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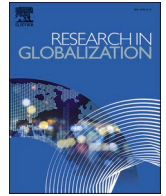
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Kenya's macroeconomic policies and trade efficiency within the East African Community: A stochastic frontier analysis

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ABSTRACT

Despite Kenya dominating trade volumes in the East African Community (EAC), it has been trading below its potential within the region. This is also in spite of the increased scope of the country's trade opportunities resulting from the region's increased market integration. Empirical evidence has shown that macroeconomic policies influence international trade flows. However, there is limited empirical evidence on the effect of macroeconomic policies on trade efficiency. The few existing studies on this topic have also used estimation techniques that depict efficiency as being drawn from an average level of trade and not the optimal level of trade, as well as also not separating the effects of inefficiencies from the statistical noises. This, therefore, creates a knowledge gap that this study aims at investigating by using the stochastic frontier gravity model (SFGM), to determine the effect of Kenya's macroeconomic policies on its trade efficiency within the EAC. The study used annual panel secondary data for the period 2000 to 2021. This study finds that the GDP of Kenya and that of its EAC trading partners, the geographical distance and border significantly affects trade volume. It also finds that globalization plays a significant role in influencing Kenya's trade. For the inefficiency model variables, exchange rate depreciation was found to significantly increase trade efficiency, while increase in tariff rate had an adverse and significant effect. Further, the study included corruption as a control variable and found that it significantly increases trade inefficiency. Kenya, though trading at an average efficiency level of 86.91 percent, was found to have high unexploited trade potentials within the region especially with Tanzania and Uganda. The study recommends that Kenya's policymakers deliberately advance the macroeconomic policies that promote trade efficiency while at the same time closely monitor the ones that hinder efficiency.

Introduction

International trade is very important in the growth and development of both the developed and the developing economies (Otinga, 2009). In the developing economies, it has greatly contributed to economic growth, poverty reduction and expansion of markets for goods and services, hence improving the welfare of the citizens (Okenna & Adesanya, 2020). Of greater importance, however, is the efficiency with which countries trade with each other. Trade efficiency refers to the measure of the degree of how much trade potential has been realized in a given economy. A key factor that influences trade efficiency is macroeconomic policies (Wang & Tian, 2020) which shape the direction and

volume of trade between countries as well as influence the efficiency with which countries trade with each other (Kubedran, 2016).

According to the World Trade Organization [WTO], (2015), macroeconomic policies have direct effect on trade flows in that expansionary fiscal and monetary policies increase the aggregate spending, including the spending on imports, and also influence how resources are allocated between the tradables and the non-tradables. Since trade efficiency is determined by trade flows between countries, then by extension the macroeconomic policies that affect trade flows have direct effect on trade efficiency. There however exist conflicting empirical findings on the relationship between macroeconomic policies and trade flows. Mahona and Mjema (2014) found that exchange rate positively impacts

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trade flows between countries while Adekunle and Gitau (2013) found that it has a negative effect. Further, Hassan, (2017) found that average tariff rate adversely affects trade flows while Miankhel et al. (2015) found average tariff rate to be insignificant in influencing trade flows.

Empirical studies have also established that membership in trade agreements has a positive effect on a country's trade efficiency (Baier & Bergstrand, 2001; Hassan, 2017; Mahona & Mjema, 2014). These trade agreements are designed by countries for the purposes of increasing their trade efficiency through elimination of various trade and investment barriers (Barone, 2022). The trade agreements and arrangements have been facilitated by increased globalization and interconnectedness between countries. Other than opening up the countries to the global community, globalization has increased opportunities for local businesses by expanding their market base and hence enabling them to reach global markets. It has also led to reduced tariffs and quotas among other trade barriers, thereby facilitating smooth flow of goods and services across international borders (Nzau, 2023).

Kenya, like many other countries experiencing the benefits of globalization, has signed many trade agreements spreading across regional, bilateral as well as multilateral agreements. Among the regional agreements that Kenya has signed include the East African Community (EAC), which is a Preferential Trade Agreement (PTA) that currently comprises of seven member states (EAC, 2022). The EAC is one of the most integrated trade and economic regions in Africa, and has successfully introduced the customs union and the common market protocol in a bid to enhancing intra-EAC trade, and is in the process of achieving a monetary union (EAC, 2022). Other regional agreements that Kenya has entered into include the Common Market for Eastern and Southern Africa (COMESA), and hence enjoys the preferential tariff rates. It is as well a beneficiary of the African Growth and Opportunities Act (AGOA), and hence exports apparels, handicrafts and textiles duty free to the United States. Among the multilateral agreements that Kenya has signed include the World Trade Organization (WTO) and the African Continental Free Trade Area (AfCFTA) (International Trade Administration, 2022). Kenya has as well entered into many bilateral trade agreements and arrangements with many countries across the globe. These trade agreements open the country up to the global community, and hence enjoys the benefits of increased product market integration through international trade (Nzau, 2023).

It is noteworthy that Kenya dominates intra-EAC trade volumes, and is a net exporter into the economic bloc. Kenya exports to the region such diversified products as fuels, machinery, transportation equipment, lubricants, and chemicals, and imports cereals, vegetables, beverages and other agricultural products from the region (Muluvi et al., 2016). According to KNBS (2017), Kenya's trade flows within the EAC are enhanced by factors that include the liberalization policies, removal of trade barriers and geographical proximity of the EAC member states.

Over the years however, Kenya has been trading below its potential within the EAC despite the increase in trade opportunities within the region that are brought about by the EAC's integrated market (Raga et al., 2021). This might be caused by the EAC's remaining trade barriers including cumbersome licensing requirements and bureaucratic procedures (Krishnan et al., 2018; WTO, 2019). Nyabera (2022) posits that Kenya's exports into the EAC have dropped from 22.5 % of the intra-EAC trade in 2010 to 19.9 % in 2022 despite the signing of the EAC Common Market Protocol in 2010 that was anticipated to boost trade and commerce within the region. Among the factors that would be attributed to the drop in trade levels and the nonattainment of Kenya's trade potential within the EAC is macroeconomic policies (Majune & Mwanja, 2021).

This study focuses on specific macroeconomic policies that include, exchange rate, tax rate and average tariff rate as proxies for monetary, fiscal and trade policies respectively. The choice of these policies is motivated by the fact that they directly influence a country and consumers' trade-off consumption decision between imports and the locally produced goods (Kubendran, 2016) in addition to them being among the major macroeconomic policies that influence the direction of trade.

