African Journal of Business and Economic Research (AJBER)
(Online) ISSN 1750-4562 (Print) ISSN 1750-4554

Indexed by SCOPUS, UGC CARE List, IBSS, EBSCO, ProQuest, ABDC, SAJE, COPERNICUS, ERIH PLUS, CABELL, Sabinet and J-Gate

Vol. 21, (Issue 1), March 2026

pp 131 - 153

Economic Complexity and Economic Growth Rate in Sub-Saharan Africa

DOI: https://doi.org/10.31920/1750-4562/2026/v21n1a6

[1]Chuma Maxwele
Email: S216765447@mandela.ac.za

[2]Godfred Anakpo
Email: Godfred.Anakpo@mandela.ac.za
&

[3]Syden Mishi
Email: syden.mishi@mandela.ac.za
[1,2&3]Nelson Mandela University, Gqeberha (Port Elizabeth)

Abstract

Producing huge amounts of goods does not necessarily make a country competitive. Rather, what makes a country competitive is its ability to invest in research and development, thereby increasing to increase its level of economic complexity. This study investigates the impact of economic complexity on economic growth rate in Sub-Saharan African countries for the period 1995 to 2022. The study estimated Fixed Effects (FE) and Random Effects (RE) with panel corrected standard errors (PCSE), as well as fully modified least squares (FMOLS) for robustness check purposes. The main results from the models demonstrate that economic complexity negatively impacts economic growth. This implies that the current levels of economic sophistication in Africa are low, and therefore, economic sophistication cannot have an impact on growth. Furthermore, Africa's economic progress is often urban-centric, creating an asymmetric growth model that fails to integrate or uplift rural areas. Hence, the present study suggests that policies must be put in place to ensure the poor have a share in the gains of economic sophistication.

***Keywords*:** *Economic complexity, Economic growth, Sub-Saharan Africa, Panel Corrected Standard Errors*

1. Introduction

Geographers often seek to classify places using various scales of development, usually dividing them into "developed" and "developing," "first world" and "third world" countries or "core" and "periphery (Jacobs, 2023). This separation has prompted the study to ask why some countries are poor while others are rich. Following Wolla (2017) and Hausmann, Yildirim, Chacua, Hartog, and Matha (2024), divergent national growth rates are primarily driven by variations in factor endowments and the relative productivity of labour and capital. This point is well articulated by Escobari (2013) that before the industrial revolution took place, the disparities in per capita incomes between high-income countries and low-income countries was a factor of four. However, that factor today is greater than 100. Consequently, a divergence has emerged between nations that have successfully implemented structural bridging mechanisms and those that remain trapped in developmental stagnation. Put simply, a higher productivity rate leads to a higher economic growth rate, which in turn allows a country to escape poverty. On the other hand, the new school of economics, known as "economic complexity," pioneered by Hidalgo and Hausmann (2009), indicates that cross-country income differences among countries and economic growth rates are explained by economic complexity. In other words, the differences in both developing and developed countries occur because of differences in economic complexity. According to Inoua (2021), developed countries produce different types of products, which range from unsophisticated to highly sophisticated products, while developing countries produce comparatively fewer and more unsophisticated products. Mealy, Farmer, and Teytelboym (2019) and Uribe (2025) confirm that economic complexity serves as a definitive metric for identifying the specific productive capabilities that differentiate developed economies from their developing counterparts.

However, outside of South Africa and Mauritius, African economies have largely failed to achieve structural transformation, remaining reliant on raw material exports while other developing regions have pivoted toward high-value manufacturing (Ajakaiye and Jerome 2013). A report by the United Nations on Trade and Development [UNCTAD] (2022) reveals that Sub-Saharan Africa is among the least diversified regions in the world regarding exports. The primary products (commodities) account for more than 60 per cent of the productive structure in Sub-

Saharan Africa, which leaves the region highly vulnerable to global shocks (Breitenbach, Chisadza, and Clance, 2022). Like many developing countries, Sub-Saharan Africa is in dire need of sustainable growth; hence Anyanwu (2014) is of the view that such growth is a precondition for broader development as it enlarges the scope for the masses to be productive and creative. Furthermore, it makes it possible to achieve some other important objectives, such as the creation of resources to support education, health care, and other important Millennium Development Goals (MDGs). However, there is growth in Africa, but it reflects an unsustainable growth. According to the African Capacity Building Foundation [ACBF] (2017), Sub-Saharan Africa has been benefiting from strong economic growth since the year 2000. Following Asia, the region has been the second-fastest-growing region in the world. However, the economic growth has failed to improve the standard of living, reduce the number of people living under the poverty-line, or reduce unemployment rates in the region. Ndulu, Chakraborti, Lijane, Ramachandran, and Wolgin (2007) postulate that Africa's sluggish growth when compared to other regions, has been singled out as one of the reasons the region is lagging in eradicating poverty. Since the 1960s, the income per capita grew at about one-fifth of the average rate for other developing countries. Although the per capita incomes for Africa and East Asia were at par during the 1960s, in the year 2003 the GDP per capita of East Asian countries was five times higher than that of Africa.

The East Asian 'miracle' was underpinned by developmental statism; governments assumed a proactive role in directing economic growth, identifying market failures in resource allocation, and deploying strategic interventions to catalyse industrialisation. Furthermore, government interventions were also used to pick winners in the manufacturing sector. The main goal for this action was to promote cooperation and competition among firms, which later led to industrialisation (Park, 2002). Hence Gala, Rocha, and Magacho (2018) document that economic complexity reinforces a structuralist approach because structuralism states that industrialisation is a necessary precondition for increasing productivity and income per capita, employment and consequently poverty reduction. The approach states that economic development is predicated on the structural reallocation of resources from low-productivity activities to high-productivity sectors, where increasing returns to scale can be leveraged to drive exponential growth.

