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GENERAL & APPLIED ECONOMICS | RESEARCH ARTICLE

The effect of agricultural trade openness on economic growth in the East African Community

Daniel Otieno Jabuya¹*, Fredrick Odhiambo Sule¹ and Michael Jairo Ndwiga¹

Abstract: The study examined the effects of agricultural trade openness on economic growth in the EAC. We empirically analyzed the issue in five countries from 2000 to 2021. Panel data estimation methods were used in the study. The variables were found to be integrated of order one and zero. There was presence of cointegration, cross-sectional heterogeneity and cross-sectional dependence. The CS-ARDL results revealed that agricultural trade openness and economic growth enjoyed a long-run relationship. The empirical results indicated that the effect of agricultural trade openness on economic growth was positive and significant in the long run. Bootstrap panel granger causality analysis was applied in testing the nature and direction of causal relationships between variables. The results indicated that a unidirectional causal relationship existed between agricultural trade openness and economic growth. This implies that an increase in trade openness promotes economic growth. Based on the findings of the study, we recommend that strategies aimed at promoting trade openness should be complemented with strong policies to enable EAC countries to reap more growth benefits associated with open trade.

Subjects: Economic Theory & Philosophy; Macroeconomics; Microeconomics; Econometrics; Economic Forecasting; International Economics; Development Economics

Keywords: trade openness; economic growth; bootstrap; granger causality; cross-sectional dependence; East African Community

1. Introduction

Trade is viewed as a strong pillar of economic growth due to economic constraints faced by various countries. The desire for expansion of trade is partly influenced by the increase in the number of regional trade agreements. Currently any discussion on global development agenda must incorporate trade. The share of Africa in world exports is still very low. Africa's share of global exports is a meagre 3%. Intra-African trade accounts for 15% of its total trade (WTO, 2022). The performance of an economy is mostly evaluated through the growth of its Gross Domestic Product (GDP). Identification of drivers and sources of growth has been the objective of many previous studies. The results of those previous studies have identified Foreign Direct Investment (FDI), domestic investment, imports and exports as key drivers of economic growth (Gokmenoglu et al., 2015).

Various economists hold the belief that expansion of trade may be a powerful tool in promoting growth. Liberalization of trade is viewed as a reform initiative geared towards welfare improvement. By opening up its economy for trade, a country can increase its productivity through





© 2023 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent. increased competition. International trade also promotes effective allocation of resources (Nikalaos & Pavlos, 2016). By engaging in open trade, a country is able to achieve rapid and less volatile growth. Developing countries require a higher and sustained growth to catch up with developed economies. Trade liberalization has been viewed as a strategy for developing countries to improve their participation in international markets, acceleration of technical progress and promotion of economic growth and development (Sakyi et al., 2012).

The contribution of trade on growth has been a major focus of discussions in several studies. Smith (1776) indicated that trade was a way of disposing excess production and expanding the market. Due to the increased role of globalization characterized by high number of regional integrations, trade liberalization and technological advancement have underscored the important role played by trade in the global economy. The growth of global trade has been influenced by improved participation of Less Developed Countries (LDCs). The share of world exports from LDCs grew from 34% in 1980 to 47% in 2011 (Were, 2015). However, current statistics indicate that the participation of LDCs in global trade has been reducing. The share of exports from LDCs in global merchandise trade was merely 1.1% in 2022 which was an increase of 0.07 from 1.02% achieved in 2021 (WTO, 2022).

Agriculture plays a critical role in the EAC economy. The sector contributes more than 30% of the GDP in the region. More than 60% of the EAC population are employed in agriculture. Agriculture is the main source of livelihood in rural areas where approximately 70% of the region's population live. About 60% of foreign exchange earnings in the EAC are received from the sale of agricultural goods. Despite these benefits from the agricultural sector, the region still relies on food imports (EAC, 2022).

In recent years, agricultural trade has gained increased attention and is viewed as a global growth and equity indicator. Agricultural trade liberalization promotes exports and foreign markets accessibility (Sotamenou & Negwelah, 2018). The EAC economy is dominated by agriculture. The EAC member states trade in agricultural commodities among themselves. They also export agricultural commodities to other countries. The intra EAC trade in terms of imports and exports among partner states increased from 13% in 2019 to 20% in 2022 (EAC, 2022).

