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Examining coffee export performance in Eastern and Southern African countries: do bilateral trade relations matter?

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ABSTRACT

This study examines the impact and implications of the East African Community and the Common Market for Eastern and Southern Africa preferential trade agreements on coffee export performance of eight East and Southern African countries. The analysis employed a static and dynamic gravity modelling framework for the period 1998–2013. Following several robustness checks, the study found that regional trade agreements play a vital role in increasing coffee trading in East and Southern African countries. Factors including geographical distances, income, and population size in importing and exporting countries are also statistically significant determinants of coffee exports. The study also found that the exporting countries are currently under-performing with respect to their maximum potential to the global market indicating room for improvement.

1. Introduction

Green coffee bean is one of the major cash crops in East and Southern African countries mainly produced for export purposes (Salami, Kamara, and Brixiova 2010). This crop constitutes a significant share of total export value in countries such as Ethiopia, Burundi, and Uganda, making the sector vital to their economy. The sector is also important in Kenya, Malawi, Rwanda, Tanzania, and Zambia in creating substantial employment and income generation opportunities for the farmers (FAO 2016). The sectoral role to the economy could further be enhanced through the elimination of various forms of trade barriers among coffee trading countries. With the initiation of the African Union (AU), countries across the continent have been working towards the formation of common trade areas by ratifying an agreement called the "African Continental Free Trade Area (AfCFTA) pact" which is expected to increase the trade flows between countries across the continent (African Union 2018).

There has been literature examining the coffee export performance in the East African countries (see, e.g., Bellemare, Barrett, and Just 2013; Boansi and Crentsil 2013; Jaramillo et al. 2011). These studies suggested that factors including climate variability, price volatility and declining competitiveness in the international coffee market have been contributing to the existing poor sectoral performance. Other studies also examined the coffee sector performance from individual country perspectives, and results indicated that absence of standards, supply chain constraints, lack of cooperatives, and poor coffee quality are the main determinants (see, e.g., Chiputwa, Spielman, and Qaim 2015; Minten et al. 2014; Mujawamariya, D'Haese, and Speelman 2013). The existing literature on the

performance of the East African coffee sector, however, is mainly focused on the production side challenges such as climate variability, supply chain constraints, and modern technology adaption issues, while less attention has been put on the importance of regional trade agreements (RTA). Such a research gap in the current literature should be filled in order to allow effective trade policy design and implementation in the coffee sector.

Trade economist suggested that establishing common trade agreements and free economic zones can increase trade volume and improves the societal welfare among the traders through removal of different trade barriers (Baier, Bergstrand, and Mariutto 2014; Baier and Bergstrand 2007; Carrere 2006; Krueger 1997; Schott, Jung, and Cimino 2015; Whalley 1998). Notably, these agreements can create an open market, lower trade costs, eliminate trade barriers such as tariffs and customs duties, enhance jobs and ultimately improves the trade performances. In East and Southern Africa, the intra-industry trade has been initiated following the creation of trade agreements among countries in the region. These include the East African Community (EAC) and Common Markets for East and Southern Africa (COMESA). The ECA aims to bring custom union, common market, monetary union and finally political federation among member states, while COMESA has prior objectives of forming a free trade area (FTA), customs union (CU), trade promotion (TP) and bringing economic prosperity through regional integration among the member states. These economic communities encompass one of the largest markets in the region, with COMESA member countries alone accounting for around 500 million population.

Therefore, this study aims to investigate the impact of RTA among East and Southern African countries, i.e. COMESA and EAC, and other trade determinants such as internal market size, geographical distances, and cultural differences on coffee trade performance. Our analysis employs both the static and dynamic gravity modelling framework with consideration of the Multilateral Resistance Terms (MRT) (e.g. see, Anderson and Van Wincoop 2003; Baldwin 2006; Gallego, Rodríguez-Serrano, and Casanueva 2019; Olivero and Yotov 2012). In order to achieve these goals, we employed a panel data for eight East and Southern African countries for the period of 1998–2013. These data sets are obtained from the world development indicators (World Bank 2015) and "Centre d'Etudes Prospectives et d' Informations Internationales" (CEPII) database (CEPII 2015).

The key contribution of this study is twofold. First, the study provides valuable empirical contributions to the existing literature by analysing how RTA could improve the coffee trade performance in East and Southern African exporting countries. Second, results from the study are expected to provide empirical support for policy design and implementation in the coffee sector that aims to increase trade performance through the creation of RTA. The study finally concludes by highlighting the prevailing trade barriers, performances, and potentials of the East and Southern African coffee exporting countries.

2. Review of the coffee farming sector

2.1 State of production at a global scale

Coffee is produced in more than 50 developing countries, providing income for approximately 25 million farmers (Petit 2007). This makes coffee production one of the main cash crop sector and a significant source of livelihood, employment and foreign exchange in most of developing countries. There are countries known for coffee production on a global scale. In this respect, countries from Latin America, Asia, and Sub-Saharan Africa constitute the largest producers of green coffee in terms of value and quantity, as illustrated in Figure 1 (FAO 2016). The figure illustrates that Brazil is the main producer of green coffee beans in 2013, followed by Vietnam, Indonesia, Colombia, and India. Importantly, the coffee sector accounts for a significant proportion of foreign earnings in some of the countries listed. For instance, in countries such as Ethiopia, Uganda, and Burundi, the share of coffee exports relative to total export earnings exceeded 10% in 2013, although the importance of coffee for other countries is still lower (FAO 2016; World Bank 2015).
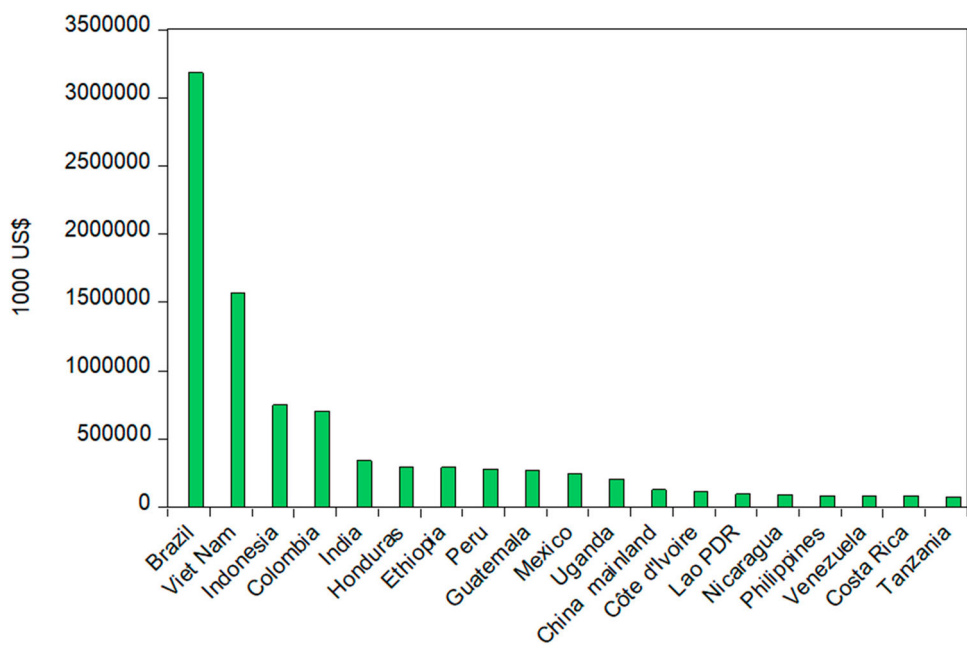
Figure 1. Top green coffee producing countries of the world in 2013.
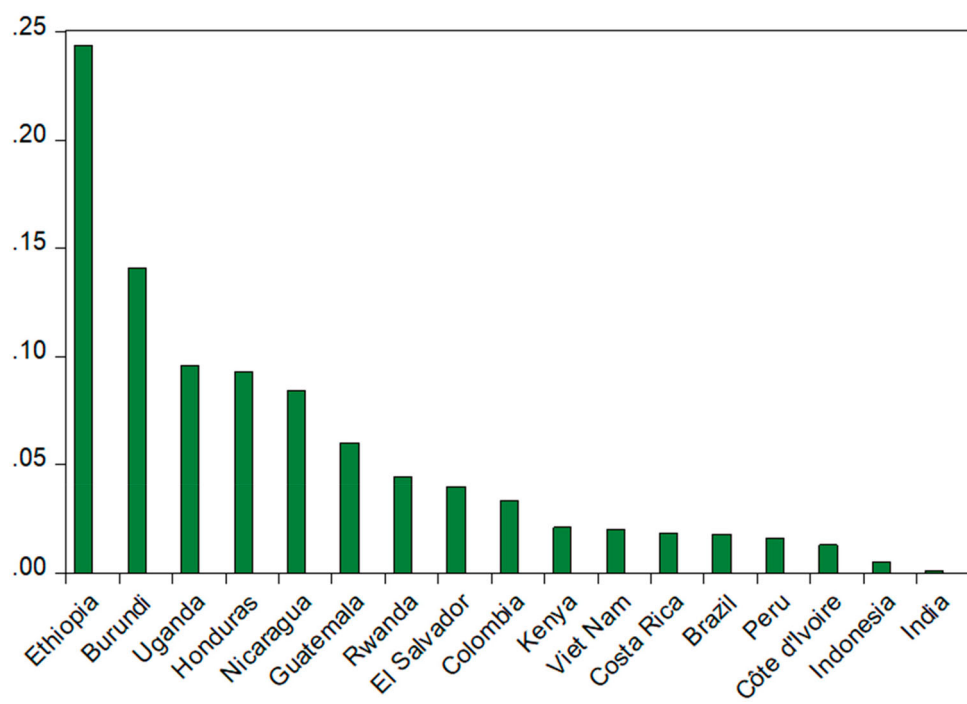
Figure 2. Share of coffee export in the total agricultural export earnings for selected countries in 2013.

