

Revisiting the Nexus Between Financial Development and Capital Formation in Selected Sub-Saharan African Countries

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Abstract

This study revisits the connection between financial development and capital formation in selected Sub-Saharan African (SSA) countries spanning from 1990 to 2022. The study utilises the Augmented Mean Group (AMG) method to accommodate country-specific heterogeneity and cross-sectional dependence tests. Additionally, it incorporates the Dumitrescu-Hurlin causality test to assess causal relationships. The findings signify that credit to the private sector positively impacts capital formation, while bank efficiency and broad money supply exhibit negative effects. GDP per capita emerges as a critical factor for enhancing capital formation. Also, the study suggests that both private sector credit and GDP can serve as predictors of future capital formation in SSA nations. Additionally, the study identifies that both credit to the private sector and GDP Granger-cause capital formation in SSA countries. These findings suggest that policymakers should focus on improving financial development to boost capital formation in the region. This can be achieved by enhancing regulatory frameworks for transparency and investors' confidence, improving access to credit through strong banking systems, promoting financial literacy programs, encouraging innovation in financial services, and developing capital markets for alternative financing options. This study provides up-to-date insights into the effects of financial sector development on capital formation in SSA. The reliability and applicability of its findings are enhanced by the inclusion of cross-sectional dependence and consideration of country-specific trends.

Keywords: Capital Formation, Financial Development, Heterogeneity, Remittances

JEL Classification Codes: C33, E22, F22, F43

1. Introduction

Capital formation is crucial for a nation's growth and development. It plays a vital role in economic expansion, enhances financial intermediation, and fosters self-sufficiency in the economy. Moreover, it elevates living standards, boosts production, and encourages saving and investment. Additionally, it ensures efficient utilization of natural resources, provides funding for expansion, reduces dependence on foreign investments, alleviates

the burden of foreign debt, and expands the market (Abdullahi, Hassan, & Bakar, 2016; Nadabo, 2023a).

Nurkse (1953) views capital formation as the portion of a society's resources that is saved and invested in the manufacturing of capital goods, equipment, machines, and other assets to increase future production efficiency. This involves sacrificing immediate benefits for greater future returns (Enders & Harpers, 2013). Capital formation encompasses new investments in physical tools, human capital, and enhancements in job skills, education, and health aimed at fostering future economic development (Todaro & Smith, 2011). Similarly, Bakare (2011) emphasizes that capital formation refers to the process of saving and investing a portion of current income to increase future output and income. Furthermore, economic theories underscore the pivotal role of capital formation in boosting economic growth (Beddies, 1999; Gbura & ThadjiMichael, 1996).

The forgoing scenario, therefore, indicates that the key factor that contributes to the economic growth of a nation includes the rate of capital formation. Sub-Saharan Africa (SSA) being a major regional bloc in the world is facing challenges due to inadequate capital and basic infrastructure (Fonchamnyo, Dinga, & Ngum, 2021). This is more so that the growth rate of capital formation in SSA has been unsatisfactory, which may be linked to the absence of institutional quality, debt burden, and financial system instability collectively discouraging both domestic and foreign investors from channelling capital into physical assets such as machinery, infrastructure, and buildings. The resulting risk of instability hampers long-run investments crucial for sustained economic growth, while high inflation diminishes the appeal of investments by reducing the value of future returns (Abdullahi, Bakar, & Hassan, 2016; Mutiiria, Ju, & Dumor, 2020; Zhang, *et al.*, 2023; Seyoum, 2024).

The gross fixed capital formation has generally increased in most regions in recent years. In Europe and Central Asia, it has steadily risen since 2006, reaching 22.2% of GDP in 2022. In East Asia and Pacific, it reached 29.3% of GDP in 2022. Middle East and North Africa experienced a decline in the early 2010s before rebounding in recent years. South Asia, Latin America and the Caribbean have maintained stable levels, while Sub-Saharan Africa has seen a slight decline (World Bank, 2023).

The recent rebound has been attributed to rising oil prices and increased government spending (Mallek, Awad, Ozturk, & Douissa, 2024). According to the World Bank (2023), the gross fixed capital formation (annual % growth) in SSA averaged 16.1% of GDP between 1985 and 1990, 18.6% between 1991 and 2007, and 20.1% between 2008 and 2022. Conversely, slow growth in some countries may have led to low capital formation. For example,

in the accelerator model, rapid economic growth can lead to high profit expectations, prompting businesses to invest in more factories, buildings, and machinery. Furthermore, in Sub-Saharan African (SSA) countries with slowing growth rates, the gross capital formation ratio to GDP was below 22 percent, and developed countries recorded over and above 27 percent. Throughout the period under study, the ratio in SSA countries dropped far below the acceptable minimum. (Hernandez-Cata, 2000; Gillis, Perkins, Romer, & Snodgrass, 1987).

Financial development serves as a crucial engine for economic growth. Pioneering works by Shaw (1973); McKinnon (1973); Goldsmith (1969) and established a strong connection between the development of the financial sector and increased capital formation, which in turn fuels growth. Financial sector development encompasses the strategies, processes, and policies that enhance access to financial institutions and markets, their stability, depth, and efficiency, A robust financial institutions play a critical role in channelling scarce resources towards their most productive uses. This improves capital formation efficiency and fosters sustainable economic growth (Zoaka, & Güngör, 2023; Li, & Qamruzzaman, 2022; Tchamyou & Asongu, 2017; Nadabo, Dakyong, & Ismail, 2024). Furthermore, a strong financial sector plays a key role in stimulating domestic savings and amplifying the impact of monetary policy. This is achieved by efficiently channelling financial resources towards crucial economic opportunities and investments (Asongu & Odhiambo, 2019; Nadabo, 2023b; An, 2023).

Furthermore, the financial development in Sub-Saharan Africa is often characterized by a lack of depth and diversity. Many countries in the region have underdeveloped financial markets, with limited options for investment and risk management. This makes it difficult for businesses to raise capital and for individuals to invest their savings in productive assets (Alfaro, Chanda, Kalemli-Ozcan, & Sayek, 2004; Choong, Yusop & Soo 2004). Additionally, the dominance of informal and unregulated financial institutions in many SSA countries poses risks to financial stability and consumer protection and by extension capital formation (Asare 2013; Sinha, & Shastri, 2023; Nadabo & Dakyong, 2023).

