Turkish Journal of African Studies

e-ISSN : 3062-1909
Publisher : Sakarya University

Vol. 2, No. 2, 107-127, 2025

Research Article

How Does Agricultural Sector Dynamics Influence Economic Growth in Kenya? An Empirical Investigation of Key Drivers

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Received: 20.05.2025
Accepted: 31.10.2025
Available Online: 31.10.2025

Abstract: Kenya's agricultural sector, renowned for its tea and horticultural exports, is pivotal to the nation's economic development. This study investigates the effects of agricultural sector variables on Kenya's economic growth from 1995 to 2021, with a particular focus on agricultural export-led growth. Findings challenge the conventional support for agricultural exports as a primary driver of economic growth in Kenya, as exports show a positive but statistically insignificant effect on GDP per capita under the FMOLS and CCR models. This weak evidence for export-led growth suggests that potential gains from exports may depend on broader factors such as value addition, export diversification, and better access to international markets. Additionally, agricultural imports had a positive but insignificant impact on economic growth, indicating potential contributions through access to vital inputs and technology. In contrast, agricultural employment exhibited a significant negative relationship with growth, implying an economic shift from agriculture toward industrial and service sectors, which can foster higher productivity. Government spending on agriculture, however, negatively impacted growth, indicating inefficiencies in resource allocation. The study recommends that Kenya enhance export competitiveness, improve government spending efficiency, and focus on value addition in agriculture. Strategic interventions to address structural inefficiencies, support sectoral transformation, and elevate productivity are essential to harness the agricultural sector's potential for sustained economic growth.

Keywords: Kenya, Agriculture, Economic Growth, Exports, CCR, FMOLS

1. Introduction

Agriculture is frequently regarded as the backbone of developing economies, and Kenya is a prime example. The Kenyan economy heavily relies on agriculture, a major employment source and a critical determinant of GDP (Okemwa, 2021). Kenya is one of the world's largest exporters of tea and cut flowers, despite being a net importer of agricultural products (Kamau et al., 2024). Agriculture contributes 33% directly to GDP and an additional 27% through linkages with other sectors. Over 40% of the population, including more than 70% of rural inhabitants, is employed in agriculture. The sector accounts for 65% of Kenya's export revenue. Accordingly, the agricultural sector has a central position in the economy among sectors, including manufacturing, construction, tourism, transportation, education, and other services (FAO, 2024). Recent years have seen substantial growth in agricultural exports, particularly fruits and vegetables, which increased by 84.3% and 35.4%, respectively, by Q3 2023 (KNBS, 2023). While this growth highlights the sector's potential, it also reflects a dependency on primary agricultural exports, which are less competitive globally. Agriculture has significantly contributed to poverty reduction in rural areas (Wankuru et al., 2019). However, limited funding remains a challenge, with only 4% of commercial banks' lending directed towards agribusiness. Government spending has varied, with approximately USD 575.1 million allocated in 2021/22, USD 519.8 million in 2022/23, and USD 684 million in 2023/24, focusing on subsidies, irrigation, value addition, climate change mitigation, and the blue economy (Treasury & Planning, 2021; 2022; 2023).

Agricultural output in Kenya is primarily subsistence-based. Additionally, small farmers face market access issues, exacerbating rural poverty (Wankuru et al., 2019). Important exports include tea, coffee, avocados, and horticultural products. The debate on international trade, tracing back to Adam Smith and David Ricardo, emphasizes specialization and comparative advantage in fostering economic growth

Cite as (APA 7): Okoth, E. (2025). How does agricultural sector dynamics influence economic growth in Kenya? An empirical investigation of key drivers. *Turkish Journal of African Studies*, *2(2),* 107-127.

(EG) through exports (Alemayehu & Tilahun, 2021). However, the impact of agricultural exports on EG remains contested, with varying findings (Alemayehu & Tilahun, 2021). Research by Wamalwa & Were (2021) supports the transition towards an export-led economy, noting the positive impact of agricultural exports on EG and their dependence on domestic output growth. Similar conclusions are drawn by Seok & Moon (2021), highlighting the potential of agricultural exports to enhance EG through market expansion and technology acquisition.

Despite trade liberalization and export promotion efforts, Kenya's export growth has been sluggish, focusing mainly on primary agricultural goods (Wamalwa & Were, 2021). Trade openness is essential for enhancing agricultural growth and economic development. However, primary agricultural exports may hinder EG, suggesting a need for diversification towards manufacturing and non-agricultural exports (Busari et al., 2022). Value addition in agricultural products is critical for EG, enhancing competitiveness and driving export earnings through processing, packaging, and branding (Arifah & Kim, 2022). Empirical evidence supports the export-led growth hypothesis, emphasizing the significant impact of value-added agricultural exports on EG (Wamalwa & Were, 2021). Exchange rate volatility can significantly impact business export performance. Sudden fluctuations in exchange rates may create adverse effects. Maintaining a market-determined exchange rate and implementing monetary policies to control inflation are recommended to drive economic expansion (Kiptarus et al., 2022). Positive correlations between trade openness and EG emphasize the benefits of open trade policies for economic expansion (Nguyen, 2019). A stable macroeconomic environment with low inflation, competitive exchange rates, and an open trading regime is crucial for sustainable EG and attracting investments. By incorporating these variables into the study, a comprehensive analysis of the impact of the agricultural sector at large may be better explained.

Kenya's economy is deeply intertwined with its agricultural sector, which is a vital source of employment, income, and foreign exchange earnings. Despite its significant potential and GDP contribution, Kenya faces persistent economic stagnation, rural poverty, and external trade imbalances. There is a growing need to understand the catalytic role of agriculture in EG. While various policies and programs have been implemented to promote agricultural exports, their actual impact on Kenya's EG remains unclear. Existing studies often overlook intermediate mechanisms and contextual factors influencing these relationships, with mixed findings and limited empirical evidence specific to Kenya. This study aims to fill this gap by examining the nuanced impacts of agricultural exports and imports, agricultural employment, value addition in agriculture, and government agricultural spending on EG. Using a comprehensive econometric model and time series data from 1995 to 2021, the research intends to provide detailed insights for policymakers, stakeholders, and development practitioners to design effective strategies that maximize the economic benefits of the agricultural sector, fostering sustainable growth and development in Kenya.

