

Effects of Mobile Money and Virtual Banking on the Financial Performance of Deposit Money Banks in Nigeria

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Abstract

Nigeria's banking sector has undergone rapid digital transformation driven by mobile money services and virtual banking channels. This study examines the effects of mobile money transactions (MMT), internet banking transactions (IBT), and USSD transactions on the cost-to-income ratio (CIR) of deposit money banks (DMBs) using bi-annual time-series data from 2013 to 2025. Employing the autoregressive distributed lag (ARDL) bounds testing approach, the analysis reveals channel-specific and time-variant impacts. In the short run, mobile money transactions significantly reduce CIR, indicating improved operational efficiency. However, in the long run, MMT exerts a positive and significant effect on CIR, suggesting increased cost pressures from competition and integration expenses. Internet banking and USSD transactions show largely insignificant effects on CIR in both short and long runs. The error correction term confirms a stable long-run relationship with a 37.4 per cent adjustment speed per bi-annual period. These findings highlight the nuanced implications of digital financial innovations for bank efficiency in an emerging market context. The study contributes to literature on fintech disruption and offers strategic insights for banks and policymakers.

Keywords: Mobile money, virtual banking, cost-to-income ratio, deposit money banks, ARDL model, financial inclusion, Nigeria

Introduction

Nigeria's banking sector has undergone a profound transformation over the past decade, propelled by deliberate policy interventions from the Central Bank of Nigeria (CBN), rapid technological advancements, and the explosive growth of fintech innovations. Central to this evolution are the CBN's cashless economy initiatives, the National Financial Inclusion Strategy (NFIS), and the liberalization of digital payment services. Launched in 2012, the NFIS aimed to reduce financial exclusion from 46.3 per cent in 2010 to 20 per cent by 2020, with ambitious targets for access to payments, savings, credit, insurance, and pensions (Central Bank of Nigeria, 2012). Subsequent revisions, particularly NFIS 3.0 in 2022, adjusted the exclusion target to 25 per cent by 2024 while setting a long-term vision of 95 per cent formal financial inclusion by 2030. These policies have been complemented by the cashless policy (expanded nationwide since 2013), the Nigeria Inter-

Bank Settlement System (NIBSS) Instant Payments (NIP) platform, and progressive regulatory frameworks for Payment Service Banks (PSBs), open banking, and fintech licensing.

The outcomes have been remarkable. Mobile money services, led by non-bank operators such as OPay, PalmPay, Moniepoint, and telecom-linked platforms (e.g., MTN MoMo), have recorded unprecedented growth. Licensed mobile money operators processed transactions valued at ₦71.5 trillion in 2024, a 53.4 per cent increase from ₦46.6 trillion in 2023, with transaction volumes rising 23 per cent to 3.9 billion (NIBSS, 2025). Concurrently, overall electronic payments reached a historic ₦1.07 quadrillion in 2024, representing a 79.6 per cent year-on-year increase, while NIP handled over 12 billion transactions (NIBSS, 2025; Nairametrics, 2025). Virtual banking channels, including internet banking, mobile applications, and unstructured supplementary service data (USSD) codes offered by deposit money banks (DMBs), have equally flourished. These developments have significantly broadened financial access, particularly in rural and underserved areas where traditional bank branches remain scarce, elevating formal financial inclusion from 56 per cent in 2020 to approximately 64 per cent in 2023, with overall inclusion reaching 74 per cent by 2024–2025, largely driven by non-bank digital channels (EFInA, 2023, 2025).

Despite these impressive gains in transaction volumes, financial inclusion, and operational reach, the net impact of mobile money and virtual banking on the performance of traditional deposit money banks remains highly contested. On one hand, bank-led digital channels have generated additional fee-based revenue, enhanced customer loyalty, reduced branch-related costs, and supported low-cost deposit mobilization. Several empirical studies have documented positive associations between digital transaction volumes (mobile banking, internet banking, POS, and ATM) and key profitability indicators such as Return on Assets (ROA) and Return on Equity (ROE) (Hassan & Bassey, 2025; Iyobo & Shaba, 2025; Onyia et al., 2026). On the other hand, the rise of non-bank mobile money operators has intensified competition, leading to transaction migration, fee compression, revenue cannibalization, elevated compliance and cybersecurity expenditures, and potential disintermediation of traditional banking services (Vincent et al., 2025; Uko, 2026; Okonkwo & Ekwueme, 2022).

