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Determinants of intra-East Africa Community (EAC) trade

Maleshoane Majara

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Corresponding author: majaramv@gmail.com

Determinants of intra-East African Community trade

Maleshoane Majara

Corresponding author: Maleshoane Majara (majaramv@gmail.com)

Abstract: In spite of the existence of trade arrangements, including a common market, trade patterns are low within the East African Community (EAC). However, trends in trade with non-EAC members have shown significant growth, and seem to be increasing more than trade among members. Thus trade agreements that aim to foster trade within the EAC seem not to have achieved any real economic progress, and the theoretical benefits of regional integration have not significantly materialized in East Africa. Empirical study is required to offer diagnostic and better knowledge about intra-EAC trade patterns and to pinpoint the factors that affect trade flows within the EAC. This paper therefore aims to examine trade intensity, and to identify factors that restrict trade expansion among EAC members.

Keywords: trade, regional integration, intra-Africa trade, East African community, gravity model, Hausman-Taylor model
JEL classification: F10, F12, F14, F15

1 Introduction

1.1 Background information

Given the scarcity of resources and the fact that no country can independently satisfy the needs and wants of its population, world trade has gained popularity and become the most reliable way of promoting growth. World trade has also become a significant factor in improving standards of living, creating employment, improving countries' balance of payments, and making it possible for consumers to have a wide variety of goods and services to choose from (Vijayasri 2013). Current examples of some of the benefits of world trade are those brought by the African Growth and Opportunity Act (AGOA).[1]

Since the passing of the AGOA, the region's abundant natural resources and blossoming economic potential have attracted more foreign investors. These include state-supported enterprises from countries such as China, which has become sub-Saharan Africa's largest trading partner (Williams 2015). Another notable mark made by the AGOA is the creation of jobs for thousands of Africans, improving citizens' standards of living and helping to alleviate poverty on the continent (Williams 2015). It is trade benefits such as these that have made world economies grow into a single highly integrated global market (OECD 2017).

Notwithstanding these trade benefits, the impacts of commodity price shocks and unbalanced trade gains, whereby some economies lose out regardless of overall net benefits, are a major concern. To confront these daunting experiences and strengthen global bargaining power, the OECD (2017) has advocated that countries should pool their resources in regional arrangements. This is because it is believed that effectively integrating countries on a regional level will assist such economies to tap into global markets.

Defining the concept, Hill (2011) indicated that regional integration refers to an agreement between countries which belong to the same geographical region, with the aim of improving trade patterns by eliminating tariffs and non-tariff barriers among member countries (Hill 2011). However, even though eliminating trade barriers is an important step in improving trade patterns, the desired effects will not be experienced if the removal of trade barriers is not complemented by other trade policy measures Hill (2011).

Accordingly, in an attempt to induce trade and investment policies and to provide a remedy for Africa's fragmentation, African leaders have advocated unity (integration). Among others, Ghana's Kwame Nkrumah was one of the visionary leaders who advocated unity in Africa. Nkrumah believed that regional integration would ensure that Africa would be taken seriously on the world stage, and would help the continent to be an independent actor. The initiative was also believed to be Africa's remedy to its 'twin problems' of high poverty and low levels of economic growth (Jordaan 2014). Furthermore, Seid (2013) indicated that a call for strong and viable intra-Africa unity would help the continent to reap gains from economies of scale, promote industrialization, and accelerate growth.

Moreover, 16 of the 54 African countries are landlocked. It is believed that this situation hinders these countries from independently experiencing economic growth. Thus, the geographical

[1] Roughly 40 sub-Saharan African countries have AGOA beneficiary status, including five EAC members: Burundi, Kenya, Rwanda, Tanzania, and Uganda (Mfumukeko 2016).

structure of some countries in Africa is said to deprive these countries of the opportunity to expand and become independently competitive (Alemayehu and Haile 2008). Authors believe that trade integration is therefore an imperative that will help Africa to address and reorganize the skewed trading practices which in the past maintained the continent's over-reliance on exporting primary commodities. In the same vein, Jordaan (2014) maintains that Africa's geographical structure, low economic growth, and high reliance on international markets are driving forces in the formation of regional trade unions.

The history of debates around regional integration in Africa dates as far back as the early 1900s, when the South African Customs Union was established (Olivier 2010). It was believed the union would be the most efficient step towards achieving the common goal of 'pan-Africa', a united Africa working together with the aim of creating a better future for the continent (Olivier 2010). It was this vision that gave rise to the formation of numerous Regional Economic Communities (RECs) operating at the subcontinental level and serving the agenda of regional integration (Olivier 2010). To date, there are eight RECs on the continent (Seid 2013).

Unfortunately, the plethora of regional trading blocs has given rise to almost all, if not all, African countries being members of more than one REC. This issue of overlapping membership is argued by some to be one of the factors that hinder the process of integration (Seid 2013). Notwithstanding the existence of these numerous RECs in Africa, the record on intra-African trade has been a disappointing one, with trade flows still influenced by colonial and historical ties (Jordaan 2014).

Table 1: Share of exports from Africa's RECs, 2012–15

	REC member countries		Non-REC member African countries		Non-African countries	
REC	2012	2015	2012	2015	2012	2015
Southern African Development Community (SACD)	17.3	19.5	2.3	2.7	80.4	77.8
East African Community (EAC)	19.7	18.1	13.9	15.2	66.4	66.6
Economic Community of West African States (ECOWAS)	7.6	12.1	5.0	6.3	87.4	81.6
Intergovernmental Authority on Development (IGAD)	14.4	12.0	12.8	14.2	72.8	73.8
Common Market for Eastern and Southern Africa (COMESA)	7.6	11.7	3.4	5.6	89.0	82.7
Arab Maghreb Union (UMA)	2.1	3.4	1.3	2.7	96.6	93.9
Economic Community of Central African States (ECCAS)	0.8	1.5	4.1	4.9	95.1	93.6

Source: International Monetary Fund (2016).

As the statistics in Table 1 show, the notion of building a united Africa with improved levels of intra-African trade has not significantly materialized. This is because trade between REC member countries is very low, while trade between these countries and non-African countries continues to flourish. Notwithstanding positive developments in most African RECs, the lack of progress and weak intra-regional trade—regardless of a number of treaties—calls for further exploration. Should the weakness of intra-African trade solely be associated with a lack of policy implementation? Or should it be associated with some features of African countries, features which led Foroutan and Pritchett (1993) among others to believe that even without trade restrictions, the scope of Africa's trade is basically modest? The current study sets out to address these questions by investigating other determinants of intra-regional trade. This follows from the fact that, as Hill (2011) has argued, eliminating tariffs alone seems not to be enough to achieve

high intra-regional trade. Given the time frame and scope of the current research, the focus will be confined to examining factors that account for low intra-regional trade in the case of the EAC.

1.2 EAC

In an attempt to reduce Africa's reliance on nations outside the continent, African governments have committed themselves through successive agreements to pursuing a united Africa. The motive behind the efforts towards the continent's regional integration lies in the history of colonialism. Trade in Africa has been seen as a way of putting an end to heavy reliance on the continent's colonizers. Among the most successful unions on the continent is the EAC, the regional intergovernmental organization of Burundi, Kenya, Rwanda, South Sudan, Uganda, and the United Republic of Tanzania (Drummond et al. 2015).

The EAC was founded in 1967, with Tanzania, Kenya, and Uganda being the only members at that time. In 1977 the EAC collapsed; it was revived in 2000. Thereafter the organization expanded and became a united and successful organization of six member countries, with South Sudan being the sixth member. To achieve high intra-EAC trade, trade liberalization was one of the most significant tools in the EAC policy agenda. Unlike other RECs in Africa, which have mostly relied on free trade to induce trade among partner states, EAC has gone beyond free trade: in an attempt to boost trade among its member states, it has established a customs union.

