# A WITS-SMART simulation analysis of trade creation, diversion and welfare effects of the African tripartite region

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**Abstract:** The paper employed WITS-SMART simulations to test Jacob Viner's theory of trade creation and diversion effects in the tripartite free trade area (TFTA) signed between COMESA, EAC and SADC. Simulations used standardised 2-digit trade data. The four product classifications employed are raw materials, intermediate, consumer and capital goods whilst the economic sectors are agriculture, industrial and petroleum. Results indicated trade potential trade to be created or diverted, net trade, revenue and overall welfare effects. In total, the tripartite region will have net gains of approximately USD 2.1 trillion per annum. Specifically, the trade in the industrial sector has a 34% potential, intermediate goods 24% whilst agriculture sector will likely contribute 18% to net trade gains. Trade in raw materials and petroleum sector have the least potential contributions of 3% and 1%, respectively. The study recommends promoting the industrial sector to cater for structural changes and sync with the fourth industrial revolution.

**Keywords:** WITS-SMART simulation; trade creation; trade diversion; welfare effects; revenue effects; economic growth; economic sector.

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## 1 Introduction

Conversations around regional economic integration began to produce much fruits after the majority of conventional trade theories were able to indicate, from various angles, that trade is not a zero-sum game. This implied that partners stand to mutually benefit by trading with other as opposed to operating as silos. These trade gains emanate from

varying advantages such as division of labour and specialisation, comparative advantages, varying levels of factor endowments (or intensities) and also relative prices (Smith, 1776; Ricardo 1817; Mill, 1920; Napoleoni, 1975; Irwin, 1996). However, in 1950, Jacob Viner postulated a ground breaking model which contrasted the generally embraced hypothesis during his era (Viner, 1950). He argued, using his theory of trade creation and trade diversion, that trade arrangements among nations do not always lead to increased economic welfare (Gurova, 2014, Musila, 2005). Trade creation refers to a situation in which trade shifts from high- to low-cost supplier in the economic community due to the new trade agreement whilst trade diversion occurs when imports shift from a non-member economy which is producing at a lower cost to a member of the economic community producing at a higher cost (Cattaneo, 2009). The latter usually occurs when trade barriers such as common tariffs are designed in a way which shields high-cost suppliers who are members of an economic community so that the efficient non-member countries cannot access the market leading to loss in overall economic welfare if diversion outweighs creation (Santosa, 2018; Karambakuwa et al., 2015; Gurova, 2014).

Although debates on regional economic integration in Africa dates back as far 1963 at the launch of the Organisation of African Unity (OAU) which was renamed as the African Union (AU) in 2002, the subject was revived in the continent in the past decade. Consequently, the 26 member countries of COMESA, EAC and SADC[1] signed the Tripartite Free Trade Agreement (TFTA) in 2015 in El Sham Sheijk, Egypt and more recently the African Continental Trade Agreement (AfCFTA) in March 2018 in Kigali, Rwanda in order to boost intra-African trade and improve the economic and welfare gains of Africans. These large and ambitious continental projects will likely result in mixed results with some economies gaining more than others due to the trade diversion and trade creation effects. The changes brought about by these trade agreements will also likely lead to structural changes (Wamboye and Sergi, 2019; Santosa, 2018; Ahmed, 2012) and African policy makers should be informed on the nature of changes which are likely to occur (Azu, 2019).

Unlike most studies which employ econometric studies to analyse integration effects, this paper intends to add to economic literature by performing trade simulations at the sectoral level using the 26 member countries of the TFTA to infer at the likely changes which are likely to happen in the continent. The results from this study can be used to infer judgements to the recently signed AfCFTA agreement which is almost twice as large in its membership. Secondly, the sectoral analysis is likely inform policy makers on the likely structural changes which are likely to occur due to the FTA.

## 2 Literature review

The notion of trade creation and trade diversion implies that not only will economies be turned into winners and losers, but also will the economic sectors. This then implies that those owners of factors of production which are export-oriented will stand to gain more while the income of the import-oriented products shrinks (Ryu, 2018; Mold and Mukwaya, 2017; Lim and Ho, 2013). The effect is that, factors of production will begin to migrate towards more rewarding sectors leading to structural changes which, if not well managed, will cause more harm than good (Santosa, 2018; Fakher, 2016). Consequently, Wamboye and Sergi (2019) argued that capital flows and economic

development in Africa should be understood in the context of economic integration. In practice, trade creation and diversion are influenced by the level of elasticities among other factors. The import elasticity influences the level of trade creation. In general, a positive correlation exists between trade creation and import elasticity. On the other hand, the trade diversion effect is also largely influenced by the elasticity of substitution commonly known as the Armington elasticity (Makochekanwa, 2012). When the substitution elasticity is higher, the respective economy or economic sector will experience more trade diversion since the products being produced in that country or sector can be easily substituted (Endoh, 1999; Brutton, 1998).

Mold and Mukwaya (2017) highlighted that the welfare effects of economic integration must be properly analysed due to several reasons. Firstly, FTAs imply removal of trade restrictions mean governments can no longer collect the much needed customs revenue which signifies a loss. This revenue consists a very significant source of income for most African governments in providing public and merit goods (Wamboye and Sergi, 2019). Thus, the FTAs might lead to a negative developmental effect if not properly managed. Secondly, removal of trade barriers also imply that infant and strategic industries are no longer protected from regional or international competitors which are usually large and predatory in nature (López-Cariboni, 2019). This leads to skewness and polarisation of benefits towards larger economies like South Africa, Kenya and Egypt which have comparative advantages. A similar argument was raised by Lee (2019) who argued that size matters and economic capacity should be accounted for in order to provide a level playing field when settling trade disputes especially between developed and developing economies. These disputes usually are likely to arise in Africa when smaller and vulnerable economies within the economic community feel disadvantaged and polarised by free trade.

