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Assessment of the Economic Effects of Regional Integration: Multisectoral Approach for Tanzania

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Abstract

The study investigated the economic effects of Tanzania's participation in free trade arrangements with the member states of the East African Community (EAC) and Southern African Development Community (SADC). While similar studies relied on a Gravity model and old data, this paper used the latest revised trade statistics and conducted a simulation analysis using World Bank's WITS-SMART model. Findings from the Gravity model, using the Generalized Method of Moments (GMM) techniques confirm several other studies that Tanzania's participation in EAC and SADC contributes to trade creation while RoW had trade diversion.

Decomposed analysis by the WITS-SMART model found a persistent increase in trade creation over the period 2015-2020, driven by imports of manufactured intermediate goods, transport, and logistic facilities. The upward trend in trade creation reflects Tanzania's increasing contribution to intra-regional trade with EAC/SADC. Trade diversion was modest, averaged at 0.5 percent of Tanzania's import bill over the period 2015-2020. The relatively low level of trade diversion despite tariff incentives was associated by the surveyed firms to non-tariff barriers and supply shortfalls in the region. The Welfare effect was positive and equivalent to 0.04 percent of Tanzania's real GDP for 2020. The Revenue effect was a loss averaging at 0.2 percent of the value of annual imports over the period 2015-2020.

Based on these findings, the study recommends the need for the Government and private sector to scale up industrialization, agriculture, transportation services and logistics. Further, the Government is advised to fast-track business environment reform agenda to attract more FDIs and integrate the economy into regional and global value chains. Revenue loss cannot be avoided but could be minimized by restraining the importation of goods that the country has a competitive and comparative advantage. Persistence of NTBs calls for Partner States' resolve to existing NTBs and improve connectivity for more intra-trade and fostering firms' participation in the integration agenda.

1.0 Introduction

The pace of economic integration in Africa accelerated since 1990s motivated by among other factors, the need to increase trade and investment flows as well as bargaining power (Baldwin & Venables, 2004; Biswaro, 2011). Tanzania is among founding members of the East African Community (EAC) since 2000, Southern African Development Community (SADC) since 1992 and among the champions in the establishment of the African Union Continental Free Trade Agreement (AfCFTA) as well as the Tripartite Free Trade Agreement (TFTA) involving COMESA, SADC and EAC.

The frequently asked questions are whether Tanzania is benefitting from integration arrangements; and whether Tanzania is making an impact in the integration process. Several empirical studies have attempted to answer these questions, but they rather focussed on the overall trade effects. Sector and commodity-level trade effects in multiple trade blocs have not been investigated rigorously in the Tanzanian context. This study used the latest sectoral and commodity level data to examine economic effects of regional integration focusing on Tanzania participation in free trade arrangement with the member states of EAC and SADC. Specifically, the study examined the magnitude of trade effect using the Gravity model on revised and disaggregated trade statistics and decomposed the overall trade effect in terms of trade creation, diversion, tariff revenue effect and ultimately assessing the implied total welfare effect using World Integrated Trade Solution - Single Market Partial Equilibrium Simulation Tool (WITS-SMART), which has the advantage of simulating the response of imports to changes in the tariff rates and permits analysis at a disaggregated level (sector, commodity etc.), which is the basis for tariff negotiations as it resolves a number of aggregation biases.

The study is motivated by the fact that intra-EAC/SADC trade is on the rise. For example, Tanzania's intra - EAC/SADC trade more than tripled from USD 0.9 billion in 2004 to around USD 3.0 billion in 2020 (NBS & TRA 2021). Hence, there is a need to update decision-makers on the extent Tanzania is gaining or losing through the integration windfall. The study is also a precursor to potential benefits and losses that Tanzania may accrue by participating in the Africa Continental Free Trade Agreement (AfCFTA). Further, a need to furnish the Government of Tanzania, particularly the Tanzania Revenue Authority (TRA) with empirical data for establishing tariff revenue loss under regional integration arrangement, and the extent to which gain from trade effect surpasses revenue loss from the integration. For example, Uganda Revenue Authority (URA) experienced a significant drop in revenue collections from the EAC member states associated with the removal of tariffs (URA report 2019).

This paper attempted to address several gaps from previous similar studies. First, there are very limited sectoral or product or firm level-specific studies on trade effects were conducted in the region, Tanzania in particular. The few studies with broader coverage such as that of Busse et al, (2003) need to be updated with studies that use the latest data. The second gap is that,

most previous studies focused on one trade bloc at a time, this study investigated the trade impacts of Tanzania in multiple regional integration trade blocs (i.e., EAC and SADC).

The rest of the study is organized as follows: Section Two provides an overview of regional integration, drawing on Tanzania experiences. Section Three is a literature review, presenting a theoretical and empirical review. Section Four is the methodology and Section Five discusses the findings. Section Six is the conclusion and recommendations.

2.0 Concept of Regional Integration and Tanzania Experiences

2.1 Conceptual Issues

Regional integration is a process and a state of affairs involving measures designed to eliminate trade restrictions between national economies (Balassa, 1961 and Viner, 1950). Usually, integration involves one or more written agreements that describe the areas of cooperation in detail, as well as some coordinating bodies representing the countries involved. Regional integration takes several forms namely a Free-Trade Agreement (FTA), Customs Union (CU), Common Market (CM) and an Economic Union (EU) (Balassa, 1961). FTA leads to the abolition of tariffs and quantitative restrictions between the member countries. CU is a combination of FTA and common external tariff (CET) whereby member states agree to treat trade with non-member countries similarly. The CM is CU plus the removal of restrictions on factor mobility like labour and capital. EU is a CU combined with a common monetary system and policies. Economic Integration presupposes the unification of monetary and fiscal policies (Hailu, 2014; Balassa, 1961). EAC presents a more advanced case of a common market, while SADC countries are on free trade agreements. In addition, the two blocs have adopted a free movement of a person's protocol with varying degrees of implementation.

2.2 Tanzania Trade with EAC and SADC

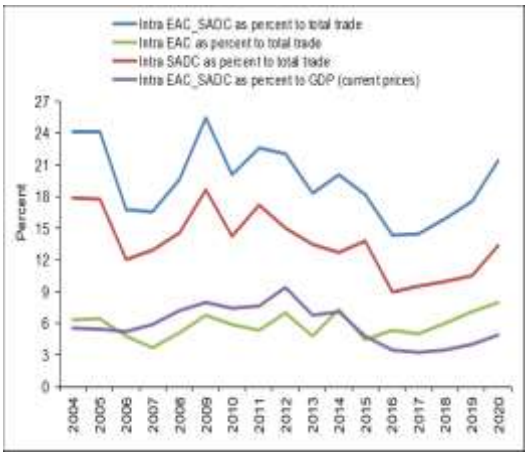
The signing of the EAC Customs Union Protocol in March 2004, Common Market Protocol in 2010 and the full-grown FTA in the SADC region added impetus to intra-regional trade in which Tanzania is among the major players in regional trade. The overall value of Tanzania's intra-regional trade (exports and imports) with EAC and SADC more than tripled from USD 0.9 billion in 2004 to around USD 3.0 billion in 2020 (NBS & TRA 2021).

In terms of share to total trade (as shown in **Chart 2.1**), the pattern of Tanzania's intra-EAC/SADC trade is mixed. The trade flow has been quite volatile over the period 2004 – 2015, corresponding to external trade structure which was largely influenced by dynamics from the rest of the world, quite dependent on weather conditions and was mainly in raw form and thus vulnerable to price fluctuations. Tanzania's intra-EAC/SADC trade recorded a sharp decline

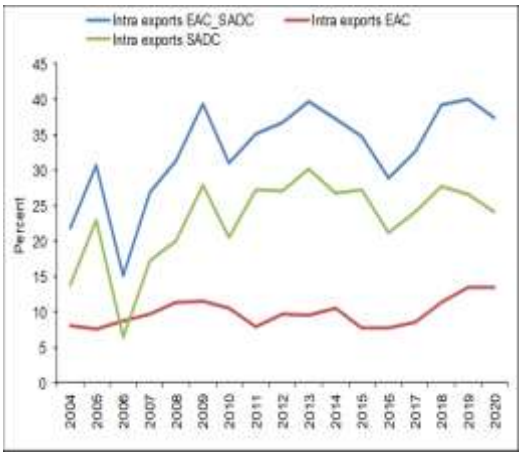
between 2005 – 2006 and improved between 2007 – 2008 before declining sharply in 2009, owing to the second-round effects of the global financial crisis on commodity exports. The dwindling trend persisted over the period 2011 – 2016, partly due to a fall in the world market price for gold which impacted South Africa, a key regional trade partner in gold. Tanzania's intra-EAC/SADC trade pattern stabilized and peaked over the period 2017 – 2020, from 16 percent (around USD 1.7 billion) in 2017 to 20 percent (around USD 3 billion) in 2020, owing to favourable gold prices, improved transport and communication logistics, rise in manufacturing activities that contributed to value addition and increased exports of manufactured products such as plastic items, sugar, edible oil, cement, wood products, textiles and steel products.

