DETERMINANTS AND WELFARE EFFECT OF TRADE FLOWS IN SUB-SAHARAN AFRICA: EMPIRICAL EVIDENCE FROM SADC AND COMESA

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Abstract

This study investigated the determinants and welfare effects of intra-Sub Saharan Africa trade from 1996 to 2021. The study utilized Negative Binomial Pseudo Maximum Likelihood for the analysis. The study's findings revealed that Gross Domestic Product (GDP), population, distance, time taken for import, bilateral real exchange rate, voice and accountability, law and order, and government effectiveness are the key determinants of trade flows in SADC. Furthermore, the results indicated that GDP, population, distance, common official language, landlocked of both countries, time taken for import procedures to be completed, bilateral real exchange rate, reduction in political instability and absence of violence, and regulatory quality determined trade flows in COMESA. The study also found that intra-regional trade leads to welfare reduction for SADC member countries and a welfare-enhancing situation for COMESA. Thus, the study recommended that policymakers give transportation facilities the required attention to reduce trade barriers. Also, the policymakers in SADC should introduce policies and incentives that will encourage members to import from other members of the bloc. Finally, policies towards making the governance institutions and security apparatus viable should be implemented to promote trade and enhance welfare in SADC and COMESA.

Keywords: trade flow; welfare; sub-saharan African; sadc; comesa; NBPML

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1. Introduction

The literature has grossly articulated the importance of trade in economic growth and development. Trade creates competitiveness, enlarges the market, enables access to technological innovation that enhances the capacity to compete in the world market (Cipollina, 2022 and Oshota and Wahab, 2022). Trade also raises local productive efficiency, leading to a broad transformation of product composition of output and exports from primary products to high-tech agricultural and manufacturing goods, thereby allowing the trading partners to capture the potential benefits of increasing returns to scale (Ancharaz et al., 2011). Moreover, trade creates additional competition in the local economy and consequently raises the productive efficiency of local firms.

Liberalized economies have undoubtedly contributed enormously to global poverty and unemployment reduction. For instance, the remarkable economic growth and poverty reduction experienced in East Asia were made possible through trade expansion (United Nations Conference on Trade and Development (UNCTAD) and United Nations (UN), 2014). Also, the emergence of South East Asia countries as world leaders is attributable to their global market access through trade. It is also evident from the international trade literature that the effect of trade on economic development depends on the degree of openness and to maximize trade benefits, countries across the world, including African countries have introduce different strategies to eliminate trade restrictions (Benjamin and Foye, 2022). Krugman and Obsfeld (2000) and Markusen et al. (1995), among others, submitted that free trade improves welfare while restrictive trade reduces welfare. Consequently, the degree of the effect of trade on economic development depends significantly on the extent to which goods and services are allowed to flow.

There is not enough evidence on the determinants of trade flow in Sub-Saharan Africa (SSA), including the Southern African Development Community (SADC) and Common Market for Eastern and Southern Africa (COMESA). Besides, it is difficult for SSA countries to transform economic integration and the growth effect of international trade to welfare improvement. Many countries are still under-develop despite economic integration. Poverty remains the biggest problem in the region, making the region one of the poorest and most vulnerable regions globally. About 60 and 35.4 percent of the residents in SADC and COMESA, respectively, live under $1.90 per day poverty line (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), 2022; Du-Toit, 2023). Also, the unemployment rate in many COMESA countries is very high (COMESA, 2021), and 26.5 percent of the biggest unemployment rate recorded in Africa comes from the Southern Africa region

(Shawa et al., 2020). If trade is welfare-enhancing, trade behavior must be examined if development does not follow economic growth (Yi, 1998; Wang-Sonne, 2018).

Different studies have analyzed the determinants of intra-regional trade (Oshota and Wahab, 2022; Huyen et al., 2017; Yayo and Asefa, 2016; Trivić and Klimczak, 2015). Also, a few studies have attempted to investigate the role of governance in intra-regional trade as well as the welfare effect of intra-regional trade (Oshota and Wahab, 2022; Gammadigbe, 2021; Abban, 2020; Huyen et al., 2017; Bekkers, 2019; Otieno et al., 2016). Despite the existing studies, the determinants of intra-region trade determinants remain an empirical issue in the SSA region. In addition, not much has been done on the welfare effect of trade flow in SSA, especially in SADC and COMESA. Also, studies that consider the role of governance in their analysis of the determinant and welfare effect of trade flow with a specific focus on SADC and COMESA are sparse. Thus, this study advances the body of knowledge by incorporating trade facilitation and governance variable into the gravity model employed to analyze the determinants and welfare effects of trade flow within SADC and COMESA.

These two Regional Economic Communities (RECs). were selected for a number of reasons. First, they are the two most prominent Eastern and Southern African arrangements (Khandelwal, 2004), and they form the core part of the tripartite free trade area agreement (COMESA, 2021). Moreover, the two regions benefited from the $2.5 million grants by the African Development Bank (AfDB) group to advance cross-border power trading in SSA (African Development Bank Group (AfDB), 2021). Also, the two RECs have similar trade policies, and some countries are members of the two RECs (Gondwe, 2021; Mgemezulu, 2007). The study utilized Negative Binomial Pseudo Maximum Likelihood. This technique is unique and suitable for the analysis because it is less restrictive and produces robust results. Also, the second stage of the regression does not require an instrument.

The remaining part of the study is divided into four sections. The literature review is presented in section 2. Section 3 uncovers the methodology and section 4 reports discusses the result. Finally, the study presents the conclusion in section 5.

