Global Value Chain Participation and Food Security in Sub-Saharan Africa: A Sector Analysis

Kouakou Martinien KOFFI[1]
Yapo Kambo Paul Rodrigue ALLE[2]
Kwami Ossadzifo WONYRA[3]

DOI: 10.24818/mer/2026.02-03

ABSTRACT
This article analyses the effect of participation in global value chains on food security in the region, with a focus on a sectoral analysis of value chains. Using panel data from 26 countries in sub-Saharan Africa over the period 2008-2022 and a dynamic model estimated by the two-stage GMM method, the results obtained reveal that overall participation in value chains, both upstream and downstream, has a positive and significant effect on food security as a whole. However, they do not guarantee the stability of the food supply. In contrast, sectoral value chains reduce the average protein supply, reduce the variability of per capita food supply, decrease the share of energy intake from cereals, roots, and tubers, as well as agricultural value added per worker. Based on these results, the authorities should promote trade policies aimed at strengthening integration into regional value chains while emphasising local processing of products to improve the stability of food supply.

KEYWORDS: *Participation in value chains, food security, dynamic panel*

JEL CLASSIFICATION: *C33, F15, Q18J*

1. INTRODUCTION

Food insecurity is an increasingly critical challenge in the world today, particularly in developing countries, where it poses a direct threat to human life. This phenomenon has intensified since the COVID-19 crisis (Tabe-Ojong et al., 2023). In Africa, the food crisis is reaching an unprecedented intensity, putting millions of people at increased risk of hunger in the near future. This worsening is the result of a combination of exogenous shocks, including the war in Ukraine, persistent conflicts, climate hazards, the global economic slowdown, and the aftermath of the pandemic, profoundly affecting the most vulnerable populations (Darwis et al., 2024). In this context, structural inequalities, particularly social and gender, are reinforced, with women and girls being particularly exposed, illustrating the multidimensional and systemic nature of food insecurity. In addition, Upton et al. (2016) show that food insecurity and malnutrition not only harm health and human development but also affect learning, productivity, and broader economic growth. In light of these findings, food insecurity remains one of the main development challenges in sub-Saharan Africa. African countries, like the international community, have committed to sustainably reduce undernourishment as part of Sustainable Development Goal 2, which aims to end hunger and promote sustainable agriculture. However, the recent succession of global shocks seriously jeopardizes the achievement of the goal of "Zero Hunger" by 2030.

Given the importance of food security, several researchers have focused on its determinants, including openness to international trade. Indeed, many studies highlight that trade openness

[1] Alassane Ouattara University, Bouaké, Côte d'Ivoire, martinienkoffikkm@gmail.com
[2] Alassane Ouattara University, Bouaké, Côte d'Ivoire, paul01alle@gmail.com
[3] University of Kara, Kara, Togo, wonyra.ossa@gmail.com

contributes to improving food security (Gnedeka & Wonyra, 2023; Dithmer & Abdulai, 2017; Baye, 2016; Sibanda, 2015). In a context where production is fragmented and trade is no longer limited to bilateral transactions, the concept of participation in global value chains (GVCs) is emerging as a key analytical framework (Taguchi, 2014). This concept, linked to production segmentation, vertical specialisation and trade in intermediate goods (Amador & Cabral, 2016), offers new insights into the mechanisms through which trade affects food security.

Participation in GVCs can influence food security through a variety of channels. On the one hand, it facilitates technology transfer and innovation. Producers in these chains benefit from access to advanced agricultural techniques and technologies that can increase yields and improve crop quality, thus reducing food insecurity (Giuliani et al., 2005; Montalbano et al., 2018). On the other hand, it stimulates productive diversification, since increased demand within chains encourages farmers to diversify their crops, limiting the risks associated with dependence on a single production and improving nutritional diversity (World Bank, 2018). These mechanisms confirm the idea that better controlled integration into GVCs can be a lever for agricultural modernisation and food resilience.

However, other studies point to the opposite effects. Through the price channel, participation in GVCs can accentuate the transmission of international shocks, exposing producers to global fluctuations (Angelidis & Varsakelis, 2023; Florio et al., 2025). The OECD report (2023) also shows that the globalisation of value chains is creating critical dependencies, especially in food chains, making countries vulnerable to disruptions affecting the world's major producers. Moreover, when the value added is mainly captured by the upstream or downstream segments of the chains, small local producers remain marginalised (Pietrobelli & Rabellotti, 2011). Some studies also find a negative link between trade openness, GVC participation, and food security (Abdullateef & Ijaiya, 2010; Wittman et al., 2010). Thus, integration into GVCs can simultaneously generate opportunities and increase vulnerabilities, posing a real strategic dilemma for African countries. In addition, Songsermsawas et al. (2023) point out that the development of agricultural value chains does not automatically guarantee an improvement in food security, which depends on how the chains are structured and the integration of nutritional components. Similarly, Paul et al. (2024) show that, although increased participation in agricultural GVCs is positively associated with food energy consumption and negatively associated with the prevalence of undernourishment, the effects remain highly heterogeneous across countries' income levels, revealing a structural complexity of the relationship between GVCs and food security.

Therefore, integration into GVCs, through trade, can generate both positive and negative effects on food security and nutrition, both globally and at the national level (Adjaye-Gbewonyo et al., 2019; Dithmer & Abdulai, 2017; Van den Broeck et al., 2018). This lack of theoretical and empirical consensus is reviving the debate, especially in an African context where countries are seeking to strengthen their integration into global value chains. Moreover, the majority of existing work has focused on trade openness or overall participation in GVCs, without taking into account a sectoral analysis of value chains. To address this gap, this article analyses the effect of value chain participation on food security in sub-Saharan Africa, using an explicitly sectoral approach.