Apart from removal of trade barriers through FTAs such as the AfCFTA, Wamboye and Tochkov (2016) argued that Africa is also characterised by several other constraints which inflate the transaction costs of intra-African trade. These include but not limited to low densities of income per capita which then reduces the value of transactions conducted within the continent. In essence, majority of intra-African trade is characterised by cross-border traders who are mostly small to medium enterprises. In addition, the continent is also characterised by poor road and rail infrastructure leading to poorly developed cross country links (UNECA, 2015). These costs of transacting across borders are also expatiated by continental size since the continent covers a much wider geographical space compared to the European Union and the Asian Pacific region (Mold and Mukwaya, 2017). Thus, *ceteris paribus*, it would still be more expensive to transact in Africa due to size alone. Other contributory factors include tightened regulatory policies in especially in the aviation sector. This lowers both competition and efficiency (Wamboye, Tochkov and Sergi, 2015). Linked to the above argument is the fact that the geo-political configuration of Africa is fragmented into small domestic markets which translated into lack of small economies (Classen et al., 2016; Obasaju et al., 2019) implying that intra-Africa trade was challenging. Perhaps large FTAs such the TFTA and AfCFTA will address some of these challenges since it is aimed at transforming the African continent into one giant market. However, Wamboye and Sergi (2019) argued that the nature of capital flows, economic integration and development in Africa was being reshaped by rapid proliferation of mobile cellular technology, improved governance quality, infrastructure and human capital development, liberalisation of financial markets among other factors.

Large continental trade agreements such as the TFTA and AfCFTA are aimed at lessening the gap between the wealthier and poorer economies. This is sometimes referred to in economic literature as economic convergence (Mundell, 1973; World Bank, 2013; AfDB, 2014). Africa is characterised by a wide variance in terms of Gross Domestic Product per capita (GDPP) at Purchasing Power Parity (PPP). 2010 USD based figures reflected the following figures: Botswana, Mauritius and Seychelles had the highest values of around USD 14,000 whilst South African and Angola had USD 10 700 and USD 8200, respectively. Values for Namibia was USD 6900 and Egypt closely followed at USD 6 200. The lower end of the tail had economies like Lesotho, Kenya and Zambia whose values were USD 1700, USD 1600 and USD 1500, respectively. Zimbabwe and the Democratic Republic of Congo were outliers with values of USD 500 and USD 300 (World Bank, 2013; AfDB, 2014, 2016). The rationale behind these figures is that opening up trading borders under the pretext of free trade areas like TFTA and AfCFTA will likely lead to polarisation of benefits since it will be a David and Goliath case on the continental markets. The only difference in this case is that, Goliath will reign. These figures are likely to become even more revealing once sectoral statistics are taken into account. In other words, there are several complexities around the intra-African trade debate which must be taken into account if free continental trade is to be truly sustainable. This study will tackle one piece of the pie and add to economic literature by analysing the potential effects of a large continental free trade area, the TFTA, by performing a sectoral analysis.

## 3 Empirical modelling

This paper employs the World Integrated Trade Solution-Software for Market Analysis and Restrictions on Trade (WITS-SMART) model which was developed and is extensively employed by the World Bank in analysing effects on RTAs. The WITS-SMART model provides integrated analytical tools which allow for simulation analysis on tariff reductions and is compatible with globally reputable data sources. These include the Common Format for Transient Data Exchange (COMTRADE), Trade Analysis and Information Systems (TRAINS) and the United Nations Conference on Trade and Development (UNCTAD) (Makochekanwa, 2012). The paper also employed standardised trade data at the 2-digit level which is more aggregated than the 4- and 6-digit level since the paper is including many countries and sectors (26 countries and seven sectors, respectively). The WITS-SMART model has an effective practical application both in terms of performing simulations since one can evaluate alternative phase out scenarios such as

- reduced tariff by various percentages
- total elimination of tariffs or even
- varying degrees of elasticities.

In addition, the model gives results in actual USD terms as opposed to econometric models which present results in technical ‘significant’ and ‘not significant’ terms which may be challenging to communicate results to non-technical policy makers (ACBF, 2017).

Simulations are conducted under the assumption of infinite elasticity of supply. This assumption is rational since most if not all African economies are too small to influence global trade by manipulating their domestic supply (Mold and Mukwaya, 2017). The paper also assumes an Armington assumption on substitution value of 1.5 which that products are similar but slightly differentiated. For instance, under this assumption, coffee from Kenya will be a close but not perfect substitute to coffee from South Africa. The variances are derived from factors such as place of origin, branding among others. Other studies, however, have used different values depending on their rationale such as country, time, industry or sector. For instance, Hoekman et al. (2001) employed smaller values whilst Francois and Reinhardt (1997) assumed a larger value of 5. The following empirical estimations were made for this study:

$$TC_{ijk} = M_{ijk} \times \eta \times \frac{\Delta_{ijk}}{\left(1+t_{ijk}\right) \times \left(1+ \eta / \beta\right)} \tag{1}$$

where

$TC_{ijk}$ : trade creation

$M_{ijk}$ : imports

$t_{ijk}$: tariff

$\eta$ : import elasticity of demand

$\beta$ : export supply elasticity

$i$: commodity

$j$: exporting country

$k$: importing country.

Equation (2) represents trade diversion which largely depends on the substitution elasticity:

$$TD_{ijk} = \frac{M_{TFTA} \times M_{RoW} \left[\left(\frac{1+t_t}{1+t_0}\right)-1\right] \times \lambda}{M_{TFTA} + M_{RoW} + M_{RoW} \left[\left(\frac{1+t_t}{1+t_0}\right)-1\right] \times \lambda} \tag{2}$$

where

$TD_{ijk}$ : trade diversion

$M_{TFTA}$ : imported commodities from TFTA countries

$M_{RoW}$ : imported commodities from rest of the world

$t_t$ : tariff (where $t_0$ and $t_t$ represent pre and post integration levels of tariffs)

$\lambda$ : elasticity of substitution.

The net trade effect (TE) is the aggregate of trade creation and diversion expressed as:

$$TE = TC + TD \ . \tag{3}$$

The net revenue effect (RE) in equation (4) indicates the revenue changes after a change in tariffs. It largely depends on price and volume of imports.

$$\Delta R_{ikj} / R_{ikj} = [\Delta t_{ijk} / (1 + t_{ijk})] \times \eta \times [(1 + \beta) / (\beta - \eta)] \quad (4)$$

where

$\Delta R_{ikj}$ : the effects on revenue due to tariff changes

$\eta$ : the elasticity of demand for the importing economy

$t_{ijk}$ : tariff

$\beta$ : elasticity of supply for the exporting economy.