However, in those countries with more diversified agricultural export sectors, such as Vietnam, Brazil, Kenya, and Indonesia, the share becomes low in relative terms. Figure 2 summarises the share of coffee relative to total export earnings in some of the world's main coffee exporting countries.

From the above figures, it is clear that coffee export constitutes a significant share in Ethiopia and Burundi, reflecting the importance of the sector to the economy. In Rwanda, the sector has a minimal export share value despite that the country's agricultural landscape employs around 400,000 active coffee producers (Mujawamariya, D'Haese, and Speelman 2013).

In the context of East African countries, the agricultural sector continues to be the main contributor of foreign earnings (Salami, Kamara, and Brixiova 2010). The sector is mainly characterised by the export of green coffee bean to the rest of the world (Nyangito and Omare 2004). One of the key features of the coffee plantation in these countries is the predominance of small-scale farmers, with exception of Kenya where there are coffee estates (Lukanima and Swaray 2014). These farmers are mainly characterised by organic farms with the utilisation of traditional agricultural tools, while estates are cooperative farms with better utilisation of modern technologies and large farm size.

Some studies indicated that dominance of small-scale farmers could minimise the coffee sector's influence on the world market due to constraints associated with a low supply chain scheme and marketing infrastructure (Bacon 2005; Bolwig, Gibbon, and Jones 2009; Ha and Shively 2008; ICC 2015; Jaramillo et al. 2011; Lee, Gereffi, and Beauvais 2012). The implication is that being a small-scale producer makes most farmers vulnerable to various forms of shocks, including climate variability, price volatility, low farm productivity, slow adoption of new technologies, limited access to finance and lack of market access. Weak price transmission signals between spatially separated markets and between different levels in the value chain are also mentioned as some of the other obstacles to a well-functioning commodity market (Abdulai 2007).

At the global market, the emergence of competitiveness could favour exporters such as Brazil, Vietnam, and Colombia in deciding the world market price due to lower production cost in the respective countries (Ponte 2002). This adversely affects the export performance of coffee exporting countries in East Africa. Similarly, the collapse of the International Coffee Agreement, which was intended to promote cooperation between exporting and importing countries, resulted in a persistent fall of the international coffee price (Parrish, Luzadis, and Bentley 2005; Were et al. 2002).

2.2 Trends and trade patterns of the African coffee sector

Improving coffee trade performance in East African countries could have a substantial effect on the national economy of the respective countries. For instance, coffee exports alone generated about 26% and 22% of total export revenues in Ethiopia and Rwanda in the year 2009, respectively (Mafusire et al. 2010). Export revenue from the coffee sector constitutes a substantial share of total foreign trade in East African countries. For instance, official statistics by the Food and Agricultural Organisation (FAO) indicated that the coffee export value has increased by 55%, 21%, and 10% between 1998 and 2013 in Rwanda, Uganda and Ethiopia respectively (FAO 2016). Similarly, countries such as Burundi, Kenya, Malawi, Tanzania, and Zambia recorded an average coffee export growth of 4%, 8%, 4%, 7%, and 1% respectively, during the same period of time. The volume of coffee exports (in 1000 US$) between 1998 and 2013 for eight East African countries is illustrated in Figure 3.

