Effect of Transport Infrastructure and Institutions on Inter-Regional Trade in Sub-Saharan Africa

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Abstract
The study investigates the role of transport infrastructure and quality of institutions on trade between the East African Community and three other regional blocs in Sub-Saharan Africa using panel data for the period between 2000 and 2018. By employing gravity model for trade and Poisson-Pseudo Maximum likelihood estimator, the study finds that transport infrastructure facilitates inter- East African Community trade. Additionally, improvements in regulatory quality of the East African Community Partner States and control of corruption of the importing regional blocs have positive effect on East African Community's exports. The findings therefore suggest the need for additional investment in transport related infrastructure and improvement in quality of institutions of the East African Community Partner States for more trade.

Key Words: Transport Infrastructure; Institutions; Trade; East African Community; Sub-Saharan Africa; PPML

JEL Classification Codes: N77, N70, F15

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1. Introduction

Trade liberalization is meant to minimize both quantitative and qualitative barriers associated with trade. While there has been a significant reduction in tariffs in the recent years, a number of soft and hard barriers remain and impede trade (De, 2006). Soft barriers are linked to policies or regulations and can be addressed by trade facilitation measures. Hard barriers are linked to infrastructure and other physical barriers and usually settled by transport facilitation measures. Transport infrastructure and institutional quality are not only key determinants of a country's export levels, but also of the likelihood of exports (Francois and Manchin, 2006).

With increased competition in the international markets, firms have to adjust their production and management systems to ensure timely, reliable and flexible delivery of goods. In Africa however, limited infrastructure and poor transport network hinders firms from participating in international trade since they cannot guarantee timely delivery of goods to ensure reliable supply (Mbekeani, 2007). However, some of the delays in delivery of goods can also be attributed to poor infrastructure in both transit and national economies. Since delays can occur outside the border of a given country, it becomes difficult for a single country to overcome all the trade related obstacles.

The dependence of trade costs on infrastructure development has been emphasized in the modern literature (Anderson and van Wincoop, 2004: de Soyres et al., 2018). Trade costs vary by country, however, average trade costs for African countries seems higher than most countries around the world. The role of infrastructure in determining the volume of trade and access to markets is critical. Trade costs limit the ability of most developing countries in Africa to participate in the international trade. This is linked to lack of well-developed infrastructure and poor-quality institutions. Further, according to Limao and Venables (2001), the median landlocked country incurs transport costs 55 percent higher than the median coastal country and generally have lower trade volumes. There are about 30 landlocked countries in the world, 15 are in Africa, East African Community (EAC) has 4 landlocked countries (including South Sudan). These countries have to rely on the coastal transit countries such as Kenya and Tanzania to access the ports and world markets. Therefore, transport systems in these countries are important to the landlocked countries in the region.

Compared to other regions around the world, as of 2015, Africa and Oceania had the highest international transport costs as a percentage of the import value for all modes of transport. Freight costs were as high as 11 percent of the import values, compared to about 7 percent for the developed countries (UNCTAD, 2015). The share of transport costs in total value of imports can be an indicator of the effect of transport costs on countries' ability to participate in international trade. Therefore, infrastructure development would significantly lower the transport cost of imports and exports, thereby encouraging domestic production, support diversification efforts and increase the competitiveness of African exports.

The existing literature on the determinants on trade flows has given little attention to infrastructure and institutions in the context of inter-regional economic communities. Majority of the studies focused on individual countries and considered only transport infrastructure (hard infrastructure) without taking into consideration the aspects of soft infrastructure such as institutions (Micco and Serebrisky, 2004; Grigoriou, 2007; Bensassi et al. 2014). Others focused only on institutions and their impact on trade (Abe and Wilson, 2008; Beverelli et al., 2018; Alvarez et al., 2018). Very few studies have analysed how both hard and soft infrastructure affects trade. For example, a study by Ochieng et al. (2020) examined the link between infrastructure and institutions and trade in East Africa but did not control for overlapping membership since the sample countries belong to different Regional Economic Communities (RECs) which is likely to impact on the regional trade flows. In addition, the paper did not control for multilateral trade resistance terms. According to Anderson and van Wincoop (2003), failure to control for multilateral resistance in a gravity model estimation result in biased estimates.