Equation (5) estimates the welfare effects are basically the summation of the producer and consumers' surplus.

$$W_{ikj} = 0.5(\Delta t_{ijk} \times \Delta M_{ijk}). \quad (5)$$

### *3.1 Data description*

The data is not publicly available because one must create an account in order to access the data and perform the simulations on the World Bank website.[2] However, reference data for standard product groups used in this paper can be openly accessed.[3] Results can be replicated should one create an account on the above website and perform similar simulations using the specified assumptions. The author does not have control over the data but generated results are available upon request due to file size.

The data employed in this paper was extracted from the Harmonised Commodity Description and Coding System (HS) accessible on the World Bank website and simulations were also performed online. The HS system allows traded goods to be classified on a common basis by participating countries for customs and related purposes. Globally, the HS is a six-digit code system which consists of around 5300 product descriptions, organised into 99 chapters and clustered into 21 sections. The six digits can be disintegrated into three parts: HS-2 identifies the chapter of the goods classification, HS-4 identifies groupings within that chapter, and the more specific HS-6. The HS system was established in 1988 and is adopted by most countries worldwide and the latest revisions were done in 2007. The study employed data from the HS system to ensure consistency in terms of both data input and results which will allow effective comparisons to be made across both countries and sectors.

## 4 Findings and discussion of SMART simulation results

This section presents the results of the SMART simulation procedures for all the 26 tripartite free trade area (TFTA) member countries and the seven product classifications. The results are based on a 100% tariff reduction, which is complete and immediate removal of tariffs and 2015 trade data was used to perform the simulations because that was when the TFTA was effected. Table 1 indicates the tariff schedules used to perform simulations for each TFTA country.

**Table 1** Tariff schedules using the latest available year

| *Reporter name* | *Tariff year* | *SA (TFTA* | *WA (TFTA)* | *Standard deviation (TFTA)* | *Imports value in 1000 USD (TFTA)* | *Simple average (World)* | *Weighted average (World)* | *Standard deviation (World)* | *Imports value in 1000 USD (World)* |
|---|---|---|---|---|---|---|---|---|---|
| Angola | 2015 | 15.28 | 41.12 | 16.32 | 290.82 | 10.44 | 10.24 | 12.82 | 7336537.75 |
| Botswana | 2015 | 0.57 | 0.02 | 8.88 | 5650878.2 | 7.61 | 0.56 | 16.24 | 7551095.75 |
| Burundi | 2015 | 2.2 | 1.73 | 7.51 | 157294.44 | 10.42 | 6.13 | 12.26 | 559944.76 |
| Comoros | 2015 | 6.2 | 0.96 | 8.52 | 23168.92 | 12 | 5.04 | 8.94 | 115238.08 |
| Congo, DR | 2014 | 11.76 | 9.7 | 6.1 | 3355315.3 | 11.65 | 10.19 | 6.03 | 6495663.59 |
| Djibouti | 2014 | 18.38 | 12.84 | 9.15 | 47054.06 | 18.92 | 17.56 | 8.82 | 645337.93 |
| Egypt | 2015 | 8.73 | 0.75 | 98.1 | 767427.64 | 7.52 | 7.08 | 123.76 | 71076869.6 |
| Eritrea | 2006 | 3.99 | 1.93 | 5.64 | 36464.29 | 9.56 | 5.43 | 8.98 | 432839.18 |
| Ethiopia | 2015 | 18.15 | 12.83 | 10.91 | 567452.15 | 17.87 | 12.14 | 11.42 | 25389625.7 |
| Kenya | 2015 | 7.84 | 2.25 | 11.01 | 1916529.1 | 11.96 | 11.47 | 11.68 | 16945890.1 |
| Lesotho | 2015 | 0.27 | 0 | 6.53 | 1038305.6 | 3.6 | 2.79 | 14.4 | 1254224.27 |
| Libya | 2006 | 0 | 0 | 0 | 461991.25 | 0 | 0 | 0 | 6729085.47 |
| Madagascar | 2014 | 0.05 | 0.28 | 0.74 | 321420.74 | 10.69 | 5.99 | 7.62 | 3079377.67 |
| Malawi | 2015 | 0.15 | 0.01 | 1.43 | 1159022.2 | 9.05 | 4.24 | 10.82 | 2730483.54 |
| Mauritius | 2015 | 0.03 | 0.01 | 0.83 | 490790.06 | 1.76 | 0.68 | 6.2 | 4458341.51 |
| Mozambique | 2014 | 1.45 | 1.09 | 4.47 | 3119121.9 | 7.45 | 4.17 | 7.74 | 8743044.99 |
| Namibia | 2015 | 0.4 | 0 | 6.77 | 5301276.1 | 6.89 | 0.9 | 13.32 | 8521056.67 |
| Rwanda | 2015 | 3.34 | 1.02 | 8.5 | 629835.71 | 11.18 | 9.75 | 12.34 | 1954207.56 |
| Seychelles | 2015 | 1.81 | 1.88 | 11.44 | 109472.08 | 2.39 | 2.82 | 11.71 | 802251.86 |
| South Africa | 2015 | 1.76 | 1 | 7.53 | 5264371.1 | 6.35 | 4.38 | 12.17 | 72733768.1 |
| Sudan | 2012 | 1.87 | 1.1 | 7.14 | 634860.39 | 12.09 | 12.12 | 14.95 | 6219226.34 |
| Swaziland | 2015 | 0.2 | 0.01 | 9.15 | 1184093.5 | 4.68 | 0.99 | 15.58 | 1407365.7 |
| Tanzania | 2015 | 1.59 | 2.42 | 6.23 | 979852.49 | 11.92 | 7.28 | 11.83 | 14665700.9 |
| Uganda | 2015 | 5.55 | 2.06 | 10.26 | 1001872.5 | 11.68 | 7.88 | 11.89 | 5527015.09 |
| Zambia | 2013 | 0.24 | 0.05 | 2.24 | 6031952.4 | 10.3 | 3.35 | 10.44 | 10144571.3 |
| Zimbabwe | 2015 | 0.36 | 0.42 | 8.89 | 2968001.5 | 13.29 | 5.72 | 26.7 | 5959076.55 |

SA: Simple Average; WA: Weighted Average; SD: Standard Deviation.

*Source*: Author's computations

The average simple and weighted tariff schedules are lower than the world average. This makes economic sense because RTAs usually have lower applied rates than the bound rates of the World Trade Organisations (WTOs). The table also indicates that majority of the African countries still import their products from the rest of the world (RoW), a result also observed by Mold and Mukwaya (2017). Table 2 presents the trade creation simulation results for each economic sector and country.

