

Effect of SPS and TBT Non-tariff barriers and other covariates on Trade among EAC member countries in the pre and during COVID-19 pandemic period

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Abstract: The study sought to examine the effect of SPS and TBT Non-tariff barriers and other covariates on Trade among EAC member countries in the pre and during COVID-19 pandemic period. The study adopted panel regression models based on augmented gravity models. Secondary data was sourced from EAC states Central banks and the World Trade Organization (WTO). In the pre-COVID-19 period, Sanitary and Phytosanitary (SPS) measures and technical barriers to trade (TBT) inversely and positively impacted on trade value respectively. In the COVID-19 period, TBT had hindered intra EAC trade while SPS policies directly and strongly EAC trade. The recommends that EAC member countries should identify alternative mechanism to elimination of NTBs and adopt more integration policies rather than nationalistic policies.

Keywords: Non-Tariff Barriers, Sanitary and Phytosanitary Barriers, Technical Barriers, Economic Integration, Trade, Trade volumes, Intra EAC trade.

1. Introduction

The treaty for the establishment of EAC, in articles sets forth goals of the trading block (EAC, 2007). One of the critical goals was increase the depth and breadth of economic partnership among member nations. The common market protocols and custom union were the vehicles through which economic integration aspirations of the region was achieved in early 2005 and 2010 respectively. The purpose of the common market protocols was to achieve open trade in the region via eliminations of obstacles to trade (Eastern African Sub-Regional Support Initiative (EASSI), 2020). In the protocol, member states made a commitment to each other to eliminate all tariffs in the intra region trade among themselves. The EAC Common Market enables free trade, movement of people, labour services and capital and accords right of residence and establishment (EAC, 2009). Even though the integration of the region has improved intra region trade, the volumes and value of trade is still dismal when compared to global trade with the region (East African Business Council (EABC), 2018). In 2016, the level of Intra EAC exports was 5.9% of EAC trade with the rest of the world (EABC, 2016), while in 2018, intra EAC exports was 22.4% of the regions total export trade (EABC 2018). Trade among member has been negatively impacted by Non-Tariff Barriers (NTBs) that are still in place among EAC members states (EABC, 2020). NTBs account for most of the blockages to intra-regional trade (Oiro, Owino & Mendez-Parra, 2017). NTBs are broad policy intervention beyond tariffs the border that interferes with free trade and movement of factors of production among countries (Kinzius, Sandkamp & Yalcin, 2019). Among the kinds of NTBs, technical barriers to trade (TBT) and sanitary and phytosanitary (SPS) policies are key. (EABC, 2020). The TBT seeks put in place regulations that are technical in nature, ensure conformity to assessment processes are not discriminatory and acting as unwarranted blockage to trade. The SPS recognizes the right of WTO member to put in place mechanisms to ensure environmental and human health protection from harmful products (Calabrese & Eberhard-Ruiz, 2016).

Even though, NTBs have been hampering intra EAC countries trade, the outbreak of Coronavirus of 2019 (COVID-19), made the trade situation worse for certain aspects of trade. The virus thereafter spread to over 188 nations with over 153

million and 3.2 million people being infected and succumbing to it respectively (World Health Organization (WHO), 2021). The WHO later on declared it a pandemic on 11th March 2020 (WHO, 2020). The first case of infection with COVID-19 was reported in EAC on 13th March, 2020 in Kenya with other countries following after. The outbreak necessitated response strategies and programs that oscillated between partial to total lockdowns (East African Community, 2020).

The East African states began implementing COVID-19 related NTBs such as closing airports to passenger planes, restricting movement across borders for people and goods to only essential products and services. Further, within the countries, public gathering was stopped completely or restricted to a given predetermined number. There was also quarantine in hot spot areas within the states as well as curfews (EAC, 2020). However, while the other EAC member nation adopted most the measures, Tanzania adopted a different approach that led to strained relationship with other EAC member states and international community. Tanzania stopped the reporting of numbers of COVID-19 infection and death cases. The strained relationship resulted to complete closure of borders between Kenya and Tanzania on May 16th, 2020 (Ogunleye et al., 2020).

Globally, NTBs hampers the enjoyment or potentials of free trade as they hinder the free movement of people, goods and factors of production across national boundaries. Free trade is beneficial to nations in terms of market for products, factors of production and financial assets (Rojas & Pineda, 2020). In EAC member countries, NTBs act as obstructions towards smooth exchange of goods and service among countries even with the existence of custom union (Hangi, 2010). Several NTBs exist in EAC, which includes, unstandardized weight bridges, TBT, SPS, road blocks among others (Okumu, 2010). The Covid situation just happened to aggravate issues concerning impact of NTBs on intra EAC trade (Albertoni & Wise, 2021). The control measures for the disease made the situation of NTBs worse with some NTBs that had initially been eliminated being reintroduced and new controls being put in place hence collapse of informal cross-border trade (East African Sub-Regional Support Initiative, 2020). Most of the empirical literature were carried before the COVID 19 pandemic (Baya, 2019; Ghodsi, Grüber, Reiter, Stehrer, 2017). Additionally, research on impact of COVID 19 on trade have tended to ignore the marginal impact of SPS and TBT NTBs on intra EAC countries trade in the COVID-19 period (UNECA, 2020, 2021). This research sought to examine the difference in the effect of SPS and TBT Non-tariff on Trade within EAC member states pre and during COVID 19 pandemic.

Hence the general objective of this study was to investigate the effect of SPS and TBT Non-tariff barriers and other covariates on Trade among EAC member countries in the pre and during COVID-19 pandemic period.

2. Literature Review

2.1 Theoretical Review

This research on the nexus between NTBs and Trade is supported by the Heckscher-Ohlin (H-O) theory. The theory was postulated by Hecksher and Ohlin in 1920s to examine how nations can benefit from trade by utilizing abundant factors. The H-O expanded on the work of Ricardo by introducing capital as second factor of production for finished goods in addition to labor (Ohlin, 1933). The theory further assumes that their exist differences in factors proportions across industries and endowment across nations (Gandolfo, 2014). Capital intensive firms have low labour to capital ratio while labour intensive firms have high labour to. Further, developing counties are often endowed with labor relative to physical capital while developing countries often endowed with labor relative to physical capital stock.