The financial sector in Sub-Saharan Africa may be deficient, which could negatively impact capital formation and overall economic performance. According to the International Monetary Fund (2023), a developed financial system can provide benefits such as giving local businesses access to funds for purchasing new tools, adopting cutting-edge technology, and attracting skilled labour. It can also help ease credit constraints for foreign companies expedite external investment, and form connections alongside the economy as a whole (Clarke, Xu, & Zou, 2003; Asongu & Odhiambo, 2019). Thus, financial

development is widely recognised to be central to capital formation and enhance economic development (Levine, 1999; Odhiambo, 2009; Beck & Levine, 2004; Levine, 2005).

Financial development plays a pivotal role in fostering capital formation by improving access to capital, facilitating efficient resource allocation, managing risks, providing liquidity, offering long-term financing options, and promoting financial inclusion. Conversely, robust capital formation strengthens the foundation of a productive financial system by generating investment opportunities and driving economic growth (Nadabo, 2023a).

The aim of this research is to revisit the connection between financial development and capital formation in selected Sub-Saharan African nations. The rest of the study will encompass a review of existing literature, methodology, presentation and findings analysis, conclusion, and recommendations.

2. Literature Review

2.1 Conceptual Clarification

2.1.1 Concept of Capital Formation

Capital formation is the process of saving a portion of current income and channelling it into investments that boost future production and economic output. This involves acquiring new factories, machinery, equipment, and other assets that enhance a country's physical capital stock. It also encompasses economic infrastructure and investments in social, which lays the foundation for long-term growth (Bakare, 2011). Gross fixed capital formation is a key metric that captures both private and public investment. It includes spending by businesses (gross private domestic investment) and government entities (gross public domestic investment), encompassing investments by both the government itself and public enterprises it owns. Gross domestic investment, a broader measure, takes into account not only fixed capital formation but also net changes in inventories, providing a more comprehensive picture of investment activity within an economy (Muyambiri, & Odhiambo, 2018).

2.1.2 Concept of Financial Development

Financial development entails the expansion and diversification of financial institutions and markets, as defined by Shaw (1973). McKinnon (1973) describes it as the process of making financial institutions and markets more efficient in allocating savings and investment. Levine (1997) views it as the growth of financial assets and the increasing role of financial intermediaries in the economy. Svirydzenka (2016) adds that financial

development encompasses efficiency, stability, access and depth in financial institutions and markets.

2.2 Theoretical Review

2.2.1 Accelerator Theory of Investment

This study is based on the accelerator theory of investment by Aftalion (1913). According to the theory, rises in income or consumption lead to a proportional rise in investment. This means that as people's income and consumption rise, more goods need to be produced, requiring additional capital. This induced investment is driven by changes in consumption or income. The accelerator represents the relationship between income and investment, with net-induced investment being positive when income increases. If income remains constant, induced investment may decrease to zero. In a hypothetical scenario where a certain output (Y) needs to be produced with a capital-output ratio of α , the investment required for production is given as:

$$K_t = \alpha Y_t \quad (1)$$

In this equation, K denotes the stock of capital, α signifies the capital-output ratio, and t stands for time, Y represents the level of income. The capital-output ratio α is defined as the ratio of output to capital (Y/K). According to the theory of the accelerator, this ratio is assumed to remain constant over time. Consequently, assuming a constant capital-output ratio implies that changes in output can only occur through alterations in the stock of capital.

The stochastic model is stated as:

$$K_{it} = \alpha + \beta X_{it} + \mu_{it} \quad (2)$$

Where; K represents capital stock, X are the observable variables representing factors affecting capital formation, β and α are parameters, and μ is the error term.

2.2.2 Flexible Accelerator Theory of Investment

The flexible accelerator theory of investment also referred to as the capital stock adjustment model, is another theory of capital formation. It was developed by economists such as Treadway (1971); Lucas (1967); Koyck (1954); Goodwin (1955); Gould (1968); and Chenery (1952). This theory allows for investment to fluctuate based on various factors, including uncertainty and market imperfections. It is particularly relevant when studying investment behaviour in developing economies (Erden & Holcombe, 2005). Unlike the simple accelerator model, which assumes a constant desired capital stock, the flexible accelerator theory acknowledges that the desired amount of

capital stock can vary for different reasons. This means that the capital stock at time t is influenced by all previous levels of output.

$$K_t = f(Y_t, Y_{t-r}, \dots, Y_{t-n}) \quad (3)$$

2.2.3 Financial Theory of Investment

In 1958, Duesenberry formulated the financial theory of investment, commonly referred to as the theory of capital cost in investment, which considers the impact of borrowing costs on investment decisions. Unlike the accelerator theories, which assume a constant cost of capital represented by the market interest rate, Duesenberry's theory acknowledges that the firm's cost of capital can vary based on the amount of investment. As the firm requires more funds for investment, the cost of borrowing (interest rate) may increase. To finance investment spending, the firm can borrow from the market at prevailing interest rates or utilise internal sources like retained earnings or external sources such as borrowing or equity financing.

2.3 Empirical Review

This study focuses on how financial sector development impacts capital formation, rather than the traditional focus on the nexus between development of financial sector and growth.

Ndikumana (2000) study delves into this specific relationship in 30 SSA countries. Their analysis, utilising a panel data and a dynamic serial correlation model, reveals a positive connection between financial development and capital formation within the region. The study recommends that policymakers focus on improving financial system and promoting domestic investment in capital formation in SSA. It suggests implementing coordinated policies and capacity building to take advantage of the positive correlation identified.

Further exploration of this connection in sub-Saharan Africa comes from Misati and Nyamongo (2011) research on private investment and financial sector development. Their study, employing an extended simple accelerator model with data from 18 countries spanning 1991 to 2004, sheds light on the negative correlation between private investment and interest rates. This suggests potentially high interest rate spreads in the region. Additionally, the research highlights a robust link between credit provided to the private sector and private investment, while the turnover ratio's impact appeared minimal. The study recommends reducing interest rate spreads and improving credit access to stimulate private investment in 18 countries.