A comparison of intra-EAC trade data with other RTAs in Africa based on UN (2021) trade statistics reveals significant differences. In 2021, intra EAC trade accounted for 21% of the total exports compared to 10.2% in Economic Community of West African States (ECOWAS), 21.9% in Southern African Development Community (SADC), 1.8% Economic and Monetary Community of Central Africa (CEMAC) and 21.3% of Sub Saharan Africa (SSA). The intra EAC trade in imports during the same period accounted for 10.5% compared to 7.6% (ECOWAS), 18% (SADC), 2.7% (CEMAC) and 16.1% (SSA). Given that agriculture is the main economic activity in the region, these statistics indicate that EAC intra-regional trade is still very low.

The intra-regional trade in the EAC between the periods 2017 to 2021 accounted for 13.6% of the total trade, 20.2% (SADC), 2.1% (CEMAC), 8.9% (ECOWAS) and 18.9% (SSA). This may not augur well for the EAC region since its intra-regional trade is dominated by agricultural products unlike other RTAs like ECOWAS whose intra-regional trade is dominated by mineral fuel and lubricants. According FAO (2021), the contribution of trade to the GDP in the same period was 42.2% (SSA), 37.5% (CEMAC), 62.3% (SADC), 32.9% (ECOWAS) and 37.1% (EAC). This is an indication that the contribution of trade to economic growth in the EAC trails other RTAs in SSA. This study seeks to answer two questions. First, what is the relationship between agricultural trade openness and economic growth in the EAC?

Although liberalization of trade has been viewed as an important policy in LDCs, its effect on growth and development has been the focus of researchers and policymakers as the number of

regional trade agreements increases. Despite the change in policy, the extent to which trade openness affects growth in LDCs remains an open question that is still seeking answers. Various studies on the subject have not yet agreed on a common conclusion.

The main purpose of this paper is to analyze the relationship between agricultural trade openness and economic growth in the EAC. The use of agricultural trade in this study, as opposed to total trade, is to enable us to assess the contribution of agricultural trade on growth. This is considered to be important because agriculture plays a significant role in the EAC economy. The trade-based indicator of trade openness is calculated from the ratio of agricultural trade to GDP. The rest of the paper is organized as follows. Section 2 presents the theoretical linkages between trade openness and economic growth. Section 3 reviews empirical literature on trade openness and economic growth. Section 4 presents the empirical model specification. Section 5 presents empirical results, and Section 6 presents summary and conclusions.

2. Theoretical linkages between trade openness and economic growth

The integration of contemporary trade theories with models of endogenous growth explains that economic growth may be achieved through trade openness. These benefits may be attributed to increase in economies of scale, transfer of technology, knowledge-related externalities and increased competition. An open economy is able to acquire better technology from advanced economies, and such capabilities can lead to the achievement of higher economic growth. Openness tends to influence the productivity of local firms and industries leading to the growth of output value added and income (Yaya, 2017).

However, the ability of a country to derive benefits attributed to openness depends on the nature of endogenous technological change, the diversification and growth of industrial production and export base. Variations in technological capacity and industrial development within countries may lead to different outcomes of trade openness on economic growth. Such outcomes will depend on the size of the economy, technological proficiency and degree of industrial diversification (Silajdzic & Mehic, 2018)

The main drivers of economic growth according to endogenous theory are technological progress and innovation. Such factors are influenced by Research and Development (R&D) which helps in building a knowledge base necessary for creating and developing new procedures and products. The growth of income facilitates investment in R&D. Such investment promotes the production of new commodities and improvement in production efficiency. This leads to achievement of economic growth through innovations in production as well as exports of specific products (Constatini et al., 2023).

The other channels through which trade openness can affect economic growth include government policy and allocation of resources. By influencing allocation and distribution of resources, the level of economic growth may be influenced by trade openness. Through government policy, trade openness may lead to adoption of policies aimed at improving the competitive nature of local firms engaged in international trade. This may culminate in the implementation of stable macroeconomic policies which could lead to the achievement of sustainable economic growth (Malefa, 2020).