Despite increasing trends in coffee export values, its share in total agricultural exports significantly declined between 1998 and 2013, by an average of 6%, 4%, and 10% in Ethiopia, Uganda, and Zambia respectively. This decline is mainly associated with a rise in the relative export share of other commodities to the rest of the world (Nyangito and Omare 2004; World Bank 2015) and booming domestic coffee consumption (ICC 2015). However, the share of coffee in total agricultural export revenue has shown an increasing trend in Kenya and Rwanda, with an average growth of 1% and 27%, respectively. In particular, the significant increase in the share of coffee exports in Rwanda is mainly associated with government intervention in creating cooperatives with a legal and statutory framework that helps the sector function well (Mujawamariya, D'Haese, and Speelman 2013). Figure 4 demonstrates the share of coffee exports relative to total agricultural trade in East African countries.
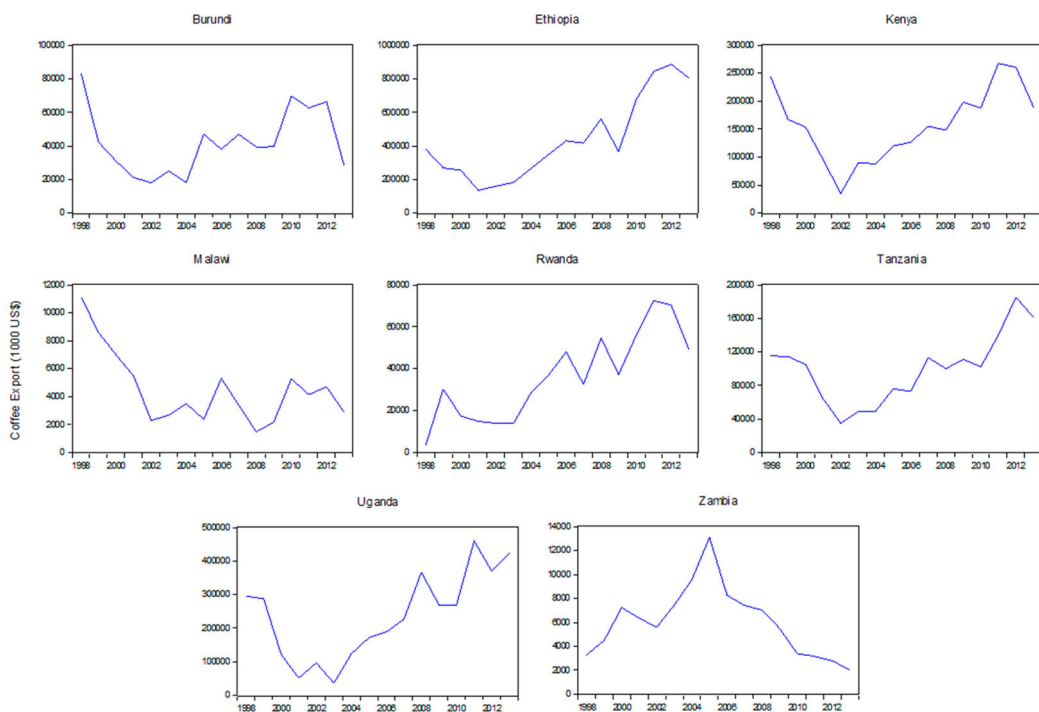
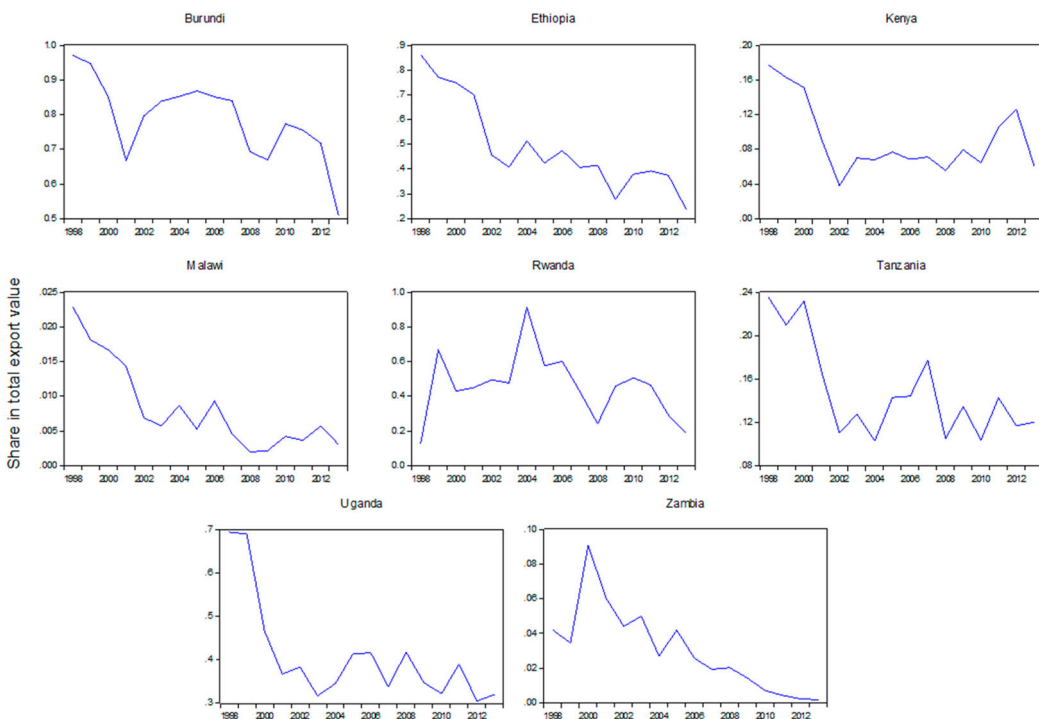**Figure 3.** Coffee exports from East African countries.

Figure 4. Share of coffee export value from total agricultural export value.

2.3 RTA in East and Southern Africa

2.3.1 Common Market for Eastern and Southern Africa

The COMESA was initially established in 1981 as the Preferential Trade Area for Eastern and Southern Africa (PTA) under the AU's framework of Lagos Action Plan and the Final Act of Lagos (COMESA 2009). The PTA was transformed into COMESA in 1994 to take advantage of larger market size, to share the region's common heritage and destiny and to allow greater social and economic co-operation. This trading block accounts currently 21 countries including Burundi, Comoros, Democratic Republic of Congo (DR Congo), Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Somalia, Sudan, Swaziland, Tunisia, Uganda, Zambia, and Zimbabwe (COMESA 2017). This economic block is believed to bring economic prosperity through regional integration for its 540 million of the population with global trade in goods worth of US$ 235 billion.

The prominent objective of COMESA is to form a large economic and trading unit that is capable of overcoming some of the trading barriers faced by the individual member states. To achieve this objective, COMESA has set up key priority development areas. These include FTA, CU and TP among member states. In terms of FTA, the trade agreement was officially achieved in October 2000 when nine of the member states[1] eliminated their tariffs on COMESA originating products (COMESA 2017). On the CU and TP, member states have been implementing various trade regulations including, adopting a road map that outlines programmes, liberalise trade and customs co-operation such as the introduction of a unified digitalised customs network across the region, improving the administration of transport and communications sector, and finally to harmonising macro-economic and monetary policies throughout the region.

The trade volume among COMESA member states has shown an increasing pattern in the past few years. For instance, the intra-trade among members have successively increased from the US$ 4 billion in 2007 to roughly US$ 9.6 billion in 2015 (COMESA 2017). Furthermore, there has been a promising development in infrastructural projects within the individual countries including Kenya, Ethiopia, Rwanda, and Mauritius, which is expected to stimulate trade exchange in the region.

Figure A1 illustrates the volume (million US$) and trends of coffee trading among and to rest of the world in COMESA member countries using the official statistics from the UNECTAD (UNECTAD 2019). The figure indicated that there has been an increasing pattern in coffee trading between the member countries and to the rest of the world. Notably, the figure showed a higher rate of increase to the rest of the world, relative to trading between the member states.

2.3.2 East African Community

EAC is a regional intergovernmental organisation of six States, namely the Republics of Burundi, Kenya, Rwanda, South Sudan, the United Republic of Tanzania, and the Republic of Uganda, with its headquarters in Arusha, Tanzania. These states accommodate around 172 million inhabitants, of which over 22% are dwelling in the urban areas. With a land area of 2.5 million square kilometres and a combined Gross Domestic Product (GDP) of US$ 172 billion, ECA bears great strategic and geopolitical significance for the member states to form an economic block (ECA 2015). The main objectives of EAC are to develop policies and programmes aimed at widening and deepening cooperation among the partner states in political, economic, social and cultural fields, research and technology, defense, security and legal affairs for their mutual benefit (EAC 2014).

