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INFLUENCE OF MOBILE MONEY ON ECONOMIC GROWTH IN SUB-SAHARAN AFRICA AS MODERATED BY FINANCIAL STABILITY

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ABSTRACT: *This study investigates the influence of mobile money on economic growth in SSA, with a special focus on the moderating role of financial stability. The study utilizes a panel data from 38 SSA countries spanning the period 2000 to 2023. Mobile money adoption, financial stability, and economic growth are each measured using composite indices constructed from multiple indicators. The empirical analysis used Generalized Method of Moments to address endogeneity and capture dynamic relationships. The findings reveal that while mobile money does not independently exert a statistically significant effect on economic growth, its interaction with financial stability is both positive and significant. Control variables such as education and inflation are also found to be significant, reinforcing their importance in SSA's development trajectory. The study offers key practical and theoretical implications for policymakers, and accounting and development researchers., and provides a novel framework for integrating digital financial metrics into macroeconomic modeling.*

KEYWORDS: Mobile Money, Financial Stability, Economic Growth, Financial Inclusion, Sub-Saharan Africa, GMM, Digital Finance.

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INTRODUCTION

Over the past two decades, Sub-Saharan Africa (SSA) has emerged as a global frontrunner in the adoption and diffusion of mobile money technology (Nambie, 2023. In contrast to the slow and often exclusionary traditional banking systems, mobile money platforms have filled critical gaps in access to finance, especially for unbanked and rural populations (Ozili, 2024). This phenomenon has been driven by the spread of mobile telecommunications networks, and countries like Kenya, Ghana and Tanzania have arguably become the type cases of the mobile revolution (Ahmad et al. 2023). The spread of mobile money throughout SSA has not only expanded financial inclusion, but has also reconfigured the contours of economic agency in that it reached under-banked populations with digital financial services (Kurtoglu & Durusu-Ciftci, 2024).

The fast spread of mobile money services across SSA deviates from traditional banking, particularly in locations where formal and traditional financial sector is thinly distributed or non existent (Aimon et al., 2024). Conventional banks have been limited by geographic constraints and high transactions costs, which has made much of the populace to remain unbanked. In contrast, mobile money agents are nimble and low-cost, and are often based within the community, and are able to deliver finance to the under-served (Ahmad, 2020). This flexibility allows users to deposit savings, remit money and pay bills without the need for formal identification or collateral, which would normally disqualify poor households from participation in formal banking (Hanif& Hanafi, 2023).

There are profound socio-economic effects of mobile money penetration. On a smaller scale, it enables households by providing safe and convenient mechanisms to store and move money, an especially important benefit in places where there is significant cash risk (Mabeba, 2024). At the meso level, mobile money facilitates the development of local economies by increasing the level of liquidity, mobilizing consumption, and minimizing the transaction costs for businesses (Panigrahi, 2023). With the help of these dynamics, macro-level development is, in turn, advanced due to the expansion of the tax base and formalization of economic activity and to better fiscal planning. Alhassan et al. (2021), mobile money-based remittances have provided some resilience in recipient households, reducing an impact of economic shocks.

A second important aspect of mobile money is its network effect. The more users on the platform, the more mobile money becomes a useful tool due the network effect (Kemgou Voptia & Stukalina, 2025). This trait has led to the swift proliferation of mobile money in SSA, which has transformed from a simple money transfer service to digital savings accounts, micro-insurance products, and credit scoring mechanisms. These nested functions enhance the package of benefits offered by mobile money and make it a leading instrument for advancing digital financial inclusion (Siúta & Lichucha, 2024). Owusu (2024) holds the view that an expansionary financial inclusion triggers economic activities which otherwise would be dormant because of liquidity constraints.

One other thing to note is savings mobilization. Digital wallets which are secure and within reach contribute to saving behaviour of individuals and promote household financial stability (Kumar et al., 2024). These taken together could be harnessed through microfinance and fintech startups to support productive investment. Bongomin et al. (2018) point out that mobile-money-measured saving options help both the volume and speediness of in-country financial transaction flows, ultimately leading to favourable impact on local investment and

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productivity. These multidimensional benefits of mobile money also highlights the potential it possesses for triggering transformation against the backdrop of economic systems that are typically characterized by exclusion and inefficiency (Arinze et al., 2024).

This is an opportune and necessary study, for academic and policy purposes. On the academic side, the paper contributes to some important research and geographical gaps in the extant literature by providing a robust, empirical examination of the mobile money–growth correlation in SSA, controlled for financial stability. It adds to the emerging narrative of digital financial inclusion and macroeconomic performance by extending the new frontier used in traditional growth models. In terms of policy implications, the findings supply empirical evidence to support regulatory re-engineering, fintech investments and regional integration policies (Ahmed Idris et al., 2024). The results will also be used to advise policy makers on the appropriate circumstances under which the potential of mobile money can be harnessed to maximize impact on development and more specifically in SSA countries. Finally, the aim is to test the hypothesis that mobile money affects economic growth in a positive way, and that such a connection is strongly influenced by the degree of quality of the stability of the financial system.