The succeeding section of the study is organized as follows. Section 2 reviews the relevant literature, both theoretical and empirical. Section 3 presents the data and the model specification. Section 4 discusses methodology and empirical results. Section 5 provides the discussion, and finally, Section 6 presents the conclusion.

2. Literature Review

2.1. Theoretical literature review

This section highlights the theoretical foundations upon which the study is grounded. Kenya's reliance on the export of primary agricultural goods can be understood through Rostow’s stages of growth theory, which outlines the progression from a traditional society to an industrialized state. Proposed by Walt Whitman Rostow in 1960, this theory is based on a model of 15 European countries, positing that economic development follows five linear stages that enable a nation to escape poverty. The initial stage,

the traditional society, features a predominantly agricultural workforce, barter-based exchanges, limited technology, low social mobility, investment below 5% of total economic production, and significant political instability. The next stage, preconditions for take-off, involves secular education, a shift from barter to monetary exchanges with banks, investments rising above 5% of national income, and a transition from agriculture to trade, industry, and commerce. The take-off stage is marked by investments rising to 10% of national income, substantial manufacturing sector development, robust social and political institutions, large loanable funds for industrial expansion, and new technologies with profits from foreign trade reinvested. This stage can be either export-based or domestically driven by internal demand (Rostow, 2010; Singh, 2018). Kenya arguably remains in this stage, heavily reliant on agricultural exports. The fourth stage, drive to maturity, involves modern technology enhancing productivity, with up to 20% of national income steadily invested. At this stage, the agricultural workforce comprises only about 20%, down from 75%, with recognized and mitigated environmental and health impacts, efficient infrastructure, and significantly reduced poverty rates. The final stage, the age of high mass consumption, features a shift from production to welfare (Rostow, 2010; Singh, 2018). Singh (2018) introduces a sixth stage, beyond consumption, marked by rising birth rates in affluent societies, with capitalization and industrialization as primary development paths and GDP growth as a measure of development.

The Export-Led Growth (ELG) theory posits that EG is driven primarily by exports, gaining prominence in the 1970s and 1980s, exemplified by the economic successes of the Asian Tigers—Hong Kong, Singapore, South Korea, and Taiwan—which implemented free-market policies and outward-oriented strategies (Kollie, 2020; Shirazi & Abdul Manap, 2005). According to ELG theory, export promotion generates positive externalities, improves the balance of payments, generates foreign income, and increases employment levels (Jimenez & Razmi, 2013; Lee et al., 2023). ELG posits that promoting exports drives economic development by optimizing resource allocation, fostering economies of scale, enhancing production efficiency through technological advancements, encouraging capital formation, and generating employment (Kalaitzi & Chamberlain, 2021; Shirazi & Abdul Manap, 2005). This concept evolved into widely acknowledged conventional wisdom, influencing World Bank policies and the development policies of numerous nations. Latin American economies, which followed inward-oriented strategies under import substitution policies, experienced lackluster outcomes, prompting a shift toward export-led orientations (Shirazi & Abdul Manap, 2005). The ELG hypothesis suggests that exports are influenced by foreign demand, stimulating demand and increasing savings, capital accumulation, and import capacity. This model is fundamental in neoclassical theory. Conversely, the growth-oriented export hypothesis (GLE) suggests that EG encourages higher exports. Economists such as Krugman (1984) and Lancaster (1980) support this view, arguing that increased growth leads to technological investments and increased productivity, leading to higher exports (Orhan et al., 2022).

The staple theory, a derivative of the ELG model, is relevant to the primary exports' role in EG. Developed by Harold Innis in the 1930s–1940s, this theory explains economic progression in newly settled regions like Canada, emphasizing the reliance on and expansion of staple goods exports. The theory, grounded in the Heckscher-Ohlin factor endowment theory and the Stolper-Samuelson income distribution theory, highlights the importance of primary exports to EG (Kipkoech, 2021). Staple exports drive EG, influencing factor demand and income distribution, with backward and forward linkages impacting investment in various industries (Droller & Fiszbein, 2021). Some studies argue that focusing on raw material exports should not hinder progress in the manufacturing and service sectors (Droller & Fiszbein, 2021). These theories collectively provide a comprehensive framework for understanding why Kenya's exports remain predominantly agricultural.

2.2. Empirical literature review

The empirical literature examining the impact of agricultural exports on EG reveals diverse findings. In the context of Kenya, Mwangi et al. (2020) establish bidirectional causality between agricultural exports and EG, underscoring the mutual dependence of these variables in driving economic advancement. Abdillahi (2017) supports this view, highlighting that trade openness, including agricultural exports, exerts a positive influence on EG trajectories. These findings are consistent with studies by Verter and Bečvářová (2016) and Arifah and Kim (2022), which highlight the constructive impact of agricultural exports on economic development. Primary agriculture forms the foundational basis for agricultural exports, as emphasized by Beckman and Countryman (2021). They underscore the pivotal role of primary agriculture in supporting export clusters and integrating small-scale farmers into export-oriented activities. Moreover, sustainable economic development necessitates enhancing agricultural productivity and diversification, an aspect reinforced by Maiga (2024). Capital stock and foreign direct investment have significantly contributed to EG, particularly in sectors like floriculture and horticulture (Osano & Koine, 2016). Trade openness in agriculture enhances the capacity of domestic farmers to participate in global markets, thereby potentially bolstering EG. Further, Evangelista et al. (2022) demonstrate that it stimulates investment ratios and capital accumulation, which are essential components of EG. However, trade openness also exposes economies to external risks, necessitating prudent state intervention to safeguard against adverse impacts (Farhad & Jetter, 2022).

