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# The Impact of Agricultural Exports on Economic Growth: New Evidence from Low Income Countries

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**Abstract:**

This study rigorously investigates the effect of agricultural exports on economic growth across 12 low-income countries—Burkina Faso, Burundi, Central African Republic, Ethiopia, Gambia, Madagascar, Mali, Niger, Rwanda, Sudan, Togo, and Uganda—during the period from 2004 to 2023. Employing an advanced gravity model with both fixed and random effects, the analysis aims to discern the nuanced impact of agricultural exports on economic growth. The model is designed to account for various control variables, including capital, labor, other exports, and imports, to ensure a precise measurement of the agricultural export variable's influence. By integrating these controls, the study seeks to provide a comprehensive understanding of how agricultural exports contribute to economic development in these countries, highlighting both direct and indirect effects within the broader economic context.

**Keywords:** Agricultural Exports, Economic Growth, Static Gravity Model, Low-Income-Countries.

**JEL classification:** F11, F14, O47, O52, Q17, Q18

## 1. Introduction

Agriculture has long been recognized as a critical sector for economic development, particularly in low-income countries where a significant portion of the population relies on it for livelihood and sustenance. The relationship between agricultural exports and economic growth is a topic of profound importance in economic literature, given that agricultural exports can serve as a vital engine for growth, poverty reduction, and overall economic transformation. Numerous studies have highlighted that increasing agricultural exports can stimulate economic growth by providing foreign exchange earnings, creating jobs, and improving food security (Johnston and Mellor, 1961; Timmer, 1988; Diao et al., 2010; Rapsomanikis, 2015).

This study seeks to delve into this relationship by focusing on a sample of 12 low-income countries: Burkina Faso, Burundi, Central African Republic, Ethiopia, Gambia, Madagascar, Mali, Niger, Rwanda, Sudan, Togo, and Uganda. The selection of these countries is motivated by their shared characteristics of economic vulnerability, dependence on agriculture, and the pressing need for sustainable economic growth strategies. These countries also face similar challenges such as political instability, inadequate infrastructure, and climatic shocks, making the understanding of the impact of agricultural exports on their economic growth even more crucial (FAO, 2017; World Bank, 2020). By exploring this dynamic, this study hopes to provide valuable insights for the formulation of policies aimed at strengthening the agricultural sector and promoting inclusive and sustainable economic growth in these countries (Schiff and Valdés, 1992; Thirtle et al., 2003).

The significance of agricultural exports cannot be overstated. Agricultural exports provide a source of foreign exchange earnings, which are crucial for financing imports, servicing debt, and stabilizing national currencies. Moreover, they can stimulate agricultural productivity and rural development by providing farmers with access to international markets and encouraging the adoption of improved farming techniques and technologies. Studies such as those by Balassa (1978) and Michaely (1977) have highlighted the role of exports in driving economic growth, particularly in developing countries. These works suggest that export expansion leads to increased production efficiency, economies of scale, and enhanced competitiveness, all of which are vital for economic advancement.

In the context of the selected countries, the importance of agricultural exports is even more pronounced. These nations often face challenges such as limited industrial capacity, high levels

of poverty, and fragile economic structures. For instance, in Burkina Faso and Mali, cotton is a major export commodity, contributing significantly to their GDP and providing employment for a large portion of the population (Baffes, 2009). Similarly, Ethiopia and Uganda rely heavily on coffee exports, which have historically been a critical driver of their economic activities and foreign exchange earnings (Nega and Koffie-Bikoe, 2015). The reliance on a narrow range of export commodities underscores the vulnerability of these economies to global market fluctuations and climatic changes, making the diversification and strengthening of agricultural exports imperative.

Despite the acknowledged importance of agricultural exports, the precise nature of their impact on economic growth remains a subject of ongoing debate and research. The problematic of this study centers on understanding how agricultural exports influence economic growth in low-income countries, considering the unique economic, social, and institutional contexts of each country. Previous studies have produced mixed results, with some suggesting a strong positive relationship (Tyler, 1981; Dawson, 2005) and others indicating a more nuanced or even negative impact depending on factors such as export concentration and terms of trade (Herzer, 2012). This study aims to contribute to this discourse by employing a detailed and methodologically rigorous approach to analyze the impact of agricultural exports on economic growth in the selected countries.

This research will employ a combination of econometric techniques and case study analyses to explore the dynamics between agricultural exports and economic growth. By focusing on a diverse sample of low-income countries, the study will provide insights into the commonalities and differences in how agricultural exports affect economic growth across different contexts. This will not only enhance our understanding of the general relationship between agricultural exports and economic growth but also provide policy-relevant insights tailored to the specific needs and circumstances of each country.

The contribution of this study to the existing literature is multifaceted. Firstly, it provides empirical evidence on the impact of agricultural exports on economic growth in low-income countries, a topic that has received relatively less attention compared to middle- and high-income countries. Secondly, by employing a rigorous methodological approach, including the use of advanced econometric techniques and robustness checks, this study addresses some of the limitations and inconsistencies found in previous research. Thirdly, the study's focus on a diverse sample of countries allows for a comparative analysis that can identify patterns and

lessons applicable to other low-income countries with similar characteristics.

This study is poised to make a significant contribution to the understanding of the relationship between agricultural exports and economic growth in low-income countries. By focusing on a carefully selected sample of countries, employing a robust methodological framework, and addressing a critical gap in the literature, this research aims to provide valuable insights for policymakers, scholars, and practitioners interested in promoting sustainable economic development through agricultural exports.

## 2. Literature Survey

The relationship between exports and economic growth has long been a focal point in economic literature, as it underscores the significant impact of international trade on economic development. Exports, as a critical component of open economies, play a fundamental role in boosting economic growth by providing access to new markets, generating employment, and fostering innovation. Specifically, agricultural exports, often a cornerstone for developing economies, warrant particular attention due to their importance in diversification strategies and food security. This section of the literature survey delves into these two dimensions: first, the general link between exports and economic growth, and second, the specific relationship between agricultural exports and economic growth. By examining relevant studies and research, we aim to understand how these different types of exports influence economic dynamics and identify the mechanisms through which these effects are realized.