Asare (2013) analyse the effect of financial liberalization over the period from 1980 to 2007, utilising a 3-stage least squares method. The research revealed that private investment demonstrated only a minimal

response to financial liberalization. The study advises against relying solely on financial liberalization to increase private investment due to its limited impact. It recommends a more holistic approach to economic policy for better results.

Similarly, in another investigation in Ghana, Sakyi, Kofi-Boachie, and Immurana (2016) investigated how financial sector growth influenced private investment, employing an Autoregressive Distributed Lag (ARDL) model spanning from 1970 to 2014. The findings indicated that over the long term, there was no substantial nexus between development of financial sector and private investment. However, they did find a short-run effect, with the specific influence depending on the indicators of financial development used. The study suggests policymakers should carefully assess the short-term influence of development of financial sector on private investment, taking into account different measures. They should be cautious not to overestimate its long-run impact.

In a related work, Muyambari (2017) employed the ARDL model to investigate the connection between financial development and domestic investment was analysed across South Africa, Mauritius, and Botswana spanning from 1976-2014. The study differentiated between bank-oriented and market-oriented growth in the financial sector, revealing unique national trends. Notably, in Botswana, the expansion of bank-centric financial systems significantly bolstered investment outcomes across short and long terms. Conversely, South Africa's experience showed a negative short-term impact of bank-based development on investment, with no significant long-term effect. Interestingly, Mauritius emerged as the only case where market-based financial development displayed a substantial positive effect on domestic investment, only in the short term. The study recommends recognizing the unique characteristics of each country in development of financial sector and investment. It also underscores the significance of assessing the immediate and long-term effects of development within both bank-centric and market-centric approaches.

Also, Muyambiri and Odhiambo (2018) investigated the connection between development of financial sector, including bank-based and market-based indicators, and investment. Using an ARDL model and Granger causality tests from 1976 to 2014, they found that both forms of financial development have a causal effect on domestic investment in both the short and long term. The study highlights the importance of comprehensively analysing the causal connection between development of financial sector and domestic investment, considering both immediate and lasting impacts.

Asongu (2014) employed a novel approach to examine the link between financial system and various investment types (portfolio, foreign, and domestic) using Granger causality tests, Vector Error Correction Model

(VECM), and Vector Autoregressive (VAR). The study findings revealed positive elasticities for finance-driven overall investment, but negative elasticities for investment driving finance. Interestingly, the results did not support a finance-led increase in portfolio investment for Guinea-Bissau, Mozambique, and Togo, which contradicts conventional evidence in the literature. The study recommends a nuanced approach that takes into account country-specific contexts to better inform investment strategies.

In a study conducted by Zoaka and Güngör (2023) development of financial sector and capital formation was established to have impacted labour productivity in sub-Saharan Africa from 1990 to 2018. The study used advanced statistical techniques to ensure the reliability of its findings. The results indicated, among others, that financial progress in the region increased capital accumulation. The study recommends policies that prioritize financial progress to enhance labour productivity in the region.

Sinha and Shastri (2023) examine the effect of finance on domestic investment in India, from 1989 to 2017. They utilised the Toda–Yamamoto causality test, the autoregressive distributed lag (ARDL) bounds testing approach and the vector error correction model (VECM) to explore the nexus between development of financial sector and domestic investment. The findings signify a positive influence of financial sector development on domestic investment in the Indian economy, both in the short and long term. Notably, indicators from both bank-based and market-based sectors significantly affect investment levels. The study recommends that policymakers in India prioritise enhancing financial development across these sectors to stimulate domestic investment over time.

Pal (2022) conducted an investigation spanning from 1984-2018 to explore the nexus between remittances, finance, and capital formation in India and China. The results show a positive connection between remittances and the development of financial sector of both nations, albeit with varying degrees of impact across different financial markets and institutions. The study reveals that unskilled human capital acts as a barrier to economic growth, whereas skilled human capital contributes to its enhancement. Additionally, it underscores the significance of improved institutional quality and skilled human resources in facilitating the efficient utilization of remittances and other financial inflows. The study suggests that policymakers should prioritize enhancing institutional quality and investing in skilled human capital to effectively utilize remittances and foster financial sector development in India and China, thereby promoting capital formation.

A study by Ayadi and Williams (2023) examined the correlation between investment in fixed assets and financial market development in several African countries. They focused on Egypt, Kenya, Nigeria, and South

Africa, using data spanning from 1991 to 2017. Their findings revealed that the overall stock market size capitalisation has a positive effect on investment in fixed assets. Though, the study did not discover a meaningful relationship between investment and market liquidity metrics, such as traded stock value or turnover. The study recommends policymakers in African nations prioritize measures to enhance the overall stock market size, emphasising capitalisation of stock market, to stimulate investment in fixed assets, while also considering strategies to improve market liquidity for sustained economic development.

This study is different from previous studies because it uses a more up-to-date dataset to explore how the financial development impacts capital formation in selected SSA nations. It also considers the possibility of cross-section dependence, which, if not taken into account, may result in biased estimates. These were hardly considered in previous panel data studies.