Akanbi et al. (2019) emphasize the positive and significant effect of government agricultural spending on EG in Nigeria, suggesting that increasing agricultural expenditure can stimulate EG by creating more employment opportunities, boosting per capita income, improving agricultural infrastructure, and reducing poverty. Additionally, Jacob (2023) and Anto et al. (2014) indicate a positive relationship between government agricultural expenditure and EG, demonstrating favorable impacts on investment, employment, GDP, and poverty reduction. Public investments in agricultural R&D, rural education, and rural infrastructure have been shown to yield significant positive returns in terms of agricultural growth, poverty reduction, and regional inequality. Conversely, other studies present a more nuanced view; Salisu and Haladu (2021) indicate that government expenditure on human capital development through social services tends to promote EG more effectively than expenditure on agriculture in Nigeria, suggesting the impact of government spending may vary across different sectors. Moreover, Emeru (2023) suggests that while the short-term effects of government expenditure on agriculture may be negative, the long-term impact on EG is considerable, highlighting the complex dynamics involved in assessing the effects of government agricultural spending.

Gross fixed capital formation (GFCF), encompassing investments in machinery, buildings, and infrastructure, plays a crucial role in enhancing productivity and economic performance (Kesar et al., 2022). It is widely recognized for its positive impact on EG, stimulating employment and fostering overall development (Elie, 2024). Value-added agriculture contributes significantly to GDP and employment generation by processing raw agricultural products into higher-value goods (Adeleye et al., 2020). Furthermore, the contribution of agriculture to employment and GDP remains substantial, particularly in rural areas (Njeru et al., 2015), highlighting its critical role in economic development. Other empirical studies examined in this study can be found in Table 1 below.

Table 1

Summary of Literature

Author(s)	Span	Region	Methodology	Results
Otieno et al., (2023)	2000-2021	East African Community	Granger causality with CS-ARDL	agricultural trade openness (+)
Utuk et al., (2023)	2000-2022	Nigeria	ARDL, Dynamic OLS	Agricultural raw material exports (+) value-added agricultural exports (-)
Kipkoech, (2021)	1964-2018	Kenya	ARDL	In the long run agricultural exports, gross capital formation and inflation (+). In the short run, gross capital formation, exchange rate and inflation (-), human capital (NA)
Ghimire et al., (2021)	1972-2019	Bangladesh	ARDL	Agricultural trade (+) without causing environmental pollution
Bakari, (2021)	2000-2021	African countries	FMOLS and DOLS, panel VECM, panel ARDL model	Long-term bidirectional causal relationship between exports and economic growth
Kouakou, (2020)	1985-2015	Ivory Coast	ARDL	Gross fixed capital, agricultural exports (+) trade openness (-)
Ali et al., (2020)	1980-2017	Pakistan	Granger causality VAR/VECM	Agricultural exports and exchange rate (+), imports (-)
Bakari and Mabrouki, (2018)	1982-2016	North Africa	Static gravity model	agricultural exports (+) and agricultural imports (NA)
Siaw et al., (2018)	1990-2015	Ghana	ARDL	Cocoa exports (+) pineapple and banana exports (-).
Mohamed and Sayef, (2017)	2006-2016	South Eastern Europe	Correlation analysis, static gravity model	Agricultural exports (+)
Mahmood and Munir, (2018)	1970-2014	Pakistan	Cointegration and Granger causality tests	Agricultural exports (+)
Ouma et al., (2016)	2000-2012	East African Community	VAR/VECM, Granger causality tests and impulse response analysis on panel data	Bi-directional relationship between agricultural exports and economic growth in Kenya.
Maina, (2015)	1960-2010	Kenya	Correlation analysis	Imports and exports (+)
Kang, (2015)	1980-2010	Major rice-exporting countries	Export-led growth hypothesis study	Rice exports (+)
Faridi, (2012)	1972-2008	Pakistan	Johansen co-integration technique	Agricultural exports (-)

Notes: The (+) and (-) imply positive and negative effects on the dependent variable, economic growth, while NA implies no effect.

In summary, the literature portrays mixed findings on the impact of agriculture on EG. When the relationship between agricultural exports and EG is evaluated, most studies argue that agricultural exports have a positive effect. Despite the significance of agricultural exports, challenges persist, including the sluggish evolution of the export industry and heavy reliance on primary agricultural

products, especially in Kenya. However, most of the existing studies have only considered agricultural exports as the sole variable in this relationship. As such, the intermediate variables that could augment the contribution of the agricultural sector—such as employment in agriculture, value addition on agricultural produce, primary agricultural exports, agricultural imports, and government spending in agriculture—have not been conclusively studied. This study considers these proxy variables to attempt to explain the agricultural sector drivers of economic growth in Kenya.

3. Data and Model

3.1. Data collection and sampling

This paper investigates the impact of the agricultural sector on Kenya's EG, focusing on key variables highlighted in the literature. GDP per capita, which is used as a measure of economic performance, is used as the dependent variable. As the major explanatory variable, agricultural export is used. Utuk et al. (2023) underscore the pivotal role of agricultural export volumes and values in stimulating economic activity and generating foreign exchange earnings. Value addition in agricultural products, as highlighted by Wamalwa and Were (2021), enhances profitability and competitiveness in exports, directly contributing to GDP growth. Government expenditure in agriculture, as supported by Wankuru et al. (2019), plays a critical role in boosting productivity, infrastructure, and technology adoption essential for sectoral growth and economic development. Additionally, agricultural employment impacts rural poverty rates and economic stability in developing countries, as noted by Okemwa (2021). The utilization of these variables in augmenting this study of the impact of agricultural exports on EG provides a comprehensive understanding of the multifaceted dynamics involved in leveraging this relationship. This study spans from 1995 to 2022, encompassing significant economic events such as structural adjustment reforms of the 1990s, the 2008 financial crisis, and the recent Covid-19 pandemic's impact on economic activity. Due to these significant events, presumed structural breaks are accounted for in the study. The secondary data sourced from the World Bank development indicators database underwent cleaning, editing, and coding for robust analysis.