A common market was another trade initiative on the EAC's agenda. This initiative was brought into force in 2010 as one of the endeavours to further liberalize intra-EAC trade (Drummond et al. 2015). In 2013, the EAC members signed a joint protocol—the EAC Monetary Union—with the aim of further improving regional integration. The EAC Monetary Union was intended to be a stepping stone to introducing a common currency among EAC member states (Drummond et al. 2015).

The fourth step after the customs union, the common market, and the monetary union was political federation. In May 2017, political confederation was adopted by EAC heads of state as a transitional model for EAC political federation. These initiatives—the customs union, the common market, monetary union, and political federation—are the efficacious key strategies towards improved regional integration that make the EAC stand head and shoulders above other African RECs: most RECs are yet to implement a common market (African Development Bank 2014).

The United Nations Economic Commission for Africa's (2018) report states that even though there is room for improvement, the EAC has made more progress in intra-regional trade than other trading blocs in Africa. This is corroborated by the statistics in Table 1. Thus, the organization is seen to be proceeding at a faster rate than most other African RECs. Most of the EAC's policies for high regional integration have been successfully implemented, and others are making progress, whereas other RECs on the continent, such as IGAD, ECCAS, and UMA, are still lagging behind (Table 2). Furthermore, according to the African Development Bank (2014), the EAC has made the greatest linear progress towards economic integration, and it is regarded as the most ambitious African REC. This is also corroborated by Table 2.

Table 2: Progress towards economic integration of RECs in sub-Saharan African

REC	Free trade	Customs union	Common market	Monetary union	Political federation
UMA					
COMESA					
EAC					
ECCAS					
ECOWAS					
IGAD					
SADC					

Note: Green=achieved; orange=in progress; blue=planned; white=not planned.

Source: African Development Bank (2014).

Notwithstanding the organization's progress, the EAC is still engulfed in debilitating challenges, some of which send chilling messages about the existence of the organization itself. One such challenge is that all EAC member countries trade more with non-members than they do with fellow EAC members. Another notable issue faced by the EAC is the multiple and overlapping memberships of partner countries. Every EAC member is a member of more than one REC. According to Mengistu (2015), this is an indication of the members' lack of commitment to the REC, which indeed further questions the significance of the REC itself.

Furthermore, the trading baskets of the EAC member countries seem to be uniform. Imports and exports among EAC countries are mostly dominated by raw materials, which then forces these countries to seek other categories of goods from non-EAC members (Mfumukeko 2016). This view is consistent with the data presented in Figures 1–6. It is because of these challenges that this study seeks to unpack some of the reasons why, regardless of all the progress made, constraints still remain within the EAC. The data presented in Table 1 and 3–8, and in Figures 1–6, seems to cast some doubt on the significance of the REC.

So, is there potential for intra-EAC trade after all? If so, what are the major restraints holding EAC partner states from realizing the gains of regional integration? It is this gap that makes one believe there might be other factors responsible for low intra-EAC trade. This implies that it takes more than being part of the best REC to realize improved trade patterns. While other RECs such as IGAD, UMA, and ECCAS would be advised to work towards implementing the ingredients of high trade integration listed in Table 2, the EAC has to try a different toolkit, since it is now on the verge of exhausting the list in Table 2. Hence, exploring other determinants of intra-EAC trade may also be of help in assisting other African countries to realize high regional integration and improved trade balances.

Like many other African countries, EAC members are characterized by a commodity composition of exports heavily dominated by primary products and a lesser proportion of manufactured goods. Their commodity structure of imports is mainly weighted towards manufactured goods and capital goods, and a high concentration of their trade is with China, India, and the United States (OECD 2017). According to Martin (2001), this high dependence of African countries on primary exports reflects a lack of investment in the infrastructure, equipment, plant, and skills required to successfully take part in global markets. These trade patterns within the region are cause for concern to proponents of regional integration as a panacea for increased economic growth. Almost all EAC members have a high export product share in primary products (seen in Tables 3–8), and this jeopardizes the trade balances of member states. Thus the establishment of the EAC and the elimination of trade tariffs is not enough to realize the benefits of regional integration in Africa. Hence an empirical study that looks at other determinants of trade integration is highly relevant.

Table 3: Burundi's top five export and import partners

Market	Partner share (%)	Exporter	Partner share (%)
Democratic Republic of the Congo (DRC)	24.85	China	12.58
Switzerland	19.79	India	11.98
United Arab Emirates	12.74	**Tanzania (EAC)**	**7.85**
Kenya (EAC)	**11.80**	**Kenya (EAC)**	**6.46**
Singapore	4.66	South Arabia	6.34

Source: World Bank (2016).

According to Table 3, a high percentage of Burundi's exports is destined for non-EAC members. Kenya is the only EAC member among Burundi's top five markets; it has a low percentage share of Burundi's exports. Thus, although Kenya imports some of its products from Burundi, it does so at a low rate (11.80 per cent), yet the DRC—a non-EAC member—has a share of 24.85 per cent of Burundi's exports. Further, Tanzania and Kenya are among Burundi's top five exporters. However, the export share of these two EAC members is less than 10 per cent, yet those of non-EAC members (China and India) are above 10 per cent. The statistics in Table 3 provide conclusive evidence that Burundi trades more with non-EAC countries than it does with other EAC members.

Table 4: Kenya's top five export and import partners

Market	Partner share (%)	Exporter	Partner share (%)
Uganda (EAC)	**11.90**	India	18.29
United Kingdom	7.88	China	12.92
Tanzania (EAC)	**7.66**	United Arab Emirates	8.31
Netherlands	6.83	Japan	5.93
United States	6.27	South Africa	5.01

Source: World Bank (2016).

Table 4 shows Kenya's top five trading partners. Among Kenya's markets, two EAC members, Uganda and Tanzania, are among the top five trading partners. There are no EAC members among Kenya's top five exporters. This is disappointing given that Kenya is regarded as one of the EAC's giants. One would have expected Kenya to be among the EAC countries that strive for high regional integration, given that it has been the most dominant player in the region (Mburu 2014).

Table 5: Rwanda's top five export and import partners

Market	Partner share (%)	Exporter	Partner share (%)
DRC	31.82	China	21.24
Kenya (EAC)	16	**Uganda (EAC)**	**11.24**
United Arab Emirates	14	**Kenya (EAC)**	**7.84**
Switzerland	8.83	India	7.42
Burundi (EAC)	**5.78**	United Arab Emirates	5.80

Source: World Bank (2016).

According to Table 5, the DRC is Rwanda's top trading market with a share of 31.82 per cent, which is 15.82 per cent higher than that of Rwanda's second trading market (Kenya). Even though Kenya and Burundi are among Rwanda's top five trading markets, these EAC members' partner shares are 15 per cent less than that of Rwanda's main trading market, the DRC. Moreover, Kenya is Rwanda's only EAC exporter. Thus, Table 5 confirms widely held views about the challenges besetting regional integration among EAC members.

Table 6: Tanzania's top five export and import partners

Market	Partner share (%)	Exporter	Partner share (%)
Switzerland	16.19	China	20.80
India	14.82	India	18.14
South Africa	13.32	United Arab Emirates	7.52
China	7.47	South Africa	6
Kenya (EAC)	**6.62**	Japan	4.71

Source: World Bank (2016).

Table 6 shows Tanzania's top five trading partners. Kenya is the only EAC member that is one of Tanzania's top five trading partners, with a percentage share of 6.62. There are no EAC members among Tanzania's top five exporters. Given that Tanzania is among the EAC's best trading partners, the fact that the country seems to trade more with non-EAC members than it does with member states implies that it takes more than within-border initiatives to improve intra-regional trade.

Table 7: Uganda's top five export and import partners

Market	Partner share (%)	Exporter	Partner share (%)
Kenya (EAC)	**18.84**	India	20.87
South Sudan (EAC)	**11.69**	China	15.83
Rwanda (EAC)	**10.48**	**Kenya (EAC)**	**10.03**
Democratic Republic of Congo	6.73	United Arab Emirates	7.34
Unspecified	5.47	Japan	6.27

Source: World Bank (2016).

