KENYA'S MACROECONOMIC POLICIES AND TRADE EFFICIENCY WITHIN THE EAST AFRICAN COMMUNITY

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DECLARATION

This thesis is my original work and has not been presented elsewhere for a degree or any other award.

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DEDICATION

I dedicate this research thesis to my dear parents Mr. John Muriu and Mrs. Marion Muriu and all my siblings, nieces and nephews.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABBREVIATIONS AND ACRONYMS

AfCFTA:	African Continental Free Trade Area
AGOA:	African Growth and Opportunity Act
CET:	Common External Tariff
COMESA:	Common Market for East and Southern Africa
DEA:	Data Envelopment Analysis
EAC:	East African Community
EU:	European Union
FDI:	Foreign Direct Investment
GDP:	Gross Domestic Product
GOK:	Government of Kenya
IMF:	International Monetary Fund
KNBS:	Kenya National Bureau of Statistics
NTBs:	Non-Tariff Barriers
OLS:	Ordinary Least Squares
PTA:	Preferential Trade Agreement
RoK:	Republic of Kenya
RTA:	Regional Trade Agreement
SAPs:	Structural Adjustment Programmes
SFGM:	Stochastic Frontier Gravity Model
SSA:	Sub-Saharan Africa
VAT:	Value Added Tax
WTO:	World Trade Organization

DEFINITION OF TERMS

Behind the border factors: These are the social, political, economic and institutional factors that are developed by the government and its institutions that directly affect a country's macroeconomy.

Beyond the border factors: These are factors that affect a country's macroeconomy but the country lacks direct control over them.

Trade flows: Movement of imports and exports between and among countries, which involves both goods and services.

Trade efficiency: The measure of the degree of how much trade potential has been realized.

Industrial policy: Strategic intervention of the government in a particular sector to boost its growth and hence raise the overall growth of the economy.

Trade potential: The maximum possible level of trade that a country can achieve under the ideal conditions of open trade policies, trade practices as well as efficient trade institutions.

Macroeconomic policies: Strategies put in place to ensure stability in the economic environment with an aim of achieving strong and sustainable economic growth

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 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 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 affect 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 closely monitor the exchange rate while at the same time put in place to progressively reduce tariff rates

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

International trade is very important in the growth and development of both the developed and the developing economies (Otinga, 2009). In the developing economies, international trade 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. According to Were (2015), trade efficiency is important in economic growth since it leads to increased competitiveness and raises innovation levels, which in turn increase production efficiency.

A key factor that influences trade efficiency is macroeconomic policies (Wang & Tian, 2020; Wang & Yan, 2021). Macroeconomic policies are crucial in shaping the direction and volume of trade between countries as well as influencing 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 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. Such contrasting findings necessitate further research in this area.

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 eight member states (EAC, 2024). 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).

This study focuses on specific macroeconomic policies that include average tariff rate, bilateral real exchange rate and tax rate as proxies for trade, monetary and fiscal policies respectively. The choice of these policies is motivated by the fact that they have been found to 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. Although exchange rate is not directly regulated by the country's monetary authority, Kenya has adopted a managed float exchange rate framework whereby the Central Bank regularly intervenes in the foreign exchange market to maintain the exchange rate at a certain range (Were, 2015). Further, studies have found exchange rate to be a very important factor in determining a country's direction and volume of trade, and therefore makes it a key factor in this study (Adekunle & Gitau, 2013; Mahona & Mjema, 2014). According to Issam (2018), increase in tariffs increase the prices of imported goods on the domestic importer, and hence reduce the amount of imports. On the other hand, Roscelin et al. (2021) posit that exchange rate depreciation adversely affects trade flows between countries, while Keen and Syed (2006) explain that higher tax rates increase the production costs in a country and hence reduce the trade flows

1.1.1 Kenya's Macroeconomic Policies and its Trade Patterns within the EAC

It is noteworthy that Kenya dominates intra-EAC trade volumes, and is a net exporter into the economic bloc as shown in Figure 1.1. 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.

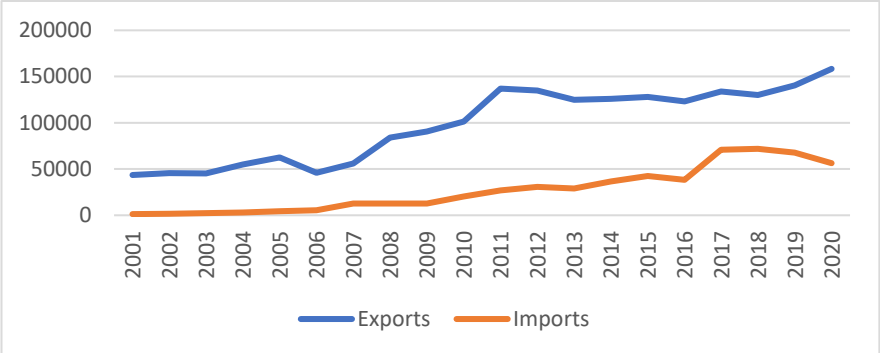

Figure 1.1: Kenya's Imports and Exports from and into the EAC

Source: Authors compilation with data from The Observatory of Economic Complexity

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). 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 & Mwania, 2021).

Since independence, the government of Kenya has implemented various macroeconomic policies with the aim of not only ensuring improved economic growth, but also raising its trading levels and giving it an edge in the EAC. Among the major policies adopted by the government include the import substitution policies of the 1960s and 1970s, the Structural Adjustment Policies (SAPs) of the 1980s, which were imposed by the World Bank and the International Monetary Fund (IMF), and the export promotion policies of the mid 1980s, through the 1990s and up to 2002 (Majune & Mwania, 2021). In order to ensure macroeconomic stability and hence economic growth and increased trade levels, the government of Kenya put in place other specific macroeconomic policies. These policies include tightening of the fiscal policy and the interest rate controls, tightening controls on the government expenditure in order to tame the soaring budget deficits and inflation levels in the country, as well as the adoption of the liberalized exchange rate in 1993 (Nyorekwa & Odhiambo, 2014; Killick and Mwega, 1990; Muriithi & Moyi, 2003; Maehle et al, 2013; Ovamba & Ouma, 2018).

After the re-establishment of the EAC in 2000, the government of Kenya continued pursuing the Export Promotion Policies up to 2002 (Nyaga, 2015). In 2005, Kenya adopted the EAC Common External Tariff (CET) which has led to a decrease in the country's average tariff rate for imports from EAC non-member countries from 20.9% in 2000 to 13.7% in 2020 (World Bank, 2021). With the aim of transforming the country into a "newly-industrializing, middle-income economy", the government of Kenya further adopted the Kenya Vision 2030 in 2008 (RoK, 2007). Among the objectives of the Vision 2030 included the promotion of decent informal trade, expanding Kenya's export base as well as transforming Kenya into a regional service hub, all of which sought to promoting Kenya's trade (RoK, 2007). The government of

Kenya further formulated the National Trade Policy which was aimed at guiding the direction of Kenya's domestic and international trade (RoK, 2017). Although there were few major policies adopted by the government since the reestablishment of EAC, Kenya remains committed to the earlier adopted policies on export promotion (Nyaga, 2015). Further, the National Trade Policy outlines the goals that shows the government's commitment in promoting Kenya's trade through supporting the available export-oriented instruments, subsidies and incentives on exports and providing assistance on exports promotion and marketing (RoK, 2017).