2. Literature Review

International trade and economic integration theories have been discussed extensively in the literature (Oshota and Wahab, 2022; Cipollina, 2022; Yabu, 2014; Mulenga, 2012; Simwaka, 2011) and the empirical literature on the determinants and welfare effect of intra-regional trade is still evolving. Sunde et al. (2009) analyzed the welfare gains of intra-trade between Zimbabwe and its trade partners in SADC using the gravity model in an ordinary least squares (OLS) framework. The analysis revealed that IIT between Zimbabwe and SADC trading is explained by distance, trade intensity, income per capita, exchange rate and GDP.

Moreover, De Mendonça et al. (2014) analyzed the effect of institutional differences between 59 countries on agricultural product trade flows using the gravity model. The empirical evidence submitted showed that the institutional differences of each country have a significant adverse effect on agricultural trade.

Trivić and Klimczak (2015) analyzed the determinants of bilateral trade among the Western Balkan countries using an augmented version of the gravity model. The study results showed that the economic determinants of bilateral trade flows have a lesser impact on bilateral trade flows compared to war, one year post-war and other noneconomic factors in the Western Balkan region.

Otieno, Mbithi, and Abala (2016) analyzed the welfare effects of economic integration in COMESA eighteen member countries and their major trading partners using the augmented gravity model of trade and random and fixed effect models. The analysis showed that exporters GDP, population, and enhanced export trade while importers GDP hinders export trade in the COMESA eighteen member countries.

Using fixed and random effects panel estimation methods, Huyen, Kien, and Heo (2017) analyzed the effects of institutional quality on six ASEAN countries' export patterns, and the results of their analysis showed that ASEAN's trading partners' higher institutional quality has a significant effect on the export performance of bloc. Moreover, the study reported that freedom to trade internationally, protection of property rights, and the legal structure of importers were major factors that attracted higher exports from ASEAN countries.

Oshota and Wahab (2022) looked at the impact of national institutional quality on bilateral trade flows in ECOWAS. The study employed a negative binomial pseudo-maximum likelihood estimator (NBPML) to analyze the gravity model and found that degree of regional integration, GDP, GDP per capita, common language, and

landlockedness strongly determines intra-ECOWAS trade. Also, the study reported that aggregated and disaggregated institutional indicators significantly and positively impact trade flows in ECOWAS and its sub-samples, WAEMU and WAMZ. The empirical evidence further showed that importing and exporting countries, reduced corruption, effective rule of law, and effective government coincide with higher trade among member countries.

It is evident from the empirical review that the literature is deficient on the determinants of inter-regional trade, especially the role of governance in intra-SSA trade. Also, there are limited studies on the welfare effect of intra-SSA trade. To fill these gaps, this study relied on the gravity model and utilized a Negative Binomial Pseudo Maximum Likelihood to analyze the determinants and the welfare effects of intra-SSA trade.

3. Methodology

3.1. Model Specification

This study adopted the specifications of the gravitational equation theory by Head and Ries (1998). The functional form of the gravity model specified by these authors is as follows:

$$M_{hf} = f(Y_h, Y_f, POP_h, POP_f, P_h, P_f, P_{hm}, P_{fx}, REM_h, REM_f, CEPII, RTA) \quad \ldots\ldots 1$$

where M_{hf} is import from h to f, Y_h and Y_f represent income of Country h and Country f respectively, POP_h and POP_f represent population of Country h and Country f respectively, P_h and P_f represent Country h and Country f price levels respectively, P_{hm} and P_{fx} represent price of Country h export and price of Country f import respectively, REM_f and REM_h denote remoteness index for Country f and Country h respectively, CEPII captures other variables in the gravity equation such as common official language, sharing of border, being landlocked, and bilateral real exchange rate between partner countries; and RTA stands for membership in the regional group, that is, CEN-SAD, COMESA, EAC, ECCAS, ECOWAS, and SADC. In order to capture trade diversion or trade creation, the RTA was modified depending on the regional bloc being studied.

The augmented form of Equation 1 was used in this study and the model is specified as:

$$M_{hf} = f(GDP_{xh}, GDP_{mf}, POP_{xh}, POP_{mf}, DIS_{hf}, COL_{hf}, LL_{one}, LL_{both}, TIM_{xh}, TIM_{mf}, REERx_{h}, REERm_{f}, GOV_{xh}, GOV_{mf}) \quad \ldots.2$$

where M_{hf} is import from h to f , GDP is the gross domestic product, POP represents the population, DIS_{hf} is the distance between Country h and Country f, COL_{hf} denotes existence of a common official language between Country h and Country f, LL_{both} and LL_c stand for a situation where both trading partners are landlocked and where one is landlocked and the other coastal respectively, TIM is time to trade, REER denotes bilateral real exchange rate (in terms of the importing country, in the sense that a higher bilateral exchange rate implies a depreciation in terms of the importing country's currency) and GOV is a representative governance indicator. Subscripts x and m signify exporting country and importing country, respectively.

The representative governance factor has six variants, including voice and account (V&A), law and order (L&O), government effectiveness (GE), reduction in political violence (RPV), regulatory quality (RQ), and control of corruption (CC). Substituting the governance indicators in Equation 2, the study obtained Equation 3 below:

$$M_{hf} = f(GDP_{xh}, GDP_{mf}, POP_{xh}, POP_{mf}, DIS_{hf}, COL_{hf}, LL_{one}, LL_{both}, TIM_{xh}, TIM_{mf}, REER_{mh}, REER_{mf}, V\&A_{xh}, V\&A_{mf}, L\&O_{xh}, L\&O_{mf}, \ldots\ldots\ldots 3$$
$$GE_{xh}, GE_{mf}, RPV_{xh}, RPV_{mf}, RQ_{xh}, RQ_{mf}, CC_{xh}, CC_{mf})$$

