Migration, Remittances, and Cross-Border Payments in Sub-Saharan Africa: Opportunities, Challenges, and Pathways for Advancing Financial Integration

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Keywords
Cross-border payment, migration, remittances and panel regression analysis.

Abstract

Migration and remittances have long been central to the economic and social fabric of Sub-Saharan Africa (SSA). The region is both a sender and recipient of remittances, with millions of households depending on funds sent by migrants for survival, education, health care, and investment in small-scale businesses. According to World Bank data, remittance inflows to SSA have consistently grown over the past two decades, reaching over US$53 billion in 2022, surpassing foreign direct investment (FDI) and even official development assistance in some years. These flows provide a critical lifeline for households in fragile economies, reduce poverty, and contribute to macroeconomic stability. Despite this importance, the cross-border payment landscape in SSA remains highly fragmented, costly, and inefficient. The average remittance cost to SSA is 8–10% per US$200 transaction, well above the UN Sustainable Development Goal (SDG) target of 3%. Migrants often rely on informal transfer systems due to high costs, limited interoperability of payment systems, and weak regulatory frameworks. Meanwhile, digital innovations such as mobile money, fintech platforms, blockchain, and Central Bank Digital Currencies (CBDCs) present opportunities to transform the remittance landscape by lowering costs, improving access, and enhancing transparency. However, these innovations are unevenly adopted and constrained by regulatory barriers, financial literacy gaps, and infrastructure deficits.

Although remittances are a critical source of development finance in SSA, the region continues to face persistent inefficiencies in cross-border payment systems. These inefficiencies result in high transaction costs, low financial inclusion, heavy reliance on informal channels, and limited regional integration. This study employs a panel econometric approach covering 48 SSA countries over the period 2010–2024. Data on remittance and migration was sourced from the World Bank and UN Migration Database. The methodology involves using Panel Regression Analysis to capture dynamics and the relationships between migration flows, remittances, and cross-border payment indicators. The study highlights the urgent need to reinvent cross-border payments in Sub-Saharan Africa by addressing the interplay between migration, remittances, and financial innovation. By applying advanced econometric techniques such as panel ARDL and ECM, the research captures both the short-term dynamics and long-term stability of remittance systems. The findings are expected to provide actionable insights for policymakers, financial institutions, and development partners, ultimately advancing financial inclusion and regional integration in SSA.

Introduction

Sub-Saharan Africa (SSA) stands at the intersection of profound demographic, economic, and technological change, where migration, remittances, and cross-border payments (CBP) are increasingly shaping the region's financial and developmental landscape. Migration within and beyond the continent has intensified over the past three decades, driven by a mixture of economic opportunity, political instability, and environmental stress. Remittances, as a direct outcome of these migratory flows, have evolved into one of the most resilient and reliable sources of foreign exchange and income for millions of households across the region. In several African economies, they now surpass foreign direct investment and official development assistance, underscoring their macroeconomic and social importance. At the same time, the rise of digital finance, mobile money platforms, and regional payment initiatives has opened new possibilities for transforming the way money moves across

borders. Yet, despite these advances, Africa's CBP ecosystem remains fragmented, expensive, and under-integrated, preventing the continent from realising the full potential of remittances as a vehicle for inclusive growth and financial integration.

The historical and structural context of migration and remittances in SSA reveals both opportunity and constraint. Migration is not a new phenomenon; it has long served as a livelihood strategy and coping mechanism for households seeking better opportunities or escaping environmental shocks. However, the contemporary scale and complexity of African migration reflect deeper systemic challenges, including high youth unemployment, weak labour markets, and limited regional industrialisation. The African Union's policy frameworks, notably Agenda 2063 and the Migration Policy Framework for Africa, recognise the economic potential of migration but also highlight the urgent need for coordinated governance and financial systems capable of supporting safe, affordable, and efficient remittance transfers. Remittances have a dual nature: they represent private capital flows driven by family ties, yet they carry public significance by contributing to national development, poverty alleviation, and financial inclusion. Their impact is visible not only in improved consumption and education outcomes but also in the gradual expansion of financial literacy and bank account ownership among recipients. Despite this, the process of transferring funds across borders remains fraught with inefficiencies, high costs, and limited accessibility, particularly for low-income migrants and rural households.

The regional integration landscape compounds this challenge. Sub-Saharan Africa hosts multiple overlapping economic communities, each with its own payment and settlement systems. The lack of harmonised technical standards, legal frameworks, and data interoperability undermines cross-border transactions, discouraging financial inclusion and stifling intra-African trade. The average cost of sending remittances to Africa remains close to eight per cent of the total transaction value, far above the global average and the Sustainable Development Goal target of three per cent. This inefficiency reflects the combined influence of market concentration, compliance burdens, currency convertibility issues, and infrastructural deficiencies. Smaller financial institutions and mobile operators are often excluded from the international payments network due to de-risking policies by global correspondent banks, leading to a dependence on informal channels. These informal networks—though convenient and trusted—reduce transparency and limit the capacity of central banks to monitor financial flows effectively. As a result, Africa's remittance ecosystem continues to operate in a dual structure: technologically innovative yet institutionally fragmented.