3. Empirical evidence

Various studies have provided evidence of positive links between openness and growth. According to Chang et al. (2009), openness significantly influences the level of economic growth. The long-run impact of openness on economic growth was discovered to be positive and significant by Gries and Redlin (2012). However, in the short run, the positive relationship was attributed to income growth.

Gorgi and Aliapourian (2008) investigated how openness affected the level of growth in Iran and some members of the Organization of Petroleum Exporting Countries (OPEC). The results showed

that there was evidence of growth induced by openness. After examining how trade restrictions and openness impacted on economic growth among Non—OECD countries, Kahnamoui (2013) concluded that in the presence of export credits, openness significantly influenced economic growth.

Ouma et al. (2016) examined agricultural trade and economic growth in the EAC. Results showed mixed outcomes for various EAC countries. There was bidirectional causality between agricultural exports and economic growth in Kenya, unidirectional causality was evident in Rwanda and no causal relationship existed in Burundi, Tanzania and Uganda.

Bakari and Mabrouki (2018) investigated the impact of agricultural trade on economic growth in North Africa. Results showed that agricultural trade had a positive correlation with GDP. However, there was a weak correlation between agricultural imports and GDP. Therefore, agricultural exports were found to be key determinants of economic growth. The study recommended the creation of more dynamic agricultural trade openness policies.

Fankem and Oumarou (2020) assessed the effects of trade openness on economic growth in SSA countries. Using the GMM technique, the study indicated that trade openness had a positive effect on economic growth. However, when accompanied by insufficient policies on price stability, investment, infrastructure, financial development and human capital development, trade openness did not stimulate economic growth. Therefore, implementation of trade openness should be accompanied by complementary policies. Ghimire et al. (2021) examined the impacts of agricultural trade on economic growth in Bangladesh. The study indicated that there was a long-run relationship between agricultural trade and economic growth.

Kadigi (2022) investigated the extent to which EAC countries had developed and if income inequalities had decreased with economic growth. Results indicated that agricultural trade, was one of the main determinants of GDP. Exports from the EAC were highly concentrated in a few sectors and high destination markets. The outcomes indicated that there was limited diversification of products and markets. The paper recommended that countries should choose the right mix of exports of goods and services by closely monitoring the prevailing market factors in importing countries, for example, change in tastes and demands.

Agyei and Idan (2022) examined the role of institutions in the nexus between trade openness and inclusive growth in SSA. Using the GMM method, the results of the study supported the view that institutions had a positive influence on the relationship between trade openness and economic growth. The recommendation was that institutions should be strengthened to promote the positive link between openness and inclusive growth.

Denwi et al. (2022) investigated how trade liberalization policy impacted on economic growth in 42 African countries. Using a pooled mean group technique, the results of the study showed that liberalization policy contributes to economic growth only up to a certain threshold beyond which it causes the economy to under heat. This result confirmed that the relationship between openness and economic growth in African countries is nonlinear.

Sunde et al. (2023) examined the impact of open trade on economic growth in Namibia. Using the ARDL cointegration technique, the study showed that the relationship between economic growth and imports was negative, while exports had a significant positive relationship with economic growth. Short-term economic growth was driven by exports, imports and trade openness. The results further suggested that liberalization of trade and export-led growth were crucial in the economic growth of Namibia.

Trade openness plays an important role in any economy because it ensures efficiency in resource allocation. It also enhances the level of competition in international and domestic

markets (Chang et al., 2009). A review of previous studies on the subject has confirmed that trade openness affects economic growth. However, contrary to studies supporting the effect of openness on growth, some studies present different results. Dowrick and Golley (2004) and Kim and Lin (2009) showed that the main beneficiaries of openness were rich countries. This is because poor countries have limited capacity to utilize knowledge accumulation and technology spillover. This is also attributed to the structure of international trade and not necessarily the volume of trade (Sakyi et al., 2012).

Based on the empirical literature review, this study makes three contributions. First, previous studies on this subject in the context of EAC assumed slope homogeneity and failed to test for cross-sectional dependence. Secondly, institutions play a critical role in the nexus between trade openness and economic growth (Agyei & Idan, 2022; Fankem & Oumarou, 2020). No study has included institutional quality as a variable in analyzing the relationship between trade openness and economic growth in the EAC. The other contribution of this study is based on the EAC free trade area policy. The findings of this study may inform trade policy reforms and adjustments in order to improve the efficiency of trade among countries.

