A transnational perspective on real sector performance in sub-Saharan Africa

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Abstract

The consistent growth of the real sector is usually an important requirement for achieving economic development. However, the challenge of growing the real sector is still a source of concern in many sub-Sahara African (SSA) countries. Despite the evidence on the effect of international trade on real sector performance, few studies have considered the effect of social indicators on real sector performance. Therefore, this study investigated the effect of international trade and social indicators on real sector performance in 24 SSA countries for years 1990 to 2023 and panel corrected standard errors estimation was employed. The results showed that manufacturing exports, agricultural raw materials imports, adult literacy rate, and access to electricity had positive significant effect on manufacturing Gross Domestic Product (MGDP). However, government effectiveness index had a negative significant effect on MGDP, and regulatory quality index had a positive insignificant effect. For agricultural Gross Domestic Product (AGDP), agricultural exports and secondary school enrollment ratio had positive significant effects, while political stability index, and urbanization rate had negative significant effects. On the other hand, agricultural machinery imports had positive insignificant effect on AGDP, and level of technology adoption had negative insignificant effect. This study concluded that international trade and social indicators determine real sector performance in SSA. The study recommended growth in exports, greater provision of educational empowerment opportunities, and improved access to electricity in order to enhance real sector performance in the selected SSA countries.

Keywords: Access to Electricity, Adult Literacy Rate, Agricultural Gross Domestic Product, International Trade, Manufacturing Gross Domestic Product, Social Indicators, Sub-Saharan Africa

JEL Classifications: D2, D24, L1, L6, L11, L23, L66, M11, O3, O55, Q01, Q1

1.0 INTRODUCTION

The history of low manufacturing productivity and poor agricultural business among countries in sub-Saharan Africa (SSA), including Nigeria reputed to be her largest economy, would obviously be acknowledged as no news (Charles et al., 2023; Akintunde et al., 2021; Fowowe, 2020; Uddin and Oserei, 2019), but speedy response to these aforementioned concerns is of importance as much has been argued about the necessity for every economy of the world to ensure the availability of staple foods, amidst other consumables requisite in first place to meet local demand/consumption, especially through increasing levels of domestic production (Mwangi et al., 2020; Uddin, 2019a; FAO, 2013). Also, there is need to proffer more insights on how sub-Saharan African countries could further their industrialization objective, given these countries' low level of participation in global trade relations as well as selected issues related to respective local economy. More so, this effort is targeted to help realize not only increase in share of agricultural contribution to total Gross Domestic Product - GDP (thus addressing food shortages, spurring food availability, and supporting significantly industrial productivity growth) but also of manufacturing value added in total GDP to over 10 percent, perhaps ideally over 20 percent. Besides, such an increase would go a long way to notably accelerate achievement of the Sustainable Development Goals (SDGs), more particularly SDGs 2, 8, 9 – zero hunger, economic growth and decent work, and industry, innovation and infrastructure, within the continent Africa (AfDB, 2022; Oyelami et al., 2022; Akintunde et al., 2021; Fowowe, 2020; Signe and Johnson, 2018; Balchin et al., 2016; McKinsey Global Institute, 2016).

In sub-Saharan Africa (SSA) on the one hand, and not withstanding that most countries in this region are known to be agriculture-based, and agriculture accounts for about 32% of their GDP on average (Obiakor et al., 2022; Oyelami et al., 2022; Fowowe, 2020; Mwangi et al., 2020; Zayone et al., 2020; Ajibola, 2016), a vivid observation of countries in this part of the world reveal an evident grappling with instances of food shortages owing to reasons including climate change (rising temperature, desertification, soil aridity), agricultural policy inconsistencies, insecurity and civil conflicts, continued resort to food imports (Charles et al., 2023; Mwangi et al., 2020; Uddin, 2019a). In Nigeria alone, it is asserted that about 26.5 million people grapple with high levels of food insecurity in 2024 (United Capital Research, 2024; Premium Times Newspaper, 2024), with a projection made of 33 million people in 2025 (WFP, 2024). In

addition, worsening the concern is that a notable number of SSA countries still continually neglect the agricultural sub-sector, lag behind in ensuring that there are enough staple foods locally, but gradually are becoming service-oriented countries while the industrial sector remains grossly underdeveloped (Oke et al., 2017; Ekpenyong, 2015; Otaha, 2013; Akinboyo, 2008), and some research results had attested that by 2030, 3.7% of the world's cultivated land, a substantial part of this noted to be among developing economies, will be encroached upon due to urbanization – another threat, amidst others, related to be a potential leading cause of decline in volume of agricultural output (Kang et al., 2023; Deng et al., 2020; Bren et al., 2016).

On other hand, the manufacturing sub-sector in most SSA countries are evident to still be at a 'tutelage stage', making a sub-optimal contribution to total regional output as manufacturing value added contribute on average only 10% of continental GDP and this is unlike in some other developing (BRIC) countries (Brazil, China) or continents such as Asia and Latin America which are far ahead, and with no gain saying its popularly acclaimed less-readiness to support light-goods production (Akintunde et al., 2021; Frankema and Waijenburg, 2018; Signe and Johnson, 2018; Bhorat et al., 2017; KPMG, 2015; Africa Center for Economic Transformation, 2014). SSA's manufacturing sub-sector has been recounted dominated by low-value production of food, beverages, tobacco, textile, clothing and wood, except for some durable and capital goods in only a few countries such as South Africa (Bhorat et al., 2017; KPMG, 2014).

Invariably, the growth of national output (and its sub-components) remains germane and a worthy goal for countries of the world; and the role which international trade could play in this respect cannot be overemphasized. In same vein, the decisive stance to ensure the maximization of gains from trade have overtime continued to dominate the discussions in international economics, and commercial policies even in developing countries are noted to go a long way to foster economic (or industrial or real sector) growth (Akintunde et al., 2021; Dada et al., 2021; Raghutla and Chittedi, 2020; Cetin and Ackrill, 2018; Nasrin and Koli, 2018; Noor and Ramli, 2018). Although, consensus also resonate that robust manufacturing and agricultural sectors – the selected real sector sub-components for this study – are fundamental pathways to economic growth (and development) (Adeyinka et al., 2023; Arazu et al., 2022; Obiakor et al., 2022; Akintunde et al., 2021; Seok and Moon, 2021; Mwangi et al., 2020; Zayone et al., 2020; Veganzones-Varoudakis and Plane, 2019; Ajibola, 2016), still notable is the assertion that these

sub-sectors of a country's economic growth are undoubtedly affected by events unfolding both from the global market (resultantly due to same country's stake or level of participation in international trade) as well as from the local economy (obviously identifiable and measureable in the form of social indicators) (Kang et al., 2023; Uddin, 2019a; Frankema and Waijenburg, 2018).

Moreover in the literature, the studies on the effect of international trade on economic growth have yielded mixed conclusions, that is, an unending debate with conflicting results (Dada et al., 2021; Raghutla and Chittedi, 2020; Noor and Ramli, 2018); and there are paucity of studies that had examined the effect of international trade and social indicators (education, quality of institutions, and quality of business environment) on real sector performance (or more specifically – manufacturing, agriculture) (Adeyinka et al., 2023; Ombuki et al., 2023; Le and Tomasi, 2023; Veganzones-Varoudakis and Plane, 2019; Gong, 2018; Veganzones-Varoudakis and Nguyen, 2018). Furthermore, previous studies that had examined the effect of social indicators on real sector performance had more often considered only one social indicator at a time in a study (Kang et al., 2023; Sekyi et al., 2023; Gomez and Borrastero, 2022; Kim et al., 2021); while still, only a few literature abound respective to SSA countries and of which had focused on the effect of international trade and social indicators on real sector performance, and these rarely updated in time scope to 2023 (Adeyinka et al., 2023; Ombuki et al., 2023; Veganzones-Varoudakis and Nguyen, 2018).

To this end, the objective of this study is to investigate the effect of international trade and social indicators on real sector performance in selected SSA countries. In other words, a pertinent question underlying this research is: to what extent does international trade alongside social indicators affect real sector performance in selected SSA countries? Nevertheless, as responses consequently to fill the aforementioned gaps in the literature, this study provides more evidence on the effect of international trade on national output by analyzing selected real sector sub-components vis-à-vis selected sub-components of total imports and selected sub-components of total exports; aligns with a few previous studies to make suggestion for a multi-faceted focus on determinants of real sector performance by considering selected proxies for international trade alongside proxies for social indicators; underscores the need for a more holistic consideration of local economy situation (utilizing selected proxies for education, quality of institutions, and

quality of business environment) to solicit worthwhile attention towards means for skill acquisition, institutional support for industry, and infrastructure provision; and offer updated evidence, relative to previous studies, on the effect of international trade and social indicators on real sector performance, employing data of selected countries in SSA for the duration 1990 to 2023, on basis of data availability, respectively. The next section of this article details the literature review. The third section recounts the methodology. The fourth section presents the results and discussions, and the fifth section concludes.