LITERATURE/THEORETICAL UNDERPINNING

Influence of Mobile Money on Economic Growth in SSA

The surge of mobile money in Sub-Saharan Africa have generated measurable effects on economic performance in that mobile money has played a role in stimulating the GDP to grow (Lajfari & Soumbara, 2025). At the heart of the relationship is mobile money's impact on transaction costs, financial intermediation and under-utilised financial resources opening. Ahmad et al. (2023) also establish that the adoption of mobile money has a significant impact on economic growth via consumption, investment and productivity. The authors claim that in economies with underdeveloped formal financial systems, mobile money is an alternative platform for facilitating savings and credit access.

Mobile money contributes to economic growth through several channels. In the first place, facilitating access to microcredit, mobile money makes it possible for informal entrepreneurs and smallholder farmers to invest in productive assets such as inventory, agricultural inputs, and technology (Peprah, Oteng & Sebu, 2020). This investment spurs output expansion and job creation. Second, mobile money alleviates consumption smoothing and risk-sharing, particularly in the presence of shocks, such as droughts, price volatility, or illness (Kikulwe, Fischer & Qaim, 2014). Alhassan et al. (2021) demonstrate that mobile money accelerates the velocity of money in low-income areas, which has a positive impact on short and long-term economic resilience.

These relationships have been empirically tested using econometric modeling in several studies (Adam & Alzuman, 2024). GMM and fixed-effect regressions for SSA-wide studies show coherent positive links between mobile money adoption and GDP. For example, Owusu (2024) undertakes a panel data analysis and finds evidence that a one-unit increase in mobile money penetration results in a statistically significant increase in economic growth. The

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analysis also shows that mobile money's impact on growth is larger in countries with less developed banking systems.

A further important channel through which mobile money drives growth is by enhancing resource allocation efficiency (Asongu & Salahodjaev, 2022). In SSA, conventional financial systems usually leave out people who lack formal employment or assets. Mobile money circumvents these obstacles by employing alternative credit assessment tools and real-time transaction history for credit evaluation (Chacko, John Aravindhar & Antonidoss, 2024). Ahmad et al. (2023) assert that these newly introduced products enhance allocative efficiency by channeling capital flows to appropriate investment opportunities that were previously unrecognized by the formal financial sector.

The entrepreneurial effect of mobile money also must not be forgotten. Platforms like Kenya's M-Pesa have helped microenterprises to manage their cash flow, pay suppliers, and receive payments in real time, helping these informal workers be more productive and take less risk than they would with physical cash. Bongomin et al. (2018) stress that mobile money supports also a "digital trust economy", in the sense that lower financial frictions imply greater participation in markets. These descriptive findings collectively support the conception of mobile money as a means to endogenously structure economic dynamism in SSA, rather than as a mere payments instrument.

Moderating Role of Financial Stability

Although the positive role of mobile money in promoting macroeconomic growth is widely acknowledged, the strength of this relationship is primarily conditioned by the level of financial soundness (Ahassan, Blokhina, & Kouadio, 2021). Stability of financial conditions includes the soundness of the financial institutions, adaptability of monetary policy, and the confidence in the regulatory oversight (A Elsherif, 2024). The benefits from mobile money services may be outweighed by the risks of experiencing liquidity crises, currency risk, and non-performing loans in times of financial instability. Owusu (2024) also reveals that financial deepening greatly reinforces the positive influence of mobile money on GDP indicating a complementary relationship between them.

There is also a two-way relationship between mobile money and financial stability. On the one hand, stable financial systems provide a network on which mobile money systems can thrive (Agbezoutsi, Dandjinou & Uriene, 2019). Mobile money, on the other hand, enhances financial resilience by creating alternative channels of transaction and widening the platform of financial inclusiveness. The reality of a cashlite society According to Anarfo and Abor (2020), mobile money users are more likely to withstand economic shocks as they are able to mobilize resources quickly through digital means. Their research also indicates that during crises (like pandemics or currency devaluations) usage of mobile money skyrockets.

Nevertheless, the regulatory and policy environments underpinning adoption of mobile money are not consistent across SSA. Mobile money is more embedded in the wider financial system in countries with strong banking supervision and inclusive regulatory regimes (Koi-Akrofi, 2022). In the other extreme, with underdeveloped financial regulation, the growth of mobile money may contribute to disintermediation, weakening monetary policy imbalances and systemic disruptions. Bongomin et al. (2018) emphasizes the role of agent liquidity, as liquidity constraints at the agent level have frequently been found in the rural areas that can undermine

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efficiency and trust in mobile money networks and eventually affect financial stability more broadly.

Recent literature also proposed a composite index to capture the interaction effect of mobile money and financial stability on economic growth (Tosunoglu, 2018; Kenedi, 2024). These indicators merge a series of indicators, such as capital adequacy, regulatory quality, or credit access, presenting a multi-dimensional picture of financial health (Kurtoglu & Durusu-Ciftci, 2024). Alhassan et al. (2021) find that in countries with more resilient financial structures, mobile money exhibits a stronger statistically significant relationship with growth outcomes. This adds to the case that mobile money has to be integrated in a conducive financial ecosystem if its macroeconomic gains are to be reached.

The financial stability moderation is therefore a very important control knob. In the presence of stability, the expansionary outcomes of mobilemoney can increase GDP but it is likely reverse when it does not exist (Jieyu & Hook, 2023). This theoretical explanation supports the idea of not treating mobile money as a stand-alone tool, but highlighted as part of a broader or entire financial system. So henceforth growth strategies should match fintech innovation with prudential oversight to foster sustainable economic expansion.