The seminal work of Hidalgo, Klinger, Barabási and Hausmann (2007) states that countries can only grow their economies by continuously upgrading the type of products they produce and export (i.e., not producing the same product over and over), and that technology, capital, institutions and skills needed to produce those new products can be more easily adapted from some products than others. Thus, "economic complexity" is a new concept in economics literature, which, according to Gnangnon (2021), relies on the premise that productive knowledge of a country is embedded in domestically produced goods and the sophistication of exported products. Which is why Hidalgo and Hausmann (2009) assert that economic complexity plays the role of a significant promoter of the wealth of nations, and it also explains the divergence in the rates of economic growth among countries. The point is strengthened by Zhu and Li (2017), who assert that high-income countries have a higher economic complexity than low- and middle-income countries; moreover, products produced by high-income countries are difficult to imitate. Furthermore, Mishra, Tewari and Toosi (2020) postulate that countries specialising in sophisticated, high-productivity tradeable goods achieve superior economic performance, underpinning the robust correlation between per capita income and economic complexity. For instance, high-income countries like Italy, Germany and Switzerland have a higher GDP per capita and a high economic complexity index. Contrarily, low-income countries like Angola, Haiti or the Bahamas have the lowest GDP per capita as well as a low economic complexity index.

Molele and Ncanywa (2022) examined the association between economic complexity and GDP per capita on selected Sub-Saharan African countries as well as in BRICS countries. Despite regional growth, Sub-Saharan Africa's GDP per capita continues to trail far behind major global economies, highlighting a failure to achieve income convergence. They further point out that this should be attributed to the economic complexity index, which is less than zero (i.e., Sub-Saharan African countries are less developed). According to Rey and Deisting (2012), this answers the question of why there has been no convergence among 53 African countries (1950-2008). These countries have remained relatively poor, stuck in a poverty trap, while countries with the same initial conditions (such as East Asian countries) have converged. Hence, Anyanwu (2014) is of the view that African countries can learn a thing or two from East Asian countries, especially China, whose economic growth has translated into remarkable improvements in the standard of

living. Crucially, at the commencement of China's structural transformation in 1978, its per capita income was merely one-third of the Sub-Saharan African average, highlighting the magnitude of its subsequent economic divergence. However, within 30 years, China managed to transform its economy and has reached an upper-middle-income status. In doing so, the country managed to lift more than half a billion of the population out of poverty. The success story of China is inspirational, and African countries can learn a lot from it. Nevertheless, the African Development Bank [AfDB] (2023) reveals that African countries demonstrated growth in 2022, and the outlook is stable for 2023 and 2024. The GDP growth for African countries is projected to average 4 per cent in 2023 and 2024, which is higher than the projected world averages of 2.7 per cent and 3.2 per cent respectively. The question remains: can this quantitative economic expansion be successfully converted into a qualitative enhancement of human welfare across Sub-Saharan Africa?

The above discussion shows that natural resource-led economic growth in Sub-Saharan African countries has occupied the body of knowledge. The empirical literature further points out that productive structures must be transformed in Africa for economic growth to have an impact on development. However, what the literature is not highlighting is that "economic complexity" *does not fall from the sky*; it depends on foreign direct investment (FDI) (i.e., fixed capital formation), and Africa has not received much FDI. East Asian (including Japan) countries were able to transform their economies because of the investment they received from Western countries. The economic complexity approach theory is based on the method of "relatedness." According to Hidalgo (2021), relatedness measures the affinity between locations and activities, while it can also be defined as a predictor of changes in specialisation. Sub-Saharan African countries have a comparative advantage in the production of natural resources because they have them in abundance. Thus, Sub-Saharan Africa, by its very nature, cannot be expected to "leapfrog" economic growth as suggested in the empirical literature because of where it is situated in the "product space." Asian countries had to learn from Western countries through foreign direct investment. With that being stated, the following section delves deeply into the relevant concepts/approaches and theories of economic complexity and economic growth.

2. Literature Review

2.1. Theoretical Literature

According to Stojkoski and Kocarev (2017), economic complexity focuses on the intangible assets of an economy; it suggests that a nation's wealth is stored in the sophistication of the output it is capable of generating. The productive structure reveals the productive capabilities (i.e., productive knowledge a country possesses) that an economy has. On the other hand, Koch (2020) believes countries can only be categorised as complex economies if their productive structures are diverse and if they export less ubiquitous products and more un-ubiquitous products. This approach relies on the "know-how" (i.e., an amount of knowledge) that a country possesses, which influences the economic performance of a country. Hence, Inoua (2021) postulates that it is possible to infer an amount of knowledge in an economy from its product diversification. The process can be framed within network theory as a tripartite model, mapping the interdependent linkages between nations, the products they manufacture, and the specific productive capabilities required to sustain that output.

Hidalgo and Hausmann (2009) posit that nations performing below their capability-adjusted income potential should focus on diversifying into all products that are technically feasible within their extant capability endowment. When they follow that route, those countries would be able to grow more quickly, relative to countries that can only grow by accumulating new productive capabilities. Furthermore, the authors suggest that the incentive to accumulate those new capabilities would depend, among other things, on the demand that the new capabilities would face, while at the same time, this would depend on how the new capabilities complement the existing capabilities to create new products.

The economic complexity approach is reinforced by structuralism, wherein industrialisation is regarded as a precondition for growth to take off, and as stated by Hidalgo and Hausmann (2009), countries should start by producing products that are feasible within their existing productive capabilities (i.e., comparative advantage); if they do, they are likely to grow quickly. Thus, in a general sense, Kanbur (2017) and Pinheiro (2025) are of the view that classically, structural transformation reflects a shift of the population from a low productivity sector to a high productivity sector. Moreover, the evolution of productivity within these sectors, for instance, changing the commodity mix through learning by doing, has generally been the focus in recent literature. However,

traditionally, industrialisation begins with an imperfect economy, like having labour in different sectors and then proceeds with a shift of this labour from a low productive sector to a high productive sector (Kanbur, 2017; and Pinheiro, 2025).