The trends of Kenya's tax rate and average tariff rate have been stable over the study period (World Bank, 2022). However, other than tax rate which was stable between 2000 and 2005, both the tariff rate and real effective exchange rates had slight downward trends. This was consistent with Kenya's trade flows to the EAC as a percentage of its total world trade, which dropped from 9.6% in 2000 to 6.7% in 2006 (Kenya National Bureau of Statistics [KNBS], 2017). Although there was a sharp increase in the real effective exchange rate in 2007 to 97.3% from 72.1% in 2006, it did not have adverse effects on trade since Kenya's trade within the EAC as a percentage of its total world trade increased from 6.7% in 2006 to 7.8% in 2007 (KNBS, 2017). The volume of trade further increased to 8.7% in 2008 after the real effective exchange rate dropped to 69.18%. The real effective exchange rate has shown consistent increases from 77.35% in 2009 to 109.64% in 2021 (World Bank, 2022). Both the tariff and the tax rates have been stable over the years from 2007 to 2017, whereby tariff rate increased from 12.4% in 2017 to 13.9% in 2021, while tax rate dropped from 17.4% in 2017 to 15.2% in 2021. Over this period, however, Kenya's trade within the EAC as a percentage of its total world trade remained stable from 2006 to 2021, averaging 8.42% (KNBS, 2017; 2022). Studies by Roscelin et al. (2021), Issam (2018), and Keen and Syed (2006) indicate that increases in real effective exchange rate, average tariff rate and the average tax rate would lead to a decrease in a country's trade flows. This has however not been the case since Kenya's trade within the EAC as a percentage of its total world trade has remained stable despite increase in the real effective exchange rate. This diversion from the theoretical proposition creates a need for this study.

1.2 Statement of the Problem

Despite the increased scope of Kenya's trade opportunities within the EAC as a result of the deepening and expansion of the region, Kenya has so far not exploited these opportunities fully (Muluvi et al., 2016). This is supported by Raga et al. (2021) who found that Kenya has not achieved its trade potential within the EAC. This low degree of efficiency might be caused by the EAC's remaining trade barriers that include cumbersome licensing requirements and bureaucratic procedures (Krishnan et al., 2018; WTO, 2019). However, this study aimed at investigating whether factors such as Kenya's macroeconomic policies play a role in influencing the efficiency with which Kenya trades within the region.

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; Semančíková, 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 therefore investigated the effect that Kenya's macroeconomic policies have on its trade efficiency within the EAC.

Empirically, most of the existing studies on trade efficiency have either used the Data Envelopment Analysis (DEA) model or the Gravity Model in their analysis (Halkos & Tzeremes, 2008; Adekunle, 2011; Ngugi, 2016). These techniques only provide the values of the estimators of the variables under study and the direction of the association between the dependent and the independent variables, but do not accommodate the random variations in trade flows. To address these shortcomings, this study used the Stochastic Frontier Gravity Model (SFGM), 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 (Atif et al., 2000).

1.3 Objectives

This study was guided by both the general and specific objectives.

1.3.1 General Objective

The aim of the study was to establish the effects of Kenya's macroeconomic policies on its trade efficiency within the East African Community.

1.3.2 Specific Objectives

The study was guided by the following specific objectives:

1. To establish the effect of Kenya's monetary policies on its trade efficiency within the EAC.

2. To determine the effect of Kenya's fiscal policies on its trade efficiency within the EAC.

3. To determine the effect of Kenya's trade policies on its trade efficiency within the EAC.

1.4 Hypotheses

The study was guided by the following hypotheses.

H_{01}: Kenya's monetary policies have no effect on its trade efficiency within the EAC.

$H_{02:}$ Kenya's fiscal policies have no effect on its trade efficiency within the EAC.

$H_{03:}$ Kenya's trade policies have no effect on its trade efficiency within the EAC.

1.5 Significance of the 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. It therefore focused on establishing how the macroeconomic policies, particularly the monetary, trade and fiscal policies, influence the efficiency with which Kenya trades within the EAC. The study found that Kenya's macroeconomic policies have a direct effect on its trade efficiency and patterns within the EAC. Particularly, the study established that depreciation of exchange rate increases trade efficiency while an increase in the average tariff rate hinders trade efficiency. This finding provides policymakers and other related actors with evidence that should guide their actions. Further, the study adds to the body of knowledge by

providing information on how social-political-institutional factors influence trade efficiency. The study found that corruption hinders the effective and efficient implementation of the macroeconomic policies which in turn decreases trade efficiency between Kenya and its EAC trading partners. It also established that Kenya has high untapped trade gaps within the EAC, and as well trades below the maximum efficient level, and hence provides evidence as to why Kenya should adopt policies that favor its trade and that increase trade efficiency.

1.6 Scope of the Study

The study sought to investigate the effects of macroeconomic policies on Kenya's trade efficiency within the EAC. It covers a period of 22 years spanning 2000 to 2021. This period covers the re-establishment of the EAC economic bloc. During this period, the region has undergone many changes including increased bilateral and multilateral ties, economic upswings and downswings, and also diverse political interventions (RoK, 2022).

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of the theories as well as the empirical studies related to this study. It also presents a summary of both theoretical and empirical literature.

2.2 Theoretical Literature

In this section, various trade theories are discussed, and they include the gravity model, the Heckscher-Ohlin theory, the Linder hypothesis and the new trade theory.

2.2.1 The 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 asserts that the force of attraction between two objects, say, *i* and *j*, is positively determined by their masses and negatively influenced by the distance between them. This law is presented as;

$$\mathrm{F}_{ij} = \mathrm{G}\left[\frac{\mathrm{M}_i \mathrm{M}_j}{\mathrm{D}_{ij}}\right] \qquad (2.1)$$

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 gravity model is presented as;

$$\mathrm{Trade}_{ij} = \mathrm{A}\left[\frac{GDP_i^* \mathrm{GDP}_j}{\mathrm{D_{ij}}}\right] \qquad (2.2)$$

where T_{ij} is the trade flows between the two 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. The model therefore asserts that trade flow is positively influenced by the economic sizes of the trading partners and negatively influenced by the geographical distance between their capitals. Since the model is multiplicative in nature, the linear relationship between the variables can be obtained by taking the natural logarithm of Equation 2.2 to give;

$$\ln \text{Trade}_{ij} = \alpha_0 + \alpha_1 \ln \text{GDP}_i + \alpha_2 \ln \text{GDP}_j - \alpha_3 \ln \text{D}_{ij} + \text{Ɛ}_{ij} \quad (2.3)$$

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 in Equation 2.4.

$$\ln \text{T}_{\text{ij}} = \alpha_0 + \alpha_1 \ln \text{GDP}_{\text{i}} + \alpha_2 \ln \text{GDP}_{\text{j}} - \alpha_3 \ln \text{D}_{\text{ij}} + \alpha_4 \ln \text{Pop}_{\text{ij}} + \alpha_5 \text{Bor}_{\text{ij}} + \alpha_6 \text{RTA}_{\text{ij}} + \text{Ɛ}_{ij} \quad (2.4)$$

where 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.

Further developments of the gravity model include those of Anderson (1979) who derived the product-differentiated gravity equation, Bergstrand (1985, 1989) who developed the gravity equation using the basic monopolistic competition models, and Helpman and Krugman (1985) who developed the increasing returns gravity equations for differentiated products technique. Other developments include those of Deardorff (1995) who proved that the gravity equation is a characterization of many models in which the standard trade theories can be justified from; while Anderson and Wincoop (2003) used the gravity model to manipulate the constant elasticity of substitution (CES) expenditure system which can be used in solving the "border puzzle". The theory is important in this study since it shows how standard country-variables affect the direction of trade between countries.