4. Methodology and data

Analysis of the effect of agricultural trade openness on economic growth is done on a panel data of five countries (N = 1, ..., 5), namely Kenya, Uganda, Tanzania, Rwanda and Burundi. The study used Real GDP Per Capita as the dependent variable. Trade openness is measured as a sum of agricultural exports and agricultural imports divided by the GDP. The other variables include, agricultural export share, agricultural import share, real effective exchange rate, government regulatory quality, membership to the EAC, gross capital formation in agriculture and agricultural labour. The data for this study are annual and accessed from World Development Indicators, 2021.

4.1. Model specification

Based on the literature of conventional growth theories, the growth equation which was first introduced by Solow (1956) and later augmented by Mankiw et al. (1992) is applied in this paper. The augmented version of Mankiw et al. (1992) neoclassical growth model is applied in generating the model for estimating the effect of trade openness on economic growth. The model recognizes the productivity of human capital in promoting growth. The model is also deemed suitable for this study because it is able to address the pull factors of trade and globalization (Denwi et al., 2022). The model is specified as;

$$\mathbf{Y}_{i,t} = \alpha_{i,t} + \alpha_1 \mathbf{X}_{i,t} + \alpha_2 \mathbf{Z}_{i,t} + \mu_{i,t}$$

Where

 $Y_{i,t}$ real GDP per capita for each country

- $X_{i,t}$ is the proxy for trade openness
- $Z_{i,t}$ vector of controlled variables
- $\alpha_{i,t}$ is the countries specific effect
- $\mu_{i,t}$ are the unforeseen factors affecting the model (stochastic error term)

The econometric model used in examining the relationship between agricultural trade openness and economic growth in the EAC is thus specified as;

$$\mathsf{GDP}_{i,t} = \alpha_0 + \alpha_1 \mathsf{ATO}_{i,t} + \alpha_2 \mathsf{AES}_{i,t} + \alpha_3 \mathsf{AIS}_{i,t} + \alpha_4 \mathsf{REXR}_{i,t} + \alpha_5 \mathsf{GRQ}_{i,t} + \alpha_6 \mathsf{EAC}_{i,t} + \alpha_7 \mathsf{GCFA}_{i,t}$$

 $+ \alpha_8 AGR_L_{i,t} + \mu_{i,t}$

Where GDP_{it} the real GDP per capita, ATO is the measure of agricultural trade openness (calculated as the ratio of sum of agricultural exports and imports to the GDP), AES is the ratio of agricultural exports to GDP, AIS is the ratio of agricultural imports to GDP; REXR is the real effective exchange rate, GRQ is the government regulatory quality, EAC is the dummy variable for EAC membership, GCFA is the gross capital formation in agriculture and AGR_L is the agricultural labour.

4.2. Model estimation

We applied panel data estimation methods: panel unit root test, panel cointegration test, slope homogeneity test, cross-sectional dependence (CSD) test, panel Auto-Regressive Distributed Lag model (ARDL) estimation and Granger causality test. The first estimation procedure is panel unit root test to check for stationarity and order of integration among the variables. Panel cointegration test is used in investigating the existence of long-term relationship between the variables. Slope homogeneity test is applied in testing for cross-sectional heterogeneity in the panel. This is because the assumption of slope homogeneity may lead to biased results. CSD test is used to test for cross correlation of errors. Failure to test and account for CSD may lead to biased and inconsistent estimates. Panel ARDL test is useful in estimating the short-run and long-run relation-ships between variables. Granger causality test is used in determining the nature and direction of causality between variables.

5. Empirical results

In testing for stationarity and order of integration, the study adopted Im et al. (2003) and Levin et al. (2002) tests. Im et al. (2003) allows for heterogeneous coefficients in the panel, while Levin et al. (2002) and Breitung (2000) tests assume that the dynamics of the autoregressive coefficients in all units of a panel are homogeneous. The null hypothesis of the tests is that a variable contains a unit root. Because we suspect that there may be heterogeneity in the panel, we apply the IPS test and include the other two tests for robustness.