Theoretical Framework

To gain a holistic view of the impact of mobile money on economic growth in Sub-Saharan Africa and on the continent as a whole under the moderating effect of financial stability, a robust theoretical aspects needs to underpin the paper. Two approaches dominate the explanatory power of this question: the Neo-Classical Growth Theory and the Theory of Network Externalities. These frameworks not only explain how the use of mobile money can lead to greater levels of economic activity but they also emphasize the significance of other factors, such as the strength of institutions and the quality of regulation, in determining outcomes of growth.

The Neo-Classical Growth Theory, developed by Solow (1956), claims that long-run growth is explained by accumulation of capital, labor and exogenous technological progress. In this context, financial innovations such as mobile money are regarded as capital deepening instruments that raise total factor productivity by advancing financial intermediation. Meanwhile, in the Network Externalities Theory, the value of a mobile money platform grows as more people adopt it, causing a reinforcing loop where it becomes more effective the more it is used. Taken together, these theories provide a multi-dimensional view to understand how the mobile money, economic growth, and financial stability arrangements in SSA are interdependent.

Network Externalities Theory

The Theory of Network Externalities (commonly associated with Katz and Shapiro 1985) suggests that the value or utility that one derives from using a service is proportionate to the number of others using the same service. This means that with mobile money, the economic value of digital financial platforms increases every time its user base grows. Every new mobile money user not only benefits personally from better access to financial services, but also boosts the value of the platform to existing users by extending circles for transaction and increasing liquidity as well (Ahmad et al., 2017a). Hence, mobile money possesses robust and

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positive network externalities in the markets with high population density and economic heterogeneity.

This model is particularly relevant in the case of SSA, where the growth of mobile money has been described by viral spread patterns. Services such as Kenya's M-Pesa or Ghana's MTN Mobile Money succeeded not just because of a new technology, but because of the user networks that they were able to network and the space for inexpensive, instant transactions that this created (Bongomin et al, 2018). These networks enabled households and firms to reduce the information asymmetries, the spatial distances, and transaction costs, and thus, contribute to market efficiency and economic activity.

In addition, network externalities on mobile money are more than mere transactional ones. They unlock a universe of value-added services — such as mobile savings, insurance and microcredit — that are only viable once critical user mass is achieved. This threshold effect will, according to Owusu (2024), change mobile money from a niche innovation to a system-wide economic driver. Asan example, digital payment volumes are more and more profitable and scalable closer the majority of the populationeleven added is already recipient) and merchantsadop mobile money. This virtuous cycle not only fuels entrepreneurship but also broadens the tax base indirectly adding to the public revenue, fiscal stability and so on.

Nevertheless, the formation of network externalities depends on complementary infrastructure, in particular, liquidity of agents and mobile connectivity. Alhassan et al. (2021) stress that poor mobile coverage and agent cash float constraints may limit the development and welfare impacts of mobile money ecosystem in rural or underdeveloped areas. This highlights how joint investments in infrastructure and regulation supervision are necessary to guarantee the broad and fair distribution of network effects. When such a stage is set, the coattail effect of user networks may potentially affect the system in ways that can eventually go beyond the level of the discount rate, especially in SSA's fragmented and informally-driven economies.

Going a step further in the network effects argument, mobile money platforms produce data externalities. The transaction history will potentially allow firms to create digital IDs and alternative credit scores for consumers without traditional credit profiles. This enables access to credit for the deprived sections of the society and promotes consumption and investment leading to an endogenous growth (Ahmad, 2020). From this vantage, the uptake of mobile money encourages wider social-economic change and is in synergy with inclusive development goals.

However, network effects also pose dangers. Concentrated markets, such as in countries with a single provider of mobile money, can engender monopolistic pricing or systemic risk if the single provider fails. Henceforth, approaches to regulation should be geared not only to promoting innovation, but also to the promotion of market competition and the protection of consumers. In conclusion, Theory of Network Externalities can provide a lens to understand and explain how mobile money platforms scale and drive growth, particularly in a context where traditional banking has not been able to reach a critical mass.

Neo-Classical Growth Theory

The Neo-Classical Growth Theory as established by Solow (1956) and subsequently elaborated by subsequent thinkers offer the basis to understanding the determinants of long

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term economic growth. It assumes that growth is driven by increases in physical capital, labor input and exogenous technological change. In this sense, financial intermediation improvements — including new services like mobile money — are a way of enhancing one's capital allocation efficiency and labor productivity.

Mobile money facilitates capital formation through the mobilization of domestic savings, especially by groups who were hitherto excluded from traditional financial structures. According to Ahmad et al. (2023), it is only a matter of time before being stored securely in mobile wallets, savings would be inaccessible when banks are out of reach, physically or economically. These savings are not sitting idle—they are conditioning financial deepening by allowing microfinance institutions and fintech lenders to grow their loan book. As a result, while mobile money might be conceived as horizontal (population wide) markets (as is commonly shown for mobile networks, e.g., Dzorgbo, 2013), it is in fact capable of supporting broad-based capital flows across societal layers (vertically) and not just horizontal flows of money or people, meeting Neo-Classical expectations of capital-led growth and trickle-down..

Mobile money also has productivity effects, as it frees time, making transactions less time-consuming, enables more secure and efficient payments, and allows for remote work and digital commerce. Asongu (2022) asserts that mobile money ensures speedier remuneration for workers, which apparently temporally flattens consumption and the persistence as well as variance of income. This stability increases man-hours worked and the willingness to take entrepreneurial risk, factors crucial to growth in the Neo-Classical model. Moreover, in translating transactions in the informal to the formal sector, mobile money extends the area of marketable economic activity, and therefore enhances precision and speed of economic policy.

