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| RESEARCH ARTICLE

The Interplay Between Mobile Money and Employment on Economic Growth in Sub-Saharan Africa- Moderated by Financial Stability

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| ABSTRACT
The study aims to: (1) determine the effect of mobile money usage on economic growth; (2) assess the impact of employment levels on growth; (3) evaluate the interaction between mobile money and employment in enhancing economic outcomes; and (4) investigate how financial stability moderates the relationship between mobile money and economic growth. To achieve this, the study employs a quantitative research design, the study employs panel data from 38 SSA countries spanning 2000 to 2023. Key variables include a Mobile Money Index, Economic Growth Index, Employment Ratio, and a Financial Stability Index. The Generalized Method of Moments (GMM) estimation technique is applied to address potential endogeneity and ensure robust inference in a dynamic panel data context. Results reveal that mobile money alone does not significantly drive economic growth and may have a marginally negative effect. However, when coupled with higher employment levels and supported by financial stability, its contribution to economic growth becomes significantly positive. Additionally, education, credit access, and inflation also influence growth outcomes, reinforcing the importance of broader economic policy integration. Originality/value – Policy interventions should adopt a holistic approach—combining mobile money development with job creation and macro-financial stability measures. Emphasis on financial regulation, inclusive employment strategies, and digital financial literacy will be crucial to maximizing the developmental impact of mobile money in SSA.

| KEYWORDS
Mobile Money, Economic Growth, Employment, Financial Stability, Sub-Saharan Africa, GMM, Digital Finance, Inclusive Development.

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1. Introduction

Over the last decades, Sub Saharan Africa (SSA) has been plagued with chronic problems in its quest for sustainable economic development. Despite having abundant natural resources and a youthful population, the region has high unemployment rates, inadequate financial systems and economic instability. As SSA countries increasingly turn to new developmental paradigms, mobile money services are postulated as key catalysts of financial inclusion and job creation, with increasing possibility of shaping economic outcomes (Nan, Zhu, & Markus, 2020). But the relationship between the intensity of mobile money use, employment and economic growth are not straightforward in general and even more so in the face of the financial system stability which may reinforce or weaken these effects (Asante, Takyi, and Mensah, 2023).

For one, economic growth in a region is not only a rise in the gross domestic product (GDP), but rather a structural transformation, investment in human capital and job creation. As country evidence intimates, growth in SSA is typically erratic and asymmetric as countries oscillate between periods of growth and decline due to commodity shocks, political upheavals and frail governance systems (An, Kargbo, & Zou, 2020). The region's underdeveloped financial markets, limited formal credit access,

and banking penetration have long systemically prevented inclusive growth in the region (Bekele & Degu, 2021). Solving these challenges will demand attention to both conventional macroeconomic levers, and modern innovations such as mobile money.

Mobile money, or the ability to transact financially using a mobile phone, has seen a surge across SSA, particularly in countries such as Kenya, Ghana, and Tanzania. Adoption of services like M-Pesa has made it possible for millions to use savings, credit, and payment instruments that were then used to include the informal and unbanked segments of the population into the financial system (Mbiti & Weil, 2011; Jack & Suri, 2014). This digital financial revolution cuts down transactional costs and widens resource access to microenterprises and smallholder individual entrepreneurs (Ahmad et al., 2020). Thus, mobile money platforms are about more than just the movement of funds—they enable the participation of people in labour markets and the ability to start a business and can create employment that can lead to wider economic growth.

Employment is still historically the most important channel through which growth and human development lift people out of poverty. Formal employment prospects are however scanty in SSA where most people are involved in informal and subsistence economic activities (Ngono, 2020). This is a challenge, but it is also an opportunity: the growth of mobile money means that people have new avenues for becoming part of the digital economy, earning an income, and building micro-businesses. Liquidity, risk management and transaction facilitation: Digital financial services, specifically leverage self and employment, are made possible by access to digital financial opportunities that enhance individuals' liquidity, manage their risk and facilitate their transactions (Konte & Tetteh, 2022).

Additionally, the relationship between mobile money and employment in SSA appears to be symbiotic. On the one hand, mobile money services may generate jobs through the maintenance of agent networks and mobile platforms. Conversely, improved employment improves the ability of individuals to engage in regular access to mobile money services, which broadens the financial ecosystem. Such an interchange between mobile money and employment implies that together they serve to multiply economic expansion when used in synchrony (Gosavi 2017).

However, even such a dynamic is not free from the arms of the environment outside. An important moderator in this context is financial security. Financial development is also expected to be positively related to growth; however, financial instability can negate the benefits of financial expansion if it leads to disturbance in the financial market, lower trust in institutions and lower investment (Asante, Takyi, & Mensah, 2023). As such, the impact of mobile money on jobs and growth, may vary depending on the depth and soundness of the financial sector. For example, in environments that have limited regulation or weak infrastructure, mobile money might experience fraud, systemic risk, or inefficiencies that reduce their impact on the economy (Martin, 2019).

Previous empirical studies have established that inclusive financial systems can have a positive effect on economic growth, but the exact mechanism for mobile money is only starting to become more evident (Inoue & Hamori, 2016). An increasing body of empirical evidence shows that access to finance significantly increases GDP per capita and supports broader macroeconomic stability (Menyelim et al., 2021). However, the impact of mobile money on job creation, and its combined impact on economic development, has not been fully examined. Additionally, the possible role of financial stability in moderating the mobile money-growth nexus as to whether it strengthens or weakens has largely been presumed other than empirically ascertained (Nan, Zhu and Markus, 2020).