This is well articulated in Lewis's (1954) classical model, which many economies begin with an unlimited supply of labour that is available at a subsistence wage. Here, the main sources from which workers come as economic development proceeds are subsistence agriculture, casual labour, petty trade and domestic service. In most cases in these sectors, when the country has a higher population growth relative to its natural resources, then the marginal productivity of labour is zero or even negative in some cases. Because of the unlimited supply (with wages being constant) of labour that is available for employment, there is an increase in profits and accumulation of capital. Then, capital formation and technical progress will increase the share of national income. What this model means is that changes in the population will have an impact on the income distribution. Kanbur (2017) is of the view that this process ends when a certain amount of labour has been pulled out of the agricultural sector, and the labour supply is no longer unlimited. As the surplus labour in the agricultural sector is absorbed by industrial expansion, wages will eventually converge, reaching a structural turning point where agricultural pay scales equalise with those in the modern industrial sector. When that happens, then the "Lewis turning point" has been reached.

However, two scholars, Kuznets (1955) and Rostow (1959), took a different approach to economic growth when they independently developed stages of economic development. Both asked two different questions about economic growth, and they both reached simple theories to answer their questions. Kuznets sought to understand the structural drivers of inequality, specifically why the benefits of growth are shared equitably in some economies but lead to widening disparities in others. On the other hand, Rostow asked what drives the movement of a population from living and working in rural areas to urban cities? Kuznetz (1955) answers his question through simulations, which capture the essence of modern developments. He stated that economic growth in developed countries occurs because of a shift away from agriculture, a process which is usually known as industrialisation and urbanisation. In this model, the income distribution of the total population may be viewed as a combination of the income distributions of both the rural population and the urban population. A conclusion that can be reached

from this theory is that, if all other factors remain constant, an increase in the weight of the urban population means an increase in the share of the more unequal of the two-component distribution. On the other hand, Rostow (1959) answered his question by proposing a model of economic history, into which countries pass through a series of stages to develop. These are defined as stages of economic growth, comprising five distinct phases: the traditional society, the preconditions for take-off, the take-off, the drive to maturity, and the age of high mass consumption.

An implication that can be made from these theories is that for a country to develop its economy, it must start somewhere. For developing countries, it can be the production of products that are feasible within their existing productive capabilities, a shift away from agriculture, the traditional society stage of growth or a precondition for the take-off stage. Nevertheless, most Sub-Saharan African countries have surpassed the primitive stages of growth, but they are struggling to industrialise their economies because of the low rate of capital formation, which is essential in developing economic complexity.

3. Empirical Literature

Stojkoski and Kocarev (2017) examined the relationship between growth and economic complexity in South-Eastern and Central Europe using panel data, and the methods of estimation employed are panel dynamic ordinary least squares (DOLS) and generalised method of moments (GMM). The empirical results indicate that economic complexity serves as a statistically significant, long-term determinant of economic growth, establishing it as a critical predictor of a nation's future prosperity. In the short-run the results show that economic complexity has no effect on economic growth. Canh and Thanh (2022) investigate the dynamics of export diversification, economic complexity and economic growth cycles with a panel data set of 70 economies from 1996 to 2014. The method of estimation is the Granger causality test, and the results reveal that there is bi-directional causality between economic complexity and export diversification, but unidirectional causality running from economic complexity to economic growth cycles. The results from the three-stage least squares estimates indicate that economic complexity has negatively impacts economic growth cycles.

Chávez, Mosqueda, and Gómez-Zaldívar (2017) use information on the productive structure of Mexican states to calculate the measure of economic complexity. This is done using the method of reflections as proposed by Hidalgo and Hausmann (2009). The study's results reveal

that the states of Mexico differ markedly in terms of the activities they specialise in and in terms of their economic complexity. The regional pattern among these states shows that northern states (i.e., found close to the borders of the United States of America) are more complex, while central states show an intermediate level of economic complexity, but states in southern Mexico display a low level of economic complexity. Another research study by Gómez-Zaldívar, Fonseca, Mosqueda and Gómez-Zaldívar (2020) studies the spill-over effects of economic complexity on the GDP per capita growth rates of Mexican states from 1993 to 2013. They do this by quantifying the indirect effect of economic complexity based on 'economic complexity' as an important factor in explaining GDP growth rates, and there is a clear regional pattern in the economic complexity of Mexican states. The results of the study show that the estimated positive spill-over effect of economic complexity on growth is not negligible, especially for the northern states, whose own economic complexity is as important as that of their neighbours. However, the results also reveal that the spill-over effect of economic complexity is negative in the southern states. Furthermore, a time-series study was conducted by ErKan and Yildiricimci (2015) on Turkey's economic complexity and export competitiveness. The results of their study indicate that Turkey has a low share of high-tech exports, which causes Turkey to have a relatively low economic complexity index and a low level of export competitiveness, which means that Turkey is below the level it should be.

Shahzad, Madaleno, Dagar, Ghosh, and Dogan (2022) explore the role of export product quality and economic complexity for the economic progress of developed economies in 28 OECD (Organisation for Economic Co-operation and Development) countries from 1990 to 2019. In doing so, their study employed fully modified ordinary least squares (FMOLS) and dynamic ordinary least squares (OLS) estimation techniques. The result of their study indicates that export quality and financial development have a positive and significantly strong impact on economic growth in the long-run. Molele and Ncanywa (2022) provide a comparative analysis of the effects of economic complexity on the performance of selected Sub-Saharan African and BRICS (Brazil, Russia, India, China, and South Africa) countries. Their study employed panel data spanning from 1994 to 2018 with the autoregressive distributive lag (ARDL) model as a method of estimation. The results of the study indicate that there is a positive relationship between economic complexity and economic performance for both Sub-Saharan African

and BRICS countries in the long-run. The short-run dynamics show that economic complexity is not significant for both Sub-Saharan African and BRICS countries.