**Table 2** Trade creation by product classification and economic sector

| *Country* | *SoP1* *TC* | *SoP2* *TC* | *SoP3* *TC* | *SoP4* *TC* | *Agriculture* | *Industrial* | *Petroleum* | *Total* |
|---|---|---|---|---|---|---|---|---|
| Angola | 15.804 | 31.092 | 26.715 | 0.198 | 46.905 | 26.904 | 0 | 147.618 |
| Botswana | 0.026 | 9.07 | 40.386 | 0.134 | 4.176 | 45.473 | 3.796 | 103.061 |
| Burundi | 109.59 | 444.62 | 2631.348 | 310.302 | 190.41 | 2360.333 | 950.19 | 6996.795 |
| Comoros | 111.58 | 1134.329 | 446.94 | 28.864 | 682.138 | 1030.392 | 9.238 | 3443.476 |
| Congo DR | 46326.2 | 484854.9 | 219543.8 | 110697.2 | 292593.4 | 673270.8 | 20287.7 | 1847573.8 |
| Djibouti | 2366.3 | 532.316 | 8683.061 | 1119.711 | 3132.308 | 7459.079 | 2109.9 | 25402.72 |
| Egypt | 578.88 | 4826.29 | 1125.47 | 405.4 | 1162.759 | 6045.323 | 0 | 14144.122 |
| Eritrea | 429.43 | 312.02 | 810.276 | 86.486 | 1135.617 | 502.594 | 0 | 3276.42 |
| Ethiopia | 8676.8 | 13783.79 | 69972.78 | 15671.37 | 18686.11 | 86154.77 | 4306.8 | 217252.5 |
| Kenya | 8.053 | 561.13 | 199.133 | 4.558 | 466.459 | 345.152 | 0 | 1584.485 |
| Lesotho | 0 | 0.275 | 20.882 | 0.018 | 0.175 | 20.999 | 0 | 42.349 |
| Libya | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Madagascar | 2.89 | 70.723 | 451.902 | 0.014 | 608.228 | 3.945 | 0 | 1137.702 |
| Malawi | 0 | 0.142 | 87.119 | 5.422 | 2.176 | 53.676 | 36.83 | 185.365 |
| Mauritius | 0 | 0 | 13.683 | 0 | 0.001 | 13.682 | 0 | 27.366 |
| Mozambique | 9123.3 | 22728.13 | 37841.71 | 21827.61 | 50619.16 | 39240.42 | 1662.9 | 183043.2 |
| Namibia | 0 | 137.811 | 57.629 | 6.74 | 0.296 | 201.892 | 0 | 404.368 |
| Seychelles | 0.63 | 0 | 32.444 | 0 | 33.074 | 0 | 0 | 66.148 |
| South Africa | 6879.8 | 7379.88 | 71144.53 | 2564.004 | 30739.38 | 64854.35 | 14.021 | 183575.9 |
| Sudan | – | – | – | – | 0 | 0 | 0 | 0 |
| Swaziland | 0 | 25.142 | 0.384 | 0 | 25.527 | 0 | 0 | 51.053 |
| Tanzania | 10.502 | 3803.681 | 935.119 | 100.533 | 113.369 | 4728.457 | 231.62 | 9923.282 |
| Uganda | 1058.2 | 5065.751 | 6526.25 | 4885.284 | 4273.986 | 13249.97 | 383.38 | 35442.8 |
| Zambia | 33.894 | 52.171 | 3271.113 | 8.228 | 259.134 | 3120.55 | 1.194 | 6746.284 |
| Zimbabwe | 0.042 | 3269.392 | 5462.289 | 4962.496 | 2006.649 | 9127.941 | 3255.2 | 28084.033 |
| Total | 75731.8 | 549022.7 | 429324.9 | 162684.6 | 406781.1 | 911856.7 | 33252.9 | 2568654.9 |

SoP1: Raw materials; SoP2: intermediate goods; SoP3: consumer goods; SoP4: capital goods.

*Source*: Author's computations

The results presented in Table 2 show that about eight economies will not have any trade created for raw materials. Generally, raw materials have low potential for trade creation because majority of African countries have abundant resource endowments and trade in this area is least likely. The six countries which have noteworthy trade creation in raw materials are Uganda, Ethiopia, Djibouti, Mozambique, Kenya and South Africa with values ranging between USD 1 million and USD 10 million. In total, the contribution to total share of raw materials is only 3% whilst intermediate goods contribute 21% to trade creation which amounts to USD 549 million. The highest contributors to trade in intermediate goods are Mozambique, Tanzania, DRC, Egypt, South Africa, Ethiopia,

Uganda and Zimbabwe. A significant share in trade in intermediate goods could be attributed to value addition on raw materials which will in turn stimulate trade. Trade in consumer goods will contribute 17% of total trade creation. This figure is likely due to cross-border activities especially by individuals and small and medium enterprises (SMEs) which characterise majority of intra-Africa trade by transactional volume. Trade creation emanating from capital goods is approximated at only 6% with a value of USD 163 million. The simulation results make economic sense because not many African countries have the capacity to produce and trade in capital goods. Figure 1 shows the proportions by product classification and economic sector.

As reflected above, the agricultural sector has potential to contribute 16% (USD 407 million). These results truly reflect that Africa is largely an agrarian continent and intra-trade is likely to be stimulated by shortages in other regions due to factors such as poor rainy seasons and droughts, civil conflicts and wars and just general increases in demand due to population increases in some parts of the continent. Similar results were obtained by Makochekanwa (2012) whose study only focused on agrifood production. However, Obasaju et al. (2019) observed that although REC positively contributed to backward integration of global value chains among ECOWAS members, it was statistically insignificant and thus required more quality inputs and intensified efforts. The industrial sector will have the highest potential contribution to trade creation of approximately 36% (USD 900 million). Although overall transactions in this category may be few, they will be of high value thereby leading to a bigger contribution. Mozambique, Ethiopia, DRC and South Africa are the top beneficiaries in this category. Finally, the petroleum sector will only contribute a meagre 1%. These results are likely to continue into the short to medium term because even though there are oil deposits in some economies, they still lack the processing capacity to make their products ready for the African market. Table 3 shows the level of trade diversion for the 26 TFTA economies.