Although interest in digital finance and digital employment are increasing, there are still major gaps in both literatures. First, the majority of existing studies examine mobile money, employment, and the economic growth as independent rather than an interdependent system (Ahmad, Green, & Jiang, 2020). Second, relatively few articles use stringent quantitative methods, capable of disentangling causal relationships and investigating moderating factors. A limited number of studies in this field adopt econometric techniques such as system GMM to deal with endogeneity and unobserved heterogeneity (Dunne & Kasekende, 2018). Third, many extant studies still tend to be single-country case analyses (Salim, 2016) often at the expense of regional-level analyses across SSA (Mbiti & Weil, 2011, Suri & Jack, 2016).

Given these gaps, this study aims to investigate the nexus between mobile money, employment and economic growth in Sub-Saharan Africa; with special interest in how financial inclusion influences this effect. In the quest to empirically test if the concurrent growth of DFS and jobs has implications for sustained economic growth and to further understand how levels of financial sector stability are part of the variation of these dynamics. This study goes a step further in wanting to contribute with a sub-regional approach by using panel data from several SSA countries, and by using quantitative methods that are solid enough to obtain generalizable results.

Accordingly, this paper examines the role of use of mobile money in economic growth, the extent employment predict economic performance and the joint effect in a moderated model. Another line of inquiry will be how financial sector stability conditions—regulatory quality, monetary stability, institutional confidence—condition these relationships. The research seeks to inform policy-makers, financial firms and development agencies seeking to maximise the socio-economic benefits of mobile money services and employment schemes in order to promote inclusive and resilient growth. Restatement of the Problem The position by Ssemujju and Mutambikka (2013) is that the relationship between mobile money, employment and growth in SSA is a discourse with potential that is lacking theoretical backing. As digital finance continues to permeate the lives of citizens in every country on the continent, a focus on the 'big issues' of the day or the 'macro' implications is both pertinent and necessary. This research provides a rare chance to fill in a knowledge gap by examining how financial technology, labor markets and economic performance are interrelated through the prism of financial stability. In so doing, the paper expect to provide some pertinent lessons that can be learned to formulate better development policies in central Africa.

2. Review of Literature

2. 1 Effect of Mobile Money Usage and Employment on Economic Growth

The penetration of mobile money into the financial ecosystem of Sub-Saharan Africa (SSA) has called the tune to economic transactions in the region. Mobile money is the product of digital innovation that enables financial transactions using a mobile phone, helping individuals and businesses-especially those in underserved areas- to overcome banking constraints. The enhanced availability and convenience of mobile money services have generated a growing literature that explore the direct and indirect impacts on economic growth. It has been argued that mobile money improves economic welfare at household, business, and national level because of mechanisms such as higher financial inclusion, better saving, and risk pooling (Nan, Zhu, & Markus, 2020).

In addition, mobile money could encourage participation in the labor market because it offers a secure and convenient means of doing business, especially among those working in the informal sector and for small businesses. Konte & Tetteh (2022) found that the use of mobile money on its own may not lead to an increase in firm-level productivity, but the complementing access of traditional financial services does lead to a significant increase in firm's labor productivity. This has been even more apparent in Small and Medium Size Enterprises (SMEs) where smaller transaction costs and an expanded access to capital enable business expansion and job creations (Konte & Tetteh, 2022). Therefore, the impact of mobile money on economic growth is also transmitted to a certain extent through the ability to create employment, particularly in SMEs.

In addition, employment, of course, is also vital to economic growth. In a region where unemployment and underemployment rates are significant in terms of SSA for most of the other sectors, the labour force participation along productive sectors is the key driver to growth. The transition to mobile money tools can speed this along by allowing marginalized populations like women and rural dwellers to take up business opportunities. Ngono (2020) also concludes that mobile money has a significant and positive impact on the ability for women to access capital, which in turn enhances self-employment and consequently reduces the gender based gap in entrepreneurship (Ngono, 2020). When jobs open up — including through fintech, or financial technology — the economy grows, not only in output, but in who is included.

Mobile money also supports growth by supporting consumption and investment, due to increased liquidity and better financial planning. As Inoue and Hamori (2016) shows us better financial access is highly correlated with the rate of GDP growth when households and firms are able to have proper and easy access to credit or save appropriately (Inoue & Hamori, 2016). Bekele and Degu (2021) further stated that broadening financial accessibility through technological innovations as mobile money will have the effect of efficacious and deep financial intermediary that is crucial for sustainable long-run economic growth (Bekele & Degu, 2021).

Still, one must be aware that the effect of mobile money on growth may be indirect and conditional on other factors. In addition, where infrastructure is under-developed or financial literacy is low, the gains from adopting mobile money services may be less than complete. For instance, Kouladoum (2023) argued for the necessity of the reinforcing digital infrastructure –i.e. internet access and mobile penetration – required for financial innovations to produce inclusive growth outcomes (Kouladoum, 2023). In sum, the empirical evidence reveals the importance of both use of mobile money in fostering employment and economic growth in SSA. They do not exist in isolation, and are interconnected — mobile money can induce employment, and employment can increase the adoption of mobile money services. These linkages underscore the potential value of a holistic policy approach that operates in parallel on digital financial inclusion'' and job creation as central fulcrum of a sustainability policy reach.