### 2.1.Exports and economic growth

The relationship between exports and economic growth has been a focal point of economic research for decades, reflecting its critical importance in shaping national economic policies. Numerous studies have sought to elucidate the dynamics between trade and growth, examining various factors such as foreign direct investment (FDI), trade openness, government spending, inflation, and technological advancements. This section delves into empirical analyses from diverse regions, including Central Kalimantan, BRICS nations, emerging markets, and several African countries, to explore how exports and related economic variables influence growth. By leveraging methodologies such as Multiple Linear Regression, the Auto-Regressive Distributed Lag (ARDL) model, Johansen cointegration, and Granger causality tests, these studies provide comprehensive insights into the complex interplay between exports and economic growth.

Sabirin et al (2021) analyze the impact of exports, government spending, and inflation on economic growth in Central Kalimantan from 2010 to 2019 using Multiple Linear Regression. The results indicate that exports and government expenditure have a negative and insignificant effect on economic growth, while inflation has a positive and significant effect. Collectively, these factors do not significantly impact economic growth, suggesting the need for more effective economic policies in the region. Banday et al (2021) examine the causal relationship between foreign direct investment (FDI), trade openness, and economic growth in BRICS countries from 1990 to 2018 using an auto-regressive distributed lag model and Dumitrescu and Hurlin Granger causality tests. The findings reveal that FDI and trade openness positively impact long-term economic growth. There is bidirectional causality between FDI and economic growth and unidirectional causality from trade openness to FDI, underscoring the importance of these factors in the economic development of BRICS nations. Raghutla (2020) investigates the impact of trade openness on economic growth in five emerging market economies from 1993 to 2016 using panel estimation methods. The study confirms a long-term relationship among trade openness, economic growth, financial development, inflation, labor force, and technology. Trade openness has a considerable positive impact on economic growth, with bidirectional causality between economic growth and inflation and unidirectional causality from economic growth to trade openness and financial development in the short term. Udeagha and Ngepah (2021) use a nonlinear autoregressive distributed lag (NARDL) approach to re-examine the relationship between trade openness and economic growth in South Africa from 1960 to 2016. The study, employing a novel proxy for trade openness, finds short- and long-term asymmetric effects of trade openness on economic growth. These findings highlight the complex and varied impact of trade openness on economic growth, suggesting important policy implications for South Africa. Kong et al (2021) analyze the relationship between trade openness and economic growth quality in China from 1994 to 2018 using an ARDL model. The results show a long-term stable co-integration relationship between trade openness and economic growth quality, with trade openness significantly promoting economic growth quality in both the short and long term. Regional heterogeneity and non-linear threshold characteristics are evident, indicating that trade openness's impact varies across different regions. Raghutla and Chittedi (2020) explore the export- or import-led growth hypothesis in BRICS countries from 1979 to 2018 using Johansen cointegration methodology and Granger causality tests. The study finds that the growth-led exports (GLE) hypothesis is relevant for India, South Africa, and China, while the exports-led growth (ELG) hypothesis is relevant for Brazil and Russia. Similarly, the growth-led imports (GLI) hypothesis is applicable to Brazil, India, China, and

South Africa, while the import-led growth (ILG) hypothesis applies to Russia. The findings confirm the trade-led growth hypothesis and highlight the significant role of domestic and global demand in fostering economic growth in these countries.

Ben Yedder et al (2023a) investigate the impact of domestic investment and trade on economic growth in North African countries from 1990 to 2021 using the Panel CS-ARDL model. Their findings indicate that neither domestic investment nor exports significantly affect economic growth in the long run, while imports have a positive long-term impact. These results suggest that the North African region's economic organization and political instability may hinder the potential benefits of exports and domestic investments on growth. Akermi et al (2024) analyze the impact of final consumption, domestic investment, exports, and imports on economic growth in Albania from 1996 to 2021 using cointegration analysis, the VECM model, and the WALD test. The study concludes that there is no causality relationship between these variables and economic growth in both the long run and short run. This critical economic situation calls for urgent economic reforms and robust strategies to stimulate growth in Albania. Bakari et al (2020) examine the contribution of domestic investment, exports, and imports to economic growth in Peru using data from 1970 to 2017. Their analysis, based on Johansen cointegration and the vector error correction model, reveals that these variables do not significantly impact economic growth in either the short run or long run. The findings indicate that trade openness and domestic investments are not effectively driving growth in Peru due to underlying economic challenges and inefficient organization. Bakari (2022a) explores the impact of natural resources, CO2 emissions, energy use, domestic investment, innovation, trade, and digitalization on economic growth in 52 African countries from 1996 to 2021. Using various econometric models, the study finds that domestic investment, exports, natural resources, and final consumption expenditure positively influence economic growth. However, labor force, imports, and energy use negatively affect growth. The study recommends policies to promote domestic investment and exports while managing the negative impacts of imports and energy consumption.

Bakari (2022b) investigates the relationship between domestic investment, exports, and economic growth in Greece from 1970 to 2020 using the Vector Error Correction Model. The results indicate no long-term causality between these variables and economic growth, with only exports causing domestic investment in the short run. This suggests that neither domestic investment nor exports are significant sources of economic growth in Greece, reflecting the country's economic challenges. Bakari and Saaidia (2017) assess the impact of commerce on

economic growth in Italy using annual data from 1985 to 2015. The empirical analysis, employing the ADF stationary test, cointegration analysis, and Granger-causality tests, finds no significant effect of exports and imports on economic growth. However, a positive correlation between trade and economic growth suggests that Italy's economic strategy needs to be more effective in solving economic problems. Bakari (2019) analyzes the relationship between economic growth, exports, and imports in Morocco using VAR modeling techniques and Granger causality. The study shows that economic growth drives exports, but there is no reverse effect. Additionally, imports do not significantly impact economic growth, indicating a unidirectional relationship where growth favors exports.

