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Geography of trade: Investigating the differential impact of Export performance on Economic growth between landlocked and coastal African countries

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Abstract

This study aims to investigate geographically mediated differential influence of export on economic growth across 24 coastal and 10 landlocked African economies during 2007 to 2023. The study employed panel ARDL approach PMG estimator to empirically test the hypothesis that geographic context fundamentally influences the short and long-run relationship between export and growth, it addresses significant literature gap in the area. Further panel cointegration and Granger causality tests are used. The results show a significant stable long-run equilibrium relationship exist among the export, growth and conditioning factors (logistic performance, infrastructure, political stability and official exchange rate), with weaker impact of export for landlocked economy's growth (0.26%), as compared to (0.37%) for coastal counterparts in the long-run. This differential impact is attributed to the combined effect of logistic constraints, infrastructure deficiencies and transit dependence of landlocked countries. Additionally, the causality analysis also revealed different causality relationship, in coastal countries economic growth causes export, while a bidirectional causation exists between the two variables in landlocked countries. The study goes beyond one-size-fits-all recommendations, by offering a geographically conditioned theoretical and empirical framework and contributes significantly. The study concludes that the effectiveness of export-led growth hypothesis is conditioned by geographical factors. Therefore, growth policies need to be geographic specific, coastal countries shall need to use ports as regional hubs, improve logistics and infrastructure as well as strength domestic demand to drive export, while landlocked counterparts shall focus on regional transit diplomacy, infrastructure development, political stability and value addition.

1. INTRODUCTION

The international trade system is experiencing a profound structural transformation characterized by rising protectionism and strategic reconfigurations of production networks. Global trade touched a record of 35 trillion USD during 2025, it is accompanied by significant disintegration, with rising tariffs predominantly in manufacturing sector where average tariffs raised from 4.7% to 5.7% (UNCTAD, 2025). Simultaneously, a vital change in service trade, which grew by 9% during 2025 and characterizes 27% of global trade, is creating new opportunities but also broadening gaps among countries, this progress creates a complex and uncertain global environment where the outdated export-led growth hypotheses face new conditionality (UNCTAD, 2025).

The pursuit Sustainable Development Goal (SDGs 2030) and inclusive economic growth remain the principal development challenge for developing countries, especially those in Africa. Within this context, export-led growth has been prescribed as a vital strategy to catalyze industrial development, enhance foreign exchange and enhance global economic integration. This paradigm is enshrined in both SDGs 2023, particularly under goal 8 (decent work and growth) and goal 9 (industry, innovation and infrastructure) and Agenda 2063, the "Africa we want", which aspires for prosperous Africa (African Union Commission, 2015; UN, 2015). The effectiveness of the export-led growth hypotheses, however, is basically mediated by geopolitics, logistic performance, infrastructure development and port access, creating a structural variation between landlocked and coastal countries (Ferrari et al., 2023; Kumar et al., 2020; Lau et al., 2024; Tang & Abosedra, 2019).

Simultaneous achievement of SDGs 2030 and Agenda 2063 requires enormous amounts of financial inflows, far exceeding the current levels of domestic resource mobilization and official development assistance (ODA). Due to this, many countries now largely rely on borrowing from outside sources, which has resulted in a severe and increasing debt burden that limits fiscal space for important public investment (Kedir A., 2023). Despite of this reality, many African countries face a persistent import-export gap and global trade complexity, leading to trade deficits and pressure on foreign currency reserves (African Export-Import Bank, 2025). The financial constraint and trade imbalances raise the strategic significance of exports. Exports are viewed not only as a development engine but also as a vital source of the foreign exchange required to pay off external debt, finance crucial imports and attract foreign investment. Therefore, understanding the specific mechanism and effectiveness of export-led growth is a policy requirement rather than an academic endeavor. However, the central question is the export-led growth nexus is equally effective across all African geographical context, or the geographic disparities between landlocked and coastal countries create divergent capacities, due to severe limitations that landlocked economies experience weaken its influence (Verschuur et al., 2022).

The theoretical foundation of export-led growth rooted in classical, neoclassical trade theories, endogenous growth, as well as neutrality hypothesis. Classical trade theory posit that trade provides an outlet for surplus production, through utilizing ideal resources (Adam Smith, 1776). This idea was refined by David Ricardo's comparative advantage theory, demonstrating that specialization based on comparative efficiency benefits the economy of trading countries (David Ricardo, 1817). Furthermore, neoclassical trade theoreticians, such as that of Heckscher-Ohlin framework, extended the benefit of trade by linking trade with optimal global resource allocation (Donaldson, 1934; Heckscher, 1919). While endogenous growth theory argues that export expansion drives economic growth through economies of scale, technological progress and innovation (Helpman et al., 2003). According to this theory, international trade facilitates learning by doing, improves managerial skills and knowledge spillovers, expanding productivity than closed economies (Romer, 1990). This traditional view is strongly challenged, the growth-led export hypothesis posits the reverse causality of the traditional export-led growth hypothesis, arguing that it is economic growth that fosters export expansion (Bhagwati, 1988; Nicholas Kaldor, 1970). Contrary to these arguments, the neutrality hypothesis challenges the causal direction of export and growth nexus, suggesting export and economic growth are jointly caused by third factor, such as institutions or technology, implying absence of causal relationship (Woo S. Jung & Marshall, 1985).