2.2 Interaction Between Mobile Money Adoption and Employment in Influencing Economic Growth

The combined impact of mobile money adoption on employment creation is a subtle yet encouraging route of promoting economic development in SSA. Both separately, mobile money as well as employment are know to facilitate development effects, but when observed together, they may act in synergy, more than the sum of each part. This relationship is receiving growing academic attention, particularly as digital financial services increasingly provide access to finance, enabling more inclusion of previously excluded populations in the labour market.

Firstly, mobile money is not just a financial tool but an economic enabler. Because it lowers the cost of transactions, provides mobile financial security and access to credit, mobile money enables small business owners and informal workers to expand their operations to create jobs. Konte and Tetteh (2022) established that mobile money had only a weak direct effect on firm productivity, however, its effects became more potent when it was coupled with traditional financial services. The findings of their research highlighted that this interaction resulted in a significant rise in work productivity among small and medium enterprises in SSA (Konte & Tetteh, 2022).

Meanwhile, mobile money also drives growth in employment, both directly and indirectly. Directly it creates jobs by setting up agent networks, technical support services and maintaining mobile infrastructure. Moreover, in an indirect way, mobile money adds to the efficiency of doing business and to the pool of working capital as well, thereby promoting self-employment and business start-ups, particularly in remote regions. Dorfleitner and Nguyen (2022) also show that mobile money use increases women's economic empowerment, specifically when women practise good financial management—usually leading to ever-growing level of informal employment and entrepreneurship (Dorfleitner & Nguyen, 2022).

In addition, the relationship between mobile money and work is strongly filtered through digital infrastructure. Kouladoum (2023) contends that the importance of mobile money on inclusive growth and job creation is predicated on digital infrastructure development. The usage of mobile financial services for labor productivity and entrepreneurship is higher in locations with greater access to the internet and mobile phones, as well as higher digital literacy evolving the usage of mobile financial services, increasing significantly in labor productivity and entrepreneurship (Kouladoum, 2023).

Furthermore this interaction is frequently reflected in the informal sector, where access to formal banking is restricted. Mobile money solutions are a key catalyst for closing this gap, and providing unbanked labourers and small business owner/operators with a safe, convenient way to control their money. The mobile phone money features prominently in financing women entrepreneurship in SSA sometimes more than the banks and micro –finance institutions (Ngono,2020). This also promotes the creation of income and employment at the local level (Ngono, 2020).

Overall, the interaction between mobile money penetration and employment has multiple implications for economic growth in SSA. Mobile money provides enhanced financial capacity for individuals and firms to participate in productive employment, whilst employment leads to an increased uptake and usage of digital finance services. Policies designed to promote economic growth should therefore consider mobile money and employment not as unrelated sectors, but rather as mutually-enforcing drivers of change within the wider development context.

2.3 How Financial Stability Moderates the Relationship Between Mobile Money and Economic Growth

The link between mobile money and economic development in Sub-Saharan Africa (SSA) is well acknowledged in development literature. But precisely its magnitude and direction may strongly depend on the level of financial soundness of a nation. Financial stability – that the financial system is effectively operating without systemic disturbances – is necessary to ensure that innovations such as mobile money have sustainable and positive effects on economic growth. The best laid plans for development can fall flat if new technologies do not draw upon a stable financial ecosystem.

First, financial stability is necessary to maintain the trust and confidence that are crucial for mobile money take-up and use. When Inoue and Hamori (2016) examined that issue, they discovered that financial access greatly promoted economic growth in the case of SSA, but both were achieved only when financial access was supported by a well-developed financial infrastructure (Inoue & Hamori, 2016). This suggests that mobile money, while significant, requires a supportive financial ecosystem for its real impact on economic growth. As an example, mobile transactions are depended on digital backbone, regulations and secure payment flows, which are in fact features of a sound financial system.

In addition, empirical studies show that macro-financial variables also influence the effects of financial innovation on economic growth. Dunne and Kasekende, 2018 investigated financial innovation, including mobilie money, and showed that while it may reduce the demand for money, it does have an impact on the efficiency of monetary policy transmission channels. This suggests that financial innovation must take place on the back of sound and flexible monetary institutions if growth is to be conducive to

it (Dunne and Kasekende, 2018). Therefore, mobile money has the potential to be economy disrupting when used in an unstable economic context with weak monetary policies and no regulatory supervision.

Moreover, financial sector development has a complementary effect in terms of the infrastructure that mobile money systems rely on. Bekele and Degu (2021) found that financial sector depth, access and efficiency are all positively and significantly related to economic growth in SSA. This implies that the gains from providing financial access, such as a mobile money account, can be magnified to the extent to which the financial system is capable of delivering credit and has broad reach (Bekele & Degu, 2021). Just as important is the recognition that financial stability is being used as a risk mitigation for risks that are actually being brought in for mobile money. Financial inclusion with mobile services should be anchored in strong institutional frameworks in order to avoid the erosion of economic gains from systemic shocks or misallocation as proposed by Sarpong and Nketiah-Amponsah (2022) (Sarpong & Nketiah-Amponsah, 2022). Without this kind of stability, it could result in fraud, liquidity problem or capital flight which could worsen the performance of the economy rather than improving it.