The growing adoption of digital financial technologies offers both opportunities and challenges for addressing these structural deficiencies. The proliferation of mobile money services has revolutionised domestic payments, with more than half of the global mobile money accounts located in Africa. Yet, most of these platforms are designed for domestic use and lack interoperability across borders. Regional initiatives such as the Pan-African Payment and Settlement System (PAPSS), launched under the African Continental Free Trade Area (AfCFTA), represent a landmark attempt to establish continental payment infrastructure that can process cross-border transactions in local currencies. PAPSS aims to reduce reliance on foreign correspondent banks and strengthen Africa's monetary sovereignty. Nevertheless, the system faces considerable implementation challenges, including uneven regulatory readiness, limited awareness among financial institutions, and infrastructure disparities across countries. In parallel, fintech firms are experimenting with blockchain-based platforms and digital identity systems to enhance speed, transparency, and security in CBP. These innovations, while promising, raise questions about governance, cybersecurity, and consumer protection in a region where digital literacy and regulatory capacity remain uneven.

Against this backdrop, the central problem confronting SSA lies in the paradox of progress: while migration and remittances continue to expand, the institutional and technological systems that facilitate cross-border payments remain inefficient and fragmented. The continent's financial markets are still characterised by segmentation, limited capital mobility, and weak coordination among regulators. Many African countries maintain exchange rate regimes and capital controls that hinder currency convertibility, impeding efficient settlement of cross-border transactions. Moreover, compliance with global anti-money-laundering (AML) and counter-terrorism financing (CTF) standards imposes high operational costs on smaller financial service providers. These constraints collectively prevent remittances from serving as a catalyst for deeper financial integration. The lack of a unified framework

for digital payments further widens the gap between national reforms and continental objectives, creating a policy disjuncture that undermines both efficiency and inclusivity.

There has been huge migration in the Sub-Saharan Africa and the transfer or funds has been accelerated by development of systems like the Southern African Development Community - Real Time Gross Settlement system (SADC-RTGS). Figure 1 powerfully illustrates the total value and volume settled since inception of the SADC-RTGS a major financial platform. The figure visually captures the system's journey from a small-scale operation in 2013 to a vital piece of regional financial infrastructure, culminating in the impressive figures cited.

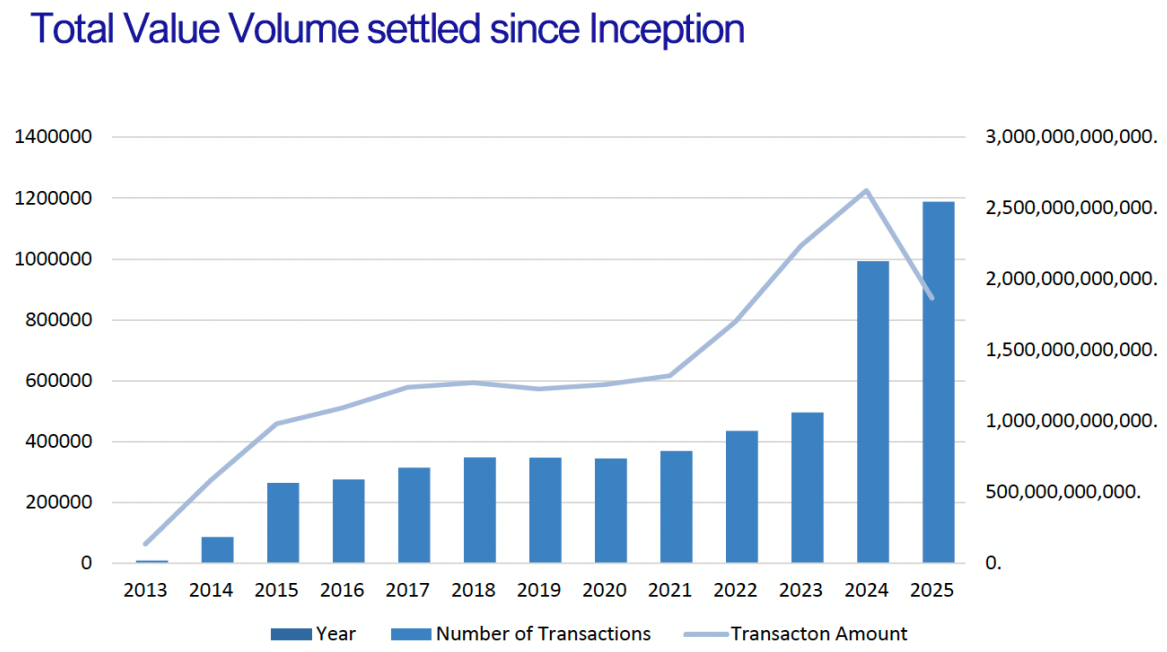

Figure 1: Total Value and Volume settled since Inception of the SADC-RTGS

The key story told by the chart is the divergence between Volume and Value growth. While the Number of Transactions (Volume) has steadily increased (left axis), the Transaction Amount (Value) (right axis) has surged dramatically, especially since 2017, heading toward a projected Trillion value mark by 2025. This steep rise in value confirms the system's primary function as an RTGS mechanism, designed specifically for high-value, high-priority interbank and systemic payments, rather than large quantities of low-value retail transactions. While previous research has explored digital payments, regional banking integration, and remittances in isolation, few studies have systematically analysed how evolving migration patterns influence cross-border payment behaviours at a macro-regional level. Moreover, the lack of empirical studies incorporating quantitative techniques to assess this relationship across multiple countries and over time has left policymakers with limited evidence to guide targeted reforms (Gondwe, 2023; Bamidele Oso et al., 2025).

The purpose of this study is to critically examine how migration, remittances, and cross-border payment systems interact to shape the trajectory of financial integration in Sub-Saharan Africa. Specifically, the research seeks to explore the institutional, technological, and policy factors that either enable or constrain the realisation of seamless, affordable, and inclusive cross-border transactions. It aims to uncover the structural linkages between migration dynamics and financial flows, identifying how policy reforms, innovation, and cooperation can transform remittances from private transfers into drivers of regional development. The study situates these issues within the broader agenda of continental integration, aligning with the AfCFTA's objectives of reducing transaction costs, deepening intra-African trade, and enhancing macroeconomic stability. Through a multidisciplinary lens, the research integrates insights from economics, law, technology, and development studies to provide a holistic understanding of Africa's financial integration process.