Capital to labor endowment describes the comparative factor abundancy between countries and that countries enjoy comparative advantage when they produce commodities in line with their relative factor abundance. Further, the theory assumes that differences among trading counties is explained by relative factor endowment and that trade will be advantageous and will occur among countries when the countries have differing comparative factor endowments and different firms and industries adopt different capital labour ratios (Feenstra and Taylor, 2017). Further, countries tend to benefit from trade when they extract, manufacture and sell products that are made available from relatively abundant factors of production (Suranovic, 2012; Obuya & Olweny, 2017). Even though H-O theorem explains reasons why countries trade, it has some gaps regarding its predictive power given that trade among countries cannot only be explained by relative factor endowment. Further, empirical literature has shown technology endowment may outweigh labor endowment many times (Gandolfo, 2014). The H-O theorem has posited that if a country cannot benefit from trade where they produce and export commodities in line with their abundant factor due to distortions of factor prices by other countries, then trade protection through NTBs and other measures is justified. Further, countries may impose restrictions to free trade to protect infant industries especially in line of production where they possess comparative advantage. The protection is thus justified to give the infant industries opportunity to grow and compete in the global arena.

2.2 Empirical Review

The nexus between NTBs and trade globally, regional and locally exist. Kinzius, Sandkamp and Yalcin (2019) investigated the effect of NTBs on imports. The study adopted gravity model and data was extracted from Global Trade Alert database. The

research showed that NTBs hampers exports. The study further revealed different NTBs impact on trade to a different magnitude. Kinzius, Sandkamp and Yalcin (2019) was restricted to measures restricting imports into the implementing country only. Hence, there is need for another study that specifically focuses on SPS and TBT Non-tariff barriers and how they influence trade both export and import trade. Further there is need to examine the effect of NTBs in the COVID-19 period. Ghodsi (2020) examined the effect TBTs reported China on its imports for manufacturing from 2002–2015. The study used gravity model that controls for sample selection bias, multilateral resistance, endogeneity bias and heterogeneity of exporting firms. The study establishes major effect of TBT on imports. The impact was however differentiated across exporting countries implying that some exporting countries were affected more with the TBT being selectively prohibitive. Ghodsi (2020) was carried out in China with different economic environment.”

Vickers et al. (2020) evaluated whether the COVID-19 impacted on trade in products of food in nature among countries in Commonwealth. The study revealed programs to contain COVID-19 spread abruptly disrupted international merchandise trade. The study revealed that national and regional lockdowns resulted in the interruption of trade in foods products. Vickers et al. (2020) was limited to food products in Commonwealth countries and was limited to few data points at the onset of COVID-19 pandemic, there is therefore need for another study that has more data points and carried specifically within EAC focusing on all export and import types. Okute (2017) investigated the impact of NTBs on volume of trade among exporters from Kenya to EAC region. The research was based on explorative research type with the study targeting nine thousand five hundred and eighty-five exporters from Kenya of which one hundred and twenty-one were sampled. The study administered questionnaires to collect primary data that was further analyzed. The findings revealed that various NTBs to hampered trade in EAC region. Okute (2017) was based on descriptive analysis hence could not establish causal effect relationship between NTBs and trade. Further, the study was carried out before COVID-19 hence does not capture effect of associated shocks on trade.

Khaliqi, Rifin, and Adhi (2018) evaluated whether SPS and TBT impacted on Indonesian export of shrimp. The gravity model was used with results revealing that the GDP of exporting nations as well as forex rate inversely effected shrimp exports. Additionally, the trade cost and GDP of the importers have direct effect exports. Further, the study revealed that SPS and TBT policy do impact exports of shrimp from Indonesia to the world. Akin-Olagunju and Yusuf and Okoruwa (2018) examined the influence of the SPS standards on coco exporters’ competitiveness. The study revealed that increasingly stringent SPS global standards enhanced trade. UNECA (2020) examined whether COVID-19 had adverse social and economic impacts in Eastern Africa. Secondary data was extracted from UNCTAD, CB of Kenya, Rwanda, Uganda Tanzania, Burundi, International Monetary Fund (IMF) among other institutions. Trend and structural break analysis showed extensive impacts of the pandemic on the region. The study revealed that formal merchandise trade (imports and exports) values have recovered sharply from the declines in the second quarter of 2020. Likewise, services trade performance has remained dismal for countries in the region, mainly due to the sharp drop in tourism. UNECA (2020) was based on data points at the beginning of pandemic and another study needs to be done that has more data points. Fernandes, Lefebvre and Rocha (2018) evaluated whether SPS and TBT polices via PTA impact on exports of from Columbia, Chile and Peru. The study adopted data extracted from World Bank Deep from 1996 to 2015. The study adopted gravity equation. The study revealed that existence of PTA agreements increased firm’s exports in destination markets. The study also showed that SPS and TBT were major for smaller firms.

Santeramo (2020) evaluated how trade in agricultural products was impacted by SPS measures. The study specifically compared the impact of SPS on volume of trade for members and nonmembers of regional trade agreements (RTA). The study findings revealed that befits received from being a signatory to RTAs declined with implementation of nondiscriminatory SPS measures. Further, both SPS and RTAs catalyze trade. RTAs offer opportunity for members to renegotiate SPS members thus improving trade among members of RTA. Santeramo (2020) was not based in EAC countries hence a study in EAC states is necessary. Ghodsi (2021) examined the effect of different TBTs on imports of ICT goods globally. The goods were evaluated based on HS from 1996-2018. Pseudo Poisson Maximum Likelihood (PPML) technique was adopted in parameter estimation. The findings showed that TBTs in general have a major direct impact on the value of imports. However, a few TBTs acted as barriers to trade hence impacted on value and volume of trade negatively. Ghodsi (2021) study was not localized in EAC member states and moreover it is focused on ICT goods only. Escaith and Khorana (2021) examined whether COVID-19 pandemic impacted trade in Commonwealth member states. The research utilized secondary data to estimate loses in trade arising from COVID-19 pandemic. The study was a simulation of possible future impacts of COVID-19 on flow of trade based on 3 conditions including a consensus, pessimism and optimism. The results showed that trade is inversely impacted with advanced nations being affected more and the severity of effect is based on magnitude and duration the pandemic will last. Escaith and Khorana (2021) was on the commonwealth countries hence there is need for another study that focuses on EAC countries. Further, the study did not examine the indirect effect of COVID-19 on trade through NTBs. Erokhin and Gao (2020) examined the interactions between food trade, food prices and COVID-19 cases. The study happened among forty-five countries with autoregressive method, causality test, and variance decomposition being adopted. COVID-19 impacts were greater among developed countries compared to developing countries with regards to food inflation. The less developed countries were affected more in terms of food security risk. Erokhin and Gao (2020) was based on food trade hence there is need for another study that extends the breath of the study in all merchandise traded in the context of EAC states.