Chart 2. 1: Tanzania Trade with EAC and SADC Countries

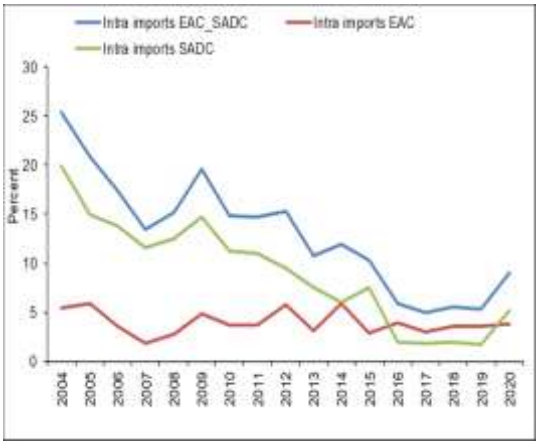
Share of Tanzania Intra-EAC/SADC Trade to Total Trade



Share of Tanzania Intra-EAC/SADC Export to Total Export



Share of Tanzania Intra-EAC/SADC Imports to Total Imports



Source: (Tanzania Revenue Authority and The National Bureau of Statistics)

3.0 Literature Review

3.1 Theoretical Review

The concept of trade creation and diversion dates back 1950's in Jacob Viner's classic book "The Customs Union Issue" (Viner, 1950). It refers to the generation and redirection of trade flows due to preferential trade arrangements (i.e., FTA or CU). The FTA or CU may lead to more trade among member states as expensive imports from non-member states are replaced with cheaper imports from the partner country with comparative advantages. Further, savings realised from cheap imports increase purchasing power of domestic consumers/producers and thus the ability to import more from the FTA or CU (Shinyekwa I. M., 2015, Hailu, 2014; Balassa, 1961).

On these theoretical underpinnings, regional integration may create new trade (*trade creation*) attributable to production efficiency and savings from tariff reduction and removal of non-tariff barriers. Regional integration may also have *trade diversion* effect, as the applied preferential trade arrangements including tariff cuts and common external tariff (CET) may replace imports from non-member countries with cheaper imports from a member country.

Cheaper imports improve consumption efficiency which may then translate to *welfare gain*. It is also pointed that domestic producers competing with the lower-cost imports from partner country may lose, but their loss is less than the gains to the consumers (Gasiorek et al., 2019)[2]. Literature also provides two underlying principles if a member state is to optimize welfare gain. First, member states should specialize in production of commodities where a country has comparative advantage (Ricardo, 1821)[3]. Second, Member states should produce and export a commodity whose raw materials and factors of production can cheaply be sourced locally and otherwise, import from a member states (Heckscher (1919) and Ohlin (1933)). Unless these principles are adhered to, trade diversion may result to welfare loss especially when the initially cheaper imports from competitive non-member countries are replaced by more expensive imports from a member states. This distortion worsens if the replaced imports are intermediate goods as the efficiency gained in production will be compensated with efficiency loss resulting from importing from a higher cost member state. Nonetheless, this is implied, especially when the CET are very high (especially on the so-called sensitive goods).

On the negative side, a country participating in a regional integration arrangement may experience *tariff* revenue *loss* as goods from member states are lowly taxed and some fetch

[2] Nevertheless, this is not obvious, but rather would depend on the relative elasticities. The higher the demand elasticity, the lower the difference between host domestic cost and partner countries cost, the higher would be the welfare gain. The converse is also true.

[3] The theory of comparative advantage holds that even if one nation can produce all goods more cheaply than can another nation, both nations can still trade under conditions where each benefit (Recardo, 1821). This theory emphasizes on relative efficiency.

zero tariff rates. Trade diversion may also contribute to a loss in tariff revenue as taxable imports from RoW are replaced by duty-free imports from the trade partners (Krist, 2013).

Other associated effects of regional integration that are outside the scope of this study include, improved efficiency from increased competition and access to larger markets which may have bearing on scale of production and foreign direct investment (FDI) flow in the trade bloc.

3.2 Empirical Review

Gravity model has widely been used to estimate in aggregate level existence of trade creation and trade diversion. As summarized in **Table 3.1,** Yang *et al*. (2013) applied Gravity model to examine the impact of the ASEAN-China FTA (ACFTA) on exports, for a sample of 31 countries from 1995 to 2010. The study results revealed that ACFTA leads to substantial trade creation, especially in the case of manufactured goods and chemical products. Shinyekwa *et al.* (2013) investigated whether the EAC has diverted or created trade using an augmented gravity model on a panel data set of 70 countries that trade mainly with the EAC partner-states for the period 2001-2011. The findings indicated that EAC has been more trade-creating than trade-diverting, mainly due to adoption of a common external tariff (CET) structure. Shujiro and Misa (2010), used the gravity model to examine the impacts of FTA for 67 countries across 20 commodities during 1980-2006. The study revealed the existence of trade creation from FTA with the European Union (EU) particularly on agricultural commodities.

In addressing the inability of the Gravity Model to decompose trade effect, the World Bank WITS-SMART partial equilibrium model has been widely used in estimating the economic effects of regional integration. WITS-SMART has proven to be robust in disaggregating the trade effects into trade creation, trade diversion, revenue effect, welfare effect and price effect. For example, Nattabi et al., (2020) examined the potential impact of the AfCFTA on the EAC trade with the rest of Africa. They found that EAC states participating in AfCFTA are likely to incur tariff revenue losses, although this varies in absolute amounts and proportions. Uganda and Burundi will experience positive welfare effects while Kenya, Tanzania and Rwanda will experience negative welfare effects. Mugano *et al.* (2013) assessed the impact of the SADC FTA on Zimbabwe using WITS-SMART Model. The results showed trade creation of USD 39 million, consumer welfare effect of USD 7 million and revenue loss of USD 42 million. Abdelmalki *et al*. (2007) used the WITS-SMART model to analyse the FTA between the USA and Morocco. The results show that preferential tariff led to a rise in import from the USA which increased consumer welfare through the reduction of price. Othieno *et al.* (2011) assessed the welfare effects of the EAC customs union using the WITS-SMART model. They found that the governments experience revenue losses due to their participation in regional integration. *Detailed summary on the use of Gravity model and WITS-SMART model is provided in* **Table 3.1.**

Table 3. 1: Summary of the Literature Review

AUTHOR	OBJECTIVE	MODEL	FINDINGS	GAPS
Nattabi *et al*., (2020)	To examine the potential impact of the AfCFTA on the East Africa Community (EAC) trade with the rest of Africa.	WITS-SMART	EAC states are likely to incur tariff revenue losses, although this varies in absolute amounts and proportions. Uganda and Burundi will experience positive welfare effects while Kenya, Tanzania and Rwanda experience negative welfare effects.	• The study focused on EAC only and used unrevised data from the Trade Map database of the ITC instead of those from TRA and NBS that are more reliable as were revised for a period of 2015-2020. • Failed to elaborate factors that may lead to welfare losses in some EAC countries participating in AfCFTA including Tanzania.
Abrego et al., (2019)	To estimate the welfare effects of the AfCFTA.	Computable general equilibrium model (CGE)	After undertaking simulations involving the full elimination of import tariffs and a tariff-equivalent reduction in NTBs by 35%. The results show that welfare improves by 0.05 % with tariff elimination and by 1.7 % with a reduction in NTBs for all AfCFTA's participating countries. Furthermore, welfare increases by 2.1 % for all the countries for simulations involving both tariff elimination and reduction.	Unable to disaggregate the tariff effects by sectors and commodity.
Saygili et al. (2018)	Estimating the effect of full elimination of tariffs among African countries.	Computable general equilibrium model (CGE)	Full elimination of tariffs among African countries increases GDP by close to 1 percent and creates an overall welfare	Unable to disaggregate the tariff effects by sectors and commodity.

AUTHOR	OBJECTIVE	MODEL	FINDINGS	GAPS
			gain of about USD16.1 billion in the long run.	
Shinyekwa & Othieno (2013)	Investigate whether the EAC Regional Trade Agreement has diverted or created trade.	Gravity Model	EAC has been a more trade creating than trade diverting, mainly due to removal of internal tariffs and adoption of a common external tariff (CET) structure.	Unable to quantify the trade effects in terms of values and disaggregate the effects by sectors and commodity.
Shujiro & Misa (2010)	Examine the impacts of regional trade agreements on commodity trade for 67 countries for 20 commodities.	Gravity Model	Existence of trade creation from regional trade agreements with the European Union (EU) particularly on agricultural commodities.	Didn't establish the trade effects among RECs in the region.
Mugano et al. (2013)	Assess the impact of SADC Customs Union on Zimbabwe	WITS-SMART	Trade creation of USD 39 million, consumer welfare of USD 7 million and revenue loss of USD 42 million.	Used old data and based on SADC only.
Othieno et al. (2011)	Assessed the welfare effects of EAC customs union	WITS-SMART	Governments face losses in tariff revenue which should not be overlooked, because, the progression of tariff revenue in general, was also unstable.	Used old data and based on one REC.
Abdelmalki et al. (2007)	Analyse the free trade agreement between the United States and Morocco	WITS-SMART	A drop in tariff on the side of Morocco due to the FTA; Also, the FTA led to a rise in import from the USA which increased consumer welfare through the reduction of price.	Used old data and lacks regional experiences.
Busse *et al*., (2003)	To assess the overall impact of the EAC on trade flows.	Partial Equilibrium Model	The results show that considerable trade effects cannot be expected in EAC, except for a very narrow range of products.	Used old data and based on EAC only.