Table 7 shows Uganda's top five trading partners. Uganda is the only EAC member whose top three trading markets are fellow EAC partners; with the other EAC members, it is the DRC that occupies the first rank. China and India have the highest exporter shares for Uganda, with Kenya occupying third position.

Table 8: South Sudan's top five export and import partners

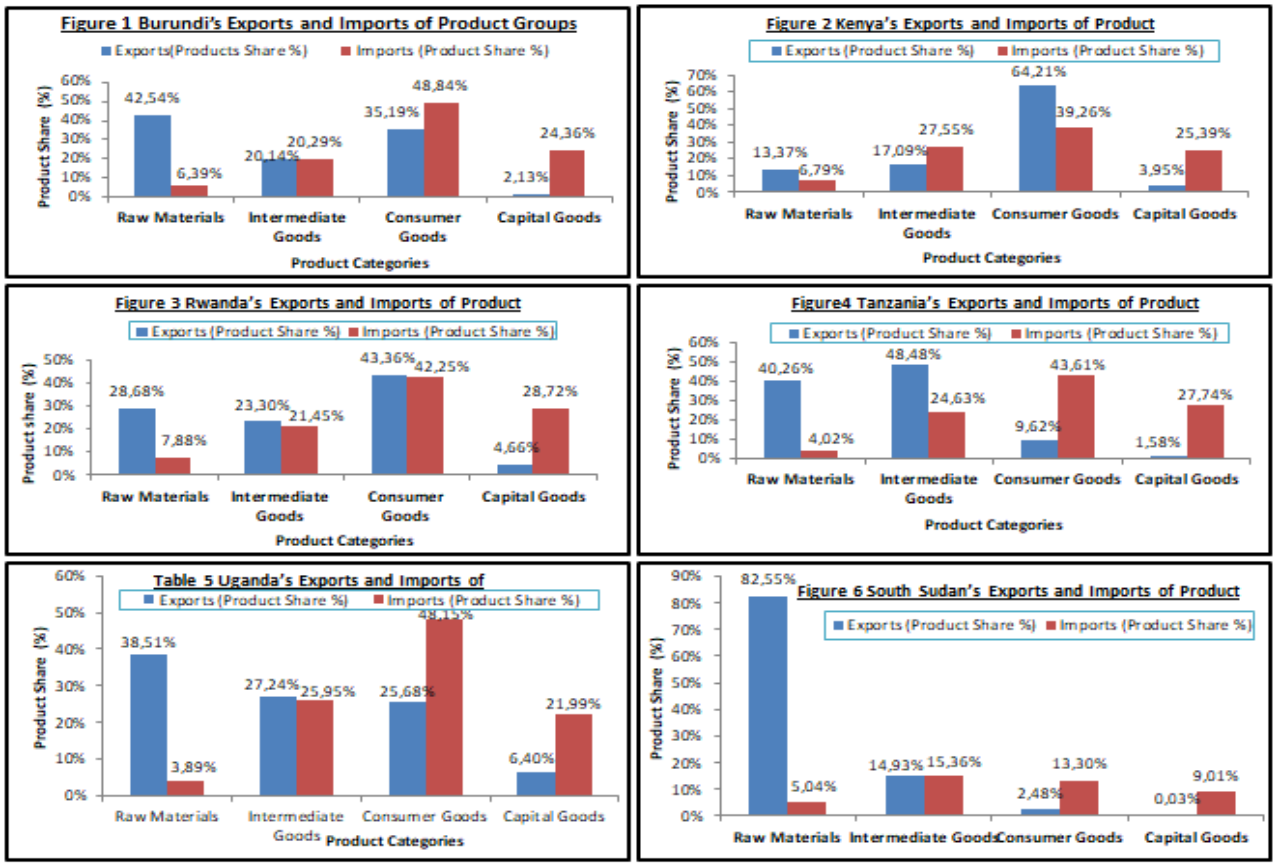
Market	Partner share (%)	Exporter	Partner share (%)
China	52.43	China	22.76
United Arab Emirates	14.42	Jordan	8.59
Saudi Arabia	14.38	India	8.53
India	3.65	Egypt	6.49
Egypt	2.72	United Arab Emirates	5.57

Source: World Bank (2016).

According to Table 8, there are no EAC members among South Sudan's top five markets or exporters. This raises questions about the initiatives the EAC has put in place to promote trade among EAC partners.

Moreover, since Africa is abundant with a large quantity of raw materials, one might expect African countries to extract and process these resources into finished goods and then export them. However, as Figures 1–6 show, the EAC's exports are mostly raw materials, and a large proportion of its imports are finished products—imported mostly from non-EAC countries, according to Tables 3–8. This implies that in order to meet demand, other product categories (consumer goods and capital goods) have to be imported from other countries.

Figures 1–6: EAC countries' exports and imports by product group



Source: World Bank (2016).

2 Literature review

This section provides a review of the literature on the determinants of intra-regional trade. The section is divided into theoretical and empirical literature, presented in sections 2.1 and 2.2 respectively.

2.1 Theoretical literature

The literature on regionalism dates back to Viner (1950). Viner's view was that the impacts of regional integration can be either 'trade-diverting' or 'trade-enhancing'. He argued that, as with any other form of trade liberation, the main objective of regionalism was to enable producers to expand their production and then reap the benefits of the economies of scale. Consumers and less competitive producers who would collapse if they were to compete in global markets would be the beneficiaries of such initiatives. Viner (1950) called this 'trade creation (enhancing)'. He further indicated that after the formation of economic unions, goods under consideration would become cheaper. This was because the benefits of trade creation lay in the elimination of custom tariffs at the borders of integrated members, leading to further price reductions.

Trade diversion, on the other hand, would transpire when the elimination of tariffs among member states led to trade flows being diverted from cost-efficient member states to less efficient ones. Viner (1950) indicated that trade creation would only happen when member states shifted their reliance on high-cost products supplied by local firms to importing from low-cost trading partners,

whereas trade diversion would happen when expensive products from member countries were replaced by cheaper products from non-member states. Marinov's (2015) take on this is that consumers within a trade bloc import goods and services at relatively low prices. This is because trade between trading partners is free of tariffs, which then boosts consumers' savings.

Thus the initial understanding was that regional integration had the ability to increase intra-regional trade performance and improve efficiency by expanding markets. This was believed to be welfare-enhancing. However, Viner (1950) contended that the welfare-enhancing effects of preferential trade negotiations were somewhat ambiguous if the agreements only depended on eliminating tariffs. According to Viner, there was more to high intra-regional trade than just eliminating tariffs; hence countries should look beyond border trade measures to reap the benefits.

Baldwin and Venables (2004) indicate that the determinants of intra-regional agreements depend on allocation, accumulation, and location factors. Accumulation is said to operate through technology or infrastructure spillover effects, which in turn influence the long-term growth and development of trading partners. The authors further indicate that this effect has an impact on factor prices, such as the rate of return on capital for members and non-member countries. This is believed to have an influence in increasing the proportions of investment in physical and human capital. This can lead to an agglomeration effect, contingent on trade cost changes. Moreover, trade within countries in the same region is believed to offer a solution to structural challenges faced by small national markets, and also to be a strategic component for mitigating the negative impact of imbalanced multilateralism (Anderson and Blackhurst 1993).

Similarly, Biswaro (2003) indicates that previous literature on regional integration has emanated from comparative advantage theory. Biswaro points out that regional integration initiatives also have their roots in liberal economists' interest in improving trade patterns by eliminating tariffs and non-tariff barriers between partners. Such initiatives also build on policies that induce unity among members and trade restrictions against non-member countries. Other ingredients include the free movement of production factors, the harmonization of policies, and the acceptance of a common currency. The motive behind fostering closer regionalism implies the development of new policy rules. This involves developing regional trade mechanisms that encourage intra-regional trade flows, and imposing rules which ensure no trade defection (Biswaro 2003).