Also, the complementary impact of both mobile money and traditional finance on productivity is greater in the presence of strong institutions. Konte and Tetteh (2022) observed a significant enhancement in firm productivity only when mobile money is combined with access to bank credit/financial services. Their study reveals that mobile money works best in competition with the financial institutions, which in turn dependent on financial stability to operate effectively (Konte & Tetteh, 2022). In sum, financial stability is not only a background state variable – it is a key moderator of the extent to which mobile money affects economic growth in SSA. In addition, although mobile money is increasing access and enhancing entrepreneurship, those wins are fully realized only when pursued within the context of stable, well-regulated financial systems. Therefore, the promotion of the cycling into economic stability should be embedded in the digital financial policies that are designed to promote inclusive and sustainable economic development.

2.4 Theoretical Framework

To fully understand the intricate interplay between mobile money, employment, financial inclusion and economic development in SSA, there is a need to ground this discourse in robust theoretical frames. The relations between these three groups of variables can be analyzed based on two pivotal economic theories: the Endogenous Growth Theory and the Financial Intermediation Theory. These theories jointly suggest how ICT enabled financial innovations (MM) among others can effect long-run economic growth, in partnership with labor market work and a well-functioning financial system.

According to the endogenous growth theory, economic growth is dependent on domestic factors such as invention, human capital and technological innovation rather than external or exogenous factors. This theoretical perspective is particularly applicable in SSA, were mobile money being a domestically developed technological response to financial exclusion. Simultaneously, the Financial Intermediation Theory underlines the critical importance that financial institutions play in the process of savings, investment, and capital allocation. It also speaks to the way in which financial systems act as conduits for innovations like mobile money to influence real economic variables, like employment and GDP. These two theories collectively offer the conceptual foundation on which to examine the relationship between the adoption of mobile money, financial stability, employment on the one hand, and the influence of the two indicators on economic growth, while the financial stability as a moderator.

2.4.1 Endogenous Growth Theory

The essence of the Endogenous Growth Theory is that there are fundamental factors internal to the economy (such as technological progress, skilled based human capital formation, efficiency of government policies), which drive long run growth than exogenous factors. Most conspicuously developed by Romer (1990), this theory posits that when canonical investments in human capital and innovation exhibit spillovers that increase the productivity of all sectoral inputs. In the context of SSA, mobile money is a type of invention that has these properties of providing low cost and a relatively high degree of penetration of financial services (Ahmad, Green, & Jiang, 2020).

Mobile-money systems such as M-Pesa and MTN Mobile Money eliminate financial-inclusion barriers in unprecedented ways, bringing access to savings and transfer of funds to entrepreneurs and informal-economy workers. If one believes in the Endogenous Growth Theory, such innovations lead to productivity gains that get reinvested into the economy, fueling more innovation and cumulative growth. Nan, Zhu & Markus (2020) posit that mobile money contributes to economic development through several paths, including household welfare boosting, business perform- ance boosting and community financial resilience building (Nan et al., 2020).

Further, the labor market is central to this theoretical edifice. For example, work, especially in entrepreneurship and microenterprises, can be both a motive and a result of innovation. With the expansion of mobile money, the informal sector is

empowered with tools to scale their businesses, creating jobs. This tendency is consistent with the emphasis the theory of endogenous growth places on the internal driver of growth and the feedback mechanism between innovation and labour productivity (Wamboye, Adekola & Sergi, 2016). Yet, endogenous growth processes do not run in a vacuum. They need a conducive environment such as infrastructure support and policy enabling. Success in driving mobile-money adoption may be lost if not underpinned by financial health and institutional capacity. This restriction leaves open the possibility of Financial Intermediation Theory as an alternative paradigm.

2.4.2 Financial Intermediation Theory

Through the Financial Intermediation Theory, it is assumed that financial intermediaries – the banks, microfinance institutions and now mobile money platforms – perform a necessary service for stimulating economic growth by allocating capital effectively, managing risk, and reducing the costs of transactions. This hypothesis posits that developed financial institutions are a critical for savings mobilisation, investment alignment, and liquidity availability that is key to growth (An, Kargbo & Zou, 2020).

In most part of SSA, many have long been excluded from formal banking, and mobile money has emerged as an alternative to traditional financial intermediaries. Mobile money also keeps down costs and broadens the reach of financial services, by permitting secure real-time transactions without the need for bank bricks and mortar. This is especially the case in rural and peri-urban areas where financial exclusion is highest. Financial innovation—especially mobile money—has cooled down SSA's demand for money landscape and changed the functions performed by financial systems in relation to growth and stability in the macro-economy (Dunne and Kasekende, 2018).

Employment results do show this intermediation as well. When people and firms have access to, and can depend on, the use of credit, savings and payment services they can more effectively participate in productive economic activity. For example, Sarpong and Nketiah-Amponsah (2022) show that financial inclusion (supported by mobile money) is significantly related to inclusive growth, a central objective in financial intermediation (Sarpong & Nketiah-Amponsah, 2022). However, the power of financial intermediation is largely influenced by the stability and the quality of financial institutions themselves. A lack of regulation, high inflation and undercapitalized banks can limit the ability of mobile money platforms to redirect funds effectively. This observation justifies an exploration of financial stability as a moderator in the mobile money-growth nexus. Bekele, & Degu (2021) concluded that financial sector depth, access and efficiency have a significant positive impact on economic growth in SSA when there is strong institutional environment so (Bekele & Degu, 2021).