Source: Authors prepared summary

4.0 Methodology

4.1 Econometric Gravity Model

Based on Tinbergen, J. (1962), the basic Gravity equation used in the study is defined as:

$$X_{ijt} = S_{it} M_{jt} \emptyset_{jt} \quad (1)$$

Where Xijt is the monetary value of exports from country i to j at time t, Mjt denotes importer-specific factors that influence the importer's demand at time t (e.g. the importing country's GDP, population, reserves etc.) and Sit comprises exporter-specific factors at time t that influence exports (e.g. the exporter's GDP, Foreign Direct Investment (FDI), population etc.), representing the total amount exporters are willing to supply. represents the ease of exporters in country i to access market j at time t; could include distance, language etc.

The basic gravity model is augmented to include other variables that are relevant to explain the impact of various policy issues on trade flows. In these, dummy variables were applied to capture regional integration initiatives. Therefore, the following augmented equation was developed:

$$exp_{jt} = \propto + \gamma_1 imp_{it} + \gamma_2 gdppartner_{it} + \gamma_3 gdptanzania_{jt} + \gamma_4 res_{it} + \gamma_5 pop_{jt} + \gamma_6 fdi_{jt} + \gamma_7 dist_{ij} + \gamma_8 EAC_{ij} + \gamma_9 SADC_{ij} + \gamma_{10} RoW_{ij} + + \epsilon_{ijt} \quad (2)$$

Where exp stands for exports, imp stands for imports, gdppartner stands for the GDP of the EAC/ SADC trade partner states, gdptanzania stands for the GDP of Tanzania, pop stands for the population, fdi stands for the Foreign Direct Investment (FDI), dist stands for the distance between the capital cities of the trade partner states, res denotes the reserves of the partner states, j stands for Tanzania, i stands for the trade partner states, t represents time, EAC represents a dummy variable (of which 1 if trade partner is the member of EAC and 0 otherwise), SADC represents the dummy variable (of which 1 if the trade partner is the member of SADC and zero otherwise), RoW represents the dummy variable (of which 1 if the trade partner is neither the member of EAC nor SADC and 0 otherwise).

The coefficients for EAC and SADC dummy variables capture the change in exports as a result of participation to the EAC/SADC regional integration initiatives. If the coefficients for these dummy variables are positive and statistically significant then it represents trade creation and if they are negative and statistically significant then it represents trade diversion (Yang & Martinez-Zarzoso, 2013). Further, if the coefficient of RoW dummy variable is positive and statistically significant then it represents trade diversion and if it is negative then it represents trade creation (ACFTA, 2013).

Equation (2) is converted to natural log into equation (3) in-order to compute elasticities, as follows:

$$lnexp_{jt} = \propto + \gamma_1 lnimp_{it} + \gamma_2 lngdppartner_{it} + \gamma_3 lngdptanzania_t + \gamma_4 lnres_{jt} + \gamma_5 lnpop_{jt} + \gamma_6 lnfdi_{jt} + \gamma_7 lndist_{ij} + \gamma_8 EAC_{ij} + \gamma_9 SADC_{ij} + \gamma_{10} RoW_{ijt} + \epsilon_{ijt} \quad (3)$$

Generalized Method of Moments (GMM) and Fixed Effect (FE) regression models were employed to estimate factors influencing exports between Tanzania and EAC, SADC as well as rest of the world. FE removes the effect of those time-invariant characteristics so we can assess the net effect of the predictors on the outcome variable. For example, the political system of a particular country in the sample could affect its trade performance or real GDP. GMM is a dynamic model and convenient for estimating unobserved effects in the model. Woodlridge (2001) stipulates that either heteroscedasticity or serial correlation is present, a GMM procedure can be more efficient than the FE estimator, although the likely gains in standard applications are largely unknown.

The study used panel data for 16 years from 2004 – 2019, across 25 countries (4 EAC, 13 SADC and 8 non-EAC & SADC trade partners). The data for exports and imports of Tanzania with trade partners were obtained from the Tanzania Revenue Authority (TRA) revised database, whereas the data for imports of the trade partners was obtained from the United Nations (UN) Comtrade Database. The data for FDI stocks and GDP were obtained from the United Nations Conference on Trade and Development (UNCTAD) statistics, whereas the data on reserves were obtained from the World Bank Statistics and distance data sourced from google maps.

The use of panel data was intended to control omitted variable bias, address endogeneity and multicollinearity problems, provide better analysis of dynamic (i.e., time series) adjustments at individual section unit level without aggregation bias and allow for coverage of more observations from cross-section units and time dimensions, hence leading to efficient estimation and avoiding biases (Wooldridge, 2010).

4.2 WITS-SMART Model

To complement the GMM and FE estimations, simulation analysis was undertaken based on the partial equilibrium model known as World Integrated Trade Solution (WITS) (2011), called the Single Market Partial Equilibrium Simulation Tool (SMART) model, developed by the World Bank. Unlike other models such as CGE and Gravity, the WITS-SMART model has the advantage of simulating the response of imports to changes in the tariff rates and permits analysis at a disaggregated level (sector, commodity etc.), which is the basis for tariff negotiations as it resolves a number of aggregation biases (Nattabi et al., 2020). Nevertheless, WITS-SMART lacks attribute of undertaking inter-sectoral input-output linkages as CGE does. Despite this shortfall WITS-SMART remains a relatively robust analytical tool widely used in

quantifying the effects of tariff policy reforms. Details about the model are summarized in Appendix IV and are freely accessible on the World Bank website.

When simulating the effects of tariff reductions on trade, the WITS-SMART model assumes three elasticities; export supply, import demand and import substitution. Export supply elasticity measures the responsiveness of the quantity of exports per unit price change. The Model assumes to be infinite (i.e., equal to 99 or more), meaning market adjusts only through quantity since suppliers are price takers. Nevertheless, since import demand is a function of production capacity and ability to export, EAC and SADC markets could hardly cope instantaneously with importers' demand (in terms of quantity, quality, and varieties) after tariff reduction, hence price adjustment is inevitable. Thus, in this study export supply elasticity of 10 was used as computed by the Trade Law Centre (tralac) when undertaking a study on South Africa-Zambia FTA. Implying that for every 1 percent increase in the export price of a product, the quantity of exports of the product by a particular country will increase by 10 percent (Punt & Sundry, 2016) . Import demand elasticity measures import demand response to change in cost of imports (i.e. tariff). It is assumed to be elastic and positively correlated with the trade creation. In this study, import demand elasticity of -1.2 (computed by IMF) was used (Tokarick, 2010), implying that 1 percent decrease in tariff will increase imports by 1.2 percent. Import substitution elasticity is another important assumption in the model which largely influence trade diversion. It records the rate of substitution between two commodities originating from different country considering Armington assumption that similar goods from different countries are imperfectly substitutable. When import substitution elasticity is higher, the respective economy will experience more trade diversion since the products being produced in that country or sector can be easily substituted. In the WITS-SMART model import substitution elasticity is given at 1.5 percent for each commodity (WITS, 2011). That is, 1 percent decrease in the price of imports (i.e., the import tariff) relative to the import price from the RoW, the quantity of imports from the partner country will increase by 1.5 percent. This is quite close to the real world and thus adopted in this study.

Tariff regimes employed to the WITS-SMART model include the SADC Trade Protocol of 1996 and EAC 2010 agreed tariff rates. The EAC tariff rates were based on the principle of asymmetry whereby, a common external tariff (CET) was set at 0 percent for raw materials, capital goods, agricultural inputs, selected medicines, and medical equipment; 10 percent for intermediate goods and other essential industrial raw materials; and 25 percent for finished products (EAC, 2012).

5.0 Findings

5.1 GMM Results of the Gravity Model

In **Table 5.1**, the GMM-two step estimates show that coefficient of both *EAC_dummy* and *SADC_dummy* variables are positive and statistically significant at 1 percent level, suggesting trade creation and that per unit improvement in EAC border efficiency (i.e. reduction of barriers and costs) was found to increase Tanzania exports by 10.7 percent, whereas in SADC region, increase Tanzanian exports by 7.7 percent. In terms of magnitude, coefficient of EAC was higher than that of SADC in GMM and FE, reflecting that degree of trade creation in EAC exceeds that of SADC. EAC proximity to Tanzania and the scale of integration may explain the observed discrepancy.

The variable for the RoW_dummy was found to be positive and statistically significant at 1 percent, implying presence of trade diversion whereby trade moves away from RoW to EAC and SADC region at the rate of more than 10 percent per unit reduction in tariff or increase in cost of trade with the RoW. The export elasticity with respect to its lagged variable is 0.087, which implies that a 10.0 percent increase in the previous year export of Tanzania will lead to an increase of 8.7 percent of the current Tanzanian export. Further, the export elasticity with respect to the distance is 4.08 meaning that, a 10 percent increase in the distance (i.e., transport costs) between Dar es Salaam and the capital cities of the partner states, reduces Tanzanian exports by 40.8 percent. Export elasticity with respect to the GDP of the partner state is 0.94, meaning that a 10 percent increase in the GDP of the partner state will increase Tanzanian exports by 9.4 percent.

