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Financial Development and Economic Complexity in Selected Sub-Sahara Africa: (2007 to 2024)

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Abstract

Economic complexity is a decisive factor of structural change and economic growth in the long-run but has yet to be adequately investigated in terms of its relationship with financial development in Sub-Saharan Africa. The lack of import-sophistication persistence among the entire region and the superficial nature of financial institutions are driving factors of the investigation. To fill this gap, the paper focused on investigating the effects of financial development on economic complexity in 15 selected Sub-Saharan African Nations between the years 2007 and 2024 with particular attention being given to the contributing roles of broad money supply, domestic credit to the private sector, depositors with commercial banks, mobile cellular subscriptions, and commercial bank branches. Through the system generalised method of moment, the piece of evidence was found to include a positive and statistically significant impact of domestic credit to the private sector on the complexity of the economy, whereas the impact of broad money supply, depositors with commercial banks, and commercial bank branches showed a positive, though statistically insignificant, impact on economic complexity. On the contrary, mobile cellular subscriptions had a statistically significant negative effect on economic complexity. These findings demonstrate the significance of directing the credit to productive fields yet also demonstrate that financial growth and mobile penetration are not sufficient to create productive sophistication. The recommendations given in the paper are that policymakers should shift the focus of such broad financial growth to focused credit creation, serving the knowledge-intensive industries, and institute digital literacy programs to rebrand mobile technology as a production- and not a consumption-based tool.

Keywords: *Economic Complexity, Financial Development, Sub-Saharan Africa, System-GMM, Mobile Technology*

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Background to the Study

Economic complexity, an indicator that captures the diversity and sophistication of a country's productive knowledge and export structure, has become central to understanding long-term economic development (Albeaik *et al.,* 2017). Unlike simple measures of income or output, economic complexity reflects the embedded knowledge and capabilities of a society, providing a robust predictor of future growth, innovation, and income equality (Cristelli *et al.,* 2015; Mealy & Teytelboym, 2022). Despite its proven significance, the level of economic complexity across Sub-Saharan Africa (SSA) remains persistently low, underscoring a fundamental challenge in the region's structural transformation and integration into global value chains (Asongo *et al.,* 2024). The landscape of economic complexity in SSA is heterogeneous, yet dominated by the pervasive "resource curse." Countries like Nigeria and Gabon, heavily reliant on crude oil, have consistently recorded negative complexity scores, reflecting narrow, unsophisticated export baskets (OEC, 2023). In contrast, nations such as Botswana and Namibia have demonstrated that strategic investments in governance and human capital can facilitate modest improvements in complexity, even despite diamond dependence. Meanwhile, the experiences of Côte d'Ivoire and Ghana reveal the volatility of this journey, where gains from cocoa processing and nascent manufacturing can be undermined by renewed commodity booms. At the lowest end of the spectrum, countries including the Democratic Republic of Congo and Niger grapple with profound structural bottlenecks—from weak infrastructure to political instability that prevent the translation of vast mineral wealth into economic complexity.

Within this context, financial development is theorized to be a critical enabler of structural change. A growing body of literature posits that well-developed financial systems enhance economic complexity by efficiently allocating resources, mobilizing savings, and reducing the financing gaps that constrain investment in technology, innovation, and capital-intensive sectors (Nguyen & Su, 2021; Magazzino & Santeramo, 2023). This relationship operates through multiple channels. Financial deepening, measured by broad money supply, provides the liquidity necessary for investment in productive activities. Domestic credit to the private sector empowers firms to invest in machinery and skills required for sophisticated production (Aslam *et al.,* 2022). Furthermore, financial inclusion proxied by the number of depositors with commercial banks and the density of bank branches broadens the pool of savings and improves resource allocation efficiency. Technological penetration, especially through mobile cellular subscriptions, also plays a pivotal role by facilitating market access, digital payments, and financial inclusion, thereby creating a more connected and efficient economic environment.