Ali, Fugazza and Vickers (2020) examined the nexus between exports in primary commodities and the COVID-19 in China,

UK, USA, EU and Australia. The study utilized export scenarios and historical trends. The research showed that supply and demand shocks emanating from COVID-19 was hurting trade. Ali, Fugazza and Vickers (2020) was based tend analysis where the standard deviation of import values was exclusively associated with COVID-19 shocks. Kahenu (2014) examined the impact on NTBs on Kenyan exports to EAC. The study collected primary data from respondents and secondary data from reported NTBs between the periods 2007-2013. The results revealed that the fall in exports from Kenya between 2012 and 2013 was explained by NTBs introduced by trading partners. Anyona (2018) was based on exploratory design hence could not establish causation effect between trade and NTBs. Ghodsi et al. (2017) examined whether varied kinds of NTBs impacted on international from 1995 and 2014. Data was sourced from WTO. The study used gravity model with the findings showing that NTBs impeded trade.

3. Methodology

3.1 Theoretical Framework

Analytical research design was adopted to examine the causation between NTBs and trade. The study adopted panel regression models in examining the nexus between NTBs and trade in the pre and during COVID-19 pandemic period. (Gujarati & Porter, 2003). The study adopted gravity model to quantify EAC member countries trade in the pre and during COVID-19 pandemic. The simplest gravity model is given in equation [1].

$$T_{ij} = A * \left(\frac{Y_i Y_j}{d_{ij}} \right) \dots \dots \dots [Equation 1]$$

Where T_{ij} is the export and import of country i & j , $Y_i * Y_j$ is the product of GDP of country i and j and d_{ij} is the geographic distance between trading pair capital cities. In accordance to the model, ceteris paribus, volume of trade between two countries is direct function of the product of the GDPs of the two countries trading with each other. Further, the volume of trade between trading pairs is an inverse function of the distance between the trading pairs capital cities. Therefore, higher GDPs product and shorter distance should lead to high trade volume between the two trading countries and vice versa (Krugman & Obstfeld, 2006). Dummy variables are often included to capture the effect of the qualitative variables such as sharing of national language, sharing of a border and trade agreements (Stay & Kulkarni, 2016). The effect of SPS and TBT NTB can be added to the model. The effect of COVID-19 pandemic shocks being qualitative factors affecting trade were added in the augmented model as dummy variables.

3.2 Empirical Framework/Model specification

Even though there exist different variants of gravity model applied in various empirical studies, the current study adopted model suggested by Krugman and Maurice (2005) as shown in equation [1]. To model the effect of SPS and TBT Non-tariff barriers and other covariates on Trade among EAC member countries in the pre and during COVID-19 pandemic period, the model in equation [1] was augmented by adding SPS and TBT NTBs. The resulting gravity model in the form presented in equation [2] was used to estimate the effect of SPS and TBT NTBs and other covariates on trade among EAC member countries in the pre COVID-19 pandemic period.

$$\ln(T_{ijt}) = \alpha_0 + \alpha_1 \ln(GDP_{it} * GDP_{jt}) + \alpha_2 \ln(SPS_{it} * SPS_{jt}) + \alpha_3 \ln(TBT_{it} * TBT_{jt}) + \alpha_4 \ln(PoP_{it} * PoP_{jt}) + \alpha_5 Exr_{ijt} + \alpha_6 \ln D_{ij} + \alpha_7 La + \alpha_8 Bo + \epsilon_{ijt} \dots \dots \dots [Equation 2]$$

Where:

T_{ijt} : Value of Trade

GDP_{it} and GDP_{jt} : Gross Domestic Product of trading pairs respectively.

PoP_{it} and PoP_{jt} : Population of trading pairs respectively.

Exr_{ijt} : Exchange rate between trading pairs.

D_{ij} : Distance in kilometers between capital cities of trading pairs.

La : common national official language.

Bo : Sharing of border dummy variable.

α_i = is parameter estimates where i is 1,2,.....,7

ϵ_{ijt} : Error term, \ln = Natural Logarithm

i and j are reporting country and trading partner of reporting country respectively.

NTB_{it}: Non-tariff barriers imposed by country i in time t
 NTB_{jt}: Non-tariff barriers imposed by country j in time t
 t=2014, 2015, ..., 2019.

The model in equation [equation 2] was modified further by adding dummy variable COV to capture COVID-19 shocks. The study further adopted monthly data from April 2019 to March 2021. This translates to 12 months before COVID-19 struck and 12 months after COVID-19 struck. The resulting gravity model in the form presented in equation [4] was used to estimate nexus between SPS & TBT NTBs and other covariates on Trade among EAC member countries in the COVID-19 pandemic period.

$$\ln(T_{ijt}) = \alpha_0 + \alpha_1 \ln(GDP_{it} * GDP_{jt}) + \alpha_2 \ln(SPS_{it} * SPS_{jt}) + \alpha_3 \ln(TBT_{it} * TBT_{jt}) + \alpha_4 \ln(PoP_{it} * PoP_{jt}) + \alpha_5 Exr_{ijt} + \alpha_6 \ln D_{ij} + \alpha_7 La + \alpha_8 Bo + \alpha_9 COV + \epsilon_{ijt} \dots \dots \dots [Equation 3]$$

Where:
 COV: COVID-19 dummy variable
 t= 2019April, 2019 May... 2021 March.
 α_i = is parameter estimates where i is 1,2,.....,8

3.3 Variables Definition and Measurement

The Table 1 has the variable notation, measurement and the expected sign of the nexus between the regressand and regressors.