This duality creates a complex dynamic: while digital innovations expand the overall financial ecosystem, they simultaneously pressure incumbent banks' traditional income streams and operational models. Structural challenges in the Nigerian context, including inconsistent network infrastructure, rising cybersecurity threats, uneven digital literacy, and evolving regulatory requirements, further moderate these effects. Moreover, existing literature reveals significant inconsistencies. Some studies report positive short- and long-run impacts from specific channels, while others document insignificant or negative effects, often attributable to high upfront costs, fraud vulnerabilities, or competitive margin squeezes. Critically, most prior research has focused on aggregate e-banking or profitability metrics (ROA/ROE), with limited attention to operational efficiency as measured by the cost-to-income ratio (CIR). Few studies have disaggregated non-bank mobile money transactions from bank-led virtual banking channels (internet banking and USSD), and even fewer incorporate post-2023 data that captures the full impact of recent developments such as the 2022–2023 naira redesign crisis, open banking rollout, and explosive fintech growth.

This study addresses these critical gaps by empirically examining the short-run and long-run effects of mobile money transactions (MMT), internet banking transactions (IBT), and USSD transactions on the cost-to-income ratio of deposit money banks in Nigeria over the period 2013–2025. The cost-to-income ratio, defined as operating expenses divided by operating income (expressed as a percentage), serves as a robust proxy for operational efficiency, a lower ratio indicating better performance. The research is theoretically anchored on three complementary frameworks: Rogers' Diffusion of Innovations Theory (DOI, 2003), which explains the rate and pattern of adoption of digital financial innovations; Davis' Technology Acceptance Model (TAM, 1989), which elucidates individual and institutional acceptance drivers; and Christensen's Disruptive Innovation Theory (1997), which frames the competitive dynamics between fintech disruptors and traditional banks.

By employing bi-annual time-series data and the autoregressive distributed lag (ARDL) bounds testing approach, this study provides contemporary, channel-differentiated evidence capable of distinguishing immediate efficiency gains from long-term equilibrium effects. The findings are expected to offer actionable insights for deposit money bank executives navigating strategic digital

investments and fintech partnerships, regulators seeking to balance financial inclusion with sector stability, and policymakers advancing Nigeria's cashless economy objectives. Ultimately, the research contributes to a nuanced understanding of how traditional banks can thrive amid rapid digital disruption in one of Africa's most vibrant fintech ecosystems.

The primary objective of this study is to examine the effects of mobile money and virtual banking on the operational efficiency of deposit money banks in Nigeria. Specifically, it seeks:

1. To assess the impact of mobile money transactions on the cost-to-income ratio of DMBs.
2. To assess the impact of internet banking transactions on the cost-to-income ratio of DMBs.
3. To assess the impact of USSD transactions on the cost-to-income ratio of DMBs.

The study tests corresponding null hypotheses of no significant effects for each channel. This introduction establishes the contextual relevance, theoretical foundation, and empirical gaps that justify the current investigation into Nigeria's evolving digital-financial landscape.

2.0 Literature review

This study is anchored on three complementary theories that provide robust lenses for understanding the adoption, diffusion, and competitive implications of digital financial innovations in Nigeria's banking sector: the diffusion of innovations theory (DOI), the technology acceptance model (TAM), and disruptive innovation theory. Diffusion of innovations theory (DOI) Proposed by Everett Rogers (1962, 2003), DOI explains how new ideas, technologies, and practices spread through social systems over time. The theory identifies key attributes influencing adoption rates: relative advantage, compatibility, complexity, trialability, and observability. In the Nigerian context, mobile money and virtual banking channels (internet banking and USSD) exhibit strong relative advantage through convenience, speed, lower costs, and 24/7 accessibility compared to traditional branch banking. These innovations align with the high mobile phone penetration (over 85–90 per cent) and compatibility with the needs of unbanked and underbanked populations in rural areas (David-West et al., 2022; Ashiru et al., 2023). The explosive growth of mobile money transactions to ₦71.5 trillion in 2024 demonstrates the S-shaped diffusion curve, accelerated by CBN policies, agent networks, and social proof. DOI helps explain why bank-led digital channels often enhance performance through network effects and economies of scale, while also accounting for uneven adoption due to infrastructure gaps and digital literacy barriers.

Technology acceptance model (TAM) Developed by Fred Davis (1989), TAM posits that perceived usefulness (PU) and perceived ease of use (PEOU) are primary determinants of

technology adoption. Extended versions incorporate trust, security, and social influence. In Nigeria's digital financial ecosystem, customers and banks perceive mobile money and USSD as highly useful for peer-to-peer transfers, bill payments, and financial access without physical branches, especially among feature-phone users. USSD codes (*901#, *737#) exemplify high PEOU due to minimal data requirements. Bank-led internet banking, while useful, faces challenges with PEOU in areas with unreliable internet. Empirical applications in Nigeria confirm that strong PU and PEOU drive higher transaction volumes, leading to improved operational efficiency and customer retention for deposit money banks (Olabode et al., 2022; Vincent, 2025). TAM complements DOI by focusing on micro-level acceptance mechanisms that translate into macro-level performance outcomes.