Additionally, Calì (2009) indicates that if economies are to enjoy the benefits yielded by intra-regional trade, there are vital determinants of intra-regional trade that can act in favour of member states. According to Calì, geographical location is a non-tariff natural barrier to access to particular markets which can be targeted through effective government intervention. According to a report by the World Trade Organization (2013), there are six factors that have an impact on regional trade: demographic change, investment, technology, institutions, transport costs, and energy and other natural resources. According to the report, demographic change affects trade via import demand and countries' comparative advantages. The report indicates that an ageing population, an improved education system, migration, and female participation in the labour force are also vital for improving trade performance. Moreover, physical infrastructure investment is believed to facilitate economies' integration into regional supply and demand chains.

On the other hand, capital accumulation, improvements in technology, and the knowledge associated with investment, especially foreign direct investment, can enable economies to move up the value chain by altering their comparative advantage. The World Trade Organization (2013) also indicates that technological progress in one country can have positive spillover effects on other member states. For instance, landlocked countries depend on appropriate infrastructure established to smooth trade movements. Other countries in the region can also have a stronger influence on the provision of public goods, which may include hard and soft infrastructures.

Maruping (2005) also believes that infrastructure has the ability to unlock opportunities for economic development, regional and global commerce, and enhanced global competitiveness. According to the World Trade Organization (2013), policy actions that aim to reduce transport costs and to offset the impacts of increased fuel costs are necessary for improving regional trade. This can be accomplished by improving the quality and quantity of infrastructures, establishing more competition on transport routes, and encouraging innovation. Lastly, the World Trade Organization (2013) report indicates that improving the quality of institutions, particularly in relation to contract enforcement, can also reduce trade costs.

2.2 Empirical literature

Most studies that aim to determine intra-regional trade have followed Tinbergen's (1962) seminal work. In a pioneering attempt to model economic networks, Tinbergen proposed the gravity model of international trade. Employing this model, he studied the trade patterns of the European Community, the Association of South-East Asian Nations (ASEAN), Mercosur, and Australia-New Zealand (Frankel and Wei 1997). His findings revealed that trade blocs had a strong influence on bilateral trade. The results showed that Australia-New Zealand and ASEAN boosted trade among their partner states fivefold and more. The findings also showed that regardless of high levels of intra-European Community integration, trade between 1960 and 1970 was mostly affected by countries' size, economic development, common language, contiguity, and proximity.

Examining the potential of Africa's regional and internal trade with a particular emphasis on West and Central Africa, Geda and Seid (2015) make use of the Poisson pseudo-maximum likelihood estimator. Their results are statistically significant and have the expected signs. The proxy for multilateral resistance—the remoteness index—is found to significantly affect bilateral trade; a proxy for preference—per capita income—is found to negatively affect bilateral trade. Moreover, Makochekanwa (2012) employs the panel gravity approach to determine the impacts of regional trade agreements on selected food products (rice, maize, and wheat). This analysis is made for three African RECs: COMESA, SADC, and EAC. He finds that the coefficients of the traditional gravity variables significantly affect trade patterns. Given these findings, Makochekanwa (2012) concludes that the three trade blocs have an impact on the selected agro-foods.

Another relevant study determining key factors in the dynamics of regional trade integration is by Zannou (2010), who also applies the gravity model to geographical, socio-cultural, commercial, and economic factors, using data on ECOWAS. Zannou employs pooled ordinary least squares (OLS) estimation and fixed effect methods. According to the results, economic growth has a great influence on intra-community trade patterns. Population growth is also found to proportionately affect trade patterns among ECOWAS members. Trade factors such as language, geography, and common currency are also believed to trigger trade flows.

At the economic policy level, national currency appreciation penalizes regional trade flows by reducing trade patterns, whereas commercial openness is found to positively stimulate intra-regional trade flows (Zannou 2010). When all fixed effects are taken into account, exchange rates, population, and openness are the only factors that are found to affect intra-ECOWAS trade. On the other hand, per capita income seems to have an influence when other fixed factors are controlled for. This implies that there are other factors influencing ECOWAS trade that are not taken into account in Zannou's model. These factors can explain the volume of intra-regional trade in a greatly superior manner to economic dynamics (Zannou 2010).

In addition, after a rich study of factors influencing intra-regional trade, Marinov (2015) concludes that the basis underlying regional integration in developing countries cannot only be explained by the dynamic and static effects which regulate integration within developed economies. Marinov

believes that this is because in developing countries, some trade determinants have a strong influence on trade patterns. Controversially, he suggests that other factors have a weak influence on countries' willingness to participate in regional trade blocs. Given these findings, Marinov argues that in order to assess the determinants of integration, factors such as economic development, production characteristics, economic structure, demand preferences, trade policies, and regimes need to be taken into account.

3 Methodology and data

3.1 Gravity model

The commonly used analytical framework for international trade is the gravity model. The model has been applied in numerous articles and research papers covering all trade areas. The model's popularity emanates from its ability to estimate the impacts of various trade disciplines, from the traditional view of tariffs as the main determinant of trade, to the new approach that looks into 'behind-border' measures (Anderson 2016)—which is the key focus of the current study. Thus, the current study will go beyond within-border measures.

The first attempts to apply the gravity model date from the early 1960s (Poyhonen 1963; Tinbergen 1962). Thereafter the model gained popularity and was believed to produce a good fit in various economic disciplines. The original gravity model of economic interaction over space was inspired by Newton's law of physical gravity (Anderson 2016). The thinking behind this was that economic flows could differ with the masses of economic activity at departure and destination, and negatively with the distance between departure and destination (Anderson 2016).

Despite the model's success, the gravity model has been criticized for lacking theoretical foundations (Matyas and Konya 2004). In Shinyekwa and Othieno's (2013: 9) words, 'the model was heavily criticized for lacking the ingredients of prominent models of international trade that include the Ricardian model […] and the Heckscher-Ohlin (H-O) model […] as the basis for trade theories'. However, this is certainly no longer the case, given the growing advancements made in both theoretical and empirical work on the gravity model: 'it is remarkable to observe that in the space of a little more than a decade, the gravity model has gone from a theoretical orphan to having several competing claims to maternity' (Serlenga and Shin 2004: 4). Following the criticisms of the lack of theoretical framework, trade economists provided theoretical justifications for the model, based on different foundations. The first initiative was that by Anderson (1979), who provided a theoretical foundation for the model based on constant elasticity of substitution, goods differentiated by country of origin, and preferences for goods—the 'Armington assumption'. The implication of this assumption is that at equilibrium, all countries are expected to participate in trade. In Bergstrand's (1985) view, the gravity model of trade is based on monopolistic competition, established by Krugman (1980). According to Bergstrand, the implication of the model is that countries with homogenous characteristics trade different commodities because consumers' preferences differ.

3.2 Model specification

This subsection draws its inspiration from Anderson (1979), Bayoumi and Eichengreen (1997), Cheng and Wall (2005), and Portugal-Perez and Wilson (2012). The subsection begins with the traditional gravity model. The rationale behind this model is that trade flows are based on countries' economic sizes and the distances between trading partners (Roy and Rayhan 2012). The standard proxy for size is gross domestic product (GDP) (Shinyekwa and Othieno 2013). The

derivation of the model, however, will not be shown in the current study, since a number of published articles have made sufficient contributions to deriving the model.