Each governance indicator features one at a time, giving rise to six equations for SADC and COMESA. To capture the welfare effect of the individual RECs, that is, if their formation leads to trade diversion (welfare inhibiting) or trade creation (welfare enhancing), the study used a set dummy denoted by D, each representing a SADC or COMESA in Equation 4:

$$M_{hf} = f(GDP_{xh}, GDP_{mf}, POP_{xh}, POP_{mf}, DIS_{hf}, COL_{hf}, LL_{one}, LL_{both}, TIM_{xh}, TIM_{mf}, REER_{mh}, REER_{mf}, V\&A_{xh}, V\&A_{mf}, L\&O_{xh}, L\&O_{mf}, GE_{xh}, GE_{mf}, \ldots.4$$
$$RPV_{xh}, RPV_{mf}, RQ_{xh}, RQ_{mf}, CC_{xh}, CC_{mf}, D)$$

The SADC Model

The Southern African Development Community (SADC) was founded in 1999. The 16 SADC member countries used for the analysis are Angola, Botswana, Congo DR, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia, Comoros, Madagascar, and Zimbabwe. The model

for determinants of intra-SADC imports and resultant welfare effect is as stated in Equation 5:

$$\ln M_{hf} = \alpha_0 + \alpha_1 \ln GDP_{xh} + \alpha_2 \ln GDP_{mf} + \alpha_3 \ln POP_{xh} + \alpha_4 \ln POP_{mf} + \alpha_5 \ln DIS_{hf} + \alpha_6 COL_{hf} + \alpha_7 LL_{one} + \alpha_8 LL_{both} + \alpha_9 \ln TIM_{xh} + \alpha_{10} \ln TIM_{mf} + \alpha_{11} \ln REER_{xh} + \alpha_{12} \ln REER_{mf} + \alpha_{13} V\&A_{xh} + \alpha_{14} V\&A_{mf} + \alpha_{15} L\&O_{xh} + \alpha_{16} L\&O_{mf} + \alpha_7 GE_{xh} + \alpha_{17} GE_{mf} + \alpha_{18} RPV_{xh} + \alpha_{19} RPV_{mf} + \alpha_{20} RQ_{xh} + \alpha_{21} RQ_{mf} + \alpha_{22} CC_{xh} + \alpha_{23} CC_{mf} + \alpha_{24} DCOMESA + \mu_1 \quad \ldots\ldots 5$$

where α_0 is the intercept, α_1 to α_{24} are respective coefficients of individual explanatory variables in the model and particularly β_{24} is the coefficient of dummies for COMESA, μ is the disturbance term, and ln is natural logarithm. α_1, α_2, α_3, α_4, α_6, α_{11}, α_{12}, α_{13}, α_{14}, α_{15}, α_{16}, α_{17}, α_{18}, α_{19}, α_{20}, α_{21}, α_{22} and $\alpha_{23} > 0$; α_5, α_7, α_8, α_9, α_{10}, and < 0. For coefficient α_{23}, negative sign signifies trade creation (or welfare enhancing) effect of COMESA for the SADC while positive implies trade diversion or welfare reducing effect for the SADC.

The COMESA Model

The Common Markets for Eastern and Southern Africa (COMESA) was founded in 1994 and has a membership of 19 countries. Of these 19 countries, 2 (Egypt and Libya) are not part of SSA and are thus excluded from our analysis. The list of member countries is Burundi, Comoros, Congo, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Swaziland, Uganda, Zambia, and Zimbabwe. The model for determinants of intra-COMESA imports and resultant welfare effect is as specified below:

$$\ln M_{hf} = \alpha_0 + \alpha_1 \ln GDP_{xh} + \alpha_2 \ln GDP_{mf} + \alpha_3 \ln POP_{xh} + \alpha_4 \ln POP_{mf} + \alpha_5 \ln DIS_{hf} + \alpha_6 COL_{hf} + \alpha_7 LL_{one} + \alpha_8 LL_{both} + \alpha_9 \ln TIM_{xh} + \alpha_{10} \ln TIM_{mf} + \alpha_{11} \ln REER_{xh} + \alpha_{12} \ln REER_{mf} + \alpha_{13} V\&A_{xh} + \alpha_{14} V\&A_{mf} + \alpha_{15} L\&O_{xh} + \alpha_{16} L\&O_{mf} + \alpha_7 GE_{xh} + \alpha_{17} GE_{mf} + \alpha_{18} RPV_{xh} + \alpha_{19} RPV_{mf} + \alpha_{20} RQ_{xh} + \alpha_{21} RQ_{mf} + \alpha_{22} CC_{xh} + \alpha_{23} CC_{mf} + \alpha_{24} DSADC + \mu_2 \quad \ldots\ldots 6$$

where α_0 is the intercept, α_1 to α_{24} are respective coefficients of individual explanatory variables in the model and particularly β_{24} is the coefficient of dummies for COMESA, μ is the disturbance term, and ln is natural logarithm. α_1, α_2, α_3, α_4, α_6, α_{11}, α_{12}, α_{13}, α_{14}, α_{15}, α_{16}, α_{17}, α_{18}, α_{19}, α_{20}, α_{21}, α_{22} and $\alpha_{23} > 0$; α_5, α_7, α_8, α_9, α_{10}, and < 0.

For coefficient α_{23}, negative sign signifies trade creation (or welfare enhancing) effect of SADC for the COMESA while positive implies trade diversion or welfare reducing effect for the COMESA.

3.2. Method of Estimation

This study conducted a preliminary analysis to determine the attributes (mean, minimum, and maximum) of the panel data used for the analysis. To establish the determinant of intra-regional trade flow and resultant welfare effect, the study utilized a modified Poisson model, also known as negative binomial pseudo maximum likelihood (NBPML) and zero-inflated models. This technique has several advantages over other panel analytical techniques, especially the fixed-effects model, random-effects model (REM), and Haus-man–Taylor (HT) estimator (Oshota and Wahab, 2022). First, NBPML is suitable when the dependent variable has zero values and the number of zeroes the model predicted is less than the number of zeroes observed (Burger et al., 2009; Silva and Tenreyro, 2011). NBPML has lesser restrictions and can accommodate time-invariant variables, such as distance and common language. In addition, it avoided unnecessary instruments in the second stage of the regression analysis and addressed the problem of endogeneity among the regressors. Unlike random effect estimator, NBPML does not impose strict exogeneity of orthogonality between the independent variables and the error terms.