2.0 LITERATURE REVIEW

2.1 Conceptual issues

International trade is duly posited to refer to the flow of items across borders of world economies; the purchase and sale of internationally-traded commodities. In other words, international trade would refer to the purchase and sale of commodities or items across borders of world economies; and instead of representation with aggregate proxies, effort is made in this study, and in line with some previous studies (Zayone et al., 2020; Ogbonna, 2015; Sheridan, 2014; Lee, 1995), to adopt the usage of sub-aggregate variables. More so, the proxies suitably adopted (the volume of manufacturing exports, the volume of agricultural exports, the volume of agricultural raw materials imports, and the volume of agricultural machinery imports) are in sync with the peculiarities of sub-Saharan African countries as they are reputed to be popular agrarian exporting nations (with examples of items including cotton, sesame seeds, cocoa) alongside been much imports dependent, both in terms of capital needs and also even in terms of raw materials such as certain agro-allied inputs – chemicals, fertilizers, oils and fats according to the Standardized International Trade Classification (S.I.T.C.) of goods. These proxies in this study for international trade quite frankly reflect these SSA countries' trade relations with the rest of the world, for the exchange of internationally-traded commodities (Frankema, 2023; Arazu et al., 2022; Oyelami et al., 2022; Dada et al., 2021; Edeme et al., 2020; Mwangi et al., 2020; Zayone et al., 2020; Uddin and Oserei, 2019; Signe and Johnson, 2018).

Whereas social indicators represent identifiable factors that reflect the peculiarities of any individual country, nation or economy, and these factors encompass varied categories of interest

including education, fiscal, and business environment (Land and Sirgy, 2021; Wong, 2014; EEA, 2004). Over time, a select number of studies had argued that the abundance of talent reserve, the appropriateness of fiscal incentives, and the availability of infrastructure are notable prerequisites for successful industrial growth (Jadhav and Arora, 2023; Oyelami et al., 2022; Mwangi et al., 2020; AfDB et al., 2017; Egbuche, 2017; Ideozu, 2017; LBS Sustainability Centre, 2017; Ossa and Chang-Tai, 2016; Zhang et al., 2016; Wei and Balasubramanyam, 2015; Dornfield, 2014; Eloot et al., 2013; Peng, 2013; Deloitte China, 2011; Ark et al., 2008), and so in the context of this study, and in line with these previous studies, the case is made for a collaborative focus on indicators that attest of education; education brings to the fore an attention on the means / measure / medium to forming a literate mind, to forming an individual or inhabitant of a country into a literate person, the process to skill acquisition, job-readiness, workplace relevance, or the mental, academic, professional opportunities to equipping an individual for intellectual contribution to output creation or output growth. At the same time, the quality of institutions (drafting / announcement and implementation of policies, level of stakeholders' engagements) evoke interest on actions in polity, industry, and unintended consequences due to regime change / government transition. Although, the quality of business environment concisely solicits the need for a business-friendly atmosphere, strengthened especially by the availability or provision of infrastructure. Consequently, the specific categories of social indicators adopted in this study are the three following: (a) education (with adult literacy rate, secondary school enrollment ratio as proxies), (b) quality of institutions (with government effectiveness index, regulatory quality index, political stability index as proxies), and (c) quality of business environment (with access to electricity, urbanization rate, level of technology adoption as proxies), on basis of data availability.

Notwithstanding, the real sector considered in this study relates to the sector responsible for the production and distribution of goods and services (from a combination of factor resources), and necessary to meet the consumption demand of such economy (Uddin et al., 2025; Ductor and Grechyna, 2015; Oduyemi, 2013). Moreover, the real sector is of two key markets namely: (1) the production factor market and (2) the output market, but the key output market/sectors - the primary sector (particularly amidst others, agriculture) and the secondary sector (manufacturing) (Uddin et al., 2025; Arazu et al., 2022; Uddin et al., 2020; Uddin and Oserei 2019; CBN, 2013; Oduyemi, 2013) are the concern here. The focus on real sector performance in this study, and in

same vein with some previous studies (Frankema, 2023; Akintunde et al., 2021; Mwangi et al., 2020; Signe and Johnson, 2018; Africa Center for Economic Transformation, 2014), is founded on the argument in economic literature that robust manufacturing and agricultural sub-sectors are fundamental sub-components of a nation's non-oil Gross Domestic Product (GDP), due to their vivid testament of contribution to progress in a country seeking industrialization as well as for their huge and notable contribution to the enhancement of economic welfare among the inhabitants of a country.

2.2 Theoretical and empirical review

Furthermore, as a theoretical intuition thereof which underlie this research, inevitably this study however lends credence to the Solow's growth model that indicate the relative importance of the growth of physical and human capital and the growth of total factor productivity (TFP) for output growth (Ombuki et al., 2023; Uddin, 2019b; Veganzones-Varoudakis and Plane, 2019; Evans, 2018; Omojolaibi and Ogbeifun, 2017; Chavula, 2014; Sheridan, 2014; Baier et al., 2006; Gollin, 2002; Lucas, 2000; Solow, 1957). From studies, while the Western countries appear to always have the highest output per worker, other regions seem to fall behind with traces of decreases observed in real output per worker in Latin America and sub-Saharan Africa, and decreases also of total factor productivity (TFP) in sub-Saharan Africa attested, as not necessarily attributable to deteriorating technology, but many other factors including decreases in competition of markets, increases in government regulation, and disruptions in private markets due to armed conflicts (Evrensel, 2002; Easterly, 2001; Carpena and Santos, 2000).

More so, from the plethora of studies that constitute the related literature therein, notable to mention are Bajo-Rubio (2022) whom examined the export-led growth hypothesis using Granger-causality tests in Spain for the duration 1850 to 2020 and thereby affirms the positive effect of exports on economic growth, Maniraguha and Ndemezo (2022) focused on 28 selected sub-Saharan Africa countries between 2004 and 2019 with the Panel Ordinary Least Squares (Panel OLS) found a positive contribution of exports to economic growth, Sheridan (2014) cross-examined a total of 117 developed and developing countries and these for a duration of 50 years (1960 to 2009) utilizing Panel OLS thus reported a claim of validity that manufacturing exports have positive effect on total output growth, while on the contrary Burney (1996) investigated the

export-led growth hypothesis in 89 countries as well as 95 countries respectively for the duration 1965 to 1980 and 1980 to 1990 using OLS and did not find support for the export-led growth hypothesis, and Konya (2006) utilized a sample of the 24 Organization for Economic Cooperation and Development (OECD) countries for years from 1960 to 1997 with Granger-causality tests but did not find support for the export-led growth hypothesis in Australia, Korea, Luxembourg, Switzerland, the UK, and the USA. On the flip side, Osei-Assibey and Dikgang (2020) with the aid of Johansen cointegration, and Granger-causality tests underscored with data on South Africa for the years 1960 to 2018 the importance of imports to economic growth, Raghutla and Chittedi (2020) whom with a cross-country perspective cross-examined the BRICS countries (Brazil, Russia, India, China, and South Africa) and these for the duration of about 40 years (1979 to 2018) using also Johansen cointegration and Granger-causality tests thus reported the import-led growth hypothesis model to be relevant for Russia, and not for other countries considered, but Werner and Olson (2014) whom examined 15 Latin American countries and for the duration 1970 to 2010 adopted Panel cointegration with error correction found generally no support for the import-led growth hypothesis.

Thereof as a pathway to further empirical research and in contrast to a continued focus solely on economic growth, two key sub-sectors or constituents of economic growth (agriculture, manufacturing – jointly referred to in this study as real sector components) were the focus (Adeyinka et al., 2023; Charles et al., 2023; Megbowon, 2016). Zhu (2023) and Pathak et al. (2023) whom examined China and Nepal with the use of Stochastic Frontier Analysis (SFA) and Quantile Regressions respectively attested of the positive effects of trade liberalization on manufacturing productivity; Ombuki et al. (2023) and Adeyinka et al. (2023) whom considered Kenya and Nigeria utilizing Maximum Likelihood Estimation (MLE) as well as Ordinary Least Squares (OLS) and General Method of Moments (GMM) respectively affirmed of the positive effect of export participation, and skills and training on manufacturing productivity, however Augier and Dovis (2013) noted for Spain, having employed Panel OLS, that exporting alone is not sufficient to guarantee success of manufacturing enterprise.

Thence, in a somewhat extensive discourse, Le and Tomasi (2023) established for Vietnam through firm-level data with Panel OLS the positive effect of international trade on industrial activities alongside the distortive effect of certain local market features, while Veganzones-

Varoudakis and Nguyen (2018) whom investigated 70 developing countries (including select number of sub-Saharan Africa – SSA countries) with the use of Principal Component Analysis (PCA) asserted of the role(s) which domestic economy conditions alongside international trade situation could account for manufacturing productivity progress. Be that as it may, as determinants of manufacturing sub-sector performance thereof could be categorized into (a) events related to the global market such as favourable international trade policy, volume of foreign direct investment (FDI), (b) firm-specific and or industry-specific nuances such as firm-level innovation and learning, firm-level heterogeneity (in size, technology adoption, etc.), ease of business entry, degree of market monopoly, and (c) other domestic economy situations such as inflation rate, interest rate, bureaucratic hurdles, business registration bottlenecks, investment climate (infrastructure, information and communication technologies (ICTs), human capacity, political stability, etc.), availability of skilled population, (level or volume of) credit to the private sector, the clamour in literature for a collaborative focus on international trade situation as well as domestic economy situation at any one time to establish supposed determinants of a country's industrial productivity growth thus could be noted (Ombuki et al., 2023; Veganzones-Varoudakis and Plane, 2019; Veganzones-Varoudakis and Nguyen, 2018; Gong, 2018).