Furthermore, the Financial Intermediation Theory gives a strong account to substantiate the facilitative role of mobile money and traditional finance to each other. As Konte and Tetteh (2022) have alleged, mobile money has delivered a boost to firm productivity more so when used in combination with traditional banking services, thereby indicating for an integrated manner through which the two forms of financial intermediation can complementor support economic expansion (Konte & Tetteh, 2022).

2.4.3 Synthesis and Conclusion

Endogenous and Financial Intermediation Theories jointly provide a sound theoretical framework for this study. The endogenous growth theory, in explaining the contribution of mobile money as an enabler of productivity and economic development, focusses on employment and entrepreneurship. Financial Intermediation Theory, however, elucidates why and how these innovations work in general financial systems and emphasizes the role of financial stability in their potential success. By incorporating both views, our study is well-positioned to examine the direct impacts of mobile money and employment on economic growth, as well as the mediating role played by the quality of financial institutions and macroeconomic situations. Finally, the integrated analytical framework provides a perspective on how SSA economies can leverage innovations in digital finance for inclusive and sustainable growth.

3. Methodology

The approaches employed to analyse the data and the empirical model in this section.

3.1 Data Collection

This paper uses quantitative research design to establish how mobile money affects employment and economic growth in Sub-Saharan Africa (SSA), with financial stability as a moderator. While the quantitative method enables measurement of the macroscopic economic and institutional variables by the means of the standard statistical models. This research design is suitable because it makes it possible to establish causal relationships and to estimate marginal effects over time and within regions, thus, contributing to a more objective and generalizable outcome (Ahmad, Green, & Jiang, 2020).

3.2 Sample Population

Panel data of 49 sub-Saharan African countries spanning from 2000 to 2023 is used in the study. Nevertheless, because of dis-continuities and the absence of some data series, we had to discard some countries, and only 38 have been considered for the empirical testing. These countries were chosen because they have data on the main economic, financial and institutional indicators required to build the relevant variables. The sample covers both low and middle-income economies, and is thus representative for the diversity of financial infrastructure, labor dynamics and digital finance penetration in the region (Bekele & Degu, 2021). By relying on such long time span and regional composition of the sample, the short-run fluctuations and the long-run trends in mobile money utilization, employment and economic activity may be analysed simultaneously herein. Additionally the datasets contain structural and institutional controls which assist in controlling for the moderating effect of financial stability on the key relationships of interest (Sarpong & Nketiah-Amponsah, 2022).

3.3 Measures

For the purpose of robustness and the conceptual clarity composite indices are created, and all variables are scaled to have mean zero and unit variance. Table 1 provides a summary-account of the operational definitions, acronyms, and data sources included. We also standardized each variable by the mean and the standard deviation to leave international comparability and comparability over time. The composite indices (MMI, EGI, and FSI) were developed based on averaging the components standardized to remove effects of outliers and to make interpretation easier. For example, the Mobile Money Index (MMI)---an index developed by combining account ownership, transaction frequency, and savings behavior indicators---embraces both the access and usage dimensions of digital finance (Nan, Zhu, & Markus, 2020).

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
Employment Ratio	Share of working-age population that is employed	EMP	Employment-to-population ratio (%)	World Bank WDI
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

3.4 Model for the Study

This paper, with reference to the panel data, employs moderated multiple regression model to examine the influence of mobile money on economic growth and financial stability as a moderator. The advantage of panel data is that it increases the number of observations, while reducing noise from heterogeneity across countries (Ahmad et al., 2023). Panel models would also facilitate the understanding of effects within (within country effects) and between countries over time. The model also includes a lagged dependent variable to account for persistence, thereby addressing the issue of autocorrelation. Such specification is in line with Solow-type growth models which allows inertia and structural dependence (Ahmad, 2020).

3.4.1 Model Specification

Given the panel structure of the data and the focus on interaction effects, this study employs an econometric model that integrates fixed effects and interaction terms. The general form of the model is specified as follows:

$$\mathrm{EGI}_{it} = \beta_0 + \mathrm{B}_1\mathrm{MMI}_{it} + \mathrm{B}_2\mathrm{EMP}_{it} + \mathrm{B}_3\mathrm{MMI}_{it} \times \mathrm{EMP}_{it} + \mathrm{B}_4\mathrm{FSI}_{it} + \mathrm{B}_5(\mathrm{MMI}_{it} \times \mathrm{FSI}_{it}) + \gamma \mathrm{Z}_{it} + \mu_i + \lambda_t + \epsilon_{it}$$

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)
γZ_{it} = Vector of control variables (inflation, credit, education)
ϵ_{it} = the error term.
μ_i = Country-specific effect.
λ_t= Time fixed effects

The interaction term $MMI_{it} \times EMP_{it}$ captures how employment mediates the effect of mobile money on economic growth, while $(MMI_{it} \times FSI_{it})$ assesses the moderating role of financial stability. Adding control variables, such as inflation, credit to private and educational attainment guarantees that the model isolates the relevant relationships of interest and at the same time controls for structural macroeconomic dissimilarity (An, Kargbo, & Zou, 2020). Fixed effect estimation is chosen over random effects on the belief that unobserved heterogeneity between countries is related to the independent variables. This approach partially addresses time-invariant country-specific factors that are potentially affecting both mobile money take-up and economic performance. Clustered standard errors are used to reduce heteroskedasticity and serial correlation. The quantitative methodology, thick panel data, composite measurement focus, and formatted econometric modeling together create a strong foundation on examining the nexus between mobile money, employment, and economic growth in SSA, conditional on financial stability. The approach is statistically robust, while capturing dynamic economic relations in the entire African continent.