Diagnostic tests such as serial or autocorrelation, heteroskedasticity, and multicollinearity were not conducted in this study because of the nature of the data set in the gravity models. It has been established that the bilateral nature of the gravity data set tends to make the test difficult to interpret if it can be performed at all (Baier and Bergstrand, 2009) because it is difficult to identify the source of the serial correlation or heteroskedasticity in the bilateral setup. Also, Silva and Tenreyro (2011) argued that fixed effects act as a test for gravity equation in the PPML approach. These effects are those characteristics that affect trade, varying with time or cross-section but not captured by the data. The first is the time effect which tests for changes in the business cycle and openness across all countries. The second effect is the exporter effect, which test for the change in propensity to export that does not depend on time. The third is the test for change in the import that does not depend on time, called the importer effect, and the fourth includes factors that could trigger a deviation from a country's new trade propensities, referred to as the country pair effect. This fourth effect is assumed to have taken account of various

issues such as serial correlation, heteroskedasticity, multicollinearity and endogeneity (Silva and Tenreyro, 2011).

3.3. Sources and Measurement of Data

The study utilized secondary data that covered the period of 1996 to 2021. Table 1 presented a detailed description of the data, measurement of data and sources of data.

Table 1. Data Description, Measurement and Sources

Variables	Description and Measurements	Sources
Merchandise Import (M)	This is a measure of trade flow and it refers to goods brought into one country from another. Values are in millions of US nominal dollars and were converted to real values by accounting for inflation, using the import deflator.	World Integrated Trade Solution (WITS)
Gross Domestic Product (GDP)	GDP is in billions of US dollars and in nominal terms. The nominal GDP values were converted into real GDP values by dividing the nominal values by the GDP implicit deflator (price index) for the US.	Word Development Indicators (WDI)
Population (POP)	This is the number of people in a country and it is in millions.	WDI
Common Official Language (COL)	This is a dummy variable for common language and the dummy is constructed such that it takes a value of 1 if a pair of trading partners has a common language and a value of zero if otherwise.	Centre d'Etudes Prospectives et d'Informations Internationale (CEPII)
Distance (DIS)	Distance is used as a proxy for transport costs and it is measured in kilometres between the main city in Country i and the main city in Country j. The distance between the capital cities of the reporting and partner countries is in Kilometers.	CEPII
Landlockedness (LL)	A landlocked country is defined as a country that is completely surrounded by land and has no access to the coast. Though three possibilities exist for landlockedness, this study captures only two. The first is a situation whereby just one of the trading partners is landlocked and the other is not, and is denoted by LL_{ONE} and the second is a situation where both trading partners are landlocked, denoted by LL_{BOTH}.	CEPII
Time(TIM)	Time to trade, that is, the time to process export supply and the time to initiate import demand is measured in days. The time taken by the reporting and partner countries (to effect trade) is used in this study.	CEPII
Real Bilateral Exchange Rate(REER)	It is the value in real terms of one currency relative to another.	WITS

Voice and Accountability (V&A)	This variable captures the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, association, and the press. The value varies from -2.5 (weak) to 2.5 (strong).	Worldwide Governance Indicators (WGI)
Law and Order (L&O)	It refers to the extent to which agents have confidence in and abide by the rules of society, including the quality of property rights, the police, and the courts, as well as the risk of crime. The value varies from -2.5 (weak) to 2.5 (strong).	WGI
Government Effectiveness (GE)	It measures the quality of public services, the quality of the civil service and its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to its stated policies. The value varies from -2.5 (weak) to 2.5 (strong).	WGI
Reduction in Political Instability and Absence of Violence (RPV)	It captures the likelihood that the government is not destabilized by unconstitutional or violent means, including terrorism, and that change of government follows due process. The value varies from -2.5 (weak) to 2.5 (strong).	WGI
Regulatory Quality (RQ)	It measures the ability of the government to provide sound policies and regulations that enable and promote private sector development. The value varies from -2.5 (weak) to 2.5 (strong).	WGI
Control of Corruption (CC)	It captures the extent to which authorities try to reduce tendencies where public power is exercised for private gain. The value varies from -2.5 (weak) to 2.5 (strong).	WGI
Dummy (D)	A dummy equals 1 for countries that trade with other countries in the other REC, and equals 0 for countries that do not trade with another in the other REC.	

4. Empirical Results

4.1. Descriptive Statistics

Average imports within the SADC region are $179862.80 billion. The GDP in the region has an average of $5650.27 billion and $6164.92 for the exporting and importing countries, respectively. Population in the region averaged 20.24 million for exporting and 20.73 million for importing countries, while the average distance between trading partners in SADC is 2,082 kilometers. The time to export and import in the SADC region is an average of 14 days.

Of the mean values of the six governance indicators, reduction in political instability and absence of violence ranks highest, with a mean value of 0.75 in the exporting and importing countries. This is followed by voice and accountability, which has a mean value of 0.65 in the exporting and importing countries and then regulatory quality ranks third with a mean value of 0.63 in the exporting and importing countries. Law and order, control of corruption and government effectiveness rank fourth, fifth and sixth with mean values of 0.57, 0.43 and 0.40, respectively.