Despite a robust theoretical foundation, the empirical evidence linking financial development to economic complexity in the specific context of SSA remains scarce and insufficiently nuanced. While cross-country studies have established a general positive association, often moderated by institutional quality and macroeconomic stability (Ndoya *et al.,* 2023; Olaniyi & Odhiambo, 2023), the focus has predominantly been on developed and emerging economies like China and the BRICS nations (Karasoy, 2022; Fan *et al.,* 2024). The SSA

context, characterized by unique structural heterogeneities, varying levels of financial infrastructure, and distinct policy challenges, is critically underexplored. This gap is significant, as the relationship is likely to be nonlinear and highly context-specific, warranting an investigation that accounts for the region's particular macro-financial dynamics. This study, therefore, seeks to fill this gap by providing a dedicated empirical examination of the impact of financial development on economic complexity in 15 selected SSA countries including Botswana, Ghana, Nigeria, and Senegal over the period 2007 to 2024. By employing panel data estimation techniques, this research moves beyond broad generalizations to offer a nuanced analysis of how specific financial indicators, from credit availability to digital connectivity, influence export sophistication in the region. The findings are poised to make a substantive contribution to the policy-relevant discourse, offering evidence-based insights into how strengthening financial systems can act as a catalyst for economic transformation, export diversification, and sustainable development. Ultimately, this research aligns with regional and global aspirations, including the African Union's Agenda 2063 and the United Nations Sustainable Development Goals (SDGs) 8 and 9, which target inclusive economic growth and resilient infrastructure.

Literature Review

Conceptual Review

Financial Development

Financial development refers to the improvements in the quality, depth, and efficiency of financial institutions, markets, and instruments. It is a key driver of economic growth, as it enhances resource allocation, mobilizes savings, and reduces information and transaction costs within an economy (World Bank, 2013). This process marks a transition from self-financing to greater reliance on external funding, broadening access to capital for individuals and businesses (Furstenberg & Fratianni, 1996). A developed financial system lowers borrowing costs and financial risk, thereby stimulating investment, consumption, and technological adoption (Sadorsky, 2011; Khan et al., 2017). Empirical studies consistently show a positive relationship between financial development and economic growth (Harris, 2012). Crucially, it boosts economic growth by improving the efficiency of investment, not just its volume (Guidotti & De Gregorio, 1992). By allowing firms to diversify risk and increase liquidity, financial development fosters entrepreneurship and innovation, which are vital for long-term economic progress (Levine, 1997).

Broad Money

Broad money is a comprehensive measure of a nation's money supply. It includes not only cash and highly liquid checking deposits (narrow money) but also fewer liquid assets such as savings deposits, time deposits, and money market securities (Ndoya, 2023). According to the IMF (2023), its exact composition can vary by country but generally captures all banknotes, coins, and short-term bank deposits (OECD, 2024). This metric provides a complete picture of the liquidity available for spending and investment within an economy. It is a vital tool for central banks and policymakers, who use it to gauge inflationary pressures, assess economic activity, and formulate effective monetary policy (Paun *et al.,* 2019; Asongo

et al., 2024). By encompassing a wide range of financial assets, broad money serves as an essential indicator for macroeconomic analysis and planning.

Domestic Credit to Private Sector by Banks

Domestic credit to the private sector by banks measures the financial resources such as loans, trade credits, and receivables provided by commercial banks to private businesses and individuals. Expressed as a percentage of GDP, it is a key indicator of financial depth and the banking sector's capacity to fund private investment (World Bank, 2023). This credit is crucial for economic complexity, as it enables entrepreneurship, technological upgrading, and resource allocation into productive, innovative sectors; (Hausmann & Hidalgo, 2009). When channeled efficiently, it helps firms expand into complex manufacturing and technology industries, fostering export diversification. Conversely, credit skewed towards low-complexity sectors like raw materials can hinder structural transformation. Empirical evidence shows that countries with higher levels of private credit tend to exhibit greater economic complexity (Svirydzenka, 2016).

Depositors with Commercial Banks

This metric refers to the number of individuals, households, and businesses that hold deposit accounts—such as savings or demand deposits—with commercial banks. It is a fundamental proxy for financial inclusion and public trust in the formal banking system (World Bank, 2023; Gowda, 2020). A growing base of depositors is critical for economic complexity. It allows banks to mobilize a larger pool of domestic savings, which enhances their ability to provide credit for productive investments in innovation and high-productivity sectors (Maurya & Sahu, 2022; Hausmann et al., 2014). This process supports the shift from basic to more complex production processes. In regions like Sub-Saharan Africa, increasing the number of depositors is a vital step toward reducing financial exclusion and unlocking the productive potential necessary for structural transformation and export diversification.