Therefore, by controlling for overlapping membership and multilateral trade resistance, this paper complements the existing evidence by focusing on both the impact of transport infrastructure stock and quality of institutions on inter-EAC trade. This is done by analysing the impact of transport infrastructure and institutions on trade between EAC and three main RECs in Sub-Saharan Africa (SSA): Southern African Development Community (SADC), Economic Community of West African States (ECOWAS) and Economic Community of Central African States (ECCAS).[1]

The rest of the paper is organized as follows: Section 2 reviews relevant literature. Section 3 discusses the methodology and data employed. Section 4 discusses the empirical results and section 5 presents the conclusion.

2. Literature

Trade costs are known to negatively impact on trade flows, a phenomenon described by iceberg melting model by Samuelson (1954). Infrastructure development serves to improve trade flows by lowering trade costs. Several studies have investigated the role of infrastructure on trade costs and volume (Wilson, et al., 2005; De, 2006; Bensassi et al., 2014; de Soyres et al., 2018). Recently, the role of institutions on trade flows has been given attention by some studies. For example, Levchenko (2004) asserts that differences in quality of institutions can create comparative advantage which is a crucial determinant of trade flows. Infrastructure and institutions are crucial for trade and countries that are performing poorly in trade and growth could be linked to dilapidated infrastructure and weak existing institutions (Chang et al., 2009; Francois and Manchin, 2013). Institutional quality has also been linked to increased trade flows (Rodrik et al., 2002). Well-developed and functional institutions should lower transaction costs for traders and hence promote the efficiency of markets. De Groot et al. (2003) augmented a gravity model to include a measure for institutional quality and established that greater quality formal institutions are associated with higher trade volumes. They also established that more trade occurs if two trading partners have similar institutional quality.

The critical role of stronger and high-quality institutions in promoting trade is further supported by Beverelli et al. (2018). The authors studied the role of institutions on international trade using data for the period between 1996 and 2006 for a sample of 63 countries. The study found a positive effect of institutions on trade between poor and rich nations. In a similar study, Alvarez et al. (2018) employed gravity model to analyse the role of institutional quality on sectoral and aggregate bilateral trade using data covering the period between 1996 and 2012 for a sample of 186 countries. The study concluded that better institutional quality is associated with more trade since incidences of uncertainty are reduced.

High trade costs can limit both intra-and inter-regional trade. Time taken to transport goods between two destinations, search for information and enforce agreements have implications on trade volumes. Additionally, bilateral trade is likely to be enhanced by quality institutions and

[1] See Table A1 in Appendix for list of member countries of the regional blocs in SSA

good communication infrastructure which act by lowering trade costs (Nordas and Piermartini, 2004). Infrastructure could have significant effect on the time costs associated with trade hence good infrastructure would promote trade (Anderson and van Wincoop, 2004). Infrastructure development can also foster trade and regional integration by encouraging movement of goods and services, individuals and information flow across nations (Clark et al., 2004).

Increased export performance is linked to well-developed infrastructure services particularly transport infrastructure. Infrastructure is significant in determining trade costs, according to Limao and Venables (2001), poor infrastructure accounts for approximately 40 percent of predicted transport costs for coastal countries and up to 60 percent for landlocked countries. They also reveal that for a country with a poorly developed infrastructure, for example, at the 75^{th} percentile in an international ranking, can reduce transport costs by 30 percent by upgrading to the 25^{th} percentile. The authors also analysed the role of infrastructure of the exporter, importer, and transit countries and established all the three categories of infrastructure promote bilateral trade flows. These findings are supported by Grigoriou (2007) who found that improvement in both the origin and destination country's infrastructures boosts exports. Additionally, Wilson et al. (2005) and Sologoa et al. (2006) found that unilateral improvements in trade facilitation measures are linked to increased volume of trade. However, Longo and Sekkat (2004) findings put a caveat on the conclusion by Limao and Venables (2001), they argue that the effect of exporter and importer infrastructures may not act symmetrically for two trading countries with distinct economic features. They concluded that both importers and importers infrastructure promote intra-Africa trade but not inter-Africa trade, in particular, between Africa and developed countries.

Using various measures of trade facilitation for specific countries country-specific data for Asia Pacific Economic Cooperation (APEC) region to determine the connection between trade facilitation and volume of trade, Wilson et al. (2003) established that improved airport and port efficiency positively affects intra-APEC trade, however, regulatory barriers discourage trade. Limao and Venables (1999) used three different data sets to establish how transport depends on infrastructure and geography in SSA trade. Using a basic gravity model, their analysis of bilateral data confirm that a decline in quality of infrastructure from the median to the 75^{th} percentile increases transport costs by 12 percent points and reduces the volume of trade by 28 percent.