Kenya's trade volume with the EAC member countries has increased marginally from 813.35 million US dollars in 2000 to 2,581.08 million US dollars in 2021. The real effective exchange rate has also increased drastically from 77.41 in 2000 to 140.81 in 2021 (International Monetary Fund (IMF), 2023). Kenya's tax rate has remained almost constant and recorded a rate of 18.12 percent in 2000 and 17.17 percent in 2021, and averaged 17.30 percent during the study period. The tariff rate imposed on imported goods, which is measured as the simple un-weighted average applied on all products that are subject to a tariff declined from 20.9 percent in 2000 to 13.1 percent in 2021. This decline is attributed to the benefits of signing the common market protocol by the EAC member countries in 2010 (EAC, 2022). Studies by Roscelin et al. (2021), Issam (2018), and Keen and Syed (2006) indicate that increases in real effective exchange rate, tariff rate and tax rate would lead to a decrease in a country's trade flows. This has however not been the case since Kenya's trade volume within the EAC has been on an upward trend despite the increases in the real effective exchange rate and the constant tax rate level. This diversion from the theoretical proposition creates a need for study.

This study acknowledges the importance of macroeconomic policies in shaping the direction and volume of trade between countries, and the efficiency with which countries trade with each other. Particularly, it is guided by the general objective of establishing the effects of Kenya's macroeconomic policies on its trade efficiency within the East African Community. It further narrows down to three specific objectives that include assessing the effect of Kenya's monetary policies on trade efficiency within the EAC, to determine the effect of Kenya's fiscal policies on trade efficiency within the EAC and to find out the effect of Kenya's trade policies on trade efficiency within the EAC. The study also examines the effect of globalization on Kenya's trade.

Despite the several empirical studies conducted on trade, most of the studies have focused on the effects of macroeconomic policies on trade flows without paying attention to trade efficiency (Emisembe, 2021; Mahona & Mjema, 2014; Semančiková, 2016). Some other studies have investigated the concept of trade efficiency without incorporating the effect of macroeconomic policies (Lei & Li, 2021; Mutethia, 2019; Wang & Tian, 2020). There is therefore insufficient evidence on the link between macroeconomic policies and trade efficiency, more so in the developing countries. This study makes an important contribution to literature by examining the extent to which Kenya's macroeconomic policies affect its trade efficiency within the EAC, and as well includes corruption in the analysis to control for the macroeconomic policies. It also incorporates globalization index and terms of trade to investigate the effect that the interconnection of global economies has on trade. The findings of this study provide the policymakers with an understanding of the extent to which their actions of formulating and implementation of the macroeconomic policies shape the efficiency of Kenya's trade within the EAC, and acknowledge the policies that increases efficiency and those that act on the contrary. The study further builds on its relevance by using the stochastic frontier gravity model, which accommodates the random variations in actual trade flows, thereby making it possible to produce trade potential levels and efficiency scores that are consistent with the actual trade flows under normal market conditions.

This study follows a structured approach, with section 2 presenting the literature review. Section 3 contains data and the methodological techniques that were applied in the analysis of this study. Section 4 contains the empirical analysis and discussion of results, while section 5 summarizes the study and provides policy implications.

Literature review

Theoretical literature

Trade theories

The Heckscher-Ohlin model, developed by Eli Heckscher and Bertil Ohlin in 1933, states that countries would specialize in the production

and hence exportation of commodities whose production required intensive use of a factor that a country has abundance in, and import the goods whose production requires the intensive use of a factor that a country did not possess in abundance. Going by this argument, Kenya, which is labour abundant, will produce labor-intensive goods and export them to the other countries, and import capital-intensive goods from the capital-abundant countries. The Linder Hypothesis, developed by [Staffan Linder \(1980\)](#), explains that countries will produce and hence export manufactured commodities in the instances where there exists a sizeable domestic market, and when it has production efficiency, and export more of the manufactured commodities to countries within its locality, and with overlapping demand structures such as similar tastes and income levels as the exporting country. This theory is applicable in that it is expected that Kenya will trade more with the EAC member states, since they share similar demand structures and same geographical locality. The New Trade Theory, developed by [Paul Krugman in 1980](#), argues that even though there are negligible differences in comparative advantage for countries which are endowed with similar factors, there exists economies of scale in production which sufficiently generates the advantageous trade between them. Although the EAC countries tend to be endowed with similar factors of production, and with the same production capabilities, Kenya would take advantage of its economies of scale and hence increase its export volume.

Empirical literature

[Longo and Sekkat \(2001\)](#) evaluated the hindrances to the intra-African trade using the gravity model for the period between 1980 and 1997. The study revealed that the level of development, a country's GDP and its income level influences a country's trade flows. As is the expectation of the gravity model, the geographical distance as well as country dimension had adverse effects of trade flow. Further, political instability, sound economic policies, trade policy, and infrastructure significantly affected trade flows. The current study improves on this study by using current data from 2001 to 2021 which will produce more reliable results.

[Geda and Kibret \(2002\)](#) used the gravity model to evaluate the factors that determine trade flows in COMESA for the period between 1980 and 2000. The study found that all the variables of the standard gravity model apart from distance, had positive and significant effect. The study further found that favorable macroeconomic policies were key in determining Africa's bilateral trade. Further, the intra-regional trade was found to be negatively affected by the regional integration arrangements. However, the study considered macroeconomic policies as one variable, which this study disintegrates into monetary, fiscal and trade policies for better analysis and reporting.

Using the stochastic frontier technique, [Hassan \(2017\)](#) sought to find out the determinants and the constraints of the export industry in Bangladesh for the period between 2008 and 2011. The study sought to reveal and expose the unutilized export potential between Bangladesh and 40 of its top trading partners. The study found that the export volume was influenced primarily by the population, distance, average tariff rates, GDP as well as the preferential agreements. However, it was found that among all these factors, only distance and tariffs had a negative impact on trade volume, while the rest impacted it positively. On the constraining aspect, [Hassan \(2017\)](#) found that corruption, customs and restrictive border procedures as well as port inefficiencies were the main factors. The study did not put into consideration the aspect of macroeconomic policies in its analysis, which the current study seeks to do. Further, it uses very few years, and hence the current study will use a 22-year period between 2000 and 2021.

[Adekunle and Gitau \(2013\)](#) studied on the trade flows that existed between China and 46 Sub-Saharan African countries by the use of the gravity model. The study gave special attention to the countries that produced oil and for the period between 1990 and 2008. The study also used panel data techniques of random and fixed effects in the analysis. The study found that similar language, same border, GDP, regional

integration as well as population significantly and favorably influenced trade flows. On the flipside, geographical distance, exchange rate and landlockedness, though were significant, they adversely affected trade flows between China and the SSA countries. Other than exchange rate, this study incorporates other macroeconomic policies that include tariff rate and tax rate that were not considered by [Adekunle and Gitau \(2013\)](#).