Nonetheless, besides other determinants of agricultural sub-sector performance worth mention, Kang et al. (2023), Deng et al. (2020), Bren et al. (2016) with the Spatial Durbin Analysis and Stochastic Frontier Analysis respectively attest of how increased urbanization, especially in Less-Developed Countries (LDCs), deter agricultural activities, investments and growth. Also, the existent linkages thus observed by literature between the enlisted determinants of agricultural growth, amidst other determining factors, for example between (government) agricultural expenditure (or spendings) and fertilizer availability, accessibility and affordability in Manda et al. (2019) using Instrumental Variable (IV) technique, educational attainment and information and communication technologies (ICTs) from Chavula (2014) utilizing Panel OLS, employment in agriculture and favourable land tenure system relative to Oke et al. (2017) with also Panel OLS, amongst other studies thereby portend the argument in literature somewhat for a multi-faceted consideration of social indicators as domestic economy situation measures, rather than focus on a single social indicator as determinant of industrial productivity growth at any one time.

2.3 Implications of the review for the current study

As a result, since the studies on the effect of international trade on economic growth have yielded mixed conclusions (Dada et al., 2021; Raghutla and Chittedi, 2020; Noor and Ramli, 2018) and there are paucity of studies that had examined the effect of international trade and social indicators (education, quality of institutions, and quality of business environment) on real sector performance (manufacturing, agriculture) (Adeyinka et al., 2023; Ombuki et al., 2023; Le and Tomasi, 2023; Veganzones-Varoudakis and Plane, 2019; Gong, 2018; Veganzones-Varoudakis and Nguyen, 2018), even so sparse respective to sub-Saharan Africa and these rarely updated in time duration to 2023, and as previous studies that had examined the effect of social indicators on real sector performance had more often considered only one social indicator at a time in a study (Kang et al., 2023; Sekyi et al., 2023; Gomez and Borrastero, 2022; Kim et al., 2021), this research provided more evidence on the effect of international trade on national output by analyzing selected real sector sub-components vis-à-vis selected sub-components of total imports and selected sub-components of total exports; aligns with a few previous studies to make suggestion for a multi-faceted focus on determinants of real sector performance by considering selected proxies for international trade alongside proxies for social indicators; offer updated evidence, relative to previous studies, on the effect of international trade and social indicators on real sector performance by employing data of selected countries in SSA for the duration 1990 to 2023, on basis of data availability; and underscored the need for a more holistic consideration of local economy situation (utilizing selected proxies for education, quality of institutions, and quality of business environment) to demonstrate them as collaborative determinants of real sector performance and to solicit joint and worthwhile attention towards means for skill acquisition, institutional support for industry, and infrastructure provision, respectively.

3.0 METHODOLOGY

3.1 Theoretical framework

The Solow (1957) growth model as reiterated informed the theoretical intuition to this research, and its testament as illustrated in Mankiw et al. (1992) is by adoption shown below.

With two inputs, capital and labour, and the assumption of a Cobb-Douglas production function, production at time t is given by

$$Y(t) = K(t)^{\alpha}(A(t)L(t))^{1-\alpha} \qquad 0 < \alpha < 1 \quad \ldots\ldots\ (3.1)$$

Where Y is output, K capital, L labor, and A the level of technology. Also, L and A are assumed to grow exogenously at rates n and g:

$$L(t) = L(0)e^{nt} \qquad \ldots\ldots\ (3.2)$$

$$A(t) = A\ (0)\ e^{gt} \qquad \ldots\ldots\ (3.3)$$

Thus, the number of effective units of labour, $A(t)L(t)$, grows at the rate n + g.

As g reflects primarily the advancement of knowledge, which is not country-specific, the $A(0)$ term reflects not just technology but resource endowments, climate, institutions, and so on; it may therefore differ across countries. It is also assumed that

$$\ln A(0) = a + \epsilon \qquad \ldots\ldots\ldots\ldots\ (3.4)$$

Where '*a'* is a constant and 'ϵ' is a country-specific shock, while 'n' in (3.2) however is independent of or unaffected by ϵ.

3.2 Model specification

Therefore, following the aforementioned theory and in line with some previous studies (Ombuki et al., 2023; Veganzones-Varoudakis and Plane, 2019; Evans, 2018), the models estimated for this study are as follows;

$$MGDP = f(MANEX, AGIMP, ADLR, GEI, RQI, ACCEL, FDI, GHEXP, CRPVS) \quad (3.5)$$

Where:

MGDP represents Manufacturing Gross Domestic Product; MANEX represents Manufacturing Exports; AGIMP represents Agricultural Raw Materials Imports; ADLR represents Adult Literacy Rate; GEI represents Government Effectiveness Index; RQI represents Regulatory Quality Index; ACCEL represents Access to Electricity; FDI represents Foreign Direct Investment; GHEXP represents Government Health Expenditure; and CRPVS represents Credit to the Private Sector.

Equation (3.4) is more explicitly written as:

$$MGDP_{it} = \beta_0 + \beta_1 MANEX_{it} + \beta_2 AGIMP_{it} + \beta_3 ADLR_{it} + \beta_4 GEI_{it} + \beta_5 RQI_{it} + \beta_6 ACCEL_{it} + \beta_7 FDI_{it} + \beta_8 GHEXP_{it} + \beta_9 CRPVS_{it} + \epsilon_{it} \quad (3.6)$$

Where, β_0 denotes constant term, β_1-β_9 are the coefficients, and ϵ_{it} is the stochastic error term. The a priori expectation: $\beta_1 > 0$, $\beta_2 < 0$, $\beta_3 > 0$, $\beta_4 > 0$, $\beta_5 > 0$, $\beta_6 > 0$, $\beta_7 > 0$, $\beta_8 > 0$ & $\beta_9 > 0$

In addition,

$$AGDP = f(AGREX, AGMIM, SER, POSTI, URBNR, LETAD, AGRLD, DCPVS, EMAGR) \quad (3.7)$$

Where:

AGDP represents Agricultural Gross Domestic Product; AGREX represents Agricultural Exports; AGMIM represents Agricultural Machinery Imports; SER represents Secondary Enrollment Ratio; POSTI represents Political Stability Index; URBNR represents Urbanization Rate; LETAD represents Level of Technology Adoption; AGRLD represents Agricultural Land;

DCPVS represents Domestic Credit to Private Sector; and EMAGR represents Employment in Agriculture.

Equation (3.6) is more explicitly written as:

$$AGDP_{it} = \alpha_0 + \alpha_1 AGREX_{it} + \alpha_2 AGMIM_{it} + \alpha_3 SER_{it} + \alpha_4 POSTI_{it} + \alpha_5 URBNR_{it} + \alpha_6 LOGLETAD_{it} + \alpha_7 AGRLD_{it} + \alpha_8 DCPVS_{it} + \alpha_9 EMAGR_{it} + d_{it} \quad (3.8)$$

Where, α_0 denotes constant term, α_1- α_9 are the coefficients, and d_{it} is the stochastic error term. The a priori expectation: $\alpha_1 > 0$, $\alpha_2 < 0$, $\alpha_3 > 0$, $\alpha_4 < 0$, $\alpha_5 < 0$, $\alpha_6 > 0$, $\alpha_7 > 0$, $\alpha_8 > 0$ & $\alpha_9 > 0$

3.3 Data and measurement issues

This research thus employed annual panel dataset covering the duration 1990 to 2023, which is, 34 years. The study sample thereof refers to 24 selected countries out of the 48 sub-Saharan African countries based on data availability. The selected countries cover the four sub-Saharan Africa regions – a total number of six countries from each region (Central Africa – Angola, Democratic Republic of Congo, Cameroon, Sudan, Gabon, Republic of Congo; East Africa – Ethiopia, Kenya, Tanzania, Uganda, Mozambique, Mauritius; South Africa – South Africa, Zimbabwe, Zambia, Botswana, Malawi, Namibia; and West Africa – Nigeria, Cote d'Ivoire, Ghana, Senegal, Mali, Burkina Faso).

Although the top six economies from their respective sub-Saharan Africa region, these countries are selected for reasons including their attainment of such height of Gross Domestic Product (GDP) and consequently their being exemplary in the process of realizing industrialization in Africa. Thus, this study demonstrated the use of secondary data, sourced from reputable information depositories as statistical databases, of which are the World Bank Development Indicators (WDI) database, World Bank Governance Indicators (WGI) database, World Integrated Trade Solution (WITS) statistics database (see Tables 3.1 and 3.2).

Table 3.1: Data and measurement issues for Manufacturing sub-Sector Model

Variable	Description	Measurement	Source
Dependent variable			
MGDP	Manufacturing Gross Domestic Product	Manufacturing value added as a percentage of total Gross Domestic Product	WDI 2025
Independent variables			
MANEX	Manufacturing Exports	Manufacturing Exports as a percentage of total merchandise exports	WDI 2025
AGIMP	Agricultural Raw Materials Imports	Agricultural raw materials imports as a percentage of total merchandise imports	WDI 2025
ADLR	Adult Literacy Rate	Literacy rate, adult total (as a percentage of people ages 15 and above)	WDI 2025
GEI	Government Effectiveness Index	Perceptions of the quality of policy formulation and implementation, with 0 corresponding to lowest rank, and 100 to highest rank	WGI 2025
RQI	Regulatory Quality Index	Perceptions of the ability of the government to formulate and implement sound policies, with 0 corresponding to lowest rank, and 100 to highest rank	WGI 2025
ACCEL	Access to Electricity	Percentage of population with access to electricity.	WDI 2025
Other Independent variables			
FDI	Foreign Direct Investment	Foreign direct investment, net inflows as a percentage of Gross Domestic Product	WDI 2025
GHEXP	Government Health Expenditure	Domestic general government health expenditure as a percentage of Gross Domestic Product	WDI 2025
CRPVS	Credit to the Private Sector	Monetary sector credit to private sector as a percentage of Gross Domestic Product	WDI 2025