The table indicate that trade diversion in raw materials will be approximately 1% (USD 5.6 million) with Ethiopia experiencing the highest level (USD 2.4 million) followed by DRC and Mozambique (USD 1.2 million and USD 1 million, respectively). The results make economic sense because the large resource endowments also imply that it is least likely diversion in raw materials will be experienced. Diversion in intermediate goods amounts to USD 40 million which is approximately 9%. The countries likely to experience the highest diversion in intermediate goods are Ethiopia, Egypt, Uganda, DRC, Mozambique and South Africa. Since majority of these are coastal economies, it is likely that they were importing these goods from efficient non-member producers from the rest of the world prior to the free trade agreements. Similar reasoning could be applied to consumer and capital goods which have a trade diversion share of USD 126 million (27%) and USD 60 million 13%, respectively. Figure 2 shows trade diversion in proportions.

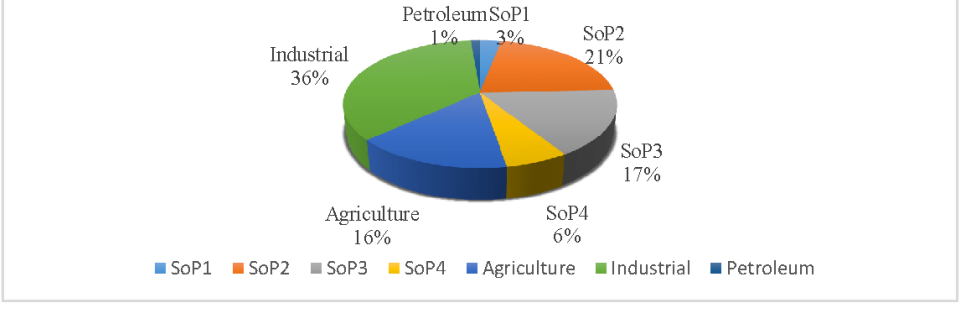
Agriculture has little diversion of about 7% which is a rational result since Africa is agro-based, it will be unlikely that the continent will import agricultural produce from inefficient producers. In addition, majority of African countries have relaxed tariffs on agricultural products in order to supplement on nutrition, health and food security. However, trade diversion in the industrial sector is significantly higher at 41% which approximates to USD 192 million. It is important to note that while the proportion maybe high, the absolute figure in terms of trade diversion are low which will result in positive net welfare effects which are presented in Figure 3.

**Table 3** Trade diversion by product classification and economic sector

| *Country* | *SoP1* | *SoP2* | *SoP3* | *SoP4* | *Agriculture* | *Industrial* | *Petroleum* | *Total* |
|---|---|---|---|---|---|---|---|---|
| Angola | 4.501 | 57.983 | 10.269 | 0.307 | 62.44 | 10.621 | 0 | 146.121 |
| Botswana | 0 | 0.897 | 8.46 | 0.014 | 0.002 | 9.368 | 0.005 | 18.746 |
| Burundi | 0.656 | 62.413 | 691.597 | 199.299 | 29.902 | 472.564 | 454.867 | 1911.298 |
| Comoros | 4.093 | 18.891 | 106.095 | 7.82 | 46.453 | 85.688 | 4.761 | 273.801 |
| Congo DR | 1227.716 | 18012 | 41183.16 | 31346.3 | 16135.35 | 75126.61 | 1594.378 | 184625.5 |
| Djibouti | 117.696 | 198.45 | 2531.69 | 507.075 | 657.81 | 1783.696 | 913.406 | 6709.823 |
| Egypt | 261.737 | 2970.59 | 1269.481 | 688.578 | 837.03 | 4545.132 | 0 | 10572.54 |
| Eritrea | 19.688 | 88.617 | 275.357 | 77.872 | 247.194 | 214.338 | 0 | 923.066 |
| Ethiopia | 2446.74 | 12152.4 | 28910.68 | 4994.67 | 9712.443 | 37556.87 | 2155.513 | 97929.32 |
| Kenya | 3.084 | 21.547 | 64.679 | 3.071 | 35.673 | 60.822 | 0 | 188.876 |
| Lesotho | 0 | 0 | 7.318 | 0 | 0 | 7.318 | 0 | 14.636 |
| Libya | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Madagascar | 3.492 | 41.752 | 685.171 | 0.024 | 910.876 | 4.879 | 0 | 1646.194 |
| Malawi | 0 | 0.083 | 35.085 | 3.102 | 0.09 | 32.335 | 5.841 | 76.536 |
| Mauritius | 0 | 0 | 29.436 | 0 | 0.001 | 29.577 | 0 | 59.014 |
| Mozambique | 1045.614 | 1507.41 | 6093.371 | 9627.75 | 2319.274 | 15221.18 | 733.697 | 36548.29 |
| Namibia | 0 | 147.528 | 10.093 | 1.268 | 0.037 | 158.853 | 0 | 317.779 |
| Seychelles | 0 | 0 | 1.029 | 0 | 1.029 | 0 | 0 | 2.058 |
| South Africa | 377.915 | 1532.6 | 33234.3 | 3116.79 | 3297.08 | 35518.29 | 32.428 | 77109.41 |
| Sudan | | | | | | | | 0 |
| Swaziland | 0 | 0 | 0.759 | 0 | 0.759 | 0 | 0 | 1.518 |
| Tanzania | 10.516 | 752.359 | 656.699 | 157.007 | 105.287 | 1560.989 | 53.911 | 3296.768 |
| Uganda | 68.466 | 2861.93 | 4455.125 | 4682.46 | 1012.736 | 11020.92 | 85.95 | 24187.59 |
| Zambia | 0.442 | 19.752 | 1366.243 | 10.599 | 37.154 | 1361.284 | 0.681 | 2796.155 |
| Zimbabwe | 0.027 | 56.839 | 4170.98 | 4459.41 | 3.168 | 6734.659 | 3492.698 | 18917.78 |
| Total | 5592.383 | 40504 | 125797.1 | 59883.4 | 35451.79 | 191516 | 9528.136 | 468272.8 |

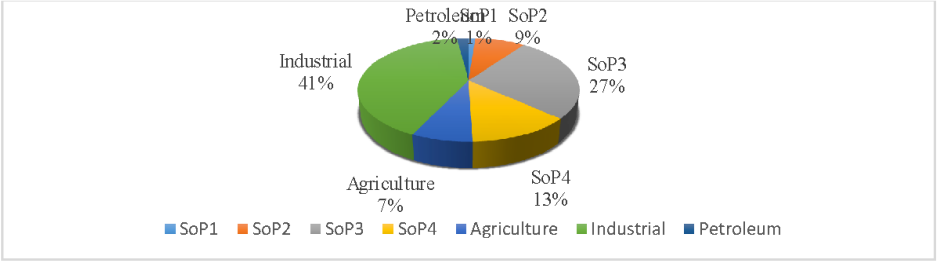
*Source*: Author's computations

**Figure 1** Proportions of trade creation by product classification and economic sectors (see online version for colours)