By controlling for transactions costs, free trade regime coordination, geographic, economic and political factors, De (2006) used gravity model to investigate the role of transaction costs and infrastructure in explaining trade and access to markets in Asia. Gravity model was employed for 15 Asian countries using data covering the period 2000 and 2004. Using a structural model, he found that transaction costs and trade mobility infrastructure such as roads, rails, ports and telecommunications significantly explain trade variations in Asia. Similarly, using transport indexes for 43 countries covering the period 1996 to 2000, Clark et al. (2004) employed gravity model to establish the determinants of maritime transport costs. To control for endogeneity, they employed instrumental variable technique and established that an improvement in port efficiency from 25^{th} percentile to 75^{th} percentile reduces maritime transport costs by more than 12 percent, resulting in increase in bilateral trade by 25 percent. Micco and Serebrisky (2004) used US import data for the period 1990 to 2001 to identify the determinants of air transport costs using reduced form approach. They found that improving air transport infrastructure and quality of regulation from 25^{th} to 75^{th} percentile lowers transport cost by 15 percent and air transport costs by 14 percent respectively. They further established that reduction in transport costs by 8 percent through open air agreements increases trade by approximately 10 percent.

Some studies have investigated the effect of soft infrastructure on trade. For example, using institutional process and transparency as indicators of soft infrastructure, Abe and Wilson (2008) found that more gains in trade are realized with reduced corruption and improvement in transparency in APEC countries with low trade performance. By controlling for importer fixed effects and exporter remoteness, Freund and Rocha (2011) used World Bank's Ease of Doing Business data for 146 countries and established that transit delays have the largest negative economic effects on African exports. Bensassi et al. (2014) estimated a gravity model augmented for logistics and transport infrastructure using bilateral exports data for 19 Spanish regions and 45 countries covering the period 2003 to 2007. Using a random effects model, their findings suggest that logistics is key in determining trade flows, specifically; the number, size and quality of logistics facilities have positive effect on exports volumes.

A study by Ochieng at al. (2020) analysed how both transport infrastructure stock and institutions affect trade in East Africa region for a sample of 11 countries covering the period 2000 and 2018. By employing gravity model for trade, the authors found that transport infrastructure and developed institutions enhance trade within the East Africa region. This study differs from Ochieng et al. (2020) in three ways. First, while Ochieng et al. (2020) focused only on the East Africa region, this study extends the sample to cover the SSA and by taking into considerations the RECs which have an impact on the trade flows in the SSA region. Second, as opposed to Ochieng et al. (2020), this study goes further to control for the effect of overlapping membership of different RECs in SSA. Third, this study controls for multilateral trade resistance unlike Ochieng et al. (2020) that did not properly control for that.

While evidence on transport infrastructure and institutions and their impact on trade exists, most the studies have focused outside the African region and not focused on RECs (Sologoa et al., 2006; De, 2006; Grigoriou, 2007; Bensassi et al. 2014; Alvarez et al., 2018; Beverelli et al., 2018). With the coming up of African Continental Free Trade Area (AfCFTA) meant to promote intra-African trade, a study which examines how transport infrastructure and quality of institutions affects trade while taking into cognisant the impact of the existing RECs is important. Therefore, this study complements the existing evidence by examining the impact of transport infrastructure and institutions on inter-regional trade in SSA.

3. Methodology

3.1 Gravity Model

The study adopts an augmented Gravity model. Gravity model was first introduced Tinbergen (1962), and later modified by Anderson (1979), to include trade costs under the assumption that each country produces a unique product, which applies the concept of product differentiation. Anderson and van Wincoop (2003) further modified the model to capture multilateral trade resistance (MTR) terms. Gravity model is augmented to include transport infrastructure, institutional and other explanatory variables which are likely to impact on bilateral trade flows. The log-linear form of the equation is as follows:

$$
\begin{aligned}
ln\, EX_{i,j,t} = {} & \gamma_o + \gamma_1 \ln GDP_{i,t} + \gamma_2 \ln GDP_{j,t} + \gamma_3 D_{i,j,t} + + \gamma_4 lnPOP_{i,t} + \gamma_5 lnPOP_{j,t} \\
& + \gamma_6 \ln TI_{i,t} + \gamma_7 lnTI_{j,t} + \gamma_8 CC_{i,t} + \gamma_9 CC_{j,t} + \gamma_{10} RQ_{i,t} + \gamma_{11} RQ_{j,t} \\
& + \gamma_{12} lnAR_{i,t} + \gamma_{13} lnAR_{j,t} + \gamma_{14} OL_{i,j,t} + \gamma_{15} EL_{i,j,t} + + \gamma_{16} WTO_{i,j,t} \\
& + \gamma_{18} CB_{i,j,t} + \gamma_{19} CR_{i,j,t} + \gamma_{20} MM_{i,j,t} + \delta_i \alpha_i + \delta_j \alpha_j \\
& + \varepsilon_{i,j} \qquad (1)
\end{aligned}
$$

Where

i and *j* are exporting and importing regions respectively and *t* is time period. $EX_{i,j,t}$ represents total exports from i^{th} country in EAC region (EAC region) to the j^{th} country in other regional economic blocs in SSA at a given time, *t; GDP* refers to gross domestic product; *D* represents distance between capitals of country *i* and *j* (it acts as a proxy for transport costs); *TI* stands for transport infrastructure index; *POP* stands for population; *CC* represents control of corruption index; *RQ* refers to regulatory quality; *AR* represents land area in square kilometres; *OL* stands for official language dummy, where 1= same official language in country *i* and *j*, 0 –otherwise; *EL* stands for ethnic language dummy, where 1= same ethnic language spoken by 9 % of the population in country *i* and *j*, 0 –otherwise, *WTO* represents dummy for World Trade Organization (WTO) trade agreements, with 1= WTO member, 0 otherwise; *CB* refers to common border dummy, where 1= country *i* and *j* share a common border, 0 –otherwise; *CR* stands for common religion dummy, where 1= same religion between country *i* and *j*, 0 –otherwise; *MM* refers to dummy for multiple membership, where 1= EAC Partner State is also a member of another REC in SSA, 0 –otherwise; $\alpha_i$and $\alpha_j$are exporter and importer fixed effects (MTR terms) and $\mathcal{E}_{i,j}$ is the error term.

3.2 Poisson Pseudo Maximum Likelihood Estimation

In the presence of many zeros [2] in bilateral trade and heteroscedasticity, Poisson Pseudo Maximum Likelihood (PPML) performs well (Silva and Tenreyro, 2006, 2011). PPML assumes conditional variance as proportional to conditional mean. PPML estimator has the ability to produce consistent estimates of the non-linear gravity model. The fact that a PPML estimator is used in estimation does not imply that the data used must follow a Poisson distribution. A functional form of gravity model estimated using PPML is given as:

$$\begin{aligned} EX_{i,j,t} = exp[\gamma_o &+ \gamma_1 \ln GDP_{i,t} + \gamma_2 \ln GDP_{j,t} + \gamma_3 D_{i,j,t} + +\gamma_4 lnPOP_{i,t} + \gamma_5 lnPOP_{j,t} \\ &+ \gamma_6 \ln TI_{i,t} + \gamma_7 lnTI_{j,t} + \gamma_8 CC_{i,t} + \gamma_9 CC_{j,t} + \gamma_{10} RQ_{i,t} + \gamma_{11} RQ_{j,t} \\ &+ \gamma_{12} lnAR_{i,t} + \gamma_{13} lnAR_{j,t} + \gamma_{14} OL_{i,j,t} + \gamma_{15} EL_{i,j,t} + +\gamma_{16} WTO_{i,j,t} \\ &+ \gamma_{18} CB_{i,j,t} + \gamma_{19} CR_{i,j,t} + \gamma_{20} MM_{i,j,t} + \delta_i\alpha_i + \delta_j\alpha_j] \\ &+ \varepsilon_{i,j} \qquad (2) \end{aligned}$$

where

$EX_{i,j,t}$ −The value of bilateral exports from country *i* to *j* at time *t*. This is modelled for each exporting country in the EAC and other Member States of other RECs in SSA.

PPML model generates estimates of $EX_{i,j}$ instead of $lnEX_{i,j}$ hence the problem of underestimation of large trade flows and total volume of trade is avoided (Burger et al., 2009). Furthermore, the estimation of PPML using maximum likelihood technique makes the estimates to be adapted to the actual data, implying that the sum of the predicted values is virtually identical to the sum of the input values.