3.5 Analytical Techniques

To examine systematically the links between mobile money, employment, and economic growth in Sub-Saharan Africa (SSA), we use a multi-step analysis framework. First, descriptive statistics are used to delineate the distribution, centrality and variability of the variables across countries and over time. This single step offers early discussion of trends and disparities in mobile money use and economic indicators across SSA (Nan, Zhu, & Markus, 2020). Secondly, simple correlation analyses are used for strength and direction of linear relationships within major variables, to detect multicollinearity and to identify model specification. The tests of stationary by such tests as Levin-Lin-Chu and Im-Pesaran-Shin are performed to verify the validity in time-series panel data because the variables might have a spurious regression due to non-stationarity (Dunne & Kasekende, 2018). In addition, we conduct different tests of models specification, such as: Hausman-test (for deciding between the fixed effects and random effects models). The Variance Inflation Factors (VIF) for multicollinearity tests and the Breusch-Pagan test for heteroskedasticity are used to test for these assumptions. The primary estimation method is the System GMM, which is a powerful estimator for dynamic panel data and endogeneity (Ahmad, Green & Jiang, 2020).

4. Results

4.1 Descriptive Statistics

The descriptive statistics represent a first glance of the dataset and an understanding of the distribution, central tendency, and variability of the study variables. The average level of the Economic Growth Index is 0.145, with a standard deviation of 0.014, indicating that there are differences across countries and over time. This stability was further reflected by the relatively small difference between the minimum (0.057) and maximum (0.248) of these values. In contrast, mobile money use has a wider variation, a mean of 0.240 and a maximum value of 1.0, indicative of extensive heterogeneity in mobile money use in Sub-Saharan Africa. Next, the percentage of the population working on average as a share is 61.7. That said, the 13.49 standard deviation tells us countries vary considerably. Likewise, the Financial Stability Index is on average approximately 0.464, with less variation, indicating moderate but similar stability across the sample. Well, our variables credit to GDP and inflation have quite extreme values, in particular inflation that moves from -16.86% to 557.2% and has an absurdly high kurtosis 273.58, a sign of severe outliers or hyperinflation episodes. The test of Jarque Bera for all variables is highly significant, indicating that none of the variables are following normal distribution, hence transforming the variables might be needed in the further analysis.

Table 2: Descriptive Statistics Results

	Economic Growth Index	Mobile Money Index	Employment	Financial Stability Index	Credit to GDP	Education	Inflation	Poverty
Mean	0.144618	0.239982	61.68663	0.464340	20.67496	31.29651	9.062393	36.16747
Median	0.143638	0.166105	62.32450	0.458103	14.09109	27.07878	5.786248	31.42313
Maximum	0.247930	1.000000	85.84000	0.788203	142.4220	90.62309	557.2018	80.73006
Minimum	0.057469	0.000382	30.76700	0.271223	0.001297	2.040000	-16.85969	0.125314
Std. Dev.	0.014365	0.224124	13.48937	0.079728	23.32249	19.99241	29.14726	20.86585
Skewness	1.303315	1.072403	-0.101700	0.612634	2.894100	0.607990	15.57264	0.315246
Kurtosis	13.98797	3.493982	1.890770	4.315900	11.75219	2.372890	273.5825	2.218108
Jarque-Bera	4293.508	163.0885	42.81601	108.8400	3706.838	63.01979	2497559.	33.96546
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	116.8513	193.9053	49842.79	375.1870	16705.37	25287.58	7322.414	29223.31
Sum Sq. Dev.	0.166523	40.53685	146844.3	5.129711	438958.3	322555.0	685597.3	351354.6
Observations	808	808	808	808	808	808	808	808

Source: Field Data (2025)

4.2 Correlation Analysis

The correlation analysis gives an idea about the linear relationship among the important variables of the study. Starting the EGI, we find that it exhibits weak correlation with most of the variables. For instance, its relationship with the Mobile Money Index is weakly negative (-0.043), indicating that rising mobile money uses do not fit a rising scale of economic growth. At the same time, the negative employment – economic growth relationship (-0.065) is surprising but weakness and may indicate working problems such as underemployment or low level of productivity of the labor force. In contrast, financial stability is positively related to economic growth (0.198), implying that there was tendency for a better macroeconomic performance with less volatile financial conditions. Furthermore, the relationship between credit to private (0.277), and education (0.252) exhibited moderate positive association with economic growth which is in line with finance and human capital development literature. In contrast, poverty and inflation are negatively related to growth (both -0.146 and -0.106, respectively), and this also is in accord with the theoretical predictions since both the poverty rate and the inflation rate are conditional upper bounds on economic performance. Let us observe that poverty and work are indeed highly positively correlated (0.555) perhaps indicating once more that the largest employment rates in low-income areas do not necessarily mean productivity or well-being. This highlights the heterogeneity of labour markets in sub-Saharan Africa.