Nguéda and Kelly (2022) sought to explore a connection between economic complexity and foreign direct investment (FDI) in Sub-Saharan Africa from 1998 to 2019, using ordinary least square (OLS) as a method of estimation. The analysis reveals that in Sub-Saharan Africa, foreign direct investment has a positive and significant impact on economic complexity. This means that FDI is a foundation for economic complexity. Ncanywa, Mongale, Ralarala, Letsoalo, and Molele (2021) investigated the impact of economic complexity on income inequality in selected Sub-Saharan African countries from 1994 to 2017. Their study utilised autoregressive distributed lag (ARDL) as a method of estimation. The main results of the study show that economic complexity can be used to reduce income-inequality differences in Sub-Saharan Africa. Beyene (2024) examined the effect of economic complexity on income inequality in 24 African countries between 2000 and 2018, with the generalised method of moments (GMM). The study reveals that economic complexity significantly increases income inequality in Africa. While Mesagan and Vo (2024) examined the importance of economic complexity on the resource-led growth in 28 African countries, using the pool mean group (PMG) as method of estimation. The results of the show that economic complexity has a negative impact on growth in the short-run, but the impact is positive in the long-run. An inference that is made from their study is that economic complexity can be used as a channel for promoting long-term resources in African countries. Tabash, Mesagan, and Faroq (2022) examined the dynamic linkage between natural resources, economic complexity and economic growth in 24 African countries for the years 1995 to 2017, with GMM as a method of estimation. The study reveals a dichotomy in growth drivers: while natural resource rents exert a negative pressure on economic expansion, economic complexity demonstrates a robust and statistically significant positive correlation with long-term growth. Their results further reveal that economic complexity has a positive impact on natural resources.

The above literature attempted to examine the effect of economic sophistication on economic growth. While there is a lack of literature on this field, the evidence seems to be pointing in the same direction that economic complexity does have a significant effect on economic growth in higher-income countries. However, the diminutive literature reveals that economic sophistication lowers growth in African countries,

implying that this area is insufficiently researched. Thus, the objective of this research is to examine the effect of economic complexity on economic growth in Sub-Saharan African countries. Previous studies have utilised GDP and GDP per capita as proxies for economic growth. According to the World Bank (2025) Gross domestic product (GDP) refers to the sum of the gross value added by all resident producers in the country, plus product taxes, and subtracting any subsidies that were not included in the value of the product. While GDP per capita refers to the gross domestic product, which is divided by the mid-year population of a country. However, this study differs in its approach and uses an actual *economic growth rate*, which is calculated based on the rate of change of real GDP. Thus, it will contribute to the body of knowledge, especially in the context of Sub-Saharan Africa, where there is limited research in the field.

4. Method

4.1. Data

To examine the association between economic complexity and economic growth in 27 Sub-Saharan African countries for the years 1995 to 2022 (It should be noted that study utilises an unbalanced panel data, as a result EViews Software transformed the data into 24 countries instead of 27), the study employs exploits fixed effects (FE) and random effects (RE) with panel corrected standard errors (PCSE) as well fully modified least squares (FMOLS) for robustness check purposes. To examine the effect of economic complexity on economic growth, the study employs annual data sourced from the following databases. The main explanatory variable, economic complexity index (ECI) has been sourced from the Atlas of Economic Complexity database/Harvard Growth Lab [https://atlas.cid.harvard.edu/rankings]. The measure of the ECI was pioneered by Hidalgo and Hausmann (2009), using an HS (Hamornised System) data classification, which covers approximately 5000 products across 10 categories from 1995 to 2022. "The ECI takes data on exports, and reduces a country's economic system into two dimensions: (i) the "diversity" (i.e. the number) of products in the export basket, and (ii) the "ubiquity" of products in the export basket (i.e. the number of countries that export similar products). The least complex countries, at the bottom of the ECI rank, are those that export few different types of products (i.e. have export baskets that are not diversified), and those products that they do export are exported by many other countries (Hausmann et al.,

2014). On the other hand, the "economic growth rate" is the annual growth rate of GDP at market prices, the aggregate is based on the constant 2015 prices, which are expressed in American dollars. The variable of economic growth is sourced from the Global Economy database [https://www.theglobaleconomy.com/]. The other explanatory variables which include foreign direct investment, government expenditure, inflation and population growth, were also sourced from The Global Economy. A description of these variables is provided in Table 1 below.

Table 1: Variable Description

Variable	Notation	Data source	Unit
Economic complexity index	ECI	Havard Growth Lab	Index
Economic growth	EG	Global Economy	Percent
Foreign direct investment	FDI	Global Economy	Percent
Government Expenditure	GOV	Global Economy	Percent
Inflation	INF	Global Economy	Percent
Population growth	PG	Global Economy	Percent

4.2. Model Specification

The present study examines the effect of economic complexity on economic growth in Sub-Saharan African countries from 1995 to 2022. To investigate the effect, the study employs the method of fixed effects and random effects with panel corrected standard errors (PCSE), as well as the fully modified least square (FMOLS) method. The choice of the usage of PCSE and FMOLS is motivated by the presence of cross-section correlation (dependency) in panel data (see Table 4). Therefore, the conventional econometric techniques will not be utilised as they are likely to yield to wrong results. The study utilises the PCSE estimator (Beck and Katz, 1995) to mitigate potential issues of contemporaneous correlation and heteroscedasticity often found in panel data. According to Moundigbaye, Rea, and Reed (2017), the PCSE approach preserves the weight of observation for autocorrelations and uses a sandwich estimator to account for cross-sectional correlations in calculating the standard errors.