2.2.2 The Heckscher-Ohlin Theory

Heckscher Ohlin (1933), the 20th century economists in their study on international trade established how countries could optimize trade by taking advantage of the factors of production that they "owned" in abundance. By using the factors of production that constitute of labour, land and capital, the two economists concluded that the costs of these factors are determined by the market forces of demand and supply. In this case, they established that the factors whose supply exceeded their demand were cheaper as compared to those whose demand exceeded their supply. According to Carpenter and Dunung (2012), the Heckscher-Ohlin model, popularly known as the H-O model,

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 postulation therefore, Hill (2011) and Salvatore (2016) argue that countries like the US which are capital intensive will produce and hence export capital-intensive goods, and import labor-intensive goods from countries that are labour abundant. In this study therefore, it is expected that 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.

2.2.3 The Linder Hypothesis

Linder (1980) developed the Overlapping Demands Theory which explains that the direction of trade involving heterogeneous manufactured goods depends on the demand side and not on the supply side. According to Salvatore (2016), the Linder Hypothesis 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 the same tastes and income levels as the exporting country. Since per capita GDP and hence standard of living is determined by the factor endowments of the countries, capital abundant economies tend to be richer than labour-abundant ones. Therefore, the capital abundant (rich) countries will tend to trade more with other rich ones while poor labour-abundant countries will trade with other poor countries. The theory however makes the assumptions that there exist overlapping demand structures within the countries that have common per-capita income. This theory actually doesn't overrule trade occurrences between the developed and the developing economies, but explains that this happens in the presence of the overlapping demand structures which are as a result of inequality in the distribution of income within countries. In this study, the 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.

2.2.4 The New Trade Theory

This theory was developed by Krugman (1983) to explain why countries with the same production capabilities and also endowed with similar factors of production extensively engage in trade with each other. This theory 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 (Carbaugh, 2006; Suranovic, 2010) This theory majorly looks at the industry-level trade other than at the country level and hence explain the rationale as to why governments incorporate the industrial policy. As posited by Ngugi (2016), the theory incorporates other key trade dimensions that include the technological know-how, impacts of increased efficiency, effects brought about by economies of scale as well as productivity at the industrial level. This theory therefore implies that 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.

2.3 Empirical Literature

Various researchers have conducted studies on the subject of trade. To support this study, the empirical studies were brought forth in this section as follows:

Longo and Sekkat (2001) conducted a study to evaluate the hindrances to the intra-African trade using the gravity model for the period between 1980 and 1997. Other than the traditional variables of the gravity model, the study included culture and language, inadequate infrastructure, ethnic diversity, trade policy, currency inconvertibility and political instability. The study revealed that the level of development, a country's GDP and its income level influence a country's trade flows. As is the expectation of the gravity model, the geographical distance as well as country dimension had adverse effects on 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 produces 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. This study improves on the study by Geda and Kibret (2002) by disintegrating the macroeconomic policies into monetary, fiscal and trade policies for better analysis and reporting.

Serlanga and Shin (2007) investigated the bilateral trade flows by the use of the gravity model among 15 European countries for the period between 1996 and 2005. The study found that common border, the GDP variables, relative factor endowments and relatively equally-sized trading partners to be significantly positive. Further, population and geographical distance were found to have a significant but adverse effect on trade flow. Other than the standard gravity model variables investigated in the study by Serlanga and Shin (2007), the current study improves on this study by incorporating the specific macroeconomic policies in its analysis.

Adekunle and Gitau (2013) studied on the trade flows that existed between China and 46 Sub-Saharan Africa (SSA) 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. In the study, GDP, exchange rate, FDI, per-capita GDP and inflation, and their effect on trade flow were evaluated. 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 significant, 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). The study also used a more developed estimation technique to determine the efficiency scores and potential levels.

Deluna and Cruz (2013) also used the SFGM for the Philippines in order to evaluate the effectiveness and potential of bilateral exports between the nation and its trading partners between 2009 and 2012. The study's findings show that export performance is influenced by partner's income, market size, and distance. Their research also reveals an interesting additional finding: the efficiency level between the Philippines and her

trade partners ranges from 38% to 42%, indicating a pretty large level of inefficiency in the former's exports. The findings also imply that improved labour market conditions in the importing nation, a similar language, decreased corruption, and the Philippines' participation in trade blocs like ASEAN, APEC, and the WTO all lead to increased export efficiency. The current study improves the study by Deluna and Cruz (2013) by incorporating more specific macroeconomic policies as well as using current time period between 2000 and 2021.

The efficacy of India's bilateral agricultural exports to 112 trade partners between 2000 and 2013 was investigated by Barma (2017). The study showed that while GDP, population, and business freedom all positively affect India's bilateral agricultural exports, distance, being landlocked, the real exchange rate, trade freedom, and freedom from corruption all negatively affect India's exports. The study used the SFGM and maximum likelihood estimation (MLE) on panel data. Lastly, the efficiency levels of the nation's agricultural exports to trade partners varied significantly. The current study improves on this study by including tax rate, average tariff rate as well as globalization index into the study which have a direct influence on a country’s patterns of trade.

With the use of 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 uses a 22-year period between 2000 and 2021.

For a selection of Asian economies between 2006 and 2015, Demir, Bilik, and Utkulu (2017) estimated the impact of competitiveness on trade efficiency using the stochastic frontier gravity model. A standardized measure of revealed comparative advantage

was developed to act as a stand-in for competitiveness. The results emphasized the significance of variables such as GDP per capita, population density, closeness, official language shared, colonizer, free trade agreements, and the global economic downturn in influencing export performance. The study recommended that countries increase their investments in R&D and human resources to advance their industrial technologies in order to fortify their competitive advantages. The current study is based on a broader time frame as well as specific macroeconomic policies. It also incorporates corruption control and investigates how it affects trade efficiency.

Atif et al. (2017) used SFGM and MLE to evaluate Pakistan's agricultural exports using data spanning from 1995 to 2014. The results demonstrate that currency rates, tariff rates, common boundaries, common cultures, colonial history, and PTAs were the main drivers of farm exports. The study concluded that there is a great deal of unrealized potential between Pakistan and the bordering Middle Eastern and European nations. The previously listed studies, however, only consider the nations' ability to trade; they make no mention of the factors that contribute to the current state of inefficiency. The study by Atif et al. (2017) only considers agricultural exports. However, the current study uses the total trade volume between Kenya and the EAC countries, and also uses more current data in its analysis.

Vietnam's trade efficiency under the ASEAN Free Trade Agreement was studied by Hai and Thang (2017). The authors show that by bridging the gap between actual and potential trade, ASEAN membership and trading partners' economic independence generated trade efficiency. Kumah (2017) also looked at the West African Monetary Zone's (WAMZ) trade efficiency using panel data and SFGM on exports for 45 nations from 2000 to 2014. This study employed the Battese and Coelli (1988) and Kumbhakar (1990) models to examine trade integration among WAMZ member nations. The author found that there is very little trade amongst members of the monetary zone, indicating that there is now a large trade potential. The current study improves the study by Hai and Thang (2017) and Kumah (2017) by incorporating more specific variables. It also improves the study by Kumah (2017) by incorporating the modelling by Greene (2005a, b) on true fixed and true random effects.