Table 5. 1: Results of the Estimated GMM

lnexp	Coefficient	z-value	p-value
L.lnexp	0.086658	1.68	0.094**
lnimp	0.410540	1.61	0.107
lnpop_partner	0.172608	0.92	0.359
lnGDP_Tanz	0.324490	0.152	0.128
lnGDP_partner	0.943881	2.71	0.007***
lnFDI_partner	-0.222256	-1.54	0.124
lndistance	-4.083690	-7.88	0.000***
lnreserve	-0.024000	-0.17	0.861
EAC_dummy	10.763510	6.23	0.000***
SADC_dummy	7.695560	4.83	0.000***
RoW_dummy	14.890140	3.71	0.000***
Constant	5.796664	1.34	0.180
N = 375			
AR(1) P-Value = 0.000			
AR(2) P-Value = 0.577			
Sargan test of overidentifying restrictions			
Prob > chi2 = 0			

Source: Study Findings
Note: **** = 1% significance level, ** = 5% significance level

5.2 Fixed Effect Results of the Gravity Model

Further to GMM, FE approach was used to estimate the Gravity model. The choice of the FE model was guided by the Hausman (1978) statistical test for selecting between the FE and RE models, whereby the test results in **Table 5.2** supported use of FE, implying that the error terms are not correlated and thus FE is suitable. The Hausman tests if errors are correlated with regressors in the model. The null hypothesis is that there is no correlation and hence the preferred model is FE. Results on Hausman test indicated Chi-square of 3.7 degree of freedom. The smaller p-value (0.05) of the Chi-square statistics test implies that RE is rejected in favour of FE. (Torres-Reyna, 2007).

Table 5. 2: Hausman Test Results

	Statisitical Test
Chi2	3.70
Prob > Chi 2	0.05

Source: Authors' Computations

FE findings in **Table 5.3** corroborates those of GMM. Further, the coefficients for lnimp, lnPOP_partner and lnGDP_tanz were found to be statistically significant at 1 percent level. Export elasticity with respect to imports of partner state is 0.704, which implies that a 10.0 percent increase in import of partner state will lead to increase of 7.0 percent of Tanzanian export to partner states, confirming existence of intra-trade. A 10.0 percent increase in the population of the partner states will lead to 6.37 percent increase in the export of Tanzania. The export elasticity of FDI inflows for partner states is 0.243, meaning that a 10 percent increase in FDI inflows to the partner states will reduce Tanzanian exports by 2.43 percent, reflecting that FDIs to the region increase import substitution activities.

Table 5. 3: Results of the Fixed Effect Model

lnexp	Coefficient	t-value	p-value
lnimp	0.704000	5.76	0.000
lnpop_partner	0.636000	10.08	0.000
lnGDP_Tanz	0.116000	6.09	0.000
lnGDP_partner	0.162000	1.04	0.301
lnFDI_partner	-0.243000	-2.53	0.012
lndistance	-0.105900	-4.76	0.000
lnreserve	-0.232000	-2.81	0.005
EAC_dummy	4.855000	10.54	0.000
SADC_dummy	4.059000	9.09	0.000
RoW_dummy	10.807000	5.10	0.000
Constant	-17.126000	-5.40	0.000
N = 400			
R-sq = 0.6904			
Prob > F = 0.000			
corr (u_i, Xb) = -0.0180			

Source: Study Findings

5.3 Simulation Analysis using WITS-SMART Model

The WITS-SMART model was employed to a commodity level import data – HS 8 digit codes for a period of six years, from 2015 to 2020 in order to quantify Tanzania trade effect in EAC/SADC market and decompose by sector and commodity.

5.3.1. Trade Effect

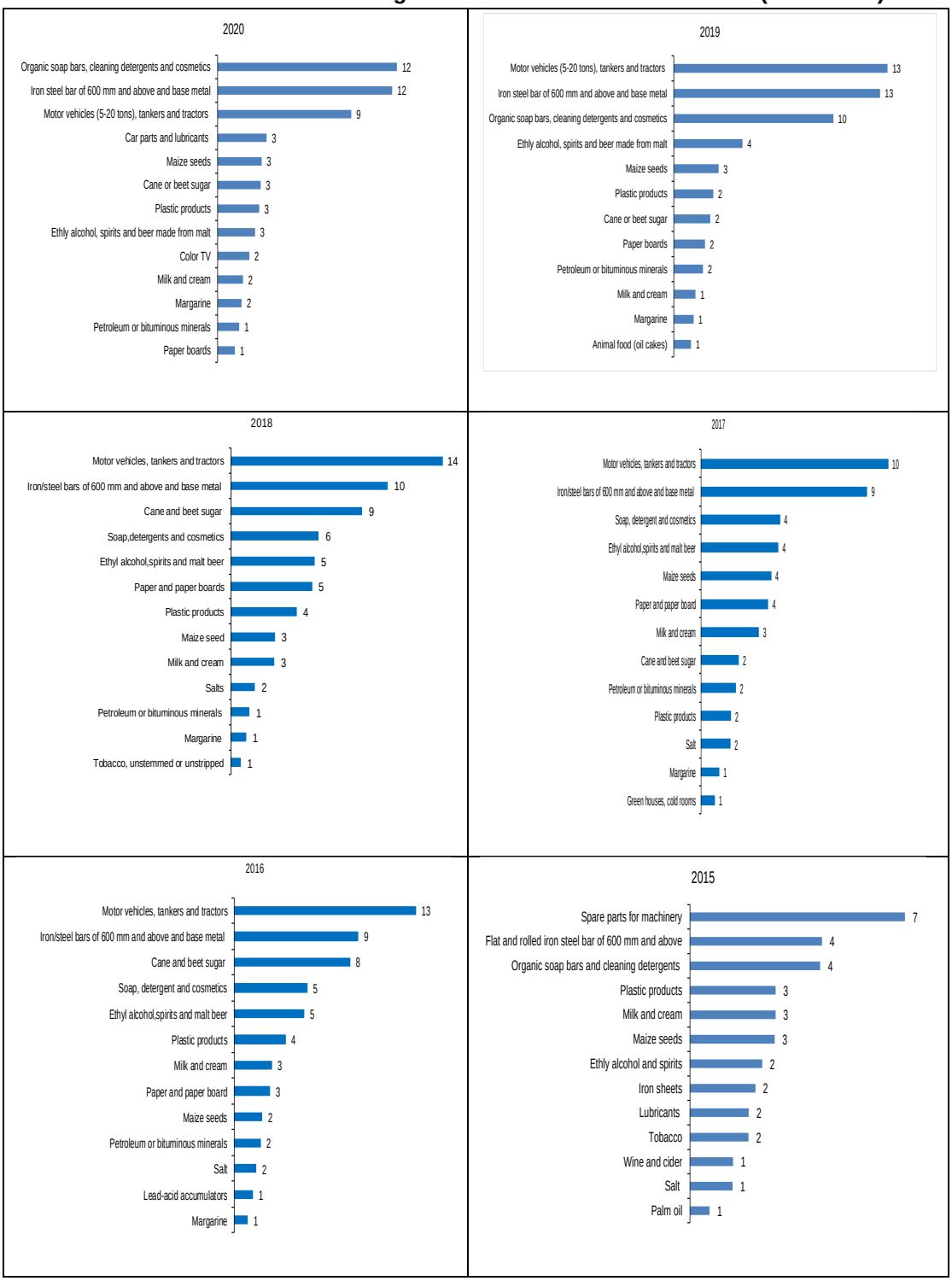
Based on the WITS-SMART simulation analysis, Tanzania trade effect to the EAC/SADC market was estimated at around USD 145 million per annum over the period 2015 to 2020, equivalent to around 2 percent of Tanzania total value of annual import bill. In terms of trend, trade effect increased by 90.5 percent to USD 165 million in 2020 compared to the level recorded in 2015. Much of the increase in trade effect emanated from new imports arising from saving made from tariff reduction (i.e. trade creation) which on average accounted for 61.0 percent. The share of trade diversion from RoW averaged at 30 percent and the price effect was 9.0 percent of the average trade effect per annum.

A significant portion of the trade effect occurred in the SADC region, totaling USD 97 million annually or 67% of the EAC/SADC trade effect. Meanwhile, the EAC's average impact was USD 48 million annually, which is equivalent to 33% of the EAC/SADC trade effect.

5.3.2. Trade Creation

Consistent with the findings from the Gravity model, simulations analysis revealed the existence of trade creation which persistently increased and doubled to around USD 102.0 million or 1.2 percent of merchandise imports in 2020 from around USD 51.0 million or 0.6 percent of merchandise imports in 2015. The upward trend in trade creation reflects Tanzania's increasing contribution to intra-regional trade with EAC/SADC economies. The Manufacturing sector contributed the most to trade creation and the main commodities include iron/steel bars of 600 mm, plastic products, spirits, beer and group items composed of soaps, detergents and cosmetics. Other significant contributors to trade creation were agriculture-related inputs and equipment mainly maize seeds and transport and logistics comprising the import of commodities such as motor vehicles, fuel tankers and tractors. Over 2019-2020, manufacturing, transport and agriculture sectors contributed to over 30.0 percent of trade created by Tanzania in the two regional blocs (**Chart 5.1**).