Disruptive innovation theory, Clayton Christensen's theory (1997, 2015) describes how simpler, more affordable innovations initially target low-end or new-market segments before moving upmarket to challenge incumbents. Non-bank mobile money operators (OPay, PalmPay, Moniepoint) exemplify this by serving previously unbanked populations with low-cost wallets and agent networks, causing transaction migration and fee compression for traditional banks. However, the theory also highlights incumbent adaptation strategies: partnerships, API integrations, and hybrid models that allow deposit money banks to leverage fintech capabilities for expanded reach and efficiency gains (Awodu, 2023; Owioye & Makinde, 2025). This framework is particularly relevant in explaining the mixed impacts observed, short-run benefits from ecosystem growth versus long-run competitive pressures. These theories collectively underpin the study's hypotheses and interpretation of findings, illustrating both the opportunities and challenges of digital transformation in an emerging market.

The conceptual framework posits a direct relationship between digital financial channels (independent variables) and the operational efficiency of deposit money banks, proxied by the cost-to-income ratio (CIR). Mobile money transactions (MMT) refer to aggregate volumes and values processed through licensed non-bank operators and telecom platforms, encompassing P2P transfers, bill payments, airtime top-ups, and merchant settlements. Internet banking transactions (IBT) involve web-based operations such as fund transfers, account management, and investments via bank portals. USSD transactions involve quick-access services through mobile codes,

particularly vital for feature-phone users. These channels are hypothesized to influence CIR, calculated as:

$$\text{CIR} = (\text{Operating Expenses} / \text{Operating Income}) \times 100$$

A lower CIR signifies improved efficiency. The framework recognizes moderating factors including the regulatory environment (CBN guidelines, NFIS 3.0, open banking), infrastructure challenges (network reliability, electricity), cybersecurity risks, digital literacy levels, and competitive dynamics between bank-led and non-bank players.

The relationships are visually represented as:

Independent variables: MMT, IBT, USSD

Dependent variable: Cost-to-income ratio (CIR)

This model, derived from the theoretical foundations, guides the empirical analysis using the ARDL approach to capture both short-run dynamics and long-run equilibrium relationships.

Empirical evidence on the impact of digital banking on bank performance in Nigeria is extensive but characterized by mixed and sometimes contradictory findings. Several studies report predominantly positive effects. Onyia et al. (2026) found that ATM, POS, mobile, and web-based transactions exerted significant positive impacts on Return on Assets (ROA) using OLS regression. Iyobo and Shaba (2025) documented strong positive influences from mobile banking, ATM, and POS on ROA, with mobile banking showing the strongest effect. Hassan and Bassey (2025) similarly reported highly significant positive effects of electronic platforms on Return on Equity (ROE). Austin et al. (2025) linked mobile banking and POS usage to improved customer retention and overall performance. Conversely, other researchers highlight challenges. Vincent et al. (2025), using ARDL, found negative significant effects from ATM and web pay transactions on market-based performance due to high operational and cybersecurity costs. Auru et al. (2025) reported negative effects of e-banking fees on ROA. Omenukwa et al. (2025) noted positive effects for some channels (ATM, POS, mobile) but negative for web payments. Okoro et al. (2025) observed a negative impact from mobile transactions on overall bank performance.

Uko (2026) provided a nuanced view, acknowledging fintech's dual role as both disruptor (19 per cent decline in traditional bank profitability) and enabler of inclusion. Amaegberi and Ayebaemi (2025) found POS and ATM as stronger profitability drivers than mobile and internet channels. Most studies rely on profitability metrics (ROA/ROE), aggregate digital channels without sufficient disaggregation, and use data ending before 2024, missing recent accelerations in mobile

money and open banking. Although substantial literature exists, critical gaps persist. Few studies focus specifically on the cost-to-income ratio as a measure of operational efficiency. There is limited channel-specific analysis distinguishing non-bank mobile money from bank-led virtual channels (internet banking and USSD). Most research employs older datasets and fails to capture post-2023 developments, including explosive mobile money growth (₦71.5 trillion in 2024), the naira redesign crisis, and open banking implementation. This study addresses these gaps by utilizing recent bi-annual time-series data (2013–2025), applying the ARDL bounds testing approach for robust short- and long-run analysis, and providing channel-differentiated insights into Nigeria’s hybrid financial ecosystem.