Table 1: Operationalization of Study Variables

Variable	Notation	Measurement	Expected sign
Dependent			
Trade	T	Trade value between reporting and trading partner in USD	
Explanatory			
GDP_1	GDP _i	GDP of reporting country in USD	+
GDP_2	GDP _j	GDP of trading partner in USD	+
SPS_1	SPS _i	The number of SPS notified as imposed by reporting country	-
SPS_2	SPS _j	The number of SPS notified as imposed by trading partner.	-
TBT_1	TBT _i	The number of TBT notified as imposed by reporting country	-
TBT-2	TBT _j	The cumulative number of TBT measures notified as imposed by trading partner.	-
PoP_1	PoP _i	Population of reporting country in numbers	+
PoP_2	PoP _j	Population of trading partner state in numbers	+
Exchange rate Exchange rate	Exr _{ij}	Monetary Currency exchange rate between reporting country and trading partner	+/-
Distance	D _{ij}	Distance between capital cities of trading pairs	-
Language	La	Official national language sharing where 1= Yes 0=No	+
Boundary	Bo	Sharing national boundary where 1= Yes 0=No	+
COVID-19	COV	COVID-19 shocks where 1= Pre-covid months 0= covid months.	-

Table 1 presents the variables definition and measurement. The expected relationship between SPS and TBT Non-tariff barriers and trade value was negative. The negative relationship results from trade inhibition caused by NTBs. Kinzius, Sandkamp and Yalcin (2019) revealed that NTBs inversely impact on imports. The expected relationship between economic growth and value of trade was positive given that increasing GDP means increasing National Income (NI) as well as purchasing power for goods and services. The expected relationship between population size and value of trade was positive. The size of the population represents the demand for products and increasing population implies increased demand for products hence more trade value. Krugman and Obstfeld (2006) version of Gravity model of international trade showed that population of countries as additional mass for bilateral trade just like GDP of the trading countries. The expected relationship between exchange rate and value of trade is not defined hence it could be negative or positive. If the change in exchange rate leads to a net reduction in value of trade between trading pairs, then then nexus between forex rate and value of trade becomes negative and vice versa (Iskan, 2016). The expected relationship between distance and value of trade was negative. The increasing distance between capital cities of reporting country and trading partner implies increasing cost of transportation that

inhibits trade (Krugman & Obstfeld, 2006). Countries that have a common national official language tends to trade more given that the traders between the two countries can easily understand each other while trading. Stay and Kulkarni (2015) revealed a positive effect of sharing a common national official language and trade between the UK and its pairs in trade. The expected relationship between COVID-19 shocks and value of trade was negative. COVID-19 pandemic led to restricted movement across borders, reduced industrial output hence reduced value of trade. UNECA (2020) revealed that formal merchandise trade (imports and exports) values declined sharply in the second quarter of 2020 when COVID-19 struck EAC countries.

3.4 Diagnostic Testing

The assumptions tested included homoscedasticity, collinearity, autocorrelation and cross-sectional dependence. In econometrics, model is said to be homoscedastic when error terms have constant and finite variance however when the variance is not constant, then the model is said to be heteroskedastic (Gujarati, 2008). Modified Wald test was utilised to examine the existence of group heteroscedasticity. The research would conclude presence of homoscedasticity if p-value generated was greater than the 0.05. In the presence of heteroscedasticity alone, the study can use robust standard errors. However, in the presence of heteroskedasticity and serial correlation, Panel correlated standard errors (PCSEs) or Feasible Generalized least squares (FGLS) should be adopted. The regression is based on the assumption of no multicollinearity. Multicollinearity exist in the estimation model when regressors are highly correlated among themselves (Goldberger, 1964). The presence of multicollinearity results to inflated coefficients. The pairwise Pearson correlation coefficient was adopted where multicollinearity is said not to exist when bivariate correlation coefficient is above 0.8 (Gujarati, 2003). Linear regression model is based on nonexistence of serial correlation. Serial exist in a model errors terms in the present time is highly correlated with its previous period values (Gujarati (2003). The regressand in the present period is explained by its own values in the previous period as well as regressors both in the present and previous period. Serial correlation is common for long time series of 10 years and above. Wooldridge Drukker test was adopted to examine the presence of serial correlation of error terms such that p-value greater than 0.05 implies absence of autocorrelation (Wooldridge, 2012). In the presence of serial correlation only, the study would adopt clustered standard errors, however, if both serial correlation and group heteroskedasticity exist in the model, the study would adopt either PCSEs or FGLS model for parameter estimation. Heterogeneity is a characteristic of panel data where there are significant differences across entities to be studied which in this case are the countries within EAC. Heterogeneity exists when something within the individual entities affects the explanatory or dependent variables and therefore needs to be controlled (Wooldridge, 2012). Fixed effects (FE) models can be used to control unobserved time-invariant variables that might affect regressand and regressors to able study examine net effect of regressors of concern variables on the regressand. In cases where the unobserved time invariant characteristic is non-correlated with regressors of concern, then, fixed effect model adoption to isolate the effect of unobserved time invariant characteristic results in inefficient estimators (Wooldridge, 2012). FE model is thus not suitable and there is need for the relationship to be modelled differently using other models like random-effects (RE) model. The research employed Hausman test to choose between FE and RE models. If p-value > greater than .05, RE ought to be adopted.

3.5 Estimation Technique

Based on the result of Hausman test, the study would decide whether to adopt fixed effect or Random effect model. In cases of violation of classical least squares assumption such that panel data exhibit serial correlation, heteroscedasticity and cross-sectional dependence, then the research would choose FGLS model.