Chart 5. 1: Commodities Contributing to Trade Creation in EAC/SADC (in Percent)



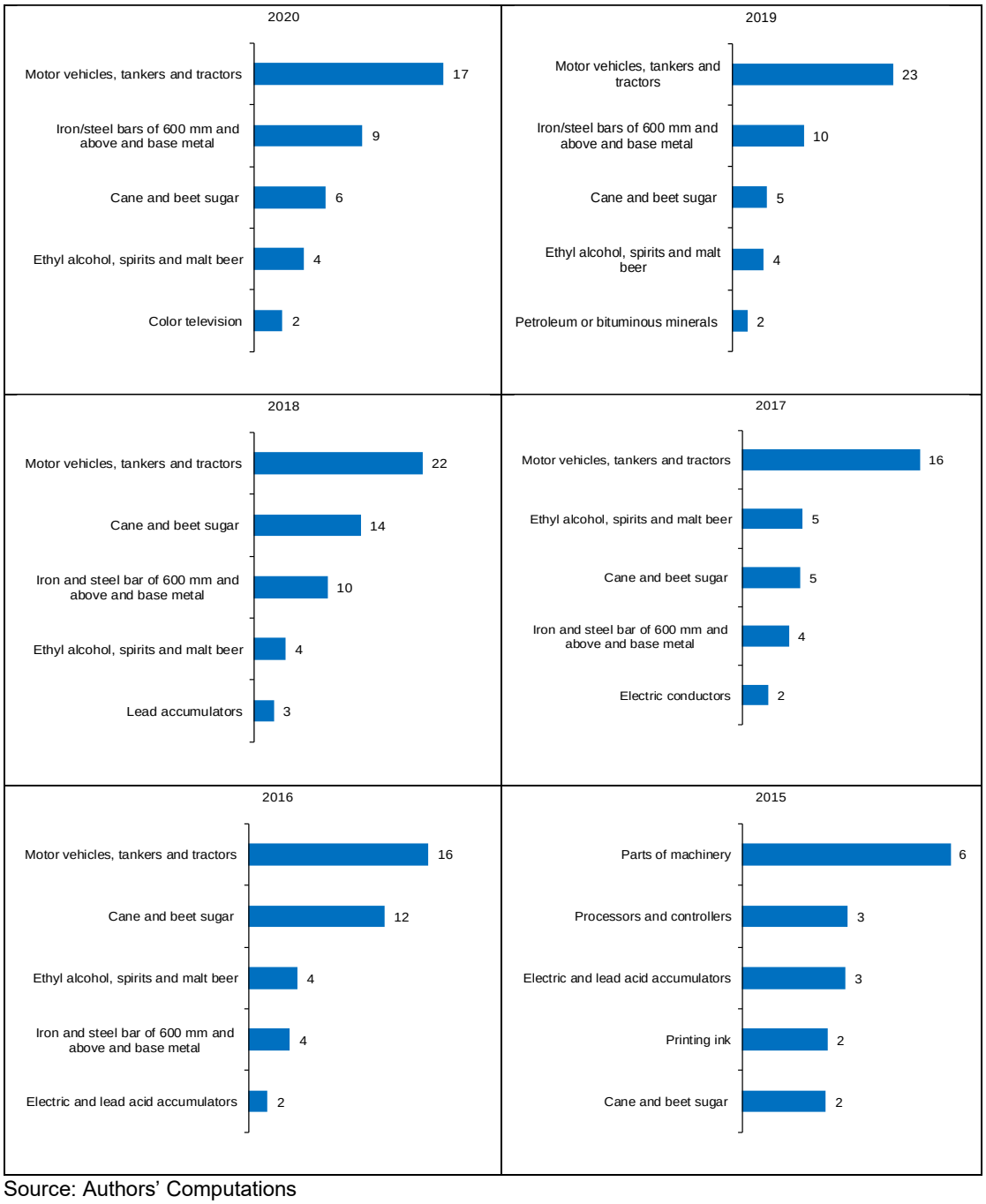
Source: Authors' Computations

5.3.3. Trade Diversion

As pointed in the literature review, trade diversion refers to the value of Tanzania's imports shifted away from the rest of the world to EAC and SADC in response to tariff cuts. Over the period 2015 to 2020, simulation analysis indicated that the value of imports diverted from RoW averaged USD 43 million per annum or 0.5 percent of Tanzania's total merchandize imports and were mainly motor vehicles and steel bars (**Chart 5.2**). The relatively low level of trade

diversion despite tariff incentives in the EAC and SADC trade blocs reflects continued dependence on the RoW which could be due to adverse effects of the non-tariff barriers, supply shortfalls and other related trade constraints observed in the firm-level survey of importers and exporters (discussed in **Sub-Section 5.4**).

Chart 5. 2: Commodities Contributing to Trade Diversion (Percent)

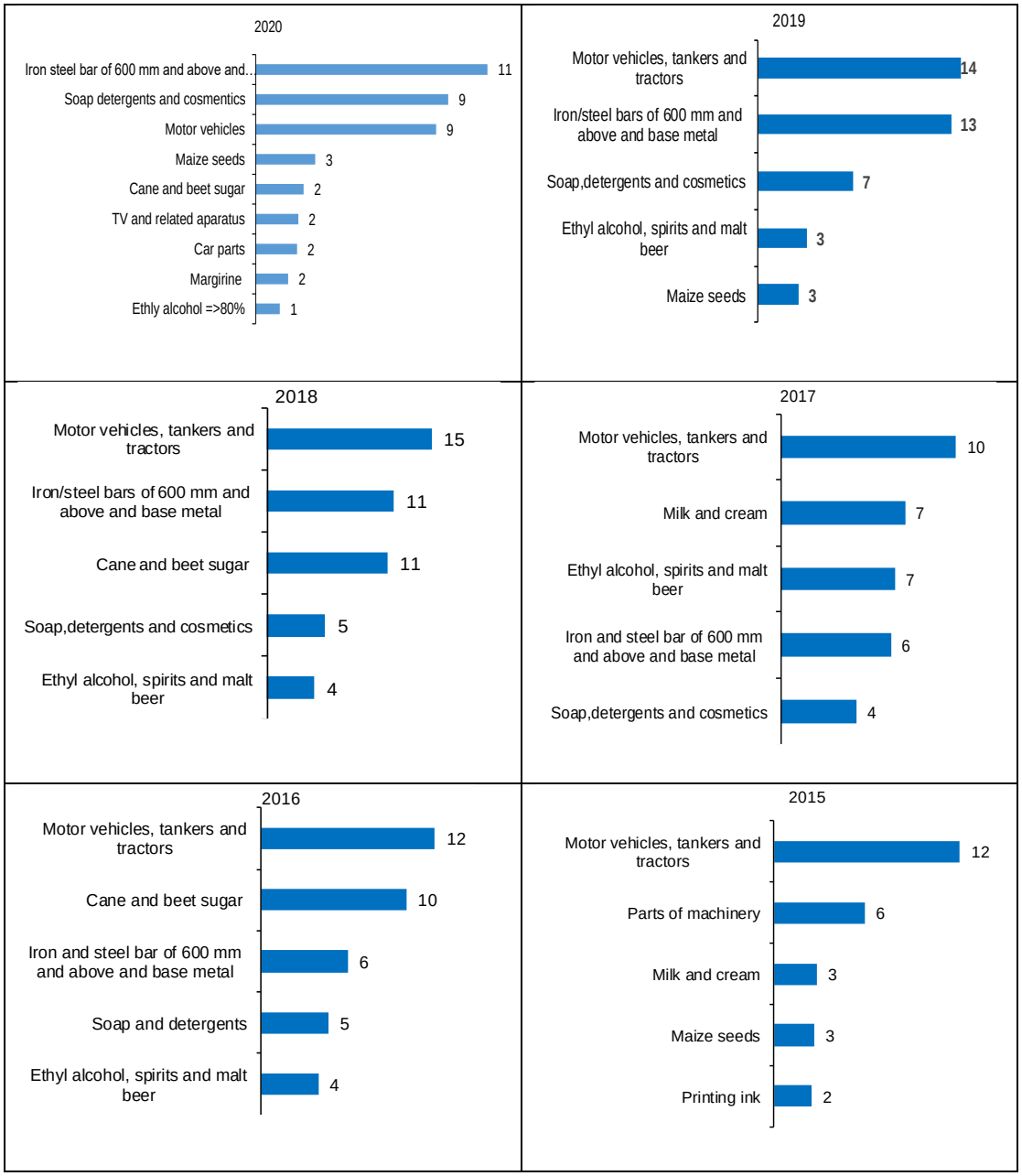


Source: Authors' Computations

5.3.4. Revenue Effect

Revenue effect is the difference between import/customs revenue at the new tariff rate and import/customs revenue at the old tariff rate. Tanzania participation to EAC/SADC regional integration initiatives has led to loss in tariff revenue, estimated at an average of USD 136 million per annum or 1.7 percent of annual import bill. The forgone tariff revenue mainly benefited commodities such as iron/steel bars (of 600 mm and above), item group of soap, detergents and cosmetics, maize seeds, motor vehicles and industrial sugar (**Chart 5.3**).