In Table 1, our findings from the three tests indicate that there is a mixed order of integration among the variables. For example, AES is stationary at both levels and first difference according to LLC and IPS test results. Therefore, we have both I(0) and I(1) variables.

Table 2 results also indicate that the variables are both I(0) and I(1). Due to the presence of mixed order of integration among variables, the most adequate model for estimation of the relationship between variables is the Panel-ARDL model.

5.1. Panel cointegration results

Cointegration test is used in investigating the existence of a long-run relationship between variables. Pedroni (2004) cointegration test and Persyn and Westerlund (2008) Error Correction-based cointegration test are applied in this study. The tests allow for a higher degree of heterogeneity and also ensure that within and across the cross-sectional units, CSD is accounted for. For robustness, Kao (1999) cointegration test, which is Engle Granger based, is also applied in estimating cointegrating relationships between variables.

Table 3 results indicate that all five statistics from Kao test are significant at 1%. In the Pedroni test, one statistic is significant at 5% and two are significant at 1%. The Westerlund statistic is significant at 5%. The results are a confirmation of long-run relation between the variables.

Table 1. Panel unit root test results (without trend)						
Variable	LLC		IPS		Breitung	
	Levels	1 st diff	Levels	1 st diff	Levels	1 st diff
GDP	0.4288	-4.7386	-1.3937	-2.1756	-5.7541	-7.5857
	(0.6660)	(0.0000)	(0.0000)	(0.0000)	(0.0817)	(0.0148)
ATO	-2.6849	-7.8061	-2.0774	-6.6903	-1.3079	-6.4442
	(0.0036)	(0.0000)	(0.0189)	(0.0000)	(0.0955)	(0.0000)
AES	-4.5448	-6.2649	-3.0420	-6.5178	-0.3722	-5.9820
	(0.0000)	(0.0000)	(0.0012)	(0.0000)	(0.3549)	(0.0000)
AIS	-0.5956	-3.0088	-1.8419	-6.8263	-2.7086	-3.8727
	(0.2757)	(0.0013)	(0.0327)	(0.0000)	(0.0034)	(0.0001)
REXR	-1.9391	-6.2516	0.0333	-4.6745	0.8562	-6.2733
	(0.0262)	(0.0000)	(0.5133)	(0.0000)	(0.8041)	(0.0000)
GRQ	-0.6945	-4.3100	0.7917	-4.6892	0.7102	-5.5714
	(0.2437)	(0.0000)	(0.7857)	(0.0000)	(0.7612)	(0.0000)
EAC	-0.7456	-3.2688	0.7893	-5.2557	-0.3135	-7.1647
	(0.2280)	(0.0005)	(0.7850)	(0.0000)	(0.3769)	(0.0000)
GCFA	-0.0388)	-4.2022	-0.6996	-6.1889	-1.5099	-3.9405
	(0.4845)	(0.0000)	(0.2421)	(0.0000)	(0.0655)	(0.0000)
AGR_L	-1.8949	-1.3091	2.8580	-1.9370	4.7480	-2.6118
	(0.0291)	(0.0953)	(0.9979)	(0.0264)	(1.0000)	(0.0045)

P-values are in parentheses.

Table 2. Panel unit root test results (with trend)						
Variable	LI	LLC		PS	Breitung	
	Levels	1 st diff	Levels	1 st diff	Levels	1 st diff
GDP	0.9858	-2.8982	-5.7728	-7.5018	-1.8469	-3.2930
	(0.8379)	(0.0000)	(0.0324)	(0.0005)	(0.0000)	(0.0000)
ATO	-2.4463	-7.1853	-3.4391	-6.3120	-3.0782	-6.7076
	(0.0072)	(0.0000)	(0.0003)	(0.0000)	(0.0010)	(0.0000)
AES	-3.8820	-6.0997	-3.7064	-6.7228	-1.9423	-6.5233
	(0.0001)	(0.0000)	(0.0001)	(0.0000)	(0.0261)	(0.0000)
AIS	2.0066	-2.5038	-2.3013	-6.9125	-1.4872	-4.9671
	(0.9776)	(0.0061)	(0.0107)	(0.0000)	(0.0685)	(0.0000)
REXR	-1.4933	-7.3773	0.2107	-5.1692	1.0074	-5.5865
	(0.0677)	(0.0000)	(0.5834)	(0.0000)	(0.8431)	(0.0000)
GRQ	-0.5095	-3.4243	-0.7197	-4.9074	1.011	-4.5102
	(0.3052)	(0.0003)	(0.2358)	(0.0000)	(0.8416)	(0.0000)
EAC	1.2119	-2.3951	-0.3195	-5.2873	0.0993	-3.2388
	(0.8872)	(0.0083)	(0.3747)	(0.0000)	(0.5395)	(0.0000)
GCFA	-1.9625	-2.1357	-2.4041	-6.2938	-1.0670	-4.7201
	(0.0248)	(0.0164)	(0.0081)	(0.0000)	(0.1430)	(0.0000)
AGR_L	-1.3974	-1.6929	1.1157	-2.5930	3.0337	-1.2901
	(0.0812)	(0.0452)	(0.8677)	(0.0048)	(0.9988)	(0.0985)