Table 2

Operationalization of Variables

Variable type	Variable name	Abbreviation as used in analysis	Measurement unit	Source
Dependent variable	Economic growth	GDP	Annual GDP per capita	World Bank
Independent variable	Total agricultural exports	AGRICEXP	Total agriculture export value million USD	World Bank
	Total agricultural imports	AGRICIMP	Total agriculture import value million USD	World Bank
	Share of agriculture in employment	AGRICEMP	Employment in agriculture (% of total employment) (modeled ILO estimate)	World Bank
	Government spending on Agriculture	AGRICSPE	Share of Government Expenditure in Agriculture %	World Bank
	Primary agriculture	PRIAGR	Agricultural raw materials exports (% of merchandise exports)	World Bank
	Value added agriculture	VAGR	Agriculture, forestry, and fishing, value added (% of GDP)	World Bank

3.2. Model

The Fully Modified Ordinary Least Squares (FMOLS) method, developed by Phillips and Hansen in 1990, is extensively utilized in this study for long-term estimation due to its robustness in addressing issues like serial correlation and endogeneity arising from cointegration relationships. FMOLS, a non-parametric approach, provides consistent estimations even with small sample sizes, making it particularly suitable for this study with 27 observations. It modifies the Cointegrated Error Correction Model (CECM) to incorporate serial correlation effects and endogeneity tests, ensuring reliable results. The FMOLS method applies to a semi-parametric correction process, resulting in asymptotically unbiased and efficient estimates. It assumes a single equation method and a single cointegrating vector. FMOLS is suitable when series are cointegrated in first differences (I(1)). Additionally, the Canonical Cointegrating Regression (CCR) method, proposed by Park in 1992, is employed as a robustness check, CCR demonstrates that internal consistency issues can be eliminated with transformations, correcting asymptotic bias. The FMOLS method was employed to examine the relationship between variables, addressing endogeneity concerns through conventional OLS adjustments. It is a superior estimator for long-run coefficients (You et al., 2022). The CCR regression employs a stationary conversion method to establish long-run correlations between stochastic regressors and cointegrated adjustment equations. This process yields normally distributed squared residuals and simultaneously addresses biases due to synchronous regressors, eliminating endogeneity concerns (Wamboye & Nyaronga, 2018; You et al., 2022).

Furthermore, both FMOLS and CCR methods demonstrate efficacy with variables exhibiting I(1) and stationary characteristics. Results remain robust irrespective of the estimator utilized, though spurious outcomes may occur if any of the variables are stationary at I(2) (You et al., 2022). FMOLS and CCR are chosen over Ordinary Least Squares (OLS) due to their ability to produce unbiased estimations, especially in the presence of problems like autocorrelation and heteroskedasticity in model residuals. By employing FMOLS and CCR, this study aims to obtain robust and reliable results against different estimation approaches. The methodology applied here is like that used by Bakari (2021), Merlin and Chen (2021), and Yurdakul (2018). The general equation applied in the study is as below.

$$Y = \propto + \beta_i \boldsymbol{X}_i + \mu \quad \text{----------(1)}$$

Where **Y** is the EG measured by GDP per capita per annum. **X** is the vector of the independent variables including the share of total employment in agriculture, reflecting the sector's labor intensity; total agricultural exports and imports in million USD, respectively, assessing trade dynamics' influence, government spending on agriculture as a percentage of total expenditure, indicating fiscal support on agriculture; the percentage of agricultural raw materials exports among merchandise exports, indicating primary agricultural export composition; and agriculture, forestry, and fishing value added as a percentage of GDP, measuring sectorial contribution to economic output. The $\propto$ is the constant to the equation, **μ** is the random error term, whereas **β** coefficients represent the estimated effects of each variable on EG, capturing their respective contributions to GDP per capita growth across the study period.

To attempt to correct the normality, heteroskedasticity and, correlation in the base variables in the analysis, this current study used variables in natural logarithmic forms. The above equation is then summarized as below.

$$lnY_t = \propto + \beta_t ln\boldsymbol{X}_t + \mu_t \quad \text{----------(2)}$$

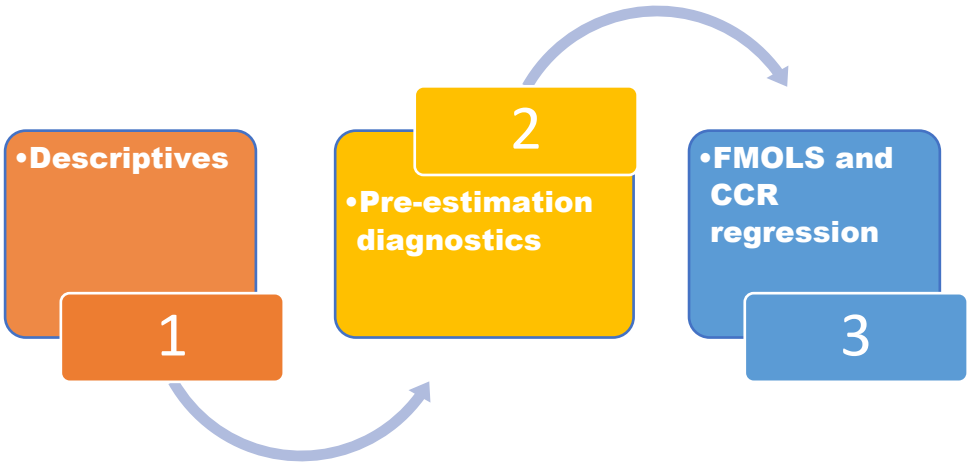
4. Methodology and Empirical Results

4.1. Methodology

The study uses a structured four-stage analysis shown in Figure 1. It starts with descriptive statistics, then diagnostic tests, including unit root tests (Zivot-Andrews unit root test and Phillips-Perron test) to assess stationarity, and Gregory-Hansen co-integration tests to identify long-run relationships. In the final stage of empirical analysis, FMOLS and CCR are used to model these relationships robustly, handling endogeneity and serial correlation.

Figure 1

Empirical Strategy



The dataset over the period 1995- 2021 comprised 27 observations for each of the variables used. Economic growth measured as GDP per capita; the mean value was 2863.45, with a standard deviation of 1090.79. The data ranged from a minimum of 1798.748 to a maximum of 5236.612, showcasing variability within the dataset. The skewness of 0.855 indicates a moderate right skew, while the kurtosis of 2.336 suggests a distribution with relatively heavy tails compared to a normal distribution. AGRICSPE had a mean value of 3.674, with a standard deviation of 1.347, and exhibited a similar distribution pattern. For agricultural trade, the mean AGRICEXP amounted to 2385.624, with a standard deviation of 1109.608. AGRICIMP had a mean value of 1476.935 and a standard deviation of 1041.355. Both variables showed moderate positive skewness, with skewness values of 0.006 and 0.414, respectively. Detailed descriptives are in Table 3 below.