COMESA's average intra-REC imports are $3234.06 billion. The values obtained for imports are low compared to SADC's imports. Concerning the GDP, the average in exporting and importing countries stands at $4903.33 and $4903.33, respectively, which is lower than SADC. The population averaged 21 million people, and the average distance between trading pairs within this region is 2,366 kilometres. The average time to export and import is 18 days, which is higher than SADC, indicating that COMESA may be least efficient in export and import processing.

Reduction in political instability and absence of violence ranks highest with a mean value of 0.67 in the exporting and importing countries. It is, however, below that of the SADC. This is followed by regulatory quality, which has a mean value of 0.56 in the exporting and importing countries, being lower than that for SADC. Voice and accountability rank third, with a mean value of 0.55 for exporting and importing countries, while law and order and government effectiveness rank fourth and fifth, with mean values of 0.46 and 0.42, respectively. Control of Corruption ranks lowest, with a mean value of 0.39 for exporting and importing countries.

Table 2. SADC and COMESA Descriptive Statistics

	SADC			**COMESA**		
Variable	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
GDP_X	5650.27	0.01	90863.70	4903.33	0.01	28568.40
GDP_M	6164.92	0.01	90863.70	4903.33	0.01	28568.40
POP_X	20.24	1.58	54.96	21.42	9.82	46.05
POP_M	20.73	1.58	54.96	21.42	9.82	46.05
COL	0.42	0.00	1.00	0.17	0.00	1.00
DIS	2082.86	683.95	3857.43	2366.93	1450.18	3857.43
LL_{ONE}	0.25	0.00	1.00	0.25	0.00	1.00
LL_{BOTH}	0.15	0.00	1.00	0.25	0.00	1.00
TIM_X	14.86	0.00	68.00	18.21	0.00	68.00
TIM_M	14.53	0.00	68.00	18.21	0.00	68.00
$REER_X$	17.55	0.00	119.15	9.47	0.00	106.20
$REER_M$	17.55	0.00	119.15	9.47	0.00	106.20
$V\&A_X$	0.65	0.08	0.92	0.55	0.25	0.79
$V\&A_M$	0.65	0.25	0.92	0.55	0.25	0.79
$L\&O_X$	0.57	0.25	1.00	0.46	0.25	1.02
$L\&O_M$	0.57	0.25	1.00	0.46	0.25	1.02
GE_X	0.40	0.00	0.88	0.42	0.25	0.75
GE_M	0.40	0.00	0.88	0.42	0.25	0.75

RPV_X	0.75	0.51	0.91	0.67	0.51	0.89
RPV_M	0.75	0.09	0.95	0.67	0.09	0.82
RQ_X	0.63	0.09	0.95	0.56	0.09	0.82
RQ_M	0.63	0.51	0.91	0.56	0.51	0.89
RQ_X	0.43	0.00	0.83	0.39	0.08	0.67
RQ_M	0.43	0.17	0.83	0.39	0.08	0.67
M	179862.80	0.00	5039108.00	3234.06	0.00	60271.24

4.2. Determinants of Intra-SADC Bilateral Trade and Welfare Implications

The results of the estimated models on determinants of trade flows within SADC are presented in Table 3. The eight (9) equations in Table 3 are arranged as follows: equation one presents the estimates of the conventional gravity variables only and, in this case, includes GDP, population, distance, common official language and landlockedness. Equation two retains them but adds trade facilitation variables which, in this case, are time and exchange rate. Equation three captures the welfare effect and the variables in equation two. Each of the remaining Equations, four to nine, features, in addition to the regressors in Equation three, the six governance indicators, with only one featuring one at a time to guard against a multicollinearity problem. This model records an average pseudo-R2 value of 0.24 across the 9 equations. This value is well within the acceptable margin. Hence, the study concluded that the model can reasonably predict the effect of the individual explanatory variables in the model on trade flows.

The coefficients of the GDP for exporting countries ($lnGDP_x$) are positive and significant, averaging about 10.20 across the 9 equations, implying that income aids trade flow in this region. This finding is consistent with the submission of Oshota and Wahab (2022) and the theoretical prediction that income should positively affect import. The coefficients of GDP for importing countries ($lnGDP_m$), on the other hand, turn out as negative and significant, averaging -1.26 across the nine equations and implying that imports fall with a rise in income. Though this finding negates the postulation of a positive effect of income on imports, it conforms with the submission of Otieno, Mbithi, and Abala (2016). This observed adverse effect of income on imports suggests that most intra-SADC trade items are inferior goods whose demand falls as income rises.

The coefficients of population in the exporting countries ($lnPOP_x$) are negative and significant, with the coefficients averaging -30.02 across the 9 equations, implying that population size retards trade flow in this region. This finding contradicts the basic gravity provisions and the postulation that population should positively affect

trade flow. But it conforms to the findings reported by Frankel, Romer, and Cyrus (1996). The coefficients of population in the importing countries ($lnPOP_m$), on the other hand, are positive and significant, averaging 2.36 across the 9 equations. This finding conforms to the earlier postulation on the effect of population on import and the results obtained by Otieno, Mbithi, and Abala (2016).