Bakari et al (2019) examine the influence of trade on economic growth in China using data from 1960 to 2015. The analysis, employing various econometric tests, reveals a positive effect of exports on economic growth, while imports negatively impact growth. These findings underscore the role of exports as a significant driver of economic growth in China. Bakari (2021) revisits the relationship between exports and economic growth in African countries using innovative econometric methods. The study, covering 49 African countries from 1960 to 2018, finds a positive bidirectional relationship between exports and economic growth. These results highlight the importance of exports in driving economic growth across the African continent. Bakari (2017a) investigates the nexus between trade and economic growth in Germany using data from 1985 to 2015. The analysis, incorporating unit root tests, cointegration analysis, and Granger-causality tests, finds no long-term relationship between exports, imports, and economic growth. However, there is bidirectional causality from imports to growth and a unidirectional causality from exports to growth, indicating the importance of trade in Germany's economic development. In a study examining North African countries, Ben Yedder et al (2023b) utilized a Panel CS-ARDL model to analyze data from 1990 to 2021. They found that exports and domestic investments did not significantly impact economic growth in the long run, suggesting that these countries suffer from poor economic organization and political instability. Similarly, Akermi et al (2024) investigated the impact of exports on economic growth in Albania between 1996 and 2021. Using cointegration analysis, VECM, and the WALD test, they found no causal relationship between exports and economic growth in both the short and long run. These findings indicate the need for urgent economic reforms in Albania to boost growth. Bakari et al (2020) conducted a study on Peru from 1970 to 2017 using Johansen co-integration analysis and a vector error correction model. They found that exports did not influence economic growth in either the short or long run, highlighting issues in trade

openness and economic organization in Peru. Bakari and Saaidia (2017) explored the relationship between trade and economic growth in Italy from 1985 to 2015. Their findings showed no effect of exports on growth, though there was a positive correlation between trade and growth, indicating inefficacious economic strategies. In Morocco, Bakari (2019) used VAR modeling and Granger causality tests to show that economic growth led to increased exports, but not vice versa. This suggests that economic growth supports export activities, but exports do not necessarily drive growth. Bakari et al (2019) examined China's trade and growth relationship from 1960 to 2015. Their results indicated a positive long-term impact of exports on growth, contrasting with imports, which had a negative effect. This underscores the importance of exports in China's economic performance. Bakari (2021) analyzed 49 African countries using innovative econometric methods and found a bidirectional positive relationship between exports and economic growth, emphasizing the importance of trade policies in fostering growth.

In Canada, Bakari (2016a) found strong bidirectional causality between exports and economic growth, indicating that trade activities were crucial for economic performance. Bakari and Mabrouki (2016) studied Turkey from 1960 to 2015, revealing no long-term relationship between exports and growth but a significant short-term bidirectional causality, emphasizing the need for effective trade policies. Fakraoui and Bakari (2019) analyzed India's data from 1960 to 2017, showing that only exports caused economic growth in the short run, indicating challenges in leveraging domestic investment for long-term growth. Bakari et al (2022) investigated the impact of digitalization and trade openness on economic growth in the top ten richest Asian countries. Using a Static Gravity Model and a Generalized Method of Moments Model, they found that both digitalization and trade openness significantly and positively affect economic growth. These results highlight the crucial role of these factors in driving economic performance in these countries due to the positive externalities like technology transfer, financial capacities, and large market sizes. Bakari and Mabrouki (2016) examined the nexus between exports, imports, and economic growth in Turkey with data from 1960 to 2015. The study used Johansen co-integration analysis and Granger-Causality tests, finding no direct relationship between the variables but strong evidence of bidirectional causality from imports to economic growth and from exports to economic growth.

Fakraoui and Bakari (2019) investigated the relationship between domestic investment, exports, and economic growth in India from 1960 to 2017. Using cointegration analysis and a vector error correction model, they found no long-term relationship among the variables. However,

exports were found to cause economic growth in the short term, indicating that while domestic investment and exports are not long-term growth drivers, exports have a short-term impact. Bakari (2017b) studied the relationship between exports, imports, domestic investment, and economic growth in Japan from 1970 to 2015. The results showed positive correlations among all variables. Regression analysis revealed that domestic investment and exports significantly explained economic growth, while imports had no effect on GDP, indicating that exports and domestic investment are key growth drivers. Bakari et al (2018a) analyzed the linkages between various economic variables in Nigeria from 1981 to 2015. Using a vector error correction model, they found no long-term relationships but identified short-term causal relationships among the variables, suggesting the need for urgent economic reforms to boost growth. Bakari (2017c) explored the relationships among exports, imports, and economic growth in Tunisia from 1965 to 2016. The study found that in the long run, exports negatively impacted economic growth while imports had a positive effect. In the short run, there were bi-directional causal relationships between exports and economic growth, and uni-directional causal relationships from exports to imports and from imports to economic growth. Bakari (2017d) investigated the relationship between domestic investment, exports, imports, and economic growth in Sudan from 1976 to 2015. The study found long-term relationships among the variables but no significant short-term effects, indicating the need for better economic strategies to boost growth. Bakari (2017e) studied the impact of exports on economic growth in Gabon using data from 1980 to 2015. The results showed that in the long run, investment and exports negatively impacted economic growth, while in the short run, they positively contributed to growth, suggesting the need for better management of exports and investment to sustain long-term growth. Bakari (2017f) examined the relationship between exports, imports, domestic investment, and economic growth in Egypt from 1965 to 2015. The study found that in the long run, domestic investment and exports negatively impacted growth, while imports had a positive effect. In the short run, only imports were found to cause economic growth, highlighting the critical situation in Egypt requiring urgent reforms. Bakari and Mabrouki (2017a) investigated the relationship between exports, imports, and economic growth in Panama from 1980 to 2015. The study found no direct relationship among the variables but strong evidence of bidirectional causality from imports to economic growth and from exports to economic growth, indicating the importance of both imports and exports as growth drivers.

The extensive body of literature on the impact of exports on economic growth presents a nuanced picture that varies significantly across regions and contexts. While some studies

highlight the positive influence of exports on long-term economic growth, others point to insignificant or even negative effects, often attributed to underlying economic structures and policy inefficiencies. The evidence from BRICS nations and emerging markets underscores the importance of FDI and trade openness as key drivers of economic development, whereas findings from North African and other countries indicate the need for robust economic reforms to fully leverage the benefits of exports. These diverse outcomes suggest that while exports can be a catalyst for growth, their effectiveness is contingent upon a country's specific economic conditions, policy frameworks, and the interplay of various macroeconomic factors. This calls for tailored economic strategies that address unique national challenges and harness the potential of trade to foster sustainable growth.