Source: Authors

Table 3.2: Data and measurement issues for Agricultural sub-Sector Model

Variable	Description	Measurement	Source
Dependent variable			
AGDP	Agricultural Gross Domestic Product	Agricultural value added as a percentage of total Gross Domestic Product	WDI 2025
Independent variables			
AGREX	Agricultural Exports	Agricultural raw materials exports as a percentage of total merchandise exports	WDI 2025
AGMIM	Agricultural Machinery Imports	Agricultural machinery imports	WITS 2025

		product share as a percentage of total machinery imports	
SER	Secondary Enrollment Ratio	School enrollment, secondary (as a percentage of gross)	WDI 2025
POSTI	Political Stability Index	Perceptions of the likelihood of political instability, with 0 corresponding to lowest rank, and 100 to highest rank	WGI 2025
URBNR	Urbanization Rate	Urban population as a percentage of total population	WDI 2025
LETAD	Level of Technology Adoption	Mobile phone subscriptions (per 100 people) - subscriptions to a public mobile telephone service using cellular technology. Post-paid and prepaid subscriptions are included	WDI 2025
Other Independent variables			
AGRLD	Agricultural Land	Percentage of land area, which is estimated as part of the land area that is arable and is under lasting / transitory cropping; lasting / temporary pastures including land under market / kitchen gardening and under temporary fallow	WDI 2025
DCPVS	Domestic Credit to Private Sector	Domestic credit to private sector as a percentage of Gross Domestic Product	WDI 2025
EMAGR	Employment in Agriculture	Employment in agriculture as a percentage of total employment	WDI 2025

Source: Authors

In respect to some of the variables considered for this study, a list of sub-aggregate variables as proxies for international trade was employed in line with some previous studies (Dada et al., 2021; Mwangi et al., 2020; Zayone et al., 2020; Megbowon, 2016; Ogbonna, 2015; Sheridan, 2014; Siliverstovs and Herzer, 2006; Giles and Williams, 2000; Lee, 1995), and this is also argued in the literature suitable to aid a better grasp of the prevailing realities in the understudied economies. The data proxies for international trade are as follows respectively: volume of manufacturing exports and volume of agricultural raw materials imports (related to manufacturing), and volume of agricultural exports and volume of agricultural machinery imports (related to agriculture). Whereas, the data proxies for social indicators include: for education (adult literacy rate, secondary school enrollment ratio); for quality of institutions (government effectiveness index, regulatory quality index, political stability index); and for

quality of business environment (access to electricity, urbanization rate, whereas in respect to level of technology adoption – mobile phone subscriptions (per 100 people)).

The data approach (or empirical strategy) employed in this study – in measure of real sector performance (manufacturing, agriculture) – was partly informed by the perspective that growth in real sector activities is seemingly not all evident from total real Gross Domestic Product (GDP) growth statistics, but rather more evident in monetary worth of output from sub-sectors such as manufacturing, agriculture as well as in their contribution to real GDP over time (Frankema, 2023; Veganzones-Varoudakis and Plane, 2019; Signe and Johnson, 2018).

3.4 Estimation method

A three-step empirical procedure was notably undertaken in this study. The first step – the pre-estimation process include descriptive analytics (or summary statistics), and stationarity / unit root (Levin, Lin and Chu – LLC, and Im, Pesaran and Shin W-stat - IPS, with its cross sectional dependence version i.e. Im-Pesaran-Shin W-stat – CIPS) tests / technique), correlation, co-integration (Westerlund, Pedroni and Kao), and cross sectional dependence (Pesaran's cross sectional dependence – CSD) tests (Oyelami et al., 2022; Akintunde et al., 2021; Dada et al., 2021; Seok and Moon, 2021; Edeme et al., 2020; Mwangi et al., 2020; Pala, 2019; Omojolaibi and Ogbeifun, 2017; Cetintas and Barisik, 2008).

Next was the second step – the estimation process. In line with previous studies such as Adeleye et al. (2023), Oyelami et al. (2022), Akintunde et al. (2021), Dada et al. (2021), Seok and Moon (2021), Mwangi et al. (2020), Omojolaibi and Ogbeifun (2017), Takam et al. (2017), Gollin et al. (2002), Vogel (1994), panel data analysis had been evident to be suited for cross-country empirical studies. Thus, the rationale in this study was to utilize the (static) panel data estimation technique for the analysis of the data collected, in order to proffer answer to the research question. Besides, to use (static) panel estimation method would in no manner be out of order as such still could enable the consideration of country-specific characteristics as well as the absence of serial correlation, heteroschedasticity, and cross sectional dependence. In addition, the static panel data estimation technique was employed because the emphasis of this study is not on dynamics of adjustment, which often calls for dynamic panel data analysis.

More particularly, the Panel Corrected Standard Errors (PCSE) estimation technique was such deemed to be implemented for this study, in first place been that the number of countries to be examined (N) is less than the number of time period to be considered (T) i.e. N < T. Also, in event of no cross sectional dependence among the countries (with whose dataset) to be examined, the Panel Corrected Standard Errors (PCSE) estimation technique has the ability to address serial correlation and heteroschedasticity (Adeleye et al., 2023). Whereas, if cross sectional dependence persist among the countries to be examined (as in respect to their dataset), same Panel Corrected Standard Errors (PCSE) estimation technique has the capability to address all (triple) possibilities of cross sectional dependence, serial correlation and heteroschesdasticity. Notable as well, this (static) panel data estimation technique (or procedure) has the prowess to provide reliable findings, even in instances of both balanced and unbalanced panel dataset, though with no less than 300 observations. Otherwise, an alternative estimation technique – the Driscoll-Kraay Standard Errors (DKSE) panel estimation technique (with capability also to address all (triple) possibilities of cross sectional dependence, serial correlation and heteroschesdasticity) could be utilized. It is no gain saying that the Haussmann test was alongside carried to ascertain the appropriate panel estimation pathway (i.e. whether fixed effect or random effect) to adopt for empirical deductions.

Finally, the third step – the post-estimation process was to undertake autocorrelation/serial correlation, heteroschedasticity tests, amidst others.

4.0 RESULTS AND DISCUSSIONS

4.1 Presentation of results

This section presented the data as well as the regression estimation results deployed to investigate the effect of international trade and social indicators on real sector performance in selected sub-Saharan Africa (SSA) countries. A general examination for the features of the dataset utilized in this study was undertaken to ensure suitability, reliability, and appropriate usage.

Respective to the manufacturing sub-sector model, the descriptive / summary statistics (Table 4.1A.1) show the mean values of Manufacturing Gross Domestic Product (% of Total Gross

Domestic Product) – MGDP, Manufacturing Exports (% of Total Merchandise Exports) – MANEX, Agricultural Raw Materials Imports (% of Total Merchandise Imports) – AGIMP, Adult literacy rate total (% of people ages 15 and above) – ADLR, Government Effectiveness Index – GEI, Regulatory Quality Index – RQI, Access to Electricity (% of Total Population) – ACCEL, Government Health Expenditure (% of Total Gross Domestic Product) – GHEXP, and Monetary Sector Credit to Private Sector (% of Total Gross Domestic Product) – CRPVS were 11.305%, 22.580%, 1.216%, 64.307%, 30.752 percentile rank, 33.438 percentile rank, 40.053%, 1.609%, and 19.219% respectively across the selected SSA countries for the time period under review and these with respective standard deviation values lower than the mean signify that the dataset clustered around the mean, except Foreign Direct Investment, net inflows (% of Total Gross Domestic Product) – FDI with mean 2.633% and standard deviation greater than the mean suggesting variability or susceptibility to fluctuation. To quickly put, an about 3% minimum manufacturing contribution to total Gross Domestic Product, noticeable in select countries such as Angola, Gabon, Republic of Congo, Ethiopia, for the years under review portray the underperformance of the manufacturing sub-sector in the selected SSA countries for this study. Additionally, a minimum value of 13%, 1 percentile rank, 0.9 percentile rank, and 0.5% adult literacy rate, government effectiveness index, regulatory quality index, and proportion of population with access to electricity respectively across the selected SSA countries for the time period under consideration show that more efforts still need be made to leverage the human resources endowed within the selected sub-Saharan Africa countries purposely to support manufacturing sub-sector growth, that paucity of trust in the polity in the selected sub-Saharan Africa countries to formulate appropriate industry-support policies need be acknowledged, that wide-spread conviction of sound policies to drive industry growth has rarely been the case across the selected SSA countries and such disposition need be considered, and that speedy solutions to enhancing electricity distribution and access by the populace need be embarked upon across the selected SSA countries.

The pairwise correlation matrix (Table 4.1A.2) shows no severe cases of correlation, except between GEI and RQI, GEI and CRPVS, RQI and CRPVS. However, it is important to emphasize that correlation is not a standard measure or test of multicollinearity. A further confirmation of the absence of multicollinearity was carried out using the Variance Inflation Factor – VIF analysis, a reciprocal of the Tolerance Level – TOL analysis, as presented (Table

4.1A.3). The mean VIF value 3.49 indicated absence of multicollinearity, as VIF higher than 10.0 signify high multicollinearity (or Tolerance Level above 0.10 is preferred). Evidence of cross-sectional dependence among the variables (Table 4.1A.4) respective to the selected SSA countries for the years under consideration though persists. In Table 4.1A.5, in summary, the variables show integration of mixed order (I(0), I(1)). Meanwhile Tables 4.1A.6 and 4.1A.7 affirmed the existence of longrun relationship between the variables understudied in this research. Whereas, following the panel corrected standard errors (PCSE) estimation (Table 4.1A.8), international trade (in the context of manufacturing exports and agricultural raw materials imports) as well as of the social indicators (adult literacy rate, access to electricity) respective to the selected SSA countries for the time period under review was vivid to have positive efficacy on manufacturing gross domestic product, and this was much in line with the a priori expectation.