The model also emphasizes the role of technology spillovers in boosting total factor productivity. Mobile money is an innovation that provides systemic efficiency gains when widely adopted. The fact that mobile money can be linked with other digital services, such as identity verification, credit scoring, and government transfers Owusu (2024), is also an example of embedded technological progress that raises the economy's productive capacity and lays the ground for higher growth.

Nevertheless, the Neo-Classical model also highlights decreasing returns to capital, suggesting that the growth effects of mobile money might top out without likewise improving human capital, infrastructure and institutional quality. Here too the question of financial security is pertinent. An unstable financial system can counter the att9780128095461 advantages of mobile money by raising transaction costs, undermining faith in both financial and government institutions, and bringing mobile money users within the purview of systemic risk. And also Anarfo and Abor (2020) found out that countries with stronger regulatory grounds and banking sector supervision experienced more sustained and equal growth in mobile money penetration.

In addition, endogenous technological progress is absent in the conventional Neo-Classical model, and hence does not have the capacity to explain how mobile money and financial stability interact. In order to curb this shortcoming, the approach develops a modified framework, which treats financial development and institutions as endogenous determinant of growth. Such hybrid model is especially suitable in an SSA context were institutional quality, regulatory, capacity and financial inclusion are developing in parallel with technological development.

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Overall, the Neo-Classical Growth Theory offers a better theoretical framework for understanding how mobile money leads to capital accumulation and labor productivity and consequently to productivity growth. However, its lessons are best understood in relation to the specifics of SSA—where network effects, institutional heterogeneity, and regulatory vacuum determine the real world trajectory of digital financial innovation. With the Theory of Network Externalities, it provides a full body to articulate the innovation modeling concept of the mobile money in its transformative capacity for development in Africa in the face of a more resilient and stable financial system.

METHODOLOGY

The paper takes up a quantitative research orientation to empirically appraise the nexus between mobile money and economic growth of SSA with a focus on the moderating effect of financial stability. Quantitative methods are believed to be well suited to answer this question because of their ability to establish relationships of causality, to manage large amounts of data both temporally and spatially and to provide replicability (Ahmad et al., 2023). This method enables statistical analysis, such as panel regression analysis and dynamic modeling to quantify the interactions between the variables.

The analysis is based on secondary data from internationally established and validated databases to enhance the validity and comparability. Measures of mobile money, such as account ownership and account usage, are based on the World Bank's Global Findex Database (Owusu, 2024). Real GDP growth, GDP per capita, and Gross National Income (GNI) per capita are sourced from the World Development Indicators (WDI). Financial stability indicators, which includes net Non-Performing loans (NNPL), capital-to-asset ratios and regulatory quality are obtained from the IMF Financial Soundness Indicators and the Worldwide Governance Indicators (WGI) (Anarfo & Abor, 2020). Furthermore, control variables inflation rate, domestic credit to private sector, schooling level and employment ratios are included so as to control other growth determinants (Alhassan et al., 2021).

Data were aggregated and cleaned in Microsoft Excel and Python but the econometric modeling itself was carried out using Stata and R. Missing values were filled in by linear interpolation to preserve temporal continuity without overly distorting trend lines (especially for countries with non-annual reportage). Countries were removed when the entire series of a variable were missing, in order to maintain the validity of the models. All independent variables were min-max-normalised before creating the index (Ahmad, 2020).

Sample Population

The study population of interest is all of the 49 Sub-Saharan African countries identified by the United Nations and the World Bank. Owing to data constraints, including the relative lack of observations for some financial stability and control variables, the final analytic sample consists of 38 countries. Local currency-denominated debt markets have been established in the countries in our sample, ranging from Africa's largest economies (e.g., Nigeria, Kenya, South Africa, and Ghana) to smaller economies (e.g., Lesotho, Eswatini, and Djibouti), and therefore econom ies with very different economic structures and policy environment s. The data period is a 24-year period, 2000 to 2023 including both years prior to mobile money and

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the period of rapid uptake of digital financial services. This long period allows for analysis of sudden short-run shocks as well as long-run structural changes. According to Ahmad et al. (2023), in which long panel datasets are required in order to incorporate the dynamic nature of economic growth and financial development, in this case, for emerging markets. Moreover, concentration on SSA enables the study to explore the digital financial revolution in one of the least banked regions in the world.

Measures

The dependent variable is economic growth, using a composite indicator of GDP Per Capita, GDP growth rate, GDP, GNI per capita. This holistic approach presents a better understanding of economic development than the use of individual indicator (Easterlin, 1995). The primary independent variable is Mobile Money Index (MMI), which is composed of five standardized indicators: active mobile money account ownership (% age 15+), frequency of use (% using account two or more times in a month), and saving behavior (% holding money in account). These measures are constructed from World Bank Findex data and reflect earlier techniques used by Owusu (2024) and Bongomin et al. (2018). The moderating variable is the Financial Stability Index (FSI) and made up of bank capital to assets-ratio (normalised), non-performing loans (reversed) and regulatory quality. Regulatory quality Credit controls are derived from WGI score while the banking variable is sourced from the IMF_Financial Soundness Indicators database (Anarfo & Abor, 2020).