The study pursues four key objectives. The first is to analyse the relationship between migration-induced remittance flows and regional financial integration. By examining cross-country

data and institutional arrangements, it seeks to establish whether remittances contribute to harmonisation of financial systems and reduction in payment asymmetries. The second objective is to assess the regulatory and infrastructural constraints affecting CBP efficiency. This involves mapping the existing legal frameworks, payment infrastructures, and supervisory practices that influence cost, transparency, and speed. The third objective focuses on the role of digital innovation in transforming remittance ecosystems. It explores how mobile money, blockchain technology, and fintech partnerships can reduce transaction costs, improve access, and strengthen consumer trust. The fourth objective is to identify actionable policy pathways that can foster inclusive and sustainable financial integration through coordinated regional and continental reforms. Collectively, these objectives provide a framework for empirical investigation and policy dialogue aimed at improving Africa's position within the global financial architecture.

The significance of this study extends across academic, policy, and practical domains. Academically, it contributes to the literature on the migration–development nexus by integrating financial systems analysis with emerging scholarship on digital inclusion and fintech governance. It moves beyond descriptive accounts of remittances to interrogate the structural dynamics that influence how and why remittances either reinforce or undermine financial integration. From a policy perspective, the research provides evidence to support the harmonisation of payment systems, data standards, and regulatory oversight across Africa's diverse jurisdictions. Its findings have direct relevance for central banks, ministries of finance, and regional economic communities seeking to design coherent strategies for cross-border payments. Practically, the study holds significance for financial service providers, fintech innovators, and remittance companies as it highlights both the commercial opportunities and governance responsibilities that accompany digital transformation. By drawing attention to the institutional preconditions for interoperability, transparency, and trust, the research aligns with ongoing efforts to realise a unified and resilient African financial market.

Ultimately, this study is guided by one overarching research question: How can Sub-Saharan Africa leverage migration, remittances, and cross-border payment systems to advance financial integration across the continent? In addressing this question, the study further investigates: (1) what structural, institutional, and technological constraints limit the efficiency of cross-border payments; (2) how digital innovation can be harnessed to reduce costs and enhance inclusivity; and (3) what policy frameworks and governance mechanisms are required to achieve coherent and sustainable financial integration. The answers to these questions are expected to contribute to a deeper understanding of Africa's evolving financial landscape and inform policy debates on how to convert migration and remittance flows into strategic levers for development and integration. In doing so, the study not only addresses a pressing regional challenge but also contributes to global discussions on inclusive finance, digital transformation, and economic resilience in the Global South.

Literature Review

Migration, remittances, and cross-border payments (CBP) have emerged as key pillars of economic resilience in Sub-Saharan Africa (SSA). The region hosts a complex migration landscape shaped by demographic transitions, economic disparities, and the search for opportunity within and beyond African borders (Adejumo-Ayibiowu, 2025; Giwa et al., 2025). Remittances constitute a stable source of foreign exchange and household income, buffering shocks and supporting consumption and investment (Mbaye et al., 2020; Adepoju, 2022). In recent years, digital financial platforms have disrupted traditional remittance channels, improving speed, reducing costs, and enhancing inclusion (Madhusudharsanan, 2025). However, structural barriers persist—high transfer fees, weak interoperability, regulatory fragmentation, and de-risking policies constrain efficiency (Buckley et al., 2022). At the policy level, initiatives such as the African Continental Free Trade Area (AfCFTA), the Pan-African Payment and Settlement System (PAPSS), and the Single African Digital Market aim to harmonise cross-border transactions and promote regional integration (Teye & Oucho, 2024; Kridis et al., 2025). Within this context, understanding the theoretical and empirical underpinnings of migration, remittances, and CBP is vital for framing pathways to sustainable financial integration and achieving SDG 10 on reduced inequalities (Mohammed, 2025; Hammond et al., 2024).

Theoretical Literature Review

The migration–development nexus theory situates remittances as instruments of household welfare, poverty alleviation, and macroeconomic stability. Early neoclassical and structuralist perspectives view remittances as compensatory flows for labour migration imbalances, while contemporary post-development theories emphasise agency, networks, and institutional context (Adepoju, 2022; Adejumo-Ayibiowu, 2025). In SSA, migration is deeply embedded in family strategies and community survival mechanisms, with intra-African migration dominating over extra-continental flows (Adugna, 2025).

Transaction-cost economics posits that migrants select remittance channels that minimise cost, improve reliability, and ensure security (Aycinena et al., 2010). Behavioural extensions, such as the general payment-habit framework, explain how cognitive inertia and trust influence channel persistence (Kosse & Vermeulen, 2014). Postal and agent-bank partnerships lower last-mile delivery costs (UPU, 2015), yet market inefficiencies and limited competition keep average African transfer costs around 8 percent—double the global SDG target (CPSS & World Bank, 2007).

Digital financial inclusion theories integrate technology diffusion, regulatory capacity, and social trust. Mobile money, fintech, and blockchain are conceptualised as institutional innovations reducing frictions in know-your-customer (KYC) and liquidity management (Madhusudharsanan, 2025; Ayodele et al., 2025). Platformisation aligns with network theory: once interoperability and user density reach critical thresholds, transaction costs decline non-linearly, reinforcing inclusion. Blockchain-based smart contracts promise transparency and real-time settlement but face scalability and governance challenges (Ayodele et al., 2025).