P-values are in parentheses.

5.2. Slope homogeneity test

The significance of this test is that economic outcomes in one EAC country may be different from the other. The study employs Pesaran and Yamagata (2008) test in testing for homogeneity of slopes. The test is applicable to balanced and unbalanced panels. According to Bersvendsen and Ditzen (2021), it is suitable in cases where there is cross-sectional dependence. The null hypothesis of the test is homogeneity of slope coefficients.

Table 3. Panel cointegration test results

Kao Cointegration test

	Statistic	p-value		
Modified DF t	-12.3845	0.0000		
DF t	-9.9235	0.0000		
ADF t	-6.6336	0.0000		
Unadjusted Modified DF t	-13.5563	0.0000		
Unadjusted DF t	-9.9818	0.0000		
Pedroni Cointegration test				
Modified PP t	1.8018	0.0358		
PP t	-5.6160	0.0000		
ADF t	-3.2770	0.0005		
Westerlund Cointegration Test				
Variance ratio	0.4908	0.0231		

Table 4. Slope homogeneity test results

H₀: slopecoefficientsarehomogeneous

Delta	p-value
3.794	0.000
adj. 4.897	0.000

Table 5. Cross sectional dependence Exponent estimation and Test				
Variable	CD	CDw	CDw+	CD*
GDP	-0.47	-1.34	11.32	2.67
	(0.639)	(0.001)	(0.000)	(0.008)
ATO	-1.44	2.67	14.08	0.29
	(0.149)	(0.007)	(0.000)	(0.769)
AES	4.43	-2.09	12.09	0.77
	(0.000)	(0.037)	(0.000)	(0.440)
AIS	6.46	-2.61	18.83	1.07
	(0.000)	(0.009)	(0.000)	(0.286)
GRQ	0.25	-0.54	15.79	0.97
	(0.805)	(0.589)	(0.000)	(0.330)
REXR	-0.18	-2.50	17.43	2.37
	(0.855)	(0.012)	(0.000)	0.018)
EAC	15.32	-2.92	45.53	1.23
	(0.000)	(0.004)	(0.000)	(0.220)
GCFA	5.71	-2.26	18.16	4.07
	(0.000)	(0.024)	(0.000)	(0.000)
AGR_L	-0.44	-0.76	28.74	1.31
	(0.662)	(0.445)	(0.000)	(0.191)

Table 4 results indicate that p-values of the test are significant at 1% level. This leads to rejection of the null hypothesis and confirmation of slope heterogeneity.

5.3. Cross sectional dependence test

The study used the Pesaran (2015) test for cross-sectional dependence. Failure to test and account for CSD may lead to biased and inconsistent estimates. The test generates four statistics and

Table 6. Comparison of mean group estimator and Common Correlated effects (CCE) pooled Estimation

H₀ : slopecoefficientsarehomogeneous

Delta	p-value
-3.22e+04	0.000
adj2.46e+04	0.000

p-values for each variable. The four statistics are, CD (Pesaran, 2015, 2021), CDw (Juodis & Reese, 2022), CDw+ (Fan et al., 2015) and CD* (Pesaran & Xie, 2021). The test is done under the null hypothesis of weak CSD against the alternative of strong CSD. Failure to account for dependence between cross-sectional units leads to CSD. The existence of such dependence violates the OLS assumption about the error term being independent and identically distributed. It may also lead to omitted variable bias and endogeneity (Pesaran, 2015).