Studies on regional blocs have also emerged in relation to the SFGM. The effectiveness of bilateral commerce between the 13 newly admitted EU members and

the 18 Western European nations was examined by Stack, Pentecost, and Ravishankar (2018). The authors analyzed a panel of current bilateral commerce between EU members and newly admitted nations between 1995 and 2012 using the SFGM and MLE methodologies. The researchers found that while distance and being a landlocked country had a detrimental influence on commerce, characteristics including income and per capita income gap, common borders, languages, colonial links, and regional integration had a favorable impact. The results also showed that trade integration among new members has significantly increased. The current study adds to this study by including Kenya's macroeconomic policies as well as investigating how corruption influences trade efficiency.

Additionally, Boadu et al. (2021) conducted a more recent investigation. The authors discovered that while distance had a negative impact on Ghana's bilateral exports, GDP and population had a favorable impact using the SFGM and a panel of 61 trading partners. The authors show that trade agreement participants, language, corruption, trade freedom, and institutional quality all improve export efficiency. However, the cost of taxes, the availability of electricity, and financial development increased the inefficiency of exports. Ultimately, the findings showed that Ghana's trading partners have enormous untapped export potential. Examining the function of trade agreements and their effects on export efficiency is essential to delving deeper into the causes of the significant amount of untapped export potential. All of these agreements aim to liberalize trade by getting rid of any barriers that could prevent future progress. Although this study has dealt on a myriad of factors, the current study improves on it by incorporating Kenya's specific macroeconomic policies and examining how it affects its trade efficiency.

In the Kenyan context, Orindi (2011) conducted a study on the determinants of exports and trade restraining factors in Kenya such as distance and policy-engineered factors by the use of the gravity model for the years between 1985 and 2007. The study analyzed the export volume between Kenya and 25 of its key trading partners by the use of OLS and the panel data technique. As predicted by the gravity model, geographical distance had a negative association while GDP positively influenced trade. Further, the study sought to find out whether the importing countries with their population levels above 100 million for instance China, the US, and Japan imported from Kenya below the predictions of the model, which was found to be the case. Rather

than just establishing the determinants of exports and the factors that restraint trade, this study investigates how macroeconomic policies affect the efficiency with which Kenya trades with the EAC using current data between 2000 and 2021.

A study by Mahona and Mjema (2014) to establish the reason for Kenya and Tanzania's dominance in 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.

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. The aim of the study was to find out the effects of transport infrastructure, GDP, regional trade agreements (RTAs), institutional quality as well as distance on the bilateral trade flows in Kenya. 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 positive 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) carried out a study of 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. Contrary to the model however, distance did not have any significant effect on trade, same case to population which negatively impacted trade flows. 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.

2.4 Summary of Literature and Research Gaps

Theoretical literature explains the factors that influence the direction and volume of trade, with the Gravity Model explaining that the direction of trade is largely influenced by the economic sizes of the trading partners and the geographical distance between them. The Heckscher-Ohlin theory explains that the direction of trade is influenced by the factor endowment of the trading partners while the Linder Hypothesis posits that trade direction and volume is influenced by the overlapping demands structures that they possess. The New trade theory on the other hand explains that trade flows between countries are influenced by the economies of scale of the trading partners.

In line with this research, only Longo and Sekkat (2001) and Geda and Kibret (2002) investigated the influence of economic and macroeconomic policies on trade policy and found that they positively impact trade flows. However, the studies did not disintegrate these policies into monetary, fiscal and trade policies, which makes it difficult to draw conclusions on the exact effect of individual policies. Further, most of these empirical studies especially in the Kenyan context drew their emphasis on the gravity model, which only provides the coefficient values of the variables under study and the direction of the association between the dependent and the independent variables but does not accommodate the random variations in the actual trade flows. Few studies in the Kenyan context used the stochastic frontier gravity model (Mutethia 2019). However, the studies by Hassan (2017) and Mutethia (2019) do not incorporate the effects of macroeconomic policies, which this study seeks to incorporate. This

study used the Stochastic Frontier Gravity Model (SFGM), which in addition to providing the direction and the strength between variables, accommodates the random variations in actual trade flows and hence makes it consistent with the potential trade flows under “normal” economic conditions. This study also incorporates the proposition by Greene (2005a, b) on true fixed and true random effects model which most of the study did not pay attention to.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter explains the various methods and techniques that were used in carrying out this study. The chapter explicitly presents the research design, theoretical and empirical framework, and various pre-testing and post-testing techniques that were carried out in this study.

3.2 Research Design

This study employs the use of the causal research design. In this design, the strength as well as the direction of the relationship between the dependent and the independent variables is brought forth. This research design is key in this study since the study focuses on finding out the extent and direction of association between Kenya's macroeconomic policies and trade efficiency within the EAC.

3.3 Theoretical Framework

3.3.1 The Standard Gravity Model

The Gravity model was first used by Tinbergen (1962) and Poyhonen (1963) to measure trade flows. It was developed from the Newton's universal gravitation whose general form is given by:

$$\mathrm{Trade_{ij}} = \mathrm{A}\left[\frac{\mathrm{GDP_i^* GDP_j}}{\mathrm{D_{ij}}}\right] \qquad (3.1)$$

where $\mathrm{Trade_{ij}}$ represents the trade volume between country i and its trading partners, j. $\mathrm{GDP_i}$ and $\mathrm{GDP_j}$ represents the gross domestic products of country i and its trading partners, j. $\mathrm{D_{ij}}$ represents the geographical distance between the two trading countries and A is a constant. Subscript i represents Kenya while j represents the EAC countries in all the variables. 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 geographic distance between them.

Taking the logarithm of Equation 3.1 transforms it to:

$$\ln\mathrm{Trade}_{ij} = \alpha_0 + \alpha_1 \ln\mathrm{GDP}_i + \alpha_2 \ln\mathrm{GDP}_j - \alpha_3 \ln\mathrm{D}_{ij} + \alpha_4 \delta_{ij} + \varepsilon_{ij} \ldots\ldots(3.2)$$

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 iid disturbance term.

3.3.2 The Stochastic Frontier Gravity Model

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_{ij}) which represents pure randomness and a one-sided non-negative human-factor inefficiency term (μ_{ij}) - which are obtained by splitting the random disturbance term (ε_{ij}). 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 and efficiency.

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

$$\mathrm{Trade}_{ijt} = f(x_{ijt}, \beta)\exp(\varepsilon_{ijt}) \tag{3.3}$$

Splitting the ε_{ijt} to the random error term and the inefficiency term gives:

$$\mathrm{Trade}_{ijt} = f(X_{ijt}, \beta)\exp(v_{ijt} - \mu_{ijt}); \quad \mu_{ijt} > 0 \tag{3.4}$$

Taking natural logarithms on both sides;

$$\ln\mathrm{Trade}_{ijt} = \ln f(X_{ijt}, \beta) + v_{ijt} - \mu_{ijt}, \ \mu_{ijt} > 0 \tag{3.5}$$

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;

$$T^{*}_{ijt} = f(X_{ijt}, \beta)\exp(v_{ijt}) \tag{3.6}$$

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

$$TE_{ijt} = \frac{T_{ijt}}{T^{*}_{ijt}} = \exp(-\mu_{ijt}); \qquad \mu_{ijt} > 0; \;\; TE_{ijt} \epsilon (0,1) \tag{3.7}$$

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 3.7 shows that trade efficiency and trade volume are positively correlated.

In equation 3.7, 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-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 (3.7).