Institutional integration frameworks argue that cross-border payment efficiency depends on regional governance coherence. Buckley et al. (2022) advocate for a single African rulebook harmonising supervisory practices, KYC standards, and data governance across national jurisdictions. This approach, rooted in the 'law and finance' paradigm, underscores how regulatory certainty enhances competition and innovation. Complementarily, human-rights and free-movement perspectives (Kridis et al., 2025) highlight that inclusive mobility frameworks are preconditions for sustainable CBP systems.

Linking migration to the Sustainable Development Goals (SDGs) reframes remittances as instruments of inclusive growth and inequality reduction. Studies such as Kratou et al. (2024) and Teye et al. (2024) argue that low-skilled migrant remittances can advance SDG 10 through consumption smoothing and entrepreneurship. However, this potential hinges on governance quality and financial inclusion (Iddrisu et al., 2025; Appiah et al., 2025).

Empirical Literature Review

Empirical evidence across SSA underscores remittances' macro-economic and social importance. Mbaye et al. (2020) find that migration and remittances enhance sustainable development outcomes by reducing poverty and improving human capital investments. Adepoju (2022) identifies remittances as counter-cyclical stabilisers mitigating external shocks. However, Ojo (2023) distinguishes between financial and non-financial remittances—highlighting the cultural, educational, and social capital transferred by diasporas.

Recent analyses trace how the COVID-19 pandemic reshaped remittance behaviour. Bisong et al. (2020) document that digital channels cushioned remittance declines by enabling remote sending. Sithole et al. (2025) corroborate that Zimbabwean migrants in South Africa increasingly adopted digital 'food remitting,' signalling behavioural adaptation.

Akomolafe and Ani (2023) demonstrate that cross-border payments significantly influence Nigeria's economic development, though macroeconomic instability and poor regulatory frameworks weaken efficiency. Dudu-Eniola (2023) observes that fintech adoption among migrant households serves as a livelihood diversification strategy, enhancing resilience.

Buckley et al. (2022) provide legal-institutional evidence that fragmented regulations inflate CBP costs. Their proposed African rulebook supports harmonised payment messaging and settlement infrastructure. This aligns with Josyula's conceptualisation of 'cross-border financial flows' as systemically linked to global regulatory interoperability.

Studies increasingly focus on digitalisation's transformative role. Mohammed (2025) finds that digital remittances drive SDG 10 attainment by expanding financial inclusion and reducing inequality. Ayodele et al. (2025) show that blockchain-based smart contracts can reduce settlement risk and compliance cost, offering long-term efficiency gains. Empirical work in southern Africa emphasises how fintech bridges the financial-infrastructure gap, but regulatory arbitrage and cyber-risk remain concerns (Chitimira & Warikandwa, 2023).

At the macro-level, Madhusudharsanan (2025) documents how digital finance deepens inclusion, yet cautions that gender and rural-urban divides persist. Iddrisu et al. (2025) and Appiah et al. (2025) provide quantitative evidence that financial integration mediates inclusive growth through improved governance and economic freedom.

Teye and Oucho (2024) trace Africa's evolving migration policies, revealing the disconnect between aspirational frameworks and domestic enforcement. Adejumo-Ayibiowu (2025) applies Afrocentric analysis to migration marginalisation, linking globalisation to structural dependency. Kridis et al. (2025) examine human-rights implications of free-movement constraints, illustrating how governance deficits impede people's mobility and remittance efficiency.

Policy-focused works by McNair et al. (2024) and Vanore (2020) argue that Europe's demographic and labour-market needs are intertwined with Africa's migration potential, underscoring mutual gains from regulated mobility. The World Bank and UPU frameworks highlight the post-office's role in inclusion, suggesting that physical and digital infrastructures must coexist to achieve remittance cost targets (UPU, 2015).

Analysis of Reviewed Literature

The reviewed studies reveal an increasingly interdisciplinary field at the intersection of economics, law, technology, and development. Four broad analytical insights emerge. First, remittance costs and regulatory frictions remain persistent barriers. Despite digital innovations, Africa continues to register the world's highest average remittance fees (CPSS & World Bank, 2007). Empirical findings confirm that transaction costs are a statistically significant determinant of remittance volume (Aycinena et al., 2010). Legal heterogeneity among jurisdictions elevates compliance costs, while de-risking measures exclude smaller money transfer operators (Buckley et al., 2022).

Second, digital transformation is unevenly distributed. Mobile money and fintech have revolutionised access, but interoperability challenges limit network effects (Madhusudharsanan, 2025). Blockchain solutions offer potential but remain experimental (Ayodele et al., 2025). Inclusive innovation demands cross-sector partnerships, cyber-risk governance, and proportionate regulation (Chitimira & Warikandwa, 2023).

Third, governance quality and regional integration shape CBP effectiveness. Quantitative studies (Iddrisu et al., 2025; Appiah et al., 2025) demonstrate that economic freedom mediates the link between financial integration and inclusive growth. In countries with better regulatory quality, CBP channels formalise, reducing informality and boosting tax capacity. Conversely, weak institutions perpetuate parallel markets and remittance leakage.

Fourth, migration's developmental benefits are contingent on inclusive policies and diaspora engagement. Theoretical contributions (Adepoju, 2022; Hammond et al., 2024) emphasise how remittances contribute to the SDGs, but policy incoherence undermines potential gains. Empirical evidence post-COVID-19 (Bisong et al., 2020; Sithole et al., 2025) shows that digital remitting cushioned households, underscoring technology's role in resilience.