Another advantage of PPML is that in the presence of heteroscedasticity, the regression estimates are still efficient particularly when large sample is used. In addition, the multiplicative form of PPML gives a natural way to handle the zero-valued trade flows. In the presence of fixed effects PPML is still consistent. Like in simple OLS fixed effects can be applied in a model as dummy variables. This is important when using a gravity model which sometimes include importer and exporter fixed effects.[3] Unlike OLS model which drops zero

[2]Zeros in the gravity model implies no bilateral trade between a pair of countries. In such a case exports or imports are recorded as zeros.

[3]"Alternative Gravity Model Estimators". Accessed at: https://www.unescap.org/sites/default/files/6%20%204.%20Alternative%20Gravity%20Model%20Estimators_0.pdf

trade values in a model, PPML has additional property of including zero trade observations in the model. A sample selection bias may occur when the zero observations are dropped from a model.

3.3 Data

The study covers a 19-year period, between 2000 and 2018. Bilateral exports data was obtained from Direction of Trade Statistics database of the International Monetary Fund and measured in current US dollars; GDP is measured in current US $ obtained from World Development Indicators (WDI) of World Bank; distance is obtained from CEPII database and is measured as the weighted distance in kilometres between the trading capitals; transport infrastructure stock is obtained from African Development Bank (AfDB) Socio-Economic database. Data on population was obtained from WDI while Institutional related indicators, control of corruption index and regulatory quality were obtained from the Worldwide Governance Indicators of the World Bank. Data on the rest of the variables such as land area and dummy variables namely: official language, common ethnic language, WTO, common border and common religion was obtained from CEPII database. Multiple membership dummy was based on authors' elaboration as shown in Table A1 in the appendix.

4. Results and Discussion

4.1 Transport Infrastructure and Inter-Regional Trade in SSA

The regression results are presented in Table 1. From the findings, most of the variables have the expected signs and conform to the theoretical expectations and the Gravity model. The results in Table 1 indicate that both exporter's and importer's transport infrastructure are important for inter-regional trade. An increase in stock of transport infrastructure in EAC by 1 percent leads to an increase in the volume of exports to SADC and ECCAS regions by 0.69 and 0.68 percent respectively. Similarly, an increase in the stock of destination region's infrastructure contributes positively to EAC's exports. Increasing the stock of transport infrastructure in SADC and ECOWAS by 1 percent increases the volume of EAC's exports by 0.93 percent and 0.35 percent respectively. The importing region's infrastructure has a stronger impact on exports compared to the exporting region's infrastructure for EAC-SADC region, implying that the EAC Partner States would benefit more by if the stock of SADC infrastructure improves. The result of a positive relationship between transport infrastructure stock and export volumes conform to the previous findings by Wilson et al. (2005), De (2006), Sologoa et al. (2006), Grigoriou (2007) and Bensassi et al. (2014). The similarity in study findings is linked to the measurement of infrastructure variable, that is, this study and the other studies used transport infrastructure which was measured as stock variable.

Quality of institutions of the exporter countries play significant role in determining the volume of exports between regional economic blocs in SSA. The ability of a government to formulate and implement policies that encourage private sector development is captured by the regulatory quality index. The relationship between regulatory quality of the EAC and exports to other RECs is positive. Hence, improving the regulatory quality of the EAC Partner States has the potential of increasing the volume of EAC's exports to other RECs in SSA. Control of corruption index of EAC has a positive relationship with exports to ECCAS region but not statistically significant for SADC and ECOWAS region. However, an improvement in control of corruption index in SADC and ECCAS would positively contribute to EAC's exports. The impact was negative but not statistically significant for trade between EAC and ECOWAS region. The finding of a positive relationship between regulatory quality and exports are in line with the findings by Francois and Manchin (2013), Alvarez et al. (2018) and Beverelli et al.

(2018) all of which were mainly focused on low-income countries, hence likely to have similar institutional quality.