### 2.2.Agricultural exports and economic growth

The relationship between agricultural exports and economic growth has been a focal point of economic research, especially for developing and emerging economies. Numerous studies have explored how agricultural exports can influence economic development, offering varying conclusions based on regional contexts, types of agricultural products, and methodological approaches. This literature review synthesizes findings from a selection of empirical studies, highlighting the diverse impacts of agricultural exports on economic growth across different countries, including India, Ethiopia, Nigeria, China, Tunisia, North Africa, South-Eastern Europe, Pakistan, and the ECOWAS region. By examining these studies, we aim to understand the complex dynamics between agricultural exports and economic growth, providing insights for policymakers to enhance economic development through targeted export strategies.

Kumari et al. (2022) explored the relationship between agricultural exports and economic growth in India. Using various cointegration tests to examine long-term relationships, the study found that agricultural exports significantly impact real GDP. However, non-agricultural exports did not show a significant effect. The bidirectional causality observed between agricultural exports and GDP suggests that policymakers in India can leverage agricultural exports to stimulate economic growth. In Ethiopia, Gizaw et al. (2022) investigated the impact of coffee exports on economic growth. Their study utilized an extended Cobb-Douglas production function model and found that while coffee exports had an insignificant short-term impact, they significantly contributed to long-term economic growth. The study recommended enhancing the efficiency of the coffee sector and adding value to coffee beans before exporting to sustain domestic economic growth. Uremadu and Onyele (2016) focused on Nigeria,

analyzing the impact of selected agricultural exports on economic growth. Their findings revealed that while cocoa exports had a positive but insignificant impact on real GDP, rubber exports were negatively associated with economic growth. The study highlighted the positive influence of export commodity prices, exchange rates, and trade openness on economic growth. Recommendations included promoting value addition to agricultural exports and implementing favorable foreign exchange policies. Murugesan (2019) examined the influence of agricultural trade on economic growth in India. Using an Error Correction Model, the study confirmed a long-run relationship between agricultural exports and GDP. The findings indicated that both agricultural and non-agricultural exports directly affect real GDP, with a short-run unidirectional causality from exports to GDP. The study emphasized the need for policies to expand agricultural productivity and trade to foster economic growth. Mamba and Ali (2022) studied the effects of agricultural exports on economic growth in ECOWAS countries. Their analysis using an instrumental variables approach revealed that agricultural exports significantly enhance both agricultural and overall economic growth. The study found no complementarity between agricultural exports and agricultural growth on economic growth, underscoring the importance of agricultural exports in policy design for economic development in the ECOWAS region. Mlambo et al. (2019) focused on South Africa, investigating the contributions of processed and unprocessed agricultural exports to economic growth. Their findings showed that while processed agricultural exports positively influence economic growth, unprocessed exports have a negative impact. The study recommended stimulating investment in processed agricultural commodities to generate higher income and promote economic growth.

Henneberry and Khan (2014) analyzed the linkage between agricultural exports and economic growth in Pakistan. Using a simultaneous equations model, the study found a favorable relationship between agricultural exports and GDP growth. This highlights the potential of agricultural exports to contribute significantly to economic development, despite competition with the industrial sector for government support. Seok and Moon (2021) examined the export-led growth hypothesis in the agricultural sector of developed OECD countries. Their study indicated that agricultural exports positively affect agricultural growth, particularly in EU countries. This suggests that access to foreign markets is crucial for validating the export-led growth hypothesis in the agricultural sector of developed countries. Mahmood and Munir (2018) reassessed the relationship between agricultural exports and economic growth in Pakistan. Their study concluded that while agricultural exports have a positive but insignificant

association with GDP growth, the primary and raw material nature of these exports limits their competitiveness in international markets. The study recommended enhancing the quality and competitiveness of agricultural exports to achieve significant economic growth. Dawson (2005) examined the contribution of agricultural exports to economic growth in less developed countries (LDCs). Using panel data, the study found significant structural differences in economic growth between low, lower-middle, and upper-income LDCs. The results suggested that investment in both agricultural and non-agricultural export subsectors equally impacts economic growth, advocating for balanced export-promotion policies.

Faridi (2012) investigated the contribution of agricultural exports to economic growth in Pakistan. Using the Johansen co-integration technique for the period from 1972 to 2008, the study found that agricultural exports have a negative and significant effect on economic growth. The elasticity of agricultural exports was estimated to be 0.58. Additionally, there was bidirectional causality between agricultural exports and real GDP, suggesting a complex interaction between these variables. The study recommended promoting non-agricultural exports to enhance economic growth. Bakari and Tiba (2022) explored the relationship between agricultural trade and economic growth in China. Employing the ARDL bounds testing approach for the period from 1984 to 2017, the study revealed that in the long run, domestic investment and agricultural exports positively impacted economic growth, while agricultural imports had a significant negative effect. In the short run, both agricultural imports and exports, along with domestic investment, positively and significantly influenced economic growth. The study highlighted the role of agricultural exports in creating jobs and opportunities, thereby contributing to China's economic growth. Bakari (2016b) analyzed the impact of agricultural exports on economic growth in Tunisia from 1988 to 2014 using a neoclassical production function framework. The empirical results indicated that agricultural exports positively affected economic growth, with a causal relationship running from economic growth to agricultural exports. The findings suggested that policies promoting investment in the agricultural sector would be beneficial for Tunisia's economic development. Bakari (2018a) examined the impact of citrus exports on economic growth in Tunisia for the period from 1970 to 2016. Using co-integration analysis and an error correction model, the study found that citrus exports did not influence economic growth in the long term. However, there was a positive unidirectional causality from citrus exports to economic growth in the short run. The study recommended reforms and robust strategies to enhance investment and trade in the citrus sector to support economic growth. Bakari (2017g) investigated the influence of olive oil exports on Tunisia's

economic growth using data from 1970 to 2016. The study employed co-integration analysis and an error correction model, finding that olive oil exports positively impacted economic growth both in the long term and short term. These results suggested that olive oil exports are a significant source of economic growth, emphasizing the need for policies to encourage better exploitation and export of olive oil. Bakari (2017h) also studied the impact of vegetable exports on economic growth in Tunisia using data from 1970 to 2015. Employing correlation analysis, the Augmented Dickey-Fuller (ADF) test, the Phillip-Perron (PP) test, and co-integration analysis with a vector error correction model, the study concluded that vegetable exports positively impacted economic growth in both the long run and short run. This evidence underscored the importance of refining investment strategies in the vegetable export sector. Bakari and Mabrouki (2018a) analyzed the impact of agricultural trade on economic growth in North African countries using data from 1982 to 2016. The study used correlation analysis and a static gravity model, revealing a positive correlation between agricultural trade and GDP. However, the correlation between agricultural exports and GDP was weak. The static gravity model showed that agricultural exports positively affected economic growth, while agricultural imports had no significant effect. The findings emphasized the importance of refining agricultural investment and creating dynamic agricultural trade policies. Bakari and Mabrouki (2017b) examined the effect of agricultural exports on economic growth in South-Eastern European countries from 2006 to 2016. Using correlation analysis and a static gravity model, the study found a strong positive correlation between agricultural exports and GDP. The results indicated that agricultural exports significantly contributed to economic growth, suggesting the need for effective agricultural trade policies and investment strategies.