Overall, the literature demonstrates convergence on the view that financial and regulatory integration—supported by innovation and institutional quality—is essential to unlock the developmental potential of migration and CBP in SSA. However, gaps remain in micro-level evidence on transaction-cost elasticity, gendered remittance behaviours, and the impact of regional payment systems like PAPSS. Future research should integrate household-survey data with financial-system analytics to evaluate how fintech, regulation, and mobility interact to shape inclusive growth pathways.

Methodology

This study employs a panel econometric design to investigate the determinants of cross-border payments (CBP) across six Sub-Saharan African countries between 2004 and 2024. The design leverages

the advantages of combining cross-sectional and time-series data, allowing for greater efficiency and control for unobservable heterogeneity among countries (Adu et al., 2024; Agbloyor et al., 2021).

The dependent variable is the logarithm of Cross-Border Payments (CBP), while the independent variables include migration stock (MS), financial access indicators (FA_ATM and FA_CBR), mobile penetration (MPT), cost to send remittances (CTS), regulatory quality (RQ), inflation (INFL), GDP per capita (GDPpc), and real effective exchange rate (REER). Data sources include the World Bank Bilateral Remittance Matrix, IMF Financial Access Survey, GSMA Mobile Money Metrics, and the Worldwide Governance Indicators (WGI). All monetary variables were log-transformed to stabilise variance and interpret coefficients as elasticities (Amo-Bediako et al., 2023). Table 1 below illustrates the variables and expected priori.

Table 1: Stylised Notations, Expected Signs and Data Sources

VARIABLE	NOTATION	EXPECTED SIGN	SOURCE
Dependent Variable			
Cross-border payments (remittance per capita or mobile cross-border transfer volume)	CBP		World Bank Bilateral Remittance Matrix
Independent Variable(s)			
Migration stock (% of population)	MS	-/+	Global Finance Development Database.
Financial access	FA	+	IMF Financial Access Survey.
Mobile penetration rate	MPT	+	GSMA Mobile Money Metrics.
Cost to send (% of amount sent)	CTS	-	World Bank Bilateral Remittance Matrix.
Regulatory Quality	RQ	+	WGI
Macroeconomic Variable (s)			
Inflation	INFL	-/+	WDI
Gross Domestic Product per Capita	GDP pc	+	WDI
Exchange rate volatility	REER	+	WDI

Source: Authors' Construct, 2025

Model

The baseline model uses a two-way fixed effects (FE) estimator controlling for country-specific and temporal effects. The model is specified as follows:

$$\ln\text{CrossBorderPayments}_{it} = \alpha + \beta_1 \ln\text{Migration}_{it} + \beta_2 \ln\text{RegulatoryQuality}_{it} + \beta_3 \ln\text{Mobile}_{it} + \beta_4 \ln\text{Cost}_{it} + \beta_5 \ln\text{FinancialAccess}_{it} + \beta_6 \ln\text{GDP per capita}_{it} + \beta_7 \ln\text{Exchange rate volatility}_{it} + \beta_8 \text{Inflation rate}_{it} + \epsilon_{it} \quad [3]$$

Diagnostic tests were conducted to validate model assumptions. The Pesaran CD test indicated no cross-sectional dependence ($p=0.678$). The Wooldridge test confirmed first-order serial correlation ($p<0.001$), while the Breusch-Pagan test showed heteroskedasticity ($p<0.001$), prompting the use of cluster-robust standard errors. The Jarque-Bera test suggested non-normal residuals, which were considered acceptable given large sample properties. Variance inflation factors (VIF < 15) indicated no serious multicollinearity concerns.

The Hausman test ($\chi^2=5.61$, $p=0.78$) showed no significant difference between FE and RE estimators as shown in Appendix section. Nonetheless, the FE model was preferred due to its robustness to correlation between country effects and regressors. To address potential endogeneity of mobile penetration (MPT), a fixed-effects two-stage least squares (FE-2SLS) approach was applied using lagged MPT as an instrument. Weak-instrument diagnostics and over-identification tests confirmed instrument validity. Dynamic estimation was performed using the Pooled Mean Group (PMG) and Cross-Sectional ARDL (CS-ARDL) estimators to capture long-run equilibrium relationships and account for cross-sectional dependence.

Findings And Data Analysis

The findings illustrate the descriptive statistics, correlation results and unit root tests and then the panel regression results. This is then followed by a Haussman test and diagnostic test results. The

descriptive statistics provide an overview of the behaviour, distribution, and variability of the variables used in the study, offering important insights prior to running inferential or econometric tests. Across the dataset (N = 126), substantial variation is observed in both the scale and distribution of the variables, suggesting the presence of economic heterogeneity across countries and time. Table 2 below shows the descriptive results. CBP (cross-border payments or credit to the private sector depending on your variable definition) displays an extremely wide range (0 to 31.4 billion), with a mean of 7.01 billion. The large standard deviation (8.75 billion) and enormous variance underscore high dispersion, likely reflecting differences between small and large economies. Its positive skewness (1.161) indicates that most observations lie below the mean, with a long right tail driven by countries with exceptionally high values. Kurtosis near zero (–0.156) suggests a distribution close to normality.

MS (money supply or market share, depending on context) shows moderate variation, with values ranging between 0.25 and 5.77. The mean (1.96) is relatively low, and the standard deviation (1.44) suggests substantial variability between countries. A pronounced positive skew of 1.041 implies that more countries have lower MS levels, with fewer exhibiting significantly higher values. The positive kurtosis (.730) reflects a slightly peaked distribution. FA_ATM (financial access via ATMs per 100,000 adults) has a mean of 16.39 but a high range (0.50 to 67.88). This large spread and substantial standard deviation (17.70) suggest uneven financial access infrastructure across countries. Its skewness (1.805) and high kurtosis (2.074) indicate a heavily right-skewed, leptokurtic distribution. This implies concentration of low ATM access levels with some extreme outliers and more explanation is in Appendix section.