This study contributes to the literature for several reasons. First, no research has so far examined this relationship in a targeted way for sub-Saharan Africa, even though integration into GVCs represents a potential lever for transforming food systems. Second, it mobilises a

sectoral analysis of agricultural, manufacturing, mining, and services value chains, in addition to an analysis of overall GVC participation. The study also uses several food security indicators to capture its multidimensional dimension. Thirdly, methodologically, it is distinguished by the use of a panel of 26 countries over the period 2008-2022 and by the application of the GMM method as a two-step system, ensuring a rigorous treatment of endogeneity and a better consideration of the dynamics of food security in the region.

The results show that countries in sub-Saharan Africa need to promote trade policies that facilitate their integration into regional value chains in order to improve food security. More specifically, the authorities should strengthen regional integration policies while giving priority to local processing of products, which is essential for stabilising food supplies. The rest of the article is structured as follows: a literature review, methodology, the results and discussion, and finally, the conclusion.

2. VALUE CHAIN AND FOOD SECURITY: A REVIEW OF THE LITERATURE

Since the work of Smith (1776) and Ricardo (1817), there has been growing interest among researchers in the impact of international trade on various aspects of the economy, including food security. Based on the Heckscher-Ohlin theory, which postulates that countries export goods that make intensive use of their abundant factors of production and import those that require scarce factors. In the context of food security, this theory suggests that each country should identify its comparative advantage in the agricultural sector, draw on its specific resources, and reorient its trade policies to develop its value chains. This would improve food security while reducing dependence on imports. Thus, participation in global value chains (GVCs) in the agri-food sector is increasingly seen as a major driver of economic transformation and food security (Gereffi & Fernandez-Stark, 2016).

In addition, the academic literature shows that participation in GVCs can boost food security and economic transformation through several mechanisms. The income channel allows producers to access more remunerative markets, increase their productivity, and strengthen the purchasing power of rural households (Montalbano et al., 2018). The technology channel promotes the dissemination of standards, innovations, and best practices, boosting agricultural productivity and food availability (Zhang et al., 2023). Empirically, several studies confirm these positive effects. Ndlovu (2022) shows that smallholder farmers integrated into contract chains in Southern Africa have a 15% lower rate of food insecurity, thanks to improved incomes and access to credit. Nugraha et al. (2024), on a panel of developing countries from 1995 to 2019, find that agricultural participation in GVCs significantly improves the overall food security index by increasing total factor productivity and exported value added. Zhang and Sun (2023) confirm that participation boosts productivity, strengthening the domestic food supply.

In addition, GVC integration promotes the transfer of technology, capital, and know-how, boosting productivity and incomes (Montalbano et al., 2018) and enhancing farm income stability and smallholder food security (Swinnen & Kuijpers, 2019; Barrett et al., 2017). Access to global trade networks and higher value-added products allows countries, even with limited resources, to take advantage of globalisation (Swinnen, 2016; Minten et al., 2009; Cattaneo et al., 2013; Swinnen & Vandeplas, 2014). Moreover, when value added is captured mainly by intermediate links or processors, small producers remain vulnerable (Pietrobelli & Rabellotti, 2011). Theoretically, simple GVCs, limited to the export of raw materials, offer few gains in terms of food security, while complex GVCs, integrating processing and

services, allow for better value capture and greater income stability (Montalbano and Nenci, 2022). Countries dependent on imported processed products are also more exposed to global fluctuations and supply disruptions (Gereffi et al., 2021). Paul et al. (2024) highlight that, for lower-middle-income countries, participation can reduce stunting while increasing the prevalence of undernourishment and overweight.

3. METHODOLOGY

3.1 Model Specification

This paper uses an inter-country input-output table (IRP) to estimate the effect of participation in global value chains (GVCs) on food security. Drawing on the work of Gnedeka and Wonyra (2023), we specify and estimate the following model:

$$FS_{it} = \alpha + \beta FS_{it-1} + \gamma GVCs_{it} + \vartheta CV_{it} + \varepsilon_{it} \quad (1)$$

With FS_{it} food security and FS_{it-1} represents its delayed value; $GVCs_{it}$ indicates participation in global value chains; CV_{it} represents a set of control variables and ε_{it} the error term.

3.2 Sources and Description of Variables

The data used in this study are time series covering the period 2008-2022 for 26 countries. The choice of countries and time periods is due to data availability constraints. These come from sources such as the World Development Indicators (WDI), the FAO (FAOSTAT), the UNCTAD (United Nations Conference on Trade and Development) EORA database, WITS-EORA, and the Worldwide Governance Indicators (WGI).

Table 1. Summary of the variables used

Variable	Description	Sources
APS	Average Protein Supply	FOA-STAT
PCFSV	Variability in per capita food supply	FAO-STAT
SDES	Share of energy intake from cereals, roots, and tubers	FAO-STAT
AGR_VA	Agricultural value added per worker	WDI
GVCs	Participation in global value chains	CNUCED-EORA
FVA	Participation in global upstream value chains	CNUCED-EORA
DVA	Participation in global downstream value chains	CNUCED-EORA
AGR_GVC	Agriculture's participation in global value chains	WITS-EORA
MAN_GVC	Manufacturing industry participation in global value chains	WITS-EORA
MIN_GVC	The mine's participation in global value chains	WITS-EORA
SERV_GVC	Participation in service value chains	WITS-EORA
FDI	Inward foreign direct investment inflows as a percentage of GDP	WDI
GDP per capita	Gross domestic product per capita	WDI
Internet	Utilisateur d'internet en % de la population	WDI