[Ngugi \(2016\)](#) conducted a study on the bilateral trade flows between Kenya and other EAC countries using the standard gravity model for the period 1994 to 2014. In order to estimate the augmented gravity model equation, the study used both OLS and random effects techniques. The study revealed that GDP, institutional quality as well as transport infrastructure had a confident and significant effect on trade flows. Unlike the expectations of the standard gravity model, however, membership to the EAC was not found to influence Kenya's bilateral trade flows. The study concluded that the pattern and direction of bilateral trade flows in Kenya greatly followed the Linder hypothesis. According to the study, the trade volume between Kenya and countries with the same level of per capita income, demand structures, as well as factor endowments was high and intense. The current study improves on this study by investigating Kenya's trade efficiency within the EAC and examining how macroeconomic policies affect this trade efficiency.

[Mutethia \(2019\)](#) studied on Kenya's export efficiency and potentials with 20 of its key trading partners using the stochastic frontier gravity model from 2010 to 2017. According to the study, GDP positively impacted trade as forecasted by the gravity model, while distance and population had no significance. Further, Kenya traded efficiently under the AGOA and EU frameworks but not in COMESA. The study also found that Kenya's highest export efficiency was with the US, UK, Uganda, Egypt and Pakistan. Further, there was high and untapped trade potential between Kenya and Europe and the Middle East, as well as with Rwanda, Somalia and Burundi. The current study improves on the study by [Mutethia \(2019\)](#) by not only examining the export efficiency, but by investigating Kenya's trade efficiency within the EAC and how this efficiency is affected by the macroeconomic policies that the government of Kenya puts in place.

A study by [Mahona and Mjema \(2014\)](#) to establish the reason as to why Kenya and Tanzania dominated trade within the EAC region as well as the determinants of trade used the aggregated gravity model for the period between 2009 and 2011. The study found that the formation of the EAC bloc as well as liberalization measures favorably and significantly affected trade. Further, GDP positively influenced exports. The study also revealed that GDP, other than GDP per capita significantly influenced trade flows between Kenya and Tanzania. A negative association was found to exist between trade and geographical distance between countries. Other key factors positively influencing trade flows within the EAC were trade openness, population as well as exchange rate coefficients. The current study improves on this study by incorporating tax and tariff rates in addition to the exchange rate, and examines how they affect Kenya's trade efficiency within the EAC.

Data and methodology

Data

This study seeks to investigate how Kenya's macroeconomic policies affect its trade efficiency within the East African Community. Particularly, the study evaluates the monetary, fiscal and trade policies, with a closer focus on bilateral real exchange rate, tax rate and average tariff rate as proxies for the three policies respectively. Further, the study incorporates the variables of the standard gravity model which include GDP of both Kenya and the EAC countries, Population of Kenya and that of its EAC trading partners, geographical distance between the capital cities of Kenya and that of each trading partner as well as a dummy variable for common border. The study as well included corruption as a control variable to control for the macroeconomic policies. Further, in

order to establish the influence of globalization on Kenya's trade, both the globalization index and terms of trade incorporated. The study uses annual panel secondary data of Kenya's trade volume with the EAC member countries which include Tanzania, Uganda, Rwanda, Burundi and South Sudan, for the period 2000–2021, and employs the use of causal research design. The source and the expected signs of the study variables are elaborated in section 3.4.

Theoretical framework

The standard gravity model

This model was first developed by Tinbergen (1962) and Poyhonen (1963) who postulated that trade flows between two trading partners is determined by their economic sizes and the geographical distance between their capitals. According to Head, (2003), this model was developed from the Newton's "Law of Universal Gravitation", which is presented as follows;

$$F_{ij} = G \left[\frac{M_i M_j}{D_{ij}} \right] \quad (3.1)$$

Where F_{ij} is the force of attraction between the two objects, M_i and M_j represent the masses of the two objects, D_{ij} represent the distance between them, while G is the gravitational constant which depends of the relevant unit of measurement.

In international trade, the model is presented as;

$$\text{Trade}_{ij} = A \left[\frac{\text{GDP}_i^* \text{GDP}_j}{D_{ij}} \right] \quad (3.2)$$

Where Trade_{ij} is the trade flows between two trading countries, A is a constant, GDP_i and GDP_j are the economic sizes of the two trading partners, while D_{ij} is the geographical distance between their capitals. According to the model, trade flows have a positive correlation with the product of the GDP of any two trading countries, and negatively correlates with the geographical distance between them. Since the model is multiplicative in nature, the linear relationship between the variables can be obtained by taking the natural logarithm⁴ of equation (3.2) to give;

$$\ln \text{Trade}_{ij} = \alpha_0 + \alpha_1 \ln \text{GDP}_i + \alpha_2 \ln \text{GDP}_j - \alpha_3 \ln D_{ij} + \alpha_4 \delta_{ij} + \varepsilon_{ij} \quad (3.3)$$

Where α_0 is a constant, α_1 to α_4 are coefficients of the explanatory variables, and δ represents all other influencing variables. ε_{ij} is an independent and identically distributed (iid) disturbance term.

Since there are other factors that influence bilateral trade flows such as population, membership into regional trade agreements, and tariffs, Chen et al. (2017) represented the augmented gravity model as follows;

$$\ln T_{ij} = \alpha_0 + \alpha_1 \ln \text{GDP}_i + \alpha_2 \ln \text{GDP}_j - \alpha_3 \ln D_{ij} + \alpha_4 \ln \text{Pop}_{ij} + \alpha_5 \text{Bor}_{ij} + \alpha_6 \text{RTA}_{ij} + \varepsilon_{ij} \quad (3.4)$$

Where T_{ij} is the trade volume between two trading countries, GDP_i and GDP_j are the economic sizes of the reporting and the trading country respectively, Pop_{ij} is the population of the two trading countries, Bor_{ij} is a dummy that takes the value of 1 if the trading partners share a common border and 0 otherwise, and RTA_{ij} is a dummy taking a value of 1 if the two countries have signed a common trade agreement and 0 otherwise. α_0 is a constant while α_1 to α_6 are coefficients. ε_{ij} is the error term.