3.4 Empirical Model

In addition to the variables of the standard gravity model in Equation 3.2, this study incorporates other country-specific factors that include population and border. It as well incorporates the variables that link Kenya to the global community that include globalization index and the terms of trade, and specifies the trade Equation 3.5 as follows;

$$\ln\mathrm{Trade}_{ijt} = \beta_0 + \beta_1 \ln\mathrm{GDP}_{it} + \beta_2 \ln\mathrm{GDP}_{jt} + \beta_3 \ln\mathrm{POP}_{it} + \beta_4 \ln\mathrm{POP}_{jt} - \beta_5 \ln\mathrm{DIS}_{ij} + \beta_6 \mathrm{BOR}_{ij} + \beta_7 \mathrm{ToT}_{it} + \beta_8 \mathrm{GLOB}_{it} + \nu_{ijt} - \mu_{ijt} \quad (3.8)$$

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, ν_{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 in Equation 3.9.

$$\mu_{ijt} = \alpha_0 + \alpha_1 \mathrm{BRER}_{it} + \alpha_2 \mathrm{TR}_{it} + \alpha_3 \mathrm{TAR}_{it} + \alpha_4 \mathrm{CORPI}_{it} + \varepsilon_{ijt} \quad (3.9)$$

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 3.3.2, however, Equations (3.8) and (3.9) were estimated in a one-step estimation procedure to produce both the frontier and the inefficiency estimates in a single step.

3.5 Definition and Measurement of Variables

This study used annual panel secondary data of Kenya's trade volume with the EAC member countries for the period between 2000 and 2021. The variables used in this study are as follows;

$Trade_{ij}$ - This represents the trade volume between Kenya and each of the EAC member country, j. Its data was 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 goods which include the demand for imports. High population sizes can also translate to increased production of commodities in response to the high demand. Increased production increases the commodities available for export. 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 was 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:

$$\text{BRER} = {}^{eP^*}/_{P} \qquad (3.10)$$

where e is the price of the EAC countries respective 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. Tax rate is obtained by dividing the total tax revenue collected each year by the gross national income of the same year, and then multiplied by a hundred. Data for gross national income was extracted from the WDI database of the World Bank while that of tax revenue was obtained 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 was extracted from Transparency International database, and ranges between 0 to 100. Zero (0) indicates high level of corruption while 100 indicates zero corruption level.

3.6 Data Processing and Analysis

The data was subjected to the following diagnostic tests to check its fitness before the formal analysis was conducted.

3.6.1 Test for Cross-Sectional Dependence

Cross-sectional dependence refers to the interrelation between various cross-sectional units such as house-holds, firms or countries. Panel models are likely to contain cross-sectional dependence in the error terms. This could be caused by the spatial dependence, idiosyncratic pairwise dependence in the disturbances with no specific pattern of common components, or the presence of unobserved components and

common shocks that are part of the error term (Hoyos & Sarafidis, 2006). The effect of cross-sectional dependence in econometric estimation depends on the magnitude of the correlations across cross-sections as well as the nature of the cross-sectional dependence. Cross-sectional dependence in models results to efficiency loss in least squares and also produces inconsistent estimators (Lee, 2002: Andrews, 2005) and hence must be treated. This study adopts the Breusch-Pagan Lagrange Multiplier (LM) test developed by Breusch and Pagan (1980). This test is appropriate in models where the number of time periods (T) is greater than the number of cross-sections (N), which is the case in this study. The null hypothesis states that there is no cross-sectional dependence, and the decision rule is to reject the null hypothesis if the p-value is greater than 5 percent.

3.6.2 Unit Root Test

Given that most time series data have a tendency to be non-stationery, it is crucial to check for the presence of a unit root or "random walk with drift". This helps in avoiding statistical problems such as obtaining spurious regression results, where the estimation parameters are found to be statistically significant when in real sense they are not. Unit roots must therefore be detected, and if present be dealt with by transforming the data to achieve stationarity. The choice of the appropriate test for unit root is determined by the presence or absence of cross-sectional dependence. In the absence of cross-sectional dependence, the first-generation unit root tests such as the Levin and Lin (1993), Levin, Lin and Chu (2002), Harris and Tzavalis (1999) or the Im, Pesaran and Shin (2003) are used, while the second-generation unit root tests are used in the presence of cross-sectional dependence (Hurlin & Mignon, 2006). In the presence of cross-section dependence, this study adopts the second-generation cross-sectionally augmented ADF (CADF) test that was proposed by Pesaran (2007). This unit root test method augments the standard Dickey-Fuller regressions with the averages of the cross sections of each individual series in their lagged levels and also in the first-differences. The CADF test is appropriate in the presence of cross-sectional dependence, and is well suitable for both balanced and unbalanced panel data models which is in line with the data set in this study. The null hypothesis states that the panels contain unit roots and the decision rule is to reject the null hypothesis if the p-value is less than the 5 % significant level.

3.6.3 Test for Co-integration

Cointegration is an analytical tool used to describe both short- and long-term dynamics and look for common trends in multivariate time series. When two or more predictive variables in a time-series model have the same stochastic drift, they are said to be cointegrated. Cointegration test is used to evaluate whether there exists a long run relationship among time series study variables. The test is relevant in instances where the variables exhibit non-stationarity. This study adopts the Pedroni panel co-integration test developed by Pedroni (1999, 2004) to determine whether there exists a long-run relationship between the variables. Pedroni (1999, 2004) formulated the seven test statistics that seek to test the null hypothesis that there is no cointegration in nonstationary panels. Unlike the standard time series cointegration tests, this test does not take normalization or the precise number of cointegrating relationships into account. Rather, the hypothesis test only measures the strength of the evidence—or lack thereof—for cointegration between two or more variables in the panel. The seven test statistics are divided into two groups: panel statistics, which pool the statistics along the within-dimension, and group-mean statistics, which average the outcomes of individual country test statistics. The seven test statistics include the nonparametric (ρ and t) and the parametric (augmented Dickey–Fuller [ADF] and v). In this case, ρ, t and the ADF statistics are found in both the panel and group-mean statistics, while v statistic if found in the panel test only. The decision rule is to reject the null hypothesis of no cointegration when the panel v goes to positive infinity while the other six statistics go to negative infinity.

3.7 Post-Estimation Tests

3.7.1 Test for Multicollinearity

Multicollinearity is a phenomenon where the independent variables are highly correlated in a multiple regression model. The problem of multicollinearity leads to loss of precision in estimates. Multicollinearity could make estimates obtained in a regression output to be statistically insignificant when in actual sense they should not, or even make the estimates to have incorrect signs and exaggerated magnitudes. It also makes it difficult to distinguish the exact effect of each individual variable and also causes instability problems whereby small changes in observations results to huge changes in the estimates (Fomby, Johnson & Hill, 1984; Groβ, 2003). In order to

establish whether the explanatory variables are correlated with each other, the Variance Inflation Factor (VIF) method was used. This technique is important since it is able to quantify the magnitude of correlation between independent variables and also shows the extent to which multicollinearity causes the variance of the regression coefficient to be inflated. The null hypothesis states that there is no multicollinearity and the rule of the thumb is to reject the null hypothesis if the VIF values are greater than 10. Based on the nature of this study, two multicollinearity tests were carried out. As explained in section 3.3.2, this study contains two models, the standard gravity model and the inefficiency model, which are specified in section 3.4. Although the analysis is caried out in a one-step estimation procedure, each of these models has its own properties and assumptions, and hence makes it necessary to carry out the test for multicollinearity separately. Further, it is very probable that the variables of the beyond-the-border factors in the standard gravity model be highly correlated with the behind-the-border factors of the inefficiency model. However, Wang and Schmidt (2002) explain that correlation between the frontier variables and the inefficiency factors would have no effect on the estimation output in the one-stage estimation procedure.