Variable	Description	Sources
Population	Total population	WDI
Governance	Good governance score ranges from -2.5 to +2.5	WGI
Political stability	Political stability and absence of violence/terrorism vary between -2.5 and +2.5	WGI

Source: Authors

3.3 Estimating Technique

Estimating equation (1) using the ordinary least squares (OLS) or two-stage least squares (2SLS) method leads to biased and inconsistent estimators, including in fixed-effect or random-effect models. This inconsistency results mainly from the presence of the delayed dependent variable among the regressors, which is usually correlated with the error term. In order to overcome these limitations, this study uses a dynamic model estimated by the generalised moment method in a system. This approach is specifically suited to the analysis of dynamic panel data and is based on the assumption that the data generation process is inherently dynamic, with the current values of the dependent variable influenced by their past realisations. It also makes it possible to take into account the possible correlation between explanatory variables and past or current error terms (Zergawu et al., 2020). In addition, the GMM method is an appropriate framework for dealing with endogeneity problems, when certain explanatory variables are correlated with the error term (Arellano & Bover, 1995; Blundell & Bond, 1998).

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Descriptive statistics reveal a high degree of heterogeneity in sub-Saharan Africa. Food security remains fragile, with a low average protein intake and high variability in supply, reflecting large disparities and vulnerability to shocks. The dependence on cereals, roots, and tubers reflects low nutritional diversification, while agricultural productivity remains very uneven. Finally, participation in global value chains is concentrated and dominated by domestic value added, indicating a predominantly upstream insertion.

Table 2. Descriptive Statistics

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
APS	390	64,51105	15,66601	29,6	110
PCFSV	390	38,80513	31,14355	2	207
SDES	390	60,75683	9,833486	42	82
AGR_VA	390	2191,681	2199,9	289,0703	15513,81
GVCs	285	4067629	1,16E+07	43843,76	6,75E+07
FVA	285	1100624	3573739	18956,13	2,15E+07
DVA	285	6586978	1,69E+07	57116,82	9,44E+07
AGR_GVC	208	0,602601	0,2437365	-0,063	0,891
MAN_GVC	208	0,0615042	0,3257514	-0,5900192	0,6275801
MIN_GVC	208	0,5999519	0,2178397	0,0238024	0,8781561
SERV_GVC	208	0,3946106	0,202638	-0,0088752	0,7441694
FDI	390	4,509823	4,899197	-10,0384	38,9429
GDP per capita	390	2169	2434.619	290.156	11643.5

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
Internet	390	20,58466	18,99565	0,25	75,5
Population	390	28300000	37000000	510336	219000000
Governance	390	-0,6627584	0,5714371	-1,718959	1,150494
Political stability	390	0,2351943	0,0224111	0,192247	0,315434

Source: Authors

4.2 Results and Discussion

Table 3 presents the analysis of the effect of participation in value chains on food security. This assessment uses four indicators: average protein supply (APS), variability in per capita food supply (PCFSV), share of energy intake from cereals, roots, and tubers, and agricultural value added per worker (AGR_VA). In addition, the significance of dependent variables delayed at 1% indicates a strong persistence of food security over time. Overall, our estimates show that overall participation in global value chains significantly improves food security in sub-Saharan Africa. In other words, full integration into GVCs enhances food availability, agricultural productivity, and the protein content of food, confirming the relevance of participation in value chains in the dynamics of food security in sub-Saharan Africa.

This performance can be explained by the fact that integration into value chains provides increased access to technologies, organisational innovations and optimised production practices, which generates productivity gains and improves product quality. These effects promote an increase in agricultural incomes and, therefore, an improvement in food security (Ndubuisi et al., 2025). In addition, the diversification of markets and increased competitiveness brought about by participation in GVCs allows producers to increase their resilience to global fluctuations. These results are in line with the findings of Nugraha et al. (2024), Ndlovu et al. (2022), Reardon et al. (2009), and Swinnen and Kuijpers (2019). However, while GVCs improve food availability overall, they do not guarantee stability of supply, not least because many countries in sub-Saharan Africa remain largely dependent on food imports. This dependence exposes them directly to international disruptions, which can amplify the variability of available supply (Montalbano & Nenci, 2022).

Table 3. Analysis of the Effect of Overall Participation in Global Value Chains on Food Security

	(1)	(2)	(3)	(4)
Variables	**Log (APS)**	**Log (PCFSV)**	**Log (SDES)**	**Log (AGR_VA)**
Log (APS) (-1)	0.203***			
	(0.003)			
Log (PCFSV) (-1)		0.406***		
		(0.000)		
Log (SDES) (-1)			0.778**	
			(0.010)	
Log (AGR_VA) (-1)				0.0664***
				(0.003)
Log (GVCs)	0.0397***	0.333***	0.0014**	0.0782***
	(0.001)	(0.001)	(0.000)	(0.001)
FDI	0.0002***	0.0058***	0.0001***	0.0007***
	(0.000)	(0.000)	(0.000)	(0.000)
Log (GDPcap)	0.0099***	0.427***	-0.0150***	-0.0948***