The stochastic frontier gravity model (SFGM)

The stochastic frontier model was first proposed by Meeusen and van den Broeck (1977) and Aigner et al. (1977). It consists of two error terms namely – the two-sided normal error term (ν_{ijt}) which represents pure randomness and a one-sided non-negative human-factor inefficiency term (μ_{ijt}) – which are obtained by splitting the random disturbance term (ε_{ijt}). Unlike the conventional gravity model, the SFGM is very effective in providing the trade potentials and efficiency levels which are easily comparable to the actual trade levels. This trade potential levels indicate the maximum levels of trade that a country can attain, given a combination of social-political-institutional factors. Further, the SFGM estimation is able to separate the effect of beyond-the-border factors from behind-the-border constraints, and the random error term. This makes it possible to evaluate the extent to which the behind-the-border constraints influence trade potentials.

In its general form, the SFGM is stated as follows;

$$\text{Trade}_{ijt} = f(x_{ijt}, \beta) \exp(\varepsilon_{ijt}) \quad (3.5)$$

$$= f(x_{ijt}, \beta) \exp(\nu_{ijt} - \mu_{ijt}); \mu_{ijt} > 0 \quad (3.6)$$

Taking natural logarithms on both sides;

$$\ln \text{Trade}_{ijt} = \ln f(x_{ijt}, \beta) + \nu_{ijt} - \mu_{ijt}, \mu_{ijt} > 0 \quad (3.7)$$

In this case, Trade_{ijt} represents trade volume between countries i and j at time t , x_{ijt} represents all the factors that affect trade at time t while β represents the parameters that the model seeks to estimate. ν_{ijt} and μ_{ijt} are as explained above, but at time t .

In the absence of the human factors, trade potential is obtained using the formula;

$$T_{ijt}^* = f(x_{ijt}, \beta) \exp(\nu_{ijt}) \quad (3.8)$$

However, trade efficiency is obtained by the trade volume to trade potential ratio, and is given by;

$$\text{TE}_{ijt} = \frac{T_{ijt}}{T_{ijt}^*} = \exp(-\mu_{ijt}); \mu_{ijt} > 0; \text{TE}_{ijt} \in (0, 1) \quad (3.9)$$

Where TE_{ijt} is the trade efficiency between country i and its trading partner, j at time t . T_{ijt} is the trade volume between country i and j while T_{ijt}^* is the potential trade level between country i and its trading partner, j at time t .

Equation (3.9) shows that trade efficiency and trade volume are positively correlated.

In equation (3.9), a country's bilateral trade is fully efficient if the TE is equal to 1, while a value of 0 represents total inefficiency. Indeed, a value of 1 indicates that actual trade is equal to the bilateral potential trade volume between the trading countries. Values between 0 and 1 indicates that country-specific factors play a crucial role in influencing the efficiency with which countries trade. Trade efficiency increases as the values move from 0 to 1.

The study uses the one-step estimation procedure proposed by Kumbhakar et al. (1991), Huang and Liu (1994), and Battese and Coelli (1995) which estimates both the frontier and the technical inefficiency factors in a single step. This is in the view that the two-step estimation technique was criticized by Simar, Lovell and ven den Eeckaut (1994) and Wang and Schmidt (2002) as producing biased estimates whenever the frontier determinants and the exogenous variables affecting technical inefficiency are correlated. Wang and Schmidt (2002) further emphasized that the second step of the two-step estimation procedure would understate the effect of the exogenous variables on efficiency whether the frontier determinants are correlated with the inefficiency exogenous variables or not. Additionally, the study adopts the Greene (2005a, b) true fixed and true random effects models which are able to separate the time varying inefficiency and the unit-specific time-

⁴ Logarithm transformations are preferred in models since they transform skewed data and make it to approximately conform to normality, thus making it easy to interpret the patterns in the data. Since data have different units of measurements, logarithm transforms the data into simplified form and hence creates uniformity in data values.

invariant unobserved heterogeneity, and therefore avoids misspecification bias.

The study further uses truncated normal distribution, and a transformation which was proposed by Jondrow et al. (1982), commonly referred to as JLMS estimator, to derive the technical inefficiency scores. The technical inefficiency scores are generated by separating the error term into v and μ , and then considering the mean of μ , conditional on (v, μ) using both the half normal and the exponential cases. After acquiring the trade efficiency scores, the trade potential levels are then obtained directly using equation (3.9).

Empirical model

In addition to the variables of the standard gravity model in equation (3.3), this study incorporates other country-specific factors that include population and border. It as well incorporates the variables that links Kenya to the global community that include globalization index and the terms of trade, and specifies the trade equation (3.7) as follows;

$$\ln \text{Trade}_{ijt} = \beta_0 + \beta_1 \ln \text{GDP}_{it} + \beta_2 \ln \text{GDP}_{jt} + \beta_3 \ln \text{POP}_{it} + \beta_4 \ln \text{POP}_{jt} + \beta_5 \ln \text{DIS}_{ij} + \beta_6 \text{BOR}_{ij} + \beta_7 \text{ToT}_{it} + \beta_8 \text{GLOB}_{it} + v_{ijt} - \mu_{ijt} \quad (4.0)$$

Where, Trade_{ijt} is the trade volume between country i and its EAC's trading partner, j at time t , GDP_{it} and GDP_{jt} are the economic sizes of the reporting and the trading countries respectively, POP_{it} and POP_{jt} represent the population of Kenya and that of the EAC partner countries, DIS_{ij} is the geographical distance between Nairobi and country j 's capital city, BOR_{ij} is a dummy that takes the value of 1 if the trading partners share a common border and 0 otherwise, ToT_i is Kenya's terms of trade while GLOB_i represents Kenya's overall globalization index. β_0 is a constant, β_1 to β_8 are the coefficient parameters of the explanatory variables, v_{ijt} and μ_{ijt} are as explained above.

This study seeks to determine the effects of macroeconomic policies on trade efficiency between Kenya and its EAC counterparts. However, since bilateral, multilateral, and socio-political-institutional factors can influence the extent to which macroeconomic policies affect the volume of a country's trade, this study included corruption perception index as a control variable to control for the macroeconomic policies. The inefficiency model is specified as follows;

$$\mu_{ijt} = \alpha_0 + \alpha_1 \text{BRER}_{it} + \alpha_2 \text{TR}_{it} + \alpha_3 \text{TAR}_{it} + \alpha_4 \text{CORPI}_{it} + \varepsilon_{ijt} \quad (4.1)$$

Where μ_{ijt} is a non-negative one-sided error term representing country-specific factors of the exporting country at time t that constrain its trade from reaching the potential level given the determinants of its trade. This one-sided error term also identifies the degree to which actual trade levels deviate from the potential levels. α_1 , α_2 , α_3 and α_4 are the coefficients of the independent variables. BRER , TR , and TAR , which are the behind-the-border or inefficiency elements, represents Kenya's bilateral real exchange rate, tax rate and average tariff rate respectively, while CORPI , which is a control variable, represents corruption perception index. ε_{ijt} is the random error term.