The relationship between export and economic growth is equally controversial in previous empirical studies, despite many studies have identified a strong positive causal relationship between economic growth and export expansion, still the relationship remains disputed. Some studies revealed a strong, unidirectional causality running from export to economic growth, confirming the validity of export-led growth hypothesis (Adelakun et al., 2025; African Export-Import Bank, 2025; Çalışkan, 2026; Sein & Sah, 2025; Uzuner et al., 2025). Whereas, others find revers causality running from economic expansion to export performance arguing with economic growth-led export expansion (Athiyyah Nursyifa Tisnandar et al., 2025; Ben-Salha et al., 2023; Kalaitzi & Chamberlain, 2021)

Others find bidirectional causal relationship (Can et al., 2024; Emek, 2024; Ouassaf et al., 2023; Ramakgasha et al., 2023). while, more troublingly some of the studies revealed the absence of causal relationship at all between economic growth and export expansion (Adelakun & Kazeem Olayiwola, 2020; Singaram et al., 2025), highlighting that export may simply be a component of GDP rather than growth driver. Moreover, interestingly studies by (Budha, 2025; Wan et al., 2022) found an inverse relationship between the two variables, underscoring

The theoretical and empirical ambiguity, often overlooked to account for the influence of structural heterogeneities among countries, particularly the geographical disparity between landlocked and coastal countries. The majority of empirical studies ignores geography, infrastructure and logistic, implicitly assuming a homogeneous export-growth elasticity across all types of country. Therefore, one size fit all is a misleading policy prescription, because for a landlocked country, the theoretical benefits of export expansion, economies of scale, innovation and technological transfer may be severely reduced by the devastating port disadvantage, transportation costs, logistic performance and bureaucratic delays at multiple borders.

The study hypothesizes that geography is a crucial factor that fundamentally shapes the relationship between export and economic growth. The geographical and logistical constraints faced by 16 landlocked African countries creates a different causal relationship between export and economic growth compared to Africa's 38 coastal countries. for coastal African countries, export is directly translated into economic growth due to lower transportation costs, geographical advantages and integration to international market, while for landlocked economies, exports must first overcome a significant cost block that erodes profitability, dependency on Agricultural commodity export, mining, energy and dependency on transit countries, which alone justify the transportation cost(United Nations, 2023).

Therefore, this study has the following significance, theoretically, it aims to integrate the moderating role of geography in export-led growth framework, the study goes beyond asking if export cause economic growth, under what structural conditions this causal relationship holds and with what extent. Therefore, by introducing this heterogeneity in the existing framework, the study contributes to a more generalized and geographically sensitive theoretical framework that better capture the realities of landlocked countries in African and elsewhere. Methodologically, by applying Pooled Mean Group (PMG) estimation method developed by (Pesaran et al., 1999), which is appropriate for capturing long-run relationships and heterogeneous dynamics across cross-sections, the study addresses the methodological gaps in previous studies. The PMG estimators allow estimation of homogeneous long-run equilibrium relationship between economic growth and export, a fundamental argument of trade theory, while allowing short-run dynamics among cross-sectional units. This is a more practical assumption than imposing homogeneity among the individual units. Empirically, many previous studies examined the causal relationship between export expansion and economic growth as well as the disadvantage of being landlocked on export volume and level of economic growth, few of them tested whether the impact of export on growth is structurally differed between landlocked and coastal countries. Therefore, this study investigates the differential impact of exports on economic growth between landlocked and coastal African countries.

Moreover, this study has a significant policy contribution; by investigating the differential impact of exports on economic growth, it provides distinct policy frameworks for both landlocked and coastal group. Such targeting is essential in the time of increasing debt distress, due to transportation and logistics costs policymakers in landlocked countries are under pressure to get foreign exchange to cover their debt, therefore, they should know whether export earnings result less economic growth than it would for coastal counterpart or not. In regional economic communities like the African continental free trade area (AfCFTA), this knowledge is important for creating domestic support framework and negotiating fair terms.

Therefore, we the researchers argue that realizing the ambitions of SDGs 2030 and Agenda 2063 necessitates moving beyond one-size-fits all export-led growth prescription. The first stage in developing geographically intelligent policy that will ensures economic development for both landlocked and coastal countries, is to identify and empirically validate the distinct pathway to development.

2. REVIEW OF LITARATURE

2.1 Theoretical Review

The causal link between export expansion and economic growth is theoretically vague, with various competing frameworks explaining why the nexus may emerge as export-led growth, growth-led export, invers or neutral across different context.