3.7.2 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 ($\gamma$) 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.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSIONS

4.1 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.

4.2 Descriptive Statistics

Table 4.1 provides the statistical summary of the data used in this study.

Table 4.1: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min.	Max.
$TRADE_{ij}$	99	370.6832	344.4116	11.55	1346
GDPi	99	54.8607	32.1406	12.71	109.700
GDP_j	99	15.6374	16.6383	0.7847	67.840
POP_i	99	42.5897	6.8079	30.85	53.01
POP_j	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
ToTi	99	94.2247	5.1034	86.17	104.6
GLOB	99	54.0250	2.8319	48.08	57.04
$BRER_i$	99	14.8922	9.6072	0.0153	39.1882
TR_i	99	17.2435	0.9553	15.3049	19.5212
TAR_i	99	13.7081	2.7535	11.7	20.9
$CORPI_i$	99	24.1616	3.6132	19	31

Table 4.1 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 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 ranged between 0.785 billion US dollars and 67.84 billion US dollars in GDP. The population size of Kenya increased marginally from 30.85 million to 53.01 million people. 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 4.1, the geographical distance constituted of nearby countries whose capital cities were 506.06 kilometers away and far away countries whose capital cities were 894.96 kilometers 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.

4.3 Correlation Analysis

Correlation analysis shows how variables are related with each other, including the direction and magnitude of association. The correlation analysis is presented in Table 4.2. Table 4.2 reveals that the GDP of EAC partner countries positively and highly correlates with trade. This means that the growth of the countries' economies leads to increased welfare and purchasing power of the citizens which ultimately leads to increased trade. Kenya's population and GDP has a high and positive association with each other. This implies that increase in the economic size of the country is positively influenced by increase in its market size. Growth of a country's market size leads to an increase in the demand for its goods and services which spurs production. This in turn increases the supply of commodities for domestic consumption and ultimate export of the surplus. This leads to increased growth of the country's economy.

Table 4.2: Correlation Matrix

Variables	TRADE	GDPi	GDPj	POPi	POPj	DIS	BOR	ToT	GLOB	BRER	TR	TAR	CORPI
TRADE	1												
GDPi	0.285	1											
GDPj	0.765	0.378	1										
POPi	0.297	0.986	0.386	1									
POPj	0.78	0.178	0.923	0.178	1								
			-		-								
DIS	-0.807	0.118	0.507	0.121	0.664	1							
						-							
BOR	0.653	0.085	0.626	0.087	0.735	0.574	1						
ToT	0.041	0.406	0.109	0.355	0.066	0.043	0.031	1					
GLOB	0.289	0.754	0.354	0.838	0.136	0.111	0.08	0.12	1				
BRER	0.793	0.218	0.558	0.227	0.622	-0.72	0.319	0.047	0.199	1			
		-	-	-	-	-	-	-					
TR	-0.175	0.683	0.234	0.665	0.126	0.069	0.049	0.397	-0.491	-0.193	1		
		-		-	-	-	-						
TAR	-0.244	0.532	-0.26	0.645	0.111	0.071	0.051	0.143	-0.818	-0.203	0.399	1	
											-	-	
CORPI	0.261	0.941	0.353	0.92	0.162	0.119	0.085	0.374	0.67	0.181	0.645	0.474	1

The correlation analysis further indicates the presence of a high and negative correlation between geographical distance and trade. This implies that the further away a country is from its trading partners, the lesser the trading activities between them. Table 4.2 also reveals a negative correlation between tariff rates and trade implying that high tariff rates impede trade. This is also the case with tax rate, since high tax rates reduce the disposable incomes of citizens and hence reduces their purchasing power. High tax rates also reduce the amount available for production and investment by corporations and hence reduces their production capacities. Finally, Table 4.2 shows that the control of corruption positively influences trade. If the level of corruption in a country could be controlled or rather reduced, it would increase the resources available for production and investment and hence promote trade.

4.4 Pre-Estimation Tests

4.4.1 Cross-Sectional Dependence

This study sought to examine whether there exists interrelation between the East African Community countries under study under the null hypothesis of no cross-sectional dependence between them. The test results are presented in Table 4.3.

Table 4.3: Breusch-Pagan LM Cross-sectional Dependence Test

Chi2(10)	Probability value
20.665	0.0236
Complete observations over panel units: 11	

Table 4.3 points to a rejection of the null hypothesis of no cross-sectional dependence. This implies the presence of cross-sectional dependence in the model at the 5 percent (5%) level of significant. This finding would be expected due to the EAC members' geographical proximity, their economic integration, common cultural ties as well as their overlapping demand structures. The presence of cross-sectional dependence leads to inconsistent estimators and hence should be dealt with. In order to solve this problem, this study adopts the proposition of Greene (2005a, b) by incorporating the panel data techniques. Greene (2005a,b) proposes the use of true fixed and true random effect models that help in accounting for the "time-invariant country-specific factors" which contribute to cross-sectional dependence. This is useful in controlling for the unobserved heterogeneity and the potential correlations among countries.

4.4.2 Unit Root Test Results

Most time series data set usually exhibit the problem of non-stationarity, and hence it is important to run the test for the purposes of ascertaining all the data sets are stationary. This helps to avoid obtaining spurious regression results. In the presence of cross-sectional dependence, the cross-sectionally augmented ADF (CADF) test was used and the results presented in Table 4.4. The null hypothesis was that all panels contain unit roots and the decision rule was to reject the null hypothesis if the p-values of the Z (t-bar) are less than 0.05 or 5 percent significance level. However, as it will be observed, the test for stationarity is irrelevant as far as stochastic frontier analysis is concerned.

Table 4.4: CADF Test for Stationarity

Variable	I(0)		I(1)		I(2)		I(3)	
	Z (t-bar)	P-value	Z (t-bar)	P-value	Z (t-bar)	P-value	Z(t-bar)	P-value
lnTRADEij	1.607	0.946	-1.071	0.142	-1.442	0.075	-	-
lnGDPi	9.797	1.000	9.215	1.000	8.794	1.000	8.794	1.000
lnGDPj	1.892	0.971	0.652	0.743	-0.138	0.445	-1.894	0.029
lnPOPi	9.797	1.000	9.215	1.000	8.794	1.000	8.794	1.000
lnPOPj	4.671	1.000	1.850	0.968	-0.996	0.160	-0.770	0.221
lnDISij	9.797	1.000	9.215	1.000	8.794	1.000	8.794	1.000
BORij	9.797	1.000	9.215	1.000	8.794	1.000	8.794	1.000
ToTi	9.797	1.000	9.215	1.000	8.794	1.000	8.794	1.000
GLOBi	9.797	1.000	9.215	1.000	8.794	1.000	8.794	1.000
BRERi	3.426	1.000	-0.502	0.308	-0.954	0.170	-0.927	0.177
TRi	9.797	1.000	9.215	1.000	8.794	1.000	8.794	1.000
TARi	9.797	1.000	9.215	1.000	8.794	1.000	8.794	1.000
CORPIi	9.797	1.000	9.215	1.000	8.794	1.000	8.794	1.000

Based on Table 4.4, it is important to note the trends of the Z (t-bar) values as well as those of the p-value. Other than trade, GDP and population of the EAC member countries under study and the bilateral real exchange rate whose variables appear to respond to differencing, all the other variables portray a similar trend with exactly similar z (t-bar) values and p-values of 1.000. The trend of these variables is attributed to the repetitive nature of their values across panes. It is important therefore to note that the test for unit root is not relevant in stochastic frontier analysis since the models are structured differently from the common time-series models. Actually, unit root tests are applied in time series data where they are designed to test the behaviour of these data sets. The nature of the stochastic frontier models, however, is that they

analyse the cross-sectional aspect of the data in either the production or efficiency models.