	(1)	(2)	(3)	(4)
Variables	**Log (APS)**	**Log (PCFSV)**	**Log (SDES)**	**Log (AGR_VA)**
	(0.001)	(0.006)	(0.002)	(0.004)
Internet	0.0005***	-0.0017***	4.22e-05***	0.0035***
	(0.000)	(0.000)	(0.000)	(0.000)
Log (Population)	-0.0805***	0.723***	-0.00631***	-0.0004***
	(0.001)	(0.001)	(0.000)	(0.006)
Governance	-0.0425***	0.0625***	-0.0114***	0.0520***
	(0.000)	(0.002)	(0.001)	(0.002)
Political stability	-0.0684***	1.285**	-0.0230***	-0.143***
	(0.003)	(0.010)	(0.002)	(0.014)
Observations	233	233	233	233
Number of countries	26	26	26	26
No. of instruments	23	21	20	25
AR1 p-value	0.0611	0.0104	0.0040	0.0186
AR2 p-value	0.164	0.0306	0.844	0.434
Hansen p-value	1	0.000	1	1
Sargan p-value	0.992	0.788	0.901	0.999

The symbols ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively

Source: Authors

Table 4 below presents the impact of upstream and downstream participation on food security. Overall, they show that both upstream and downstream participation improves food security, while increasing the variability of per capita food supply. This means that regardless of a country's position in global value chains, they enhance overall food security through improved access to markets, technologies, and contracts (Del Prete et al., 2016).

Table 4. Analysis of upstream and downstream involvement on food security

	(1)		(2)		(3)		(4)	
Variables	**Log (APS)**		**Log (PCFSV)**		**Log (SDES)**		**Log (AGR_VA)**	
Log (APS) (-1)	0.193***	0.0505**						
	(0.002)	(0.023)						
Log (PCFSV) (-1)			0.415***	0.396***				
			(0.000)	(0.001)				
Log (SDES) (-1)					0.786***	0.770**		
					(0.009)	(0.010)		
Log (AGR_VA) (-1)							0.0986***	0.0535***
							(0.004)	(0.003)
Log (FVA)	0.0556***		0.398***		0.0034***		0.0257***	
	(0.002)		(0.000)		(0.000)		(0.001)	
Log (DVA)		0.0091**		0.206***		-0.0049***		0.0839***
		(0.004)		(0.001)		(0.000)		(0.001)
FDI	0.0001***	-7.64e-05***	0.0051***	0.0066***	0.0001***	0.0001***	0.0008***	0.0008***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log (GDPcap)	-0.0210***	0.0450***	0.302***	0.536***	-0.0159***	-0.0115***	-0.0565***	-0.0738***
	(0.000)	(0.001)	(0.003)	(0.009)	(0.002)	(0.002)	(0.004)	(0.004)
Internet	0.0006***	0.0005***	-0.0016***	-0.0018***	7.30e-05***	5.59e-05***	0.0035***	0.00352***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log (Population)	-0.0843***	-0.0701***	0.735***	0.760***	-0.0064***	-0.0044***	0.0162***	-0.0006***
	(0.001)	(0.005)	(0.001)	(0.003)	(0.000845)	(0.000)	(0.006)	(0.005)
Governance	-0.0413***	-0.0095***	0.0621***	0.0651***	-0.0118***	-0.0117***	0.0471***	0.0425***
	(0.000)	(0.003)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)
Political stability	-0.0658***	-0.0585***	1.413***	1.258**	-0.0231***	-0.0239***	-0.132**	-0.156**
	(0.004)	(0.006)	(0.008)	(0.015)	(0.002)	(0.001)	(0.017)	(0.016)
Observations	233	233	233	233	233	233	233	233
Number of countries	26	26	26	26	26	26	26	26
No. of instruments	23	19	22	21	21	21	21	21
AR1 p-value	0.0376	0.003	0.011	0.012	0.003	0.005	0.015	0.025
AR2 p-value	0.171	0.058	0.030	0.030	0.883	0.880	0.283	0.459
Hansen p-value	0.999	1	0.138	1	1	1	1	1
Sargan p-value	0.999	0.994	0.780	0.780	0.899	0.918	0.997	1

The symbols ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively

Source: Authors

The analysis of the effect of sectoral participation in value chains on food security, presented in Table 5, highlights contrasting results. Estimates show that sectoral participation (agriculture, manufacturing, mining, and services) has negative coefficients for all food security indicators. Indeed, sectoral participation in individual value chains reduces the average protein supply (columns 1 to 4), decreases the variability of per capita food supply (columns 5 to 8), reduces the share of energy intake from cereals, roots, and tubers (columns 9 to 12), and weakens agricultural value added per worker (columns 13 to 16). These results are therefore at odds with those obtained for overall participation.

This sectoral reading reveals the tensions characteristic of a structural transformation. The rise of manufacturing and services, or the orientation of agricultural sectors toward export crops, can reduce the local supply of protein products (meat, fish, pulses) and lead to a reallocation of labour away from agriculture, which explains the observed decline in agricultural value added per worker (Montalbano & Nenci, 2022). At the same time, the nutritional transition induced by trade openness and urbanisation characterised by greater availability of processed foods and vegetable oils can reduce the caloric share of cereals without increasing protein intake, resulting in a divergence between caloric diversification and protein depletion (Popkin & Ng, 2022). Moreover, even if sectoral participation may, for reasons of specialisation or export orientation, reduce local production of certain nutritious commodities (animal proteins, food crops), its structural effects, better vertical coordination, greater access to international markets, and more stable incomes tend to make food supply less volatile, more predictable, and more resilient to shocks.

However, reducing supply variability does not guarantee an improvement in nutritional quality or food self-sufficiency. If imported foods or processed foods become dominant, it can lead to an unbalanced diet. This situation underlines the need for sub-Saharan African countries to support their integration into GVCs through policies to diversify local food chains (including proteins, food crops, local processing), secure supply chains, and protect small-scale producers, so that supply stability is accompanied by improved nutritional quality and strengthened food sovereignty.

Table 5. Analysis of sectoral participation on food security (GMM estimation in two-stage system).