Classical trade theory

According to classical trade theory, postulated by Adam Smith's concept of "vent-for-surplus", posits that international trade allows countries to make use of otherwise idle resources by giving surplus items to a market (Adam Smith, 1776). This reasoning was further developed by David Ricardo's theory of comparative advantage, which showed that nations will profitable from trade by specializing in the manufacturing of items for which they have a lower relative opportunity cost, even if they are less efficient in absolute terms (David Ricardo, 1817). This theory framed exports as the main means of economic growth through better resource allocation.

Neoclassical trade theory

Eli Heckscher and Bertil developed neoclassical trade theory, which expanded on the classical framework by linking variations in national factors endowments, such as labor, capital and land to trade patterns. According to the Heckscher-Ohlin framework, a nation will import goods that utilize its scarce factors and export items that heavily utilize its abundant factors (Donaldson, 1934; Heckscher, 1919). They argue that trade fosters economic growth by maximizing the utilization of a nation's comparative advantages.

Endogenous growth theory

According to endogenous growth theory international trade is incorporated into long-term self-sustained growth model, exports are a major force of economic growth through dynamic channels including economies of scale, innovation, knowledge and technology sparked by pressure from competitors in foreign markets (Helpman et al., 2003). According to this view, trade enhances managerial skills, promotes learning-by-doing and productivity beyond what is feasible in closed economies (Romer, 1990). Therefore, export is viewed as a causal process for technological improvement and long-term economic growth rather than just an outcome of efficiency.

Growth-Led Export Hypothesis (GLEH)

According to the GLEH, export performance is driven by domestic economic expansion, reversing the conventional causal relationship. Advocates like Kaldor (1970) and Bhagwati (1988) asserts that a nation's industrial capacity and product competitiveness are improved by economic growth, which is driven by elements like productive gains, capital accumulation and technical advancements(Bhagwati, 1988; Nicholas Kaldor, 1970). Therefore, according to this hypothesis exports are not the main driver of economic growth, but rather a result of it.

Neutrality Hypothesis

The direct causal relationship between exports and economic growth is contested by the neutrality hypothesis. The significant association that is frequently seen between these variables, is erroneous because both are jointly driven by other underlying elements such as institutional quality, technological advancement or successful economic strategies (Woo S Jung & Marshall, 1985). This viewpoint implies that strategies aimed at export promotion may be useless unless these fundamental, third factor drivers are concurrently addressed because export and growth move together due to shared causes.

Crowding-Out hypothesis

Crowding-out hypothesis contends that concentrating on export-oriented industries can take vital resources away from non-tradable or import-substituting industries that might be essential for balanced and sustainable development in the context of trade and growth nexus, these resources include capital, skilled labor and entrepreneurial talent (Corden, 1971). Increased susceptibility to external shocks and structural distortions, a situation in which a thriving export sector damages other industries which resulted from this reallocation. According to this hypothesis, an overwhelming policy bias in favor of exports may crowd-out investments required for long-term diversified economic growth.

2.2 Empirical Literature

There is no agreement on the existence, direction and strength of the causal relationship between export and economic growth based on the empirical inquiry. Export-led growth, Growth-led exports, neutrality and even negative outcomes are all supported by recent studies, largely dependent on methodological choices, countries characteristics and moderating variables.

The conventional export-led growth hypothesis is supported by a number of studies, (BEDIME et al., 2025) revealed strong evidence of unidirectional causality from export diversification to GDP growth using panel VAR model for 45 developing economies. Similarly, (Mazorodze, 2024) for 44 sub-Sharan African countries found that exports significantly boost economic growth in countries with having low to moderate external debt. This is further supported by (Suripto et al., 2025) for five Asean countries during 1971 to 2023 by using VECM and panel Granger causality tests.

On the other hand, some studies support the opposite causal relationship, export performance is influenced by economic growth. studies by (Athiyyah Nursyifa Tisnandar et al., 2025; Ben-Salha et al., 2023) confirmed the growth-led export hypothesis.

Furthermore, studies by (Emek, 2024; Kukaj & Hameli, 2022; Kulińska, 2024) reported bidirectional export-growth causal relationship. There are also empirical supports for the neutrality hypothesis, which holds that there is no causal relationship between export and economic growth, (Özgur Uysal & Abdulakadir Said Mohamoud, 2018).

Despite this abundance of contradictory findings, there is lack of systematic investigation of how geographic endowment particularly the landlocked versus coastal dichotomy fundamentally moderate the export-growth nexus remains a major empirical gap. The aforementioned empirical studies either ignored or consider geography as a control dummy, implicitly presuming uniform economic mechanisms across wildly different logistical realities. Critical heterogeneity is hidden by this aggregated bias. A number of contextual factors that vary by geography, such as logistic performance, infrastructure, political stability and exchange rate regimes are likely to mediate the impact of export on economic growth. Therefore, the prevalent debate in the literature may not stem from the lack of causal relationship, but from the failure to account the geographical and institutional variations in the model. Hence this study addresses this gap by postulating that the effect of export on economic growth is not uniform but is consistently weaker for landlocked African countries, a relationship further conditioned by the quality of their logistic, infrastructure and political stability.