In addition, as with the agricultural sub-sector model, the descriptive / summary statistics (Table 4.1B.1) show the mean values of Agricultural Gross Domestic Product (% of Total Gross Domestic Product) – AGDP, Secondary School Enrollment Ratio (% gross) – SER, Political Stability Index – POSTI, Urbanization Rate (% of Total Population) – URBNR, Agricultural Land (% of Total Land Area) – AGRLD, and Employment in Agriculture (% of Total Employment) – EMAGR were 19.464%, 41.131%, 33.050 percentile rank, 39.923%, 44.038%, and 50.231% respectively across the selected SSA countries for the time duration under consideration and these with respective standard deviation values lower than the mean demonstrating that the dataset clustered around the mean, except Agricultural Raw Materials Exports (% of Total Merchandise Exports) – AGREX, Agricultural Machinery Imports share (% of Total Machinery Imports) – AGMIM, Level of Technology Adoption (proxied with Mobile Cellular Subscriptions, per 100 people) – LETAD, and Domestic Credit to Private Sector (% of Total Gross Domestic Product) – DCPVS with mean(s) 7.474% , 11.760%, 46.619, and 22.100% and standard deviation greater than the mean indicating variability or susceptibility to fluctuation.

The pairwise correlation matrix (Table 4.1B.2) shows no severe cases of correlation, except between EMAGR and SER. Nevertheless, it is important to reiterate that correlation may not necessarily be an evidence of multicollinearity. A further confirmation of the absence of

multicollinearity was carried out using the Variance Inflation Factor – VIF analysis, a reciprocal of the Tolerance Level – TOL analysis, as presented (Table 4.1B.3). The mean VIF value 1.62 indicated absence of multicollinearity, as VIF higher than 10.0 signify high multicollinearity. Evidence of cross-sectional dependence among the variables (Table 4.1B.4) respective to the selected SSA countries for the years under consideration though persists. In Table 4.1B.5, in summary, the variables show integration of mixed order (I(0), I(1)). Meanwhile Tables 4.1B.6 and 4.1B.7 affirmed the existence of longrun relationship between the variables understudied in this research. In the meantime, also following the panel corrected standard errors (PCSE) estimation (Table 4.1B.8), international trade (in the case of agricultural raw materials exports) and the social indicators (secondary school enrollment ratio, political stability index, urbanization rate) were revealed to make notable effects on agricultural gross domestic product within the period of time under review in the selected SSA countries, and this as well was in line with the a priori expectation.

Worthy to note also are emphasis that in both context of the manufacturing as well as agricultural sub-sector model(s) (Tables 4.1A.8 and 4.1B.8), F-testparm suggests Fixed Effects Model (FEM) is more efficient than Ordinary Least Squares (OLS); Breusch-Pagan LM test signifies preference for Random Effects Model (REM) over OLS; and Hausmann test favours FEM over REM. Modified Wald test connoted presence of heteroschedasticity, and Woodridge test indicated evidence of serial correlation. Notwithstanding, panel corrected standard errors (PCSE) was employed because it can resolve the cross-sectional dependence, heteroschedasticity, and serial correlation issues present in the models (Adeleye et al., 2023; Reed and Ye, 2011).

4.2 Discussion of findings

The findings from this study reveal that both international trade (manufacturing exports as well as agricultural raw materials imports) and social indicators (adult literacy rate, government effectiveness index, and access to electricity) make significant effect on manufacturing Gross Domestic Product in the sub-Saharan Africa (SSA) countries examined for the years under review. Such thereof show the need for a multi-faceted consideration as to the determinants of manufacturing sub-sector performance in the selected SSA countries. This aforementioned is in line with studies such as Ombuki et al. (2023), Veganzones-Varoudakis and Nguyen (2018). Veganzones-Varoudakis and Nguyen (2018) through the examination of 70 developing countries

over the period 2004 and 2015 using Principal Component Analysis (PCA) attested of the roles which domestic economy conditions and international trade could account for manufacturing productivity progress, while Ombuki et al. (2023) in a country-specific study focused on Kenya for the duration 2007 to 2018 and having utilized Maximum Likelihood Estimation (MLE) reported of the positive effect of export participation and domestic investment climate on manufacturing productivity.

Whereas, the PCSE result (Table 4.1A.8) therein this study affirmed the beneficial stance of manufacturing exports, the notable supplementary role of agricultural raw materials imports to manufacturing industry input needs, and the need for abundance of talent reserve, appropriateness of fiscal incentives, and availability of / accessibility to electricity, all better as jointly needed to ensure growth of manufacturing output in the selected SSA countries. Furthermore, the suggestion for a collaborative consideration of measures of domestic economy situation in a bid to enhance manufacturing output growth seemed obvious. This research showed the possible effect of increased literacy among especially the youth population, alongside prudent formulation of industry-related policies and heightened access to electricity on manufacturing output, and such is related to findings in some previous studies such as Veganzones-Varoudakis and Plane (2019), Adeyinka et al. (2023) whom using a dataset on India for the duration 2013, M6 to 2014, M12 with Principal Component Analysis (PCA) demonstrated the efficacy of literacy, governance, and infrastructure, amidst others, on manufacturing sub-sector growth, and as a Nigeria-focused study with data for the years 2007, 2009, and 2014/2015 used Ordinary Least Squares (OLS) and General Method of Moments (GMM) showed the positive effect of skills and training, infrastructure availability, and fiscal support on manufacturing productivity respectively.

However, in respect to manufacturing exports, Uddin and Oserei (2019), Signe and Johnson (2018), Bhorat et al. (2017), KPMG (2015), African Center for Economic Transformation (2014) had emphasized that more efforts still need to be done to improve its competitiveness relatively to similar output from some other parts of the world by the domiciled manufacturing firms in the examined SSA countries, and in same vein that though agricultural raw materials imports could serve in the interim as evoked by Mwangi et al. (2020), Ogbonna (2015), Ossa (2015), its unsustainable nature depictive in terms of the strain on a country's foreign exchange reserve to

meet her recurring imports financing demands thereby speaks volume for manufacturing firms as well as governments to commit themselves to and or support some form of backward integration plans – the local sourcing of these agricultural raw materials inputs – in the long term as remarked in Uddin (2025), Uddin et al. (2025), Uddin (2023), Uddin and Oserei (2019), Davies (2009).

More so, as with the case of government effectiveness index, Jadhav and Arora (2023), AfDB et al. (2017) asserted the inevitable stance for sound policy formulation on part of all industry stakeholders (Heads of Government, policymakers, industry practitioners so that the manufacturing sub-sector's delimitating effect of possible poor policy formulation for industry growth could be averted. Additionally, as the findings bear resemblance to some previous studies, in the context of access to electricity, Egbuche (2017) had succinctly put that in Nigeria for instance the lack of reliable electricity supply has largely affected textile production, and many manufacturers rely on diesel generators which further increase production costs, thereby aggravating the difficulty for local manufacturers to compete with output from countries like China where power supply is more stable, and as reiterated speedy solutions to enhancing electricity distribution and access need be embarked upon if industrialization is to remain a worthy goal for the selected SSA countries.

On the other hand, the significant effect of international trade (agricultural exports) and social indicators (secondary school enrollment ratio, political stability index, and urbanization rate) on agricultural Gross Domestic Product in the selected SSA countries over the years under consideration, as presented by the PCSE estimation result therein this study, recounted the significant part which the successful trade of agricultural exportables, a more literary-equipped youth populace, prevalent political upheavals, as well as a rapid geographical outflux or sectoral reallocation of potential agricultural labour played for agricultural Gross Domestic Product growth in these countries for the duration of time under review. Such however was associated to a plurality of studies including Kang et al. (2023), Huang et al. (2022), Seok and Moon (2021), Evans (2018), Gong (2018), Barro and Lee (2001), Pritchett (2001).

Seok and Moon (2021) and Gong (2018) with the use of Granger Causality test and Stochastic Frontier Analysis (SFA) for Organization for Economic Cooperation and Development (OECD)

countries and China data respectively for the years 1997 to 2016 and 2004 to 2015 affirmed the positive impact of agricultural exports on agricultural sub-sector growth. Kang et al. (2023) and Huang et al. (2022) also with a dataset on China for the duration 2005 and 2019 and 1996 to 2018 utilized the Spatial Durbin Model as well as the System Generalized Method of Moments (Sys-GMM) raised concerns of the effect of urbanization on agricultural production. More so, Barro and Lee (2001) and Pritchett (2001) in respective cross-country studies made an acclaim of the significant contribution of formal education, especially in rural settings, to agricultural output growth. Evans (2018) with data on 44 African economies between 2001 and 2015 and using Sys-GMM as well related the detrimental role which non-aligned/contentious regime change or recurring instances/cases of policy somersault due to government in transition or country-wide political-related/socio-cultural disturbances could bear for agricultural sub-sector growth.