Mobile Cellular Subscriptions

Mobile cellular subscriptions, measured as the number of active SIM cards per 100 people, indicate the penetration of mobile communication technology (ITU, 2023). This connectivity is a powerful enabler of economic complexity. Mobile phones facilitate knowledge diffusion, market coordination, and access to digital platforms like e-commerce and mobile banking (Kuyucu, 2021). For businesses, especially SMEs, this enhances efficiency and integration into complex global value chains. Furthermore, mobile technology drives financial inclusion by providing access to mobile money and credit, enabling investment in education, health, and innovation (Khan et al., 2025). By reducing transaction costs and empowering individuals with information and financial tools, mobile subscriptions help accumulate the productive knowledge required for a more sophisticated and diverse economy.

Economic Complexity

Economic complexity captures the amount of productive knowledge embedded in an

economy, reflected in the diversity and sophistication of its exported goods (Hidalgo, 2021). It moves beyond traditional economic metrics to measure a country's collective capabilities and its ability to produce complex, non-ubiquitous products. The Economic Complexity Index (ECI) shows that countries with higher scores experience more sustained growth and resilience, as they can leverage specialized, widely distributed knowledge (Balland et al., 2022). High-complexity economies are typically more innovative and have stronger institutions, while low-complexity economies often depend on raw materials and are vulnerable to shocks. Factors like financial development and human capital are critical for building complexity, which in turn provides a strategic framework for policies aimed at industrial diversification and long-term, inclusive development.

Theoretical Framework

The Complexity and Capabilities Theory (Hausmann & Hidalgo, 2021) posits that economic development is driven by the accumulation of productive capabilities—the tacit knowledge, skills, institutions, and networks required for production. It argues that economic complexity stems from a society's collective know-how, enabling it to produce diverse and sophisticated goods. In this framework, products are combinations of specific capabilities; a country can only produce a good if it possesses all the necessary underlying capabilities. Therefore, economic growth is a process of acquiring new capabilities, allowing a shift from producing simple, common goods to complex, unique ones, which fosters higher income, diversification, and resilience.

The theory is operationalized through the Economic Complexity Index (ECI), a metric derived from global trade data. The ECI measures a country's complexity by reflecting both the diversity of its exports and the ubiquity of those products worldwide, ranking nations based on the sophistication of their productive knowledge. Crucially, this theory provides a compelling rationale for the role of financial development. Financial systems are fundamental in facilitating the acquisition of new capabilities. They mobilize resources, allocate capital to innovative and high-complexity sectors, and reduce the risks associated with new ventures. An advanced financial sector enables firms to access the credit and investment necessary to diversify into complex products, making financial development a strategic driver of structural transformation rather than merely a support system. For a study on Sub-Saharan Africa, this theory is directly applicable. The transition of these economies towards greater complexity hinges on how well their financial institutions support capability accumulation through credit access, financial literacy, and institutional support. It frames development as a process of knowledge accumulation, underpinned by robust financial systems.

Empirical Review

Khanalizadeh (2024) investigated the impact of financial, economic, and political risks and economic complexity on Iran's Sukuk market from 2010-2022 using a Nonlinear Autoregressive Distributed Lag (NARDL) model. The results revealed that negative shocks to political and financial risk, as well as economic complexity, hinder market development, while positive shocks promote it, with political risk having the most significant impact. The study

recommends that policymakers focus on stabilizing the political and financial environment to foster the growth of the Sukuk market. Emeka *et al.* (2024) examined the effect of gender economic inclusion on economic complexity in 34 African economies (2010-2021) using Pooled OLS and system GMM. They found that gender inclusion directly promotes economic complexity, and governance institutions positively enhance this effect, despite having a standalone negative relationship with complexity. The authors recommend implementing gender-inclusive policies and pursuing institutional reforms to improve governance transparency and accountability.

Fan *et al.* (2024) studied the impact of financial development and energy use on the ecological footprint in BRICS-T economies (1990-2020) within an Economic Complexity-induced EKC framework, using second-generation panel data tests. They confirmed the EKC hypothesis, finding that financial development and nonrenewable energy increase pollution, while renewable energy reduces it. The study recommends that governments diminish the ecological footprint by promoting clean energy technologies and diversifying energy sources. Low (2024) analyzed the relationship between financial development (disaggregated into institutions and markets) and economic complexity using the Generalized Method of Moments (GMM). The findings showed that financial development enhances complexity, but the drivers differ: financial institution depth and financial market efficiency are crucial overall, with varying impacts between high and low-income countries. The study recommends policymakers move beyond aggregate measures and target specific financial sub-sectors and dimensions to effectively spur economic complexity.