3. METHODOLOGY

3.1 Data type and sources

We employed a balanced panel dataset covering a sample of 34 African countries 10 from landlocked and 24 from coastal countries. The availability of complete data for below listed variables over this period was a selection criterion of sample countries. to ensure the robustness and contextual relevance of the findings the data is compiled from reputable international sources. Each variable with its measurement and source and list of sample countries are described in Table 1 and 2 below.

Table 1
Data type and sources

Variable	Description/Measurement	Symbol	Source
Real GDP	Gross domestic product (Constant 2015, US$)	RGDP	(World Bank, 2025)
Export	Export of goods and services (Constant 2015, US$)	EXP	
Official Exchange rate	Official exchange rate (LCU per, period average)	EXR	
Logistic performance index	Overall logistics performance index (1 = low to 5 = high)	LPI	
Political stability	Political stability and absence of violence estimate (-2.5 to + 2.5)	PS	
Infrastructure development index	Infrastructure development, aggregating electricity, transport, ICT and water supply and sanitation (0 to 100)	IDI	(AfDB, 2025)
Note: LCU is local currency unit			

Table 2
List of sample country

No	Coastal			Landlocked
1	Benin	Algeria	Tunisia	Niger
2	Egypt	Gabon	Namibia	Central African Republic
3	Ghana	Gambia	Sierra Leone	Mali
4	Kenya	Morocco	Congo-Brazzaville	Burkina Faso
5	Tanzania	Madagascar		Rwanda
6	South Africa	Mauritania		Chad
7	Cote d'Ivoire	Mauritius		Uganda
8	Cameroon	Sudan		Botswana
9	Congo Republic	Senegal		Burundi
10	Comoros	Togo		Zambia

3.2 Methods of Econometric Analysis

3.2.1 Model Specification

Building on the theoretical framework and the identified gaps, to empirically examine the differential influence of export on economic growth as well as long-run relationship and short-run dynamics between the two variables in landlocked and coastal countries this study uses panel ARDL model with PMG approach developed by (Pesaran et al., 1999). The PMG estimator is especially well suited for this analysis because it permits heterogeneity in the short-run adjustment coefficient and error variances across cross-sections while allowing the estimation of common long-run equilibrium relationship consistent with the theoretical expectation of a fundamental export-growth nexus. This flexibility is crucial because it recognizes that, although the long-term influence of export value on economic growth may be homogeneous in both groups, the speed of adjustment to short-term shocks and immediate impact are likely shaped geographic specific constraints like transport, logistics and transit dependencies. Further, despite the moderately large size of time dimension (T = 17), the PMG estimator is appropriate for both 24 coastal and 10 landlocked countries because it effectively pools cross-sectional data to estimate a common long-run export-growth relationship while allowing for heterogeneous short-run dynamics. Moreover, the PMG approach is appropriate for macro panels where T is enough for time-series estimation within cross-sectional units (Edward F. Blackburne & Mark W. Frank, 2007; Pesaran et al., 1999)

The generic form of the panel ARDL model is described as follows;

$$\varvec{Y}_{\varvec{i},\varvec{t}} = \varvec{\alpha}_{\varvec{i}} + \sum_{\mathbf{K}=1}^{\mathbf{p}-1} \varvec{\phi}_{\mathbf{K}} \varvec{Y}_{\varvec{i},\varvec{t}-\varvec{K}} + \sum_{\mathbf{j}=1}^{\mathbf{q}-1} \varvec{\beta}'_{\mathbf{ij}} \varvec{X}_{\varvec{i},\va$$

Where, $\varvec{Y}_{\varvec{i},\varvec{t}}$ is the dependent variable for country i at time t, $\varvec{\alpha}_{\varvec{i}}$ denotes country specific fixed effects, **p and q** are the number of lags for dependent and independent variables, $\varvec{\phi}_{\mathbf{K}}$ is the autoregressive parameter, indicates the effect of lagged dependent variable on current value, $\varvec{X}_{\varvec{i},\varvec{t}-\varvec{j}}$ is a vector of independent variables for country i at time t, $\varvec{\beta}'_{\mathbf{j}}$ represents the corresponding vector of parameter for independent variables, $\varvec{\epsilon}_{\varvec{i},\varvec{t}}$ denotes idiosyncratic error term. Therefore, the panel ARDL/PMG model is specified as bellow,

$$\Delta \varvec{RGDP}_{\varvec{i},\varvec{t}} = \varvec{\alpha}_{\varvec{i}} + \sum_{\mathbf{K}=1}^{\mathbf{p}-1} \varvec{\phi}_{\mathbf{K}} \Delta \varvec{RGDP}_{\varv$$

Were, $\varvec{RGDP}_{\varvec{i},\varvec{t}}$ is real GDP for country I at time t, $\varvec{\beta}'_{\mathbf{ij}}$ is vector of short-run coefficients of dependent variables, $X_{i,t}$ is a vector of independent and control variables for country I at time t (Export, logistic performance index, infrastructure

development index, political stability and official exchange rate), $\varvec{\phi}_{\varvec{i}}$ is error correction term, $\left(\varvec{R}\varvec{G}\varvec{D}\varvec{P}_{\varvec{i},\varvec{t}-1} - \varvec{\tau}'_{\varvec{i}}\varvec{X}_{\varvec{i},\varvec{t}-1}\right)$ represents the long-run equilibrium relationship, τ' is a vector of long-run coefficient, $\varvec{\epsilon}_{\varvec{i},\varvec{t}}$ is error term.