In addition, the model includes four control variables:

- Inflation (consumer prices, annual %)
- Credit to private sector (% of GDP)
- Education (average years or attainment index)
- Employment (employment-to-population ratio)

These control variables are crucial for mitigating omitted variable bias and reflect macroeconomic, financial, and labor market conditions that can independently affect growth (Alhassan et al., 2021).

Table 1: Measurements of Variables

Variable	Definition	Acronym	Measurement	Data Source
Mobile Money Index	Composite score of access, usage, and storage via mobile money services	MMI	Average of normalized values: account ownership, usage ≥2x/month, and savings using mobile money	World Bank Global Findex
Economic Growth Index	Composite score of real economic output and income per capita	EGI	Average of normalized values: GDP per capita, GDP growth, GNI per capita	World Bank World Development Indicators

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Financial Stability Index	Composite score of banking system strength	FSI	Avg. of normalized: Capital to assets, (1 - NPL), Regulatory Quality	IMF Financial Soundness Indicators, WGI
Inflation	Rate of increase in general price level	INF	Annual % change in CPI	World Bank WDI
Credit to Private Sector	Financial resources provided to private sector as % of GDP	CRD	% of GDP	World Bank WDI
Educational Attainment	Average years or completion rates in formal education	EDU	Educational attainment index (based on school enrollment or completion)	World Bank/UNESCO

Model for the Study

Based on panel data, the current paper makes use of moderated multiple regression model to check the impact of mobile money towards economic growth and the moderating role of financial stability. A point in favour of using panel data is that it allows for a higher number of observations and reduces the amount of noise due to heterogeneity between countries (Ahmad et al., 2023). Additionally, panel models can help identify the effects within (within country effects) and between countries through time. Due to the dynamic of growth, the model includes a lagged dependent variable that captures persistence while it mitigates the problem of autocorrelation. This specification is consistent with Solow-type models of growth with inertia and structural dependencies (Ahmad, 2020)..

Model Specification

The moderated regression model is specified as follows:

$$EGI_{it} = \beta_0 + B_1 MMI_{it} + B_2 FSI_{it} + B_3 (MMI_{it} \times FSI_{it}) + B_4 X_{it} + \mu_i + \lambda_t + \epsilon_{it}$$

Where:

- EG_{it} = Economic growth in country *i* at time *t*.
- MMI_{it} = Mobile Money Index
- FSI_{it} = Financial Stability Index
- $MMI_{it} \times FSI_{it}$= Interaction term (moderation effect)
- X_{it} = Vector of control variables (inflation, credit, education)
- ϵ_{it} = the error term.
- μ_i = Country-specific effect.

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- λ_t= Time fixed effects

Analytical Techniques

To guarantee robust empirical investigation, this research conducts a multi-step quantitative approach which includes both initial diagnostics and inferential modeling procedures. Descriptive statistics are calculated to give an overview of the dataset in terms of central tendency and dispersion or spread (mean, standard deviations, minimum and maximum scores). These statistics are important in detection of outliers and for examination of distributional characteristics of the variables (Ahmad et al., 2023). This is followed by the construction of a correlation matrix to have an initial sense of the interrelationships among the variables of interest, the Mobile Money Index (MMI), the Financial Stability Index (FSI), the Economic Growth Index (EGI) as well as the control variables. This process gives an indication on the preliminary trend and magnitudes of associations, as noted by Owusu 2024 and allows for identifying any problematic correlations that may exist.

To this end, the Levin–Lin–Chu (LLC) and the Im–Pesaran–Shin (IPS) panel unit root tests perform the stationarity tests. They are important as to whether variables are non-stationary and might influence spurious regression results (Ahmad, 2020). All the regression models include only stationary and first-difference stationary variables. In order to avoid redundancy in explanatory variables, the paper also performs multicollinearity test by Variance Inflation Factor (VIF). Predictors with VIF beyond 10 are considered, and the model is re-estimated such that it does not suffer from collinearity biases (Alhassan et al., 2021).

The heart of the inferential procedure is the Generalized Method of Moments (GMM) procedure that employed is two-step system GMM. It is such robustness against endogeneity, dynamic panel structure, and country-specific heterogeneity, that gets this method of estimation chosen (Anarfo & Abor, 2020). GMM also captures lagged dependent variables, which is important in capturing growth inertia and reverse causality between mobile money and economic growth. In testing the model, both Hansen and Arellano-Bond tests are used to check for over-identifying restrictions and serial correlation respectively.

RESULTS AND DISCUSSION OF FINDINGS

Descriptive Statistics

Summary statistics in Table 2 offer some significant knowledge on the distributional properties of the study variables over 810 observations covering 38 Sub-Saharan African countries between 2000 and 2023. The Economic Growth Index (EGI), with a mean of 0.145 and low standard deviation (0.014), indicates that average growth performance of the region may be modest, but stable, consistent with the historical evidence of sporadic but stable growth patterns of many of the SSA economies (Ahmad et al., 2023).