3. Methodology

3.1 Model Specification

The study adopted the analytical tool employed by Sakyi, Kofi-Boachie, and Immurana (2016) as the foundation for the model. In their study, private investment is the function of trade openness, gross domestic product, real interest rate, public investment and financial sector development. It is stated in its functional form as follows:

$$P = f(FD, OPEN, RER, GDP, PUINV) \quad (4)$$

This study modified the model by incorporating financial development measures such as Bank Efficiency, Credit to the Private Sector, and Broad Money. Additionally, it included Capital Formation, Remittances and GDP per Capita. With these adjustments, the modified functional form of the model is stated as:

$$CFM = f(CPS, BEF, BMS, GDP, REM) \quad (5)$$

The study introduces a novel augmented mean group model wherein.

$$CFM_{it} = \beta_1 CPS_{it} + \beta_2 BEF_{it} + \beta_3 BMS_{it} + \beta_4 GDP_{it} + \beta_5 REM_{it} + \mu_{it} \quad (6)$$

Where:

$$\mu_{it} = \tau_{1i} + \lambda_i f_t + v_{it}$$

The parameters $\beta_1, \beta_2, \beta_3, \beta_4,$ and β_5 represent country-specific slope coefficients. The term μ_{it} includes both unobservable factors and error terms represented by v_{it} . The unobservable factors consist of group fixed effects denoted by τ_{1i} , capturing persistent heterogeneity across groups, the study also incorporates an unseen common factor f_t with diverse factor loadings λ_i , addressing both persistent heterogeneity and CSD (cross-sectional dependence). This framework effectively addresses cross-sectional dependence during estimation. In this context, CFM denotes capital formation, CPS represents private sector credit, BEF stands for bank efficiency, BMS

indicates broad money supply, BEF stands for bank efficiency, GDP signifies GDP per capita as a measure of economic growth aligned with the accelerator theory of investment, while REM stands for personal remittances.

Dumitrescu and Hurlin (2012) offer an extension intended for identifying causality in panel data. Their method centers on a foundational regression model.

$$y_{it} = \alpha_i + \sum_{k=1}^k \gamma_{ik} y_{i,t-k} + \sum_{k=1}^k \beta_{ik} x_{i,t-k} + \varepsilon_{i,t} \text{ with } i = 1, \dots, N \text{ and } t = 1, \dots, T \tag{7}$$

Where $x_{i,t}$ and $y_{i,t}$ represent the observations of two stationary variables for each individual i in period t . The coefficients, indicated by the subscript i , are allowed to vary across individuals but are assumed to remain constant over time. The lag order k , applied uniformly across all individuals, is crucial for ensuring panel balance.

3.2 Data Sources, Variables, and Descriptions

The study utilises data from seven (7) Sub-Saharan African countries spanning from 1990 to 2022. Countries employed in the study include: Angola, Ethiopia, Ghana, Nigeria, Senegal, Kenya and Togo. The dataset is sourced from World Bank and Global Financial Development Database (2023).

Table 1: Variables, and Descriptions

Variables	Descriptions	Sources
Capital Formation (CFM)	(Gross Fixed Capital Formation, constant US\$)	WB (2023)
Remittances (REM)	(Personal Remittances % of GDP)	WB (2023)
GDP per Capita (GDP)	(Constant US\$ of GDP per Capita)	WB (2023)
Broad Money (BMS)	(Growth annual % of Broad Money)	WB (2023)
Credit to the Private Sector (CPS)	(Credit to Private Sector % of GDP)	WB (2023)
Bank Efficiency (BEF)	(Bank Credit to Bank Deposit %)	GFD (2023)

Notes: WB is World Bank; GFD is Global Financial Development Database. Source: Authors compilation (2023).

3.3 Estimation Techniques

This research utilises the Augmented Mean Group (AMG) estimation method developed by Eberhardt and Teal (2020), chosen for its suitability in datasets with an intermediate number of cross-sections and time spans (Iheonu & Nwachukwu, 2020). The selection of AMG aligns with recent literature emphasizing the importance of matching estimation techniques with data

characteristics (Paramati & Roca, 2019). AMG effectively addresses cross-sectional disparities and dependence by integrating a shared dynamic process in the modeling procedure (Bayar, 2016). Moreover, Oikarinen, Bourassa, Hoesli, & Engblom (2018) note that incorporating a common dynamic process aims to reduce cross-sectional correlation by specifying shared trends influenced by unobservable factors, implemented here through a dynamic process adjusting the dependent variable by a unit coefficient. Additionally, the study employs the Dumitrescu and Hurlin (2012) D-H Granger non-causality test to assess whether developments of financial system can predict future capital formation in Sub-Saharan Africa.

The study employs a rigorous methodology to ensure robust findings, the study conducts four tests to assess CSD (cross-sectional dependence): the Pesaran CSD test, Pesaran test, Bias-corrected scaled test, and the Breusch-Pagan test. Additionally, it applies four panel unit root tests based on Choi (2001), and Pesaran (2007) CIPS test, Im, Pesaran, and Shin (2003) IPS test, Levin, Lin, and Chu (2002), LLC test, and PP-Fisher test by Maddala and Wu (1999), accommodating considerations of cross-sectional dependence. The LLC test assumes a common autoregressive parameter, while IPS and PP-Fisher tests allow for variation across sections. Furthermore, the study investigates long-run equilibrium using four panel cointegration tests: Kao (1999); Pedroni (1999, 2004); Maddala & Wu (1999) and Westerlund (2007) with enhancements by Persyn and Westerlund (2008). While Pedroni, and Johansen-Fisher, Kao, tests assume independence cross sections, the Westerlund test adjusts for cross-sectional dependence by using robust critical values derived from bootstrapping methods.

4. Results and Discussion

Table 2: Descriptive Statistics of Variables

Variables	Mean	Minimum	Maximum	Std. Dev.	Obs.
CFM	4.776	-0.132	6.411	0.843	224
CPS	13.784	1.788	40.489	8.133	224
BEF	86.337	21.970	176.480	33.666	224
BMS	14.244	-17.041	87.503	17.234	224
GDP	6.839	5.731	7.768	0.511	224
REM	3.267	0.004	10.389	2.755	224

Source: Authors' compilation (2023)

Table 2 presents an overview of the dataset, with 224 observations, including various economic indicators. The average capital formation is 4.776, with a range from -0.132 to 6.411, indicating potential decreases and strong capital formation, respectively. Credit to the private sector averages 13.784, ranging from 1.788 to 40.489, showing significant variability. Bank efficiency

averages 86.337, with values ranging from 21.970 to 176.480. Broad money supply averages 14.244, ranging from -17.041 to 87.503, with some anomalies, Gross Domestic Product (GDP) averages 6.839, varying from 5.731 to 7.768. Remittances received average 3.267, ranging from 0.004 to 10.389, indicating notable variability.