Table 3

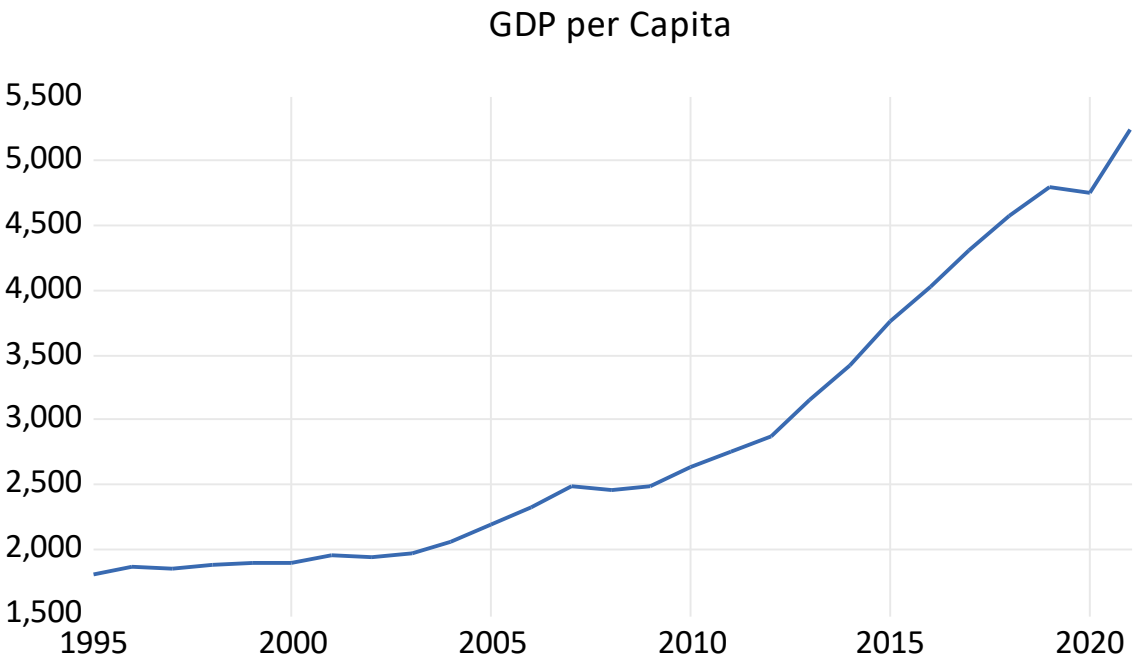
Descriptive Statistics

Variables	Obs	Mean	Std. Dev.	Min	Max	Skew.	Kurt.
GDP	27	2863.45	1090.79	1798.748	5236.612	.855	2.336
AGRICEMP	27	40.8	4.588	33	46.6	-.319	1.685
AGRICSPE	27	3.674	1.347	1.54	5.653	-.172	1.675
AGRICEXP	27	2385.624	1109.608	544.397	4117.84	.006	1.615
AGRICIMP	27	1476.935	1041.355	106.353	3417.189	.414	1.821
PRIAGR	27	11.04	2.461	6.528	15.838	-.243	2.417
VAGR	27	22.511	3.797	16.255	28.744	.327	1.805

The Kenyan economy has shown significant growth in GDP per capita over the study period, despite changing economic dynamics as in Figure 2. This growth can be attributed to the effectiveness of Kenya's economic policies and strategies in fostering development and prosperity. This trajectory of the Kenyan economy underscores its resilience and progress (World Bank, 2019).

Figure 2

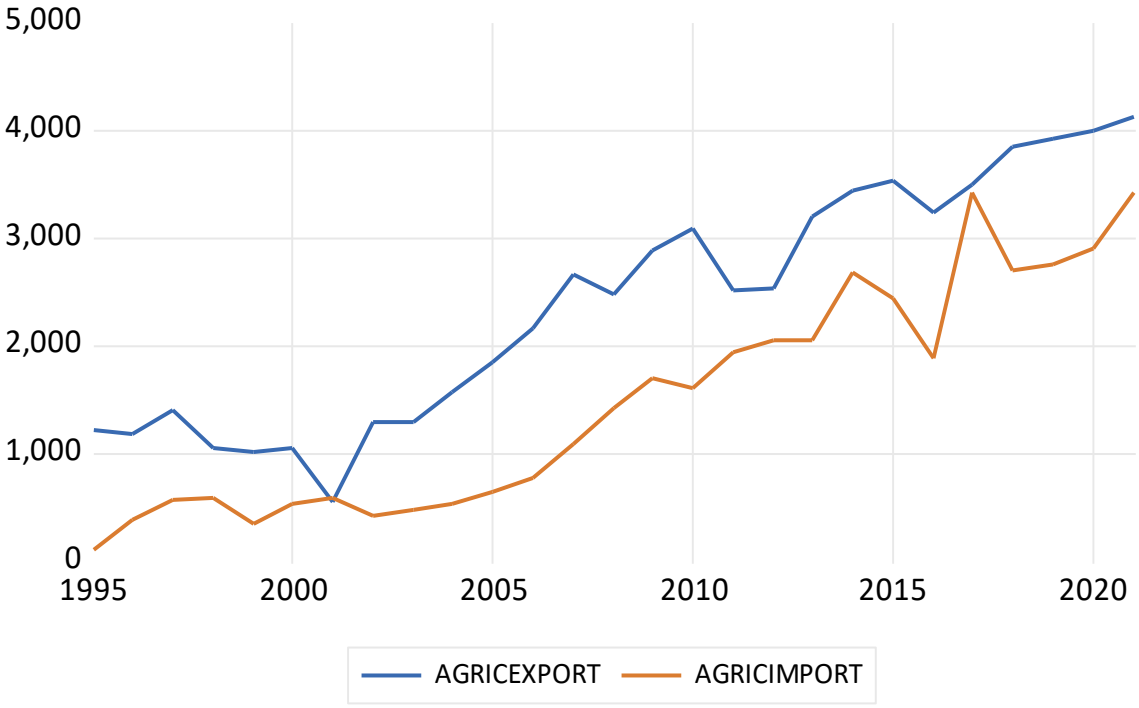
Trends in GDP Per Capita



This current study also examines the trends of agricultural imports and exports in Kenya. It is found that Kenya generally exports a higher value of agricultural products than it imports. Shown in Figure 3. According to available data, Kenya relies heavily on agricultural exports, which constitute 58% of its total exports, while imported goods primarily consist of manufactured products, comprising 63% of total imports. This pattern underscores Kenya's role as a net exporter of agricultural commodities, with key exports including tea, roses, coffee, cut flowers, palm oil, and nuts (Maurer et al., 2023).