The mathematical formulation of the traditional gravity model is expressed as:

$$T_{ijt} = \alpha {Y_{ijt}}^{\beta_1} {D_{ij}}^{\beta_2} \varepsilon_{ijt} \quad [1]$$

where T_{ijt} represents trade flows between countries i and j at time t. Trade flows may be exports, imports, or net exports. Given the objective of the current study, T_{ijt} represents net exports among EAC countries at time t. Y_{ijt} represents countries' GDP. DIS_{ij} represents the geographical distances between EAC countries: Arusha (the site of the EAC headquarters) is used as the reference point to calculate the straight-line distance between each EAC country and Arusha. This is calculated from a standard map of the world constructed to scale. α and β are the parameters to be estimated. ε_{ijt} represents the error term, assumed to follow a normal distribution with zero mean and constant variance.

In Anderson and Wincoop's (2004) view, the traditional gravity model does not fully explain trade flows between trading partners. It is for this reason that some authors incorporate a set of dummies and other variables that provide a further explanation of trade patterns among trade partners. Dummies believed to be vital determinants of intra-trade include a common language, a common border, whether a country is an island or landlocked, and membership of a regional trading agreement. Given the robustness and significance of incorporating these dummies, this study also incorporates these variables.

Furthermore, in investigating the determinants of intra-EAC trade, the current study—like Portugal-Perez and Wilson's (2012) study—enriches the traditional gravity model by including infrastructure. This is because it is believed that distance does not fully describe transport costs; hence incorporating infrastructure gives a more reliable estimate of transport costs. Moreover, there are other variables that are also believed to be vital in determining intra-trade, but whose inclusion in international trade research is still lacking. Hence, in order to contribute to the literature, the current study improves the gravity model by adding such variables. These include population, terms of trade, fiscal policy, and exchange rate.

Incorporating these variables, the augmented gravity model becomes:

$$T_{ijt} = \alpha {Y_{ijt}}^{\beta_1} {DIS_{ij}}^{\beta_2} {POP_{ijt}}^{\beta_3} {TOT_{ijt}}^{\beta_4} {FIS_{ijt}}^{\beta_5} {EXC_{ijt}}^{\beta_6} {INFRA_{ijt}}^{\beta_7} {BORD_{ij}}^{\beta_8} {LANG_{ij}}^{\beta_9}$$
$$ {LAND_{ij}}^{\beta_{10}} {EAC_{ijt}}^{\beta_{11}} {OTHER_{ijt}}^{\beta_{12}} \varepsilon_{ijt} \quad [2]$$

POP_{ijt} represents the population at time t. TOT_{ijt} represents terms of trade for each member at t. FIS_{ijt} represents fiscal policy for each member at t. EXC_{ijt} represents the exchange rate of EAC members at t. $INFRA_{ijt}$ represents transport- and trade-related infrastructure between EAC members at t. $BORD_{ij}$ represents a dummy for EAC members with a common border, taking the value of one if they have the same border and zero otherwise. $LANG_{ij}$ represents a dummy for a common language, taking one if members have a common language and zero otherwise. $LAND_{ij}$ represents a dummy for being landlocked, taking the value of one if EAC members are landlocked and zero otherwise. EAC_{ijt} represents membership of EAC at t, taking one if the country is a member and zero otherwise. $OTHER_{ijt}$ represents membership in multiple RECs at t, taking one

if the country is a member of multiple RECs and zero otherwise. Other variables are as per the definitions given for equation 1.

The specification of the linearized gravity model is as follows:

$$LT_{ijt} = \mathrm{L}\alpha + \beta_1 LY_{ijt} + \beta_2 LDIS_{ij} + \beta_3 LPOP_{ijt} + \beta_4 LTOT_{ijt} + \beta_5 LFIS_{ijt} + \beta_6 LEXC_{ijt} + \beta_7 LINFRA_{ijt} + \beta_8 BORD_{ij} + \beta_9 LANG_{ij} + \beta_{10} LLAND + \beta_{11} LEAC_{ijt} \beta_{12} LOTHER_{ijt} \varepsilon_{ijt} \quad [3]$$

L shows that the variables are in logarithmic form.

3.3 Variables and expected signs

- GDP (Y): this is a proxy for economic size. Its relationship with net exports can be positive or negative. As GDP increases, the variety of tradable products (exports) and net exports increases; as GDP decreases, exports reduce, making next exports deteriorate.
- Population (POP): this is a proxy for market size. Its relationship with net exports can be trade-enhancing or trade-inhibiting (Eita 2007). A negative relationship represents an absorption effect. In such a case, the domestic market is said to be large enough to consume more local products, thereby reducing the volume of local produce that could be exported. The reverse of this leads to a trade-enhancing situation (Yabu 2014).
- Terms of trade (TOT): TOT is the ratio of export prices to import prices. It measures relative competitiveness. If export prices increase relative to import prices, then exports become less competitive, and TOT improves. As a result, the value of net exports deteriorates. Negative TOT means that exports are more competitive than imports, meaning net exports will improve (Reinsdorf 2009).
- Fiscal policy: assuming an expansionary fiscal policy, if government spending increases or taxes are cut, aggregate demand will increase, and will thus lead to higher levels of imports. An increase in import demand with exports remaining the same will lead to trade deficits. Contractionary fiscal policy will reduce the country's aggregate demand, thereby lowering imports and leading to a trade surplus (Monacelli and Perotti 2008).
- Exchange rate (EXC): this is a proxy for relative prices. Currency appreciation makes a country's products more costly for foreign markets and reduces price competitiveness. The coefficient of the exchange rate will be negative, implying that exchange rate appreciation discourages exports (Wang and Badman 2017). A weaker domestic currency makes exports more competitive and imports more expensive, thereby improving net exports.
- Transport costs: these are captured by distance, and by dummies for landlocked status, borders, language, and infrastructure. Transport costs increase with distance, for countries that are landlocked, and for islands; transport costs are low for neighbouring countries and countries with common language(s) and borders (Nordås and Piermartini 2004).
    - Distance (DIS): this is inversely related to net exports, since neighbouring countries incur lower transport costs, while countries that are far apart incur higher transport costs. Thus, transport costs increase with distance and negatively affect net exports.
    - Landlocked (LAND): transport costs are anticipated to be high for landlocked countries and lower for neighbouring countries. Hence, LAND negatively affects net exports.

- Common language (LANG): this captures information costs. Trade patterns are better for countries with a common language. Hence, transport costs for countries with a common language will reduce, with a positive effect on net exports.
- Border (BORD): the impact on trade patterns of a common border between countries is expected to be positive, since such countries are closer to each other, reducing transport costs.
- Transport- and trade-related infrastructure (INFRA): given that information on infrastructure is either unavailable or of bad quality, this study uses an index ranging from one to seven to measure the quality of infrastructure, and the question asked is: 'is the transport- and trade-related infrastructure extensive and efficient?' Responses range from one ('strongly disagree') to seven ('strongly agree)'. If the values of this variable are far from seven, then the impact of INFRA on net exports will be negative. If the values of this variable are close to seven, the impact of INFRA on net exports will be positive, implying good-quality infrastructure.

- EAC is expected to be positive, implying that being a member of EAC has a positive impact on net exports.
- OTHER is expected to be negative, since overlapping memberships by partner countries are an indication of a lack of commitment among members, which is expected to negatively affect net exports.

3.4 Estimation method

When estimating the gravity model, most researchers have adopted the pooled OLS technique. This estimation method is believed to provide a good fit for proving the connection between trade or GDP and the variables stipulated in the previous subsections. Over time more researchers have enriched the gravity model, and Silva and Tenreyro (2006) among others have employed the Monte Carlo simulation. This simulation reveals that in the presence of heteroscedasticity, the estimation of non-linear models using OLS leads to biased estimates. Sevestre (2002) has indicated that the OLS estimator assumes an identical model for all partner states. This implies that there are no special characteristics that determine trade relations besides those included in the model. As a result, there has been a shift in the literature towards other regression methods.