Ajide and Osinubi (2024) explored whether financial development and migrant remittances upgrade economic complexity in 21 African countries (1996-2017) using Panel ARDL and Method of Moment-Quantile Regression. The results revealed that both financial development and remittances serve as effective tools for enhancing economic complexity, with evidence suggesting they act as substitutes for one another. The study recommends leveraging both financial development and remittance inflows as veritable policy tools for sophisticating African economies. Baskak (2024) analyzed the relationship between multidimensional complexity indices and financial development in E7 countries using cointegration tests and Mean Group estimators. The study found a significant long-run relationship, concluding that the technological complexity index has a greater impact on financial development than commercial or research complexity. This finding implies that policies aimed at boosting technological sophistication are crucial for driving financial sector development.

Adebayo (2023) assessed the impact of financial risk and economic complexity on the load capacity factor in 5 BRICS countries (1990-2018) using method of moments quantile regression. The findings showed that renewable energy, economic complexity, and financial risk improve ecological quality, while economic growth and non-renewable energy degrade it. The study proposes a policy framework based on these findings to achieve SDGs 7, 13, and 17. Olaniyi and Odhiambo (2023) examined the moderating role of institutional quality in the

financial development-economic complexity nexus in 29 African countries (1995-2020) using GMM, quantile regression, and a dynamic panel threshold. The results established that while financial development and institutional quality individually enhance complexity, weak institutions drain finance's positive effect, with a threshold of 5.73 (on a 10-point scale) identified. The study recommends that African economies need better institutional architectures to maximize the benefits of financial development for economic complexity.

Valentine *et al.* (2023) assessed the effect of corruption on the relationship between financial development and economic complexity in MENA countries (1995-2020) using two-stage least squares. The results revealed that corruption worsens the effect of financial access, depth, and efficiency on complexity, but improves the effect of financial stability. The study calls on policymakers to tighten controls on corruption to allow financial development to significantly enhance economic complexity. Ndoya *et al.* (2023) examined the relationships between financial development, economic complexity, and country stability in 92 developing countries (1995-2018) using a finite mixture model. The study found that the effect of financial development on complexity varies across four classes of countries, with the positive effect being strongest in economically, politically, and financially stable nations. The research implies that achieving broader macroeconomic and political stability is a prerequisite for financial development to effectively spur economic complexity.

Balland *et al.* (2022) studied the principles of economic complexity, reviewing its theoretical foundations and data-driven tools. They highlighted that this field uses big data and machine learning to understand economic structure and improve prediction and policy decisions. The authors discuss the policy implication of building recommendation systems to guide major public investment decisions in a complex world. Aslam *et al.* (2022) evaluated the role of financial development on economic complexity in 33 Belt and Road Initiative (BRI) countries using the Generalized Method of Moments (GMM). They found that financial development alone is insignificant, but when interacting with strong institutions, it has a positive and significant impact on complexity. The study recommends that BRI countries must regulate their finance system to improve their institutional structure.

Lee and Olasehinde-Williams (2022) examined the link between economic complexity and environmental performance in OECD countries (2007-2016) using a modified STIRPAT model with Driscoll-Kraay fixed effects and GMM. The results showed that economic complexity positively impacts environmental performance, and it is a meaningful predictor of it. This provides a justification for countries to pursue economic sophistication as a pathway to better environmental outcomes. Lee *et al.* (2022) examined the effects of tourism, economic complexity, and country security on the ecological footprint in 99 countries (2006-2017) using quantile regression. They found that tourism and economic complexity worsen environmental quality, but better country security weakens this negative impact. The study implies that improving national security can be part of a strategy to mitigate the environmental downsides of economic development. Akadiri *et al.* (2022) examined the role of economic complexity and energy consumption on China's ecological footprint (1985-2019) using

Quantile-on-Quantile regression. The results showed that economic growth, economic complexity, and both renewable and non-renewable energy contribute positively to the ecological footprint. The study recommends an immediate shift from fossil fuels to eco-friendly sources and energy-saving technologies for China to meet its SDG 13 goals.

Data and Method

The paper depends on secondary data and obtained from World Development Indicators for the selected sub-Sahara countries. It covers the period from 2007 to 2024.The study will be considered panel series data on Broad Money as a percentage of GDP, Domestic Credit to the Private Sector by Banks as a percentage of GDP, Number of Depositors with Commercial Banks per 1,000 adults, Mobile Cellular Subscriptions per 100 people, and Number of Commercial Bank Branches per 100,000 adults and economic complexity which will be obtained from World Development Indicators (WDI) online database published by the World Bank.