Stochastic models further use a specific functional form which is mostly based on the production and cost functions to estimate efficiency. Unlike in time-series data that focuses on the properties of the variables under study, the stochastic frontier models basically analyse whether the inputs and outputs in either a production or an inefficiency model are related. Since stochastic frontier models focus on the cross-sectional part of the data whose every observation reflects a distinct entity at a given point in time, whether the variables are stationary or not is not as much of an issue. Using cross-sectional data, the stochastic frontier models focus on efficiency estimation rather than the time-series properties of the variables. As a result, in the context of these models, tests of unit root – which are pertinent to time-series data to evaluate stationarity – are neither required nor appropriate.

4.4.3 Test for Cointegration Results

Pedroni panel co-integration test developed by Pedroni (1999, 2004) was used to determine whether there exists a long-run relationship between the study variables, The null hypothesis of the Pedroni test states that there is no cointegration in nonstationary panels. Under the null hypothesis, the Pedroni cointegration test statistics are normally distributed with zero mean and constant variance. The results of the cointegration test based on the Pedroni technique are as presented in Table 4.5.

Table 4.5: Pedroni test for Cointegration

No. of Panel units: 5 No. of observations: 99 Data has been time demeaned Time trend has been included	Regressors: 6 Avg no. of observations per unit: 20	
Test Statistic	Panel	Group
v	-1.561	.
rho	0.2512	0.9174
t	-4.712	-6.431
adf	-3.742	-5.556

Table 4.5 indicate the values of the panel and group test statistics with the seven test statistics. According to the decision rule of the Pedroni test for cointegration, the null hypothesis of no cointegration is rejected if the v statistic tends to positive infinity while the other six statistics tend to negative infinity. According to the finding in Table 4.5, the study does not reject the null hypothesis since the value of the panel v is negative while those ones of the panel and group rho (ρ) are positive contrary to the decision rule of the null hypothesis. This finding therefore means that there is no cointegration amongst the study variables. This would be expected because the test for cointegration requires that the variables be stationary at first differences. The finding as well points to the irrelevance of the cointegration test in stochastic frontier models due to the reasons given in section 4.3.2. Based on the nature of the stochastic frontier models, it is therefore difficult to conclude on the cointegration amongst the study variables.

4.5 Stochastic Frontier Gravity Model Estimation Results

4.5.1 The Estimates of the Maximum Likelihood

The estimation output of the stochastic frontier gravity model is presented in Table 4.6. The table contains two very important columns that are key in the interpretation of the model. The 'Frontier' column contains the variables of the gravity model, otherwise known as the Standard Gravity Model estimates. These are all the beyond-the-border factors under study in this analysis. The other important column is the 'Inefficiency Model (Mu)', which contains the variables on the inefficiency model. The inefficiency model variables are basically the behind-the-border factors that include Kenya's macroeconomic policies as well as corruption control which is a control variable. Usigma is the technical inefficiency error component while Vsigma is the idiosyncratic error component. Table 4.6 also shows the Wald Chi^2 value which is statistically significant. The value shows the overall model, or rather the set of all variables in this model are collectively significant.

Table 4.6: 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}		-0.056546**		
		(0.0235391)		
TR_{it}		-0.3562012		
		(0.3220465)		
TAR_{it}		0.1192855*		
		(0.0620031)		
$CORPI_{it}$		-0.219324**		
		(0.1069467)		
Constant		9.682745	-2.56664***	-3.272952***
		(6.411844)	(0.64476)	(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
Time variable: YEAR	Obs per group: min = 11
	avg = 19.8
	max = 22
	Prob > chi2 = 0.0000
	Wald chi2(6) = 756.95
	sigma_u = 0.2771158***
Log simulated-likelihood = -1.3017	sigma_v = 0.1946649***

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

The values in parenthesis are the standard errors

4.5.2 Summary of the Stochastic Frontier Trade Gravity Model Estimates

The results of the maximum likelihood estimation for the beyond-the-border factors in Table 4.6 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 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 Savrul and Incekara (2015).

The study found the population of both the reporting (Kenya) 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). Mutethia (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.

4.5.3 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. It also contains corruption perception index which is a control variable in the study. The interpretation of the inefficiency model is that, the signs of the estimates are reversed when interpreting in terms of efficiency. When interpreting tariff rate in the form of the inefficiency model for example, it would be that it has a positive effect of trade inefficiency. Interpreting in terms of efficiency which is the case in this study, however, the interpretation is that tariff rate has a negative effect on efficiency. This means that increase in tariff rates hinders 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 contrary to 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. The finding of this study contradicts that 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 corruption 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).

4.5.4 Trade Efficiency Scores Estimates per Country

Table 4.7 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.

Table 4.7: 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

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 4.7, 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 4.7 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.

4.5.5 Trade Potential Estimates per Country

Equation (3.7) provides the calculation of trade efficiency. The trade efficiency scores obtained in Table 4.7 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 4.8.

Table 4.8: 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	64.7992	9.0576
Rwanda	184.9300	80.54	229.6217	44.6917
South Sudan	162.3509	91.27	177.8883	15.5373
Tanzania	539.0182	85.65	629.3553	90.3371
Uganda	807.2091	91.08	886.2452	79.0361
Total	1749.2500		1987.9097	238.6599

As indicated in Table 4.8, 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 4.8 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 remains unexploited.

4.6 Post-Estimation Tests

4.6.1 Multicollinearity

Test for multicollinearity measures the degree of correlation between the study variables. It establishes whether the variables are highly correlated which presents problems in the regression analysis. This test was carried out for the two models, that is, the standard gravity model and the inefficiency model, and the results presented in Tables 4.9 (a) and (b). Although the variables of the two models could be highly correlated, Wang and Schmidt (2002) explain that this correlation does not have any effect on the estimation output in the one stage estimation procedure. This explains the reason for carrying out the test for multicollinearity for the standard gravity model and the inefficiency model independently. Table 4.9 (a) presents the test for multicollinearity results for the standard gravity model variables.

Table 4.9 (a) indicates that the VIF values for the variables of the standard gravity model are all below 10. This indicates the absence of highly correlated variables, pointing to non-rejection of the null hypothesis of no multicollinearity among study variables. This therefore means that there is no detection of multicollinearity among these variables.

Table 4.9 (a): Test for Multicollinearity for Standard Gravity Model

Variable	VIF	1/VIF
lnGDPi	9.761	0.102
lnPOPi	9.273	0.108
lnPOPj	9.065	0.11
lnGDPj	8.857	0.113
GLOBi	6.963	0.144
BOR	2.746	0.364
lnDIS	2.451	0.408
ToTi	1.28	0.781
Mean VIF	6.300	

Table 4.9 (b): Test for Multicollinearity for the Inefficiency Model

Variable	VIF	1/VIF
CORPIi	1.897	0.527
TRi	1.760	0.568
TARi	1.336	0.749
BRERi	1.061	0.943
Mean VIF	1.513	

Table 4.9 (b) presents the variables of the inefficiency model. The finding show that all the variables have a VIF value of less than 10 and a mean value of 1.513. This points to non-rejection of the null hypothesis of no multicollinearity. There is therefore no multicollinearity amongst the study variables.