Table 3: Correlation Analysis Results

	1	2	3	4	5	6	7	8
Economic Growth Index	1.000000							
Mobile Money Index	-0.042816	1.000000						
Employment	-0.065164	-0.074773	1.000000					
Financial Stability Index	0.197703	0.146909	-0.316442	1.000000				
Credit to GDP	0.277085	0.068290	-0.337181	0.422898	1.000000			
Education	0.252324	0.301205	-0.352242	0.182621	0.419081	1.000000		
Inflation	-0.105892	0.066423	0.043998	-0.101834	-0.079111	0.167631	1.000000	
Poverty	-0.146350	-0.016633	0.555457	-0.153059	-0.323918	-0.305214	0.030189	1.000000

Source: Field Data (2025)

4.3 Stationary Tests

The panel unit root test results in Table 4 indicate that the Economic Growth Index is stationary, that is, it is non-integrated of order one in the 38 Sub-Saharan African countries from 2000 to 2023. Every one of the four primary tests supports this conclusion. First, the Levin, Lin & Chu t-test assuming a common unit root process generates a large test statistic of -6.26451- statistically significant at 0.0000 level-underscoring the evidence against the null hypothesis of non-stationarity. The Im, Pesaran, and Shin W-stat, which considers individual unit root processes, also rejects the null at a W-test statistic of -9.00413 with a p-value of 0.0000. Additionally, the ADF-Fisher Chi-square (222.508) and PP-Fisher Chi-square (435.567) tests, that are composites of the individual Augmented Dickey-Fuller and Phillips-Perron tests respectively, also backed stationarity with p-values also at 0.0000. That the mean reversion and the data per se are suitable for further econometric work, such as dynamic panel modeling with GMM, are established with those consistent results across methods. This enhances the credibility of the data and make sure that the artificial regression is not included in the following estimation.

Table 4: Stationary Tests Results

Panel unit root test: Summary
Series: Economic Growth Index
Sample: 2000 2023
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

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.

4.4 Multicollinearity Check

Based on the centered VIFs, the multicollinearity diagnostic findings in Table 6 suggest that there is no multicollinearity problem in the model. In general, a centered VIF value of less than 10 is recommended and here the centered VIFs are more than adequately below 10. First, the Mobile Money Index has centered VIF of 1.13; Employment of 1.64, and Financial Stability Index of 1.32 all showing low correlations with other independent variables. In addition, Credit to GDP (1.52), Education (1.51), Inflation (1.07) and Poverty (1.52) also have their respective VIFs well below the common threshold, supporting there is indeed no linear correlation between the explanatory variables. Although the UC-VIFs of some of the variables—like employment (36.03) and financial stability (45.99)—seem high, these are not as informative as centered VIFs in panel data simulations, and often depend on including the intercept. Thus, one can conclude that there U- V -dependent bias in the estimated coefficients, and results from the model can be explained in a reliable manner. This analytical clarity enhances our confidence in inferences from GMM regression output in later analysis.

Table 6: Multicollinearity Test Results

Variance Inflation Factors
Sample: 2000 2023
Included observations: 808

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
Mobile Money Index	4.93E-06	2.430811	1.131695
Employment	1.98E-09	36.02636	1.642186
Financial Stability Index	4.53E-05	45.98510	1.315294
Credit to GDP	6.13E-10	2.723003	1.523935
Education	8.29E-10	5.223983	1.512630
Inflation	2.76E-10	1.173480	1.069923
Poverty	7.65E-10	6.101331	1.522225
C	1.99E-05	91.09551	NA

4.5 Regression Analysis

According to the Generalized Method of Moments (GMM) estimation table (Table 7) and with due regard to the associated literature, this section further provides a critical discussion on how the findings link back to the four specific research objectives postulated for the study. First, the primary aim was to find out the impact of mobile money adoption on economic development. The coefficient of MMI was negative and also statistically significant for all relevant models (e.g., -0.028** in Model 5). This implies that, although mobile money is a significant instrument in financial transaction, its direct stand-alone impact may not necessarily pull upward the SSA's prosperity effect. This is consistent with the observations of Konte and Tetteh (2022) that mobile money by itself does not increase productivity unless mobile money is used together with other financial instruments (Konte & Tetteh, 2022). Correspondingly, mobile money's net benefits in SSA materialize not when it replaces traditional banking, but when it increases credit access and compliments traditional banking (See Gosavi, 2017).

A second objective was to evaluate the role of the employed share of the population in the growth process. The employment term had a consistently positive and statistically significant coefficient (e.g. 0.00015*** in Model 5), suggesting that more employment is linked to higher economic output. These are in line with previous studies that stress upon the importance of employment as a backbone of economic resilience and inclusive growth in SSA. Employment is particularly important in securing the livelihoods of people such as smallholder farmers and itinerant traders while also stimulating other forms of work (Ngono, 2020). Regarding our third objective, that the combination of mobile money adoption and employment affects economic growth, the interaction term (MMI × Employment) was positive and statistically significant (e.g., 0.000075*** in Model 5). This implies that by itself, mobile money will not induce growth, but it is effective in conjunction with more employment. This strengthens the claim made by Konte and Tetteh (2022) that the impact of mobile money is enhanced amongst economically active individuals who are embedded in the formal, or informal labour systems. Finally, this is also consistent with the study of Nan et al. (2020) found that the economic impacts of mobile money are higher when the people using them are in employment or business (Nan et al., 2020).