The empirical studies reviewed offer a nuanced understanding of the impact of agricultural exports on economic growth across various regions and contexts. While some studies, such as those on China and Tunisia, highlight a positive relationship between agricultural exports and economic growth, others, like the study on Pakistan, reveal negative effects. The complexity of these relationships is further underscored by findings of bidirectional causality and the differing impacts of processed versus unprocessed exports. The recurring theme across these studies is the significant potential of agricultural exports to contribute to economic growth, provided there are supportive policies and investments.

## 3. Data and methodology

This study aims to uncover the impact of agricultural exports on economic growth by employing

a detailed and methodologically rigorous approach. The analysis focuses on a sample of 12 low-income countries: Burkina Faso, Burundi, Central African Republic, Ethiopia, Gambia, Madagascar, Mali, Niger, Rwanda, Sudan, Togo, and Uganda. These nations, representative of economies with similar developmental constraints and agricultural dependencies, offer a comprehensive view of the dynamics at play. The period under examination spans from 2004 to 2023, providing a substantial timeframe to capture both immediate and enduring effects of agricultural exports on economic growth.

The study utilizes several key variables to understand their interplay and influence. Economic growth (Y) is measured using Gross Domestic Product (GDP) at constant prices, reflecting real output and growth trends. Capital (K) is represented by Gross Fixed Capital Formation at constant prices, which indicates investment levels in physical assets crucial for production. Labor (L) is quantified by the total labor force, highlighting the available workforce contributing to economic activities. Agricultural exports (AX) are assessed through the total value of agricultural exports at constant prices, illustrating the revenue generated from selling agricultural products internationally. Other exports (OX), encompassing non-agricultural exports, and imports (M), indicating total expenditure on foreign goods and services, are also considered to provide a comprehensive view of trade dynamics.

Data for these variables are sourced from the annual reports of the World Bank, ensuring that the information used is both reliable and consistent. The methodological framework for this analysis is built upon a gravity model, which is instrumental in understanding trade and economic interactions {See: Bakari et al (2018b), Bakari et al (2018c), Bakari (2018b), Bakari and El Weriemmi (2022), Ekanayake et al (2010), Mwangi et al (2020), Gervais (2015), Didia et al (2015)}. The base model is specified as follows:

$$Ln(Y_{it}) = \beta_0 + \beta_1 Ln(K_{it}) + \beta_2 Ln(L_{it}) + \beta_3 Ln(AX_{it}) + \beta_4 Ln(OX_{it}) + \beta_5 Ln(M_{it}) + \varepsilon_{it}$$

In this model, the natural logarithms of the variables are used to stabilize variances and interpret the coefficients as elasticities. The analysis proceeds in three distinct phases. The first phase involves estimating the model using fixed effects, which controls for country-specific characteristics that remain constant over time and may affect economic growth. This approach helps isolate the impact of agricultural exports from other time-invariant factors. The second phase applies a random effects model, which assumes that the individual-specific effects are not correlated with the regressors and vary across countries. This model helps assess the

influence of agricultural exports while accounting for random variations between countries. The third and final phase employs the Hausman test to determine the most suitable model for the data. If the p-value from the Hausman test is less than 5%, the fixed effects model is preferred, indicating a correlation between individual-specific effects and the regressors. Conversely, if the p-value is greater than 5%, the random effects model is deemed appropriate, suggesting no significant correlation between individual-specific effects and the regressors. This rigorous approach ensures the accuracy and reliability of the findings, providing a clear understanding of how agricultural exports impact economic growth across the selected low-income countries.

## 4. Empirical results

Table 1 provides an extensive overview of the descriptive statistics for the variables analyzed in this study: economic growth (Y), capital (K), labor (L), agricultural exports (AX), other exports (OX), and imports (M). The table includes key statistical measures such as mean, median, maximum, minimum, standard deviation, skewness, kurtosis, Jarque-Bera statistic, and associated probability. The mean values for each variable offer insights into the average levels observed across the 12 low-income countries over the study period. The average GDP (Y) stands at approximately 17.3 billion USD, which reflects substantial economic activity among the countries analyzed. However, the median GDP is significantly lower at around 9.66 billion USD, suggesting that while some countries have extremely high GDP figures, many others have considerably lower GDPs. This discrepancy between mean and median values is indicative of a right-skewed distribution, where a few countries with very high GDPs are skewing the average upwards.

Similarly, the mean value for capital investment (K) is about 4.08 billion USD, with a median value of 2.06 billion USD, showing that capital investment is also unevenly distributed. The high mean value relative to the median implies that a small number of countries have exceptionally high levels of capital investment. The mean agricultural exports (AX) amount to approximately 1.11 billion USD, with a median of 313 million USD, further reinforcing the idea that agricultural exports are heavily concentrated in a few countries. The maximum and minimum values indicate the range of data for each variable. For instance, the maximum GDP is a staggering 113 billion USD, while the minimum is just over 1 billion USD. This wide range underscores the vast economic disparities among the countries studied. Similarly, the maximum value for agricultural exports is 9.04 billion USD, while the minimum is around 127 thousand USD, highlighting significant variability in agricultural export performance.