VARIABLES	Log (APS)				Log (PCFSV)				Log (SDES)				Log (AGR_VA)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Log (APS) (-1)	0.107**	0.119***	0.102**	0.133***												
	(0.017)	(0.006)	(0.040)	(0.003)												
Log (PCFSV) (-1)					0.401***	0.401***	0.496***	0.456***								
					(0.0105)	(0.029)	(0.013)	(0.008)								
Log (SDES) (-1)									0.657***	0.662***	0.765***	0.689***				
									(0.020)	(0.018)	(0.036)	(0.018)				
Log (AGR_VA) (-1)													0.0901***	0.330***	0.289***	0.161***
													(0.019)	(0.023)	(0.008)	(0.036)
AGR_GVC	-0.307***				-1.954***				-0.044**				-0.0316			
	(0.035)				(0.293)				(0.019)				(0.037)			
MAN_GVC		-0.202***				-1.442***				-0.018***				-0.074***		
		(0.016)				(0.224)				(0.008)				(0.024)		
MIN_GVC			-0.140***				-0.835***				-0.009***				-0.043**	
			(0.026)				(0.098)				(0.005)				(0.017)	
SERV_GVC				-0.170***				-0.192				-0.006***				-0.095***
				(0.013)				(0.317)				(0.002)				(0.032)
FDI	-0.0002**	-0.0002***	-0.0003***	-0.0004***	0.008***	0.013***	0.007***	0.0004***	2.69e-06***	6.80e-06***	-1.32e-06***	4.05e-05***	0.0002***	0.0006***	-0.001***	8.27e-05***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log (GDPcap)	-0.042**	-0.023***	0.0043***	-0.033***	0.964*	0.959*	1.230**	1.422*	-0.0193***	-0.0169***	-0.0029***	-0.0105***	-0.0641***	0.0108***	-0.0555***	-0.0765***
	(0.010)	(0.005)	(0.007)	(0.005)	(0.090)	(0.096)	(0.045)	(0.060)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.005)	(0.001)	(0.014)
Internet	0.0007***	0.0005***	0.0007***	0.0002***	0.0061***	0.0005***	0.0060***	0.0045***	1.17e-05***	3.50e-05***	8.83e-05**	9.75e-07	0.0020***	0.0013***	0.002***	0.0012**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log (Population)	0.0371**	-0.020***	-0.0156**	-0.0237***	0.779	0.407	0.302	0.0996	0.0004***	-0.0085***	-0.0043***	-0.00980**	0.0497**	-0.093**	0.0070**	-0.0085**
	(0.015)	(0.003)	(0.012)	(0.002)	(0.133)	(0.110)	(0.068)	(0.142)	(0.005)	(0.005)	(0.007)	(0.00455)	(0.036)	(0.027)	(0.014)	(0.038)
Governance	0.0092***	-0.0016***	0.0154***	0.0023***	-0.434***	0.0255	-0.179***	-0.237***	0.0038**	0.0048***	-0.0014***	0.0029***	0.0152**	-0.0259***	0.0823***	0.035**
	(0.005)	(0.001)	(0.004)	(0.002)	(0.064)	(0.073)	(0.022)	(0.081)	(0.001)	(0.001)	(0.000)	(0.001)	(0.014)	(0.009)	(0.003)	(0.022)
Political stability	-0.0035**	0.0224***	0.0675**	-0.0462**	1.129	0.939	2.029	1.101	-0.0431***	-0.0387***	-0.0152***	-0.0486**	-0.497*	-0.712*	-0.335**	-0.620*
	(0.016)	(0.006)	(0.018)	(0.014)	(0.187)	(0.490)	(0.107)	(0.230)	(0.007)	(0.007)	(0.006)	(0.013)	(0.079)	(0.050)	(0.036)	(0.085)

VARIABLES	Log (APS)				Log (PCFSV)				Log (SDES)				Log (AGR_VA)			
Observations	157	157	157	156	157	157	157	156	157	157	157	156	157	157	157	156
Number of countries	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
No. of instruments	23	23	23	24	23	21	23	23	23	22	23	23	23	23	23	23
AR1 p-value	0.0317	0.0331	0.0371	0.0475	0.00845	0.0640	0.0129	0.00611	0.00327	0.00272	0.00126	0.00277	0.0317	0.0102	0.0135	0.0129
AR2 p-value	0.452	0.698	0.451	0.801	0.0865	0.0116	0.0719	0.134	0.857	0.778	0.958	0.756	0.0280	0.0434	0.0472	0.0389
Hansen p-value	0.593	0.946	0.801	0.907	0.980	0.963	0.995	0.938	0.978	0.956	1	0.999	0.912	0.999	0.999	0.817
Sargan p-value	0.943	0.990	0.555	0.928	0.474	0.901	0.789	0.495	0.994	0.995	0.995	0.997	0.789	0.466	0.605	0.778

The symbols ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively

Source: Authors

5. CONCLUSION

Food security remains a major concern for sub-Saharan African countries. The objective of this article was to analyse the effect of participation in global value chains on food security in the region, with a focus on a sectoral analysis of value chains. Using panel data from 26 countries in sub-Saharan Africa over the period 2008-2022 and a dynamic model estimated by the two-stage GMM method, the results obtained reveal that overall participation in value chains, both upstream and downstream, has a positive and significant effect on food security as a whole, even if it does not guarantee the stability of the food supply. However, the sector analysis shows that participation in agricultural, manufacturing, mining, and service value chains is associated with negative coefficients for all food security indicators. This divergence between global and sectoral effects underlines the importance of the internal structure of value chains and the low local processing of primary products. Based on these results, the authorities should promote trade policies aimed at strengthening integration into regional value chains while emphasising local processing of products to improve the stability of food supply. Thus, in order to make progress towards the SDG goal of "Zero Hunger", integration into value chains must be accompanied by a strategy for the transformation and promotion of local products.