As explained above in section 3.2.2, however, equations (4.0) and (4.1) will be estimated in a one-step estimation procedure to produce both the frontier and the inefficiency estimates in a single step.

Definition and measurement of variables

The variables used in this study include;

Trade_{ij}

This represents the trade volume between Kenya and each of the EAC member country, j . Its data is extracted from the Observatory of Economic Complexity database. It is measured as the summation of Kenya's exports and imports into and from the EAC, in million US dollars.

Gross Domestic Product (GDP_{it} and GDP_{jt})

This represents the economic sizes of Kenya and that of the East African country j at time t . The expected sign is positive since the more the country's real GDP is for country i , the higher the general welfare of the citizens which translates to a higher purchasing power thus increased imports and exports, while for country j , the higher the GDP level the more it will import from country i and as well export into it. Its data was extracted from the World Development Indicators (WDI) database of the World Bank. It is measured in billion US dollars.

Population (POP_{it} and POP_{jt})

This represents the market size of Kenya and that of the East African country j . It is expected to have a positive sign since the larger the market size, the higher the demand for imports. Data was extracted from the WDI database of the World Bank, and is measured in million individuals.

Distance (DIS_{ij})

This represents the geographical distance between Nairobi and the East African country j 's capital city and it's a proxy for transportation costs. It is expected to have a negative sign since the further away a country is, the higher the transportation costs involved, and hence the lesser the trading activities. Data was extracted from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) website. Geographical distance is measured in kilometers.

Border (BOR_{ij})

This represents a common border. It is a dummy variable taking the value of 1 if the countries share the same border and 0 otherwise. Shared border translates to low transaction costs which makes trade more efficient and hence the expected sign is positive.

Terms of Trade (ToT_{it})

This is the ratio of a country's export price index to its imports price index. A country's terms of trade are positive if the prices of its export increase more than the prices of its imports, which would lead to an increase in a country's balance of trade. It is hence expected to have a negative effect on trade due to reduced exports. Its data is extracted from The United Nations website.

Globalization Index (GLOB_{it})

This comprises of the economic, political and social aspects of globalization. Globalization refers to the interconnectedness and interdependence of world economies and populations that is brought about by increased trade in goods and services across borders. It is expected to have a positive influence on trade. Data was extracted from The Swiss Institute of Technology in Zurich and ranges between 0 and 100, with higher values indicating greater globalization.

Exchange Rate (BRER)

This is a proxy for monetary policy. It is the bilateral real exchange rate which is constructed as the value of Kenya's goods against country j 's goods. Its expected sign is positive, since a depreciation of the Kenyan shilling relative to country j 's currency makes the domestic goods cheaper thereby boosting Kenya's exports. However, exchange rate depreciation reduces domestic demand for imports only if the country's demand for imports is price elastic and encourages exports only if the supply of exports is price elastic. Unfortunately, African countries lack these conditions so they do not benefit much from either depreciation or appreciation. Data was computed using the bilateral nominal exchange rate data extracted from the UN COMTRADE database and the consumer price indices (CPI) extracted from the World Development Indicators (WDI) database of the World Bank, using the formula:

$$\text{BRER} = eP^*/P \quad (4.2)$$

Where e is the price of the foreign currency relative to a unit of the Kenya Shilling, P^* is the Kenya's CPI while P is the CPI of each of the EAC member countries under study.

Tax Rate (TR)

This is a proxy for fiscal policy. Tax rate refers to the percentage at which corporations and individuals in a country are taxed. High tax rate reduces the disposable income thereby reducing the consumption of goods including imports, and hence reduces the trade flows of a country. Its expected sign is negative. Data was extracted from the WDI database of the World Bank as well as from Kenya Statistical Abstracts of the Kenya National Bureau of Statistics (KNBS), and it's presented in percentages.

Tariff Rate (TAR)

This is a proxy for trade policy. This study uses the simple mean applied tariff which is the unweighted average of the rates applied to all products that are subject to tariff and it's calculated for all the goods that are traded. Tariffs increase the prices of imported goods to domestic consumers. They therefore impede trade. Its expected sign is negative. Its data is extracted from the World Integrated Trade Solutions (WITS) database of the World Trade Organization, and it's presented in percentages.

Corruption Perception Index (CORPI)

This is a control variable which ranks countries according to the extent to which their public sector is perceived to be corrupt. Corruption siphons public resources to private individuals and entities, and hence affects the efficiency of implementation of macroeconomic policies. It is a control variable that controls for macroeconomic policies. Its data is extracted from Transparency International database, and ranges between 0 and 100. Zero (0) indicates high level of corruption while 100 indicates zero corruption level.

Robustness check for stochastic frontier gravity model

Aigner, Lovell and Schmidt (1977) proposed the use of the maximum likelihood functions to calculate the variance parameters which conform to the applicability of the stochastic frontier models. These variance parameters include the sigma squared and the gamma. In their calculation, sigma squared is obtained by $\delta_T^2 = \delta_\mu^2 + \delta_v^2$ while gamma is obtained by $\gamma = \delta_\mu^2 / \delta_T^2$. Gamma (γ) indicates the proportion of total trade flows that is as a result of trade inefficiency, and ranges between 0 and 1. A value of 0 indicates that all the deviations from the frontier are accounted for by the statistical noise effect, while a value of 1 indicates that all the deviations from the frontier are as a result of technical inefficiency effects, meaning that behind-the-border factors lead to inefficiency.

Empirical analysis and discussion of results

Introduction

This chapter presents the analytical results of this study. It explains the descriptive statistics, diagnostic tests, as well as the output of the stochastic frontier gravity model and their interpretations. In it, the trade efficiency scores, the trade potential and trade gaps are presented.

Summary Statistics

Table 1 provides the statistical summary of the data used in this study.

Table 1 indicates that the number of observations is 99 as opposed to the expected 110 since the study period is 22 years between 2000 and 2021. This is because, the data for the Republic of South Sudan

Table 1
Summary Statistics.