Official reports indicated that both intra-trade among member states have significantly grown over the last few years with the total exports from the intra-EAC trade amounted to US$ 3207 million while the total imports amounted to US$ 1533 million, thus giving an intra-trade surplus of US$ 1678 million (EAC 2016). Furthermore, the export structure has also been changed over the course of the community's regional integration. For instance, the share in the total exports of primary products fell from 53% in 2002–2004 to 44% in 2010–2012, while the export of the

manufactured products has been growing steadily. Export markets also shifted towards other markets in sub-Saharan African countries (SSA) and Asian countries (UNCTAD 2018). Notably, the share of SSA in EAC exports has increased from 30% in 2002–2004 to 36% in 2010–2012, while the share of Asian countries in EAC exports has increased from 17% to 26% over the same period. Despite this progresses, the contribution of intra-EAC trade remains limited, accounting for only 19% of EAC exports in 2010–2012 (UNCTAD 2018).

Figure A2 illustrates the volume (million US$) and trends of coffee trading among and to rest of the world in EAC member countries using the official statistics from the UNECTAD (UNECTAD 2019). The figure indicated that there has been an increasing pattern in coffee trading between the member countries and to the rest of the world. Notably, the figure showeda higher rate of increase to the rest of the world, relative to trading between the member states.

3. Methodological framework

3.1 Empirical strategy – the gravity model

Following the work of Tinbergen (1962) and Pöyhönen (1963), the gravity model has been widely used to examine trade performance in different contexts. Thus, our empirical strategy also utilises the augmented gravity modelling framework as an instrument to examine the impact of RTA on coffee export performance. The traditional gravity modelling approach links trade flow to various economic indicators and distances such as the national income of trading countries and the physical distances between the trading countries. Meanwhile, recent studies have rigorously expanded the model by incorporating other economically meaningful variables such as potential markets (instrumented by population size), trading block, country integration, community membership and other sets of dummies representing shared cultural and historical characteristics (e.g. see, Dal Bianco et al. 2015; Head and Mayer 2014; Martínez-Zarzoso 2013; Melitz 2003; Saggi, Stoyanov, and Yildiz 2018). Therefore, we started by defining the standard gravity model as follows:

$$X_{ijt} = \alpha_0 Y_{it}^{\alpha_1} Y_{jt}^{\alpha_2} N_{it}^{\alpha_3} N_{jt}^{\alpha_4} D_{ij}^{u} \tag{1}$$

where X_{ijt} is the value of trade flow from exporting country i to importing country j, Y_{it} and X_{jt} represent the incomes in i and j, N_{it} and N_{jt} are the market size in country i and j which is denoted by the population size in the respective countries. The term D_{ij} explains the transport cost with the distance between trading pairs (in kilometres). Taking log-linearisation, the gravity model becomes:

$$\log X_{ijt} = \alpha_0 + \alpha_1 \log Y_{it} + \alpha_2 \log Y_{jt} + \alpha_3 \log N_{it} + \alpha_4 \log N_{jt}$$
$$+ u \log D_{ij} + \gamma \sum_d Z_{ij} + \pi_{i1} + \pi_{j1} + \phi_t + V_{ijt} \tag{2}$$

The term Z_{ij} is a vector of $1 \times M$ matrix capturing the effects of cultural and historical ties between the trading pairs including contiguity, common language, colony, official common language and regional trading agreement. We have also considered the time fixed effects, ϕ_t and the idiosyncratic error term, V_{ijt} in our model. The terms, π_{i1} and π_{j1} are country and time dummies, respectively, representing a time-varying MRT. Introducing these terms in the gravity modelling framework minimises bias linked to incorrect deflation of trade (e.g. see, Baldwin 2006). Meanwhile, the approach by Helpman, Melitz, and Rubinstein (2008) suggested that including a country and time fixed effects in order to address the issues of MRT needs to estimate *2NT* dummies for unconditional trade and this will lead to 240 dummies in our case. Therefore, we followed a two-stage estimation approach, i.e. selecting an equation in the first step and specifying the trade flow equation in the second step. This approach is expected to consider the potential bias due to omission of the extensive margin

in the standard gravity model which is represented by the number of exporters. Considering these premises, the first step model specifies the log of bilateral exports from country i to country j as a function of distance, common language, country level fixed effects, $\varphi_{ij}{}^2$ and other socio economic determinants is given as:

$$\log X_{ijt} = \alpha_0 + \varphi_{ij} + \lambda_t + \pi_{i2} + \pi_{j2} + \alpha_1 \log Y_{it} + \alpha_2 \log Y_{jt} + \alpha_3 \log N_{it}$$
$$+ \alpha_4 \log N_{jt} + \alpha_5 \log D_{ij} + \gamma \sum_d Z_{ij} + \varepsilon_{ijt} \tag{3}$$

Equation (4) provides the second step estimation with a latent variable specification for the trade flow i.e. one if the country i trades with country j as follows:

$$L_{ijt}^* = \beta_0 + \psi_t + \psi_i + \psi_j + \beta_1 \log Y_{it} + \beta_2 \log Y_{jt} + \beta_3 \log N_{it}$$
$$+ \beta_4 \log N_{jt} + \omega \log D_{ij} + \gamma \sum_d Z_{ij} + e_{ijt} \tag{4}$$

where $L_{ijt}^* = K\eta$, with

$$L_{ijt} = \begin{cases} 1 \text{ if } L_{ijt}^* > 0 \\ 0 \text{ otherwise,} \end{cases} \tag{5}$$

with K standing for a vector of all covariates given in Equation (4). Considering φ_{ij} in our final model provides a basis for the coefficients that account for potential trade barriers, such as α_5 on distance D_{ij} to be interpreted as elasticity estimates of the country's trade with respect to distance (Helpman, Melitz, and Rubinstein 2008). The other issue in estimating Equation (3) is related to the exclusion of zero trade flows. In this respect, Helpman, Melitz, and Rubinstein (2008) indicated that the selection effect may induce a significant relationship between the unobserved ε_{ijt} and the trade barriers, D_{ij} in which trade pairs with large observed trade barriers, i.e. high D_{ij} are likely to have low unobserved trade barriers denoted by high ε_{ijt}. We also assumed that the idiosyncratic term is normally distributed and given by $e_{ijt} = V_{ijt} + \varepsilon_{ijt} \sim N(0, \sigma_v^2 + \sigma_\varepsilon^2)$. Our final explanation is related to addressing the selection and heterogeneity bias in the sample we have used. These empirical challenges are addressed in the second stage specification by implementing a non-linear estimation of the predicted values of the latent variable, $L_{ij}/\sigma_\eta \equiv \hat{L}_{ij}^* = \Phi^{-1}(\hat{\rho}_{ij})$ with $\hat{\rho}_{ij}$, where $\hat{\rho}_{ij}$ is the predicted probability of exports from country i to j from Equation (5), and $\Phi(.)$ is the cumulative density function with a unit normal distribution (Helpman, Melitz, and Rubinstein 2008; Martínez-Zarzoso, Felicitas, and Horsewood 2009). At the end, we have used a panel fully modified ordinary least squares estimator (see Phillips and Hansen 1990) to derive parameter for the static model. This estimator robust to issues of endogeneity and serial correlation problems even in the absence of priori cointegration relations test.