ACKNOWLEDGMENTS
The authors are indebted to the editor and reviewers for their constructive comments.

REFERENCES

Abdullateef, U., & Ijaiya, A. T. (2010). Agricultural trade liberalization and food security in Nigeria.*Journal of Economics and International Finance, 2* (12), 299.

Adjaye-Gbewonyo, K., Vollmer, S., Avendano, M., & Harttgen, K. (2019). Agricultural trade policies and child nutrition in low-and middle-income countries: a cross-national analysis. *Globalization and health*, *15*(1), 1-17.

Amador, J., & Cabral, S. (2016). Global value chains: A survey of drivers and measures. *Journal of Economic Surveys*, *30*(2), 278-301.

Angelidis, G., & Varsakelis, N. C. (2023). Economic shock transmission through global value chains: An assessment using network analysis. *International Advances in Economic Research, 29*(3), 111-128.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of econometrics, 68*(1), 29-51.

Barrett, C. B., Christiaensen, L., Sheahan, M., & Shimeles, A. (2017). On the structural transformation of rural Africa. *Journal of African Economies, 26*(suppl_1), i11-i35.

Baye, S. R. (2016). *Assessing Trade Liberalisation on Food Security in Sub-Saharan Africa* (SSA) (Doctoral dissertation, University of Ghana).

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of econometrics, 87*(1), 115-143.

Darwis, K., Salam, M., Munizu, M., & Diansari, P. (2024). A review of global research trends on the impact of the COVID-19 pandemic on food security. *Agriculture & Food Security, 13*(1), 43.

Del Prete, D., Magrini, E., Montalbano, P., & Nenci, S. (2016). *Global agro-food value chains: New evidence from SSA.* Food and Agriculture Organization of the United Nations. https://openknowledge.fao.org/items/1fa684fe-2031-4e56-b69b-9e967225b1b7

Dithmer, J., & Abdulai, A. (2017). Does trade openness contribute to food security? A dynamic panel analysis. *Food policy, 69*, 218-230.

Florio, A., Siena, D., & Zago, R. (2025). Global value chains and the Phillips curve: A challenge for monetary policy. *European Economic Review, 174*, 104966.

Gereffi, G., & Fernandez-Stark, K. (2016). *Global value chain analysis: A primer (2nd ed.)*. Duke University Center on Globalization, Governance & Competitiveness. duke.edu

Gereffi, G., Lim, H. C., & Lee, J. (2021). Trade policies, firm strategies, and adaptive reconfigurations of global value chains. *Journal of International Business Policy, 4*(4), 506.

Giuliani, E., Pietrobelli, C., & Rabellotti, R. (2005). Upgrading in global value chains: lessons from Latin American clusters. *World development, 33*(4), 549-573.

Gnedeka, K. T., & Wonyra, K. O. (2023). New evidence in the relationship between trade openness and food security in Sub-Saharan Africa. *Agriculture & Food Security, 12*(1), 31.

Montalbano, P., & Nenci, S. (2022). Does global value chain participation and positioning in the agriculture and food sectors affect economic performance? A global assessment. *Food Policy, 108*, 102235.

Montalbano, P., Nenci, S., & Pietrobelli, C. (2018). Opening and linking up: firms, GVCs, and productivity in Latin America. *Small Business Economics, 50*(4), 917-935.

Ndlovu, P. N., Thamaga-Chitja, J. M., & Ojo, T. O. (2022). Impact of value chain participation on household food insecurity among smallholder vegetable farmers in Swayimane KwaZulu-Natal. *Scientific African, 16*, e01168.

Ndubuisi, G., Mensah, E. B., Avenyo, E. K., & Sakyi, D. (2025). Global value chains and the innovativeness of firms in Africa. *Technovation, 146*(10327), 6.

Nugraha, H., Nurmalina, R., Achsani, N. A., Suroso, A. I., & Suprehatin, S. (2024). Global Value Chain Participation in the Agricultural Sector and Its Impact on Food Security. *International Journal of Sustainable Development & Planning, 19*(10).

Paul Jr, M., Nana, I., Zimmermann, A., & Jafari, Y. (2024). Trends and evolution of global value chains in food and agriculture: Implications for food security and nutrition. *Food Policy, 127*, 102679.

Pietrobelli, C., & Rabellotti, R. (2011). Global value chains meet innovation systems: are there learning opportunities for developing countries?. *World development*, *39*(7), 1261-1269.

Popkin, B. M., & Ng, S. W. (2022). The nutrition transition to a stage of high obesity and noncommunicable disease prevalence dominated by ultra-processed foods is not inevitable. *Obesity reviews, 23*(1), e13366.

Reardon, T., Barrett, C. B., Berdegué, J. A., & Swinnen, J. F. (2009). Agrifood industry transformation and small farmers in developing countries. *World development, 37*(11), 1717-1727.

Ricardo, D. (1817). *Principles of Political Economy and Taxation*, John Murray, London.

Sibanda, O. S. (2015). Trade liberalisation and its impact on food security in Sub–Saharan Africa. *International Journal of Public Law and Policy, 5*(1), 92-107.

Smith, A. (1976). *An inquiry into the nature and causes of the wealth of nations* (R. H. Campbell, A. S. Skinner, & W. B. Todd, Eds.). Oxford University Press/Liberty Fund. (Original work published 1776)

Songsermsawas, T., Mabiso, A., Arslan, A., Chiarella, C., & Savastano, S. (2023). Agricultural value chains and food security in the Pacific: Evidence from Papua New Guinea and Solomon Islands. *Global Food Security, 39*, 100719.