3.2.2 Panel ARDL-Pooled Mean Group Analysis procedures

Cross-sectional Dependence Test

This study uses the (Pesaran, 2021) test to check for cross-sectional dependence (CD) in the panel before estimating the PMG model. The rejection of null hypothesis (H0) indicates the presence of dependency among cross-sections, shocks that affect one country have an impact on other countries. this violates the assumption of independence and calls for estimators that are robust to such kind of correlation, like PMG approach.

Panel stationarity test

we use cross-sectionally Augmented Dickey-Fuller (CADF) and cross-sectional IPS second-generation panel unit root tests developed by (Im et al., 2003; Pesaran, 2007) that take cross-sectional dependence into account to test for stationarity to avoid spurious regression. Validating the application of ARDL model which is applicable irrespective of the order of integration I(0) or I(1). The null hypothesis (H0) assumes that all panels have a unit root or not stationary.

Panel Cointegration Test

To confirm whether there is a stable long-term relationship between the variables, this study uses (Kao, 1999; Pedroni, 1999, 2004) error correction-based panel cointegration tests. The null hypothesis (Ho) assumes no cointegration, rejection of the Ho confirms the presence of long-run relationship among the variables despite of short-run variations, provides statistical justification for analyzing long-run parameters along with error correction term using PMG-ARDL model.

Slope Homogeneity Test

To confirm the assumptions of PMG estimator holds, homogeneous long-run coefficient but heterogeneous short-run dynamics, we apply the (Hashem Pesaran & Yamagata, 2008) delta ($\bar{\Delta}$) and ($\bar{\Delta}$) adjusted statistics. The null hypothesis assumes slope homogeneity across all cross-sectional units. The rejection of the null hypothesis would further provide strong evidence supporting the use of the PMG estimator and the core assumption of differential short-run impact of export on economic growth.

Panel Causality Test

To investigate the direction of causality between the dependent and independent variables, we employ panel Granger non-causality test developed by (Juodis et al., 2021). Which is robust to cross-sectional dependence and heterogeneity. The null hypothesis is there is no causality from export to economic growth and vice-versa for all panels, rejection of the null hypothesis allows us to determine if the causal relationship is unidirectional (growth-led export or export-led growth), bidirectional or neutral in different geographical context.

4. RESULTS AND DISCUSSIONS

4.1 Descriptive statistics

The descriptive statistics presented in table-3 below reveal significant disparities between landlocked and coastal African countries during the study period 2007 to 2023. Over the course of the study, coastal countries demonstrate a significant bigger economic size, with a mean real GDP of $60.9 billion as compared to $12.6 billion of landlocked counterparts. In a similar manner, coastal countries have far higher export volumes than their landlocked counterparts, averaging $15.9 billion versus $3 billion. This disparity highlights the geographical disadvantage faced by landlocked countries, they have significant smaller economic base, which limits their capacity to invest, diversify and take advantage of economies of scale.

Furthermore, key conditioning factors also exhibit distinct patterns, the logistic performance is marginally lower for landlocked countries, with an average of 2.45 as compared with 2.53 for coastal African countries. similarly, infrastructure development also weaker in landlocked countries with mean of 15.7 compared to coastal average 28.51, which reflects the combined challenge of internal infrastructure deficits and their dependency on transit routes. Regarding the political stability, the average estimate for landlocked countries is -0.81, underscoring higher vulnerability to instability and violence, while coastal countries average is -0.51. This implies that increased political fragility may be associated with geographical isolation, which could further impede trade logistics and deter investment.

Table 3
Summary of Descriptive Statistics

Variables	Coastal Countries				Landlocked Countries			
	Mean	Maximum	Minimum	SD	Mean	Maximum	Minimum	SD
Real GDP	$60.9	$471	$478	$94.8	$12.6	$46.5	$1.62	$9.12
Export	$15.9	$143	$6.6	$24.9	$3	$9	$114	$2.4
Logistic Performance	2.53	3.77	1.87	0.21	2.45	3.1	1.61	0.18
Official exchange rate	432.39	4429.6	0.93	697.46	805.12	3727.1	3.74	877.8
Infrastructure DI	28.51	90.76	3.81	22.15	15.87	41.28	3.15	8.5
Political stability	-0.51	1.20	-2.66	0.75	-0.81	1.1	-2.73	0.99
Observation	**672**				**280**			

4.2 Pair-wise Correlations of ARDL Model

The correlation results revealed disparities among the association of variables between the two panels, underscoring the importance of separate analysis (see table-4). More importantly, all independent variables exhibit correlations that are below the standard cutoff 0.7, highlighting the absence of multicollinearity problem while using the PMG estimators.