3.2 Dynamic gravity model specification

Our previous gravity model in Equation (3) is specified in a static panel setup which is expected to capture contemporaneous exogenous effects on trade. Meanwhile, it is suggested that trade and trade effect are dynamic processes, where the past trade values have an effect on the current level (e.g. Gallego, Rodríguez-Serrano, and Casanueva 2019; Olivero and Yotov 2012; Santeramo 2015). Therefore, we specified the dynamic gravity model by including lagged dependent variable in Equation (6) as:

$$\log X_{ijt} = \alpha_0 + \lambda_t + \theta_i + \rho_j + \omega \log X_{ijt-1} + \alpha_1 \log Y_{it} + \alpha_2 \log Y_{jt}$$
$$+ \alpha_3 \log N_{it} + \alpha_4 \log N_{jt} + u \log D_{ij} + \gamma \sum_d Z_{ijt} + \varepsilon_{ijt} \tag{6}$$

where λ_t is year fixed effects, θ_i is exporting country fixed effects, and ρ_j is importing country fixed effects. The estimate ω, i.e. provides an information on the effect of previous year trade performance and its dynamic adjustment over time. Estimating Equation (6), however, has an empirical challenge as the included lagged trade value could induce endogeneity issues that the current trade flows might be correlated with an idiosyncratic error term over time. In this context, the fixed effects estimator could give a biased estimate, specifically when there are a large N and small T (Martínez-Zarzoso, Felicitas, and Horsewood 2009). To account for these challenges, we implemented a system GMM estimator that uses the internal instrument to address the endogeneity issues (e.g. Arellano and Bover 1995; Blundell and Bond 1998). Consistency of the estimator requires fulfilment of two key assumptions, i.e. selected instruments should be free from serial correlation and the over-identification restriction must hold.

3.3 Trade potentials

The values of trade potentials of coffee exports for EAC and/or COMESA at the intensive margin are computed by a method of sample predictions applied after deriving parameter estimates from coffee trading gravity model. After we obtain the estimated results of the gravity model for bilateral coffee trade flows, we use the parameter estimates derived from the previous section to predict coffee trade between EAC and COMESA and the rest of the world captured in our sample. The ratio of the predicted trade values *(T)* derived by dynamic model and the actual trade values *(A)*, i.e. (T/A)x 100, is then used to examine the East and Southern African's coffee global trade potential. Any East and Southern African coffee exporting country *(e)* has a trade potential with another importing country *(i),* if the value of (T_{ei}/A_{ei})x 100 is positive and therefore, the exporting countries may attempt to expand the coffee trades with their respective partners.

3.4 Data description

This study uses a balanced panel data for the period 1998-2013 in eight East and Southern African, i.e. Burundi, Ethiopia, Kenya, Malawi, Rwanda, Tanzania, Uganda, and Zambia, and 139 worldwide coffee trading partners. These exporting countries a member of the COMESA and EAC trade unions or both. The data sets are extracted from two sources. First, real GDP (constant US$ 2010 which is a proxy for income) and population size that represent the magnitude of coffee producers and consumers in paired trading countries are taken from World Development Indicators (World Bank 2015). Second, the value of coffee export (US$ 1000) to the rest of trading partners, the distance between trading countries (expressed in kilometres), dummies representing contiguity, common language, colony, common colony, and common official language are taken from "Centre d'Etudes Prospectives et d'Informations Internationales" (CEPII) database (CEPII 2015). We also obtained information on the membership status of the trading unions, i.e. COMESA and EAC from the respective institution (COMESA 2015; ECA 2015).

Table 1 illustrates the descriptive statistics and definitions of the variables. The contiguity dummy was used to control for the effect when the trading pairs were contiguous countries. The dummy variable denoted by common language captures the effect of having the same official language in the trading partners. The impact of common official language on coffee trade performance is captured by a dummy, as with the trading pairs. *Comlang_ethno* is included as a dummy to control for the effect of having at least 9% of the total population in a trading partner speaking the same language.

Furthermore, the variable Colony is used as a dummy if pairs ever lived in a colonial relationship. A dummy representing a common colony is also used to capture the trade relationship if both had a common coloniser post-1945. RTA are captured in two dummies, COMESA used if the country is a COMESA member state, while EAC accounts for the EAC membership. All the continuous variables

Table 1. Definitions of variables and descriptive statistics.

Variables	Mean	Std. Dev.	Min	Max
Log of national income in exporting countries	22.6	1.0	20.7	24.1
Log of national income in importing countries	24.2	2.4	18.3	30.3
Log of population size in exporting countries	16.9	0.8	15.7	18.4
Log of population size in importing countries	15.9	2.0	10.5	21.0
Log of total coffee trading values (US dollars)	13.1	2.3	6.9	19.4
Simple distance between trading countries	6430	3510	180	16006
Contiguity (1 if pairs are contiguous, 0 otherwise)	0.04	0.19	0	1
Common language (1 if pairs have common official language, 0 otherwise)	0.29	0.45	0	1
Comlang_ethno (1 if a language is spoken by at least 9% of population in both countries, 0 otherwise)	0.22	0.41	0	1
Colony (1 if pairs ever lived in colonial relationship, 0 otherwise)	0.01	0.09	0	1
Common colony (1 if the pairs had common coloniser post-1945, 0 otherwise)	0.19	0.39	0	1
COMESA (1 if the pairs are COMESA member states, 0 otherwise)	0.88	0.33	0	1
EAC (1 if the pairs are in the East African Community, 0 otherwise)	0.63	0.48	0	1
Observations (n)	17664			
Groups (N)	1104			
Time in years (1998-2013)	16			

(population and national income in trade pairs, distance, and trade value are transformed) are line-arised using log-transformation as it handles the influence of outliers on the estimates (e.g. see Melitz 2003; Porojan 2001).

4. Results and discussions

The analysis begins by estimating Equation (3) using a pooled least square estimator as the baseline regression. Under this estimator, we pooled our sample in a different time period in order to see different possible events that may occasionally influence coffee trading (see Table 2). In Tables 3 and 4, we present estimates corresponding to the static and dynamic specifications, respectively. Each specification considers key determinants of the coffee export value such as population, GDP in both trading countries and simple distance. We also presented estimates for a set of dummies to account for cultural and historical ties between trading partners and finally, we provided estimates for coffee trade potentials.

4.1 Baseline model estimates

Baseline estimates based on a pooled least square estimator are presented in Table 2. We have used a log-linear specification of the gravity model given by Equation (2) for a single time period, i.e. for the years 2000, 2004, 2008, 2010, and the whole sample period (1998–2013) without including the MRT. Each of the selected years are characterised by specific events in COMESA and EAC member countries that cold originally induce some change in coffee trading among member states. For instance, there was a new treaty for the Establishment of the EAC and the United Republic of Tanzania officially left the COMESA block in the year 2000. Rwanda and Burundi also entered the COMESA and EAC blocks in 2004 and 2008 respectively. In the year 2010, the Republic of Seychelles officially entered the COMESA block. The corresponding results indicated that the coefficients representing the size of consumers in importing countries were negative and statistically significant[3] under all pooled least square specifications. The negative coefficient could be linked to the inconsistency of pooled OLS estimates that will be addressed in the dynamic specification. Coefficients representing the population size in the exporting countries are positive which are similar to estimates reported in the previous literature.

The national income parameters for coffee importers and exporters were positive and statistically significant in most specifications. This suggests that an average increase in income of trading partner countries could positively affect the volume of coffee export. On the other hand, the estimates for physical distance between trading partners shows a negative sign in all specifications, indicating the higher transport cost could reduce the coffee export volume. The estimates for contiguity, colony and

Table 2. Baseline estimates.