Swinnen, J. (2016). Economics and politics of food standards, trade, and development. *Agricultural Economics, 47*(S1), 7-19.

Swinnen, J., & Kuijpers, R. (2019). Value chain innovations for technology transfer in developing and emerging economies: Conceptual issues, typology, and policy implications. *Food Policy, 83*, 298-309.

Tabe-Ojong, M. P. J., Lokossou, J. C., Gebrekidan, B., & Affognon, H. D. (2023). Adoption of climate-resilient groundnut varieties increases agricultural production, consumption, and smallholder commercialization in West Africa. *Nature Communications*, *14*(1), 5175.

Taguchi, H. (2014). Dynamic impacts of global value chains participation on Asian developing economies. *Foreign Trade Review*, *49*(4), 313-326.

Upton, J. B., Cissé, J. D., & Barrett, C. B. (2016). Food security as resilience: reconciling definition and measurement. *Agricultural economics*, *47*(S1), 135-147.

Van den Broeck, G., Van Hoyweghen, K., & Maertens, M. (2018). Horticultural exports and food security in Senegal. *Global food security*, *17*, 162-171.

Wittman, H., Desmarais, A. A., & Wiebe, N. (Eds.). (2010). *Food sovereignty: Reconnecting food, nature & community*. Fernwood Publishing.

Zergawu, Y. Z., Walle, Y. M., & Giménez-Gómez, J. M. (2020). The joint impact of infrastructure and institutions on economic growth. *Journal of Institutional Economics, 16*(4), 481-502.

Zhang, D., & Sun, Z. (2023). The impact of agricultural global value chain participation on agricultural total factor productivity. *Agriculture*, *13*(11), 2151.

Appendices

Table A1. Correlation matrix (with the APS variable)

Variables	APS	GVCs	FVA	DVA	AGR_GVC	MAN_GVC	MIN_GVC	SERV_GVC	FDI	GDPcap	Internet	POP	Gov	pol_stab
APS	1.0000													
GVCs	0.1487*	1.0000												
FVA	0.1825*	0.9847*	1.0000											
DVA	0.1299*	0.9913*	0.9559*	1.0000										
AGR_GVC	-0.3328*	-0.1465*	-0.2009*	-0.1150	1.0000									
MAN_GVC	-0.0890	0.0884	0.0543	0.0913	0.7265*	1.0000								
MIN_GVC	0.0620	-0.0998	-0.1559*	-0.0709	0.3458*	0.4812*	1.0000							
SERV_GVC	-0.2074*	0.1269	0.0833	0.1401*	0.5204*	0.7952*	0.5939*	1.0000						
FDI	-0.1158*	-0.1892*	-0.1590*	-0.2163*	-0.0321	0.0141	0.1118	0.0261	1.0000					
GDPcap	0.5470*	0.4139*	0.4229*	0.4108*	-0.4526*	-0.1793*	0.0101	-0.0997	-0.1437*	1.0000				
Internet	0.3872*	0.3823*	0.3939*	0.3808*	-0.4609*	-0.2280*	-0.1788*	-0.1494*	-0.1508*	0.5355*	1.0000			
POP	-0.2661*	0.3581*	0.2414*	0.4211*	0.1635*	0.0393	0.0844	0.1226	-0.1743*	-0.1043*	-0,0326	1.0000		
Gov	0.4395*	0.2403*	0.3044*	0.2064*	-0.5614*	-0.4263*	-0.3557*	-0.2856*	-0.0260	0.6037*	0,4869*	-0.2311*	1.0000	
pol_stab	0.0772	-0.1327*	-0.1208*	-0.1465*	-0.1603*	-0.0716	-0.0941	-0.0631	0.0833	-0.0304	0,0199	-0.1786*	0.0351	1.0000

The symbols ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively

Source: Authors

Table A2. Correlation matrix (with the PCFSV variable)

Variables	PCFSV	GVCs	FVA	DVA	AGR_GVC	MAN_GVC	MIN_GVC	SERV_GVC	FDI	GDPcap	Internet	POP	Gov	pol_stab
PCFSV	1.0000													
GVCs	-0.0306	1.0000												
FVA	-0.0791	0.9847*	1.0000											
DVA	0.0120	0.9913*	0.9559*	1.0000										
AGR_GVC	0.1290	-0.1465*	-0.2009*	-0.1150	1.0000									
MAN_GVC	-0.0043	0.0884	0.0543	0.0913	0.7265*	1.0000								
MIN_GVC	0.1648*	-0.0998	-0.1559*	-0.0709	0.3458*	0.4812*	1.0000							
SERV_GVC	0.1501*	0.1269	0.0833	0.1401*	0.5204*	0.7952*	0.5939*	1.0000						
FDI	0.2908*	-0.1892*	-0.1590*	-0.2163*	-0.0321	0.0141	0.1118	0.0261	1.0000					
GDPcap	-0.0659	0.4139*	0.4229*	0.4108*	-0.4526*	-0.1793*	0.0101	-0.0997	-0.1437*	1.0000				
Internet	-0.1393*	0.3823*	0.3939*	0.3808*	-0.4609*	-0.2280*	-0.1788*	-0.1494*	-0.1508*	0.5355*	1.0000			
POP	-0.0358	0.3581*	0.2414*	0.4211*	0.1635*	0.0393	0.0844	0.1226	-0.1743*	-0.1043*	-0.0326	1.0000		
Gov	-0.1047*	0.2403*	0.3044*	0.2064*	-0.5614*	-0.4263*	-0.3557*	-0.2856*	-0.0260	0.6037*	0.4869*	-0.2311*	1.0000	
pol_stab	-0.1806*	-0.1327*	-0.1208*	-0.1465*	-0.1603*	-0.0716	-0.0941	-0.0631	0.0833	-0.0304	0.0199	-0.1786*	0.0351	1.0000