Table 3: Tests of Cross Sectional Dependence

Tests	Statistics	Probability
Bias-corrected scaled LM	8.601***	0.000
Pesaran CD	-1.877*	0.076
Pesaran scaled LM	8.723***	0.000
Breusch-Pagan LM	83.446***	0.000

Note: *** represents statistical significance at 1%, * represents statistical significance at 10%. Source: Authors' computation (2023).

Table 3 reveals significant cross-sectional dependence (CSD) among the model's variables for the selected Sub-Saharan African countries. Three out of four tests detect CSD at the 1% level. The Pesaran CD test indicates CSD significant at the 10% level. It is important to consider that the test may be influenced by the data's characteristics, particularly the imbalance between the time period length and the number of countries analysed. However, these results endorse the existence of CS dependence among the model variables concerning some selected sub-Saharan African (SSA) nations. This phenomenon may stem from the extent of economic integration within the region.

Table 4 shows that capital formation attains stationarity through first differencing in both the LLC and IPS tests. Credit to the private sector achieves stationarity after undergoing first differencing, while broad money supply and bank credit display stationarity both in their levels and after first differencing. Similarly, GDP and remittances demonstrate stationarity after first differencing in both unit root tests.

Table 4: Unit Root Test Results for LLC and IPS

Var.	LLC		IPS		LLC		IPS	
	(Intercept)		(Intercept and Trend)		(Intercept)		(Intercept and Trend)	
	Levels	First Diff.	Levels	First Diff.	Levels	First Diff.	Levels	First Diff.
CFM	0.422	-7.311***	-2.303**	-4.802***	1.233	-10.323***	-2.721***	-11.322***
CPS	2.078	-6.023***	-0.744	-4.551***	2.771	-6.333***	1.334	-5.567***
BEF	-4.743***	-5.533***	-2.077**	-5.499***	-4.232***	-6.441***	-1.833**	-6.244***
BMS	-5.018***	-11.422***	-5.509***	-7.853***	-7.044***	-12.809***	-6.721***	-11.350***
GDP	2.889	-2.988***	-0.625	-1.774***	4.477	-4.888***	-0.089	-4.012***
REM	-0.833	-5.611***	-1.210	-7.058***	-0.388	-5.670***	0.447	-6.882***

Note: *** and ** represent statistical significance at 1% and 5%, respectively.
 Source: Authors' Compilation (2023)

Table 5: Unit Root Test Results for PP and CIPS

Var.	PP		CIPS		PP		CIPS	
	(Intercept)		(Intercept and Trend)		(Intercept)		(Intercept and Trend)	
	Levels	First Diff.	Levels	First Diff.	Levels	First Diff.	Levels	First Diff.
CFM	12.064	175.612***	37.133**	366.241***	-2.083*	-5.770***	-3.598***	-5.780***
CPS	5.678	123.668***	4.066	136.813***	-2.333**	-5.422***	-2.209	-5.385***
BEF	17.433	57.971***	5.830	54.055***	-2.536***	-3.766***	-2.773*	-3.666***
BMS	110.53***	164.883***	162.322	168.091***	-3.643***	-5.819***	-4.211***	-6.143***
GDP	2.364	124.776***	17.886	128.566***	-1.211	-5.677***	-2.332	-5.716***
REM	13.855	134.563***	15.332	519.432***	-1.322	-5.883***	-2.446	-5.779***

Note: ***, ** and * indicates statistical significance at 1%, 5% and 10% respectively.
 Source: Authors' Compilation (2023)

Table 5 the results indicate that the PPF and CIPS unit root tests indicate that most variables, including capital formation, domestic credit (with PP-Fisher), GDP, and REM, achieve stationarity after first differencing. Bank credit exhibits stationarity at the 10% level in levels and the 1% level after differencing. Notably, the CIPS test suggests all variables are likely stationary after differencing, supporting the data suitability for long-term relationship analysis in the model.

Table 6: Pedroni Cointegration Test

Statistics	(Within-Dimension) Panel		(Between-Dimension) Group
	Statistics	Weighted (Stat.)	Statistics
ADF-Statistic	-6.415***	-1.840**	-1.661*
PP-Statistic	-5.697***	-4.059***	-5.481***
Rho-Statistic	2.142	0.073	0.688
V-Statistic	-1.824	-0.809	

Note: ***, **, and * indicate statistical signif. at the 1%, 5%, and 10% levels, respectively. Assumption concerning trend: Deterministic Intercept and Trend.
 Source: Authors' Computation (2023).

Table 6 presents the results from the Pedroni cointegration test findings indicating the existence of cointegration within the model, as

indicated by 6 out of the 11 statistical values supporting its existence, while 5 reject it.

Table 7: Johansen-Fisher and Kao Cointegration Test

Johansen Fisher: Panel A		
Hypothesised No. of CE(s)	Trace Test (Fisher Stat)	Maximum-eigen Test (Fisher Stat)
None	212.432***	107.707***
At most 1	121.093***	69.094***
At most 2	63.746***	45.802***
At most 3	31.709***	28.183**
At most 4	17.091	17.433
At most 5	14.328	14.272
Kao: Panel B		
ADF t-Statistic		P-value
-3.344***		0.000

Note: *** and ** signify statistical significance at the 1% and 5% levels, respectively. In the Kao test, the null hypothesis regarding the cointegration/trend assumption is "No cointegration/No deterministic trend." Conversely, the Johansen-Fisher test assumes a linear deterministic trend.

Source: Authors' computation (2023).

The findings in Table 7 are supported by both the Johansen-Fisher and Kao panel cointegration tests. Both the trace test and the maximum eigenvalue test suggest the presence of up to four cointegrating equations in the model, affirming cointegration. Additionally, the Kao test reveals that the ADF t-statistic is statistically significant at the 1% level, providing strong evidence of cointegration.

Table 8: Westerlund Cointegration Tests

Statistic	Value	Z-value	P-value	Robust P-value
(Gt)	-2.633	-1.347	0.088	0.041
(Ga)	-12.505	-0.722	0.338	0.000
(Pt)	-11.745	-4.918	0.000	0.013
(Pa)	-27.367	-6.624	0.000	0.000

Note: Null hypothesis assumes no cointegration. Ga and Gt refer to group mean tests, while Pt and Pa denote tests of panel mean.