According to Zidi and Hamdi (2024) the PCSE organizes residuals from the fitted model according to the cluster, in order for the residuals

from the clusters to be $\hat{e_1}, \hat{e_2} \ldots, \hat{e_N^3}$. These are the vectors with T elements, they are grouped as T x N matrix, while the $\hat{e_i}$ are columns:

$$E = [\hat{e_1}, \hat{e_2} \ldots, \hat{e_{N-1}}\ \hat{e_{Ni}}] \quad (1)$$

Thus, the panel corrected standard errors are obtained as the square roots of the diagonal elements of the matrix:

$$cov(b) = (X'X)^{-1}(X'(\Phi \otimes_T)X)(X'X)^{-1} \quad (2)$$

The Φ stands for N x N matrix with the $(i,j)^{th}$ element which is estimated by:

$$(\sum_{t=1}^{T} \hat{e_{i,t}}\ \hat{e_{j,t}})/T \quad (3)$$

Conversely, the FMOLS method—a non-parametric approach—offers robust estimation by effectively mitigating cross-sectional dependence and endogeneity within panel datasets (Yorucu and Kirikkaleli, 2017). On that note, the functional model followed in the present study is presented by the equation below:

$$EG_{it} = \alpha_{it} + \beta_1 ECI_{it} + \beta_2 FDI_{it} + \beta_3 GOV_{it} + \beta_4 INF_{it} + \beta_5 PG_{it} + \varepsilon_t \quad (4)$$

Where EG, ECI, FDI, GOV, INF and PG stand for economic growth, economic complexity, foreign direct investment, government expenditure, inflation and lastly population growth. $\beta_1 - \beta_5$ are the factors to be assessed, while ε_t stands for the error term.

4.3. Empirical Results and Discussions

Table 2: Descriptive Statistics

	EG	ECI	FDI	GOV	INF	PG
Mean	4.44898	-0.90334	3.94012	14.69943	24.66719	2.561455
Max	106.280	0.89494	103.340	36.14000	4145.100	10.20000
Min	-30.1500	-2.44154	-82.8900	2.050000	-8.500000	-0.190000

Source: Author's own computations

The output in Table 2 shows the mean, maximum, and minimum values generated from data for Sub-Saharan African countries from 1996 to 2022. The mean describes the average values of variables for 27 years in SSA countries. From 1996 to 2022, the average share of the economic

growth index stands at 4.45 per cent, the maximum at 106.28 percent, while the minimum value is negative 30.20 per cent. On the other hand, the average share of the economic complexity index is -0.90 points, the maximum value is 0.89 points, while the minimum value is negative 2.44 points. Overall, these values suggest that over the years, the economies in SSA countries have had higher economic growth, but that growth does not stem from higher levels of economic sophistication. As evidenced by the ECI, the region has the lowest levels of economic complexity, which makes economic growth generated from the region to be unsustainable (i.e., reliance on the primary sector).

Table 3: Matrix Correlation

Correlation Probability	EG	ECI	FDI	GOV	INF	PG
EG	1.000000 --------					
ECI	-0.096599 0.0235	1.000000 --------				
FDI	0.072271 0.0904	-0.135649 0.0014	1.000000 --------			
GOV	-0.085151 0.0459	0.278196 0.0000	0.122676 0.0040	1.000000 --------		
INF	-0.224376 0.0000	-0.092762 0.0296	-0.052886 0.2156	-0.206430 0.0000	1.000000 --------	
PG	0.164102 0.0001	-0.585412 0.0000	0.083513 0.0503	-0.384405 0.5271	0.027022 0.5271	1.000000 --------

Source: Author's own computations

The output for matrix correlations is presented in Table 3: economic growth, economic complexity, foreign direct investment, government expenditure, inflation, and population growth. The output shows weak statistical linkages between key variables, highlighting a lack of economic synchronicity and integration among the various countries in the Sub-Saharan region.

Table 4: Cross-sectional Dependency Test

Test	Statistic	Probability value
Breusch-Pagan LM	691.5089	0.0000
Pesaran scaled LM	16.66372	0.0000
Pesaran CD	17.36199	0.0000

Source: Author's own computations

This section of the study presents results on the cross-sectional dependency, which is the crucial step before examining the effect of economic sophistication on economic growth in Sub-Saharan African

countries. The issue of Cross-sectional dependency is a very common problem in panel data. According to Akinlo and Dada (2022), the issue of cross-sectional dependency in African economies emanates from the reality that these economies share common external shocks which stem from financial systems, intra-trade, and capital mobility between them. Among tests used to determine if there is a presence of cross-sectional dependency or correlation within the panel, there is Breusch-Pagan LM, Pesaran scaled LM, and Pesaran CD tests. However, Breusch-Pagan LM as a benchmark since time period (T) is greater than the number of cross-sections. As shown in Table 4 above by probability value of the Breusch-Pagan LM test is 0.000, which is lower than the 0.05 per cent threshold. Hence, the null hypothesis that states that there is "*No cross-section dependence (correlation) in residuals*" is rejected. The presence of cross-sectional correlation suggests that these economies are influenced by common shocks, necessitating the use of advanced estimators to maintain parameter consistency. In what follows is the description of the unit root results in Table 5, a step that must be performed to determine if the time-series data contains a unit root or not. When the time series-data contains a unit root, it produces spurious results, and spurious results assume certain relationships that do not exist and may also lead to incorrect inferences.