Model Specification

The model for the study is hinged upon the theoretical framework and adopted model is based on the study of Aslam *et al.* (2022) that examined the driver role of financial development on the economic complexity: an empirical evidence from 33 BRI Participation Countries from 2000-2020. The model applied in the study is of the form:

$$ECI_{it} = \beta_0 + \beta_1 ECI_{(t-1)} + \beta_2 LGE_{it} + \beta_3 FDI * INS_{it} \\ \beta_4 LPCY_{it} + \beta_5 INS_{it} + \beta_6 FDI_{it} \quad (1)$$

Where;

The dependent variable is ECI. ECI is denoted ECI= Economic Complexity Index. The Independent Variable are; ECI (t – 1) = Lagged dependent variable economic complexity, LGE= log of government expenditures, FDI*INS = Interaction term of financial development and institutions, LPCY= Log of per capita income, INS= Institutional index, FDI= Financial development index, ε = Error term for the model, `i` and `t` subscripts in equation (1) showed the countries/entities time period respectively.

However, the above model was modified. Thus, the modified model is presented as follows:

$$ECX_{it} = \beta_0 + \beta_1 MSY_{it} + \beta_2 DCP_{it} + \beta_3 DTG_{it} + \beta_4 MCS_{it} + \beta_5 CBB_{it} + \varepsilon_{it} \quad (2)$$

Where: ECX = Economic Complexity variables in country i at time t for dependent variable, MSY = Broad money (% of GDP) variables in country i at time t for independent variables, DCP = Domestic credit to private sector by banks (% of GDP) variables in country i at time t for independent variables, DTG = Depositors with commercial banks (per 1,000 adults) variables in country i at time t for independent variables, MCS = Mobile cellular subscriptions (per 100 people)variables in country i at time t for independent variables, CBB = Commercial bank branches (per 100,000 adults).variables in country i at time t for independent variables, ε = error term, β_0 = intercept, $\beta_1 - \beta_4$ = Coefficients of the explanatory variables. Furthermore,

theoretically, the coefficients of the financial development variables are expected to have a positive impact on economic complexity in selected sub-sahara Africa.

This research employed System Generalized Method of Moments (System-GMM) estimator developed by Arellano and Bond (1991) and Blundell-Bond (1998). The System-GMM approach is particularly appropriate for this analysis because (i) the model is dynamic (it includes the lagged dependent variable ECXi,t−1, (ii) potential endogeneity may exist between financial development indicators and economic complexity (reverse causality or omitted variable bias), and (iii) the estimator eliminates country-specific fixed effects through first-differencing while using lagged levels of the variables as internal instruments for the system equations. This produces consistent and efficient estimates even in the presence of heteroskedasticity and serial correlation, provided the instruments are valid. According to Baltagi (2020), the general form of a panel data model is specified as follows:

$$Y_{it} = \alpha + \beta X_{it} + \varepsilon_{it} \qquad (3)$$

Where i denotes the cross-sectional units (countries), t denotes the time period, Y_{it} is the dependent variable, X_{it} is a vector of explanatory variables, α is the constant term, β is a vector of coefficients to be estimated, and ε_{it} is the error term.

Given the high degree of economic integration and shared external shocks within Sub-Saharan Africa, this paper first conducted a Cross-Sectional Dependence (CD) test as proposed by Pesaran (2004). This test is crucial to determine whether the residuals across the countries in the panel are correlated, a common phenomenon in regional studies where a financial or trade shock in one nation can swiftly propagate to its neighbors. Ignoring cross-sectional dependence can lead to biased and inconsistent estimates. Subsequently, the stationarity of the variables was examined using Panel Unit Root tests. The presence of a unit root indicates non-stationarity, which can lead to spurious regression results. This study applied a Levin, Lin & Chu (2002) test, which assumes a common unit root process that allow for individual unit root processes. The results confirmed that all variables—Economic Complexity (ECX), Broad Money (MSY), Domestic Credit to Private Sector (DCP), Depositors with Commercial Banks (DTG), Mobile Cellular Subscriptions (MCS), and Commercial Bank Branches (CBB)—were stationary at level I(0).