Figure 3

Trends in Agricultural Exports and Imports



In the second stage of analysis, the study conducts the Breusch-Pagan-Godfrey test to assess heteroscedasticity, crucial for ensuring unbiased standard error estimates under the assumption of constant error variance across observations. The test results fail to reject the null hypothesis of homoscedasticity ($p = 0.6783 > 0.05$), indicating no significant evidence that the assumption of constant variance is violated, as shown in Table 4. Similarly, the dataset undergoes testing for serial autocorrelation using the Breusch-Pagan-Godfrey serial correlation LM test, where the null hypothesis is not rejected ($p = 0.196 > 0.05$), affirming the absence of serial correlation at the 5% significance level, as illustrated in Table 4.

To assess stationarity, the Zivot-Andrews unit root test that accounts for structural breaks and Phillips and Perron (1988) tests are applied. These rigorous statistical tests ensure robustness in the modeling approach and enhance the reliability of the study's findings regarding the impact of agricultural exports on Kenya's EG. The Zivot-Andrews unit root test constitutes an important development in the field of time series analysis and, more precisely, in the smaller subfield of finding unit roots with structural breaks. This test, introduced by Zivot and Andrews in 1992, allows for the identification of a single endogenous structural break in the trend function of a time series, which is crucial for an accurate stationarity assessment of economic and financial data (Obradović & Lojanica, 2018). This becomes particularly relevant, as traditional unit root tests like the Augmented Dickey-Fuller (ADF) often do not take structural breaks into consideration and may, therefore, provide erroneous inferences about the nature of a time series (Wilson et al., 2003).

Under the alternative models, the Zivot-Andrews test can be conducted: one allowing for a shift in the level, another allowing for a change in the slope of the trend, and another allowing both changes at the same time (Obradović & Lojanica, 2018). In this study, the latter specification is used. This is very flexible and important because economic time series experiences structural changes due to policy shifts, economic crises, or other important events (Waheed et al., 2006). For example, it has been shown that the failure to account for structural breaks might lead to spurious results, such as a series which may appear non-stationary while it is stationary with breaks (Chibi et al., 2019).

From the results in Table 4, the combined results of the Zivot-Andrews (ZA) and Phillips-Perron (PP) unit root tests robustly indicate that all variables are integrated of order one, I(1), as the null hypothesis of a unit root is rejected for their first differences at the 1% or 5% significance levels. The fact that both tests arrive at the same conclusion regarding the order of integration, regardless of whether structural breaks are considered as in ZA procedure that accounts for a single endogenously determined structural break, or in PP test which does not; strengthens the reliability of this finding and justifies proceeding with cointegration analysis to explore long-run relationships.

Table 4

Stationarity Tests

Variables	Zivot-Andrews unit root test		Phillips-Perron test	
	Test statistics (With trend and intercept)		Test statistics (With trend and intercept)	
	I(0)	I(1)	I(0)	I(1)
logGDP	-2.509	-5.003[c]	-1.481	-3.977[a]
logAGRICEMP	-4.561	-6.638[a]	-2.222	-4.509[a]
logAGRICSPE	-3.762	-11.464[a]	-2.941	-7.228[a]
logAGRICEXP	-4.084	-6.254[a]	-2.643	-7.974[a]
logAGRICIMP	-2.324	-5.920[a]	-2.796	-7.245[a]
logPRIAGR	-1.734	-8.211[a]	-1.246	-6.488[a]
logVAGR	-4.061	-5.438[b]	-2.520	-3.657[b]
Heteroscedasticity test				
Breusch-Pagan/ Cook Weisberg Heteroskedasticity Test Null hypothesis: Homoskedasticity				
Test	**Statistic**	**Probability**		
Chi2-statistic	2.04	0.1529		
Correlation test				
Breusch-Godfrey LM Test for autocorrelation Null hypothesis: No serial correlation				
Test	**Statistic**	**Probability**		
Chi2	1.407	0.2355		

Note: Critical values for Zivot-Andrews unit root test at 1%, 5%, and 10% were -5.57, -5.08 and -4.82 respectively while a, b, and c imply significance levels at 1%, 5%, and 10%.

Due to assumed structural breaks present in the dataset, and the stationarity at first difference (all variables integrated I (1)), the Gregory-Hansen (1996) cointegration test is employed. This test represents a significant refinement in time series econometrics by allowing for a single endogenous structural break within the cointegration relationship, thereby overcoming the parameter stability assumptions inherent in traditional methods such as Engle-Granger and Johansen. Utilizing modified ADF-type statistics (ADF, Zα, Zt) across three model specifications—Level Shift (C), Level Shift with Trend (C/T), and Regime Shift (C/S)—to effectively capture long-run dynamics under structural change, such as those induced by economic crises, policy reforms, or regime transitions. Widely applied in macro-financial studies, housing markets, resource-based growth analyses, and fiscal sustainability research (Ji et al., 2022; Ahmed & Jawaid, 2022; Kondowe & Osoro, 2022; Shankar & Trivedi, 2022; Shrestha & Bhatta, 2018), the Gregory-Hansen framework enhances the robustness of empirical inference in non-stationary data environments. Based on the results presented in Table 5, both the ADF and Zt statistics reject the null hypothesis of no cointegration at 5% significance level, identifies a significant regime shift in the long-run relationship, with breakpoints in 2002 and 2008. The 2002 breakpoint likely corresponds to the economic reforms and recovery following the end of the Moi era and the election of the Kibaki government, which prioritized revitalizing the agricultural sector. The 2008 breakpoint almost certainly captures the dual shock of Kenya's post-election violence and the global food and financial crises, which severely disrupted agricultural production, trade, and macroeconomic stability. The fact that the ADF and Zt statistics exceed their 5% critical values confirms a stable cointegrating relationship exists between these variables despite these structural shocks, a

finding bolstered by a robust model showing no heteroscedasticity or serial correlation. This evidence strongly suggests that agricultural employment, spending, exports, imports, and value-added have a long-run equilibrium relationship with Kenyan GDP, but that this relationship was fundamentally altered by major political and economic events in the 2000s.