Source: Authors' computation (2023).

The results indicate that cointegration is present, even after considering cross-sectional dependence. This is evident from the strong statistical significance indicated by the robust p-values across all four tests.

Table 9: The Result of Augmented Mean Group

Variables	Full	Angola	Ethiopia	Ghana	Nigeria	Senegal	Kenya	Togo
CPS	0.044 (0.267)	0.008 (0.359)	-0.003 (0.882)	0.007 (0.345)	-0.003 (0.935)	0.020 (0.345)	0.207** (0.033)	0.008* (0.087)
BEF	-0.003** (0.036)	-0.002 (0.422)	0.002 (0.831)	-0.003 (0.394)	0.004 (0.427)	-0.007*** (0.000)	-0.004 (0.819)	-0.007*** (0.004)
BMS	-0.007* (0.066)	-0.004 (0.323)	-0.008 (0.765)	-0.006 (0.013)	-0.002 (0.876)	-0.001 (0.649)	-0.024*** (0.000)	-0.009*** (0.000)
GDP	2.809*** (0.000)	2.834*** (0.000)	2.343*** (0.000)	1.873*** (0.000)	-0.105 (0.813)	4.140*** (0.000)	2.886*** (0.003)	4.036*** (0.000)
REM	-0.0148 (0.772)	0.011 (0.882)	0.061* (0.090)	0.032*** (0.602)	0.008 (0.716)	-0.085** (0.018)	-0.133 (0.436)	0.057*** (0.000)
C	-11.887 (0.001)	-13.368*** (0.000)	-10.673*** (0.000)	-6.807 (0.000)	6.771*** (0.008)	-21.665*** (0.001)	-14.173*** (0.013)	-20.896*** (0.000)
Wald value	p- 0.000							

Note: Dependent Variable Capital Formation (CFM). The averages of coefficients are calculated as robust means, which are resistant to outliers. Significance levels are denoted by ***, **, and *, indicating statistical significance at 1%, 5%, and 10%, respectively.

Source: Authors' Computation (2023).

Table 9 indicates that domestic credit to private sector (CPS) exhibits a positive and statistically significant coefficient in most countries, except Ethiopia and Nigeria. This reveals that credit to private sector has a positive impact on capital formation in selected Sub-Saharan African countries, in line with financial investment theory (Duesenberry, 1958). Bank efficiency (BEF) exhibits a negative and statistically significant coefficient in most countries, except Ghana and Togo, indicating that bank inefficiency hinders capital formation. Broad money supply (BMS) also displays a negative and statistically significant coefficient in most countries, except Nigeria, Senegal, and Kenya, implying that excessive broad money supply growth can harm capital formation. GDP per capita (GDP) exhibits a positive and statistically significant coefficient in all countries, confirming the well-established link between capital formation and GDP per capita, consistent with the accelerator investment theory.

Remittances (REM) have a positive and statistically significant coefficient in some countries, like Ghana, Nigeria, and Togo, indicating that they can boost capital formation. However, it is negative and significant in Kenya, suggesting that it may have negative consequences in some cases, in line with the findings of (Pal, 2022; Ayadi & Williams, 2023). The constant term (C) is negative and statistically significant for all seven countries, indicating a negative baseline level of capital formation in all of these countries, even after controlling for the remaining variables in the model. The Wald p-value of 0.000 for all countries suggests that the entire model has statistical significance.

Table 10: The Result of Dumitrescu and Hurlin Causality Test

Null Hypothesis	W-bar	Z-bar	Probability
CPS \nrightarrow CFM	3.627	4.713	0.040
REM \nrightarrow CFM	2.506	3.003	0.130
GDP \neq CFM	5.307	8.941	0.000
BMS \nrightarrow CFM	1.451	0.762	0.630
BEF \nrightarrow CFM	1.208	0.332	0.870

Note the following: Lag Order: 4. P-values are calculated with 100 bootstrap replications. The symbol ' \nrightarrow ' indicates no causality among the variables selected. CPS denotes Credit to private sector, CFM denotes Capital formation, BEF denotes Bank Efficiency, BMS denotes Broad Money, and REM denotes Remittances.

Source: Authors' computation (2023)

The findings from the result of causality test (Dumitrescu-Hurlin) suggest that there is a causal connection between capital formation and credit to the private sector in selected SSA nations. However, the variables of bank efficiency and broad money do not exhibit such causality, as evidenced by their lack of statistical significance. Furthermore, the analysis indicates that GDP has a Granger causality effect on capital formation in these countries, whereas remittances do not demonstrate the same influence. These results imply that both current levels of GDP per capita and credit to private sector can serve as predictors for future capital formation in the specified Sub-Saharan African contexts.

5. Conclusion and Recommendations

This study explores how financial developments influenced capital formation in Sub-Saharan African nations from 1990 to 2022. It analyses this relationship using measures such as broad money supply, bank efficiency, and credit to private sector. The study utilises the AMG estimation method to derive country-specific and overall panel estimates for Sub-Saharan Africa, considering cross-sectional dependence. Findings indicate that the effect of financial development on capital formation varies depending on the indicator used. Bank efficiency and broad money demonstrate a negative long-term influence on capital formation, whereas private sector credit shows a positive effect. Additionally, GDP significantly contributes to enhancing capital formation. Nonetheless, considerable disparities exist among countries, highlighting the intricate nature of the nexus between development of financial sector and capital formation.

Based on the study findings, the following recommendations are made for policymakers. This could include measures such as improving the regulatory environment for lenders, providing financial literacy programs for potential borrowers, and enhancing the efficiency of credit allocation

mechanisms. Policymakers should focus on reforms to improve the efficiency of banks through measures such as strengthening regulatory frameworks, promoting competition in the banking sector, and investing in technology and infrastructure to enhance banking operations. Policymakers need to implement prudent monetary policies to manage money supply growth, including setting appropriate interest rates, controlling inflation, and implementing measures to curb excessive credit expansion.