4.6.2 Goodness of fit for the 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 4.6, δ_{μ}^2 = 0.0767932, $\delta_T^2 = 0.1146876$ and hence gamma (γ), given as $\delta_{\mu}^2 / \delta_T^2$ = 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 show that the behind-the-border factors largely contribute to the trade inefficiencies between Kenya and the EAC member countries.

4.7 Discussion of Results

The study focused on both the standard gravity model and the inefficiency model variables. In the standard gravity model, the study found GDP for Kenya and that of its EAC trading partners to be positively and significantly influencing trade, which confirms the findings of Ngugi (2016), Hassan (2017) and Obeng et al. (2023). This shows that a country's GDP plays a vital role in determining a country's trade patterns. The geographical distance between Nairobi and the capital cities of the EAC member countries was found to have a negative and significant effect on trade as per prior expectation. This validates the findings of Adekunle and Gitau (2013), Mahona and Mjema (2014) and Ngugi (2016), and shows that the further away countries are from

each other, the lesser the trading activities between them due to the high transportation cost. Common border positively and significantly influences trade between Kenya and the EAC member countries which is in line with the findings of Adekunle and Gitau (2013). Shared border signifies reduced transaction costs which increases trade efficiency between the trading countries. The study as well included Kenya's terms of trade and globalization index. Globalization index, which shows how Kenya is interconnected with the global economy, was found to positively and insignificantly influence trade which supports the findings of Savrul and Incekara (2015). Contrary to the prior expectations, population of both Kenya and that of the EAC trading partners and Kenya's terms of trade were found to be insignificant factors, which contradicts the findings of Mutethia (2017). The finding however confirms those of Miankhel, Thangavelu and Kalirajan (2015) and Hassan (2017).

For the variables of the inefficiency model, a depreciation of the bilateral real exchange rate positively and significantly affects trade efficiency which is in line with the findings of Mahona and Mjema (2014) and Hassan (2017). This means that a depreciation of Kenya's shilling against the currencies of the EAC countries leads to increased trade efficiency. Depreciation of the local currency leads to reduced export prices which in turn causes increased trading activities between countries. As per the prior expectation, average tariff rate was found to have an adverse and significant effect on trade efficiency. Increased tariff rates discourage imports which ultimately leads to reduced trading activities between countries and hence reduces the efficiency with which countries trade. This finding is in line with the finding of Hassan (2017) but contrary to the findings of Miankhel, Thangavelu and Kalirajan (2015) who found it to be insignificant. Corruption perception index was used as a control variable. Corruption siphons public resources into private and individual entities, hence reducing the amount available for the implementation of macroeconomic policies. Corruption was therefore found to have a negative effect on trade, and the control of it increases trade efficiency which validates the findings of Obeng et al. (2023). Contrary to the prior expectations, Kenya's tax rate was found to be an insignificant factor affecting trade efficiency. This finding contradicts the findings of Hassan (2017) who found tax rate to have a negative and significant effect on trade efficiency.

The study further found that Kenya trades below efficiency with the five East African Community countries under study. Kenya was found to trade more efficiently with

South Sudan and Uganda, and had the lowest efficiency level with Rwanda. The average trade efficiency level of Kenya with all the five EAC countries under study was found to be 86.91 percent over the study period. This is below the efficiency level of 100 percent. Further, the study found that Kenya has high unexploited trade potentials with Tanzania and Uganda, and had low trading opportunities with Burundi. The average trade gap within the EAC was found to be 238.66 million US Dollars.

CHAPTER FIVE

SUMMARY, CONCLUSION AND POLICY IMPLICATIONS

5.1 Introduction

This chapter presents the summary and conclusion of this study. It also brings out the policy implications as well as the areas for further research.

5.2 Summary

The study investigated how Kenya's macroeconomic policies affect the efficiency with which it trades within the East African Community. It acknowledged that Kenya trades below its potential within the region, which could be caused by, among other factors, its macroeconomic policies. The study used annual panel data spanning 2000 to 2021 and conducted the analysis using the stochastic frontier gravity model which is an advancement of the standard gravity model. In addition to the macroeconomic policies, the study also investigated the effect 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. While bilateral real exchange rate depreciation was found to increase trade efficiency, an increase in the tariff rates hampers Kenya's trade efficiency within the EAC. The study found tax rate to be an insignificant factor in influencing trade efficiency. The study also found corruption as having an adverse effect on the country's trade efficiency.

The study revealed 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 efficiency level of 86.91 percent with the East African Community countries. 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 traded 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.

5.3 Conclusion

The aim of this study was to find out the effect of Kenya's macroeconomic policies in influencing its trade efficiency within the East African Community. The study concentrated on three major macroeconomic policies, that is, monetary, fiscal and trade policies which were proxied by bilateral real exchange rate, tax rate and average tariff rate respectively. The study found that bilateral real exchange rate has a positive effect on Kenya's trade efficiency. This means that the depreciation of Kenya shilling relative to the currencies of the EAC member countries increases Kenya's trade efficiency. Tariff rate, which was used as a proxy for trade policy was found to have an adverse effect on trade efficiency. Tax rate, which is a proxy for fiscal policy, was found to be an insignificant factor in determining trade efficiency. The study therefore found Kenya's monetary policies as promoting its trade efficiency while trade policies hinder the same. Fiscal policy was however found to have no significant effect on Kenya's trade efficiency.

Kenya traded at an average efficiency of 86.91 percent within the EAC over the study period. Although not fully efficient, the efficiency level is way above average. As per the expectations of the trade gravity model, Kenya traded 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 found trade gaps between Kenya and each of the EAC countries. This points to the presence of untapped trade potentials that the country should aim at exploiting.

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 paid 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 provide insights into how Kenya's macroeconomic policies influence the efficiency with which it trades with the EAC partners. 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.

5.4 Policy Implications

The gamma value provided 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. Kenya's policymakers should put in place sound policies that promote its trade. The study established that a depreciation of the bilateral real exchange rate increased trade efficiency. The Central Bank of Kenya which is mandated to control the level of exchange rate should regulate exchange rate until the optimal level of trade is achieved and the trade gaps that exists between Kenya and its EAC counterparts are fully exploited. The CBK should however be cautious when regulating the exchange rate because, although this study found that exchange rate depreciation enhances trade efficiency within the EAC, the depreciation would have adverse effects on the economy as a whole, and also limit Kenya's trade capacity with the global economies.

Policymakers should also monitor the effect of tariff rate, and work towards reducing it. This could be through signing more trade agreements and ensuring the existing ones are implemented to the letter. Policymakers should also 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 and adversely 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 with 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.

5.5 Suggestions for Further Research

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. By focusing on Kenya's macroeconomic policies, this study aimed at investigating how the country's macroeconomic policies influence its trade efficiency. However, the study looked at the broad policy categories and used one proxy for each category. This study therefore suggests that further research be done of specific policy items under each policy category. This will provide more intuitive and specific insights on the influence of Kenya's macroeconomic policies on its trade efficiency, and hence aid the policymakers in deciding the kind of policies to put in place.

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APPENDICES

Appendix I: East African Community Countries
The following EAC countries are included in the study.

1. Kenya
2. Uganda
3. Tanzania
4. Rwanda
5. Burundi
6. South Sudan