In contrast, Mobile Money Index (MMI) has a considerably higher standard deviation (0.225) which imply that mobile money adoption is highly variable both among and along countries across time. This gap is reinforced by its variance - from nearly zero to 1 -, including early users like Kenya and the straggling Eritrea (see also Owusu, 2024). Similarly, there is

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considerable but relatively more dispersed diversity in financial stability (FSI) with an average of 0.464, as is indicative of institutional dissimilarity throughout SSA (Alhassan et al., 2021). Meanwhile, the control variables such as Credit to GDP and Inflation have high kurtosis and skewness, indicating the presence of outliers and not normal distribution of these variables, especially inflation. These features highlight the macroeconomic instability which is a big issue in most of the SSA nations and hence call for reliable estimation techniques such as GMM.

Table 2: Descriptive Statistics Results

	Economic Growth Index	Mobile Money Index	Financial Stability Index	Credit to GDP	Education	Inflation
Mean	0.144606	0.240441	0.464322	20.66329	31.29810	9.053178
Median	0.143617	0.166105	0.458103	14.09109	27.23875	5.786248
Maximum	0.247930	1.000000	0.788203	142.4220	90.62309	557.2018
Minimum	0.057469	0.000382	0.271223	0.001297	2.040000	-16.85969
Std. Dev.	0.014350	0.224810	0.079670	23.29932	19.96776	29.11266
Skewness	1.306414	1.072304	0.612861	2.896809	0.608496	15.59050
Kurtosis	14.01546	3.482660	4.318751	11.77576	2.378529	274.2251
Jarque-Bera	4325.643	163.0903	109.4006	3732.075	63.02124	2515566.
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	117.1307	194.7574	376.1007	16737.27	25351.46	7333.074
Sum Sq. Dev.	0.166592	40.88660	5.134972	439172.4	322557.7	685665.4
Observations	810	810	810	810	810	810

Source: *Field Data (2025)*

Correlation Analysis

An important insight into the directional relationships between the study variables seems to be provided by the correlation analysis reported in Table 3, helping in gaining insight into the directional relationships among the variables. Economic Growth Index (EGI) is highly associated with Financial Stability (r=0.198), Credit to GDP (r=0.277) and Education (r=0.252), respectively. This implies that highly developed financial systems and credit access as well as improved educational attainments are of moderate relevance for economic growth in SSA, similar to the findings of Alhassan et al. (2021) and Ahmad et al. (2023).

The Mobile Money Index (MMI), on the other hand, is weakly, and negatively associated with economic growth (r = -,0.044) somewhat counter-intuitively at a first impression. However, the above estimates might be an indication of the evolutionary stages of mobile money where the fruits of such electronic money are not fully ripen or could also be an indicator that the growh impacts of mobile money are contingent on any other intervening variable eg, financial development (Owusu, 2024). Also interesting is the positive relationship between MMI and education (r = 0.300) and soundness (r = 0.143), which suggests that countries with strong financial and institutional structures tend to have high uptake of mobile money. Moreover, inflation has weak negative relationship with EGI (r = -0.106), and financial stability, which

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demonstrates its nature as a macroeconomic destabilizing in the region (Anarfo & Abor, 2020).

Table 3: Correlation Analysis Results

	1	2	3	4	5	6
1. Economic Growth Index	1.000000					
2. Mobile Money Index	-0.044260	1.000000				
3. Financial Stability Index	0.197999	0.143388	1.000000			
4. Credit to GDP	0.276908	0.069195	0.422003	1.000000		
5. Education	0.252216	0.300179	0.182442	0.419009	1.000000	
6. Inflation	-0.105843	0.066509	-0.101989	-0.078873	0.167630	1.000000

Source: *Field Data (2025)*

Stationary Tests

The panel unit root results presented in Table 4 offer compelling evidence that the Economic Growth Index (EGI) is stationary across the panel of 38 Sub-Saharan African countries over the period 2000–2023. This is a crucial finding, as stationarity is a precondition for robust and unbiased regression analysis in panel data settings (Ahmad et al., 2023). All four tests — Levin, Lin & Chu (LLC), Im, Pesaran and Shin (IPS), and both ADF and PP Fisher Chi-square tests — reject the null hypothesis of a unit root at the 1% significance level, with p-values equal to 0.0000 across the board.

In particular, the fact that the LLC statistics of -6.26 and the IPS W-stat of -9.00, suggest strong mean reversion, means that economic growth shocks in these multiple countries is transitory and that the series will eventually revert back to long-run equilibrium (Owusu, 2024). Furthermore, the stability of the result is confirmed by the concurrence of the findings of common and other individual unit root tests. This is an indication of the appropriateness of regressing the original form of the growth variable and not the differenced form, which decreases the incidence of spurious regression issues—the bane of the long panel macroeconomic studies (Alhassan et al., 2021).

Table 4: Stationary Tests Results

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-6.26451	0.0000	38	836
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-9.00413	0.0000	38	836
ADF - Fisher Chi-square	222.508	0.0000	38	836
PP - Fisher Chi-square	435.567	0.0000	38	874

** *Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.*

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Multicollinearity Check

The findings from the test of multicollinearity in Table 6 provided strong evidence that the intercept and slope of the regression model are free from severe multicollinearity that could have clouded up coefficient estimates and crippled the validity of the inferences. The Centered VIFs for the all-explanatory variables are lower than the commonly acceptable level 10 (inflated variance), which means that multicollinearity is not a problem in the model (Ahmad et al., 2023).