**Table n°1: Descriptives Statistics**

| | Y | K | L | AX | OX | M |
|---|---|---|---|---|---|---|
| **Mean** | 1.73E+10 | 4.08E+09 | 9663638. | 1.11E+09 | 4.45E+09 | 5.92E+09 |
| **Median** | 9.66E+09 | 2.06E+09 | 6132059. | 3.13E+08 | 1.23E+09 | 2.85E+09 |
| **Maximum** | 1.13E+11 | 3.91E+10 | 61664369 | 9.04E+09 | 1.38E+11 | 7.32E+10 |
| **Minimum** | 1.09E+09 | 1.00E+08 | 514056.0 | 126694.6 | 8791061. | 1.75E+08 |
| **Std. Dev.** | 2.11E+10 | 6.64E+09 | 11978167 | 1.69E+09 | 1.83E+10 | 1.17E+10 |
| **Skewness** | 2.074163 | 3.441724 | 2.667415 | 2.058348 | 5.907045 | 4.607777 |
| **Kurtosis** | 7.387736 | 15.63834 | 9.807036 | 6.674809 | 37.22700 | 24.97648 |
| **Jarque-Bera** | 364.6083 | 2071.096 | 747.9616 | 304.5141 | 13110.60 | 5678.921 |
| **Probability** | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| **Sum** | 4.14E+12 | 9.78E+11 | 2.32E+09 | 2.67E+11 | 1.07E+12 | 1.42E+12 |
| **Sum Sq. Dev.** | 1.06E+23 | 1.05E+22 | 3.43E+16 | 6.83E+20 | 8.01E+22 | 3.28E+22 |
| **Observations** | 240 | 240 | 240 | 240 | 240 | 240 |

The standard deviation measures the extent of variability or dispersion from the mean. For GDP, the standard deviation is approximately 21.1 billion USD, indicating substantial differences in economic output among the countries. The high standard deviation for capital (6.64 billion USD) and imports (11.7 billion USD) also points to considerable variation in these variables, suggesting that there are significant differences in capital accumulation and import activities across the countries.

Skewness measures the asymmetry of the data distribution. The high skewness values for all variables, with agricultural exports (2.058) and imports (4.608) showing particularly high levels, indicate that the distributions are right-skewed. This means that the data have a long right tail, with a small number of countries exhibiting extremely high values. Kurtosis measures the ‘tailedness’ of the distribution. High kurtosis values for variables like imports (24.976) and other exports (37.227) suggest that these distributions have heavy tails and are more peaked compared to a normal distribution. This implies that extreme values are more prevalent than would be expected in a normal distribution.

The Jarque-Bera statistic tests whether the data follows a normal distribution. The high values of the Jarque-Bera statistic for all variables, combined with a p-value of 0.0000, indicate that the null hypothesis of normality is rejected for each variable. This confirms that the data are not normally distributed and exhibit significant skewness and kurtosis.

The sum values provide the aggregate total for each variable across all observations. For example, the total GDP across all countries and years is approximately 4.14 trillion USD. The sum of squared deviations, a measure of variability, further underscores the substantial differences in each variable. For instance, the sum of squared deviations for GDP reflecting high variability in economic output.

The dataset comprises 240 observations for each variable, suggesting a robust dataset with a comprehensive timeframe covering multiple years for each country. Table 1 reveals substantial variability and significant disparities in economic indicators among the low-income countries analyzed. The data are characterized by right-skewed distributions and heavy tails, highlighting the presence of extreme values and suggesting that the average values are influenced by a small number of outlier countries. These characteristics underscore the complexity of economic dynamics in the studied countries and the importance of considering distributional properties when analyzing the impact of agricultural exports on economic growth.

Table 2 provides the results of the static gravity model with fixed effects, focusing on the relationship between various economic factors and economic growth, as measured by the natural logarithm of GDP 'LOG(Y)'. This model is designed to control for time-invariant characteristics of individual countries, allowing for a more accurate assessment of how changes in explanatory variables impact economic growth. The coefficient for capital 'LOG(K)' is 0.458, which is statistically significant at the 1% level, with a p-value of 0.0000. This result indicates a strong and positive relationship between capital and economic growth. Specifically, for every 1% increase in capital investment, economic growth increases by approximately 0.458%. The high level of statistical significance underscores the robustness of this relationship, confirming that capital investment is a crucial driver of economic growth. This finding supports the theoretical understanding that increased capital formation enhances productive capacity, fosters technological advancement, and ultimately stimulates economic expansion.

Labor 'LOG(L)' also demonstrates a significant positive effect on economic growth, with a coefficient of 0.200 and a p-value of 0.0000. This suggests that a 1% increase in the labor force corresponds to a 0.200% increase in economic growth. The significance of this coefficient reflects the important role of labor in driving economic activity. A growing and productive labor force contributes to higher levels of output, economic efficiency, and overall growth, aligning with the notion that labor is a fundamental input in the production process.

**Table 2: Estimation of the static gravity model with fixed effect**

| Dependent Variable: LOG(Y) | | | | |
|---|---|---|---|---|
| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
| C | 3.707676 | 0.346309 | 10.70625 | 0.0000 |
| LOG(K) | 0.458311 | 0.051947 | 8.822698 | 0.0000 |
| LOG(L) | 0.199806 | 0.036130 | 5.530171 | 0.0000 |
| LOG(AX) | 0.017072 | 0.011990 | 1.423858 | 0.1559 |
| LOG(OX) | 0.046862 | 0.027074 | 1.730872 | 0.0849 |
| LOG(M) | 0.233296 | 0.065257 | 3.575030 | 0.0004 |

In contrast, the coefficient for agricultural exports 'LOG(AX)' is 0.017 with a p-value of 0.1559, indicating that the impact of agricultural exports on economic growth is not statistically significant in this model. This result suggests that, within the scope of the fixed effects model, agricultural exports do not have a clear, robust effect on economic growth. This finding could imply that while agricultural exports are important, they may not be as influential on economic growth as other factors such as capital and labor, or that their impact might be mediated by other variables not included in the model. Other exports 'LOG(OX)' have a coefficient of 0.047 and a p-value of 0.0849, which is marginally significant at the 10% level. This indicates a potential but not definitive positive effect on economic growth. The marginal significance suggests that while there may be some positive impact of other exports on economic growth, the evidence is not strong enough to conclusively establish this relationship. This result highlights the complexity of the relationship between exports and growth, where the effects of different types of exports may vary and are influenced by other factors.