Chart 5. 3: Selected Commodities that Benefited from Tariff Cuts/Reduction (Percent)



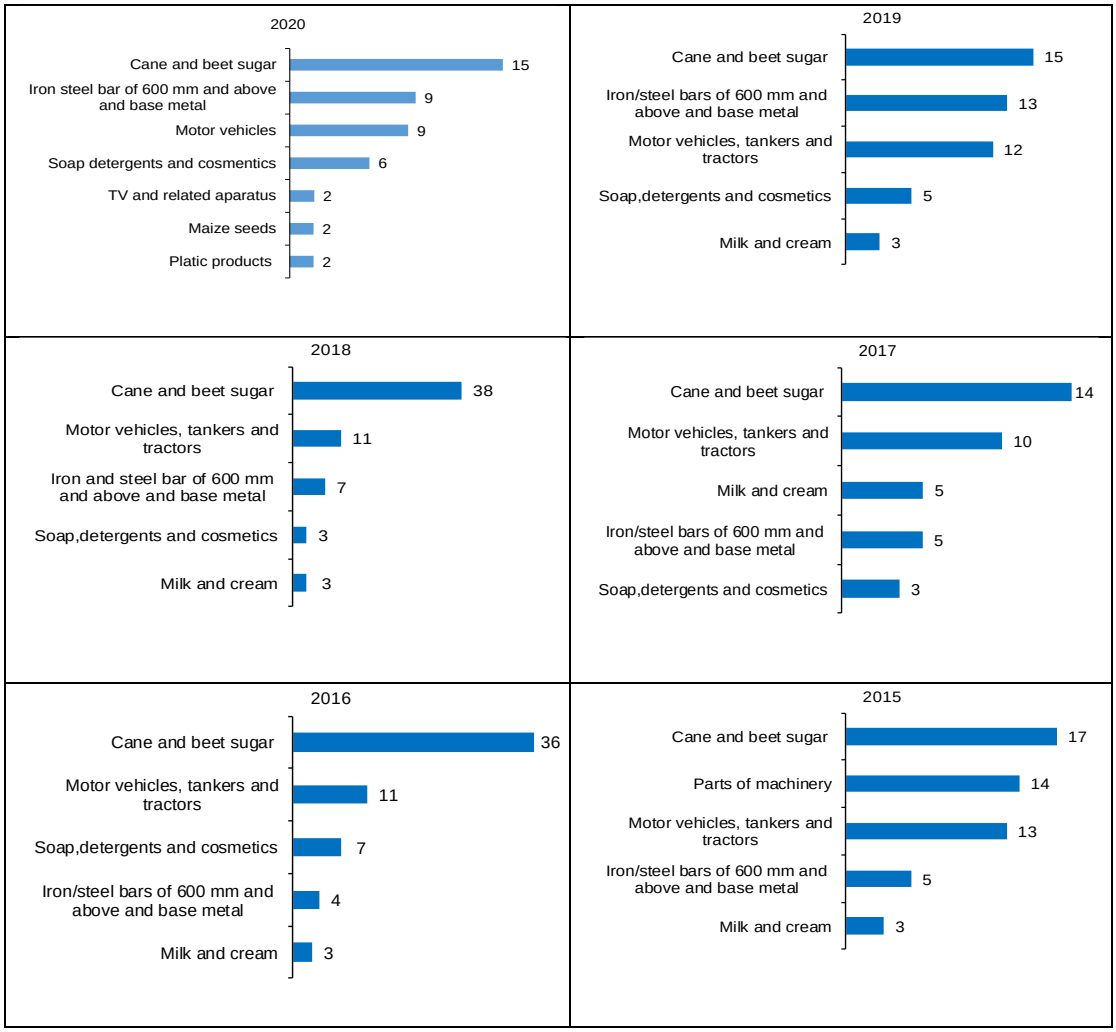
Source: Authors' Computations

Much of the revenue loss was recorded in the SADC region and accounted for 61 percent of the EAC/SADC merchandize imports. In EAC revenue loss averaged 39 percent of EAC/SADC of merchandize import commodities.

5.3.5. Welfare Effect

Welfare effects arise from the benefits consumers and producers[4] in the importing country derive from the lower domestic prices after the removal or reduction of tariffs. Over 2015-2020, domestic consumers and producers recorded a welfare effect equivalent to USD 23 million per annum or 0.04 percent of real GDP for 2020 or 0.3 percent of total imports per annum over 2015-2020. Imported commodities whose welfare effects were relatively much higher include cane and beet sugar, 600 mm iron/steel bars, motor vehicles and item group of soaps, detergents and cosmetics (**Chart 5.4**).

Chart 5. 4: Selected Commodities whose Welfare Effect were much Higher (Percent)



Source: Authors' Computations

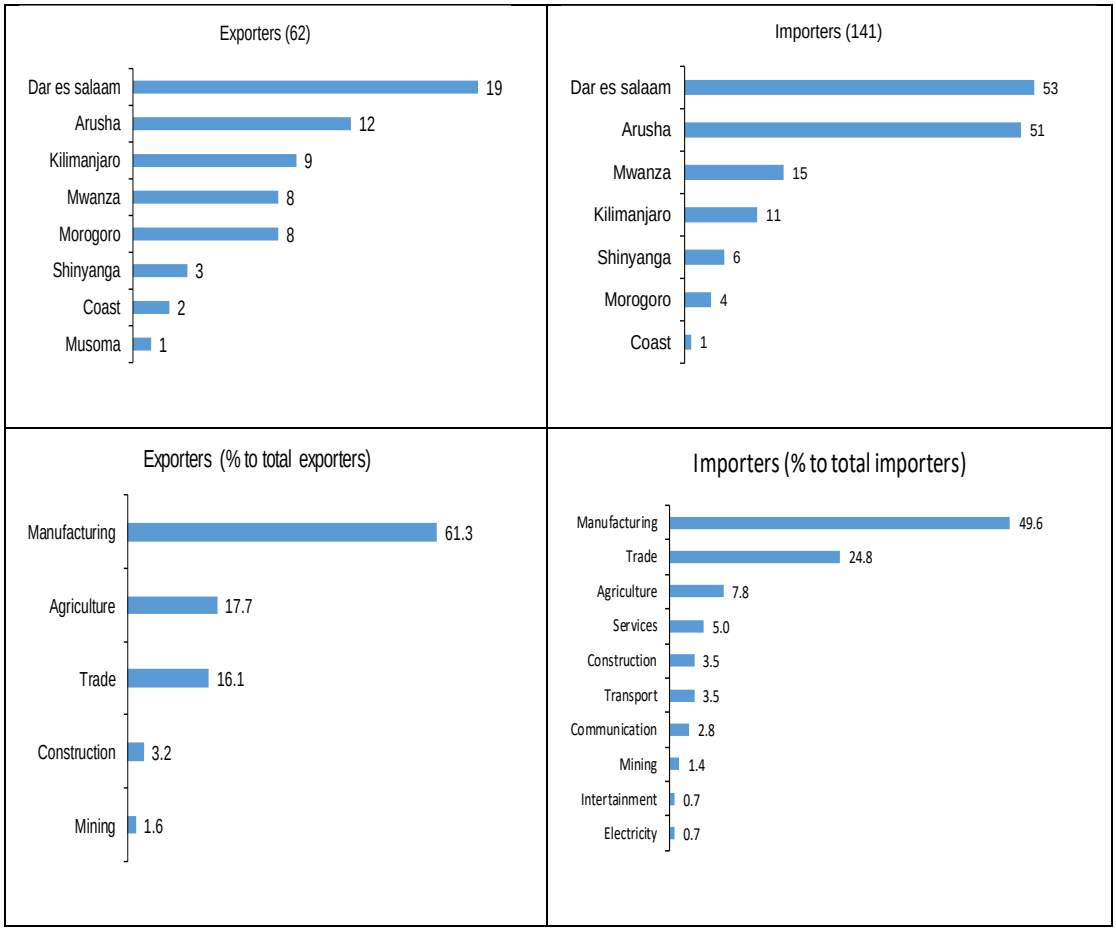
[4] Producers from exporting partners countries also benefit from relative higher regional prices compared to would be (cheaper non-member countries - world market prices) without tariff.

Much of the welfare effect for 2015-2020 was a result of imports from the SADC region, accounted for 70 percent of EAC/SADC welfare effect while in EAC region, averaged at 30 percent. These findings also negate the results from the study by Shinyekwa et al. (2020) who reported Tanzania experienced negative welfare effects.

5.4 Exporters and Importers Survey Findings

The study gathered experiences from 203 importers and exporters from eight regions in Tanzania to understand their level of participations, driving factors and encountered challenges (**Chart 5.5**). Over 61 percent of the respondents indicated to be participating in regional trade and the rest were not. A quarter of participating firms confirmed to be motivated by preferential tariffs, nevertheless they reported to be constrained with inadequate supply, limited varieties of products and denied market access due to myriad of stumbling blocks mainly the non-tariff barriers.