Table 3. Estimates of the Determinants of Intra-SADC Bilateral Trade and Welfare Implications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$InGDP_X$	8.14***	11.67***	11.17***	11.49***	6.295***	12.19***	13.24***	7.573***	10.07***
	(6.22)	(4.46)	(4.43)	(4.92)	(5.15)	(4.46)	(4.68)	(3.95)	(3.98)
$InGDP_M$	-1.89***	-1.49***	-1.12***	-1.23**	-0.66*	-1.45***	-1.39**	-1.15***	-1.02***
	(-6.26)	(-3.27)	(-3.08)	(-2.55)	(-1.98)	(-3.17)	(-2.91)	(-2.81)	(-4.35)
$lnPOP_X$	-4.5***	-41.9***	-41.8***	-35.4***	-22.2***	-41.1***	-50.1**	-11.7***	-21.3***
	(-3.35)	(-3.01)	(-3.10)	(-2.87)	(-2.91)	(-2.88)	(-3.29)	(-3.07)	(-3.44)
$lnPOP_M$	3.31***	2.45***	2.54***	2.10***	2.22***	2.47***	2.23***	1.91***	2.04***
	(10.45)	(3.39)	(4.36)	(2.82)	(3.81)	(3.44)	(2.89)	(2.94)	(4.12)
InDIS	3.63***	2.46***	1.17***	1.54***	0.99***	2.11***	2.84***	1.96***	2.14
	(2.68)	(2.40)	(2.77)	(2.83)	(2.92)	(2.99)	(2.95)	(2.78)	(2.84)
COL	0.58	0.80	-0.88	1.19	1.10	0.97	0.21	0.25	-0.64
	(0.60)	(0.81)	(-0.95)	(0.98)	(1.45)	(0.95)	(0.19)	(0.26)	(-1.03)
LL_{ONE}	-1.09	-0.65	0.35	-0.18	-1.65	-0.40	0.01	-1.20	1.04
	(-1.15)	(-0.61)	(0.34)	(-0.16)	(-1.60)	(-0.38)	(0.01)	(-1.11)	(0.65)
LL_{BOTH}	0.27	0.91	1.23	0.48	-0.99	0.58	0.47	1.23	1.62
	(0.28)	(0.88)	(1.20)	(0.47)	(-1.00)	(0.56)	(0.43)	(1.22)	(0.80)
$lnTIM_X$		0.06	0.05	0.06*	0.05	0.04	0.07**	0.05	0.80
		(1.21)	(1.36)	(1.92)	(1.55)	(1.22)	(2.08)	(1.51)	(1.58)
$lnTIM_M$		-0.14***	-0.14***	-0.18***	-0.09**	-0.13***	-0.16**	-0.11**	-0.54***
		(-2.81)	(-2.65)	(-3.80)	(-2.04)	(-2.71)	(-3.25)	(-2.31)	(-2.74)
$lnREER_X$		-0.20***	-0.09***	-0.06***	-0.07***	-0.20***	-0.12***	-0.03	-0.34**
		(-4.77)	(-4.39)	(-2.88)	(-5.14)	(-4.83)	(-4.55)	(-1.60)	(-2.39)
$lnREER_M$		0.02	0.01	0.02**	-0.01	0.02	0.02	0.02**	0.82
		(1.47)	(0.92)	(2.26)	(-0.43)	(1.38)	(1.60)	(2.18)	(0.62)
COMESA			0.08***	0.92***	0.53***	0.31**	0.54***	0.71***	1.24***

			(3.12)	(2.83)	(2.90)	(2.54)	(2.81)	(2.76)	(3.48)
$V\&A_X$				-0.13					
				(-0.02)					
$V\&A_M$				2.78***					
				(3.89)					
$L\&O_X$					0.04				
					(0.02)				
$L\&O_M$					4.11***				
					(3.60)				
GE_X						7.22***			
						(6.02)			
GE_M						1.21***			
						(3.75)			
RPV_X							12.55		
							(1.35)		
RPV_M							0.27		
							(0.36)		
CC_X								-6.21	
								(-1.53)	
CC_M								-3.11	
								(-1.22)	
RQ_X									22.24
									(1.06)
RQ_M									4.69
									(1.28)
Constant	113.5	288.7**	291.5**	191.2	119.9	252.0*	366.2**	-65.16	-46.43***
	(1.49)	(2.10)	(2.19)	(1.54)	(1.43)	(1.78)	(2.40)	(-0.56)	(-3.17)
Pseudo-R	0.24	0.22	0.26	0.21	0.27	0.25	0.23	0.28	0.24

* p < 0.1, ** p < 0.05, *** p < 0.01, and t statistics in parentheses.

Distance between trading partners (lnDIS) is found to have a positive and significant coefficient, averaging 2.09 across the 9 equations and implying that distance aids trade flows in SADC. This finding contradicts the a priori expectation that distance should have a negative effect on trade flows, and it may be because transport infrastructure in the region is well developed, in line with the explanation adduced by Carrere, Monika and Peter (2020), where they contend that the negative distance

effect is a low-income countries' phenomenon. If this contention is anything to go by, one can deduce that this finding is because SADC is relatively a high-income region.

The coefficients of the dummy representing the existence of a common official language (COL) between a trading pair, the coefficient of the dummy representing the scenario whereby only one trading partner is landlocked (LL_{ONE}), and the coefficient of the dummy representing the scenario whereby the trading pair are both landlocked (LL_{BOTH}) are all insignificant in the trade flow models for SADC. This implies that common official language and issues of landlockedness do not affect trade flows in this region.

The coefficients of the time taken for exports to be shipped ($lnTIM_x$) are not significant, suggesting that time does not influence trade flow in this region, but the coefficients of time taken for import procedure to be completed ($lnTIM_m$) are negative and significant, in line with the a priori expectation and the Hillberry and Zhang (2015). They average 0.17 across the 8 equations, implying that import falls as the time taken rises. This finding shows that time impedes import in SADC and agrees with the postulation that time should have a negative effect on imports.

The coefficients of bilateral real exchange rate appreciation of the currency of the exporting partner ($lnREER_x$) are negative and significant, averaging 0.10 across the 8 equations and thus implying that trade flow falls with an appreciation of the exporter's currency. This finding is consistent with the apriori expectation that imports should fall as the exporter's currency appreciates. However, the coefficients of bilateral real exchange rate depreciation of the importer's currency are not significant, implying that depreciation of the importer's currency does not count for import demand.