In view of the foregoing remarks in the literature thereof jointly, it is prudent to note that a non-acknowledgement of both international trade situation and domestic economy situation side-by-side in a bid to identify potent determinants of agricultural sub-sector performance in the considered SSA countries would be an incomplete empirical undertaking. Also, to buttress here, the efficacy shown of the social indicators (secondary school enrollment ratio, political stability index, and urbanization rate) in relation to agricultural Gross Domestic Product from the PCSE estimation result respective to the SSA countries examined during the period of the study confirmed clearly the role which domestic economy situation could portend in respect to agricultural sub-sector growth. Some other studies over time also corroborated the established findings. Reimers and Klasen (2013) with a cross-country focused data for years 1961 to 2002 using Panel OLS found a significant impact of schooling on agricultural productivity. In addition, Deng et al. (2020) with focus on China as well for the duration 2000 to 2014 and having utilized Stochastic Frontier Analysis (SFA) attested of an undesirable effect of urbanization on agricultural Gross Domestic Product, and to this end recounted the need also for Heads of Government, especially in developing countries, and jointly with other industry stakeholders, to tame the possible heightened rural-urban population drift, forestall the mild but eventual unfavourable rural agricultural labour reallocation to urban industrial centres' jobs, and address rural-urban infrastructure distribution disparities/imbalances with dedicated efforts towards infrastructure provision, availability and accessibility, fostering manufacturing-agricultural linkages through industrial/agro-allied and logistics hubs/parks, amidst other options

in a bid to preserve agricultural output growth which could partly ensure food security in respective countries.

Meanwhile, there are some studies such as Edeme et al. (2020), Uddin and Oserei (2019), Ajibola (2016), Sanjuan-Lopez and Dawson (2010), Dawson (2005), and these respective to agricultural exports whom had relayed that in developing countries more efforts need be done to improve its value chain, possibly in the form of output/product rethinking on part of agricultural firms so as to enable access/entry/penetration into new markets and thereby mitigate her exposure to international trade shocks. Besides, as with the established efficacy of secondary school enrollment ratio, the similar view in Barro and Lee (2001) and Pritchett (2001) made note the challenge that the empirical affirmation solicits for Heads of Government and other educational sub-sector stakeholders in developing countries to concentrate more on the means or medium through which her inhabitants are formed into literate persons so as to enable the continued supply of potential productive labour for agricultural sub-sector growth.

4.3 Policy implications

While still, the vivid contributory role of access to electricity to manufacturing Gross Domestic Product from the PCSE estimation result for the selected SSA countries over the duration considered remarkably solicits SSA industry leaders (Heads of Government, policymakers, industry practitioners, and other manufacturing sub-sector stakeholders) in the respective countries to go above and beyond, work jointly, and leverage all possible intra- and inter-continental ties/connections so that through viable partnerships and project implementations such as an increasing number of off-grid power solutions the Mission 300 (Million) African Electrification Agenda pioneered by the World Bank Group and African Development Bank Group would be a reality.

Also, the potent effect of the international trade as well as the social indicators proxies towards manufacturing Gross Domestic Product growth, and somewhat also for agricultural Gross Domestic Product growth, as associated with the selected SSA countries for the time period under review demonstrated the undeniable need for all industry stakeholders in the selected SSA countries to support the momentum and mobilize all resources and enablers to aid the attainment of the High Five Priorities of the African Development Bank (AfDB) for industrialization in

Africa as well as to maximize the potential benefits of the African Continental Free Trade Area (AfCFTA) formed by the African Union for manufacturing and agricultural sub-sectors growth.

Lastly, following the positive testament of adult literacy rate and secondary school enrollment ratio to manufacturing Gross Domestic Product and agricultural Gross Domestic Product in the PCSE estimation results for the selected SSA countries over the period of time under review, the selected SSA countries for this study are encouraged to (further) embrace the Youth Employment and Skills (YES) program already been implemented and efficacious in six SSA countries - Ghana, Cote d'Ivoire, Ethiopia, Niger, Rwanda, and Uganda for improved literacy and eventual industry absorption of participants, especially among SSA youth population.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The empirical account thereof had been purposeful to investigate the effect of international trade and social indicators on real sector performance in selected sub-Saharan Africa (SSA) countries, more particularly for the period 1990 to 2023 – a duration of 34 years.

The findings speak volume that talent reserve, fiscal support and policy implementation, and access to electricity / infrastructure are sine qua non for real sector growth. In addition, the need for a multi-faceted focus as to the determinants of real sector performance is vivid, since international trade if well explored in the form of exportables or product rethinking alongside value chain revamp, amongst other options could further SSA trade competitiveness.

More notably, at this time of the Russian-Ukraine war, popular clamour for firms to align their processes in sinc with the attainment of the Sustainable Development Goals (SDGs), as well as potential benefits accruable from the African Continental Free Trade Area (AfCFTA), the stance for intentional efforts towards successful industrialization both on part of manufacturing and agricultural firms and of governments and other industry stakeholders in the selected SSA countries is obvious as governments and other industry stakeholders in the selected SSA countries now have to take a stand for their onward progress more so as firms now and going forward have to rethink, refine, reposition their processes for growth, relevance, competitiveness,

and sustainability. Hence, meeting domestic as well as international demand now compels more efforts to deepen already existing industrialization initiatives, and to also ensure the enactment and or fruitful implementation of new ones.

5.2 Recommendations

Consequent to the findings revealed in this study, the following remarks/observations/suggestions are of worth to mention.

i. It is affirmed from this study that manufacturing exports, agricultural raw materials imports, agricultural exports made significant positive effect on manufacturing and agricultural GDP respectively across the selected SSA countries and for the time period under review. However, manufacturing and agricultural firms in these selected SSA countries are challenged to greatly increase their manufacturing and agricultural exportables, and to do this could be through more vigorous embrace of sustainable production, amidst other initiatives.

ii. In addition, since access to electricity made a significant positive effect on manufacturing GDP across the selected SSA countries and for the duration under review, appropriate and strategic partnerships and project / policy implementations such as an increasing number of off-grid power solutions, amongst others are solicited for on part of manufacturing sub-sector stakeholders (Heads of Government, policy makers, industry practitioners, other industry stakeholders) in the selected SSA countries.

iii. Lastly, in as much as adult literacy rate as well as secondary school enrollment ratio had significant positive effect on manufacturing and agricultural GDP respectively over the years under review and across the selected SSA countries, a greater provision of educational empowerment opportunities still could be made by educational sub-sector stakeholders to leverage the intellectual power of the SSA youth population for both manufacturing and agricultural sub-sectors' growth in the selected SSA countries through a plurality of formal and out-of-school educational empowerment initiatives. However, these be contemplated in line with respective countries' educational and socio-cultural history. For example, the Bridge Skill program implemented in Kenya; the Youth Employment and Skills (YES) program

implemented in Ghana, Cote d'Ivoire, Ethiopia, Niger, Rwanda, and Uganda; the Empowering Africans through Education Initiative (BeMINT 2.0 program) implemented in Nigeria could be explored in some other SSA countries.

5.3 Suggestions for future research

Also notable are suggestions for future research. First, a further examination of the effect of international trade on national output could be to analyze some other real sector sub-components or some other sub-components of economic growth vis-à-vis selected sub-components of total imports and selected sub-components of total exports. Additionally, an assessment of the combined potency of some other social indicators on some other sub-components of economic growth could be explored. While still, a global cross-country comparative study amongst regions of the world on the effect of international trade and social indicators on real sector performance may be undertaken.

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Table 4.1A.1: Descriptive/Summary Statistics for the Manufacturing Sub-Sector Model

	MGDP	MANEX	AGIMP	ADLR	GEI	RQI	ACCEL	FDI	GHEXP	CRPVS
OBS	729	631	636	148	600	600	694	755	518	774
MEAN	11.305	22.580	1.216	64.307	30.752	33.438	40.053	2.633	1.609	19.219
S. DEV	4.964	22.067	0.737	21.247	20.323	20.336	25.694	4.777	1.091	18.079
MIN	2.541	0.002	0.115	13.000	1.081	0.980	0.534	-17.292	0.062	0.491
MAX	33.346	96.225	4.213	95.000	84.615	86.058	100.00	40.167	5.297	104.89

Authors' compilation, 2025 with Stata 18

Note: Manufacturing Gross Domestic Product (MGDP) Manufacturing Exports (MANEX), Agricultural Raw Materials Imports (AGIMP), Adult Literacy Rate (ADLR), Government Effectiveness Index (GEI), Regulatory Quality Index (RQI), Access to Electricity (ACCEL) Foreign Direct Investment (FDI), Government Health Expenditure (GHEXP) and Credit to the Private Sector (CRPVS).

Table 4.1A.2: Pairwise Correlation Matrix for the Manufacturing Sub-Sector Model

	MGDP	MANEX	AGIMP	ADLR	GEI	RQI	ACCEL	FDI	GHEXP	CRPVS
MGDP	1.000									
MANEX	0.356	1.000								
AGIMP	0.307	0.319	1.000							
ADLR	-0.020	0.523	0.145	1.000						
GEI	0.190	0.796	0.388	0.468	1.000					
RQI	0.234	0.748	0.339	0.392	0.944	1.000				
ACCEL	0.296	0.570	0.165	0.496	0.632	0.610	1.000			
FDI	-0.277	-0.162	-0.008	-0.004	-0.123	-0.121	-0.227	1.000		
GHEXP	-0.099	0.514	-0.179	0.523	0.592	0.546	0.389	0.064	1.000	
CRPVS	0.170	0.700	0.287	0.530	0.828	0.803	0.748	-0.097	0.608	1.000

Authors' compilation, 2025 with Stata 18

Note: Manufacturing Gross Domestic Product (MGDP) Manufacturing Exports (MANEX), Agricultural Raw Materials Imports (AGIMP), Adult Literacy Rate (ADLR), Government Effectiveness Index (GEI), Regulatory Quality Index (RQI), Access to Electricity (ACCEL) Foreign Direct Investment (FDI), Government Health Expenditure (GHEXP) and Credit to the Private Sector (CRPVS).