Based on Table 5 results, we reject the null hypothesis of weak cross-sectional dependence. As a result, the panel has cross-sectional dependency.

5.4. Accounting for CSD

The strong CSD therefore needs to be accounted for. If this is not done, our regression estimates may turn out to be biased and inconsistent. We therefore approximate the strong CSD by adding Cross Sectional Averages (CSA) as further covariates. The estimator is defined as Common Correlated Effects (CCE) estimator (Pesaran, 2006). The main advantage of the CCE estimator is that it does not require the specification of common factors in advance as compared to principal component analysis (Bersvendsen & Ditzen, 2021).

Estimating the model with CSA which involves the comparison of CCE estimator with the mean group estimator eliminates CSD from the panel

5.5. CS-ARDL estimation

Our panel unit root results confirmed that our variables had mixed orders of integration. We also discovered the presence of slope heterogeneity and cross-sectional dependence. The variables also had a long-run relationship. Based on these findings, Panel Auto-Regressive Distributed Lag (ARDL) model should be applied in analyzing the relationship between the variables (Ditzen, 2021; Ameziane & Benyacoub, 2022). However, the presence of strong CSD makes the Cross-Sectional ARDL (CS-ARDL) to be the most suitable method compared to other panel ARDL estimation techniques (Ditzen, 2021).

The CS-ARDL results indicate that short-run economic growth is driven by exchange rate, institutional quality and membership to the EAC. In the short run, openness has a negative and insignificant effect on economic growth. However, in the long run, openness, exchange rate, institutional quality and EAC membership are significant determinants of economic growth. A 1% increase in trade openness makes the economy to grow by 0.03 units. A one percent increase in government regulatory quality and EAC membership increases economic growth by 0.016 units and 0.02 units, respectively.

Table 6 shows the results of estimating the model with CSA. This involves the comparison of CCE estimator with the mean group estimator. The test results are significant at 1%, a confirmation that CSD does not exist the panel.

5.6. Panel causality results

Panel causality analysis is implemented using a procedure proposed by (Dumitrescu & Hurlin, 2012). In performing the test, we assume that there may be causality for some and not all variables. In cases of cross-sectional dependence, the method proposed a bootstrap procedure

Table 7. Panel CS-ARDL estimation results Common Correlated Effects Estimator – (CS-ARDL Panel)

Variables	Coefficients	Std. Error	p-value		
Short run estimation					
L.GDP	0.5013463	0.0708983	.000		
ATO	-0.003881	0.0319776	.574		
AES	0.0037782	0.0497969	.413		
AIS	-0.015505	0.1188511	.265		
REER	-0.713946	0.0183665	.023		
GRQ	0.0020905	0.0045332	.006		
EAC	0.0112298	0.0325293	.000		
GCFA	0.1734451	0.4212627	.156		
AGR_L	0.7026037	0.2555339	.212		
Long run estimation					
ATO	0.0300436	0.0256139	.050		
AES	0.0417365	0.0016881	.319		
AIS	-0.072174	0.2381147	.115		
REXR	0.3754486	0.2216139	.207		
GRQ	0.0160789	0.0522893	.012		
EAC	0.0205560	0.3112757	.000		
GCFA	0.0537448	0.1027108	.199		
AGR_L	0.0453816	0.4251063	.151		

Table 8. Panel granger causality results					
Null hypothesis	Z-bar-Statistic	P-value			
ATO does not granger cause GDP	3.6405	0.0280			
GDP does not granger cause ATO	4.9193	0.1220			
GDP does not granger cause AES	2.5796	0.3170			
AES goes not granger cause GDP	4.6883	0.1250			
GDP does not granger cause AIS	3.6164	0.2870			
AIS does not granger cause GDP	3.2838	0.2870			
REER does not granger cause GDP	-0.0682	0.0040			
GDP does not granger cause REER	6.1513	0.9540			
GRQ does not granger cause GDP	7.7864	0.0410			
GDP does not granger cause GRQ	0.0107	0.9920			
EAC does not granger cause GDP	2.9603	0.0470			
GDP does not granger cause EAC	0.0401	0.0450			
GCFA does not granger cause GDP	0.5662	0.2610			
GDP does not granger cause GCFA	7.7236	0.8810			
AGR_L does not granger cause GDP	9.3332	0.2710			
GDP does not granger cause AGR_L	-0.5080	0.5060			
p-values computed using 1000 bootstrap replications.					