Table 5

Cointegration Tests

Gregory-Hansen Test for Cointegration with Regime Shifts					
Test	Statistic	Breakpoint Date	Confidence interval		
			10%	5%	1%
ADF	-5.74	2002	-5.31	-5.56	-6.05
Zt	-5.86	2008	-5.31	-5.56	-6.05
Zα	-28.44	2008	-54.38	-59.40	-70.18

4.2. Empirical results

The confirmation of stationarity at first difference and establishment of a cointegration relationship through the Gregory-Hansen cointegration test justify the application of Fully Modified OLS (FMOLS) to analyze the long-term relationship between the explanatory variables and EG in Kenya. Additionally, for robustness, the study employs the CCR approach. From the analysis in this third stage, both FMOLS and CCR analyses reveal significant insights. Agricultural exports, agricultural imports, exhibit positive but insignificant impacts on GDP per capita in both FMOLS and CCR models. Conversely, Government spending on agriculture and share of employment in agriculture demonstrates a negative and significant effect across both models. The models exhibit strong explanatory power, with adjusted R-squared values of 99.76% for FMOLS and 99.72% for CCR, underscoring the robustness and significance of these findings at the 99% confidence level. Detailed results are presented in Table 6 below.

Table 6

Regression Results from FMOLS and CCR

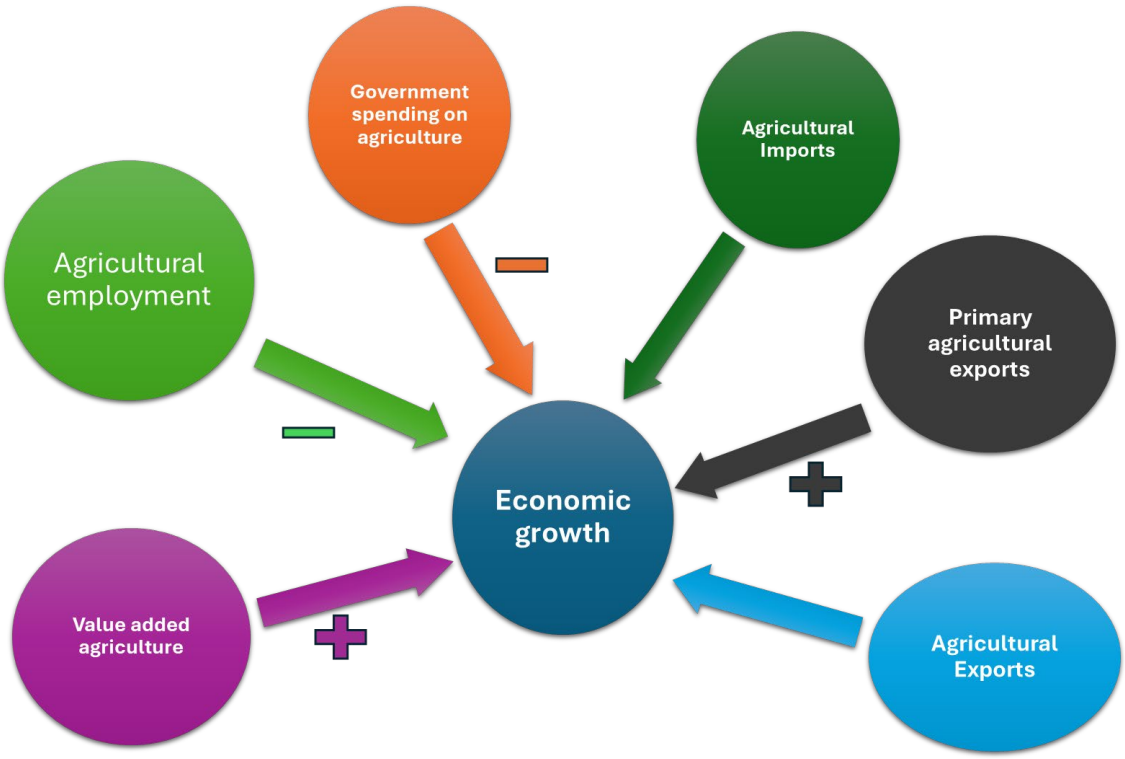
logGDP Dependent var.	Fully Modified Ordinary Least Squares (FMOLS)	Canonical Cointegrating Regressions (CCR)	
	Coefficients	Coefficients	
logAGRICEMP	-3.4455*** (0.3408)	-3.6183*** (0.3212)	
logAGRICEXP	0.0241 (0.0178)	0.0396 (0.0268)	
logAGRICIMP	0.0182 (0.0197)	0.0184 (0.0141)	
logAGRICSPE	-0.0871*** (0.0172)	-0.0730*** (0.0204)	
logPRIAGR	0.0648** (0.0269)	0.0994** (0.0466)	
logVAGR	0.1489** (0.0589)	0.1717** (0.0677)	
Constant	19.9916*** (1.5415)	20.3833*** (1.3843)	
@Trend	-0.0123** (0.0050)	-0.0154** (0.0057)	
Adjusted R^2	0.997608	Adjusted R^2	0.997218
Number of obs	27	Number of obs	27
S.E. of regression	0.020243	S.E. of regression	0.021829
Long run variance	0.000272	Long run variance	0.000272
S.D. dependent variable	0.351176	S.D. dependent variable	0.351176
Mean dependent var.	7.912	Mean dependent var.	7.912

Notes: *** p<.01, ** p<.05, * p<.1 Standard errors are in parenthesis

Empirical findings on long-run estimators are presented in Figure 4.