Variables	Y = 2000	Y = 2004	Y = 2008	Y = 2010	All Years
GDP of importing country (log)	0.651***	0.523***	0.725***	0.755***	0.595***
	(0.078)	(0.076)	(0.093)	(0.094)	(0.022)
GDP of exporting country (log)	1.056***	0.844***	0.087	0.078	0.281***
	(0.333)	(0.275)	(0.291)	(0.291)	(0.071)
Population in importing country (log)	−0.327***	−0.251***	−0.326***	−0.364***	−0.255***
	(0.078)	(0.079)	(0.093)	(0.094)	(0.022)
Population in exporting country (log)	0.537	1.368***	1.536***	1.823***	1.274***
	(0.425)	(0.384)	(0.434)	(0.446)	(0.102)
Distance between trade pairs (log)	−0.148	−0.139	−0.207	−0.496*	−0.0392
	(0.228)	(0.227)	(0.283)	(0.294)	(0.065)
Contiguity (dummy)	2.163**	2.013**	2.373**	1.490	2.315***
	(0.981)	(0.967)	(1.123)	(1.133)	(0.272)
Common official language (dummy)	0.173	−0.544	0.467	−0.0439	−0.0797
	(0.499)	(0.500)	(0.582)	(0.591)	(0.135)
Common national language (dummy)	−0.072	0.717	0.290	0.289	0.653***
	(0.516)	(0.521)	(0.614)	(0.634)	(0.144)
Colony (dummy)	3.989*	0.0478	0.540	2.176	2.739***
	(2.153)	(1.534)	(2.538)	(2.403)	(0.600)
Common Colony (dummy)	0.592	0.263	0.082	0.279	0.010
	(0.443)	(0.432)	(0.488)	(0.494)	(0.114)
COMESA trade partners (dummy)	0.710	0.795	0.825	1.488**	0.330**
	(0.572)	(0.568)	(0.589)	(0.584)	(0.146)
EAC (dummy)	1.694***	1.155***	1.718***	1.373***	1.354***
	(0.285)	(0.251)	(0.333)	(0.349)	(0.077)
Constant	−41.82***	−49.02***	−38.29***	−40.95***	−37.07***
	(4.479)	(4.129)	(5.103)	(5.002)	(1.153)
Observations	1.062	1.078	1.069	1.061	17.036
R-squared	0.196	0.205	0.160	0.168	0.147

Note: Robust standard errors are in parentheses.
***$p < .01$.
**$p < .05$.
*$p < 0.1$.

common colony have a positive association with coffee export, while the estimate for a common official language and common national language have a mixed coefficient (see Table 2). Interestingly, coefficients for COMESA and EAC have a positive sign in all specifications, suggesting regional trade agreement could have a positive impact on the coffee export performance. Overall, most of the pooled least square estimates show the expected result, while some of them have an ambiguous coefficient. This could be related to the case that estimating a gravity model using pooled least square estimator is limited in capturing the effects of any unobserved factors that could be fixed or varies across country and time period (e.g. Baier and Bergstrand 2007). Furthermore, it has been indicated that estimates for RTA dummies could be highly unstable in the case of single country estimate over a period of time (Baier and Bergstrand 2007; Saggi, Stoyanov, and Yildiz 2018).

4.2 Static model estimates

Results for the static gravity model are presented in Table 3. Columns (1) and (2) show estimates based on group of years, i.e. between 1998–2006 and 2007–2013 respectively, while column (3) provides estimates for the whole sample. The idea behind classifying the whole sample before and after the year 2006 is to consider the global coffee market situation in connection to the world financial crises. Similar to the baseline specifications, we have controlled market size (population size) and national income in both importing and exporting countries, distance in kilometres, and other control variables. Population size in coffee exporting countries has a positive and statistically significant coefficient.

Estimates for GDP in importing and exporting countries have a mixed coefficient sign. Before, the financial crises, the sign becomes positive while negative after the financial crises. This could reflect the potential adverse effects of the global economic environment on coffee export performance of

Table 3. Estimates for the static model.

Variables	(1)	(2)	(3)
GDP of exporting country(log)	1.433***	−0.562	0.458
	(0.313)	(0.358)	(0.300)
GDP of importing country(log)	0.244	−0.104	−0.161*
	(1.002)	(0.079)	(0.091)
Population size in exporting country(log)	1.829**	2.711***	1.941***
	(0.736)	(0.858)	(0.650)
Population size in importing country(log)	−0.064	−0.018	−0.049
	(0.076)	(0.084)	(0.074)
Distance to between trade pairs(log)	−1.062**	−2.350***	−1.673***
	(0.533)	(0.540)	(0.496)
Contiguity trading pairs (dummy)	4.316***	1.303	2.304*
	(1.574)	(1.744)	(1.386)
Common language (dummy)	0.258	0.038	0.111
	(0.381)	(0.386)	(0.360)
Trading with colony (dummy)	4.911*	−0.054	1.634
	(2.748)	(3.017)	(2.415)
Common colony (dummy)	0.183	0.105	0.398
	(0.577)	(0.631)	(0.521)
Trading pairs are COMESA members (dummy)	1.321***	−1.044**	0.278
	(0.427)	(0.468)	(0.413)
Trading pairs are EAC members (dummy)	1.436***	1.406***	1.412***
	(0.248)	(0.252)	(0.235)
Zeta (standard error from second stage)	−2.814	0.572	−4.238
	(7.319)	(7.120)	(6.593)
IMR (Inverse mills ratio)	−16.791	−4.540	−6.722
	(12.53)	(11.53)	(10.33)
Constant	−55.626**	0.000	−23.671
	(27.659)	(19.186)	(14.76)
Observations	10,668	8520	17,035
Long Run SE	8.550	7.756	10.24
Bandwidth (neweywest)	74.26	67.38	94.30
Observations	10,668	8520	17,035
Year FE	Yes	Yes	Yes
Bilateral FE	Yes	Yes	Yes

Note: Robust standard errors are in parentheses.
***$p < .01$.
**$p < .05$.
*$p < .1$.

the countries. GDP in the exporting countries have a positive and statistically insignificant effect. Apparently, it has a negative and statistically significant estimate in the case of importing countries. The effect of distance between trading pairs is negative and different from zero in each specification, indicating that distance is of the critical determinants of coffee export.

An increase in distance by one kilometre between trading partners results in a 1.7% decrease in export value. Eventually, this indicates that being distant from the exporting countries to importing countries reduces significant influences on coffee trade performance in East and Southern African countries. Looking at the overall results in column (3), our study provides interesting findings on the effects ECA and COMESA membership on coffee export performance. Specifically, the EAC membership indicates significant positive contributions on intra-coffee trading in all specifications. Unlike in the second column, the intra-trade of coffee among COMESA members exhibit positive effect of RTA. The impact of population size in exporting country is positive and statistically significant at 1% level, suggesting that a 1% increase in population size results in a 1.94% increase in coffee export value. Similarly, if the trading countries are sharing a common border which is controlled by contiguity have a positive effect on coffee export value. In this regard, the coffee export value is 2.30% higher if the trading pairs have a common geographical border compared to those trading partners without a common border.

To deal with the issue of country heterogeneity and bias of self-selection, we use a two-stage estimation technique as shown in Equations (3)–(5), and we follow a similar approach by Helpman, Melitz, and Rubinstein (2008). The results are also provided in Table 3. Both coefficients from the

Table 4. Dynamic model estimates.