Variable	Obs	Mean	Std. Dev.	Min.	Max.
TRADE _{ijt}	99	370.6832	344.4116	11.55	1346
GDP _{it}	99	54.8607	32.1406	12.71	109.700
GDP _{jt}	99	15.6374	16.6383	0.7847	67.840
POP _{it}	99	42.5897	6.8079	30.85	53.01
POP _{jt}	99	23.5204	16.6678	6.308	63.59
DIS _{ij}	99	723.2447	138.866	506.0586	894.96
BOR _{ij}	99	0.5556	0.4994	0	1
ToT _{it}	99	94.2247	5.1034	86.17	104.6
GLOB _{it}	99	54.0250	2.8319	48.08	57.04
BRER _{it}	99	14.8922	9.6072	0.0153	39.1882
TR _{it}	99	17.2435	0.9553	15.3049	19.5212
TAR _{it}	99	13.7081	2.7535	11.7	20.9
CORPI _{it}	99	24.1616	3.6132	19	31

commenced from 2011 when the country gained its independence. During the study period, the trade volume between Kenya and the EAC member countries ranged from a low of 11.55 million US dollars to a high of 1346 million US dollars. The average trade volume is 370.68 million US dollars, indicating that in most of the years, the trade volume was below average. The economic size of Kenya ranged between 12.71 billion US dollars and 109.70 billion US dollars, with an average of 54.86 billion US dollars. The economic size of Kenya's EAC trading partners increased from 0.785 billion US dollars to 67.84 billion US dollars in GDP. The population size of Kenya increased marginally from 30.85 million to 53.01 million. The country with the lowest market size in the study years had 6.308 million people, while the largest had 63.59 million people. According to Table 1, the geographical distance constituted of nearby countries whose capital cities were 506.06 km away and far away countries whose capital cities were 894.96 km away from Nairobi. For boarder, 1 indicated countries that share a common border with Kenya, and 0 otherwise. Kenya's terms of trade ranged from 86.17 to 104.6 over the study period, with an average value of 94.22. The globalization index for Kenya, which shows its openness to the global economy, ranged between 48.08 percent and 57.04 percent. For the variables of the inefficiency model, Kenya's bilateral real exchange rate increased from 0.0153 percent to 39.1882 percent, with an average value of 14.89 percent. The values of the tax rate revolved within the brackets of 15.30 and 19.52 percent, while those of the tariff rate ranged between 11.7 percent and 20.9 percent. The values for corruption perception index ranged between 19 and 31 index points, with a mean value of 24.16.

Stochastic frontier gravity model estimation results

The estimates of the maximum likelihood

The estimation output of the stochastic frontier gravity model is presented in Table 2.

Summary of the stochastic frontier trade gravity model estimates

The results of the maximum likelihood estimation for the beyond-the-border factors in Table 2 indicate that both the GDP of Kenya and that of the trading countries j , the geographical distance, border and globalization, are statistically significant and have the expected signs.

The estimated parameters of GDP of Kenya and that of the trading partners reveals a positive and significant effect on trade which is in line with the expectation of the standard gravity model, and as well conforms to the findings of Ngugi (2016), Hassan (2017) and Obeng et al. (2023). GDP is a proxy for economic size of a country, and hence an increase in GDP is expected to increase consumers' general welfare, which in turn increases the consumption and production levels. This as well triggers an increase in the demand for imports, and increases the goods and services available for export. As expected in the standard gravity model, geographical distance has a negative and significant effect on trade volume between the reporting country, i and its trading partners, j . This

Table 2
Maximum Likelihood Estimates.

Variables	Frontier	Inefficiency Model (Mu)	Usigma	Vsigma
lnGDP _{it}	0.1821257** (0.0743587)			
lnGDP _{jt}	0.1446662* (0.0789124)			
lnPOP _{it}	0.0293033 (0.1128864)			
lnPOP _{jt}	0.079254 (0.1429159)			
lnDIS _{ij}	−2.769812*** (0.1295694)			
BOR _{ij}	0.334835** (0.1695208)			
ToT _{it}	−0.0050091 (0.0043987)			
GLOB _{it}	0.0069065* (0.0193129)			
Constant	22.40383*** (0.8467384)			
EXR _{it}		−0.0565459** (0.0235391)		
TR _{it}		−0.3562012 (0.3220465)		
TAR _{it}		0.1192855* (0.0620031)		
CORPI _{it}		−0.2193236** (0.1069467)		
Constant		9.682745 (6.411844)	−2.56664*** (0.64476)	−3.272952*** (0.1925965)
Observations	99	99	99	99
Number of Panels	5	5	5	5
True random-effects model (truncated-normal distribution)		Number of Obs = 99		
Group variable: ID		Number of groups = 5		
		Obs per group: min = 11		
		avg = 19.8		
		max = 22		
Time variable: YEAR		Prob > chi2 = 0.0000		
		Wald chi2(6) = 756.95		
Log simulated-likelihood = -1.3017		sigma_u = 0.2771158***		
		sigma_v = 0.1946649***		

Usigma is the technical inefficiency error component, Vsigma is the idiosyncratic error component.

* Means 10% significance level, ** means 5% significance level, *** means 1% significant level.

Standard errors in parenthesis.

is in line with the findings of [Adekunle and Gitau \(2013\)](#), [Mahona and Mjema \(2014\)](#) and [Ngugi \(2016\)](#). This shows that the further away the trading partner is, the higher the transportation costs and hence the less the countries involve in trade. The parameter estimate for border has a positive and significant effect on trade flows, which satisfies the expectation of the standard gravity model, and conforms with the findings of [Adekunle and Gitau \(2013\)](#). Common border increases the trading efficiency and implies reduced transaction costs between the trading partners.

The study examined the effect of globalization on Kenya's trade, and as per the prior expectation, it was found to have a positive and significant effect. Globalization opens up a country to the global economy which increases its trading activities. This is due to the increased trade agreements and arrangements that countries enter into, and the increased technology and transport efficiency that promotes trading efficiency ([Nzau, 2023](#)). The interconnectedness between countries leads to creation of trade pacts and firmer ties, which act to reduce the trade barriers such as the tariff and the non-tariff barriers that would rather impede trade. The finding of this study is in line with that of [Savurul and Incekara \(2015\)](#).

The study found the population of both the reporting and the trading countries to be insignificant in influencing trade flows between Kenya and the EAC countries. This is because, trade patterns in the East African region are driven by factors such as a country's comparative advantage, specific product demand, resource endowment as well as the consumers' purchasing power, all of which have a low correlation with the population sizes of the countries. This finding is in line with the findings of [Miankhel, Thangavelu and Kalirajan \(2015\)](#) and [Hassan \(2017\)](#). Muteithia (2017), however, found that the population of both the reporting

and the trading partner have a negative and significant effect on trade. Kenya's terms of trade, although had the expected sign, was found to be insignificant in influencing trade. This would be due to the country's increased unrestricted imports that have damaged its local industries as well as the worsening unfavorable balance of trade.