Table 4.1A.3: Variance Inflation Factor for the Manufacturing Sub-Sector Model

Variable	VIF	1/VIF
GEI	10.53	0.0949
RQI	9.77	0.1023
MANEX	2.20	0.4553
CRPVS	2.04	0.4895
GHEXP	1.95	0.5134
ACCEL	1.58	0.6320
AGIMP	1.25	0.7986
ADLR	1.09	0.9197
FDI	1.04	0.9619
MEAN VIF	**3.49**	

Authors' compilation, 2025 with Stata 18

Note: Manufacturing Gross Domestic Product (MGDP) Manufacturing Exports (MANEX), Agricultural Raw Materials Imports (AGIMP), Adult Literacy Rate (ADLR), Government Effectiveness Index (GEI), Regulatory Quality Index (RQI), Access to Electricity (ACCEL) Foreign Direct Investment (FDI), Government Health Expenditure (GHEXP) and Credit to the Private Sector (CRPVS).

Table 4.1A.4: Cross-Sectional Dependence Test for the Manufacturing Sub-Sector Model

Variables	CD-Test	P-Value
MGDP	-3.334	0.001***
MANEX	17.749	0.000***
AGIPM	15.997	0.000***
ADLR	6.668	0.000***
GEI	74.932	0.000***
RQI	79.731	0.000***
ACCEL	78.128	0.000***
FDI	20.438	0.000***
GHEXP	76.536	0.000***
CRPVS	29.324	0.000***

Authors' compilation, 2025 with Stata 18

***Note:* ***, **, * denote 1%; 5% and 10% significant levels respectively**

Note: Manufacturing Gross Domestic Product (MGDP) Manufacturing Exports (MANEX), Agricultural Raw Materials Imports (AGIMP), Adult Literacy Rate (ADLR), Government Effectiveness Index (GEI), Regulatory Quality Index (RQI), Access to Electricity (ACCEL) Foreign Direct Investment (FDI), Government Health Expenditure (GHEXP) and Credit to the Private Sector (CRPVS).

Table 4.1A.5: Unit Root Test for the Manufacturing Sub-Sector Model

	Level			First Difference			
Variables	**LLC**	**IPS**	**CIPS**	**LLC**	**IPS**	**CIPS**	**Remarks**
MGDP	-2.089**	-1.787*	-1.956	N/A	-6.208***	-5.544***	I(0), I(1)
MANEX	-5.688***	-2.740***	-3.061***	N/A	N/A	N/A	1(0)
AGIMP	-3.754***	-2.733***	-3.401***	N/A	N/A	N/A	1(0)
ADLR	-11.073***	-6.029***	-5.684***	N/A	N/A	N/A	I(0)
GEI	-2.986***	-4.050***	-2.563***	N/A	N/A	N/A	1(0)
RQI	-3.181***	-3.874***	-2.602***	N/A	N/A	N/A	1(0)
ACCEL	0.956	-2.031***	-2.895***	46.095	N/A	N/A	1(0)
FDI	-3.563***	-3.007***	-3.496***	N/A	N/A	N/A	1(0)
GHEXP	-1.028	-1.734*	-2.199**	-9.262***	-5.616***	N/A	I(0), I(1)
CRPVS	-2.429***	-1.520	-2.319***	N/A	-5.683***	N/A	I(0), I(1)

Authors' compilation, 2025 with Stata 18
***Note:* ***, **, * denote 1%; 5% and 10% significant levels respectively**
Note: Manufacturing Gross Domestic Product (MGDP) Manufacturing Exports (MANEX), Agricultural Raw Materials Imports (AGIMP), Adult Literacy Rate (ADLR), Government Effectiveness Index (GEI), Regulatory Quality Index (RQI), Access to Electricity (ACCEL) Foreign Direct Investment (FDI), Government Health Expenditure (GHEXP) and Credit to the Private Sector (CRPVS).

Table 4.1A.6: Kao Test for Cointegration for the Manufacturing Sub-Sector Model

Test	Statistic	P-Value
Modified Dickey-Fuller t	-1.095	0.137
Dickey-Fuller t	-2.449	0.007***
Augmented Dickey-Fuller t	-2.432	0.007***
Unadjusted modified Dickey-Fuller t	-4.037	0.000***
Unadjusted Dickey-Fuller t	-4.053	0.000***

Authors' compilation, 2025 with Stata 18
***Note:* ***, **, * denote 1%; 5% and 10% significant levels respectively**

Table 4.1A.7: Pedroni Test for Cointegration for the Manufacturing Sub-Sector Model

Test	Statistic	P-Value
Modified Phillips-Perron t	4.832	0.000***
Phillips-Perron t	0.402	0.344
Augmented Dickey-Fuller t	1.752	0.039**

Authors' compilation, 2025 with Stata 18
***Note:* ***, **, * denote 1%; 5% and 10% significant levels respectively**

Table 4.1B.1: Descriptive/Summary Statistics for the Agricultural Sub-Sector Model

	AGDP	AGREX	AGMIM	SER	POSTI	URBNR	LETAD	AGRLD	DCPVS	EMAGR
OBS	806	635	746	464	597	816	878	767	688	791
MEAN	19.464	7.474	11.760	41.131	33.050	39.923	46.619	44.038	22.100	50.231
S. DEV	12.282	11.319	13.750	23.836	23.876	16.885	47.103	17.812	26.236	19.794
MIN	1.579	0.000	0.151	5.061	0.472	11.076	0.001	7.783	0.491	5.318
MAX	62.277	88.742	94.712	111.802	93.75	91.029	174.025	84.393	142.422	86.031

Authors' compilation, 2025 with Stata 18

Note: Agricultural Gross Domestic Product (AGDP) Agricultural Exports (AGREX), Agricultural Machinery Imports (AGMIM), Secondary Enrollment (SER), Political Stability Index (POSTI), Urbanisation Rate (URBNR), Level of Technology Adoption (LETAD) Agricultural Land (AGRLD), Domestic Credit to Private Sector (DCPVS) and Employment in Agriculture (EMAGR).

Table 4.1B.2 Pairwise Correlation Matrix for the Agricultural Sub-Sector Model

	AGDP	AGREX	AGMIM	SER	POSTI	URBNR	LETAD	AGRLD	DCPVS	EMAGR
AGDP	1.000									
AGREX	0.296	1.000								
AGMIM	-0.171	0.216	1.000							
SER	-0.778	-0.405	0.260	1.000						
POSTI	-0.458	-0.063	0.069	0.366	1.000					
URBNR	-0.647	-0.268	0.197	0.634	0.152	1.000				
LETAD	-0.455	-0.300	0.111	0.643	-0.004	0.535	1.000			
AGRLD	-0.183	-0.342	-0.133	0.304	-0.137	0.107	0.349	1.000		
DCPVS	-0.667	-0.225	0.353	0.777	0.318	0.418	0.443	0.388	1.000	
EMAGR	0.775	0.212	-0.231	-0.811	-0.377	-0.577	-0.534	-0.278	-0.678	1.000

Authors' compilation, 2025 with Stata 18

Note: Agricultural Gross Domestic Product (AGDP) Agricultural Exports (AGREX), Agricultural Machinery Imports (AGMIM), Secondary Enrollment (SER), Political Stability Index (POSTI), Urbanisation Rate (URBNR), Level of Technology Adoption (LETAD) Agricultural Land (AGRLD), Domestic Credit to Private Sector (DCPVS) and Employment in Agriculture (EMAGR).

Table 4.1B.3: Variance Inflation Factor for the Agricultural Sub-Sector Model

Variable	VIF	1/VIF
EMAGR	2.39	0.4176
DCPVS	2.09	0.4787
URBNR	2.06	0.4863
SER	1.47	0.6804
AGRLD	1.45	0.6882
LNLETAD	1.39	0.7220
POSTI	1.32	0.7582
AGMIM	1.30	0.7691
AGREX	1.16	0.8647
MEAN VIF	**1.62**	

Authors' compilation, 2025 with Stata 18

Note: Agricultural Gross Domestic Product (AGDP) Agricultural Exports (AGREX), Agricultural Machinery Imports (AGMIM), Secondary Enrollment (SER), Political Stability Index (POSTI), Urbanisation Rate (URBNR), Level of Technology Adoption (LNLETAD) Agricultural Land (AGRLD), Domestic Credit to Private Sector (DCPVS) and Employment in Agriculture (EMAGR).

Table 4.1B.4: Cross-Sectional Dependence Test for the Agricultural Sub-Sector Model

Variables	CD-Test	P-Value
AGDP	33.282	0.000***
AGREX	14.655	0.000***
AGMIM	14.633	0.000***
SER	6.808	0.000***
POSTI	64.284	0.000***
URBNR	72.477	0.000***
LETAD	91.34	0.000***
AGRLD	81.259	0.000***
DCPVS	29.443	0.000***
EMAGR	78.031	0.000***

Authors' compilation, 2025 with Stata 18

***Note:* ***, **, * denote 1%; 5% and 10% significant levels respectively**

Note: Agricultural Gross Domestic Product (AGDP) Agricultural Exports (AGREX), Agricultural Machinery Imports (AGMIM), Secondary Enrollment (SER), Political Stability Index (POSTI), Urbanisation Rate (URBNR), Level of Technology Adoption (LETAD) Agricultural Land (AGRLD), Domestic Credit to Private Sector (DCPVS) and Employment in Agriculture (EMAGR).