Chart 5. 5: Survey Sample by Region (in numbers) and Sectors (in percent)



Source: Authors' Computations

The following responses were gathered from the interviewed firms that participated in regional trade (i.e., the 61.1 percent of the respondents):

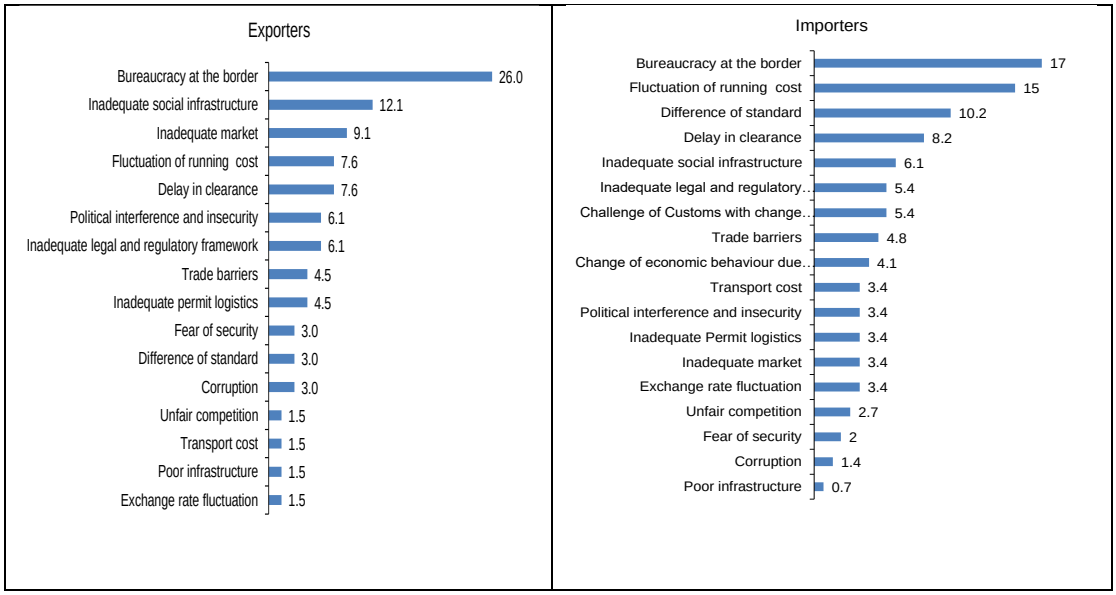
a) *Motives behind their participation.* About a quarter of importers and exporters were motivated by preferential tariffs. Proximity to markets accounted for 10.4 percent of exporters and 15.1 percent of importers, reflecting reduced costs in terms of freights and time for accessing the markets. Profitability was another important driver, accounted for 14.3 percent and 9.9 percent of importers and exporters, respectively.

b) *Ease of market access.* Only 6.5 percent of exporters and 5.2 percent of importers reported to have easy access to EAC and SADC markets. The rest encountered difficulties. When asked if this is due to stiff competition, over 60 percent of exporters refuted and instead, indicated that competition was moderate but complained on NTBs to be the major bottlenecks.

c) *Quality of goods in the EAC/SADC markets.* More than 70.7 percent of exporters and importers expressed satisfaction on the quality of goods supplied in the EAC/SADC markets. Reasons pointed to satisfactory quality include compliance to standards (63.6 percent of exporters and 68.4 percent of importers). Increasing use of modern technology was another important factor, accounted for 23.7 percent of exporters.

d) *Challenges encountered.* Several challenges were pointed to inhibit access to EAC/SADC markets. Bureaucracy at the borders ranked highest by both importers and exporters. Price instability due to fluctuating running costs was another bottleneck to importers. Limited market was also pointed by exporters to hinder regional business. **Chart 5.6** detailed summary of challenges encountered by exporters and importers.

Chart 5. 6: Challenges Inhibiting Access to EAC and SADC market



Source: Authors' Computations

Non participation to EAC/SADC regional integration initiatives was reported by 38.9 percent of the respondents due the following reasons:

a) *Inadequate supply and varieties of goods*. The survey revealed that 40.4 percent out of 141 interviewed importers experienced difficulties to obtain adequate supply of goods particularly raw materials as some are non-existent and some are overpriced. Consequently, continued sourcing goods from the rest of the world particularly China and India.
b) *Limited market for exports.* 35.5 percent of exporters could not be able to find market of their produce in the region, partly due to low prices hence resorted to exporting to the rest of the world.

6.0 Conclusion and Recommendations

This study used the gravity model to investigate the effects of trade and then conducted a simulation analysis using the WITS-SMART partial equilibrium model to estimate the effects of applied tariff relief on trade with partner states in EAC/SADC and the rest of the world. The WITS-SMART model broke down the trade effect in terms of trade creation and diversion, and estimated the implications of regional integration on tariff revenue, ultimately assessing the total welfare effect. To supplement the empirical findings, the study also conducted a firm-level survey of selected exporters and importers, gathering their experiences with regional trade agreements.

Findings from the gravity model for both FE and GMM approaches, indicated that the EAC, SADC and RoW dummy variables had positive signs and statistically significant at one percent level. This implies that Tanzania's participation to regional trade contributes to trade creation and also divert trade from RoW. Simulation analysis quantified the trade effect and estimated the revenue effect as well as implied welfare effect. Trade effect averaged at USD 145 million per annum over the period 2015 to 2020, equivalent to around 2 percent of Tanzania total value of annual import bill and was mainly in form of trade creation. Trade creation doubled to around USD 102.0 million or 1.2 percent of import bill in 2020 from around USD 51.0 million or 0.6 percent of import bill in 2015. The manufacturing sector explained much of the trade creation followed by transport and logistics and agriculture-related imports. Value of imports diverted from RoW over the period 2015-2020 averaged at USD 43 million per annum or 0.5 percent of Tanzania's total imports and were mainly motor vehicles and steel bars. Loss in tariff revenue was estimated at USD136 million per annum or 1.7 percent of value of imports per annum. The forgone tariff revenue mainly benefited commodities such as iron/steel bars (of 600 mm and above), item group of soap, detergents and cosmetics and motor vehicles. Welfare gain was estimated at USD 23 million per annum over the period 2015-2020 or 0.04 percent of real GDP for 2020. Imported commodities whose welfare gain were relatively higher include cane and

beet sugar, 600 mm iron/steel bars, motor vehicles and item group of soaps, detergents and cosmetics.

Although preferential arrangements within EAC/SADC have a significant impact on Tanzania's trade effect, other global uncertainties such as the global financial crisis, Eurozone crisis, Brexit, and the USA-China trade war may also contribute to this trend whereby motivated countries in the region to trade each other. It is worth noting that these aspects are not within the scope of the study and requires further research to fully understand.

On policy implications and recommendations, the study is a pre-cursor to the formulation of policies that could optimize trade gains and minimize revenue loss from regional integration. Findings from this study may also provide bearing on how Tanzania could effectively participate in the AfCFTA. On this backdrop, the following policy actions are recommended:

i. The Government in collaboration with the private sector need to sustain and scale-up industrialization, agriculture, transport and logistics. This is backed by the findings that trade creation was driven by manufactured goods, transport, construction materials and agriculture related imports. It is thus critical to expand and diversify the manufacturing base and raising local value-added content of resource-based produce. To achieve this would require among other interventions, continued investment in human, capital-taking advantage on youth demographic dividend, strengthening institutional frameworks and capabilities for industrial policy design and implementation, and effective delivery of support services as well as Research and Development, technology and innovation capabilities to foster structural transformation of the manufacturing sector and industrial upgrading including transforming Micro, Small and Medium Enterprises into a viable and sustainable industrial entities.

ii. The Government to continue with its reform agenda to improve the business environment, in accordance with the National Blueprint for Regulatory Reforms to Improve Tanzanian Business Environment. Among areas of emphasis include instituting friendly tax regime, infrastructure development, total removal of red tape, fighting corruption, ensuring fair competition, digitalizing the economy, promoting research and developments, financial inclusion and continued economic liberalization especially on agriculture sector. These will attract more FDIs and facilitate the integration of the economy into the regional and global value chains. Consequently, it will strengthen production capability including the promotion of import-substitution industries and broadening the products mix in the identified niche areas such as iron and steel industries, sugar, maize seeds, soap detergents, cosmetics, textiles, edible oils and assembly of motor vehicles and tractors. This is based on the findings that trade diversion was quite minimal as the EAC/SADC market failed to meet the demand

for most of Tanzania's imports and thus the economy remains largely dependent on RoW.

iii. Revenue loss in regional integration cannot be avoided but could be minimized by restraining from importing goods that Tanzania has a competitive and comparative advantage. Such goods include industrial sugar, soap, maize seeds, cosmetics, plastic products and steel products.

iv. As pointed in the exporters and importers survey that NTBs are still among major constraints to intra-regional trade. Partner states are encouraged to enhance mechanism for resolving existing NTBs and refrain from imposing new ones to foster cross border trade by among other, attracting more firms to join and scale up participation in EAC/SADC integration agenda.

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APPENDICES

APPENDIX I: DESCRIPTIVE STATISTICS

Analysis of the variables of interest shows that they are normally distributed with skewness of around 0 and a kurtosis above 1.

Variable	Mean	Standard Deviation	skewness	kurtosis
lnexp	3.081773	2.491615	-0.76083	3.058866
lnimp	19.20367	4.325254	-0.63074	1.815576
lnPop_partner	2.985145	2.131659	-0.22129	3.387618
lnGDP_tanz	10.47008	0.434878	-0.44122	1.879494
lnGDP_partner	10.91285	2.679684	0.540811	2.363795
lnFDI_partner	9.466175	2.853724	-0.06562	2.730853
lndistance	8.152731	0.818438	-0.09428	2.056129
lnreserve	18.19522	4.435783	-0.60523	1.969966
EAC_dummy	0.16	0.367065	1.854852	4.440476
SADC_dummy	0.56	0.497009	-0.24175	1.058442
RoW_dummy	0.32	0.46706	0.771744	1.595588

APPENDIX II: THE CORRELATION MATRIX:

Appendix II depicts the correlation matrix between *lnexp* as dependent variable and its explanatory variables. Evidently, *lnexp* was found to be positively associated with all independent variables except for *lnimp, lnreserve* and *SADC_dummy*.

	lnexp	lnimp	lnPop_ partner	lnGDP _tanz	lnGDP_ partner	lnFDI_ partner	lndistance	lnreserve	EAC	SADC	Others
lnexp	1										
lnimp	-0.4	1									
lnPop_partner	0.7	-0.4	1								
lnGDP_tanz	0.2	0.1	0	1							
lnGDP_partner	0.6	-0.6	0.8	0.1	1						
lnFDI_partner	0.5	-0.5	0.6	0.2	0.9	1					
lndistance	0.3	-0.7	0.5	0	0.8	0.8	1				
lnreserve	-0.4	1	-0.4	0.1	-0.6	-0.5	-0.7	1			
EAC_dummy	0.1	0.2	0	0	-0.3	-0.4	-0.5	0.3	1		
SADC_dummy	-0.5	0.6	-0.6	0	-0.5	-0.3	-0.3	0.6	-0.5	1	
Others_dummy	0.5	-0.9	0.6	0	0.8	0.8	0.8	-0.9	-0.3	-0.6	1

APPENDIX III: TEST STATISTICS

Panel Unit Root:

The study applied panel unit root tests that neglect the presence of both structural breaks and cross-section dependence. Specifically, the Levin et al. (2002) (LLC) adjusted t-statistic test, tests for a common unit root process as well as the W-statistic suggested by Im et al. (2003) (IPS), the Fisher-type ADF test as proposed by Choi, 2001; Maddala and Wu, 1999 assumes individual unit root processes are applied. Results of both tests strongly rejected the null hypothesis of unit root at level thus assuming the alternative hypothesis of non-stationarity, as indicated in the Table below.