Summary of the inefficiency model estimates

In the inefficiency model, the study estimated the effect of three behind-the-border or inefficiency factors, which include bilateral real exchange rate, tax rate and average tariff rate on trade efficiency. In line with the prior expectations, the study found that exchange rate positively and significantly influences trade efficiency, which supports the findings of [Mahona and Mjema \(2014\)](#) and [Hassan \(2017\)](#). This indicates that depreciation of the Kenyan shilling against the EAC currencies increases trade efficiency. Currency depreciation causes a reduction in export prices, which triggers exporters to export more. It should however be noted that a depreciation in the exchange rate encourages exports only in the instance where the supply of exports is price elastic. However, African countries do not benefit much from either depreciation or appreciation of their currencies since they lack this condition.

Average tariff rate was used as a proxy for trade policy. In line with the prior expectation, this study found that the average tariff rate negatively and significantly affects trade efficiency. As Kenya increases its tariff rate, it discourages imports since they become expensive to the domestic consumer. A reduction in imports ultimately reduces the trade flows between trading partners, and hence reduces the efficiency with which countries trade. This finding is in line with the findings of [Hassan \(2017\)](#) who obtained similar results, but against those of [Miankhel,](#)

Thangavelu and Kalirajan (2015) who found tariff rate as having insignificant effect on trade.

As per the prior expectation, tax rate (TR) has a negative effect on trade efficiency. This implies that as the tax rate increases, it hinders trading activities between Kenya and its EAC trading partners by reducing the disposable incomes of the consumers which in turn reduces their purchasing power, as well as increasing the cost of production. However, tax rate is found to have an insignificant effect on trade efficiency, and therefore this makes it a poor proxy for fiscal policy. The findings of this study are against those of Hassan (2017) who found average tax rate as having a negative and significant effect on trade.

Corruption perception index was used as a control variable and indicates the level of corruptness that a country is perceived to be. The study found corruption to be a significant factor that needs to be controlled for. Corruption reduces the amount of resources available for the effective and efficient implementation of macroeconomic policies. Failure to reduce the corruption levels in a country negatively influences the outcome of the laid down policies, which in turn increases trade inefficiencies. This finding validates the findings of Obeng et al. (2023).

Trade efficiency scores estimates per country

Table 3 provides the estimates of the trade efficiency (TE) scores. They range between 0 and 100 percent, with 0 indicating total inefficiency while 100 indicates total efficiency.

Over the study period, the average trade efficiency for the five EAC countries was 86.91 percent, which is way above average. This indicates that the efficiency with which Kenya trades with its EAC trading partners, though not fully efficient, is quite high, with inefficiency level of only 13.09 percent. From Table 3, the lowest efficiency level achieved was 35.48 percent for Burundi in 2000. This is basically because, in the said year, Burundi had not joined the EAC and hence was not enjoying the benefits of EAC's economic integration, and neither had it entered into many trade agreements with Kenya. Table 3 further indicates that the highest trade efficiency level was 97.90 percent for Uganda in 2020. Kenya has signed several bilateral agreements, and had by 2020 created a good trading rapport with Uganda.

During the study period, Kenya traded with the highest efficiency with South Sudan at 91.27 percent. This would partially be due to the number of years considered for the country, and partially because, when South Sudan joined EAC, it found an already established, well efficient

and economically integrated region whose operations had already taken off. Uganda had the second highest average efficiency level of 91.08 percent. Uganda has been among Kenya's top 5 trading partners in the world, which explains its high level of efficiency. Kenya exports such products as palm oil, coated flat-rolled iron, common salt and cement to Uganda, and imports dairy products, wood and wood products, mineral fuels and sugar (Muluvi et al., 2016). Rwanda recorded the lowest average efficiency level of 80.54 percent.

Kenya's average efficiency was lowest between 2000 and 2004, averaging 59.84 percent, which was slightly above average. During this period, EAC only comprised of Kenya, Uganda and Tanzania, and faced many challenges including mistrust among members, underdeveloped infrastructure, and regional integration setbacks due to challenges of multiple membership into other trade blocs. After the signing of the EAC Customs Union Protocol in 2005, Kenya's average trade efficiency exhibited a significantly large upward trend, averaging 89.88 percent for the period 2005 to 2009. This increase in efficiency is as a result of improved trade arrangements as well as the increased production and technical efficiency within the EAC region (EAC, 2022).

With the establishment of the EAC Common Market in 2010, Kenya's average trade efficiency with the EAC trading partners under study further improved and averaged 94.18 percent for the period 2010 to 2021. The main aim of this protocol was to facilitate the widening and deepening of the cooperation among the EAC member states, as well as ensuring free movement of factors of production across the borders of the EAC countries (EAC, 2022). Kenya's average trade efficiency was highest in 2020 and 2021 which recorded 96.35 and 96.79 percent respectively. Kenya played a major role in the production and export of Covid-19 equipment to the EAC member states and hence the high efficiency levels.

Trade potential estimates per country

Equation (3.9) provides the calculation of trade efficiency. The trade efficiency scores obtained in Table 3 are used to calculate the values of average trade potential between Kenya and its EAC trading partners and the findings are as shown in Table 4.

Table 4 reveals that Kenya has been trading below its potential with all the five EAC members states under study. It indicates that Uganda has the highest trade potential of 886.25 million US dollars, and has the second highest unexploited trade which is estimated to be 79.04 million US dollars. Tanzania has the second highest trade potential at 629.36 million US dollars, and also records the highest trade gap of 90.34 million US dollars which is yet to be exploited. There are few trade opportunities between Kenya and Burundi which has a trade potential of 64.80 million US dollars. Burundi as well has the lowest trade gap amongst all the EAC countries, which is about 9.06 million US dollars. Basically, Table 4 indicates that there is huge trade potential between Kenya and its EAC counterparts estimated to be about 1,987.91 million US dollars. Kenya appears to have exploited the highest level of potential trade in the EAC, with the unexploited trade being about 238.66 million US dollars. This indicates that, of all the available trade potential in the EAC, Kenya has exploited about 87.99 percent, while only 12.01 percent

Table 3
Trade Efficiency Scores.