The coefficient of voice and accountability in the exporting countries ($V\&A_x$) is not significant, implying that it does not affect trade flow. However, the coefficient of it in the importing countries ($V\&A_m$) is positive and significant. This finding is in line with our postulation. The indicator of law and order in the exporting countries ($L\&O_x$) records an insignificant coefficient, implying that laws and order do not matter for trade flow in SADC. However, the coefficient of its equivalent in the importing countries ($L\&O_m$) is positive and significant. This is in line with the postulation that voice and accountability should positively affect imports.

The coefficients of the government effectiveness indicator in both the exporting countries (GE_x) and importing countries (GE_m) are positive and significant, implying

that government effectiveness aids both trade flow. This finding agrees with the stated postulation that government effectiveness should positively affect trade flows. Reduction in political instability and absence of violence, control of corruption, and regulatory quality in exporting and importing countries record insignificant coefficients. They are, therefore, not drivers of trade flows in SADC.

Regarding the welfare aspect of SADC bilateral trade flows, the coefficient of the COMESA dummy is reported in the table. The coefficient of SADC imports from COMESA is positive and significant, implying that there is import diversion to the COMESA region. This development is welfare-reducing for SADC member countries.

4.3. Determinants of Intra-COMESA Bilateral Trade and Welfare Implications

The results of the estimated models on determinants of trade flows within COMESA are presented in Table 4. This model records an average pseudo-R2 value of 0.16 across the 9 equations. Given that this value approximates 0.20, which is within an acceptable margin, it is concluded that the model can reasonably predict the effect of the individual explanatory variables in the model on trade flows.

Table 4. Estimates of the Determinants of Intra-COMESA Bilateral Trade and Welfare Implications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$InGDP_X$	-0.14	-0.05	0.32*	0.29	0.32*	0.05	0.31	0.11	0.35
	(-0.95)	(-0.03)	(1.83)	(0.75)	(1.79)	(0.19)	(0.68)	(0.62)	(1.01)
$InGDP_M$	-0.49*	-0.68**	-0.14***	-0.04**	-0.23*	-0.03**	-0.15***	-0.18*	0.15***
	(-1.97)	(-2.40)	(-2.76)	(-2.17)	(-1.97)	(-2.74)	(-2.80)	(-1.98)	(2.80)
$lnPOP_X$	3.81***	1.08	46.97***	51.66***	50.09***	36.73**	47.67***	45.27***	49.24***
	(2.66)	(0.64)	(-2.64)	(-2.81)	(-2.90)	(-2.21)	(-2.68)	(-2.82)	(-2.83)
$lnPOP_M$	4.319***	2.744*	33.85**	38.86**	33.35**	25.23*	34.77**	33.94**	36.31**
	(3.28)	(1.85)	(2.16)	(2.27)	(2.21)	(1.80)	(2.20)	(2.46)	(2.32)
InDIS	-17.64***	-19.80***	-0.72**	-5.99	-2.90**	-1.19*	-0.70**	-4.31***	3.83
	(-6.31)	(-6.99)	(-2.15)	(-1.03)	(-2.54)	(-1.94)	(-2.14)	(-2.82)	(1.80)
COL	-2.263***	-2.808**	-3.07**	-2.03**	-1.49**	-2.73	-2.75**	-2.79**	-2.22**
	(-5.61)	(-5.53)	(-2.02)	(-2.15)	(-2.05)	(-1.60)	(-2.06)	(-2.51)	(-2.07)
LL_{ONE}	0.620	-1.924	33.89	40.13*	34.83	24.34	34.91	32.92*	36.91
	(0.42)	(-0.99)	(1.61)	(1.97)	(1.22)	(1.62)	(1.54)	(1.94)	(1.29)
LL_{BOTH}	0.286**	0.216***	0.051**	0.322**	0.521*	0.275**	0.217***	0.212**	0.259**
	(2.01.)	(2.91)	(1.97)	(2.01)	(1.95)	(2.63)	(3.43)	(2.12)	(2.37)
$lnTIM_X$		-0.02	0.07	0.07	0.08	0.08	0.07	0.08**	0.08
		(-1.09)	(1.09)	(1.18)	(1.30)	(1.36)	(1.03)	(2.42)	(1.22)
$lnTIM_M$		0.05**	0.14**	0.02***	0.02*	0.13**	0.13**	0.25**	0.01**
		(2.39)	(2.53)	(2.72)	(1.95)	(2.50)	(2.46)	(1.99)	(-2.44)
$lnREER_X$		-0.07***	-0.06**	-0.13**	-0.06**	-0.14**	-0.14**	-0.42**	-0.03**
		(-3.31)	(-2.11)	(-1.97)	(-2.01)	(-2.19)	(-1.98)	(-2.17)	(-2.46)

$lnREER_M$		-0.01	0.01	0.02*	0.01	0.02	0.01	0.02	0.01
		(-0.51)	(1.25)	(1.79)	(1.23)	(1.47)	(1.17)	(1.15)	(1.16)
SADC			-56.1*	-64.6*	-58.4***	-44.3**	-57.3**	-55.6***	-59.5***
			(-2.44)	(-2.56)	(-2.61)	(-2.11)	(-2.48)	(-2.73)	(-2.61)
$V\&A_X$				3.24					
				(1.03)					
$V\&A_M$				8.01					
				(1.16)					
$L\&O_X$					-5.50				
					(-1.62)				
$L\&O_M$					-2.06				
					(-1.06)				
GE_X						-5.43			
						(-1.46)			
GE_M						-0.78			
						(-0.26)			
RPV_X							1.63**		
							(2.41)		
RPV_M							0.81**		
							(2.52)		
RQ_X								3.68**	
								(2.26)	
RQ_M								4.54**	
								(2.34)	
CC_X									1.05
									(0.48)
CC_M									2.15
									(0.91)
Constant	25.60	116.5*	239.1***	193.9***	285.2***	233.6***	234.9***	257.6***	210.5***
	(0.50)	(1.90)	(3.49)	(2.72)	(3.88)	(3.72)	(3.38)	(4.31)	(2.81)
Pseudo-R	0.17	0.19	0.19	0.15	0.18	0.16	0.12	0.14	0.17

* p < 0.1, ** p < 0.05, *** p < 0.01, and t statistics in parentheses.