Variable	Im, Pesaran and Shin Level	Philips–Perron Level	Levin–Lin–Chu Level
lnexp	-3.4309***	-5.3309***	-5.4809***
lnimp	-4.6956***	-8.3892***	-8.632***
lnPop_partner	-5.4704***	-12.8637***	-24.4799***
lnGDP_tanz	-2.5859***	-1.9706***	-9.3955***
lnGDP_partner	-3.4979***	-6.3602***	-6.6784***
lnFDI_partner	-1.1155***	-4.9822***	-9.9627***
lnreserve	-1.7661***	-5.5927***	-6.5807***

Cointegration Test:

To examine the existence of a long run relationship of dependent and explanatory variables, the study tested for cointegration using the Kao integration test. Kao test assumes the null hypothesis of no cointegration and uses the residuals determined by a panel regression to construct the test statistics and determine the asymptotically normal distribution. The results of the cointegration test strongly reject the null hypothesis of no cointegration, meaning that there is a long-run relationship between *lnexp* and the exploratory variables used in the model. The results of the Kao cointegration test are shown in the Table below Cross-Section **Dependence**:

The results of the cross-sectional dependence the test are shown in Table below. The results signify no problem of cross-sectional dependence within our FE model.

	Statistics
CD	53.09
P-value	0.00

The test for serial autocorrelation of the Gravity Model:

The test for serial autocorrelation shows that the specified Gravity model is free from autocorrelation problem with the p-value greater than the threshold of 5 percent. Sargan test of over-identification as well fail to reject the null hypothesis of over-identification meaning that the used instrumental variables are valid. It implies that instrumental variables are uncorrelated to some sets of residuals therefore are acceptable. Based on the above diagnostic tests, the model is well specified, and inference can be made.

APPENDIX IV: FORMULAS FOR SIMULATION OF TRADE EFFECTS, PRICE EFFECT, REVENUE EFFECT FOR THE IMPORTING COUNTRY AND WELFARE EFFECT

1. Trade creation

Trade creation is calculated in SMART model as the direct increase in imports by Tanzania attributable to a tariff reduction. Reducing tariffs on imports by a partner lowers the domestic price of the commodity in domestic market (i.e. Tanzania) thus motivating importation of the product. Trade creation is estimated in different ways depending on the *elasticity of export supply*.

a. Assumption of infinitely elastic export supply: the market only adjusts through quantity as the suppliers can meet the level of demand at the same price,
b. Assumption of finite elastic export supply: markets adjust through both price and quantity.

Based on Jammes and Olarreaga (2005) conceptual framework, Tanzania's trade creation

under the assumption of elastic supply is estimated as;

$$TC_{i,k} = \varepsilon_{ik} * m_{ik} * \frac{dt_{i,k}}{(1+t_{i,k})} * \frac{1}{(1-\varepsilon_{i,k}/\mu_{i,k})} \quad \text{..... (1)}$$

Where $TC_{i,k}$ is the trade created from product *(i*) which is the value of new imports of product (*i*) imported by Tanzania from EAC/SADC countries (*k*); $m_{i,k}$is the initial import value of product i by Tanzania from EAC/SADC countries (k); $dt_{i,k}$ is the change in tariff rate of product i imported by Tanzania from EAC/SADC countries (k); $t_{i,k}$ is the initial tariff rate of product i imported by Tanzania from EAC/SADC countries (k); ε_{ik} is the elasticity of import demand with respect to domestic price in Tanzania; and $\mu_{i,k}$ is the elasticity of export supply by EAC/SADC countries (k) with respect to export price of product (i).

2. Trade diversion effect

Trade diversion occurs when members belonging to a preferential trade area substitute imports previously sourced from non-members with those from members belonging to the preferential trade area. Trade diversion can occur because of introduction or elimination of preferential treatment for goods from one (or more sources) ceteris paribus. Based on Jammes and Olarreaga (2005) trade diversion is estimated as:

$$TD_{i,k} = \frac{m_{i,\neq k} * m_{i,k} * \frac{dt_{i,k}}{(1+t_{i,k})} * \sigma_{i,k,\neq k}\left[\frac{(m_{i,k}+m_{i,\neq k})\mu_{i,k}}{(m_{i,k}+m_{i,\neq k})\mu_{i,k}-m_{i,\neq k}}\right]}{m_{i,\neq k}+m_{i,k}+m_{i,\neq k} * \frac{dt_{i,k}}{(1+t_{i,k})} * \sigma_{i,k,\neq k}\left[\frac{(m_{i,k}+m_{i,\neq k})\mu_{i,k}}{(m_{i,k}+m_{i,\neq k})\mu_{i,k}-m_{i,\neq k}}\right]} \quad \text{..... (2)}$$

Where $TD_{i,k}$is the trade diversion of product which is the value of Tanzania imports of product i that were previously imported from the rest of the world (≠k) that are now imported from EAC/SADC countries (k); $m_{i,k}$ is the initial import value of product i by Tanzania from EAC/SADC countries (k); $m_{i,\neq k}$ is the initial import value of product i by Tanzania from the rest of the world (≠ k); $dt_{i,k}$is the change in tariff rate of product i imported by Tanzania from EAC/SADC countries (k); $t_{i,k}$ is the initial tariff rate of product i imported by Tanzania from EAC/SADC countries (k); $\sigma_{i,k,\neq k}$is the elasticity of substitution with respect to relative prices of the same product from different sources of supply and $\mu_{i,k}$ is the elasticity of export supply by EAC/SADC countries (k) with respect to export price of product (i).

3. Price effect

The price effect reflects a rise in the world price for the product whose demand increases following the tariff reduction (also known as the terms of trade effect). In other words, it is the additional import value of imports by Tanzania from EAC/SADC countries because of the increased world price. Under the assumption of elastic export supply, the change in world price can be expressed as:

$$dp_{i,k}^{w} = \frac{TC_{i,k}+TD_{i,k}}{\mu_{i,k}} \quad \text{..... (3)}$$

Where $dp_{i,k}^{w}$is the change in world price (price received by the exporter) of product *(i*) exported by EAC/SADC partner countries (*k*).

4. Total trade effect

The total trade effect is obtained by summing together the trade creation effects, trade diversion effects and price effect. The total trade effect is expressed as**:**

$$TT_{i,k} = TC_{i,k} + TD_{i,k} + dp_{i,k}^{w} \quad \text{.....(4)}$$

Where $TT_{i,k}$is the total trade effect from product (*i*) imported by Tanzania from EAC/SADC countries (*k*).

5. Tariff revenue effect

The revenue effect is the difference between import revenue at the new tariff rate and import revenue at the old tariff rate. The change in revenue ($dR_{i,k}$) is calculated as the new tariff revenue (TR_1) less the initial tariff revenue (TR_0), where the tariff revenue in each instance is calculated as the relevant quantity imported (*Q*) multiplied by the relevant tariff rate (*t*):

$$dR_{i,k} = TR_1 - TR_0 \quad \text{..... (5)}$$

$$dR_{i,k} = Q_1 * t_1 - Q_0 * t_0 \quad \text{.....(6)}$$

The loss in tariff revenue for Tanzania from imports from EAC/SADC countries (only) is estimated as the new import value (initial trade plus total trade effect) multiplied by the new tariff (initial tariff plus change in tariff) less the initial import value multiplied by the initial tariff, as follows:

$$dR_{i,k} = (m_{i,k+}TT_{i,k}) * (t_{i,k+}dt_{i,k}) - (m_{i,k*}t_{i,k}) \quad \text{..... (7)}$$

6. Welfare effect

The welfare effect arises from the benefits consumers in the importing country derive from the lower domestic prices after the removal or reduction of tariffs or the *ad valorem* incidence of non-tariff distortions. The net welfare gain is estimated as the increase in import value times the average between the ad valorem incidence of the trade barriers before and after their elimination and is expressed as:

$$dW_{i,k} = [TT_{i,k} * (t_{i,k+}dt_{i,k})] + [0.5 * TT_{i,k} * dt_{i,k}] \quad \text{..... (8)}$$

Where $dW_{i,k}$ is the change in welfare as a result of product (i) imported by Tanzania from EAC/SADC countries (k).