The symbols ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively

Source: Authors

Table A3. Correlation matrix (with the SDES variable)

Variables	SDES	GVCs	FVA	DVA	AGR_GVC	MAN_GVC	MIN_GVC	SERV_GVC	FDI	GDPcap	Internet	POP	Gov	pol_stab
SDES	1.0000													
GVCs	-0.1751*	1.0000												
FVA	-0.2169*	0.9847*	1.0000											
DVA	-0.1573*	0.9913*	0.9559*	1.0000										
AGR_GVC	0.5336*	-0.1465*	-0.2009*	-0.1150	1.0000									
MAN_GVC	0.3727*	0.0884	0.0543	0.0913	0.7265*	1.0000								
MIN_GVC	0.3025*	-0.0998	-0.1559*	-0.0709	0.3458*	0.4812*	1.0000							
SERV_GVC	0.3281*	0.1269	0.0833	0.1401*	0.5204*	0.7952*	0.5939*	1.0000						
FDI	0.1680*	-0.1892*	-0.1590*	-0.2163*	-0.0321	0.0141	0.1118	0.0261	1.0000					
GDPcap	-0.5472*	0.4139*	0.4229*	0.4108*	-0.4526*	-0.1793*	0.0101	-0.0997	-0.1437*	1.0000				
Internet	-0.3733*	0.3823*	0.3939*	0.3808*	-0.4609*	-0.2280*	-0.1788*	-0.1494*	-0.1508*	0.5355*	1.0000			
POP	0.2257*	0.3581*	0.2414*	0.4211*	0.1635*	0.0393	0.0844	0.1226	-0.1743*	-0.1043*	-0.0326	1.0000		
Gov	-0.6343*	0.2403*	0.3044*	0.2064*	-0.5614*	-0.4263*	-0.3557*	-0.2856*	-0.0260	0.6037*	0.4869*	-0.2311*	1.0000	
pol_stab	-0.0751	-0.1327*	-0.1208*	-0.1465*	-0.1603*	-0.0716	-0.0941	-0.0631	0.0833	-0.0304	0.0199	-0.1786*	0.0351	1.0000

The symbols ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively

Source: Authors

Table A4. Correlation matrix (with the AGR_VA variable)

Variables	Vagr	GVCs	FVA	DVA	AGR_GVC	MAN_GVC	MIN_GVC	SERV_GVC	FDI	GDPcap	Internet	POP	Gov	pol_stab
AGR_VA	1.0000													
GVCs	0.1300*	1.0000												
FVA	0.1308*	0.9847*	1.0000											
DVA	0.1390*	0.9913*	0.9559*	1.0000										
AGR_GVC	-0.5437*	-0.1465*	-0.2009*	-0.1150	1.0000									
MAN_GVC	-0.4575*	0.0884	0.0543	0.0913	0.7265*	1.0000								
MIN_GVC	0.0390	-0.0998	-0.1559*	-0.0709	0.3458*	0.4812*	1.0000							
SERV_GVC	-0.3051*	0.1269	0.0833	0.1401*	0.5204*	0.7952*	0.5939*	1.0000						
FDI	-0.0804	-0.1892*	-0.1590*	-0.2163*	-0.0321	0.0141	0.1118	0.0261	1.0000					
GDPcap	0.7309*	0.4139*	0.4229*	0.4108*	-0.4526*	-0.1793*	0.0101	-0.0997	-0.1437*	1.0000				
Internet	0.6013*	0.3823*	0.3939*	0.3808*	-0.4609*	-0.2280*	-0.1788*	-0.1494*	-0.1508*	0.5355*	1.0000			
POP	-0.0323	0.3581*	0.2414*	0.4211*	0.1635*	0.0393	0.0844	0.1226	-0.1743*	-0.1043*	-0.0326	1.0000		
Gov	0.5765*	0.2403*	0.3044*	0.2064*	-0.5614*	-0.4263*	-0.3557*	-0.2856*	-0.0260	0.6037*	0.4869*	-0.2311*	1.0000	
pol_stab	0.0635	-0.1327*	-0.1208*	-0.1465*	-0.1603*	-0.0716	-0.0941	-0.0631	0.0833	-0.0304	0.0199	-0.1786*	0.0351	1.0000

The symbols ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively

Source: Authors

Table A5. Results of the heteroscedasticity test

	Model 1(with the APS variable)	**Model 2 (with the PCFSV variable)**	**Model 3(with the SDES variable)**	**Model 4 (with the AGR_VA variable)**
Statistics	chi2 (12) = 15039.66	chi2 (12) = 422.18	chi2 (12) = 586.26	chi2 (12) = 5112.62
P-value	Prob > chi2 = 0,0000	Prob > chi2 = 0,0000	Prob > chi2 = 0,0000	Prob > chi2 = 0,0000

Source: Authors

Table A6. Results of the autocorrelation test for errors

	Model 1(with the APS variable)	**Model 2 (with the PCFSV variable)**	**Model 3(with the SDES variable)**	**Model 4 (with the AGR_VA variable)**
Statistics	F(1, 11) = 60.134	F(1, 11) = 332.273	F(1, 11) = 172.843	F(1, 11) = 29.582
P-value	Prob > F = 0,0000	Prob > F = 0,0000	Prob > F = 0,0000	Prob > F = 0,0000

Source: Authors