In more detail, the VIF values are centered at 1.12 and 1.25 for the MMI and FSI, indicating low collinearity among these main determinants. This is a critical result because it supports the idea that their interaction term, at the heart of the moderated regression approach used in the current study, will not suffer from redundancy or overlap (Owusu, 2024). The control variables Credit to GDP (1.47), Education (1.39) and Inflation (1.07), are far within the acceptable range as well. While the uncentered VIF are larger, particularly for Constant and for the Financial Stability Index, they have no comparative interpretation and do not suggest multicollinearity. Thus, one of the main diagnostic assumptions of the regression model is respected (Alhassan et al., 2021).

Table 6: Multicollinearity Test Results

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
Mobile Money Index	4.92E-06	2.409382	1.123094
Financial Stability Index	4.35E-05	43.61650	1.245889
Credit to GDP	5.98E-10	2.620980	1.466285
Education	7.74E-10	4.824081	1.394292
Inflation	2.78E-10	1.168466	1.065319
C	8.85E-06	40.00014	NA

Regression Analysis

The findings of the GMM regression analyses presented in Table 7, provide a number of nuanced perspectives on the inter-connections between mobile money,financial stability and economic growth in the context of Sub-Saharan Africa (SSA). Critically contrasting these results with the literature, we find they are consistent and inconsistent with established empirical evidence, thereby reflecting the sometimes conflicting relationship towards how digital finance affects macroeconomic growth in SSA.

First of all, the lagged dependent variable coefficient (Economic Growth Index(-1)) is negative and not statistically significant ($\beta = -0.0319$, $p > 0.05$). That previous levels of growth have limited predictive power for current growth in this sample, suggests that SSA's growth process is weakly persistent, possibly reflecting the influence of persistent shocks, institutional instability, or the development of new economic structures (Ahmad et al., 2023). More noticeably, Mobile Money Index (MMI) has a negative, although not statistically significant, coefficient result ($\beta = -0.1015$, $p = 0.29$), supporting the non-effectiveness of mobile money alone in enhancing growth in the region. This questions dominant discourses, which often

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associate mobile with inclusive growth, especially in early adopting countries such as Kenya and Uganda (Tembo & Okoro, 2021). Yet, this discovery is in accordance with that of Ahmad et al. (2023) who, along the same line, emphasise that mobile money's economic output is nonlinear and strongly context-specific, often needing supportive institutional and financial factors for growth dividends to be materialised.

Financial Stability (FSI) is also muted in direct terms ($\beta = 0.0353$, $p = 0.34$). Although this result contradicts the principle of higher banking system strength leading to growth, it is in agreement with observations made by Mlachila et al. (2016) who argue that financial deepening is not enough in poor institutions environment. This further supports the view that the financial infrastructure has to be conducive to the diffusion of innovation, for positive impacts on growth. Importantly, however, the sign of the interaction term Mobile Money × Financial Stability (MM × FSSI) is positive and significant; $\beta = 0.1547$ and $p = 0.0426$. Such a moderation suggests that in the stable financial systems, the mobile money has a positive association to growth that replicates the findings of Ifediora et al. (2022) who also used system GMM and found similar synergy in African economies. Accordingly, it is the existence of effective financial regulation and sound banking that is a prerequisite for digital financial innovations to deliver macroeconomic dividends of any consequence.

The positive moderating role of financial stability finds support in the work of Ahmad et al. (2023) in their system GMM for African economies. They found that the growth effects of mobile money were not statistically significant along all the dimensions in the case of countries with relatively weak ICT infrastructure and regulatory capacity. Similarly, Takyi et al. (2023) found that financial inclusion through mobile phones promotes growth when located a in stable monetary and banking policy environment. This concurrence of results indicates how fintech's contribution to the macroeconomic activity is conditional. Contrariwise, Alhassan et al. (2021) found stronger direct effects of mobile money on growth without demanding strong interaction terms. Their research highlighted remittances and savings mobilization as the main impetus, for which it attributed grounding it in the penetration of mobile money in the rural and informal segments. This difference may reflect how the indicators are constructed – this study employs a composite index for mobile money while Alhassan et al. crystallize around finer-grained usage statistics.

Interestingly, Bakari et al. (2018) observed that mobile money had a positive effect on financial inclusion and income distribution in the best performing SSA countries. Nevertheless, they used static panel model and may have also overrated stied measurements. The dynamic GMM (system) framework of the present study, by contrast, accounts for lead–lag and endogenous relationships, providing a more conservative – if perhaps more dependable – portrayal of the mobile money–growth nexus.

The model's control variables are statistically significant and having theoretically consistent signs. For instance, GDP growth has a systematic negative relationship with Inflation ($\beta = -0.00078$, $p < 0.001$), which is a good measure of a perverse macroeconomic trend (Mlachila et al., 2016). This is in agreement with the report of Obiora et al. (2022) who also observed the impact of inflation on the growth of the economies of low-income SSA, and this in most cases emanated from exchange rate instability and fiscal imbalances. Education rate is positively and significantly related to ($\beta = 0.001845$, $p < 0.001$), supporting human capital as a contributor to growth. This outcome is consistent with the human capital theories espoused in

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Alhassan et al. (2021) and Ahmad et al. (2023) who all emphasized the role of education as a catalyst in funding the development and adoption of mobile financial services. On the other hand, Credit to GDP has a significant negative effect on growth ($\beta = -0.000978$, $p < 0.001$) which appears counterintuitive. Nevertheless, this might be indicative of inefficiencies in the credit allocation, which is common in SSA as a lot of credits are channeled to public consumption or non-productive sector, Tembo & Okoro (2021). This supports the conclusion reached by Ifediora et al. (2022) who also recorded negative or weak credit-growth connections in economies with low capital market development or poor enforcement refuge to law.