Table 1: Transport Infrastructure and Inter-EAC Trade

Dependent Variable: Exports		**Method: PPML**	
	EAC-SADC	**EAC-ECOWAS**	**EAC-ECCAS**
Variable	**(1)**	**(2)**	**(3)**
Log of GDP_i	0.855***	2.405***	2.221***
	(0.228)	(0.262)	(0.780)
Log of GDP_j	0.018	0.810**	0.365*
	(0.351)	(0.365)	(0.207)
Log of $Distance$	-2.198***	-2.096***	-8.984***
	(0.285)	(0.739)	(1.862)
Log of $Population_i$	-0.297***	-7.672***	0.712
	(0.684)	(0.990)	(0.768)
Log of $Population_j$	2.088***	-30.043	2.410***
	(0.145)	(26.369)	(0.464)
Log of Transport	0.694*	-0.073	0.679**
$Infrastructure_i$	(0.356)	(0.129)	(0.311)
Log of Transport	0.927***	0.353*	0.988
$Infrastructure_j$	(0.261)	(0.214)	(2.452)
Control of Corruption $Index_i$	-1.202	0.234	0.710***
	(0.836)	(1.021)	(0.170)
Control of Corruption $Index_j$	0.482***	-0.118	2.786***
	(0.161)	(0.236)	(0.903)
Regulatory $Quality_i$	1.869**	0.816*	1.507*
	(0.847)	(0.443)	(0.852)
Regulatory $Quality_j$	0.250	-0.163	-1.743***
	(0.543)	(0.197)	(0.654)
Log of $Area_i$	0.589***	3.725***	1.486*
	(0.207)	(0.300)	(0.827)
Log of $Area_j$	-0.145	0.748***	-3.319***
	(0.117)	(0.105)	(0.945)
Official Language	-0.386	0.658***	2.246***
	(0.400)	(0.247)	(0.387)
Ethnic Language	-0.207	1.644***	0.042
	(0.190)	(0.211)	(0.426)
WTO	0.354	0.676	16.360***
	(0.272)	(0.435)	(4.578)
Common Religion	8.210***	-4.470***	-
	(1.758)	(1.219)	
Multiple Membership	0.618***	-	1.594
	(0.246)		(1.400)
Constant	-39.185***	34.014***	21.018
	(5.064)	(12.394)	(16.052)
Pseudo log-likelih.	**-12411.82**	**-728.66**	**-3682.37**
R^2	**0.7020**	**0.8473**	**0.7523**
Obs	**1350**	**1350**	**809**
Importer FE	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes

Notes: *P<0.10, **P<0.05, ***P<0.01; i and j are exporting and importing countries respectively; standard errors are in parentheses

Other important determinants of inter-EAC trade include GDP of the exporting countries, population of the importing countries and distance and have the expected signs and consistent with theory. The population of EAC has a negative relationship with exports to SADC and ECOWAS, this is attributed to increased domestic market that may discourage exports to other regions. The results also show that the size of land area of the EAC region has a positive impact on exports from EAC to other RECs in SSA. Land area for ECOWAS also positively influences exports from EAC, however, this is negative for ECCAS region. Official language also play an important role in promoting exports from the EAC region. The dummy variable for official language has the expected positive signs for ECOWAS and ECCAS, implying that countries in the two regional blocs are more likely to trade more with EAC because they share official languages. The dummy for ethnic language was positive and statistically significant for ECOWAS but not for SADC and ECCAS regions. The effect of WTO trade agreements is also positive but only statistically significant for ECCAS, signifying the important role of trade of trade agreements in promoting trade in SSA. The results also show that EAC-SADC countries are likely to trade because they have religious affiliations, however, this is contrary for trade between EAC and ECOWAS. The dummy for multiple membership has a positive impact on trade between EAC and SADC, implying more likelihood for trade. Tanzania is a member of both EAC and SADC, hence more likelihood for trade between EAC and SADC. The coefficient of dummy for multiple membership was positive for EAC and ECCAS but not statistically significant.

5. Conclusion and Policy Implications

The paper investigates the role of transport infrastructure and quality of institutions in promoting inter-EAC trade using data on transport infrastructure from AfDB and data on institutions from Worldwide Governance Indicators of the World Bank. The study analysed the performance inter-regional trade in SSA by focusing on trade between EAC and the three other regional economic blocs in SSA namely SADC, ECOWAS and ECCAS. Data on other control variables was obtained from the WDI of the World Bank and CEPII database.

The study estimated an augmented gravity model using PPML and established that transport infrastructure and institutions are important determinants of inter-EAC trade. The results confirm that both importers and exporters transport infrastructure positively influence exports from EAC to other regional economic blocs. Specifically, it is worth noting that EAC's transport infrastructure play an important role in promoting the volume of exports to SADC and ECCAS. While transport infrastructure in both SADC and ECOWAS significantly influence the volume of exports from EAC, ECCAS' transport infrastructure has a positive but not statistically significantly impact on EAC's exports.