Variables	(1)	(2)	(3)
Lagged value of Trade	0.035***	0.064***	0.049***
	(0.003)	(0.001)	(0.000)
Distance to between trade pairs(log)	−0.034	−0.660***	−0.432**
	(0.629)	(0.161)	(0.144)
GDP of exporting country(log)	0.016	0.913***	0.573***
	(0.461)	(0.065)	(0.055)
GDP of importing country(log)	0.264***	0.092***	0.119***
	(0.078)	(0.004)	(0.009)
Population size in exporting country(log)	−1.118	−0.857***	−0.872***
	(0.644)	(0.106)	(0.094)
Population size in importing country(log)	−0.525***	−0.107***	−0.213***
	(0.008)	(0.018)	(0.006)
Contiguity trading pairs (dummy)	0.835	2.076***	0.388
	(1.917)	(0.590)	(0.492)
Common language (dummy)	2.357	−0.382	0.506
	(1.471)	(0.417)	(0.364)
Trading with colony (dummy)	0.254	7.062***	5.133***
	(3.305)	(0.991)	(0.735)
Common colony (dummy)	−0.482	−0.164	0.187
	(1.005)	(0.190)	(0.178)
Trading pairs are COMESA members	0.897	1.039***	0.793**
	(1.044)	(0.170)	(0.246)
Trading pairs are EAC members	1.063	1.447***	1.820***
	(0.810)	(0.272)	(0.139)
Constant	32.766***	−2.513	9.141***
	(7.768)	(1.747)	(2.039)
Groups	1078	1094	1094
Observations	7478	8521	15999
Year FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
AR(1)	−11.51***	14.42***	−16.08***
AR(2)	1.62	0.65	1.62
Sargan's test	413.57***	2101.45***	2896.19***
Wald χ^2	140.47	446.20	565.70

Note: The Hansen test for over-identification with χ^2 and probability values in parentheses. Robust standard errors are in parentheses.
∗∗∗$p < .01$.
∗∗$p < .05$.
∗$p < .1$.

second stage predicted standard errors ζ and inverse mills ratios are negative and not statistically different from zero. These findings simply imply that there is no evidence of self-selection effects. The overall estimate under static specifications shows the expected result in terms coefficient sign with the exception of GDP and population size in the importing countries. This could be attached to the dynamic nature of coffee trade that consideration of past trade is required. We have estimated the dynamic gravity model and results are presented the subsequent subsection.

4.3 Dynamic model estimates

Estimates from dynamic specifications are reported in Table 4. Similar to the static specifications, we have classified the sample in columns (1) and (2) for the period trade between 1998–2006 and 2007–2013 respectively, while column (3) gives estimates for the whole sample. The Arellano–Bond test for serial correlation in the first difference, AR(2) is failed to be rejected in all specifications, indicating the absence of serial correlation in the error term. Besides, the Sargan–Hansen tests for joint exogeneity of the instruments indicted by Wald test statistics is not rejected at least at 10% significance level which suggests exogeneity of the instruments.

Estimates in column (1) represent the sub-sample period 1998–2006 and the estimated coefficient for lagged trade flows is statistically significant at the 1% level, indicating a dynamic process in our gravity modelling analysis. The estimate denoting population and GDP for importing countries

becomes statistically significant. Column (2) presents the estimates for the sample period between 2007 and 2013. In this specification, the estimated coefficient for lagged trade flows is still statistically significant at the 1% level, indicating a dynamic process in coffee export from East African countries. Except for variable representing the colonial relationship, all variables are statistically significant at least 10% level in explaining coffee export performance. Importantly, estimates for ECA and COMESA variables are positive and statistically significant at 1% level suggesting, the positive effect of the RTA on coffee export performance.

The last column in Table 3 represents the overall sample period i.e. 1998–2013. In this specification, all variable, except for contiguity and common colony, are statistically significant in explaining coffee export performance. The lagged dependent variable is statistically significant at the 1% level. Importantly, the statistics for Arellano–Bond test for AR(2) in first differences is not rejected confirming the absence of autocorrelation. Besides, the Hansen test for exogeneity of the instruments, as indicated by the Wald test statistics, is not rejected that the exogeneity condition is fulfilled. Overall, the estimates under dynamic specification provide estimates with the expected sign and relatively lower standard errors, implying that the predicted values become more robust. This reduces the issue of model misspecification elaborated by Martínez-Zarzoso, Felicitas, and Horsewood (2009) that could result in a biased estimate. Therefore, results from the dynamic specifications showed that examining the effects of bilateral trade agreements on coffee export performance provides a more robust estimate that can be exploited for the enhancement of trade policy in the sector.

4.4 Analysis of trade potentials

Another essential aspect of trade analysis using gravity modelling is that it can be used to analyse the trade potentials of the exporting countries. In this regard, we have computed the trade potentials over time by taking the difference between predicted and actual trade flows for exporting countries. The results are reported across eight exporting countries over the study period. The prediction indicated that exporting countries still have opportunities to exploit the international market (see Figure 5). The gap between the actual and predicted lines indicates coffee trade potentials from the East and Southern African region.

The figure also shows that most of the trade potentials are strictly positive, an indication that the countries in the regions still have significant opportunities to expand their coffee export at the international market. Notably, countries like Zambia, Tanzania, Kenya, Uganda, and Ethiopia have a substantial opportunity for the possible expansion of coffee exports as the gap between the two curves are relatively large and widen over time. However, countries such as Burundi and Malawi have a very narrowed and declining coffee trade potentials but still positive.

4.5 Comparative analysis of the results

In this subsection, we provide comparative analysis of the results from our study in relation to previous studies. From the final model estimates in Table 4, we find that the coefficient values from national income (proxied by GDP) and distance between trade partners are statistically different from zero with expected signs, positive and negative, respectively. The elasticities derived from GDP are relatively large but less than a unit. These results are in line with Silva and Tenreyro (2006) who suggested that the parameter estimates on exporter and importer's national income tend to be large, even sometimes more than a unit.

We further looked at how the physical distance affects coffee export. In this regard, we found that the estimates from pooled and static models are larger compared to the estimates from the dynamic estimator. Notably, the estimated elasticity is always negative and close to 0.75, while the dynamic estimate is relatively lower (0.37). Comparing with the existing literature such as Dal Bianco et al. (2015) and Disdier and Head (2008), the geographical distance might have a trivial effect on coffee trade.
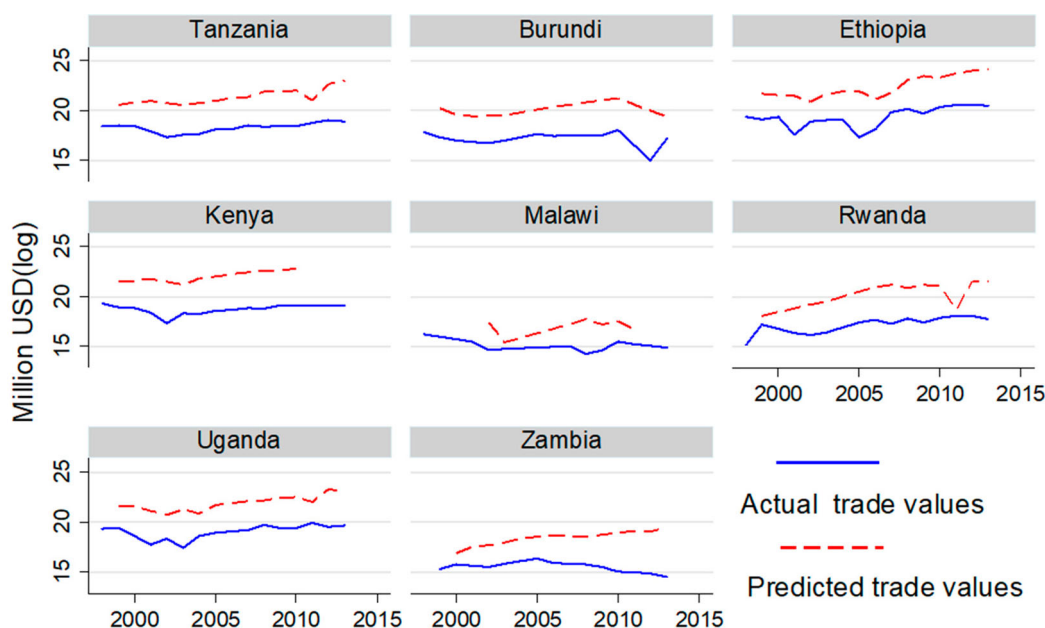
Figure 5. Coffee trade potentials of the Eastern and Southern African African countries.