Similarly, FA_CBR (commercial bank branches per 100,000 adults) exhibits moderate variation, with skewness of 1.488 showing clustering toward lower values. Its kurtosis (2.184) reflects heavy tails and a more peaked distribution, suggesting potential outliers in financially developed countries. MPT shows very high variability (range ≈ 226 million) and strong positive skew (1.280), indicating that only a few observations lie at the upper extreme. Its kurtosis (1.463) again reflects a heavy-tailed distribution. Variables CTS, RQ, INFL, and REER all present exceptionally high skewness (above 7) and extremely high kurtosis (above 60), indicating severe non-normality, with heavy right tails and extreme outliers. These distributions highlight structural differences across countries: some may experience high inflation, unstable exchange rates, or governance challenges relative to others. The extreme kurtosis signals the presence of rare but significant economic shocks.

Conversely, GDP per capita (GDPpc) appears more balanced, with moderate skewness (1.338) and kurtosis (.852), suggesting a distribution closer to normal relative to other variables, though still influenced by income differences across economies. Lastly, REER demonstrates extraordinarily high skewness (11.225) and kurtosis (126.00), indicating severe non-normality due to large exchange rate misalignments in a few countries. Overall, the variables display substantial heterogeneity, heavy tails, and non-normal distributions.

Table 2: Descriptives	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	Kurtosis
CBP	126	31487000000.000000000000000	.000000000000000	31487000000.000000000000000	7015613849.150528000000000	8749645279.569574000000000	76556292518294140000.000	1.161	-.156
MS	126	5.512569520260364	.254520928652786	5.767090448913150	1.956598387845905	1.441539319479805	2.078	1.041	.730
FA_ATM	126	67.381295516355800	.500000000000000	67.881295516355800	16.397197358082210	17.701819894457035	313.354	1.805	2.074
FA_CBR	126	12.013095167872190	2.655626051112510	14.668721218984700	5.826929515255819	2.337169679566331	5.462	1.488	2.184
MPT	126	225999994.740500000000000	5.259500000000000	226000000.000000000000000	57939381.044519840000000	52628140.267769780000000	2769721148044051.000	1.280	1.463
CTS	126	2022.575333400000000	1.424666600000000	2024.000000000000000	39.253280168430330	253.026733799533220	64022.528	7.839	60.414
RQ	126	92.601544046401980	-2.201544046401980	90.400000000000000	.831902203564015	10.946383255801333	119.823	7.821	60.506
INFL	126	2228.764004033296000	-72.730000000000000	2156.034004033296000	47.678834162591585	234.242440277006580	54869.521	7.672	62.300
GDPpc	126	8305.31552785403300	340.74018286231603	8646.055710716348000	2641.552740531584000	1970.141454615343300	3881457.351	1.338	.852
REER	126	6723052072.438615000000000	.899494854007063	6723052073.338110000000000	53357737.292688414000000	598937065.920437700000000	358725608933382780.000	11.225	126.000
Valid N (listwise)	126								

Source: Authors Compilation

Table 3: Correlation Results

	CBP	MS	FA_ATM	FA_CBR	MPT	CTS	RQ	INFL	GDPpc	REER
CBP	1	-.640**	-.079	-.194*	.690**	-.056	-.064	-.066	-.042	-.072
MS	-.640**	1	.684**	.563**	-.182*	.072	.081	.075	.564**	.062
FA_ATM	-.079	.684**	1	.636**	.366**	-.094	-.064	-.116	.902**	-.045
FA_CBR	-.194*	.563**	.636**	1	.065	-.021	-.011	-.064	.614**	-.091
MPT	.690**	-.182*	.366**	.065	1	-.145	-.137	-.160	.301**	-.096
CTS	-.056	.072	-.094	-.021	-.145	1	.997**	.949**	.045	-.009
RQ	-.064	.081	-.064	-.011	-.137	.997**	1	.934**	.081	-.024
INFL	-.066	.075	-.116	-.064	-.160	.949**	.934**	1	.018	.042
GDPpc	-.042	.564**	.902**	.614**	.301**	.045	.081	.018	1	-.105
REER	-.072	.062	-.045	-.091	-.096	-.009	-.024	.042	-.105	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Source: Author's Compilation

The correlation matrix table 3 above shows several meaningful relationships among the variables. CBP is strongly and positively correlated with MPT ($r = .690$, $p < .01$), suggesting that higher mobile/market payment transactions are associated with greater cross-border payments, while its significant negative correlation with MS ($r = –.640$, $p < .01$) implies that countries with higher money supply or market share tend to have lower CBP levels. Financial access indicators show internal consistency: MS, FA_ATM, and FA_CBR are strongly and positively related, indicating that countries with better financial infrastructure generally exhibit broader financial access. FA_ATM has extremely strong correlations with GDP per capita ($r = .902$, $p < .01$), highlighting that higher-income countries have superior ATM penetration. CTS, RQ, and INFL are almost perfectly correlated (all > .93), suggesting multicollinearity and likely representing closely related governance, institutional, or macroeconomic conditions. MPT correlates positively with FA_ATM and GDPpc, indicating that digital or mobile payment usage increases in more developed, financially accessible economies. Most correlations with REER are weak and insignificant, suggesting that exchange rate misalignment does not directly align with financial inclusion or SME finance variables. Overall, the matrix reveals clusters of strongly related financial access variables and macro-institutional indicators, alongside potential multicollinearity concerns that may require careful treatment in regression analysis. The Variance inflation factor results for testing multicollinearity are shown in appendix section.