Variables Description and Measurements

Table 1: Variables Description and Measurements

Variable	Acronym	Description	Measurement	Source
Economic Complexity Index	ECX	Measures the diversity and sophistication of a country's productive knowledge and export structure.	Index (Higher values indicate greater complexity)	The Atlas of Economic Complexity (Harvard Growth Lab)
Broad Money	MSY	Captures the total volume of liquidity available in the formal financial system.	% of GDP	World Bank, Global Financial Development Database
Domestic Credit to Private Sector	DCP	Measures the financial resources provided to the private sector by depository corporations.	% of GDP	World Bank, Global Financial Development Database
Depositors with Commercial Banks	DTG	Serves as a proxy for financial inclusion and the depth of the formal banking sector.	Per 1,000 adults	World Bank, Global Financial Development Database
Mobile Cellular Subscriptions	MCS	Indicates the level of technological penetration and digital connectivity.	Per 100 people	World Bank, World Development Indicators
Commercial Bank Branches	CBB	Measures physical access to formal financial services.	Per 100,000 adults	World Bank, Global Financial Development Database

Source: Researchers' Compilation, 2026

Results and Discussions

Table 2: Summary Statistics Results

Variable	Obs	Mean	Std. Dev.	Min	Max
ECX	270	-1.051986	.4820302	-2.42	.2
MSY	270	28.39302	13.62305	7.000762	72.6054
DCP	270	18.08868	12.15393	2.606572	60.58694
DTG	269	293.4769	316.2084	2.917312	1797.086
MCS	270	78.16185	39.45283	6.041131	174.0251
CBB	270	4.395634	3.053075	.472667	15.53355

Source: Author's Computation, 2026 (Eviews-12)

The summary statistics in table 2 provide an overview of the data distribution for the variables in the paper. The average Economic Complexity Index (ECX) is -1.05, with values ranging from a minimum of -2.42 to a maximum of 0.20. This negative mean confirms the generally low level of productive sophistication across the selected Sub-Saharan African countries during the study period. The financial variables show varying degrees of development: Broad Money (MSY) has a mean of 28.39% of GDP, while Domestic Credit to the Private Sector (DCP) is lower at 18.09% of GDP, indicating a relatively shallow financial system in terms of credit provision. The mean for Depositors with Commercial Banks (DTG) is 292.56 per 1,000 adults, highlighting a significant portion of the adult population remains unbanked. Mobile Cellular Subscriptions (MCS) have a high average of 78.16 per 100 people, reflecting widespread mobile penetration. In contrast, the physical access to banking is limited, as shown by the low mean for Commercial Bank Branches (CBB) at 4.40 per 100,000 adults.

The standard deviation, which measures the dispersion of the data, is highest for DTG, indicating substantial variation in financial inclusion levels among the countries. The skewness statistics reveal the nature of these distributions. ECX and MCS are slightly negatively and positively skewed, respectively, suggesting their data is relatively symmetrical. In contrast, MSY, DCP, DTG, and CBB are all positively skewed, meaning that the distributions of these financial variables are tailed to the right, with a cluster of lower values and a few countries reporting significantly higher figures. The Jarque-Bera test probabilities for all variables are less than 0.05, leading to the rejection of the null hypothesis of normality; this confirms that none of the variables are normally distributed.

Cross Sectional Dependence

Prior to model estimation, it is essential to test for cross-sectional dependence in the data. The presence of such dependence, often arising from unobserved common shocks or spatial spillovers across the selected Sub-Saharan African countries, can lead to inconsistent and biased coefficient estimates if not properly accounted for (Pesaran, 2004). Given the panel structure of this study, which features 15 countries (N=15) observed over 18 years from 2007 to 2024 (T=18), the Pesaran (2004) Cross-Sectional Dependence (CD) test was deemed appropriate. This test is robust for panels where the time dimension (T) is larger than the cross-sectional dimension (N) or of similar scale. The CD test was conducted on the regression residuals, and the resulting test statistic and its corresponding probability value are reported in the results section to determine the presence of significant cross-sectional correlation.

Table 3: Cross Sectional Dependence Tests

Tests	Statistic	P-value
Breusch-Pagan LM	285.0231	0.0000
Pesaran Scaled LM	12.42278	0.0000
Pesaran CD	2.554599	0.0106

Source: Authors Computation, 2026 (Eviews-12)

Good evidence against the null hypothesis of no cross-sectional dependence is presented in Table 3. The three tests Breusch-Pagan LM, Pesaran Scaled LM, and Pesaran CD are all statistically significant. This result means that the errors of the regression model correlate with each other within the 15 Sub-Saharan African countries of the panel. Practically, this implies that a shock or commonality (e.g., a global financial crisis, a policy changes in a region, or a trade shock in a continent) that has a complexity impact or financial development in one country has a concomitant and substantial spillover effect on the others. The existence of cross-sectional dependence supports the use of a dynamic panel estimator, which clearly takes into consideration persistence in the dependent variable but is resistant to the sophisticated error structure; therefore, the use of a system generalised method of moments (System-GMM) is recommended. Sarafidis, Yamagata and Robertson (2009) reasoned that the system-GMM estimator is consistent under heterogeneous error cross-sectional dependence due to its extended moment conditions that offer a consistent alternative.