It is also worthy to mention that the pooled and static estimates overestimate the impact of geographical distance which is consistent with the previous study by Dal Bianco et al. (2015).We can therefore conclude that the cost of transport induces a minimal role in affecting bilateral trading. The parameter estimates of the lagged coffee trade values from Table 4 are all statistically significant (at 1% level) showing the dynamic nature of coffee export performance.

Using the dynamic model, we also derive other interesting results of the parameter estimates on RTA'S, including EAC and COMESA. The estimated coefficients on these RTA are positive in all specifications. In the last column of Table 4, the EAC and COMESA estimates indicates that the elasticities of 1.82 and 0.79 showing RTA can improve the export volume around 182 and 80% respectively. This result also complements with the study by Parra, Martínez-Zarzoso, and Suarez-Burguet (2016) that the RTA's have substantial impact on coffee global market integrations. Our results also complement the studies by Martínez-Zarzoso, Felicitas, and Horsewood (2009) and Carrere (2006). Accordingly, Martínez-Zarzoso, Felicitas, and Horsewood (2009) evaluated the effects of preferential trade agreements between EU members and non-members using static and dynamic gravity models and found significant effects if RTA. The study by de Santis, De Benedictis, and Vicarelli (2005) analyses the impacts of intra-periphery free trade agreements in eight Eastern European countries using a dynamic gravity model, while Carrere (2006) used a static gravity model to analyse regional trade agreement (RTA) effects. In all these studies, the authors obtained similar results regarding positive and statistically significant intra-trade block effects (in the present case the EAC and COMESA trade blocks are positively and statistically significant).

Although this study found strong evidence that RTA's significantly influence the coffee trade performance, less attention was put on the potential effects of Non-Trade Measures (NTM's). In this regard, previous studies have shown that NTM's may play an important role in coffee trading, especially when trading with developed and emerging economies, where the later may friction or facilitate trade (Gebrehiwet, Ngqangweni, and Kirsten 2007; Grant and Arita 2017; Santeramo 2015; Santeramo et al. 2019). For instance, those high-income countries may impose NTM's of sanitary and phytosanitary standards, to mitigate risk in consumption and protect human health from risks linked with imported agricultural commodities. Although in this study, we attempt to account

the potential effect of NTM's through country-pair specific fixed effects, we suggest future study to specifically examine the potential role of NTM's on coffee trade dynamics.

5. Conclusions and policy implications

This paper identifies the major factors influencing coffee export performance in eight East and Southern African countries. Both static and dynamic gravity model specifications were used to examine the effects of trade agreements on social-economic growth. Importantly, two dummies defining trade flows were generated to analyse the potential implications of both coffee intra-trade within blocks and the rest of the world. The EAC dummy was used to control for the effects of coffee trade flows if the pairs are EAC members, and COMESA was a dummy when trading pairs have COMESA trade agreements.

The results from the dynamic specification found that preferential trade agreements under COMESA and EAC have a positive effect on coffee export performance of the East and Southern African countries. Specifically, the exporting country could increase their trade value by an average of up to 80% given the country is a COMESA member, while the export value could rise by 182% if the country is an EAC member. The variation in the magnitude of the two estimates could be linked to an case that the stage of market integration in the EAC is relatively high. For instance, there is a free trade preferential agreement, i.e. zero duty on import of goods and services among member countries while achieving free trade preferential agreement is in due process in the case of COMESA block (COMESA 2009; EAC 2014).

The overall results also supported the recent initiative of the AU to create the largest continental FTA through the treaty called, the AfCFTA 44 countries across the continent (African Union 2018). According to the agreement, signatories are agreed to create a single continental market for goods and services, with free movement of business persons and investments, and thus paving the way for accelerating the establishment of the Continental CU and the African CU. Therefore, policy makers should consider the role of free trade agreements for the coffee sector as an essential path towards coffee sector development. Interestingly, the trade potentials from the study revealed that there are substantial opportunities for the region to exploit the available markets as the countries are still under-exporting compared to the coffee market needs.

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Notes

1. These are Djibouti, Kenya, Madagascar, Malawi, Mauritius, Sudan, Zambia and Zimbabwe.
2. This term is an increasing function that controls a fraction of exporting countries *i* to importing countries *j* with consideration of zero values.
3. These estimates were derived from the partial differentiations of $\frac{\partial \ln X_{ijt}}{\partial \ln N_{it}}$ and $\frac{\partial \ln X_{ijt}}{\partial \ln N_{jt}}$ in the coffee trading partners.

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Appendix

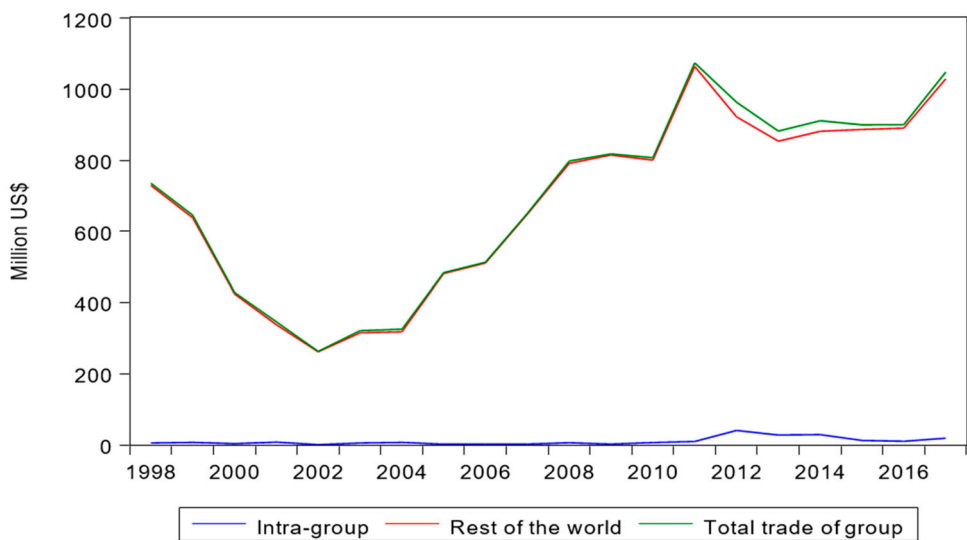**Figure A1.** Intra-trade and extra-trade in coffee among COMESA member countries.

Figure A2. Intra-trade and extra-trade in coffee among EAC member countries.