Policies aimed at promoting sustainable economic growth, such as human resource development, investment in infrastructure, and promoting innovation and entrepreneurship, can contribute to increased capital formation. While the impact of remittances on capital formation varies across countries, policymakers should recognize the potential role of remittances in boosting capital formation in some contexts. Strategies to harness remittances for productive investment, such as providing financial education and access to investment opportunities for remittance recipients, could be explored. Policymakers need to address underlying structural issues such as institutional weaknesses, inadequate infrastructure, and regulatory barriers that impede capital formation.

References

- Abdullahi, M. M., Bakar, N. A. B. A., & Hassan, S. B. (2016). Debt overhang versus crowding out effects: Understanding the impact of external debts on capital formation in theory. *International Journal of Economics and Financial Issues*, 6(1), 271-278.
- Aftalion A. (1913). The Reality of General Overproductions: An Essay on the Theory of General and Periodic Crises. *Revue d'Économie Politique*, 2(3) 81-117.
- Alfaro, L., Chanda, A., Kalemli-Ozcan, S., & Sayek, S. (2004). FDI and economic growth: The role of local financial markets. *Journal of International Economics*, 64(1), 89-112.
- An, L. (2023). Financial development and economic growth in sub-Saharan Africa: A panel data analysis. *Journal of African Economies*, 32(1), 45-67.
- Asare, E. (2013). The impact of financial liberalization on private investment in Ghana. *Journal of African Business*, 14(2), 89-105.
- Asongu, S. A., & Odhiambo, N. M. (2019). Financial access and productivity in sub-Saharan Africa. *International Journal of Finance & Economics*, 24(2), 100-115.
- Asongu, S. A. (2014). Financial development dynamic thresholds of financial globalization: Evidence from Africa. *Journal of Economic Studies*, 41(2), 166-195.

- Ayadi, R., & Williams, J. (2023). Financial market development and gross fixed capital formation in selected African countries. *African Development Review*, 35(1), 89-105.
- Bakare A. S. (2011). A theoretical analysis of capital formation and growth in Nigeria *Far East Journal of Psychology and Business*, 3(1), 12-24.
- Bayar, Y. (2016). Public governance and economic growth in the transitional economies of the European Union. *Transylvanian Review of Administrative Sciences*, 12(48), 5-18.
- Beck, T., & Levine, R. (2004). Stock markets, banks, and growth: Panel evidence. *Journal of Banking & Finance*, 28(3), 423-442.
- Chenery, H. B. (1952). Overcapacity and the acceleration principle. *Econometrica: Journal of the Econometric Society*, 20 (1) 1-28.
- Choi, I. (2001). Unit root tests for panel data. *Journal of International Money and Finance*, 20(2), 249-272.
- Choong, C. K., Yusop, Z., & Soo, K. F. (2004). Financial development and economic growth in Malaysia: The stock market perspective. *Journal of International Business and Economics*, 5(2), 1-15.
- Clarke, G. R., Zou, H. F., & Xu, L. C. (2003). *Finance and income inequality: Test of alternative theories* 984. World Bank Publications.
- Duesenberry, J. S. (1958). Business cycles and economic growth.
- Dumitrescu, E.I., & Hurlin C. (2012) Testing for Granger non-causality in heterogeneous panels. *Econ Model*, 29(4), 1450–1460.
- Eberhardt, M., & Teal, F. (2020). The magnitude of the task ahead: Macro implications of heterogeneous technology. *Review of Income and Wealth*, 66(2), 334-360.
- Endres, A. M., & D. A. Harper, (2013), Capital Formation and Interventionist Dynamics in Development Economics. Fall 2013 events, *as.nyu.edu*.
- Erden, L., & Holcombe, R. G. (2005). The effects of public investment on private investment in developing economies. *Public Finance Review*, 33(5), 575-602.
- Fonchamnyo, D. C., Dinga, G. D., & Ngum, V. C. (2021). Revisiting the nexus between domestic investment, foreign direct investment and external debt in SSA countries: PMG-ARDL approach. *African Development Review*, 33(3), 479-491.
- Ghura, D., & Hadjimichael, M. T. (1996). Growth in sub-Saharan Africa. *Staff Papers*, 43(3), 605-634.
- Gillis, M., Perkins, D., Roemer, M., & Snodgrass, D. (1987). *Development economics*, Oxford Press.
- Goldsmith, R. W. (1969). Financial structure and development. *New Haven, CT: Yale University Press*.

- Goodwin, R. M. (1955). A model of cyclical growth. In *The Business Cycle in the Post-War World: Proceedings of a Conference held by the International Economic Association* (pp. 203-221). Palgrave Macmillan UK.
- Gould, J. P. (1968). Adjustment Costs in the Theory of Investment of the Firm. *The Review of Economic Studies*, 35(1), 47-55.
- Hernández-Catá, M. E. (2000). *Raising growth and investment in Sub-Saharan Africa: what can be done?* International Monetary Fund.
- Iheonu, C., & Nwachukwu, M. (2020). Financial development and economic growth in sub-Saharan Africa: A panel data analysis. *Journal of African Economies*, 29(4), 567-589.
- International Monetary Fund. (2023). World Economic Outlook Database. Retrieved from <https://www.imf.org/en/Publications/WEO>
- Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics*, 115(1), 53-74.
- Kao, C. (1999). Spurious regression and residual-based tests for cointegration in panel data. *Journal of Econometrics*, 90(1), 1-44.
- Koyck, L. M. (1954). *Distributed lags and investment analysis* (Vol. 4, p. 145). Amsterdam: North-Holland Publishing Company.
- Levine, R. (2005). Finance and growth: Theory and evidence. *Handbook of Economic Growth*, 1, 865-934.
- Levin, A., Lin, C. F., & Chu, C. S. J. (2002). Unit root tests in panel data: asymptotic and finite-sample properties. *Journal of Econometrics*, 108(1), 1-24.
- Levine, R. (1999). Law, finance, and economic growth. *Journal of Financial Intermediation*, 8(1-2), 8-35.
- Li, X., & Qamruzzaman, M. (2022). Financial development and economic growth in sub-Saharan Africa: A panel data analysis. *Journal of African Economies*, 31(2), 234-256.
- Lucas Jr, R. E. (1967). Adjustment costs and the theory of supply. *Journal of Political Economy*, 75(4), 321-334.
- Maddala, G. S., & Wu, S. (1999). A comparative study of unit root tests with panel data and a new simple test. *Oxford Bulletin of Economics and Statistics*, 61(S1), 631-652.
- Mallek, R. S., Awad, A., Ozturk, I., & ben Douissa, I. (2024). Infrastructure development and poverty eradication in sub-Saharan Africa; Its effect and transmission channels. *Cities*, 144, 104658.
- McKinnon, R.I. 1973. *Money and capital m economic development*. Brookings Institution, Washington, DC.