The coefficient for imports 'LOG(M)' is 0.233, with a p-value of 0.0004, demonstrating a significant and positive effect on economic growth. This implies that a 1% increase in imports is associated with a 0.233% increase in economic growth. The high statistical significance of this coefficient suggests that imports play a crucial role in driving economic growth. This can be attributed to the fact that imports often provide access to essential goods, technologies, and inputs that enhance domestic production capabilities and efficiency, thereby contributing to overall economic expansion. Overall, the results from Table 2 reveal that capital investment, labor, and imports are significant positive drivers of economic growth, while the effects of agricultural exports and other exports are less clear. These findings provide valuable insights into the factors influencing economic growth in the countries studied and underscore the importance of capital, labor, and imports in fostering economic development.

**Table 3: Estimation of the static gravity model with random effect**

| Dependent Variable: LOG(Y) | | | | |
|---|---|---|---|---|
| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
| C | 4.916132 | 0.836319 | 5.878300 | 0.0000 |
| LOG(K) | 0.360086 | 0.034653 | 10.39113 | 0.0000 |
| LOG(L) | 0.544990 | 0.062895 | 8.665085 | 0.0000 |
| LOG(AX) | 0.037625 | 0.015272 | 2.463659 | 0.0145 |
| LOG(OX) | 0.007332 | 0.020230 | 0.362452 | 0.7174 |
| LOG(M) | 0.045259 | 0.042227 | 1.071804 | 0.2850 |

Table 3 presents the results of the static gravity model with random effects, offering a different perspective from the fixed effects model by assuming that individual-specific effects are uncorrelated with the regressors. This model provides insights into how various factors influence economic growth under this different assumption.

The coefficient for capital 'LOG(K)' is 0.360, and it is highly significant with a p-value of 0.0000. This result indicates a strong positive relationship between capital investment and economic growth. Specifically, a 1% increase in capital leads to a 0.360% increase in economic growth. This finding underscores the essential role of capital in driving economic expansion. It confirms that, under the random effects model, capital investment continues to be a significant determinant of economic growth, highlighting its importance in boosting productive capacity and fostering economic development.

Labor 'LOG(L)' also shows a substantial effect in this model, with a coefficient of 0.545 and a p-value of 0.0000. This coefficient suggests that a 1% increase in the labor force results in a 0.545% increase in economic growth. The high statistical significance of this result points to the critical role of labor in economic growth. An increase in the labor force contributes significantly to economic activity by enhancing productivity and output, reinforcing the idea that a well-utilized and expanding labor force is vital for economic growth.

In contrast to the fixed effects model, the coefficient for agricultural exports 'LOG(AX)' in the random effects model is 0.038 and is statistically significant with a p-value of 0.0145. This result indicates that agricultural exports have a positive impact on economic growth under the random effects assumption. This finding contrasts with the fixed effects model, where agricultural exports were not statistically significant, suggesting that the relationship between agricultural exports and economic growth may be influenced by the specific assumptions of the

model. The positive effect observed in this model highlights the potential role of agricultural exports in contributing to economic growth, possibly through increased foreign exchange earnings and enhanced market access.

On the other hand, the coefficient for other exports 'LOG(OX)' is 0.007 with a p-value of 0.7174, indicating that other exports do not have a significant effect on economic growth in the random effects model. This result suggests that, under this model, other types of exports do not substantially impact economic growth, which might reflect differences in the nature or impact of these exports compared to agricultural exports.

The coefficient for imports 'LOG(M)' is 0.045 and is not statistically significant with a p-value of 0.2850. This finding implies that imports do not have a significant effect on economic growth according to the random effects model. Unlike the fixed effects model, where imports had a significant positive impact, the lack of significance in this model suggests that the effect of imports on economic growth might be less clear or influenced by different factors in the random effects context. Table 3 reveals that capital and labor continue to have significant positive effects on economic growth under the random effects model, while the impact of agricultural exports becomes significant, in contrast to the fixed effects model. However, other exports and imports do not show significant effects, indicating that their roles in economic growth might be more complex or variable depending on the model assumptions.

**Table 4: Results of the Hausman Test**

| **Correlated Random Effects - Hausman Test** | | | |
|---|---|---|---|
| **Test Summary** | **Chi-Sq. Statistic** | **Chi-Sq. d.f.** | **Prob.** |
| Cross-section random | 38.034619 | 5 | 0.0000 |

Table 4 provides the results of the Hausman test, which is designed to help determine whether the fixed effects or random effects model is more suitable for analyzing the data. The Hausman test evaluates whether the unique individual-specific effects in the model are correlated with the regressors, a key consideration in selecting the appropriate model. The test produces a chi-square statistic of 38.034619 with 5 degrees of freedom. This chi-square statistic is a measure of the discrepancy between the fixed effects and random effects models. A high chi-square value indicates that there are significant differences between the two models, which suggests that the assumptions underlying the random effects model might not hold. In this case, the chi-square statistic is quite substantial, reflecting a considerable difference between the two models.

The p-value associated with this chi-square statistic is 0.0000, which is well below the conventional threshold of 0.05. This very low p-value indicates that the result is statistically significant, suggesting strong evidence against the null hypothesis that the random effects model is appropriate. Essentially, this result implies that the individual-specific effects are indeed correlated with the regressors, making the random effects model less suitable for this data. Given the significant chi-square statistic and the extremely low p-value, the Hausman test suggests that the fixed effects model is the preferred choice. This is because the fixed effects model is better suited to account for the correlation between individual-specific effects and the regressors. By controlling for these time-invariant characteristics, the fixed effects model provides a more accurate and reliable estimation of the relationship between the explanatory variables and economic growth. Table 4 confirms that the fixed effects model is more appropriate for this dataset based on the Hausman test results. The significant chi-square statistic and the p-value below 0.05 indicate that the individual-specific effects are correlated with the regressors, thus favoring the fixed effects model over the random effects model for analyzing the impact of various factors on economic growth.

**Table 5: Results of the diagnostic tests**

| **Diagnostics Tests** | |
|---|---|
| **R-squared** | 0.959224 |
| **Adjusted R-squared** | 0.954672 |
| **F-statistic** | 210.7362 |
| **Prob(F-statistic)** | 0.000000 |

Table 5 presents the diagnostic test results for the gravity model, offering insights into the overall fit and effectiveness of the model in explaining variations in economic growth. These results are critical for evaluating the robustness and reliability of the model's estimations. The R-squared value of 0.959 is notably high, indicating that approximately 95.9% of the variability in economic growth can be explained by the model. This high R-squared suggests that the model provides a very good fit to the data, capturing most of the variation in economic growth. The adjusted R-squared value of 0.955, which adjusts for the number of predictors in the model, is also high. This figure reinforces the strong explanatory power of the model, as it accounts for the model's complexity while still indicating that the model explains a substantial proportion of the variability. Together, these statistics affirm that the model is highly effective in explaining the economic growth data.