3.6 Sources of Data

Data was sourced from UNCTAD, Central Bank of Kenya (CBK), National Bank of Rwanda (BNR), Bank of Uganda (BoU), Bank of Tanzania (BoT), Banque de la République du Burundi (BrB), IMF, WTO, East African Community Secretariat (EACS) among other institutions. South Sudan which joined EAC recently was omitted from the study given that it has no complete data for the study period. Data for estimating the impact of TBPE of identified NTBs on intra EAC trade was collected for a period of 20 years beginning 2000-2020. Data on SPS and TBT NTBs on trade among EAC member countries in the pre COVID-19 pandemic period was sourced for seven years from 2014-2020 because of scarcity of secondary data on SPS and TBT NTBs. WTO provided secondary data on SPS and TBT NTBs from 2014-2020. Data for estimating the effect of SPS and TBT NTBs on Trade among EAC member countries during COVID-19 pandemic period was collected monthly for a period of 24 months beginning April 2019 to March 2021. The first 12 months was period before COVID-19 struck and the next 12 months was period after COVID-19 was first reported in Kenya (The first among EAC countries).

4. Results and Discussion

The study also evaluated whether SPS and TBT NTBs and other covariates impacted on intra EAC trade between member

countries in the pre and during COVID-19 challenge. The effect was examined in two levels. The first level involved the impact of SPS & TBT NTBs and other covariates EAC trade in the pre COVID-19 pandemic period based on annual data. The second level involved examining impact of SPS & TBT NTBs and other covariates on intra EAC trade among member countries during COVID-19 pandemic period based on monthly data.

4.1 Effect of SPS and TBT Non-tariff barriers and other covariates on Trade among EAC member countries in the pre COVID-19 pandemic period.

The study first examined the impact of SPS & TBT NTBs and other covariates on EAC member countries trade in the pre COVID-19 period. The examination of the objective was based on annual panel data between 2014 and 2019.

4.1.1 Diagnostic Tests

The cross-sectional dependence (contemporaneous correlation) was not tested given that the data had time series component of only six years. The Wooldridge Drukker test for serial correlation revealed the presence of autocorrelation ($p=.0006 < 0.05$). Further, Modified Wald showed that there was presence of group heteroscedasticity ($p\text{-value} = .000 < 0.05$). Given that the panel data had the twin problem of serial correlation and group heteroscedasticity without the problem of contemporaneous correlation, the study could adopt either FEM or REM with clustered robust standard errors to eliminate the problem of heteroscedasticity and serial correlation. The FEM was further eliminated given that the observed variables including boundary, language and distance were omitted by the model because they were constant within the group. The study thus utilised REM with clustered S.E.

4.1.2 Random Effect Model

The study adopted REM with clustered S.E to eliminate the problem of heteroscedasticity and serial correlation. The findings based on REM with clustered robust standard errors were shown in Table [2].

Table 2: Random Effect Model with Clustered Robust Standard Errors

lnT	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
lnGDP ₁ GDP ₂	1.756	0.186	9.43	0.000	1.391	2.121	***
lnExr	0.218	0.132	1.66	0.098	-0.040	0.476	*
D	-0.004	0.001	-4.63	0.000	-0.006	-0.002	***
La	0.164	0.537	0.31	0.760	-0.888	1.216	
Bo	-0.789	0.557	-1.42	0.156	-1.881	0.302	
lnSPS ₁ SPS ₂	-0.069	0.030	-2.33	0.020	-0.128	-0.011	**
lnTBT ₁ TBT ₂	0.017	0.051	0.33	0.741	-0.083	0.117	
Constant	-58.260	7.818	-7.45	0.000	-73.582	-42.937	***
Mean dependent var	21.463		SD dependent var	2.882			
Overall r-squared	0.869		Number of obs	60.000			
Chi-square	1452.331		Prob > chi2	0.000			
R-squared within	0.002		R-squared Overall	0.8685			

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Note: product of Sanitary and Phytosanitary of reporting country and its trading partner (SPS₁SPS₂), product of Technical Barrier to trade of reporting country and its trading partner (TBT₁TBT₂).

In Table 2, the coefficient of determination (R^2) revealed that the model explained 86.85% of the total variation in trade within EAC region. The remaining variation of 13.15% is explained by unobserved (time variant and time invariant) variables. The study thus concluded that the model had satisfactory goodness of fit. Further, the F-test showed that overall, the explanatory variables including product of SPS notified by reporting country and its trading partners (SPS₁*SPS₂), product of TBT to trade notified by reporting country and its trading partner (TBT₁*TBT₂), distance, national language sharing (La), border sharing (Bo), Exchange rate (Exr), Product of GDP of trading pairs (GDP₁*GDP₂) had significant effects on intra EAC trade. This is evidenced by .05 level of significance higher than overall p-value.

Further, the effect of the product of SPS notified by reporting country and its trading partners strongly and inversely impacted on value of trade. A 1% improvement in the number of notified SPS by reporting country and its trading partner leads to reduced value of trade by 6.9%. This finding implies that SPS measures act as inhibitors to intra EAC trade by reducing the trade values between reporting EAC nation and its trading partners within EAC. The finding agrees with Kinzius, Sandkamp and Yalcin (2019) who revealed that the NTBs inversely impacted on imports. Chen (2013) established that TBT increased trade volumes and duration of trade relationships. Further, Akin-Olagunju, Yusuf and Okoruwa (2018) revealed that SPS and TBT

policy do not affect exports of shrimp from Indonesia to the world.

Regarding the other covariates, the product of GDP of the trading pair countries and Distance had significant effects on the value of intra EAC trade. A one percent increase in distance between trading pairs capital cities within EAC led to reduced trade values. Distance was thus an inhibitor to trade given that longer distance between economic centres of countries implies increased transportation cost that makes the product more expensive in the market. Mortazavi and Do (2006) revealed an inverse effect of distance on value of trade between counties in EU. The effect of the product of the GDP of trading pairs strongly impacted on trade within EAC region. A 1% improvement in the product of the GDP of the trading pairs leads to increased trade value by 175.6%. Larger GDP means that the countries have more purchasing power in terms of national income hence their demand for products also increases. Finally, the effects of boundary sharing, national language and exchange rate were not significant in explaining trade value among EAC member countries. Krugman and Obstfeld (2006) study showed that value of trade is directly proportional to the product of the GDPs of the reporting country and its trading pairs.