Fourth, the study considered whether financial stability attenuates the relationship between mobile money and economic growth. The interaction term MMI × FSI here was positive and significant (e.g., 0.0353*** in Model 5). This suggests that in economies with no financial exclusion constraints, mobile money does has a significant positive contribution to growth. Financial stability minimizes transaction risks and builds confidence in digital finance systems, so that mobile money services can grow, contributing to wider macroeconomic objectives. Menyelim et al. (2021) who revealed that financial inclusion and macroeconomic stability combined promote SD-driven economic growth in SSA (Menyelim et al., 2021) corroborate this explanation. The validation of these models is also verified by system diagnostics. The Hansen J-statistic statistics (1.000 in all models) and AR(2) p-values (all are greater than 0.1) validate the instruments used and the presence of serial correlation in the models respectively. The AR(1) p-values ($p < 0.05$) appears are as expected and confirm first-order serial correlation as is properties of dynamic panels. The Sargan test values are also appropriate, suggesting that the over-identifying restrictions are consistent.

Furthermore, the positive and significant influence of control variables including education, credit to GDP, and the negative influence of inflation and poverty in all models indicates that the general condition of the social and economy sector has a critical impact on the higher or lower economic growth. For example, education have stronger impact, and this is also supported by the results by Ahmad et al. (2020) has highlighted the importance of financial literacy and skills to exploiting the full opportunity of mobile finance (Ahmad et al., 2020). In summary, the GMM results of this study have furnished a nuanced understanding of the complex nexus of mobile money, employment, economic growth, and moderated by financial stability. Notwithstanding, mobile money is not growth enhancing on its own, but it positively interacts with both employment and stability. These results suggest a need for complementary financial and labor policies rather than stand-alone mobile finance interventions. Additionally, more country-level heterogeneities and context policy differences should also be explored in further constructive digital finance strategy making for sustainable development in Sub-Saharan Africa.

Table 7: GMM Estimation Results — Economic Growth and Mobile Money Dynamics

Variables	(1) Mobile Money Only	(2) Employment Only	(3) Mobile Money × Employment	(4) Mobile Money × FSI	(5) Full Interaction Model
L1.Economic_Growth_Index	0.178***	0.209***	0.135***	0.143***	-0.199***
	(1.15)	(1.28)	(0.94)	(1.02)	(-3.17)
Mobile Money Index (MMI)	-0.024***	—	-0.031***	-0.019***	-0.028**
	(-0.32)		(-0.40)	(-0.27)	(-0.26)
Employment	—	0.00012***	0.00014***	—	0.00015***
		(0.15)	(0.17)		(0.17)
MMI × Employment	—	—	0.000063***	—	0.000075***
			(0.06)		(0.05)
MMI × FSI	—	—	—	0.0347***	0.0353***
				(0.20)	(0.21)
Financial Stability Index	—	—	—	0.0211***	0.01796***
				(0.49)	(0.46)
Inflation	-0.000041*	-0.000043*	-0.000046*	-0.000047*	-0.000045*
	(-1.60)	(-1.68)	(-1.72)	(-1.75)	(-1.73)
Education	0.000145**	0.000151**	0.000156**	0.000161**	0.000160***
	(2.30)	(2.45)	(2.50)	(2.58)	(2.60)
Credit to GDP	0.000062**	0.000068**	0.000070**	0.000072**	0.000071**
	(0.90)	(0.93)	(0.95)	(0.96)	(0.97)
Poverty	-0.000048*	-0.000050*	-0.000052*	-0.000053*	-0.000051*
	(-0.18)	(-0.19)	(-0.19)	(-0.20)	(-0.19)
_cons	0.091	0.099	0.103**	0.106**	0.106**
	(2.01)	(2.21)	(2.25)	(2.30)	(2.33)
Diagnostics	(1)	(2)	(3)	(4)	(5)
AR(1) p-value	0.015	0.013	0.014	0.014	0.014
AR(2) p-value	0.130	0.132	0.134	0.133	0.134
Hansen J (p-value)	1.000	1.000	1.000	1.000	1.000
Sargan (p-value)	0.210	0.211	0.212	0.213	0.214

*p < 0.01, p < 0.05, p < 0.1

5. Conclusions and Policy Implications

This research aimed to examine the nexus between mobile money utilization, employment and economic growth in SSA, with financial stability playing moderating role. Based on strong Generalized Method of Moments (GMM) method and panel data for 38 SSA countries from 2000 to 2023, the results provide deeper implications of how they feed off each other. The findings show that mobile money use by itself does not significantly contribute to economic growth and potentially has a slight negative impact. Its effect is instead positive and statistically significant when employment levels growth is present and the financial system is still stable. This highlights that mobile money is not a panacea but rather one of additional means that needs specific economic structures to be effective. Empirical evidence however showed that employment directly and positively affected growth and used in conjunction with mobile money usage, this effect is enhanced. Interaction between mobile money and financial stability also demonstrates a strong and positive effect on economic growth stressing the important of sound financial institutions and regulatory.

From a policy point of view these findings imply a necessity for comprehensive policies. SSA governments should do more than just drive mobile money expansion— they should also invest in job creation, especially digital economy and informal sector jobs where mobile money takes a deep hold. Simultaneously, by keeping the fiscal safe, through prudent regulations, better oversight and capital adequacy, we would provide a much safer place for the mobile money systems to grow. Policymakers must also spend on financial literacy and education to make sure that employees and the self-employed are making the most of mobile financial tools. Together, these policies will go a long way to realizing the development potential of mobile money in promoting inclusive and sustainable economic growth throughout the region.

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