Figure 4

Graphical Summary of Empirical Results



5. Discussion

Agricultural exports were found to positively but insignificantly influence EG in both FMOLS and CCR models, offering weak evidence for the agricultural export-led growth hypothesis in Kenya. However, other studies had highlighted the pivotal role of agricultural exports in Kenya's economic development, as noted by Kipkoech (2021) and Siaw et al. (2018), despite contrasting findings from Faridi (2012), who found a negative effect of agricultural exports. The positive impact of agricultural imports on EG suggests their potential role in enhancing productivity by supplying essential inputs and technologies, aligning with varying outcomes observed by Kouakou (2020) and Bakari & Mabrouki (2018). This current study, however, finds this positive effect to be insignificant. Conversely, the negative and significant relationship between agricultural employment and GDP per capita signals Kenya's structural transformation, where economic advancement correlates with reduced reliance on agricultural labor, consistent with insights from Okemwa (2021).

Government spending on agriculture demonstrated a negative significant effect on economic growth in Kenya. This could be due to ineffectiveness in government expenditure, further compounded by bureaucratic inefficiencies and weak institutional frameworks that slow down the realization of policies designed to improve agricultural productivity (Dincă, 2023). While there exist frameworks such as the Agriculture Sector Development Strategy (ASDS), poor implementation has limited their ability to bring about significant effects on productivity and economic growth. Furthermore, most farming in Kenya is rain-fed, and thus the sector is highly exposed to climatic shocks, which government expenditure has not fully addressed through climate-resilient approaches (Kogo et al., 2022). The failure to support sustainable practices and technology adoption among smallholder farmers aggravates the challenges facing the sector, constricting its potential to respond to environmental changes and market demands (Kathula, 2023). An absence of focus on sustainable agricultural practices and technological

development constrains investments in raising productivity, leading to stagnation in the growth potential of this sector.

Primary agricultural exports and value-added agriculture consistently contributed positively to EG, emphasizing the benefits of enhancing productivity and adding value to agricultural products, aligning with findings from Wamalwa & Were (2021). This is in line with previous studies that have closely related agricultural productivity to economic growth (Ngong et al., 2022; Okello et al., 2012).

6.Conclusion

The study examined the influence of several variables from the agricultural sector, including agricultural export, import, employment, value addition, and government spending on agriculture, on economic growth in Kenya over the period 1995 to 2021. The findings challenged the long-held strong support for an agricultural export-led growth hypothesis in Kenya, with agricultural exports showing a positive but statistically insignificant effect on EG in both the Fully Modified OLS (FMOLS) and Canonical Cointegrating Regression (CCR) models. While these results indicate weak linkages between agricultural exports and per capita GDP, there is weak evidence for the agricultural export-led growth hypothesis. The study therefore suggests that expected benefits from agricultural exports could hinge on broader contextual factors such as value addition, export diversification, and access to global markets, which would need policy focus. The role of agricultural imports on EG also emerges positively yet insignificantly, which may indicate their potential contribution to productivity by facilitating access to important inputs and technologies. There is also a negative and significant relationship between agricultural employment share and EG. This trend casts evidence on the fact that Kenya's economic transformation is pegged on a falling reliance on agricultural labor, with a transition toward more industrialized and service-oriented sectors offering potential for higher productivity and income growth. Government spending on agriculture demonstrated a negative significant effect on economic growth in Kenya. These results underscore the role that employment-related policies can play in directly influencing economic growth. The general findings emphasize the need for targeted policies that are well structured to unlock the potential of the agricultural sector in supporting Kenya's economic growth in a sustainable manner. The main recommendations include improving the export competitiveness of the agricultural sector, improving efficiency in government spending, and focusing on value addition and productivity improvement within agriculture. Strategic interventions that address inefficiencies, support structural transformation, and enhance agricultural productivity are likely to yield more sustainable growth outcomes for Kenya.

Kenya's agricultural exports significantly contribute to its EG. To optimize Kenya's agricultural sector’s contributions to economic growth, several targeted policies are recommended. First, enhancing export competitiveness by focusing on value addition and diversification is critical, as agricultural exports drive the economy but often fall short of maximizing growth without intervention. Prioritizing policies that support value addition, such as providing incentives for local processors and fostering public-private partnerships, could elevate global market competitiveness and increase the sector's economic impact. Second, improving the efficiency of government spending on agriculture is essential. Findings suggest inefficiencies within current spending practices, indicating a need for performance-based budgeting, with funds allocated to productivity-enhancing initiatives like irrigation and agricultural technology, complemented by regular evaluations and transparent accountability mechanisms. Additionally, agricultural imports should be strategically leveraged as sources of technological advancement. Reducing tariffs on vital inputs and machinery, along with supporting technology transfer programs, would make these resources accessible and enable farmers to increase yields and productivity, yielding potential growth benefits. Furthermore, addressing the employment transition from agriculture to higher-productivity sectors could relieve the negative economic impact associated with agricultural employment. This transition could be supported through vocational training that prepares agricultural

workers for roles in manufacturing, services, or value-added agriculture, encouraging labor mobility within the sector. Finally, strengthening market access and infrastructure, such as roads, storage, and digital platforms, would lower transaction costs, increase farmers' access to wider markets, and further integrate Kenya's agricultural sector within regional and global markets, driving sustainable economic growth.

This current study utilizes World Bank Development Indicators as secondary data, acknowledging potential limitations in accuracy and completeness. While FMOLS and CCR models were applied, the inclusion of sensitivity analyses could offer deeper insights, and variables such as technology adoption and infrastructure quality can be considered. The study's timeframe from 1995 to 2021 captures long-term trends but may overlook recent developments and short-term fluctuations. While this study employs tests designed to capture a single endogenous structural break, future research could further enhance robustness by employing more recent cointegration frameworks that account for multiple structural breaks or smooth transitions using Fourier functions. Generalizing findings beyond Kenya should be approached cautiously due to differing economic structures and policies elsewhere. Additionally, the complex relationships between agricultural exports, agricultural imports, EG, and sustainable development, as well as the broader impacts of agricultural trade policies on social, environmental, and economic dimensions, could be further studied.

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Article Information Form

Conflict of Interest Disclosure: No potential conflict of interest was declared by authors.

Artificial Intelligence Statement: No artificial intelligence tools were used while writing this article.

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