4.2 Effect of SPS and TBT Non-tariff barriers and other covariates on Trade among EAC member countries during COVID-19 pandemic period

The study also examined the effect of SPS & TBT NTBs and other covariates EAC member trade during COVID-19 pandemic period. The study adopted monthly secondary data from April 2019 to March 2021 which was 12 months before and during COVID-19. The study relied on 8 EAC trading pairs of countries after two pairs (Kenya- Rwanda pair and Kenya-Tanzania pair) were omitted because they lacked sufficient monthly bilateral trade figures. The study carried out test of robustness of the estimation model and chose the appropriate panel data model for estimation.

4.2.1 Descriptive Analysis

Trend analysis of bilateral trade between some EAC countries. The trend is based on monthly data running from April 2019 to March 2021. The trends are presented in Figures [1-3].

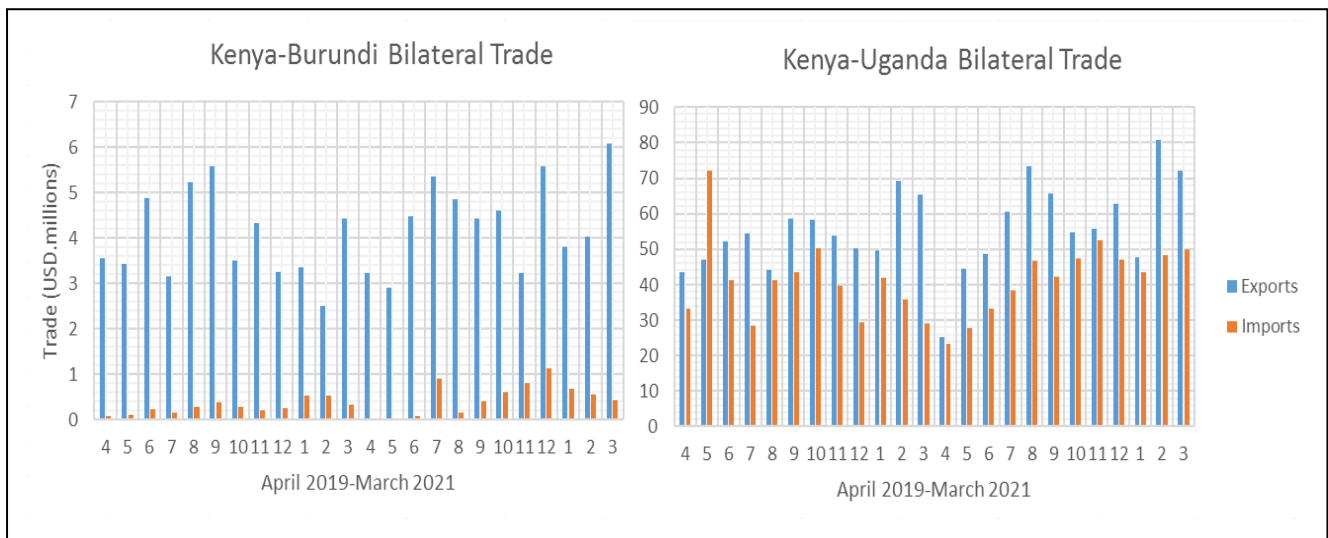


Figure 1: Bilateral Trade for Kenya-Burundi and Kenya-Uganda

The bilateral trade between Kenya and Burundi reveals that export from Kenya to Burundi fell greatly between April 2020 and May 2020. Further, imports from Burundi to Kenya also fell greatly between April 2020 to June 2020 coinciding with the first reported case of COVID-19 in Kenya after which various restrictions were put in place. However normal trade between Kenya and Burundi recovered from July 2020 onwards. The bilateral trade between Kenya and Uganda reveals that exports from Kenya to Uganda fell greatly between April 2020 with slow recovery happening between May 2020 and July 2020. Further, imports from Uganda to Kenya also fell greatly between March 2020 and May 2020 coinciding with the first reported case of COVID-19 in Kenya after which various restrictions were put in place. However normal imports from Uganda to Kenya recovered from June 2020 onwards with full recovery being realized in August 2020 [Figure 1].

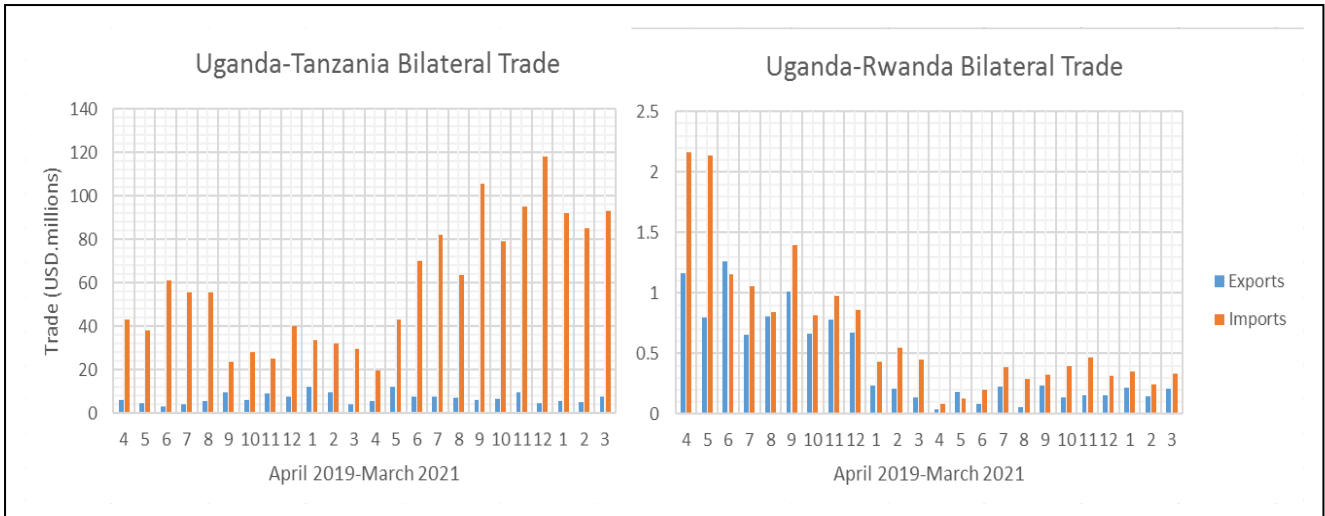


Figure 2: Bilateral Trade for Uganda-Tanzania and Uganda-Rwanda

The bilateral trade between Uganda and Tanzania reveals that exports from Uganda to Tanzania fell greatly between March 2020 and April 2020. Further, imports from Tanzania to Uganda also fell greatly in April 2020 coinciding with the first reported case of COVID-19 in Uganda after which various restrictions were put in place. However normal imports from Tanzania to Uganda recovered from May 2020 onwards. The bilateral trade between Uganda and Rwanda reveals that exports from Uganda to Rwanda and imports from Rwanda to Uganda fell greatly in April 2020 and May 2020 due to COVID-19 with slow recovery thereafter [Figure 2] .