Year	Burundi	Rwanda	S. Sudan	Tanzania	Uganda	Average TE
2000	35.48	47.82		49.24	86.92	54.86
2001	42.12	38.46		43.01	56.49	45.02
2002	38.74	36.78		44.89	63.30	45.93
2003	79.55	57.02		60.67	79.02	69.07
2004	89.99	75.41		80.62	91.26	84.32
2005	95.86	90.70		92.61	95.65	93.70
2006	94.80	70.57		86.56	87.87	84.95
2007	90.75	74.98		90.26	92.07	87.02
2008	93.48	93.51		94.40	94.57	93.99
2009	93.44	77.63		93.56	94.33	89.74
2010	93.01	75.86		93.96	94.13	89.24
2011	90.97	84.59	82.42	92.53	94.80	89.06
2012	93.54	94.87	92.69	97.14	96.57	94.96
2013	96.36	94.53	92.53	96.50	97.23	95.43
2014	94.25	95.40	92.09	97.42	96.81	95.19
2015	95.61	94.20	91.76	96.34	97.26	95.04
2016	95.37	93.11	92.23	94.27	96.85	94.37
2017	96.36	94.12	95.09	96.03	97.70	95.86
2018	94.97	92.55	88.12	95.29	97.52	93.69
2019	95.29	95.54	87.14	95.56	97.68	94.24
2020	95.62	97.09	95.31	95.85	97.90	96.35
2021	96.92	97.07	94.53	97.52	97.89	96.79
Average TE	86.02	80.54	91.27	85.65	91.08	86.91

Table 4
Kenya-EAC Trade Potential Estimates.

Country	Mean Actual Trade Volume (Million US Dollars)	Average Trade Efficiency (%)	Mean Potential Trade Volume (Million US Dollars)	Trade Gap (Million US Dollars)
Burundi	55.7416	86.02	64.79917	9.05757
Rwanda	184.9300	80.54	229.62169	44.69169
South Sudan	162.3509	91.27	177.88825	15.53735
Tanzania	539.0182	85.65	629.35534	90.33714
Uganda	807.2091	91.08	886.24521	79.03611
Total	1749.25		1987.90968	238.65988

remains unexploited.

Goodness of fit for stochastic frontier gravity model

The study used the gamma model proposed by Aigner, Lovell and Schmidt (1977) to check whether behind-the-border constraints are responsible for the inefficiencies, and hence confirm the suitability of the stochastic frontier gravity model. From Table 2, $\delta_\mu^2 = 0.0767932$, $\delta_\tau^2 = 0.1146876$ and hence gamma (γ), given as $\delta_\mu^2 / \delta_\tau^2 = 0.6696$. This indicates that gamma accounts for about 67 percent of the deviations from the frontier, which sufficiently justifies the use of the stochastic frontier gravity model in this analysis. This finding shows that the behind-the-border factors largely contribute to the trade inefficiencies between Kenya and the EAC member countries.

Conclusion and policy implications

The study investigates how Kenya's macroeconomic policies affect the efficiency with which it trades within the East African Community over the period 2000–2021. It also investigates the influence that the beyond-the-border factors have on trade volume between Kenya and its EAC trading partners. The findings reveal that common border, and the GDP of Kenya and that of the trading partners positively and significantly affects trade volume as per the expectation of the standard gravity model. Further, as per the earlier expectation, geographical distance negatively and significantly affects trade volume. The population of both Kenya and its EAC trading partners were found to be insignificant determinants of trade flows between Kenya and EAC member states. In order to understand how the interconnectedness between countries influences trade, the study investigated the effect of globalization and found that it positively and significantly influences trade as per the prior expectations. The study further sought to investigate how macroeconomic policies, which are the behind-the-border factors, influence trade efficiency. As a proxy for monetary policy, bilateral real exchange rate depreciation was found to increase trade efficiency. This finding points out to the presence of a positive correlation between monetary policy and trade efficiency. Tariff rate, which was used as a proxy for trade policy, was found to have an adverse effect on trade efficiency, indicating that trade policy negatively influences trade efficiency. Tax rate, which is a proxy for fiscal policy, was found to be an insignificant factor in determining trade efficiency. This therefore renders it to be a poor proxy for fiscal policy.

The study reveals that Kenya trades almost efficiently with South Sudan and Uganda at an average level of 91.27 and 91.08 percent respectively, while it trades with the lowest efficiency of 80.54 with Rwanda. Kenya trades at an average level of 86.91 percent with the East African Community countries. As per the expectations of the trade gravity model, Kenya trades more efficiently with countries that it shares a common border with other than Tanzania, and less efficiently with those that are far away. The study further evaluated the trade potentials and the trade gaps that exist between Kenya and the EAC member states under study and found that Kenya trades below its potential with all the countries. Kenya has high trade potential and unexploited trade gaps with Tanzania and Uganda despite them being among its major trading partners.

The gamma value provides sufficient evidence that behind-the-border or inefficiency factors, which include Kenya's macroeconomic policies, are responsible for trade inefficiencies between Kenya and the EAC member states. Policymakers should therefore put more attention on Kenya's social-political-institutional factors since they are found to have a significant influence on trade efficiency, and work toward reducing corruption levels which the study found to be significantly affecting the implementation of the macroeconomic policies. Without paying attention to these factors, it will be very difficult for Kenya to eliminate the behind-the-border constraints. This will prevent the

country from achieving its efficient trade performances as a result of these trade rigidities.

The fact that high levels of untapped trade are found in the former EAC member states means that Kenya needs to put in place policies and enter into deeper ties with these countries. Kenya, Uganda and Tanzania need to come into terms and create a firmer trade agreement, and remove the factors that impede trade such as the non-tariff trade barriers, long and unnecessary regulatory procedures, and the suspicions and mistrust that engrave them. In order for Kenya to tap the unexploited trade potentials in the region, it should adopt policies that increase trade capacity and efficiency.

In conclusion, contrary to previous studies which concentrated on beyond-the-border factors and not-so-specific behind-the-border factors such as trade agreements, infrastructure, nominal exchange rate and political factors, this study pays a clear focus on macroeconomic policies which might have significant effect on trade efficiency between Kenya and the EAC member states. Macroeconomic policies are the backbone of a country's economic growth and the drivers of economic development and sustainability, including promoting healthy trading relations between countries. The findings of this study not only provide insights into how Kenya's macroeconomic policies influence the efficiency with which it trades with the EAC partners, but also demonstrates the need for further research in this area. Furthermore, by including corruption as a variable, this study makes a major contribution to literature. Corruption is a menace in most developing countries, and this study has established that it also significantly hampers trade efficiency. Therefore, this finding has demonstrated how societal vices can influence the formulation, implementation and working of key macroeconomic policies which ultimately affect the efficiency with which countries trade.

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CRedit authorship contribution statement

Anthony Njoroge Muriu: Writing – review & editing, Writing – original draft, Visualization, Methodology, Formal analysis, Conceptualization. **Paul Mugambi Joshua:** Writing – review & editing, Writing – original draft, Visualization, Validation, Conceptualization. **Moses Mutharime Mwitto:** Writing – review & editing, Writing – original draft, Validation, Methodology, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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