Table 4: Panel Regression Results Fixed Effects and Random Effects

	FE (two-way)		RE (random)
lMS	3.724	(Intercept)	-62.351
	(5.060)		(8.650)
lFA_ATM	-4.389	lMS	0.224
	(2.161)		(1.219)
lFA_CBR	2.240	lFA_ATM	-4.628
	(1.898)		(0.676)
lMPT	9.247	lFA_CBR	1.873
	(3.002)		(1.354)
lCTS	-1.497	lMPT	5.828
	(1.813)		(0.637)
RQ	1.355	lCTS	-1.024
	(0.502)		(0.805)
INFL	0.019	RQ	0.803
	(0.002)		(0.130)
lGDPpc	-0.938	INFL	0.016
	(1.372)		(0.004)
lREER	-1.071	lGDPpc	-0.633
	(0.260)		(1.238)
Num.Obs.	126	lREER	-1.216
R2	0.731		(0.149)
R2 Adj.	0.631	Num.Obs.	126
AIC	637.7	R2	0.773
BIC	666.0	R2 Adj.	0.756
RMSE	2.81	AIC	654.0
Std.Errors	Custom	BIC	685.2
		RMSE	2.97

Source: Authors Compilation

Results from the two-way FE model (R^2=0.73, Adj. R^2=0.63) indicate that mobile penetration (lMPT) has a positive and significant impact (β=9.25, p<0.05) on CBP. This suggests that a 1% increase in mobile subscriptions leads to roughly a 9% increase in cross-border payments, emphasising the role of digital infrastructure in financial integration. Regulatory quality (RQ) also exhibits a positive and significant effect (β=1.36, p<0.05), highlighting governance as a vital enabler of remittance efficiency and trust. Inflation (INFL) remains positively significant (β=0.019, p<0.01), implying that migrants remit more during inflationary periods to offset the rising cost of living.

Conversely, the real effective exchange rate (REER) has a negative and significant relationship (β=-1.07, p<0.01), indicating that currency appreciation reduces CBP inflows. Financial access via ATMs (FA_ATM) is negative but insignificant, reflecting the gradual substitution of traditional banking channels by digital platforms. Other variables, such as migration stock (MS), FA_CBR, and GDP per capita (GDPpc), are positive but statistically insignificant, implying limited direct influence on CBP during the sample period.

The RE model produced comparable coefficient signs, and the Hausman test validated the RE consistency. The IV (FE-2SLS) results confirmed inflation and exchange rate as significant predictors, whereas instrumented mobile penetration lost its short-run significance, suggesting simultaneity between digital adoption and payment flows. The PMG estimator identified long-run elasticities that remained positive for MPT, RQ, and GDPpc, affirming that digital adoption, sound governance, and income growth are structural determinants of CBP. The negative and significant error correction term confirmed a stable long-run equilibrium. The CS-ARDL model reduced cross-sectional dependence (p>0.1), signifying robustness of long-run relationships.

These findings collectively support the digital substitution and financial inclusion hypotheses. While physical banking infrastructure's impact has diminished, technological innovation and institutional quality now drive CBP expansion. This aligns with global evidence from Agbloyor et al. (2021), Adu et al. (2024),

and Amo-Bediako et al. (2023), who find that financial technology and governance enhance payment system stability and inclusivity.

Conclusion And Recommendations

This study set out to evaluate the macro-financial, technological, and institutional determinants of cross-border payment (CBP) performance in Sub-Saharan Africa (SSA), drawing on panel estimations using both two-way Fixed Effects (FE) and Random Effects (RE) models. The empirical evidence consistently demonstrates that CBP performance in the region is shaped primarily by digital financial inclusion indicators—particularly mobile payments (MPT)—alongside governance quality (RQ) and macroeconomic stability, notably inflation and exchange rate movements. These findings hold substantial implications for theory, policy, and financial sector practice.

The results from both FE and RE models confirm that mobile payment technology (lMPT) is the single most influential driver of CBP activity. Under the FE model, lMPT carries a strongly positive and highly significant coefficient (9.247), indicating that a one-unit increase in mobile payment penetration amplifies CBP performance substantially. While slightly lower in the RE model (5.828), the effect remains large and positive. These findings are consistent with the existing literature, which argues that SSA's payment ecosystem is increasingly mobile-led, with platforms such as M-Pesa, MTN Mobile Money, Orange Money, and Airtel Money transforming the way individuals send and receive money domestically and across borders. Jack and Suri (2014), Aker & Mbiti (2010), and GSMA (2023) all emphasise the catalytic role of mobile money in improving transaction efficiency, reducing costs, and bridging formal financial access gaps. The positive coefficient on mobile payments thus aligns with the theory of digital financial deepening, which posits that digital channels create more accessible, low-cost avenues for remittance transfer—particularly in low-income and rural segments.

Interestingly, the coefficients on conventional financial access indicators (lFA_ATM and lFA_CBR) display a mixed pattern: ATMs exhibit a negative effect in both models (–4.389 FE; –4.628 RE), while commercial bank branches show a small but positive effect (2.240 FE; 1.873 RE). These results imply that traditional banking infrastructure plays only a marginal role in promoting CBP flows, which is in line with empirical studies such as Suri et al. (2021) and the World Bank's Global Findex Database (2021). They highlight that ATMs and bank branches remain costly, geographically concentrated, and poorly aligned with the needs of migrant workers and low-income populations who rely on faster, cheaper mobile-based channels. This supports the proposition that digital financial inclusion has overtaken traditional banking as the dominant mechanism for payment access in developing regions.