Table 5: Panel Unit Root Test

LLC	Intercept		Trend and intercept	
Variables	Levels	1st DIFF	Levels	1st DIFF
ECI	-1.51277*	-12.9815***	-2.37481***	-8.95742***
EG	-5.43900***	-17.5059***	-3.98028***	-13.6762***
FDI	-2.44852***	-10.8079***	-1.54969*	-7.14434***
GOV	-2.15082**	-10.4658***	-1.10718	-8.57403***
PG	-4.47244***	-1.09614	-1.30579*	1.42846
INF	-45.1634***	-60.3151***	-49.5702***	-50.3962***
ADF-Fisher	Intercept		Trend and intercept	
Variables	Levels	1st DIFF	Levels	1st DIFF
ECI	97.4570***	372.416***	110.275***	288.168***
EG	155.896***	473.089***	129.347***	411.675***
FDI	117.935***	367.596***	86.3667***	292.254***
GOV	81.0915***	249.190***	70.0325**	190.406***
PG	164.971***	258.971***	126.158***	322.041***
INF	232.882***	470.190***	421.398***	647.550***

***, **, * denotes significance at 1 percent, 5 percent, and 10 percent, respectively

In carrying out the task of panel unit root testing, the present study adopts the LLC and Fisher-type test (ADF) developed by Levin-Lin-Chu (2002) and Maddala and Wu (1999) to ascertain whether there is a presence of a unit root in the panel data. As evidenced in Table 5, economic complexity, economic growth, foreign direct investment, government expenditure, population growth, and inflation are all stationary at levels in both tests. This an indication that all these variables follow an I(0) process, which is also a long-run association between the variables utilised in the study. Thus, the study proceeds with the estimation of the models as shown in Table 6. As outlined in Table 4, the presence of cross-sectional dependency in the panel data propelled the present study to exploit robust econometric techniques to account for the problem of cross-sectional correlation in the study. In addressing this issue, the study estimates fixed effects (FE) and random effects (RE) with panel corrected standard errors (PCSE). In addition to that, the study also exploits the fully modified least squares (FMOLS) model.

Table 6: Fixed and Random Effects with Panel Corrected Standard Errors

	Fixed Effects	Random Effects	FMOLS
Variable	Coefficient	Coefficient	Coefficient
ECI	-1.833342*** (0.0072)	-0.820135* (0.0910)	-1.445117** (0.0385)
FDI	0.066915 (0.1095)	0.051647 (0.1815)	0.057167 (0.1481)
GOV	-0.080857 (0.2464)	-0.053826 (0.3293)	-0.038571 (0.5678)
INF	-0.021277*** (0.0000)	-0.020463*** (0.0000)	-0.023688*** (0.0000)
PG	1.374600*** (0.0073)	0.723525* (0.0606)	1.484410** (0.0112)
C	0.454189 (0.7787)	2.741152** (0.0280)	
Hausman Test		0.1651	

***, **, * denotes significance at 1 per cent, 5 per cent, and 10 per cent, respectively

The results in Table 6 show that in Sub-Saharan Africa, economic complexity is negatively significant towards economic growth, that is, an increase in the index of economic complexity by 1 unit, which will lead to a decrease in economic growth by 1.83 percent, 0.82 percent, and 1.45 percent according to FE, RE, and FMOLS models. These results also reveal that the index of economic complexity is highly robust, as shown

by the consistency in all three models exploited in the study. However, these results are not in line with the a priori expectations of the study. Furthermore, these results align with Canh, Schinckus, and Thanh (2020), whose three-stage least squares (3SLS) analysis suggests that economic complexity can exert a negative influence on growth across a sample of 70 economies, challenging the conventional 'complexity-as-booster' narrative. The sub-sample included 27 Low and Lower-Middle Income Economies (LMEs), 22 Upper-Middle Income Economies (UMEs), and 41 High Income Economies (HIEs). However, these findings are not consistent with the findings of Stojkoski and Kocarev (2017) where economic complexity was found to have a positive and significant effect on economic growth in Southeastern and Central Europe. The above results reflect poor productive structures in Sub-Saharan African economies; hence, the current level of economic complexity cannot translate into higher economic growth as it is significantly low. As shown by the descriptive statistics in Table 2 that some countries in the region have an ECI of -2.44 index points (which is way below zero). Necessary steps will have to be taken to address this issue, it can be investing more on innovation, information and communication technology (ICT), as well as on research and development (R&D) to advance economic sophistication in Sub-Saharan Africa.

The results from all the models employed in the study show that foreign direct investment (FDI) and government expenditure (GOV) are insignificant. This is because FDI behaves the same as ECI, as it targets the major cities, which leaves out larger segments of the population in Sub-Saharan Africa. Hence, it has no significant effect on economic growth. While government expenditure plays a major role in advancing capital formation, but it requires a lot of time to build physical capital, hence it does not have a significant effect on economic growth. Notably, inflation displays a negative and significant effect on the economic indicator index, which is in line with the a priori expectations of the study. Ekinci, Tüzün and Faith (2020) suggest that the inflation-growth nexus is not governed by a universal tipping point, as no theoretical evidence exists to mandate a specific 'optimal' rate of inflation. As a result, a comparative analysis that was conducted for Italy and Australia by Švigir and Miloš (2017) reveals that low inflation is important, but it is not a sufficient factor for economic growth. However, a study conducted by Bittencourt (2011) reveals that inflation has a detrimental effect on the

economic growth of Latin America, which is consistent with the result of the present study.

Lastly, population growth has a positive and significant effect on the economic growth in all three models. Research conducted by Peterson (2017) reveals that low population growth in developed countries creates socio-economic problems, while high populations in developing countries slow down development. Furthermore, Tsen and Furuoka (2005) examined the relationship between population growth and economic growth in Asian countries, and their results reveal that there is no strong evidence that population growth has a positive or negative impact on economic growth. However, from the above empirical results, it appears that an increase in population growth benefits economic growth in Sub-Saharan Africa. Finally, between Fixed Effects and Random Effects, Random Effects is chosen as a suitable technique.

5. Conclusion and Recommendations

This research investigated the effect of economic complexity on economic growth in 27 Sub-Saharan African countries from 1995 to 2022. The research has also contributed to the body of knowledge, as there are limited studies on the subject. The study's findings suggest that economic sophistication does not improve economic performance in Sub-Saharan Africa.