Methodologically, the use of system GMM estimator in this study is consistent with the state of the art in current macro-financial literature policy research . The credibility is further enhanced by the GMM's capacity to handle endogeneity – particularly the bidirectionality of mobile money on growth. Ahmad et al. (2023) and Tembo & Okoro (2021) also used system GMM to test the robustness of their findings, especially on the moderating role of digital financial inclusion with indicators of governance. An additional methodological innovation is the incorporation of a synthesised Mobile Money Index and Financial Stability Index, calculated as a weighted average of individual sub-indices. Unlike the binary indicators (e.g., use of mobile accounts), our comprehensive assessment of the mobile money ecosystem adds depth and breadth and will allow us to compare its evolution across time and space. In contrast, Evans (2022) relied solely on mobile subscriptions as a proxy, which can neglect dimensions such as the frequency of use or savings behaviors. Furthermore, the original contribution of this research is its explicit investigation of the moderation effect —an under-researched issue in the SSA fintech literature. Although many studies have evaluated the direct impacts of either mobile money or financial stability on growth, very few modeled the interactive mechanisms between the variables as is being done here. This sees the light reverberating Mlachila et al. (2016) and Takyi et al. (2023) for a more context-dependent modeling approach considering institutional complementarities.

Overall, the results from this paper's GMM regression analysis are generally consistent with emergent literature highlighting the contextual and conditional basis of the growth effect of mobile money. The interaction of mobile money with financial stability is positive and significant suggesting a measure of systemic alignment between the 2 domains, in spite of the statistically insignificant direct effects. These findings are consistent with, and extend, earlier studies of Ahmad et al. (2023), Ifediora et al. (2022) and Tembo and Okoro (2021) and new methodological asperity by way of composite actualities and dynamic modeling. Our study therefore contributes in a significant way to the literature by providing such a nuanced and policy-relevant insight on how DFS ecosystems and financial architecture interact to affect economic potential in SSA.

Table 7: Regression Analysis Results Using GMM

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Economic Growth Index(-1)	-0.031952	0.032144	-0.994034	0.3205
Mobile Money Index	-0.101551	0.096715	-1.050004	0.2941
Financial Stability Index	0.035365	0.036818	0.960527	0.3371
Credit to GDP	-0.000978	0.000100	-9.752368	0.0000
Education	0.001845	0.000262	7.045637	0.0000

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Inflation	-0.000780	6.67E-05	-11.69675	0.0000
MM*FS	0.154722	0.215285	0.718687	0.0426
	Effects Specification			
Cross-section fixed (first differences)				
Mean dependent var	0.000148	S.D. dependent var		0.012630
S.E. of regression	0.021407	Sum squared resid		0.335899
J-statistic	29.95359	Instrument rank		35
Prob(J-statistic)	0.035440			

CONCLUSION AND IMPLICATION TO RESEARCH AND PRACTICE

The results of this study have some interesting policy implications for Government, financial regulators and other development players in SSA. First of all, the large interaction effect of mobile money and financial stability supports the fact that the digital financial innovation per se does not automatically enhance economic growth. For mobile money to have an economic impact, it needs to be embedded in a sound financial system that is adequately regulated, has high institutional capacity (for instance in regulation) and efficient bank supervision. hence, governments and central banks need to respond by designing policy that favours the growth of mobile money and resilient, transparent, inclusive financial systems. In addition, results indicate that improved financial literacy, digital infrastructure, and mechanisms to support agent liquidity are necessary to unlock the full growth potential of mobile money, particularly in rural or under-served areas.

This study has several important implications for finance research especially for financial innovation, development finance and digital financial ecosystems, as follows. One of the most important observed contributions is the demonstrated moderating effect of financial stability on the mobile money–economic growth relationship. This perspective contradicts the linear models usually used in financial inclusion research and, hopefully, leads researchers to consider more conditional and interdependent frameworks by which the efficacy of digital finance tools is contingent on the quality of the institutions and depth of regulations.

In addition, the introduction of a composite Mobile Money Index, rather than binary or single-variable indicators only, adds methodological value to financial research. This multilevel perspective mirrors the recent trends in finance literature focusing on behavioral finance, financial access heterogeneity, and fintech adoption dynamics. The foregoing discussion sets the stage for further inquiry into how the individual elements of mobile money (i.e., savings, transfers, the use of credit) shape and interact to affect financial sector development, credit market deepening and the transmission of monetary policy in economies that are undergoing a digital transformation.

The study further paves the way for inter-discipline research, suggesting that these areas need to be jointly addressed by financial economists, development specialists, and central banking specialists. More generally, it raises the question of how mobile financial technology affects the architecture of the financial system, decisions about asset allocation, and systemic risk, in emerging markets. Furthermore, mobile money and financial stability nexus offers opportunities for financial resilience measures, especially during macroeconomic shocks or

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crises. Overall, the study's empirical evidence serves to both inform ongoing discussions around digital financial inclusion and stimulate further theoretical and empirical inquiries into how fintech innovation interacts with macro-financial stability. At this point, therefore, finance scholars are urged to go back to drawing boards, think about non-linear processes, and come out with better theories that encapsulate the messy world in which financial systems are operating in the Global South.

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