*Source*: Author's computations

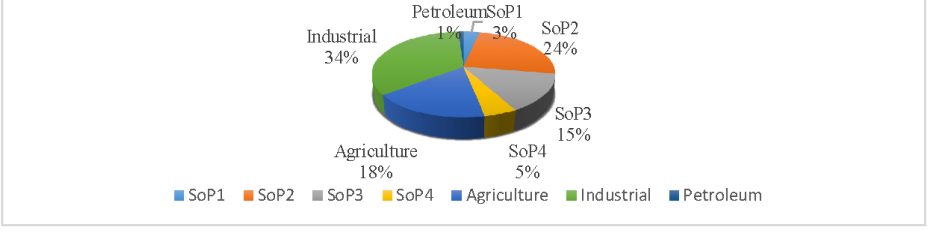
**Figure 2** Trade diversion by product classification and economic sectors (see online version for colours)




SoP1: raw materials; SoP2: intermediate goods; SoP3: consumer goods; SoP4: capital goods.

*Source*: Author computations

**Figure 3** Net trade effect by product classification and economic sector (see online version for colours)




SoP1: raw materials; SoP2: intermediate goods; SoP3: consumer goods; SoP4: capital goods.

*Source*: Author computations

The results in Figure 3 and related arguments are not significantly different from those presented and discussed earlier in the subsections of trade creation and diversion. The net effects are summarised as: industrial sector (34%), intermediate goods (24%), agriculture (18%), consumer goods (15%), capital goods (5%), raw materials (3%) and petroleum (1%). Table 4 reflects the revenue loss which is likely to be incurred by the member countries of the TFTA integration scheme when tariffs are eliminated.

Results in Table 4 clearly show that economies are likely to incur greater venue losses if the assumption is that trade conditions are restricted to TFTA countries only. The effect will, however, be neutralised when world trade is taking into account because losses will be spread out across a wider number of economies which are large ad also influenced by different set of instruments from those governing the African FTA. In other words, it is African economies which will feel the greatest impact of revenue impact of their free trade arrangements but the effect will be minimal on the global scale. Generally, those economies which are pursuing less restrictive international trade measures such as Seychelles, Mauritius and member countries of the South African Customs Union (SACU, except for South Africa) will not experience much revenue losses post the implementation of the free trade agreements because, in essence, they would have incurred these losses when they independently liberalised their borders. Table 5 provides approximate values of customs revenue as a proportion of government revenue to indicate the level of significance of customs income for each economy.

**Table 4** Revenue effects at country level

| *Country* | *Revenue effect 1000 USD* | *Revenue effect world* |
|---|---|---|
| Angola | –304.257 | –152.129 |
| Botswana | –70.418 | –36.471 |
| Burundi | –3015.257 | –1509.267 |
| Comoros | –482.245 | –241.125 |
| Congo. Dem. Rep. | –642110.193 | –337015.583 |
| Djibouti | –13486.11 | –6743.055 |
| Egypt. Arab Rep. | –12617.557 | –6437.099 |
| Eritrea | –1520.606 | –760.303 |
| Ethiopia(excludes Eritrea) | –163832.689 | –82534.487 |
| Kenya | –1822.125 | –936.522 |
| Lesotho | –38.924 | –19.462 |
| Libya | 0 | 0 |
| Madagascar | –1722.688 | –943.664 |
| Malawi | –152.944 | –76.472 |
| Mauritius | –68.366 | –34.183 |
| Mozambique | –72350.681 | –36177.856 |
| Namibia | –442.815 | –221.416 |
| Rwanda | –11170.479 | –5651.845 |
| Seychelles | –27.71 | –13.855 |
| South Africa | –131634.762 | –66246.567 |
| Swaziland | –60.702 | –30.351 |
| Tanzania | –6151.037 | –3144.46 |
| Uganda | –40185.748 | –20144.364 |
| Zambia | 6352.477 | –3180.108 |
| Zimbabwe | –27539.002 | –14400.852 |
| Total | –1124454.838 | –586651.496 |

*Source*: Author's computations

Countries with the highest proportions of customs revenue to government revenue include Lesotho (60%), Uganda (51%) and Kenya (38.6%). Angola, Mauritius and South Africa have the least figures of approximately 5%. However, the figures of Angola are inconsistent with theory and expectation and should be treated with expectation. The author suspect that incomplete data was uploaded for Angola, however, as highlighted earlier the author does not have control on the dataset and can only perform simulations with existing database. Results in Table 6 shows the aggregate revenue losses by product classification and economic sector and results are also consistent with earlier presentations in that much of the revenue loss will be incurred in the industrial sector.

**Table 5** Proportion of customs revenue in government revenue

| | *Country* | *Customs revenue % of government revenue* | *Tax revenue as % of GDP* |
|---|---|---|---|
| 1 | Angola | 5 | 5.7 |
| 2 | Botswana | 33 | 35.2 |
| 3 | Burundi | 8.2 | 17.4 |
| 4 | Comoros | n/a | 12.0 |
| 5 | DRC | 25–50 | 13.2 |
| 6 | Djibouti | n/a | 20.0 |
| 7 | Egypt | 19.74 | 15.8 |
| 8 | Eritrea | 2.9 | 11.2 |
| 9 | Ethiopia | 45.82 | 11.6 |
| 10 | Kenya | 38.6 | 18.4 |
| 11 | Lesotho | 60 | 42.9 |
| 12 | Libya | n/a | 2.7 |
| 13 | Madagascar | 49.2 | 10.7 |
| 14 | Malawi | 25–50 | 20.7 |
| 15 | Mauritius | 5 | 19.0 |
| 16 | Mozambique | 25–50 | 13.4 |
| 17 | Namibia | 25–50 | 28.8 |
| 18 | Rwanda | 7.6 | 14.1 |
| 19 | Seychelles | <25 | 32.0 |
| 20 | South Africa | 5 | 26.9 |
| 21 | Sudan$^{+}$ | n/a | 6.3 |
| 22 | Swaziland | 25–50 | 39.8 |
| 23 | Tanzania | 25–50 | 12.0 |
| 24 | Uganda | 50.8 | 12.6 |
| 25 | Zambia | 25–50 | 16.1 |
| 26 | Zimbabwe | <25 | 27.2 |

*Source*: Phiri (2011), Mkenda and Hangi (2009) and Author's compilations

**Table 6** Revenue effects by product classification and sector level

| *SoP1* | *SoP2* | *SoP3* | *SoP4* | *Agric* | *Industrial* | *Petroleum* | *Total* |
|---|---|---|---|---|---|---|---|
| –23217.4 | –137994 | –268959 | –120338 | –124327 | –440598 | –21726 | –1137160 |

SoP1: Raw materials; SoP2: intermediate goods; SoP3: consumer goods; SoP4: capital goods.