As suggested in the empirical results, economic complexity has a negative and significant impact on the economic growth in the Sub-region. The literature, on the other hand, seems to suggest that economic complexity has a positive impact on various measures of inclusive growth. However, this study found no evidence to support that claim in Sub-Saharan Africa; thus, this finding suggests that economic complexity is sensitive to economic growth in the region. As suggested earlier, economic complexity behaves like foreign direct investment; it is centralised, which excludes the masses from the benefits of growth. This suggests that regional policies must prioritise inclusive growth to ensure that the transition toward sophisticated production benefits the poor through enhanced income distribution and employment opportunities.

Funding

The study has been made possible by the main funding of the National Institute for the Humanities and Social Sciences (NIHSS) under the

project number SD20/1539, as well as Nelson Mandela University Postgraduate Research Scholarship (PGRS) (partial funding).

References

African Capacity Building Foundation (ACBF). (2017). Drivers of economic growth in Africa. *Occasional Paper No. 29:*1-33. Harare, Zimbabwe.

Ajakaiye O. and Jerome A. (2013). Economic development: The experience of Sub-Saharan Africa. 1-40. DOI:10.1093/acprof:oso/9780199671656.003.0044

Akinlo, T., and Dada, J.T. (2022). Information technology, real sector and economic growth in sub-Saharan Africa: a cross-sectional dependence approach. *Qual Quant* 56, 4241–4267. https://doi.org/10.1007/s11135-021-01308-2

Anyanwu J.C. (2014). Factors affecting economic growth in Africa: Are there any lessons from China? *African Development Review* 26, no.3: 468-493.

Atlas of Economic Complexity database. *Sub-Saharan African data.* [https://atlas.cid.harvard.edu/rankings].

Beck, N., and Katz, J. N. (1995). What to do (and not to do) with time-series cross-section data. *American political science review*, *89*(3), 634-647. doi:10.2307/2082979

Beyene, A.B. (2024). Income inequality and economic complexity in Africa: the moderating role of governance quality', *Cogent Social Sciences*, 10(1). Doi: 10.1080/23311886.2024.2341114.

Bittencourt, M. (2011). Inflation and economic growth in Latin America: Some panel time-series evidence. *Department of Economics Working Paper Series* 1-20. South Africa: University of Pretoria.

Breitenbach, M.C., Chisadza, C. and Clance, M., (2022). The Economic Complexity Index (ECI) and output volatility: High vs. low income countries. *The Journal of International Trade & Economic Development*, *31*(4), pp.566-580.

Cahn N.P. and Thanh S.D. (2022). The dynamics of export diversification, economic complexity, and economic growth cycles: Global evidence. *Foreign Trade Review* 57, no.3: 234-260. DOI: 10.1177/0015732520970441.

Canh N.P., Schinckus C., and S.D. Thanh S.D. (2020). The natural resource rents: Is economic complexity a solution for resource curse?

Resources Policy 69(2020). [https://doi.org/10.1016/j.resourpol.2020.101800].

Chávez J.C., Mosqueda M.T., and Gómez-Zaldívar M. (2017). Economic complexity and regional growth performance: Evidence from the Mexican economy. *The Review of Regional Studies* 47, (2017): 201-219.

Ekinci R., Tüzün O. and Faith C. (2020). The relationship between inflation and economic growth: Experiences of some inflation targeting countries. *Financial Studies* 24, no.1: 6-20.

ErKan, B. and Yildirimci E. (2015). Economic complexity and export competitiveness: The case of Turkey. *Procedia – Social and Behavioural Sciences* 195(2015): 524-533. DOI: 10.1016/j.sbspro.2015.06.262.

Escobari M. (2013). Economic complexity briefing. *Centre for International Development* 1-5. Cambridge, United States of America: Harvard University.

Gala P., Rocha I. and Magacho G. (2018). The structuralist revenge: Economic complexity as an important dimension to evaluate growth and development. *Brazilian Journal of Political Economy* 38, no.2: 219-236.

Gnangnon S.K. (2021). Economic complexity and poverty in developing countries. *Economic Affairs* 41(2021): 416-429. DOI: 10.1111/ecaf.12485.

Gómez-Zaldívar, M., Fonseca F.J., Mosqueda M.T. and Gómez-Zaldívar F. (2020). Spillover effects of economic complexity on the per capita GDP growth rates of Mexican states, 1993-2013. Spillover effects. *Estudios de Economía* 47, no.2: 221-243.

Hausmann, R., Hidalgo, C. A., Bustos, S., Coscia, M., Simoes, A., & Yildirim, M. A. (2014). The Atlas of Economic Complexity: Mapping Paths to Prosperity. MIT Press.

Hausmann, R., Yildirim, M.A., Chacua, C., Hartog, M. and Matha, S.G., (2024). Innovation policies under economic complexity. *World Intellectual Property Organization (WIPO) Economic Research Working Paper Series*, (79).

Hidalgo C.A. (2021). Economic complexity theory and applications. *Nature Reviews Physics*. https://doi.org/10.1038/s42254-020-00275-1

Hidalgo C.A., and Hausmann R. (2009). "The building blocks of economic complexity." In: *Proceedings of the National Academy of Sciences* 106, no.26: 10570–10575. https://doi.org/10.1073/pnas.0900943106

Hidalgo C.A., Klinger B., Barabási A.L. and Hausmann R. (2007). The product space conditions the development of nations. *Science* 317, no.5837: 1-13.

Inoua S. M. (2021). A simple measure of economic complexity. *ESI Working Paper 21-11* 1-1-12. https://digitalcommons.chapman.edu/esi_working_papers/348/

Jacobs J. (2023). "Rostow's Stages of Growth Development Model." *Thought Co.* https://www.thoughtco.com/rostows-stages-of-growth-development-model-1434564

Kanbur R. (2017). Structural transformation and income distribution: Kuznets and beyond. *Working Paper Series,* No 266. Abidjan. Ivory Coast: African Development Bank.

Koch P. (2020). *Economic complexity and growth: Can value-added exports better explain the link*. Research Paper No. 14. Vienna, Austria: EcoAstria-Institute for Economic Research.