for calculation of bootstrapped critical values (Lopez & Weber, 2017). Given that the data revealed the presence of strong CSD, we generate the bootstrapped p-values and critical values to examine the causal relationships between variables. This is done using 1,000 bootstrap replications. Since

the cross-sectional dimension of our data is less than its time series dimension (N is less than T), we use Z-bar statistic to examine the nature and direction of causality (Mwangi et al., 2020).

Table 7 shows evidence of unidirectional causality between agricultural trade openness and economic growth. The Z-bar statistic is significant at the 5% level. This implies that agricultural trade openness is a significant determinant of economic growth in the EAC. The results are consistent with the findings of Raghutla (2020) and Cheng and Ljungqvist (2021). Agricultural export and import shares do not have any causal relationship with economic growth. There is a unidirectional causality between real effective exchange rate and economic growth. The implication is that the real exchange rate affects the net trade volume and this may influence the level of economic growth. This result agrees with the findings of Ani and Ude (2021) and Lawal et al. (2016) on the effects of exchange rate on economic growth.

There is unidirectional causality between government regulatory quality and economic growth. This result suggests that trade policies have a significant effect on economic growth arising from trade openness. The result is consistent with those of Bakari and Mabrouki (2017), Fankem and Oumarou (2020) and Nugroho et al. (2021). Bidirectional causality exists between economic growth and membership to the EAC. This implies that economic integration significantly influences the level of economic growth and the feedback effect is present. This outcome is consistent with those of Shengnan (2022) and Mubasher et al. (2021). Countries with low levels of development have limited factors of production. Cooperation and integration between such countries and developed countries ensures free movement of factors of production and goods which plays an important role in promoting economic growth (See Table 8).

6. Conclusion and policy implications

The study analyzed the effects of trade openness on economic growth in the EAC. After a review of empirical research on the relationship between the variables, stationarity was tested using panel unit root tests. The variables exhibited mixed order of integration as they were both I(1) and I(0). The panel cointegration test results confirmed that variables had a long-run relationship. Slope homogeneity tests revealed the existence of slope heterogeneity. The CSD test indicated that there was strong CSD. To account for the strong CSD, our model was estimated with CSA which involved the comparison of CCE pooled and mean group estimators. The panel CS-ARDL approach was used in analyzing the nature of short-run and long-run relationships between variables. In the short run, government regulatory quality, real effective exchange rate and membership to the EAC were significant determinants of growth. In the long run, trade openness, economic integration and government regulatory quality were the main determinants of economic growth.

The bootstrap panel causality analysis was preferred in this study because our data exhibited strong CSD. According to Lopez and Weber (2017), the computation of bootstrapped critical values instead of asymptotic ones is useful in cases where CSD is present. The effect of trade openness on economic growth was positive and statistically significant. The causal relationship between economic growth and openness is unidirectional and runs from openness to economic growth. This result is consistent with the findings of Raghutla (2020), Sakyi et al. (2012), Yaya (2017) and Nugroho et al. (2021). The results are also in agreement with Nikalaos and Pavlos (2016) that openness leads to growth as proposed by the endogenous theory.

The main conclusion of this paper is that agricultural trade openness is a significant and positive determinant of economic growth. Membership to the EAC (economic integration) and government regulatory quality are also significant determinants of economic growth. The implication of these results is that EAC countries should enhance the implementation and promotion of trade and investment policies. This requires partnership and collaboration with the private sector. Strategies should also be devised to enhance export promotion among trading partners. The countries should diversify their agricultural exports and international markets to reduce vulnerabilities as a result

over reliance on certain items. The institutional framework should be enhanced and strengthened to improve the efficiency of trade openness. Exchange rates within member countries should be closely monitored to ensure stability and guard against fluctuations that may adversely affect economic growth.

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Correction

This article has been corrected with minor changes. These changes do not impact the academic content of the article.

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