*Source*: Author's computations based on SMART simulations

The welfare effects show the producer and consumer surplus for each economy under study. The results indicate that DRC will have the highest potential gainer followed by South Africa and Ethiopia. In the midst of the pack is Mozambique, Uganda, Djibouti

and Zimbabwe with values ranging between USD 2 million and USD 6 million whilst smaller or already liberated economies like Mauritius, Seychelles, Botswana, Lesotho and Swaziland will have least potential welfare gains for reasons already discussed earlier in this paper.

**Table 7** Welfare effects at country level

| *Alphabetical order* | | | *Highest to lowest* | | |
|---|---|---|---|---|---|
| *Country* | *Welfare in 1000 USD (TFTA)* | *Welfare in 1000 USD (World)* | *Country* | *Welfare in 1000 USD (TFTA)* | *Welfare in 1000 USD (World)* |
| Angola | 47.009 | 23.505 | Congo. DR | 125155.615 | 65895.232 |
| Botswana | 3.1 | 1.551 | South Africa | 38222.748 | 20089.485 |
| Burundi | 279.832 | 140.017 | Ethiopia | 32128.651 | 16152.781 |
| Comoros | 163.743 | 81.873 | Mozambique | 12999.386 | 6499.762 |
| Congo. DR | 125155.615 | 65895.232 | Djibouti | 3882.5 | 1952.007 |
| Djibouti | 3882.5 | 1941.25 | Uganda | 3858.679 | 1941.25 |
| Egypt | 723.614 | 395.276 | Zimbabwe | 3756.279 | 1907.53 |
| Eritrea | 190.649 | 95.325 | Rwanda | 1493.138 | 749.456 |
| Ethiopia | 32128.651 | 16152.781 | Tanzania | 1350.591 | 687.957 |
| Kenya | 48.825 | 24.822 | Zambia | 971.611 | 486.858 |
| Lesotho | 6.721 | 3.361 | Egypt | 723.614 | 395.276 |
| Libya | 0 | 0 | Burundi | 279.832 | 140.017 |
| Madagascar | 51.384 | 27.661 | Eritrea | 190.649 | 95.325 |
| Malawi | 17.045 | 8.522 | Comoros | 163.743 | 81.873 |
| Mauritius | 7.771 | 3.886 | Madagascar | 51.384 | 27.661 |
| Mozambique | 12999.386 | 6499.762 | Kenya | 48.825 | 24.822 |
| Namibia | 26.186 | 13.093 | Angola | 47.009 | 23.505 |
| Rwanda | 1493.138 | 749.456 | Namibia | 26.186 | 13.093 |
| Seychelles | 8.423 | 4.212 | Malawi | 17.045 | 8.522 |
| South Africa | 38222.748 | 20089.485 | Seychelles | 8.423 | 4.212 |
| Swaziland | 2.86 | 1.43 | Mauritius | 7.771 | 3.886 |
| Tanzania | 1350.591 | 687.957 | Lesotho | 6.721 | 3.361 |
| Uganda | 3858.679 | 1952.007 | Botswana | 3.1 | 1.551 |
| Zambia | 971.611 | 486.858 | Swaziland | 2.86 | 1.43 |
| Zimbabwe | 3756.279 | 1907.53 | Libya | 0 | 0 |
| Total | 225396.36 | 117186.852 | Total | 225396.36 | 117186.852 |

*Source*: Author's computations

The results in Table 7 above indicate that the welfare gains are not evenly distributed and more specifically, skewed towards those larger economies such as South Africa which already have comparative advantages in production and consumption. These results are concerning and policies must be placed to minimise the widening of the gap between rich

and poor economies, or simply polarisation of welfare gains which is the overall objective of the African Economic Community (AEC).

## 5 Conclusion and policy recommendations

The study tested Jacob Viner's theory of trade creation and diversion effects across the 26 member countries of the TFTA. A WITS-SMART simulation model was applied across four product classifications namely raw materials, intermediate, consumer and capital goods and three economic sectors namely agriculture industrial and petroleum. The study was able to show, in USD figures, the potential amount of trade to be created or diverted. In addition, the results also showed net trade, revenue and overall welfare effects.

The study recommends that economies should develop policies which stimulate trade creation not only through tariff elimination as with the case of the TFTA and AfCFTA but also through industrialisation programs such as the one already adopted by South Africa (the Fourth Industrial Revolution). Industrialisation programs are mutually beneficial in fostering intra-African trade because member countries will shift their current models of importing majority of products in this category from European and Asian economies to trading amongst themselves. This will in turn lead to sustained economic growth due to dynamic effects.

The study also recommends slow liberalisation of regional markets compared to the global economy to allow for proper structural adjustments across the economic sectors. Trade liberalisation implies structural changes which calls for several policy changes domestically. At present, Africa is pursuing a relatively aggressive integration process as signalled by the signing of the AfCFTA in 2018 before the TFTA of 2015 was even implemented. The second phase of trade instruments of the TFTA were still being negotiated. This unstructured speeding up of the process will likely lead to confusion and countries less likely to participate during the implementation phase. Thus, the paper recommends that markets not be opened up indiscriminately.

## References

ACBF (2017) *Africa Capacity Report 2017 Building Capacity in Science, Technology and Innovation for Africa's transformation*, Harare.

AEO (2016) 'Sustainable cities and structural transformation', *Trade Policies and Regional Integration in Africa*, OECD Development Centre.

AfDB (2014) *Regional Integration for Inclusive Growth*, Abidjan, Cóte d'Ivoire.