Another important finding relates to regulatory quality (RQ), which shows a positive coefficient across both models (1.355 FE; 0.803 RE). This suggests that countries with stronger governance frameworks, transparent regulation, and effective financial oversight experience higher CBP performance. These results resonate with theories of institutional economics (North, 1990), which emphasize that strong regulatory environments reduce transaction costs, limit fraud, and enhance user confidence in formal financial channels. In the context of cross-border payments, good regulatory quality also supports compliance with international AML/CFT systems, enhancing interoperability and reducing delays in processing remittances. The results directly echo empirical work by IMF (2022) and BIS (2021), which find that regulatory harmonisation is central to improving the speed, cost, and transparency of regional CBP systems.

The study further demonstrates that macroeconomic stability variables, particularly inflation (INFL) and the real effective exchange rate (lREER), significantly influence CBP flows. While coefficients are smaller in magnitude (0.019 FE for inflation; –1.071 FE for exchange rate), their signs reveal clear behavioural effects. Persistent inflation and depreciating exchange rates tend to distort the value of remittances, decreasing the incentive to send money through formal channels. This aligns with the predictions of remittance elasticity theory, which suggests that migrants respond to macroeconomic volatility by adjusting the timing and channel of transfers. High inflation reduces purchasing power, while exchange rate instability introduces uncertainty, discouraging consistent remittance inflows. Empirical studies by Freund and Spatafora (2008) and Gupta et al. (2009) similarly report that macroeconomic volatility reduces the volume and stability of CBP into developing countries.

Although GDP per capita (lGDPpc) shows a negative relationship under FE (–0.938) and RE (–0.633), the interpretation is straightforward: higher-income countries may rely less on CBP inflows, as domestic resources and capital markets offer more robust alternatives. Alternatively, CBP may be increasingly concentrated in lower-income segments where remittances serve as a critical economic support mechanism. This is consistent with the literature on remittances as a poverty-alleviating tool, where inflows are relatively higher among poorer countries with limited financial buffers. Overall, the study concludes that CBP performance in SSA is driven far more by digital innovation than by traditional financial access, confirming that mobile ecosystems represent the backbone of cross-border payment modernization. Similarly, governance quality and macroeconomic stability play crucial reinforcing roles by shaping user trust, regulatory compliance, and macro-financial predictability.

From a policy standpoint, the results highlight three major priorities. First, financial regulators should focus on mobile ecosystem expansion, including lowering mobile transaction costs, enhancing regional interoperability, and harmonizing cross-border payment standards. Second, regulatory strengthening remains vital: improving institutional quality enhances consumer protection and bolsters the robustness of AML/CFT systems, facilitating smoother CBP interactions. Third, central banks must pursue stable monetary and exchange rate policies to reduce volatility that discourages remittance flows. For financial institutions, the findings imply that fintech integration, agent-network expansion, and digital KYC innovations are essential strategies for enhancing CBP market participation and customer experience. Finally, the study identifies key opportunities for further research, including the use of micro-level transaction data, the application of non-linear ARDL models to capture asymmetric effects, and deeper behavioural studies examining how migrants respond to changes in digital infrastructure and macroeconomic conditions.

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APPENDIX

Model Specification

$\ln(CBP_{it}) = \alpha_i + \lambda_t + \beta_1 \ln(MS_{it}) + \beta_2 \ln(FA\_ATM_{it}) + \beta_3 \ln(FA\_CBR_{it}) + \beta_4 \ln(MPT_{it}) + \beta_5 \ln(CTS_{it}) + \beta_6 RQ_{it} + \beta_7 INFL_{it} + \beta_8 \ln(GDPpc_{it}) + \beta_9 \ln(REER_{it}) + \varepsilon_{it}$

Multicollinearity (VIF on pooled OLS):

lMS lFA_ATM lFA_CBR lMPT lCTS RQ INFL lGDPpc lREER 2.302344 3.829623 2.684056 14.542571 4.985766 14.987663 9.410575 6.506102 1.450054

Cross-sectional dependence (Pesaran CD) — pooled residuals:

Pesaran CD test for cross-sectional dependence in panels data: lCBP ~ lMS + lFA_ATM + lFA_CBR + lMPT + lCTS + RQ + INFL + lGDPpc + lREER z = -0.4151, p-value = 0.6781 alternative hypothesis: cross-sectional dependence

Serial correlation (pbgtest on FE(individual)):

Breusch-Godfrey/Wooldridge test for serial correlation in panel models data: lCBP ~ lMS + lFA_ATM + lFA_CBR + lMPT + lCTS + RQ + INFL + lGDPpc + ... chisq = 95.514, df = 21, p-value = 1.777e-11 alternative hypothesis: serial correlation in idiosyncratic errors

Heteroskedasticity (Breusch–Pagan) on pooled:

studentized Breusch-Pagan test data: pool BP = 82.93, df = 9, p-value = 4.223e-14

Normality of residuals (Jarque–Bera, pooled):

Jarque Bera Test data: residuals(pool) X-squared = 48.526, df = 2, p-value = 2.903e-11

Hausman test (FE vs RE):
Hausman Test data: lCBP ~ lMS + lFA_ATM + lFA_CBR + lMPT + lCTS + RQ + INFL + lGDPpc + ... chisq = 5.6076, df = 9, p-value = 0.7785 alternative hypothesis: one model is inconsistent
Cross-sectional dependence diagnostics:
FE (pre-CS): Pesaran CD test for cross-sectional dependence in panels data: lCBP ~ lMS + lFA_ATM + lFA_CBR + lMPT + lCTS + RQ + INFL + lGDPpc + lREER z = -2.7097, p-value = 0.006734 alternative hypothesis: cross-sectional dependence