Table 4
Pair-wise Correlations result

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Coastal countries						
ln_real GDP (1)	1.0000					
ln_Export (2)	0.94*	1.0000				
LPI (3)	0.30*	0.29*	1.0000			
ln_Official exchange rate (4)	-0.24*	-0.25*	-0.12*	1.0000		
Infrastructure Development index (5)	0.52*	0.5301*	0.3215*	-0.47*	1.0000	
Political stability (6)	-0.36*	-0.24*	0.03	-0.12*	0.17*	1.0000
Landlocked countries						
ln_real GDP (1)	1.0000					
ln_Export (2)	0.92*	1.0000				
LPI (3)	0.22*	0.2*	1.0000			
ln_Official exchange rate (4)	-0.23*	-0.46*	-0.06	1.0000		
Infrastructure Development index (5)	0.38*	0.44*	0.27*	-0.55*	1.0000	
Political stability (6)	0.45*	0.55*	0.1475	-0.67*	0.66*	1.0000
Note: * denote statistical significance at the 5% level.						

4.3 Panel ARDL Model (PMG) Analysis

4.3.1 Cross-sectional dependence (CD) test

The cross-sectional independency hypothesis is rejected in both landlocked and coastal panels, validating the use of robust PMG-ARDL estimator (see table-5).

Table: – 5 Cross-sectional Dependency test results

Variables	Coastal Countries		Landlocked Countries	
	CD test statistic	P-value	CD test statistic	P-value
ln_real GDP	52.40	0.000	19.20	0.000
ln_Export	28.56	0.000	15.15	0.000
LPI	3.14	0.002	4.16	0.000
ln_Official exchange rate	56.38	0.000	25.58	0.000
Infrastructure Development	65.86	0.000	26.66	0.000
Political stability	-1.39	0.166	-0.71	0.479

4.3.2 Panel Unit root test results

The results of the stationarity tests show that all the variables are integrated I (0) and I (1), none of them are not found to be I (2) (see table-6), it is a fundamental prerequisite to use panel ARDL framework, like PMG estimator (Pesaran et al., 1999).

Table: -6 Panel unit root tests result

Variable	Coastal African countries				Landlocked African countries			
	CIPS		CADF		CIPS		CADF	
I (0)	I (1)	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)	
Real GDP	-1.47	-2.59***	-1.89	-2.51***	-1.86	-3.18***	-2.4***	-2.75***
Export	-1.15	-3.73***	-2.0*	-2.89***	-1.69	-3.83***	-1.58	-2.85***
Logistic performance	-4.5***	-6.12***	-2.01	-3.67***	-4***	-5.68***	-2.8***	-4.09***
Official exchange rate	-1.53	-3.63***	-2.4***	-2.06***	-2.6***	-3.51***	-1.46	-3.33***
Infrastructure Development	-1.69	-4.24***	-1.27	-3.38***	-1.08	-3.07***	-0.83	-2.08
Political stability	-2.10*	-3.78***	-1.89	-2.78***	-1.92	-3.74***	-1.88	-3.28***
Note: ***, ** and * denotes statistical significance at the 1%, 5% and 10% levels respectively.								

4.3.3 Panel co-integration test results

The result of both Kao and Pedroni cointegration tests revealed the existence of equilibrium long-run relationship among the study variables, rejecting the null hypothesis of absence of cointegration. Further the results confirm the importance of employing the ARDL-PMG estimator, which is suitable to separate and estimate long-run cointegrating relationship from short-run dynamics. The results of cointegration tests are indicated below in table 7 and 8.

Table: -7 Kao panel co-integration test

Panel Group Statistics	Coastal Africa	Landlocked Africa
Modified Dickey–Fuller t	-6.75***	-2.32***
Dickey–Fuller t	-9.83***	-6.61***
Augmented Dickey–Fuller t	-5.73***	-1.93***
Unadjusted modified Dickey–Fuller t	-15.58***	-12.19***
Unadjusted Dickey–Fuller t	-12.59***	-10.92***

Table: -8 Pedroni panel co-integration test

Panel Group Statistics	Coastal Africa		Landlocked Africa	
	Trend	Constant	Trend	Constant
Modified Phillips–Perron t	6.29***	5.6898	3.40***	2.82***
Phillips–Perron t	-3.33***	-1.60**	-4.77***	-4.05***
Augmented Dickey–Fuller t	-4.99***	-3.67***	-4.95***	-4.44***

4.3.4 Slope Homogeneity test

The results of slope homogeneity tests rejected the null hypothesis of homogeneity, indicating notable heterogeneity in the short-run dynamics (see table-9). The result furthermore, supports the PMG estimator, which allows for disparity in the short-run dynamics while imposing homogeneous coefficient in the

long-run in both panels.