Armington, P. (1969) 'A theory of demand for products distinguished by place of production', *International Monetary Fund Staff Papers*, XVI, pp.159–178.

Azu, N.P. (2019) 'Trade alignment position in ECOWAS with gravity model', *International Journal of Economic Policy in Emerging Economies*, Vol. 12, No. 2, pp.103–112, http.//dx.doi.org/10.1504/IJEPEE.2019.099711.

Brutton, H.J. (1998) 'A reconsideration of import substitution', *Journal of Economic Literature*, Vol. 36, No. 2, pp.903–936.

Cattaneo, N. (2009) 'Production networks, economic integration and the services sector: implications for regional trade agreements in southern Africa', *Journal of Contemporary African Studies*, Vol. 27, No. 4, pp.527–547, https.//doi.org/10.1080/02589000903399496.

Endoh, M. (1999) 'Trade creation and trade diversion in the EEC, the LAFTA and the CMEA', *Applied Economics*, Vol. 31, pp.207–216.

Fakher, A. (2016) 'New patterns of world trade and foreign direct investment growth in Egypt', *International Journal of Trade and Global Markets*, Vol. 9, No. 3, pp.261–337.

Francois, J. and Reinhardt, K. (1997) 'Applied methods for trade policy analysis. A handbook', *Journal of Economic Literature*, Vol. 35, No. 3, pp.1382–1383.

Gurova, I. (2014) 'A theoretical model for trade integration in the CIS region', *Problems of Economic Transition*, Vol. 57, No. 5, pp.37–57, https.//doi.org/10.2753/PET1061–1991570502.

Hoekman, B., Kee, H. and Olarega, M. (2001) *Markups, Entry Regulation and Trade: Does Country Size matter?*, The World Bank, mimeo.

Irwin, D.A. (1996) *Against the Tide: An Intellectual History of Free Trade*, Princeton University Press, New Jersey.

Karambakuwa, R.T., Makochekanwa, A. and Kairiza, T. (2015) 'An empirical application of the gravity model to assess the trade potential of comprehensive economic partnership agreements between the European union and southern African countries', *Journal of Economics*, Vol. 6, No. 3, pp.226–237.

Lee, H.W. (2019) 'Legalisation and dispute settlement benefits: the case of the GATT/WTO', *Review of International Organisations*, Vol. 14, pp.479–509.

Lim, S.Y. and Ho. S.M. (2013) 'Nonlinearity in ASEAN-5 export-led growth: empirical evidence from nonparametric approach', *Economic Modeling*, Vol. 32, pp.136–145.

López-Cariboni, S. and Cao, X. (2019) 'When do authorisation rulers educate: trade competition and human capital investment in non-democracies', *Review of International Organisations*, Vol. 14, pp.367–405.

Makochekanwa, A. (2012) *Impacts of Regional Trade Agreements on Trade in Agrifood Products: Evidence From Eastern and Southern Africa*, African Economic Society, pp.1–28.

Mill, J.S. (1920) *Principles of Political Economy: With Some of Their Applications to Social Philosophy*, Collier, P.F., New York

Mkenda, B. and Hangi, M. (2009) *Revenue implications for EPA on Tanzania*, Deutsche Gesellschaft Für Technische Zusammenarbeit (GTZ), p.1.

Mold, A. and Mukwaya, R. (2017) 'The effects of the tripartite free trade area: towards a new economic geography in southern, eastern and northern Africa?', *Journal of African Trade*, Retrieved from http.//dx.doi.org/10.1016/j.joat.2017.05.003.

Musila, J. (2005) 'The intensity of trade creation and trade diversion in COMESA, ECCAS and ECOWAS: a comparative analysis', *Journal of African Economies*, Vol. 14, No. 1, pp.117–141.

Napoleoni, C. (1975) *Smith, Ricardo, Marx: Capitalism*, Retrieved from https.//www.scribd.com/document/319160797/NAPOLEONI-Claudio-1975-Smith-Ricardo-Marx-pdf

Obasaju, B.O., Olayiwola, W.K., Okodua, H. and Adekunle, B.S. (2019) 'Regional economic integration of ECOWAS sub-region into global value chains', *International Journal of Economic Policy in Emerging Economies*, Vol. 12, No. 3, pp.243–263, https.//dx.doi.org/10.1504/IJEPEE.2019.102774.

Phiri, A. (2011) *Customs Audit Report on the Implementation of SADC Regional Instruments and International Conventions*, Gaborone, Botswana.

Ryu, S-L. and Won, J. (2018) 'The relationship between competitive advantage and the value relevance of accounting information', *International Journal of Trade and Global Markets*, Vol. 11, Nos. 1–2, pp.118–126.

Santosa, D.B. (2018) 'Does export promotion policy benefit for ASEAN economic development?', *International Journal of Trade and Global Markets*, Vol. 11, Nos. 1–2, pp.3–11.

Smith, A (1776) 'An inquiry into the nature and the causes of the wealth of nations', *The Glasgow Ed. of the Works and Correspondence of Adam Smith*, Vol. 2, pp.1–743, https.//doi.org/10.1057/9780230291652.

UNCTAD (2010) *Trade Analysis and Information Systes (TRAINS)*, *United Nations Conference on Trade and Development*, UNCTAD, Geneva,CD-ROM. Version 8.0.

Viner, J. (1950) *The Customs Union Issue,* Carnegie Endowment for International Peace.

Wamboye, E. and Sergi, B.S. (2019) 'Exploring the nature, motives, and implications of foreign capital in Africa', *World Development Perspectives*, p.14.

Wamboye, E. and Tochkov, K. (2016) 'External debt relief initiatives and economic growth in least developed countries', *Journal of Development Areas.*, Vol. 50, No. 2, pp.213–229.

Wamboye, E., Tochkov, K., Sergi. and B.S. (2015) 'Technology adoption and growth in sub-Saharan African countries', *Comparative Economic Studies*, Vol. 57, No. 1, pp.136–167.

World Bank (2013) *Global Financial Development Report: Rethinking the Role of the State in Finance*, Washington, DC.

World Integrated Trade Solution (2017) Reference Data, Retrieved from https.//wits.worldbank.org/referencedata.html.

## Notes

[1]Common Market for East and Southern Africa, East African Community and Southern African Development Community.

[2]https://wits.worldbank.org/simulationtool.html

[3]https://wits.worldbank.org/referencedata.html