Even though in most cases the pooled OLS technique yields inadequate estimates, its estimates do provide a baseline for comparison with those made by more complex estimation methods. In this regard, the use of Hausman and Breusch-Pagan tests is of great relevance. These tests provide comparisons of pooled OLS models against the chief alternatives: random effect (RE) and fixed effect (FE) models (Miran et al. 2013). RE models are most appropriate for the estimation of trade flows between random samples drawn from a large population set (Eita 2007). If the variation across units has the ability to influence the dependent variable, then RE models become the appropriate method (Torres-Reyna 2017).

The use of RE models also requires the specification of individual effects which might have an influence on the predictors. The issue with this is that the unavailability of some variables could lead to omitted variable bias (Torres-Reyna 2017). FE models are said to be most appropriate for the estimation of trade patterns between an *ex ante* predetermined selection of countries (Eita 2007). However, Shinyekwa and Othieno (2013) indicate that FE models are associated with the limitation that time-invariant variables cannot be directly estimated. Gujarati and Porter (2009) also postulate that using FE models to estimate a regression model that includes dummies will lead to a loss of degrees of freedom. As a result, one will lack sufficient observations to make a meaningful analysis.

In summary, both FE and RE estimators are models designed to handle specific structures of panel data. The difference between the two models is whether the individual-specific time-invariant effects are correlated with the regressors or not. Measurement errors in X and endogenous changes in X might lead to biased results when one is using FE models. There are also perils in relying on RE models only. Thus, an alternative model that at least combines the merits of the two models is the most appropriate. Such a model suggested by Hausman and Taylor (1981), pooling the benefits of both FE and RE estimators.

Unlike the RE model, which assumes that the included explanatory variables are uncorrelated with the error term, the Hausman-Taylor (HT) model only uses information contained in the model to eliminate correlations between country-specific effects and the error term (Hausman and Taylor 1981). The choice of correlation between the individual effects and the regressors prompts Hausman and Taylor to propose a model where some of the regressors are correlated with individual effects. The resulting estimator is the HT estimator.

Economic studies since the 1980s have chosen between FE and RE estimators on the basis of the standard Hausman test, with the null hypothesis that RE is the preferred model, and the alternative that FE is the preferred model. Rejecting the null hypothesis implies that RE is not the appropriate model. Otherwise, the researcher reports RE. However, given the pitfalls of RE and FE models, the Hausman test is used to choose between FE and HT models. If the choice of strictly exogenous regressors based on the difference between FE and HT is not rejected, then the HT estimator becomes the appropriate model. Otherwise the test reverts to FE. Moreover, the Breusch-Pagan test is also employed to determine whether simple pooled OLS or RE is an adequate model. The null hypothesis under the test is that there are no random effects (Miran et al. 2013).

3.5 Diagnostic tests

A unit root test is performed in order to observe whether a cointegration relationship exists between variables. If all variables are stationary, an estimation method that aims to determine the relationship between the variables will be employed. If the variables are non-stationary, a cointegration test will be relevant (Shinyekwa and Othieno 2013). In determining the stationarity of the variables, different panel unit root tests can be performed, and these entail Levin, Lin, and Chu's (2002) test, which assumes that the null hypothesis entails the existence of a unit root. The other test is the Hadri, which employs the null hypothesis of no unit root. These two tests assume common autoregressive parameters across countries.

The other panel unit root test is the Im-Pesaran-Shin (IPS) test. This test allows for variation in the autoregressive parameters across countries. The IPS test is believed to have more power than the augmented Dickey-Fuller test (Straus and Yigit 2003). Pesaran (2015) indicates that not only does the IPS test allow for heterogeneity between cross-sectional units, but it also allows for simultaneous stationary and non-stationary data series. Given these justifications, the current study uses the IPS test in order to determine if there is a unit root.

3.6 Data

Most of the earlier empirical work estimating the gravity model has relied on cross-sectional estimation techniques. However, Shinyekwa and Othieno (2013) indicate that employing cross-sectional estimation methods ignores heterogeneous features related to bilateral trade relationships. Shinyekwa and Othieno (2013) also indicate that cross-sectional techniques fail to account for heterogeneous dynamics. It is for these reasons that these authors, among others, advocate the use of panel-based methods. The authors indicate that a panel-based approach has

the ability to deal with the issue of heterogeneity, as the impact of such factors can be modelled by incorporating country-pair individual effects.

The current study therefore employs yearly pairwise country panel data, with trade flows constructed for the period 1988–2016. GDP, exchange rate, transport, infrastructure, population, net exports, import and export prices, tariffs, government spending, and tax data from World Bank Development Indicators is used. Due to the lack of data for South Sudan in most of these variables, this study only determines the factors of intra-EAC trade using data for Burundi, Kenya, Rwanda, Tanzania, and Uganda. Another reason for excluding South Sudan is because it only joined the EAC in 2016; hence its inclusion in the study might not give a clear picture of trade integration in the EAC. Data on whether a country is landlocked, has a common border, or has a common language has been obtained from the Centre d'études prospectives et d'informations internationales (CEPII) gravity data set. Data on countries' membership of trading blocs has been obtained from existing information on regional trade blocs.

4 Estimation and interpretation of results

This section presents the interpretation of results based on model 3 derived in the previous section. Section 4.1 presents the diagnostic test results. Since the null hypothesis that there is a unit root was rejected, there was no need to perform the cointegration test. As a result, the researcher estimated the regression model. The results are presented in the Appendix, with the RE results presented in Table A2, and the FE, pooled OLS, and HT results presented in Tables A3, A4, and A5 respectively. Regardless of the pitfalls of some of the estimation methods (mentioned in the previous section), the current study recorded the results from all estimation methods, with the Hausman and Breusch-Pagan tests employed to determine the appropriate estimation model.

4.1 Diagnostic tests

According to the correlation matrix results, the correlation coefficients were all less than 0.80. It is Studenmund (2001)'s view that below this threshold (0.80) one can safely continue with one's estimations, since there is no issue of multicollinearity. Moreover, since non-stationarity is a common matter within most macroeconomic data, a diagnostic test on this is an excellent step in ensuring the reliability of the estimation results and the policy recommendations that follow. As a result, the current study employed an IPS unit root test for panels. The IPS test results are presented in Table A1.

According to these results, all the variables are significant at all levels. EXC is significant at five per cent and 10 per cent; OTHER is significant at 10 per cent. Given that all the variables are significant, the null hypothesis that there is a unit root has to be rejected. The alternative hypothesis is then accepted. This implies that the variables are stationary, and hence there is no need to perform the cointegration test. The regression estimations then follow, and the results are presented in the Appendix.

4.2 Breusch-Pagan test

The Breusch-Pagan test results are as follows: chi2(1)=12.43; prob>chi2=0.0004. This test determines whether heteroscedasticity exists in a linear regression model. The Breusch-Pagan test is a chi-squared test, and its test statistic is an nx^2 with k degrees of freedom. If the p-value of the Breusch-Pagan test is below an appropriate threshold (say, five per cent), then the null hypothesis that homoscedasticity exists will be rejected, and heteroscedasticity will be assumed (Cook and

Weisberg 1983). Moreover, given the OLS assumption that the variance should be constant, the presence of heteroscedasticity will imply that RE is the preferred model. According to the Breusch-Pagan test results, the p-value of obtaining a chi-square value of 12.43 is 0.4 per cent; hence the null hypothesis that homoscedasticity exists is rejected, and heteroscedasticity is assumed. Given this analysis, RE is the appropriate model.

4.3 Hausman test

Table A4 reports the Hausman test results. According to the results, the p-value of 0.9993 implies that the null hypothesis that RE is the preferred model is accepted. It is worth noting, however, that the use of RE has been ruled out on the basis that it is 'unlikely […] that individual-specific effects are uncorrelated with the relevant covariates' (Hausman and Taylor 1981: 1377). As a result, it becomes appealing to prefer the FE estimator over the RE. However, this does not make FE an appropriate model, since under FE time-invariant variables cannot be estimated. As recommended by Hausman and Taylor, the researcher employed the 'second Hausman test' under the null hypothesis that the preferred model is the HT. The p-value from the test is 0.0614, which is less than a 10 per cent level of significance. The implication is that the null hypothesis that the preferred model is HT is accepted. Hence, to determine the impacts of intra-EAC trade, the analysis is based on HT estimates.