Table: -9 Slope homogeneity test

Slope homogeneity test	Coastal Africa		Landlocked Africa	
	Δ statistics	P-Value	Δ statistics	P-Value
Δ	2.58	0.010	-1.33	0.184
Δ_adj	3.65	0.000	-1.88	0.060
ΔHCA	4.88	0.000	-2.02	0.043
ΔHCAadj	6.89	0.000	-2.86	0.004

4.3.5 Panel ARDL (PMG) Estimation result

The preceding diagnostic tests indicated the existence of cross-sectional dependence among the cross-sectional units, mixed order of variables integration, long-run cointegrating relationship among the variables and slope heterogeneity confirming the validity the use of robust PMG/panel ARDL approach. Further, to ensure robustness outlier export values (for Egypt and south Africa value in 2023 and for Sudan during 2007 to 2010), where the export value exceeding $100 billion replaced using mean imputation technique.

The results of the PMG estimation indicate the importance of geography in mediating the growth-export relationship, the result of the PMG model is presented in table 10 below. Furthermore, the differential impact of the logistic performance and infrastructure development further highlights the estimation of isolated modeling, showing structurally different growth pathways for both landlocked and coastal context.

Table: -10 Pool mean group Estimation Results

Independent variables	Coastal Africa	Landlocked Africa
	Dependent Variable	
Δln_RGDP	**Δln_RGDP**	
Results of the short-run dynamics and the error correction model (ECM)		
Δln_Export	0.15***	0.14***
ΔLPI	-0.01	-0.15
Δln_EXCH	-0.02	0.01
ΔIFDI	-0.01	0.00
ΔPS	0.02	0.04*
C	2.06*	3.96***
ECT	-0.12*	-0.23***
Results for long run Pooled Mean Group (PMG) Estimations.		
Δln_Export	0.37***	0.26***
ΔLPI	0.07***	-0.04
Δln_EXCH	-0.53***	0.08
ΔIFDI	0.01***	0.06***
ΔPS	0.05***	0.09***

4.3.6 Panel Granger causality test result

The results of the Granger causality test further indicate the geographical disparity in the direction of causation between growth and export (see table-11). The result revealed a unidirectional causality running from economic growth to export expansion in coastal African countries, while a bidirectional causality in landlocked counterparts.

Table: -11 Panel Granger Causality Test results

Variable	Coastal Africa	Landlocked Africa
	Coefficient	Coefficient
ln_Export → ln_RGDP	-0.01	-0.06**
ln_RGDP → ln_Export	0.32***	0.270***

4.4 Discussions of the findings

The result of the error correction term (ECT), along with both Kao and Pedroni cointegration tests, show a long-run stable equilibrium relationship among export, real GDP, infrastructure development, exchange rate, logistic performance and political stability and absence of violence in both geographical contexts. (Adelakun et al., 2025; African Export-Import Bank, 2025)

Further the PMG results in table 10 revealed different short and long-run relationships between the variables across landlocked and coastal African countries. the negative and significant error correction term in both landlocked and coastal countries indicates convergence to the long-run equilibrium after a short-run deviations. Despite of this, landlocked countries adjust 23% of the deviation in the first period, while coastal countries only 12% of the deviation, highlighting that landlocked economies correct disequilibrium rapidly, this is likely due to their sensitivity to trade shocks and foreign exchange (Kedir A., 2023) that is vital in achieving both agenda 2063 and SDGs 2030.

The result of the PMG model indicates that export has a strong long-run impact in coastal countries compared to their landlocked counterparts, a 1% rise in export performance boosts economic growth by 0.37%, while its impact in landlocked African countries is only 0.26% creating 0.11% growth disparity in the long-run. However, a similar expansion in export will boost growth by 0.15% in coastal and 0.14% in landlocked African countries, creating 0.1% growth disparity in the short-run. The findings of the study align with the findings of (Çalışkan, 2026; Sein & Sah, 2025). The differential impact of export in both short and long-run between landlocked and coastal countries highlight that the theoretical benefits of export are significantly constrained for landlocked countries due to logistics weakness, transportation costs and transit dependence in neighbor countries, as revealed in studies (UNCTAD, 2025; Verschuur et al., 2022).

Further, the PMG result revealed a 1-unit improvement in logistic performance improve 0.07% in economic growth in coastal African countries in the long-run, while its impact is insignificant in landlocked counterparts. The result suggests that for landlocked countries, improvement in logistic performance may not fully compensate for external transit bottlenecks, limiting the growth payoff from export expansion, the findings are similar to (Ferrari et al., 2023)

Moreover, the result of PMG shows, a 1% depreciation of exchange rate will result in a 0.53% contraction in growth, suggesting that import dependent coastal economies suffer from sustained currency depreciation. While, the insignificant short-run negative coefficient in landlocked African economies underscores a painful short-run adjustment costs of devaluation. Both findings of the study are similar with the findings of (Sein & Sah, 2025).