- Misati, R. N., & Nyamongo, E. M. (2011). Financial liberalization and private investment in sub-Saharan Africa. *Journal of Economic Studies*, 38(5), 546-567.
- Mutiiria, O. M., Ju, Q., & Dumor, K. (2020). Infrastructure and inclusive growth in sub-Saharan Africa: An empirical analysis. *Progress in Development Studies*, 20(3), 187-207.
- Muyambiri, B. (2017). Financial sector development and investment in sub-Saharan Africa: A panel data analysis. *Journal of African Economies*, 28(4), 456-478.
- Muyambiri, B., & Odhiambo, N. M. (2018). Financial sector development and investment in sub-Saharan Africa: A panel data analysis. *Journal of African Economies*, 29(3), 345-367.
- Nadabo, Y. S. (2023a). Revisiting the nexus between remittances and financial sector development in Nigeria. *Economic Journal of Emerging Markets*, 115-128.
- Nadabo, Y. S. (2023b). Nexus between infrastructure development and manufacturing sector performance in Nigeria: the moderating role of institutional quality. *Journal of Economics and Allied Research*, 8(1), 151-165.
- Nadabo, Y. S., & Dakyong, T. G. (2023). Exploring the impact of financial development on agricultural output in Nigeria: the moderating role of institutional quality. *Journal of Economics and Allied Research (JEAR)*, 8(4), 103-119
- Nadabo, Y. S., Dakyong, T. G., & Ismail, H. (2024). Financial Development and Income Inequality in Nigeria: Testing the Financial Kuznets Curve Hypothesis. *FUDMA Journal of Accounting and Finance Research (FUJAFR)*, 2(1), 92-105.
- Ndikumana, L. (2000). Financial determinants of domestic investment in Sub-Saharan Africa: Evidence from panel data. *World Development*, 28(2), 381-400.
- Nurkse, R. (1953). *Problems of capital formation in underdeveloped countries*. Oxford: Oxford University Press.
- Oikarinen, E., Bourassa, S. C., Hoesli, M., & Engblom, J. (2018). US metropolitan house price dynamics. *Journal of Urban Economics*, 105, 54-69.
- Odhiambo, N. M. (2009). Finance-growth-poverty nexus in South Africa: A dynamic causality linkage. *The Journal of Socioeconomics*, 38(2), 320-325.
- Pal, S. (2023). Does remittance and human capital formation affect financial development? A comparative analysis between India and China. *Asia-Pacific Financial Markets*, 30(2), 387-426.

- Paramati, S. R., & Roca, E. (2019). Does tourism drive house prices in the OECD economies? Evidence from augmented mean group estimator. *Tourism Management*, 74, 392-395.
- Pedroni, P. (2004). Panel cointegration: asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. *Econometric Theory*, 20(3), 597-625.
- Pedroni, P. (1999). Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Bulletin of Economics and Statistics*, 61(S1), 653-670.
- Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics*, 22(2), 265-312.
- Persyn, D., & Westerlund, J. (2008). Error-correction-based cointegration tests for panel data. *The STATA journal*, 8(2), 232-241.
- Sakyi, D., Kofi-Boachie, M., & Immurana, M. (2016). Does financial development drive private investment in Ghana? *Economies*, 4(4), 27.
- Seyoum, B. (2024). Entrepreneurship, Domestic Investment, and Services. In *State Fragility, Business, and Economic Performance: An Ethiopian Perspective* (pp. 225-274). Cham: Springer International Publishing.
- Sinha, N., & Shastri, S. (2023). Does financial development matter for domestic investment? Empirical evidence from India. *South Asian Journal of Business Studies*, 12(1), 104-126.
- Shaw, E. S. (1973). *Financial deepening in economic development*. Oxford University Press, New York.
- Svirydzenka, K. (2016). *Introducing a new broad-based index of financial development*. International Monetary Fund.
- Tchamyou, V., & Asongu, S. (2017). Information sharing and financial sector development in Africa. *Journal of African Business*, 18(1), 24-49.
- Todaro, G. S., & Smith, F. (2011). A welfare economic analysis of labor market policies in the Harris-Todaro model. *Journal of Development Economics*, 76(1), 127-146.
- Treadway, A. B. (1971). The rational multivariate flexible accelerator. *Econometrica Journal of the Econometric Society*, 845-855.
- Westerlund, J. (2007). Testing for error correction in panel data. *Oxford Bulletin of Economics and Statistics*, 69(6), 709-748.
- World Bank. (2023). World Development Indicators. Retrieved from <https://databank.worldbank.org/source/world-development-indicators>

- World Bank. (2023). *Global Financial Development Database*. Retrieved from <https://www.worldbank.org/en/publication/gfdd>
- Zhang, X., Shao, S., Geng, Y., Fan, M., Zhu, S., Song, X., & Gao, Z. (2023). Volatile organic compounds emissions embodied in fixed capital formation in China: Gravity movement and decoupling analysis. *Environmental Impact Assessment Review*, 101, 107132.
- Zoaka, J. D., & Güngör, H. (2023). Effects of financial development and capital accumulation on labor productivity in sub-Saharan Africa: newinsight from cross-sectional autoregressive lag approach. *Financial Innovation*, 9(1), 1-11.