Kuznets S. (1955). Economic growth and income inequality. *The American Economic Review* 45 no. 1: 1-28.

Levin A., Lin C., and Chu C.J. (2002). Unit root tests in panel data: Asymptotic and finite sample properties. *Journal of Econometrics,* 108, 1-24.

Lewis W.A. (1954). Economic development with unlimited supplies of labour. *The Manchester School* 1-30.

Maddala G.S., and Wu S. (1999). A comparative study of unit root tests with a panel data and a new simple test. *Oxford Bulletin of Economics and Statistics*. 61(1). 631-652. https://doi.org/10.1111/1468-0084.0610s1631

Mealy P., Farmer J.D. and Teytelboym A. (2019). Interpretating economic complexity index. *Sciences Advances* 5(2019): eaau1705. 1-8.

Mesagan, E.P., Vo, X.V. (2024). The Importance of Economic Complexity in the Resource-Growth Discourse: Empirical Evidence from Africa. *J Knowl Econ* **15**, 2772–2793. https://doi.org/10.1007/s13132-023-01227-7

Mishra S., Tewari I. and Toosi S. (2020). Economic complexity and the globalisation of services. *Structural Change and Economic Dynamics* 53(2020): 267-280. [https://doi.org/10.1016/j.strueco.2020.03.002].

Molele S.B. and Ncanywa T. (2022). Effects of economic complexity as a development index on economic performance: A Saharan Africa and BRICS comparative analysis. *Journal of Studies in Social Sciences and Humanities* 8(3):332-347.

Moundigbaye, M., Rea, W. S., and Reed, W. R. (2017). Which panel data estimator should I use? A corrigendum and extension. Economics Discussion Papers, No 2017-58. *Kiel Institute for the World Economy.*

http://www. economics-ejournal. org/economics/discussionpapers/2017-58 Page, *2*(1).

Ncanywa, T., Mongale, I.P., Ralarala, O., Letsoalo, T.E. and Molele, B.S., (2021). Economic complexity to boost the selected sub-Saharan African economies', *Journal of Economic and Financial Sciences* 14(1), a567. **https://doi.org/10.4102/jef.v14i1.567**

Ndulu B., Chakraborti L., Lijane L., Ramachandran V. Wolgin J. (2007). *Challenges of African growth: opportunities, constraints, and strategic directions* 1-251. Washington DC, United States of America: World Bank.

Nguéda R.D.N. and Kelly A.M. (2022). The nexus between economic complexity and foreign direct investment in Sub-Saharan Africa. *South Asian Journal of Social Studies and Economics*. 14(2), 41-52. DOI: 10.9734/SAJSSE/2022/v14i230377.

Park J.H. (2002). The East Asian model of economic development and developing countries. *Journal of Developing Societies* 18, no.4: 330-353.

Peterson, E.W.F. (2017). The role of population in economic growth. *Sage Open* 7, no.4: 1-15. https://doi.org/10.1177/2158244017736094

Pinheiro, C., (2025). Relatedness and economic complexity as tools for industrial policy: Insights and limitations. *Structural Change and Economic Dynamics*, *72*, pp.1-10.

Rey, S. and Deisting, F. (2012). GDP per capita among African countries over the period 1950-2008: Highlights of convergence clubs. *Economics Bulletin* 32(4): 2779-2800.

Rostow W.W. (1959). The stages of economic growth. *The Economic History Review* 12, no.1: 1-16.

Shahzad U., Madaleno M., Dagar V. Ghosh S. and Dogan B. (2022). Exploring the role of export product quality and economic complexity for economic progress of developed countries: Does institutional quality matter? *Structural Change and Economic Dynamics* 62(2022): 40-51. [https://doi.org/10.1016/j.strueco.2022.04.003]

Stojkoski V. and Kocarev L. (2017). The relationship between growth and economic complexity: Evidence from South-eastern and Central Europe. *Munich Personal RePEc Archive* MPRA Paper, no. 77837:1-16

Švigir M., and Miloš J. (2017). Relationship between inflation and economic growth: Comparative experience of Italy and Australia. *FIP* 5(2): 91-101.

Tabash M.I., Mesagan E.P. and Faraq U. (2022). Dynamic linkage between natural resources, economic complexity, and economic growth: Empirical evidence from Africa. *Resources Policy* 78(2022). [https://doi.org/10.1016/j.resourpol.2022.102865].

The Global Economy. *Database* [https://www.theglobaleconomy.com/]

Tsen W.H., and Furuoka F. (2005). The relationship between population and economic growth in Asian economies. *ASEAN Economic Bulletin* 22(3): 314-330

United Nations on Trade and Development (UNCTAD). (2022). *Economic development in Africa: Rethinking the foundations of export diversification in Africa – The catalytic role of business and financial services* 1-170. Geneva: UNCTAD.

Uribe, J.M., (2025). Investment in intangible assets and economic complexity. *Research Policy*, *54*(1), p.105133.

Wolla, S.A. (2017). Why are some countries rich and others poor? *Page One Economics*. Federal Reserve Bank of St. Louis | research.stlouisfed.org. 1-5.

World Bank (2025). World development indicators. https://data.worldbank.org Accessed online [15/06/2025]

Yorucu, V. and Kirikkaleli, D., (2017). Empirical Modeling of education expenditures for Balkans: Evidence from panel FMOLS and dols estimations. *Review of Research and Social Intervention*. 56 (2017), pp. 88-101.

Zhu S. and Li R. (2017). Economic complexity, human capital, and economic growth: Empirical research based on cross-country panel data. *Applied Economics* 49, no. 38: 3815-3828. DOI: 10.1080/00036846.2016.1270413.

Zidi, M. and Hamdi, H., (2024). A panel-corrected Standard Error (PCSE) Framework to estimate capital structure and banking performance within the Tunisian context. *International Journal of Economics and Financial Issues*, *14*(2), pp.196-202.