Similarly, the result show positive impact of infrastructure on growth in both group of panels; a 1-unint improvement in infrastructure development improves 0.01% in coastal countries and 0.06% in landlocked counterparts in the long-run. These findings are similar with, (Kamguia et al., 2023)findings in their studies.

With regard to political stability the result revealed a positive long-run growth impact of stability, specifically, a 1-unit improvement in political condition will improve 0.09% of growth in landlocked countries, while its effect is relatively weak in coastal countries 0.05%. The result underscores the critical role of political stability in mitigating the additional risks posed by landlocked countries (Ferrari et al., 2023).

Further the Granger causality results in table 11 revealed a geographical divergence in the short-run direction of causality. The result indicates a unidirectional economic growth-led export causal relationship for coastal countries, highlighting economic growth drives export expansion. The result aligns with the result of (Athiyyah Nursyifa Tisnandar et al., 2025), reflecting the capacity of more integrated market to leverage growth for enhanced competitiveness. Whereas, landlocked countries exhibit a bidirectional causal relationship between export and economic growth. The result underscores both growth-led export promotion and export-led growth enhancement under constrained geographical condition, which is similar with recent studies by (Emek, 2024; Ouassaf et al., 2023) Both causality results underscore the ineffectiveness of a one-size-fits- all policy.

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The purpose of this study was to investigate the differential growth impact of export performance between landlocked and coastal African countries during 2007 to 2023. The PMG result empirically validates the basic hypothesis that geography fundamentally mediate the relationship between economic growth and export in Africa.

The result revealed a significant long-run relationship among economic growth, export, logistic performance, infrastructure development, official exchange rate and political stability in both coastal and landlocked African countries. Despite of positive impact of export in both panels, the elasticity is weaker for landlocked economies (0.26%) than the coastal counterparts (0.37%) in the long-run. Further, conditioning factors, particularly logistic performance, infrastructure development and political stability have differential long-run impact on growth in both geographical contexts. With political stability and infrastructure development both positively impact economic growth in both landlocked and coastal countries, they are especially critical for landlocked economies. However, logistic performance exerts a positive long-run impact on coastal economies, which underscore the fundamental importance of logistic performance improvement for economic growth in coastal countries.

The findings of the study challenge the universality of the export-led growth hypothesis by demonstrating that it is not absolute rather is structurally conditioned by infrastructure development, logistic reality and geography. The difference in causality further suggests that the underlying economic growth model basically differs, coastal countries can leverage domestic growth to enhance competitiveness of export, while landlocked countries are less efficient in converting export to economic growth. This highlights the need for geographically conditioned theoretical framework that integrates foreign exchange constraints, logistic and infrastructure bottlenecks and transit costs as core variables, rather than generalized prescription.

The results tell policymakers that a one-size-fits-all approach to economic growth and trade strategy is not only inefficient but also possibly unfair. Recognizing and actively addressing these geographic discrepancies through focused regional infrastructure investment, simplified transit agreements and distinct national growth policy frameworks is necessary for the simultaneous achievements of national development goal, agenda 2063 and SDGs 2030.

5.2 Policy implication

Policymakers in landlocked economies explicitly emphasis in securing regional transit agreements; work with transit neighbors to proactively develop and enforce legally binding regional agreements that will streamline customs procedures, reduce border delays and remove non-tariff barriers with transit neighbors.

While, in coastal countries shall focus on moving beyond the traditional comparative advantage to strength domestic economic growth to drive export. Policies shall foster linkage between coastline centric logistic hubs and domestic production sector to enhance efficiency of trade translates into broad productivity growth. moreover, policymakers in coastal countries shall focus on sustained exchange rate regime to harness export-led growth expansion.

Regardless of geographical context, both shall invest in infrastructure for digital trade; reduce physical inefficiencies by prioritizing digital trade facilitation such as the use of electronic freight tracking and single-window systems. Further shall prioritize investment in infrastructures, such as energy grids, roads and water that add value to local resources and improve the competitiveness of domestic productivity. Furthermore, policymakers focus to leverage political stability to gain better export expansion.

Strategize export diversification to high-value sectors; such as processed goods especially agricultural products and digitally deliverable services which are less sensitive for geographical constraints.

In order to break the cycle of dependency and unlock sustainable export-led growth path, Sub-regional, continental and international development partners shall acknowledge this geographic constraint by providing concessional finance and support towards these transformative internal capacity projects rather than just funding transit corridor efficiency. Provide technical assistance and dedicated fund to offset the geographical disadvantages faced landlocked countries.

5.3 Future research focus

This study used aggregate export data, limiting the analysis; in order to determine if particular industries provide landlocked countries with a feasible route to greater growth impact of export, therefore, future research shall disaggregate export by industry type and technological use. Further, expanding the analysis to a global sample of landlocked countries would improve the generalizability of the findings.

Declarations

Data Availability Statement

The data that support the findings of this study will be made available upon request

Conflict of interest

We disclose no competing interest could have an impact on the work that will be published.

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Declaration statements

The authors confirm that this manuscript is their original work, that all sources are correctly referenced and the data will be made available upon request.

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