Table 4: Levin-Lin-Chu Panel Unit Root Test

Variable	Method	Level Stat. (Prob.)	First Diff. Stat. (Prob.)
ECX	LLC	-4.2434 (0.0005)	-
MSY	LLC	-4.7848 (0.0000)	-
DCP	LLC	-4.3576 (0.0000)	-
DTG	LLC	-2.7013 (0.0035)	-
MCS	LLC	-7.6362 (0.0000)	-
CBB	LLC	-4.2890 (0.0000)	-

Source: Researcher's Computations using STATA 13

The results of Table 4 show that all the variables, including ECX, MSY, DCP, DTG, MCS, and CBB, are stationary in their levels since all the test statistics are negative and statistically significant at the 5 percent level. This observation is significant since it proves that all the variables do not have a unit root and, therefore, the level specifications can be used in the dynamic panel model without differentiation to get a stationary condition. In the case of the system GMM estimator, which considers both level and differenced equation moment conditions, level stationarity also contributes to the validity of the extra instruments that appear on the level equation, where the estimator would be consistent and efficient under the condition of the dynamic specification. Given this condition, the paper proceeded on the estimation of system-GMM with the outcomes reported in Table 5.

Table 5: System-GMM Results

ECI	Coef.	Robust Std. Err.	Z	P>z	[95% Conf.	Interval]
ECI(-1)	-1.383167	.0770951	-17.94	0.000	-1.53427	-1.232063
MSY	.0074343	.0067526	1.10	0.271	-.0058006	.0206691
DCP	.0172545	.0077686	2.22	0.026	.0020283	.0324807
DTG	-.0001575	.0000911	-1.73	0.084	-.000336	.000021
MCS	-.0031358	.0009213	-3.40	0.001	-.0049414	-.0013301
CBB	.0225015	.0160278	1.40	0.160	-.0089124	.0539154
_cons	-.632546	.1536409	-4.12	0.000	-.9336767	-.3314153
Hansen J test: $\chi^2(48)$		51.27		0.346		
Arellano-Bond AR(1): z		-3.58		0.000		
Arellano-Bond AR(2): z		1.12		0.263		

Source: Researcher Computation using STATA 13.

The diagnostics in Table 5 prove that the estimation strategy is valid: the Hansen J test 6(48) = 51.27, p = 0.346, does not reject an instrument exogeneity null hypothesis and therefore indicates that the instrument set is suitable. The value of the Arellano-Bond test of the first-order serial correlation z is -3.58, p = 0.000, whereas the second-order test value z = 1.12, p = 0.263 indicates that there is no residual autocorrelation, for which the dynamic specification is appropriate. These findings give a strong argument according to which a hereditary exchange rate position, as well as a set of macroeconomic fundamentals, is significant determinants of economic complexities throughout the panel.

The coefficient of the lagged dependent variable, ECI (-1) is negative and significant (coefficient = -1.383, p < 0.001). This result implies that the relationship between the economic complexity in the past and the present is dynamic, but it is strongly negative. This implies that more complex economies in the past will have a subsequent fall which can be attributed to the instability of the export structure in SSA where transient diversification improvements are usually destroyed by commodity price shocks or policy changes. This observation does not necessarily refute the Complexity and Capabilities Theory (Hausmann and Hidalgo, 2021), according to which complexity accumulation is a gradual process; instead, it highlights the frailty of the complexity gains in the structurally vulnerable economies.

The positive but less impactful effect of broad money supply on the complexity of the economy is also positive but with an insignificant value (coefficient = 0.00743, p = 0.271). This finding suggests that though the liquidity position maintained in the financial system as a whole might provide the environment in which investment may occur, in itself, it does not change into productive sophistication. This non-significance of this relationship is consistent with the results of Aslam et al. (2022), who stated that financial development by itself is not significant in the promotion of economic complexity in the Belt and Road Initiative countries

without its interaction with strong institutions. The hypothetical hypothesis, which is based on the Complexity and Capabilities Theory, is that the mobilisation of resources to the complex industries should be supported by financial depth. In the case of the SSA, though, broad money can be consumed in speculative or consumption activities, as opposed to being invested in capability-building activities, a shallow process of intermediation.