Table 4.1B.5: Unit Root Test for the Agricultural Sub-Sector Model

	Level			First Difference			
Variables	**LLC**	**IPS**	**CIPS**	**LLC**	**IPS**	**CIPS**	**Remarks**
AGDP	-3.129***	-2.179***	-2.503***	N/A	N/A	N/A	1(0)
AGREX	-4.298***	-2.715***	-3.578***	N/A	N/A	N/A	1(0)
AGMIM	-4.211***	-3.424***	-3.925***	N/A	N/A	N/A	1(0)
SER	-0.750	-2.840***	-3.181***	-13.281***	N/A	N/A	I(0), I(1)
POSTI	-1.926**	-3.491***	-2.293***	N/A	N/A	N/A	1(0)
URBNR	-9.128***	6.479	-1.785	N/A	-0.819	-0.989	1(0)
LETAD	-0.237	-1.390	-1.718	47.654	-1.612	-4.432***	1(1)
AGRLD	25.450	-1.175	-1.707	109.721	-0.163	-2.851***	1(1)
DCPVS	-0.375	-1.331	-1.946	-8.488***	-5.311***	-5.071***	1(1)
EMAGR	25.852	-8.923***	-1.054	242.333	N/A	-3.901***	I(0), I(1)

Authors' compilation, 2025 with Stata 18
***Note:* ***, **, * denote 1%; 5% and 10% significant levels respectively**
Note: Agricultural Gross Domestic Product (AGDP) Agricultural Exports (AGREX), Agricultural Machinery Imports (AGMIM), Secondary Enrollment (SER), Political Stability Index (POSTI), Urbanisation Rate (URBNR), Level of Technology Adoption (LETAD) Agricultural Land (AGRLD), Domestic Credit to Private Sector (DCPVS) and Employment in Agriculture (EMAGR).

Table 4.1B.6: Kao Test for Cointegration for the Agricultural Sub-Sector Model

Test	Statistic	P-Value
Modified Dickey-Fuller t	-9.555	0.000***
Dickey-Fuller t	-7.212	0.000***
Augmented Dickey-Fuller t	-7.286	0.000***
Unadjusted modified Dickey-Fuller t	-11.256	0.000***
Unadjusted Dickey-Fuller t	-7.601	0.000***

Authors' compilation, 2025 with Stata 18
***Note:* ***, **, * denote 1%; 5% and 10% significant levels respectively**

Table 4.1B.7: Pedroni Test for Cointegration for the Agricultural Sub-Sector Model

Test	Statistic	P-Value
Modified Phillips-Perron t	3.021	0.001**
Phillips-Perron t	-5.644	0.000***
Augmented Dickey-Fuller t	-4.904	0.000***

Authors' compilation, 2025 with Stata 18
***Note:* ***, **, * denote 1%; 5% and 10% significant levels respectively**

Table 4.1A.8 Effect of International Trade and Social Indicators on the Manufacturing sub-Sector in selected sub-Saharan Africa countries. Dependent Variable: MGDP

VARIABLES	OLS	FE	RE	PCSE
MANEX	0.0524***	0.0805***	0.0800***	0.0524***
	(0.0126)	(0.0135)	(0.0132)	(0.0096)
AGIMP	0.7837***	0.3232	0.3576	0.7837***
	(0.0220)	(0.2435)	(0.2407)	(0.2090)
ADLR	0.01755**	0.0089	0.0093	0.0176**
	(0.0072)	(0.0058)	(0.0058)	(0.0071)
GEI	-0.0789***	-0.0260	-0.0282	-0.0789***
	(0.0269)	(0.0258)	(0.0255)	(0.0245)
RQI	-0.0437*	0.0073	0.0081	0.0437*
	(0.0251)	(0.0250)	(0.0247)	(0.0236)
ACCEL	0.0503***	0.0379***	0.0398***	0.0503***
	(0.0083)	(0.0095)	(0.0093)	(0.0070)
FDI	-0.0409	-0.0757**	-0.0757**	-0.0409
	(0.0402)	(0.0351)	(0.0348)	(0.0371)
GHEXP	-1.1449***	-0.8239***	-0.8724***	-1.1449***
	(0.2196)	(0.2085)	(0.2047)	(0.1662)
CRPVS	0.0587***	-0.0170	-0.0062	0.0587***
	(0.0145)	(0.0205)	(0.0191)	(0.0114)
Constant	7.4339***	8.7384***	8.5251***	7.4339***
	(0.3652)	(0.4496)	(0.8198)	(0.3097)
Observations	816	816	816	816
Number of c_id	24	24	24	24
R-squared	0.2087	0.5226	0.1000	0.2087
Adj. R-squared	0.1999	0.5031	0.0900	0.1999
F-Statistics	F(9, 806) = 23.62 Prob > F =0.00	F(9, 783) = 9.10 Prob > F = 0.00	Wald $chi^2(9)$ = 89.61 Prob > chi2 = 0.00	Wald $chi^2(9)$=362.50 Prob > chi2 = 0.00
Multicollinearity Test VIF Mean	3.49	-	-	-
F-Testparm	-	F(23, 645) = 22.39 Prob > F = 0.00	-	-
Breusch-Pagan LM Test	-		$Chibar^2(01)$ = 1685.62 Prob>$Chibar^2$ = 0.00	
Hausman Test	-	-	Chi^2 = 301.03 Prob > Chi^2 = 0.00	
Modified Wald Test for Heteroskedasticity	-	$Chi^2(7)$ = 9971.94 Prob > chi^2 = 0.00	-	-
Woodridge Test for Autocorrelation	-	F(1, 23) = 69.329 Prob > F = 0.00	-	-

Authors' compilation, 2025 with Stata 18

Note: **Standard errors in parentheses; ***, **, * denote 1%; 5% and 10% significant levels respectively**

Note: Manufacturing Gross Domestic Product (MGDP) is the dependent variable while Manufacturing Exports (MANEX), Agricultural Raw Materials Imports (AGIMP), Adult Literacy Rate (ADLR), Government Effectiveness Index (GEI), Regulatory Quality Index (RQI), Access to Electricity (ACCEL) are the independent variables with Foreign Direct Investment (FDI), Government Health Expenditure (GHEXP) and Credit to the Private Sector (CRPVS) as the control variables.

Table 4.1B.8 Effect of International Trade and Social Indicators on the Agricultural sub-Sector in selected sub-Sahara African countries. Dependent Variable: AGDP

VARIABLES	OLS	FE	RE	PCSE
AGREX	0.1051***	0.0133	0.0180	0.1051***
	(0.0271)	(0.0196)	(0.0200)	(0.0269)
AGMIM	0.0336	0.0050	0.0096	0.0336*
	(0.0220)	(0.0129)	(0.0132)	(0.0184)
SER	0.0405***	0.0075	0.0042	0.0405***
	(0.0117)	(0.0068)	(0.0069)	(0.0131)
POSTI	-0.0846***	-0.0095	-0.0173*	-0.0846***
	(0.0125)	(0.0095)	(0.0097)	(0.0134)
URBNR	-0.2745***	0.2025***	0.0539	-0.2745***
	(0.0233)	(0.0511)	(0.0456)	(0.0137)
LNLETAD	-0.0763	-0.7210***	-0.5025***	-0.0763
	(0.1099)	(0.0964)	(0.0899)	(0.0776)
AGRLD	-0.0265	-0.1312***	-0.1163***	-0.0265
	(0.0003)	(0.0231)	(0.0226)	(0.0162)
DCPVS	-0.0349**	0.0076	0.0175	-0.0349**
	(0.0146)	(0.0141)	(0.0140)	(0.0147)
EMAGR	0.2024***	0.2092***	0.2324***	0.2024***
	(0.0215)	(0.0323)	(0.0309)	(0.0108)
Constant	22.0117***	6.8904**	10.8808***	22.0117***
	(2.2061)	(3.0929)	(3.2597)	(1.2993)
Observations	678	678	678	678
Number of c_id	24	24	24	24
R-squared	0.6208	0.9039	0.3593	0.6208
Adj. R-squared	0.6157	0.8992	0.3507	0.6157
F-Statistics	F(9, 668) = 121.51 Prob > F =0.00	F(9, 645) = 42.74 Prob > F =0.00	Wald $chi^2(9)$ = 374.67 Prob > chi2 = 0.00	Wald $chi^2(9)$=3942.82 Prob > chi2 = 0.00
Multicollinearity Test VIF Mean	1.62	-	-	-
F-Testparm	-	F(23, 645) = 82.68 Prob > F =0.00	-	-
Breusch-Pagan LM Test	-		$Chibar^2(01)$ = 3556.12 Prob>$Chibar^2$ =0.00	
Hausman Test	-	-	Chi^2 = 39.83 Prob > Chi^2 = 0.00	
Modified Wald Test for Heteroskedasticity	-	$Chi^2(7)$ =13411.04 Prob > chi^2 = 0.00	-	-
Woodridge Test for Autocorrelation	-	F(1, 23) = 11.687 Prob > F = 0.00	-	-

Authors' compilation, 2025 with Stata 18

Note: **Standard errors in parentheses; ***, **, * denote 1%; 5% and 10% significant levels respectively**

Note: Agricultural Gross Domestic Product (AGDP) is the dependent variable while Agricultural Exports (AGREX), Agricultural Machinery Imports (AGMIM), Secondary Enrollment (SER), Political Stability Index (POSTI), Urbanisation Rate (URBNR), Level of Technology Adoption (LETAD) are the independent variables with Agricultural Land (AGRLD), Domestic Credit to Private Sector (DCPVS) and Employment in Agriculture (EMAGR) as the control variables. The level of technology adoption was transformed into natural logarithm since the other variables are in ratios or percentages.