4.4 Interpretation of the HT model

The interpretation in this subsection is based on the estimates presented in Table A6. According to the results, there are 112 observations. The prob>chi2 in the results is the probability of getting a Wald test value which is more than the observed statistic. The null hypothesis under this is that all the regression coefficients across the models are simultaneously equal to zero. In the current case, this is the probability of obtaining a chi-square value of 370.73 or more. The p-value of 0.000 leads to the conclusion that at least one of the coefficients of the regression is not equal to zero.

All variables are significant at 10 per cent levels of significance. It is worth noting that the estimates of the model are estimated as elasticity. This is because in a log-log model the variables are interpreted as elasticity. The elasticity of -0.349 implies that on average, a one per cent increase in DIS is associated with a 0.349 per cent decrease in net exports. The elasticity of 0.671 implies that on average, a one per cent increase in Y relates to a 0.671 per cent increase in net exports. The elasticity of 0.0002 implies that on average, a one per cent increase in TAR is associated with a 0.0002 per cent increase in net exports.

The elasticity of -1.085 suggests that on average, a one per cent increase in TOT relates to a 1.085 per cent decrease in net exports. The elasticity of 0.042 means that on average, a one per cent increase in FIS leads to a 0.042 per cent increase in net exports. The elasticity of 1.354 implies that on average, a one per cent increase in POP is associated with a 1.354 per cent increase in net exports. The elasticity of 0.211 means that on average, a one per cent increase in EXC decreases net exports by 0.211 per cent. The elasticity of 0.173 suggests that on average, a one per cent increase in INFRA increases net exports by 0.173 per cent.

Holding other variables constant, net exports decrease by 12.366 per cent if countries are landlocked. Net exports increase by 231.348 per cent for countries sharing a common language. Being a member of the EAC increases net exports by 761.065 per cent. Net exports decrease by 43.050 per cent for countries that are members of multiple RECs. Lastly, net exports increase by 71.087 per cent for countries that share a common border.

5 Discussion and implications of results

5.1 Discussion

The focus of this study is to determine factors that influence intra-regional trade in Africa, with particular emphasis on the East African countries of Burundi, Kenya, Rwanda, Tanzania, and Uganda. The motive behind the study is that, even though numerous RECs on the continent have put in place brilliant agendas to boost intra-trade, African countries still seem to trade more with non-African countries than they do with African countries. The statistics in Tables 1 and 3–8 are consistent with this view. Given the theory that trade integration and benefits come along with membership of an REC, the issue of low regional trade in Africa raises questions about the presence of African RECs.

It is worth noting that there are a number of success stories of countries that have experienced improved trade patterns after becoming committed members of regional trade blocs. This implies that intra-regional trade does indeed have a significant impact on trade. It is this issue that drew the researcher's attention to the question of the factors responsible for low intra-regional trade in Africa. The researcher believes that if other continents are experiencing significant growth in their trade patterns, this shows that African countries are missing out on important factors liable to improve intra-regional trade. Hence a study that looks at the determinants of regional trade integration is highly relevant for helping African countries to boost their trade patterns.

One of the initiatives that it was believed would impact significantly on intra-trade was the introduction of free tariffs among member states. This is because it was believed that doing so would make imports from non-members more expensive, thereby making goods from member states more competitive. This initiative has been in place long enough for its impact to have materialized by now. However, trade patterns among African countries are still disappointing. This implies that it takes more than just a reduction in tariffs for trade patterns on the continent to improve. It was for this reason that the researcher decided to determine the factors responsible for low intra-regional trade, using the best REC in Africa—the EAC—as the case study. The researcher believed that the choice of UMA might have led to advice such as 'the REC should implement a customs market, a monetary union, and/or a political federation'. These are obvious initiatives that seem less significant in improving the trade patterns of RECs, as the EAC has already tried their implementation. Moreover, the current study also aimed to contribute to existing literature on the determinants of intra-regional trade. The aim was to go beyond the existing literature by expanding the traditional gravity model with other significant variables that have barely been employed in the trade integration literature.

5.2 Implications

The gravity model's analogy regarding GDP is that GDP is a measure of a country's economic mass. The relationship between GDP and net exports in most studies has been found to be positive. The implication of this is that high levels of GDP lead to higher levels of production in the exporting country. A high level of income for the importing country also implies high imports. This view is consistent with the findings of the current study. According to the results shown in Table A2, GDP's influence on net exports is positive. This significant positive coefficient of GDP implies that as an economy's size increases, net exports improve.

Moreover, in the gravity model, population is utilized as a proxy for market size. In Markheim's (1994), view countries with large populations are expected to have a great resource endowment, which enables large productive activities. According to the United Nations (2017), Africa is the

second largest and second most populated continent in the world. Given this, and the fact that East Africa is ranked number one in Africa by population statistics, the coefficient of population was expected to be positive. As expected, the results in Table A6 show a statistically significant coefficient for population. The implication of this is that the EAC's exports are higher than its imports, which then indicates that there is high domestic absorption.

Another variable of interest is terms of trade, which is an indicator of a country's economic wealth. Countries whose baskets of exports mostly comprise primary products are expected to 'suffer terms of trade decline driven by price elasticity of demand and low income' (Shinyekwa and Othieno 2013: 6). EAC countries' exports are mainly primary products; hence, given Shinyekwa and Othieno's (2013) argument, the coefficient of terms of trade was expected to be negative. The influence of terms of trade on net exports was found to be statistically significant and had a negative coefficient. The implication of this coefficient is that exports are less expensive and more competitive than imports. Typically, negative terms of trade imply that a country will have lower living standards and will afford relatively fewer imports. In the current study, this implies that given that EAC members mostly export raw materials, a decline in terms of trade indicates that the price of the primary products of these countries will fall relative to the price of imported manufactured goods. A prolonged decline in terms of trade could lead to a decline in standards of living and lower GDP (Shinyekwa and Othieno 2013).

Such a decline is also expected to reduce export revenues, thereby making it hard to pay foreign external debts. A country faced with this problem will need a relatively higher percentage of national income to repay the debts in foreign currency (Shinyekwa and Othieno 2013). In the current study, the exchange rate was used as a proxy for relative prices. The impact of the exchange rate on net exports was found to be significant and positive. This relationship suggests that the EAC domestic currency is weak, stimulating exports and making imports more expensive. As a result, domestic firms will benefit from increased sales and hence employ more workers. More jobs will be created, and unemployment will decrease (Wang and Badman 2017).

Proxies for transport costs were all found to be statistically significant, and their signs were as predicted by theory. The underlying rationale for using distance as a proxy for transport costs is that the latter increase with distance, thereby decreasing net exports (Cassim 2001). The coefficient of distance was found to be significantly negative. This implies that as distance increases transport costs, net exports deteriorate. Landlocked countries are believed to incur higher transport costs than countries that lie on the coast. This is because such countries have limited modes of transport that might be cheaper (Nordås and Piermartini 2004). Hence a negative coefficient of landlocked status relates to an increase in transport costs and a decrease in net exports. If we exclude South Sudan, three of the remaining five EAC member states are landlocked (Burundi, Rwanda, and Uganda); as a result, the coefficient of landlocked status was expected to be negative.

Moreover, the positive impact of a common border on net exports implies a reduction in transport costs. The positive impact of a common border also implies that the level of integration among these countries significantly affects their trade balance (Roy and Rayhan 2012). 'It is plausible to suggest that proximity to the border of an EAC partner increases the salience of the relationship between EAC partner states, increases the likelihood of interaction with out-groups from the borderlands of other partner states, and thus increases support for further East African integration' (Knowles et al. 2014: 12).