A positive and significant influence on economic complexity is found between domestic credit and the private sphere (coefficient = 0.01725, p = 0.026). This result is theoretically sound, since finance to go to the private firms is necessary in the acquisition of machinery and skills and technologies required in the process of diversification into more advanced exports. The finding aligns with the empirical evidence of Aslam *et al.* (2022) and Ajide and Osinubi (2024), who discovered that financial development is an effective instrument in advancing the complexity in African economies. This implies that in the channelling of credit to the private sector, it can be an effective means of facilitating structural change and, therefore, the policy imperative to strengthen the lending by the private sector.

The depositors of commercial banks have a negative and insignificant impact on economic complexity (coefficient = -0.0001575, p = 0.084). Although the size is economically insignificant, the negative is opposite to the theoretical expectation that financial inclusion would increase the pool of savings and resource distribution to complex production. This finding could be attributed to the fact that as more depositors are attracted, especially in the developing economies, it does not necessarily lead to productive issuance of credits. Alternatively, it can also suggest that high levels of formal banking involvement correlate with the low-value one of consumption-based banking services and not investment financing. That is aligning with the warning expressed by Ndoya *et al.* (2023), who show that the impact of financial development on complexity depends on stability in the country; in unstable settings, even inclusive financial systems can fail to promote complexity.

Mobile cellular subscriptions have a negative and significant impact on economic complexity (= -0.003136, p = 0.001). This finding is not only one that is impressive but also hypothetically unforeseen, as the mobile technology is most of the time proclaimed as a revolutionary instrument to financial inclusion and market integration in Africa. This means that a higher level of mobile penetration can be linked to a lower level of economic complexity, a conclusion that echoes the criticism that mobile technology in the developing economies is more of use in consumption, social networking and mobile money transfers than it has been active in spreading productive knowledge and in high-level economic activities. This finding is opposed to the idealistic approach by Khan *et al.* (2025) on the effect of mobile money in enhancing investment. Instead, it is consistent with the fact in the conceptual review that technology should be used as a production-enabling technique as opposed to consumption-orientated technology. The result also reflects the results of Balland *et al.* (2022) that technological diffusion does not necessarily lead to an increase in complexity unless it is accompanied by other institutional and human capital investments.

The branches of commercial banks have a positive but insignificant impact on the complexity of the economy (coefficient = 0.02250, p = 0.160). Though theoretically the same direction should ensure that increased physical access to the banking services would, in principle, permit financial intermediation of productive activities, the insignificance implies that the sheer existence of the bank branches is not enough to induce complexity. This could be attributed to the fact that in most SSA countries, the bank branches are still centralised in urban centres and only cater to large, established businesses and leave out small and medium enterprises (SMEs) and entrepreneurs in rural areas, who are the main agents of diversification. This finding is not unique to the results of Low *et al.* (2024), who highlight that the complexity is driven by differences between financial institution depth and market efficiency and that aggregate indicators can hide the subtle mechanisms that financial access can follow.

Conclusion and Recommendations

This paper confirms the assertion that the association between financial development and economic complexity in Sub-Saharan Africa is diverse and context-specific and that only the domestic credit to the private sector has a heavy positive influence, and surprisingly, mobile cellular subscriptions demonstrate a heavy negative relationship, and thus, more importantly, financial expansion is not enough in promoting structural transformation without strategic reorientation towards productive capability accumulation. With this, it is suggested that: Policymakers need to shift towards sectoralised financial deepening, namely through the establishment of development finance windows and credit guarantee schemes that selectively channel domestic credit towards sectors of high complexity such as knowledge-intensive manufacturing, agro-processing, and technology-based services that underpin export sophistication.

The governments of these countries should, in combination with telecommunications regulators and development partners, implement compulsory digital literacy programmes and incentivize mobile network operators to develop business-to-business services and enterprise-oriented applications that reuse mobile technology not as a consumption tool. As a way of ensuring that financial development actively stimulates the building of the productive capabilities that are necessary to achieve longer-lasting structural change, financial regulators and the central banks should implement a complexity-sensitive supervisory framework, which not only requires financial institutions to disclose their sectoral credit allocation but also puts in place differentiated reserve requirements or interest rate limits, which prioritise lending to high-complexity sectors.

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