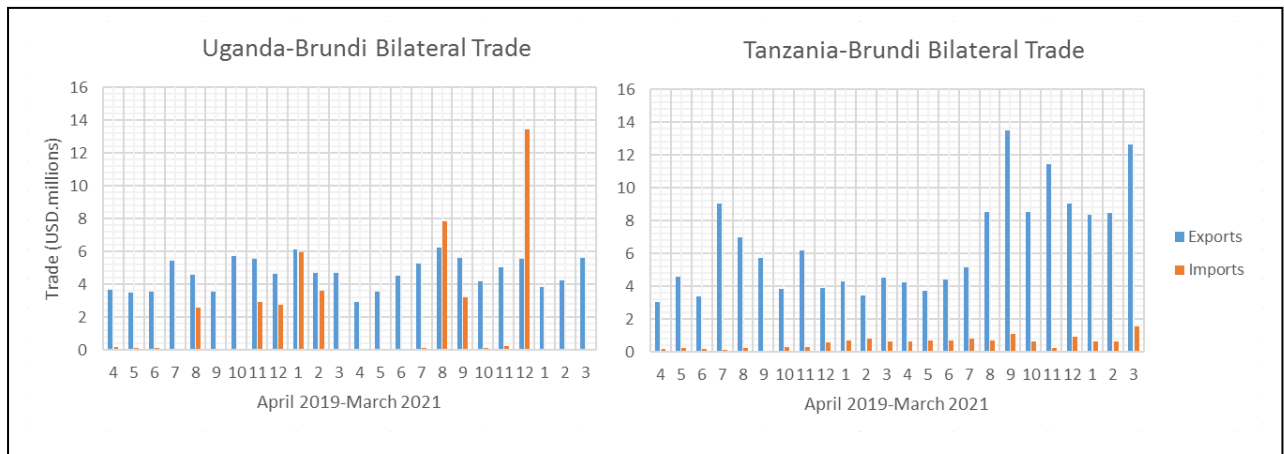


Figure 3: Bilateral Trade for Uganda-Burundi and Tanzania -Burundi

The bilateral trade between Uganda and Burundi reveals that exports from Uganda to Burundi fell greatly in April 2020. Further, imports from Burundi to Uganda also fell greatly to zero figures between March 2020 and July 2020 coinciding with the first reported cases of COVID-19 and associated restrictions. However, Exports from Uganda to Burundi recovered from May 2020 onwards. The imports from Burundi to Uganda is a little intermittent with some monthly reporting zero figures. The bilateral trade between Tanzania and Burundi reveals that exports from Tanzania to Burundi did not show much of the effect of COVID-19 with exports figures remaining relatively same between December 2019 and July 2021. This could be explained by low COVID-19 restrictions in the two nations [Figure 3].

4.2.2 Diagnostic tests

The Wooldridge Drukker test revealed that there was no autocorrelation ($p=.904 > 0.05$). The study further showed the presence of group heteroscedasticity based on Modified Wald test (the $p = .000 < .05$). Finally, Breusch -Pagan/LM test concluded presence of cross-sectional dependence (p -value was less than 0.5. The research thus concluded that estimation model suffered from contemporaneous correlation.

4.2.3 Feasible Generalized Least Squares Regression

Given that the model suffered from contemporaneous correlation and group heteroscedasticity, the study adopted the FGLS model that corrects for contemporaneous correlation and smaller standard errors introduced by heteroscedasticity [Table 3].

Table 3: Feasible Generalized Least Squares Regression

lnT	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
D	-0.003	0.000	-10.78	0.000	-0.004	-0.003	***
La	-1.713	0.403	-4.25	0.000	-2.503	-0.923	***
Bo	4.141	0.870	4.76	0.000	2.435	5.847	***
COV	-0.413	0.093	-4.43	0.000	-0.595	-0.230	***
lnSPS ₁ SPS ₂	1.603	0.201	7.97	0.000	1.209	1.998	***
lnTBT ₁ TBT ₂	-4.404	0.348	-12.65	0.000	-5.087	-3.722	***
lnGDP ₁ GDP ₂	2.910	0.281	10.34	0.000	2.359	3.462	***
lnExr	-0.017	0.077	-0.22	0.823	-0.168	0.134	
Constant	-91.034	14.371	-6.34	0.000	-119.200	-62.869	***
Mean dependent var		1.727		SD dependent var		3.988	
Number of obs		192.000		Chi-square		13656.078	

*** p<0.01, ** p<0.05, * p<0.1

Note: COVID-19 pandemic (COV)

In Table 3, F-test showed that overall, the explanatory variables including product of SPS of reporting country and its trading partner (SPS₁*SPS₂), the product of TBT of reporting country and its trading partner (TBT₁*TBT₂), distance (D), national language sharing (La), border sharing (Bo), Exchange rate (Exr), Product of GDP of trading pairs (GDP₁*GDP₂) and COVID-19 (COV) had a strong impact on intra EAC trade. COVID-19 pandemic inversely and strongly impacted on intra EAC countries trade and that the occurrence of the pandemic led to fall in intra EAC trade by 41.3% within the first twelve months after it was first reported in EAC community nations. UNECA (2020) revealed that formal merchandise trade (imports and exports) values declined sharply in the second quarter of 2020 when COVID-19 struck EAC countries. Technical barriers to trade (TBT) had hindered trade and resulted to reduced intra EAC countries trade by 440.4%. This implies that more TBT was imposed during the COVID-19 period with most EAC state reporting additional TBT measures in the year 2020 when COVID-19 was ravaging EAC countries just like other countries globally. The TBTs introduced by nations were as a result of efforts to control the spread of Virus where free flow of goods and people was controlled. This finding agrees with Ghodsi (2020) who established major effects of TBT imposed by China on imports. Sanitary and Phytosanitary (SPS) policies directly and strongly explained intra EAC trade. A one percent increase in SPS measures led to improved intra EAC trade by 160.3%. Kinzius, Sandkamp and Yalcin (2019) showed NTBs resulted to falling. Baya (2019) showed that non-tariff barriers strongly explained EAC countries trade.