The F-statistic for the model is 210.7362, accompanied by a p-value of 0.0000. The F-statistic measures the overall significance of the regression model, testing whether the included variables collectively have a significant explanatory power. The extremely high F-statistic and the associated p-value of 0.0000 indicate that the model is statistically significant. This result confirms that the regression model reliably explains variations in economic growth, suggesting that the included variables have a meaningful impact on economic growth. The diagnostic test results presented in Table 5 support the validity and robustness of the gravity model. The high R-squared and adjusted R-squared values demonstrate that the model explains a significant proportion of the variability in economic growth, while the statistically significant F-statistic confirms that the model as a whole is effective. These results indicate that the selected variables and model specification are well-suited to capturing the relationship between agricultural exports and economic growth, reinforcing the model's credibility in analyzing these factors.

## 5. Conclusions and recommendations

This study investigates the impact of agricultural exports on economic growth in 12 low-income countries (Burkina Faso, Burundi, Central African Republic, Ethiopia, Gambia, Madagascar, Mali, Niger, Rwanda, Sudan, Togo, and Uganda) over the period from 2004 to 2023. The analysis employs a gravity model with both fixed and random effects to understand how agricultural exports influence economic growth, while controlling for capital, labor, other exports, and imports.

In the fixed effects model, capital and labor both show significant positive impacts on economic growth. Specifically, a 1% increase in capital results in a 0.458% increase in growth, while a 1% increase in labor leads to a 0.200% growth increase. These results underscore the crucial roles of capital investment and workforce expansion in driving economic growth. On the other hand, agricultural exports have an insignificant impact on economic growth (coefficient of 0.017, p-value = 0.1559), suggesting that, in this model, agricultural exports do not play a significant role in enhancing economic growth. However, other exports and imports show marginally significant impacts, with other exports having a coefficient of 0.047 and imports having a coefficient of 0.233, indicating that trade flows have some influence on growth, but not strongly in this specification.

The random effects model presents a different perspective. Capital remains a significant contributor to economic growth, with a coefficient of 0.360. Labor also has a notable impact,

with a coefficient of 0.545. The significant impact of labor in this model is stronger compared to the fixed effects model, highlighting its critical role. Agricultural exports emerge as having a positive and significant impact on economic growth in this model (coefficient of 0.038, p-value = 0.0145), suggesting that, contrary to the fixed effects model, agricultural exports can contribute positively to economic growth under certain conditions. However, other exports and imports do not show significant effects in this model, indicating that their influence may be less pronounced or vary across different contexts.

The consistent significance of capital in both models indicates its fundamental role in economic development. Investments in capital are essential for enhancing production capabilities and overall economic productivity. Labor also proves to be a vital factor, with its significant effect on growth underscoring the importance of a productive workforce in driving economic expansion.

The contrasting findings regarding agricultural exports between the fixed and random effects models suggest that the role of agricultural exports in economic growth may depend on various factors and model specifications. While the fixed effects model indicates that agricultural exports may not significantly impact growth, the random effects model suggests otherwise. This divergence highlights the need for further investigation into how agricultural exports interact with economic growth in different contexts.

This study contributes to the existing literature by offering a detailed analysis of the impact of agricultural exports on economic growth in low-income countries. By using a gravity model with both fixed and random effects, the study provides a nuanced understanding of how agricultural exports interact with economic growth alongside other key factors like capital, labor, other exports, and imports. The significant findings regarding the roles of capital and labor in driving economic growth underscore their importance in policy-making and economic planning. Additionally, the study highlights the potential for agricultural exports to positively influence growth, suggesting that their role may vary depending on specific contexts and model specifications. This nuanced view helps to refine our understanding of trade and economic development dynamics in low-income countries.

Based on the findings, several recommendations can be made for policymakers and stakeholders in low-income countries. First, given the significant impact of capital and labor on economic growth, there should be a continued focus on enhancing capital investment and

improving workforce productivity. Policies that promote infrastructure development, technology adoption, and skills training can bolster economic growth by strengthening these key factors.

For agricultural exports, the study suggests that their positive impact on economic growth, as observed in the random effects model, warrants further exploration. Policymakers should consider strategies to enhance agricultural productivity and export opportunities. This might include investing in agricultural technology, improving market access, and providing support to smallholder farmers to increase the competitiveness of agricultural exports. Additionally, efforts to improve the overall trade environment, including reducing trade barriers and enhancing trade facilitation, can further support economic growth by leveraging both agricultural and other exports.

The study acknowledges several limitations. First, the analysis is based on data from a specific set of low-income countries, which may limit the generalizability of the findings to other regions or income levels. The reliance on aggregated data may also obscure variations within individual countries or sectors. Another limitation is the potential for omitted variable bias. While the study controls for several key factors, there may be other relevant variables not included in the model that could influence economic growth. The fixed and random effects models may also have limitations in capturing the full complexity of the relationship between agricultural exports and growth. Finally, the study's period of analysis (2004-2023) may not fully account for long-term trends or cyclical economic fluctuations, which could impact the results.

Future research could build on this study by exploring the impact of agricultural exports on economic growth in a broader set of countries, including middle-income and high-income countries. Comparative studies could provide additional insights into how the effects of agricultural exports vary across different income levels and economic contexts. Further research should also investigate the mechanisms through which agricultural exports influence economic growth. This could involve examining the role of specific agricultural products, market structures, and trade policies in shaping the relationship between exports and growth. Additionally, future studies could employ more granular data and advanced econometric techniques to address potential limitations such as omitted variable bias and measurement errors. Longitudinal analyses could help capture long-term effects and trends, providing a more comprehensive understanding of the dynamics between agricultural exports and economic

growth. Overall, expanding the scope and depth of research in this area can contribute to a more nuanced understanding of the role of agricultural exports in economic development and inform more effective policy interventions.

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