the SMART PE model framework to this study is relevant. The research study emulates the methodology applied by Mcculloch et al. (2001), who applied the SMART PE model to explore the implications of trade liberalization between the United States and Morocco.

It is generally accepted that when import tariffs are abolished in post-AfCFTA negotiations, commodity prices will fall, leading to trade creation. Trade creation involves stimulating trade levels after the tariff liberalization, leading to unproductive companies being outcompeted by more productive rivals. Laird and Yeats (1986) strictly developed an equation necessary to predict trade creation, trade diversion, consumer welfare, and tariff revenue. The derivation of the equation commences with the following basic trade model, which involves changes in import demand and supply:

A generalized import demand function of product *i* from nation *k* for nation *j* is given as:

$$\mathrm{M}\_ijk = f"(" Y\_j, \mathrm{P}\_ij, \mathrm{P}\_ik) \quad (1)$$

On the other hand, the export supply function of product *i* of nation *k* is expressed as:

$$X_{ijk} = f(\mathrm{P}_{ijk}) \quad (2)$$

Given free trade conditions, with ad valorem tariff adjustments, the domestic price of product *i* in country *j* from country *k* will change as follows:

$$P_{ijk} = P_{ijk}(1 + t_{ijk}) \quad (3)$$

As suggested by Laird and Yeats (1986), to get the total trade creation formula, the commodity price formula (3) is completely differentiated to derive:

$$dP_{ijk} = P_{ijk}dt_{ijk} + (1 + t_{ijk})dP_{ijk} \quad (4)$$

To get equation (5) below, equations (3) and (4) are replaced into the elasticity of import demand function:

$$\frac{dM_{ijk}}{M_{ijk}} = \eta_i^m \left(\frac{dt_{ijk}}{1+ t_{ijk}} + \frac{dP_{ijk}}{P_{ijk}}\right) \quad (5)$$

From the expression in equation (5), $\frac{dM_{ijk}}{M_{ijk}} = \frac{dX_{ijk}}{X_{ijk}}$ may be used to calculate the elasticity of export supply as follows:

$$\frac{dP_{ijk}}{P_{ijk}} = \frac{1}{Y_i^e}\frac{dM_{ijk}}{M_{ijk}} \tag{6}$$

The elasticity export function allows for accurate calculation of the trade creation effect when applied in equation (6). Counting from equation (3), the total trade effect is equal to the welfare gains of the exporting nation *k* of product *i* to nation *j*:

$$TC_{ijk} = M_{ijk}\eta_i^m \frac{dt_{ijk}}{\left((1+t_{ijk})\left(1-\frac{\eta_i^m}{Y_i^e}\right)\right)} \tag{7}$$

If $Y_i^e \to \infty$, equation (8) below is a simplified version of equation (7):

$$TC_{ijk} = \eta_i^m M_{ijk} \frac{\left(1+t_{ijk}^1\right)-\left(1+t_{ijk}^0\right)}{\left(1+t_{ijk}^0\right)} \tag{8}$$

where TC_{ijk} is the total value of trade generated in millions of dollars after product *i* has been affected by the tariff adjustment; η_i^m is the import demand function for product *i* from the related trading partner; M_{ijk} is the normal rate of import demand of the given products t_{ijk}^0 and t_{ijk}^1 and reflects tariff rates for product *i* at the initial and end periods, respectively. The prevailing volume of imports, the import demand function, and the relative change in tariff all influence the total trade creation.

Trade diversion has the potential to increase or decrease trade internationally, as opposed to trading creation. Trade diversion is a process that happens in a free trade area when competitive industries from outside the free trade market are replaced in the preferential area by less efficient industries. Laird and Yeats (1986) developed the theory behind the estimation of trade diversion under the SMART framework. To understand the derivation of the theory clearly, the elasticity of substitution (σ_M) variable is first provided. The elasticity of substitution function can be represented as a percentage difference in the relative shares of imports from two separate sources attributable to a one per cent change in the relative prices of the same commodity from the following sources:

$$\sigma_M = \frac{\frac{\Delta\left(\sum_k \frac{M_{ijk}}{\sum_k M_{ijK}}\right)}{\frac{M_{ijk}}{\sum_k M_{ijK}}}}{\frac{\Delta\left(\frac{P_{ijk}}{P_{ijK}}\right)}{\frac{P_{ijk}}{P_{ijK}}}}$$

where *K* denotes imports from other African countries in the free trade zone, and *k* symbolizes imports from the rest of the world (ROTW). Equation (9) can be extended and modified according to Laird and Yeats (1986) to obtain the trade diversion formula as provided below:

$$TD_{ijk} = \frac{M_{ijk}}{\sum_k M_{ijk}} \frac{\sum_k M_{ijk} \sum_K M_{ijk} \frac{\Delta\left(\frac{P_{ijk}}{P_{ijk}}\right)}{\frac{P_{ijk}}{P_{ijk}}} \delta_M}{\sum_k M_{ijk} + \sum_k M_{ijk} + \sum_k M_{ijk} \frac{\Delta\left(\frac{P_{ijk}}{P_{ijk}}\right)}{\frac{P_{ijk}}{P_{ijk}}}} \quad (10)$$

As a result of equation (10), the total trade diverted to other African nations within the FTA can be described as follows:

$$TD^{FTA} = \frac{M^{AFR} M^{ROTW} \left(\frac{1+t^1_{AFR}}{1+t^0_{AFR}} - 1\right) \delta_m}{M^{AFR} + M^{ROTW} + \left(\frac{1+t^1_{AFR}}{1+t^0_{AFR}} m - 1\right) \delta_m} \quad (11)$$

where M^{AFR} denotes the current imports into South Africa from African nations; M^{ROTW} represents imports from the rest of the world; t^0_{AFR} and t^1_{AFR}, respectively, denote the initial and end periods of import tariffs levied on agricultural products from African nations exported to South Africa with $t^0_{AFR} > t^1_{AFR}$. An important observation from the equation is that TD^{FTA} increases with the value of σ_M. Therefore, the addition of trade creation and trade diversion is equal to the total trade effect.

Without a doubt, trade liberalization under the AfCFTA will have revenue implications, as tariff revenue is calculated by multiplying the tariff rate by the tax base, which is the value of imported goods. As a result, the tariff revenue prior to the introduction of the AfCFTA is represented as:

$$R_0 = \sum_i \sum_k t^0_{ijk} P_{ijk} M_{ijk}$$

Following the change in tariff rate, the current revenue collection will be provided by:

$$R_1 = \sum_i \sum_k t^0_{ijk} P_{ijk} M_{ijk}$$

Considering this perspective, the tariff revenue loss to South Africa as a result of the AfCFTA will be calculated as follows:

$$RL = \sum_i \sum_k \Delta t^0_{ijk} P_{ijk} M_{ijk} \quad (12)$$

Although the AfCFTA will lead to trade creation and trade diversion, it is with no doubt that the free trade area is expected to benefit South African consumers through lower market prices. The free trade area will encourage consumers to replace expensive agricultural products with cheaper ones as a result of the tariff liberalization on agricultural imports. Thus, trade liberalization will lead to gains in consumer welfare, which can be explained in the equation below:

$$W_{ijk} = 0.5 \left(\Delta t_{ijk} \Delta M_{ijk}\right) \quad (13)$$

Where W_{ijk} denotes consumer welfare and 0.5 denotes the average difference in tariffs before and after their removal. Import prices in South Africa will decline less than they would if markets were fully liberalized, assuming an unlimited elasticity of export supply.