Countries with a common language are likely to experience an increase in net exports, as a common language smooths transport and facilitates communication (Cassim 2001). There is a significant and positive impact of transport- and trade-related infrastructure on net exports. Even though this variable is positive, its relatively low magnitude (0.017) is an indication that the quality of the

infrastructure is not satisfactory. 'It appears that time to market and the quality of infrastructure matter more than before in sectors such as textiles and clothing—a development that threaten developing countries' comparative advantage in important segments' (Nordås and Piermartini 2004: 18). Nordås and Piermartini (2004) indicate that improvements in the quality of infrastructure in developing countries is costly, however, and in the short run is beyond governments' means. This explains why the quality of infrastructure in African countries is still ranked as poor.

Being a member of a regional bloc was expected to improve net exports. This is consistent with the findings of the current study, presented in Table A2. According to these findings, the coefficient of EAC membership is significant and positive. This shows how vital it is for countries to be members of trade blocs. An increasing value of this variable signifies growing participation (integration) of each EAC member in the REC. Moreover, being a member of multiple trading blocs was expected to reduce net exports. The theoretical view on this issue is that overlapping memberships by members show a lack of commitment to the REC (Mengistu 2015). The coefficient of OTHER as a measure of membership of multiple RECs was found to be significant and negative.

5.3 Policy recommendations

In order to boost intra-EAC trade, factors that have been found to positively impact on net exports should be promoted. A high magnitude of GDP is believed to be one of the most significant determinants in improving intra-EAC trade. Hence great emphasis should be given to EAC members with higher GDPs. Moreover, central banks should pay attention to creating the essential conditions in which development and growth will prosper. For this to be achieved, two overriding principles have to be maintained: protecting domestic currency value, and preserving overall financial stability. This is because it is believed that ensuring that countries' macroeconomic environment is stable will stimulate the savings vital for financing investment opportunities.

The significant impact of transport- and trade-related infrastructures calls for an urgent implementation of an EAC infrastructure development master plan in order to smooth trade within the region. Such infrastructure reforms need to mostly target landlocked EAC members and connect them with major centres of economic activity. Further attention should be given to the quality of infrastructure in order to guarantee sustainable long-run usage of these facilities. Furthermore, the negative impact of distance on net exports suggests that sharing a border, sharing a common language, and being landlocked indicate a need for investment in communication and transport infrastructures in order to reduce shipping and international business costs. The positive coefficient of EAC membership shows the significance of intra-regional trade. As a result, active participation in the EAC is advised. This recommendation may also be of great help to other RECs on the continent.

6 Conclusion

To address the issue of low trade among African countries, regional integration is perceived to be the basis for addressing barriers to intra-regional trade. Once these barriers are eliminated through the process of regional integration, it is believed that larger regional markets will sustain production systems through economies of scale, thereby boosting overall growth and improving competitiveness. However, according to the statistics presented in Tables 1 and 3–8 and in Figures 1–6, trade among African countries is low. As a result, the continent is failing to benefit from the initiative of regional integration. This called for a study to determine the factors responsible for

low regional trade on the continent. The current study employed an augmented gravity model using the case study of the EAC to determine these factors. Pooled OLS, FE, RE, and HT regressions were employed in order to estimate the gravity model. The coefficients of the variables from the four regressions were slightly different. With the help of the Hausman test, the HT model was considered to be the preferred model, and the results' implications were based on the estimates of this model.

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Appendix

Table A1: Unit root test results

Variable	Test statistics	P-value
T	-0.1592	0.000
POP	-1.643	0.012
Y	-6.436	0.000
TOT	-2.740	0.003
FIS	-4.1570	0.001
DIS	-2.1601	0.014
EXC	-0.9423	0.021
LAND	0.0014	0.000
LANG	-1.9761	0.010
EAC	-0.0095	0.000
OTHER	-0.0047	0.076
BORD	-5.014	0.007
INFRA	-4.7914	0.000

Notes: IPS unit root test.

Source: author's calculations based on World Bank Development Indicators and CEPII gravity data.

Table A2: RE regression results

Variable	RE	
logT	Coefficients	P-value
logDIS	-1.617	0.000
logY	0.636	0.000
logTOT	-1.001	0.000
logFIS	0.043	0.176
logPOP	1.667	0.000
logEXC	0.211	0.050
logINFRA	0.017	0.001
LAND	-0.132	0.068
LANG	1.198	0.000
EAC	2.153	0.000
OTHER	-0.563	0.005
BORD	0.537	0.000
_cons	-34.680	0.000

Notes: R-square within=0.8052. No. of obs=112. Between=0.9991. No. of groups=4. Overall=0.8456. Wald chi2(10)=553.32. Corr(u_i,X)=0 (assumed). P-value>chi2=0.000.

Source: author's calculations based on World Bank Development Indicators and CEPII gravity data.

Table A3: FE regression results

Variable	FE	
logT	Coefficients	P-value
logDIS	0	.
logY	0.635	0.004
logTOT	-0.983	0.000
logFIS	0.069	0.122
logPOP	1.707	0.045
logEXC	0.283	0.090
logINFRA	0.017	0.001
LAND	0	.
LANG	0	.
EAC	0	.
OTHER	0	.
BORD	0	.
_cons	-25.548	0.011

Notes: R-square within=0.8065. No. of obs=112. Between=0.8736. No. of groups=4. Overall=0.6217. F(9,99)=45.85. Corr (u_i,X)=0(assumed). P-value>chi2=0.000.

Source: author's calculations based on World Bank Development Indicators and CEPII gravity data.

Table A4: Hausman test results

	Coefficients			
Variables	(b) FE	(B) RE	(b-B) Difference	Sqrt (diag (V_b_V_B))
POP	-5.821	-5.821	3.821	2.270
Y	0.843	0.843	-9.30	0.186
FIS	1.721	1.721	7.292	0.073
EXC	0.0000932	0.0000932	2.082	0.096
TOT	-1.119	-1.119	-2.041	0.022
TAR	0.0000217	0.000217	-1.571	0.0006
INFRA	0.832	0.832	6.271	0.0179

Notes: b=consistent under Ho and Ha. B=inconsistent under Ha, efficient under Ho. Test: Ho difference in coefficients not systematic. Chi2(4)=(b-B)'[(V_b-V_B)^(-1)](b-B)=13.00. Prob>chi2=1.0000. (V_b-V_B) is not positive definite.

Source: author's calculations based on World Bank Development Indicators and CEPII gravity data.

Table A5: Pooled OLS regression results

Variables	OLS	
logT	Coefficients	P-value
logDIS	-1.617	0.001
logY	0.636	0.000
logTOT	-1.006	0.000
logFIS	0.042	0.79
logPOP	1.667	0.001
logEXC	0.211	0.053
logINFRA	0.173	0.001
LAND	-0.132	0.068
LANG	1.198	0.000
EAC	2.153	0.000
OTHER	-0.563	0.005
BORD	0.537	0.000

Notes: No. of observations=112. F(10,101)=55.33. Prob>F=0.0000. R-squared=0.8456. Adj. R-squared =0.8304.
Source: author's calculations based on World Bank Development Indicators and CEPII gravity data.

Table A6: HT regression results

Variable	HT	
LogT	Coefficients	P-value
TVexogenous		
logDis	-1.617	0.007
logTOT	-1.085	0.000
logFIS	0.042	0.116
logPOP	1.354	0.021
logINFRA	0.173	0.001
TVendogenous		
logEXC	0.211	0.053
logY	0.671	0.000
TIexogenous		
LAND	-0.132	0.042
LANG	1.198	0.000
EAC	2.153	0.000
OTHER	-0.563	0.005
BORD	0.537	0.000

Notes: No. of observations=112. Wald chi2(9)=370.73. Prob>chi2=0.0000.

Source: author's calculations based on World Bank Development Indicators and CEPII gravity data.