The coefficients of GDP for exporting countries ($lnGDP_x$) are insignificant, implying that income does not matter for imports. On the importing countries' side, the coefficients of GDP ($lnGDP_m$) are negative and significant, averaging about 0.20 over the nine equations. This finding negates our postulation on the relationship between income and imports, even though it supports the result of Otieno, Mbithi, and Abala (2016). This perverse finding regarding COMESA importing countries may suggest that imports among the COMESA member countries are perhaps of inferior goods, having negative income elasticity of demand.

Population in both the exporting ($lnPOP_x$) and importing ($lnPOP_m$) countries in COMESA have positive and significant coefficients in the equations for trade flows,

averaging 36.94 and 27.04 across the nine equations, respectively. This finding agrees with the postulation and supports the findings of Otieno, Mbithi, and Abala (2016), among others. The coefficients of distance (lnDIS) between two trading partners are negative and significant, averaging -5.49 over the nine equations so that an increase in distance between trading partners lowers trade flows between them. This finding is in agreement with our earlier postulation as well as in support of the result reported by Jean-Francois (2005).

The coefficients of the dummy representing the existence of a common official language (COL) are negative and significant, averaging -2.46 across the nine equations. This implies that having a common official language retards trade flows in this region. This finding is contrary to the apriori expectation. The coefficients of the dummy representing the scenario whereby one of the trading partners is landlocked (LL_{ONE}) are not significant. However, the coefficients of the dummy representing a situation whereby both countries are landlocked (LL_{BOTH}) are positive and significant, averaging 0.26 across the nine equations and thus implying that trade is enhanced when both countries are landlocked. This result is perverse and against what is expected in the study.

The coefficients of the time taken for exports to be shipped in exporting countries ($lnTIM_x$) are insignificant, suggesting that this time factor does not influence trade flow. On the contrary, the coefficients of time taken for import procedures to be completed in the importing countries ($lnTIM_m$) are positive and significant, averaging 0.08 across the eight equations and, thereby, implying that bilateral imports increase with the time taken to complete the importing procedures. This finding is perverse and contradicts the postulation that the time factor should have a negative effect on bilateral imports.

The coefficients of bilateral real exchange rate appreciation of the currency of exporting partners ($lnREER_x$) are negative and significant, averaging -0.12 across the eight equations. This implies that exchange rate appreciation negatively affects trade flow is in line with our postulation. On the contrary, the coefficients of bilateral real exchange rate depreciation in importing countries ($lnREER_m$) are insignificant, implying that real exchange rate movements do not affect import demand.

Turning to the governance institution indicators as it affects trade flows, the coefficients of the indicator of voice and accountability ($V\&A_{x/m}$), law and order ($L\&O_{x/m}$), government effectiveness ($GE_{x/m}$), and control of corruption ($CC_{x/m}$) in both exporting and importing countries are all insignificant in the trade flow equations. This shows that these three indicators do not influence trade flows in

COMESA. Reduction in political instability and absence of violence in exporting countries (RPV_x) have a positive and significant coefficient of 1.63.

Similarly, the coefficient of reduction in political instability and absence of violence is positive and significant in the model for importing countries (RPV_m). This result agrees with the earlier postulation that a reduction in political instability and the absence of violence should promote bilateral trade flows. The coefficients of regulatory quality in both exporting (RQ_x) and importing countries (RQ_m) are positive and significant, with the coefficients being 3.68 and 4.54, respectively. This finding aligns with the earlier postulation that regulatory quality should enhance trade flows.

Regarding the welfare nature of COMESA bilateral trade flows, the coefficient of COMESA imports from SADC is negative and significant, showing that there is import creation with regard to SADC regional bloc. This implies that the formation of COMESA moved country members' imports away from SADC inward into COMESA and thus resulted in a welfare-enhancing situation for COMESA.

5. Conclusion and Policy Implications

Several studies have attempted to explain trade integration's drivers and welfare effects in different jurisdictions. This is so because the issue of trade is at the center of international economics and finance as it borders on growth, development and welfare. This study departs from the existing literature by investigating the determinants and welfare effects of intra-regional trade, explicitly focusing on SADC and COMESA from 1996 to 2021. The results of the NBPML revealed that GDP, population, distance, time taken for import, bilateral real exchange rate of the exporting partner, the distance between trading partners, voice and accountability in the importing countries, law and order in the importing countries, as well as government effectiveness in the exporting countries and importing countries are the key determinants of trade flows in SADC.

Furthermore, the results of the analysis indicated that GDP for importing countries, population, distance between two trading partners, common official language, landlocked of both countries, time taken for import procedures to be completed in the importing countries, bilateral real exchange rate of exporting partners, reduction in political instability and absence of violence in exporting and importing countries, and regulatory quality in both exporting and importing determined trade flows in COMESA. Moreover, there is import diversion to the COMESA region and import

creation with regard to SADC regional bloc. Thus, the study concluded that intra-regional trade reduces welfare for SADC member countries and creates a welfare-enhancing situation for COMESA.

Since distance significantly hinders trade flow in COMESA, the study recommended that policymakers give transportation facilities such as roads, rail networks and other logistics that matter for transportation the required attention to address trade barriers and reduce the negative effect of distance between trading partners. Also, the study recommended that policymakers in SADC should introduce policies and incentives that encourage members to import from other members of the bloc. SADC and COMESA must give prime attention to governance indicators. Policies towards making the governance institutions and security apparatus viable should be implemented to promote trade and enhance welfare.

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