The study used regulatory quality and control of corruption as measures of institutional quality. Improvement in regulatory quality of the exporting countries in EAC has a positive statistically significant effect on EAC's exports to other RECs in SSA. This implies that if government policies and regulations are conducive to the private sector, they are likely to expand their operations in terms of investments, production and consequently trade.

The findings reveal that improvement in control of corruption index of the importing regional blocs could significantly boost the volume of exports from EAC. However, this was only statistically significant in SADC and ECCAS but not statistically significant in ECOWAS. Other important drivers of inter-EAC trade include distance which has a negative effect on EAC's exports. Increase in GDP of the exporting countries in EAC has a potential of increasing the volume of exports. An increase in population of other regional economic blocs expands the potential market for goods from EAC hence an increase in exports. EAC is likely to trade more with other regional blocs that they share the same official and ethnic languages with than other regions without common language.

In conclusion, the paper suggests that improving the quality and quantity of EAC's transport infrastructure will promote exports from the EAC region to other RECs within SSA. A good transport infrastructure network promotes trade by lowering transaction costs. Therefore, additional investment in transport infrastructure is critical for inter-EAC trade. In addition, enhancing the quality of institutions will significantly enhance inter-regional trade in SSA.

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APPENDIX

Table A1: List of Member Countries of Regional Economic Blocs in SSA

EAC	SADC	ECOWAS	ECCAS
Burundi	Angola	Benin	Angola
Kenya	Botswana	Burkina Faso	Burundi*
Rwanda	Comoros	Cabo Verde	Cameroon
Tanzania	DRC Congo	Cote D'Ivoire	Central African
Uganda	Eswatini	Gambia	Republic
	Lesotho	Ghana	Chad
	Madagascar	Guinea	Congo
	Malawi	Guinea Bissau	DRC Congo
	Mauritius	Liberia	Equatorial Guinea
	Mozambique	Mali	Gabon
	Namibia	Niger	Sao Tome Principle
	Seychelles	Mali	Rwanda*
	South Africa	Niger	
	Tanzania*	Nigeria	
	Zambia	Senegal	
	Zimbabwe	Sierra Leone	
		Togo	

Note: In this study, countries from EAC such as Tanzania, Burundi and Rwanda have multiple membership, therefore, a dummy was introduced to control for effect of multiple memberships.

Table A2: Summary Statistics of Variables used in Gravity Model

Variable	EAC-SADC		EAC-ECOWAS		EAC-ECCAS	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Exports (Millions)	15.91	67.37	0.60	2.95	10.98	40.70
GDP_i	$1.91\text{x}10^{10}$	$1.97\text{x}10^{10}$	$1.91\text{x}10^{10}$	$1.97\text{x}10^{10}$	$1.91\text{x}10^{10}$	$1.97\text{x}10^{10}$
GDP_j	$3.18\text{x}10^{10}$	$7.50\text{x}10^{10}$	$2.84\text{x}10^{10}$	$8.47\text{x}10^{10}$	$1.86\text{x}10^{10}$	$2.71\text{x}10^{11}$
Distance	2328.15	663.60	4717.93	1030.15	2467.04	844.10
$Population_i$	$2.71\text{x}10^7$	$1.59\text{x}10^7$	$2.71\text{x}10^7$	$1.59\text{x}10^7$	$2.71\text{x}10^7$	$1.59\text{x}10^7$
$Population_j$	$1.54\text{x}10^7$	$1.89\text{x}10^7$	$1.99\text{x}10^7$	$3.76\text{x}10^7$	$1.44\text{x}10^7$	$1.96\text{x}10^7$
TI $Index_i$	8.58	3.58	8.58	3.58	8.58	3.58
TI $Index_j$	14.32	13.24	7.34	6.16	3.95	4.03
CC $Index_i$	-0.70	0.51	-0.70	0.51	-0.70	0.51
CC $Index_j$	-0.34	0.70	-0.62	0.52	-1.11	0.42
RQ $Index_i$	-0.45	0.39	-0.45	0.39	-0.45	0.39
RQ $Index_j$	-0.51	0.74	-0.69	0.44	-1.07	0.34
$Area_i$ sq. kms	364,589.2	354,439.3	364,589.2	354,439.3	364,589.2	354,439.3
$Area_j$ sq. kms	596,032.1	631,561.4	340,949.7	418,364	733,679	719,490.4
Observations	1,425		1,425		854	

Note: SD is standard deviation, TI is transport infrastructure, CC is control of corruption, and RQ is regulatory quality