Distance between the capital cities trading pairs acted as an inhibitor to intra EAC trade given the significant effect of distance on trade value. A one percent more distance in kilometres led to reduced intra EAC trade by 3%. This implies that EAC countries with longer total distance between their capital cities (economic centres) trade less compared to those whose distance between the capital cities are shorter. Longer distance between capital cities implies more transportation cost. Ricardian theory and H-O model assumed that trade between two trading countries has zero transportation cost as captured by distance between trading countries capital cities leads to reduced trade. The product of Gross Domestic Products of reporting country and trading partner strongly explained trade value. A 1% improvement in the product of reporting country and trading partner GDP leads to increased trade value by 291.0%. Gross domestic product acts as mass for trade such that countries within EAC with larger GDP traded more with each other compared with countries with smaller GDPs. Larger GDP means that the countries have more purchasing power in terms of national income hence their demand for products also increases. Khaliqi, Rifin and Adhi (2018) showed that GDP of the importers have direct effect on the export of shrimp from Indonesia. The effect of sharing of national border on trade was direct with trade improving greatly especially in the COVID-19 period. Sharing of border led to improved intra EAC trade by 414.1%. The finding implies that countries that shared a national border traded more with each other especially during the COVID-19 period compared to countries that do not share national borders. Baya (2019) showed that NTBs such as sharing of national language, sharing of border among others explained volume of trade. The sharing of national languages inversely explained trade and that it resulted to 171.3% reduction in intra EAC trade. This finding is against expectation where countries that share national language are expected to trade more with each other. However, the findings agree with Irshad, Xin, Hui and Arshad (2018) where the effect of National language sharing on Trade was inverse. The findings conflict with the Krugman and Obstfeld (2006) modified gravity model which showed that not having a common national official language act as trade inhibitor just like distance between capital cities if trading countries. Stay and Kulkarni (2015) revealed a positive effect of sharing a common national official language and trade between the UK and its trading pairs.

6. Conclusions and Recommendations

The study examined whether SPS & TBT NTBs and other covariates explained intra EAC member countries trade during COVID-19 pandemic period. Pre COVID-19, the effect of the SPS notified by reporting country and its trading partners strongly and inversely explained value of trade. A 1% improvement in the number of notified SPS by reporting country and its trading partner leads to reduced value of trade by 6.9%. This finding implied that SPS was an inhibitor to intra EAC trade such that they reduce the trade values between reporting EAC nation and its trading partners within EAC. The effect of TBT was positive; however, it was not significant hence it can be concluded that between TBT and SPS, SPS was a trade inhibitor in EAC while the effect of TBT remained very low. During COVID-19 period, the pandemic inversely and strongly explained intra EAC countries trade and that the occurrence of the pandemic led to fall in intra EAC trade by 41.3% within the first twelve months after it was first reported in EAC community nations. Technical barriers to trade (TBT) had hindered trade and resulted to reduced intra EAC countries trade by 44.4%. This implies that more TBT was imposed during the COVID-19 period with most EAC state reporting additional TBT measures in the year 2020 when COVID-19 was ravaging EAC countries just like other countries globally. The TBT introduced by nations was as result of efforts to control the spread of Virus where free flow of goods and people was controlled. Additionally, sanitary and Phytosanitary (SPS) policies directly and strongly explained intra EAC trade. A one percent increase in SPS measures lead to improved intra EAC trade by 160.3%. Based on objective three on the direction of causality between SPS and TBT Non-tariff barriers and Trade among EAC member countries in the pre-COVID-19 pandemic period. The study results revealed that only Gross Domestic Product granger caused intra EAC trade with both TBT and SPS non-tariff barriers failing to cause intra EAC trade. Additionally, Intra EAC trade does not granger cause GDP, TBT and SPS. The study thus concluded that only Gross domestic product granger causes Trade with TBT and SPS non-tariff barriers not causing trade. Further, based on the fact that COVID-19 strongly and inversely explained intra EAC trade, the EAC communities should adopt deeper regional integration policies rather than nationalistic policies to combat COVID-19 among its member states. Nationalistic policies of controlling COVID-19 proved to lead to increase in barriers to trade hence inhibiting intra EAC trade. The countries must allow free flow of commodities and factors across national borders of EAC states to ensure trade is not inhibited in any way. The countries should also be prepared for future pandemics that may arise and react more with regionalism policies. Given the significant effect of TBT and SPS barriers to trade based on both annual and monthly data, the study recommends to EAC countries to find robust mechanism of identifying and elimination undesirable TBT and SPS. Further, the countries should adopt standardized TBT and SPS measures across the EAC member states to improve better understanding by exports and importers among member states so as to encourage intra EAC trade. Data scarcity was the main limitation. SPS and TBT data was only available annually from 2014 to 2020 from the World Bank statistics. The study therefore limited the model with TBT and SPS to between 2014 and 2020. Further some trading pairs lacked monthly data on trade amongst themselves. Tanzania and Rwanda did not report monthly intra EAC trade with individual member countries. They only reported on monthly overall trade without specifying the destination. Therefore, on the model based on monthly data, the study thus omitted trade pairs involving Kenya and Tanzania and Kenya and Rwanda. Even with the limitation, the validity of study findings was not affected hence policy recommendations based on findings are sound. It is critical that further research be carried out in effect of TBT and SPS using other proxies different from the one used in this study. This would enable policy maker know whether the parameters change significantly with adoption of different proxies. Another study can also be carried out focusing on specific products given that the effect of COVID-19, TBT and SPS may differ across products.

Conflicts of Interest

“The authors declare no conflicts of interest.”

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