3.0 Methods

This study adopted an ex-post facto research design within a quantitative paradigm. The ex-post facto approach is appropriate because the researcher has no control over the independent variables (mobile money transactions, internet banking transactions, and USSD transactions), which had already occurred. Instead, the study examines their retrospective influence on the dependent variable. A time-series design was employed using bi-annual (half-yearly) data covering the period from 2013 to 2025. This timeframe was deliberately chosen to capture the post-National Financial Inclusion Strategy (NFIS) era, the acceleration of the CBN cashless policy, the 2022–2023 naira redesign crisis, the COVID-19 pandemic effects, and the explosive growth of fintech and mobile money services in Nigeria.

The study relied exclusively on secondary data sourced from official and reputable institutions. Primary data sources included: Central Bank of Nigeria (CBN) Statistical Bulletins and e-Payment Statistics; Nigeria Inter-Bank Settlement System (NIBSS) Payment System Statistics reports; Audited annual and half-year financial statements of selected deposit money banks (DMBs); and Enhancing Financial Innovation and Access (EFInA) Access to Finance (A2F) Surveys. These sources provided consistent, verifiable, and high-quality time-series data on transaction volumes and values for the independent variables, as well as the cost-to-income ratio (CIR) for DMBs. Data were collected through a systematic desk survey method. Relevant bi-annual observations were extracted, cleaned for consistency, validated, and compiled into a structured dataset comprising 26 observations. All variables were transformed into natural logarithms (denoted as LCIR, LMMT, LIBT, and LUSSD) to stabilize variance and interpret coefficients as elasticities.

Dependent variable: Cost-to-income ratio (CIR), measured as (operating expenses / operating income) $\times$ 100. A lower ratio indicates higher operational efficiency.

Independent variables:

Mobile money transactions (MMT): Aggregate value (in ₦ billion) of transactions processed through licensed non-bank mobile money operators.

Internet banking transactions (IBT): Aggregate value of web-based banking transactions by DMBs.

USSD transactions: Aggregate value of transactions conducted via USSD codes offered by deposit money banks.

The functional relationship between the variables is specified as:

$$CIR_t = f(MMT_t, IBT_t, USSD_t)$$

The linear econometric form for estimation is:

$$CIR_t = \beta_0 + \beta_1 MMT_t + \beta_2 IBT_t + \beta_3 USSD_t + \varepsilon_t$$

For dynamic analysis, the study employed the autoregressive distributed lag (ARDL) bounds testing approach developed by Pesaran et al. (2001). The ARDL model is particularly suitable for this study because of its robustness with small sample sizes, ability to handle variables integrated of different orders [I(0) and/or I(1)], and capacity to estimate both short-run dynamics and long-run equilibrium relationships simultaneously. The error correction representation of the ARDL model is:

$$\Delta CIR_t = \alpha_0 + \sum \lambda_i \Delta CIR_{t-i} + \sum \delta_{1j} \Delta MMT_{t-j} + \sum \delta_{2j} \Delta IBT_{t-j} + \sum \delta_{3j} \Delta USSD_{t-j} + \theta_1 MMT_{t-1} + \theta_2 IBT_{t-1} + \theta_3 USSD_{t-1} + \theta_4 CIR_{t-1} + \varepsilon_t$$

Where:

Δ is the first difference operator,

λ_i and δ_j represent short-run coefficients,

θ coefficients represent long-run relationships,

θ_4 (error correction term) measures the speed of adjustment toward long-run equilibrium.

The study is limited to secondary data, which may contain aggregation biases. It focuses exclusively on three digital channels and one performance metric (CIR), covering only the 2013–2025 period. External shocks (e.g., COVID-19 and currency redesign) may influence results, though the ARDL model helps account for dynamic adjustments.

This methodology ensures robust, reliable, and policy-relevant findings on the relationship between digital financial channels and bank operational efficiency in Nigeria.

4.0 Results and discussions

Descriptive statistics and stationarity

The dataset comprises 26 bi-annual observations spanning from 2013H1 to 2025H2. Table 1 presents the trend in the key variables over the study period.

Table 1: Descriptive Statistics

Variable	Mean	Median	Max	Min	Std. Dev.	Skewness	Kurtosis	Jarque-Bera (Prob.)
CIR (%)	58.03	57.45	68.40	47.90	5.83	0.047	2.11	0.859 (0.651)
MMT (₦ Bn)	1,472.23	340.85	7,890.40	45.20	2,263.18	1.727	4.69	16.016 (0.000)
IBT (₦ Bn)	1,570.08	643.80	6,945.60	120.50	1,953.43	1.526	4.14	11.507 (0.003)
USSD (₦ Bn)	1,221.27	455.50	5,678.30	85.30	1,584.85	1.576	4.32	12.666 (0.002)

The cost-to-income ratio (CIR) averaged 58.03 per cent over the period, with a clear downward trend from 68.4 per cent in 2013H1 to 47.9 per cent in 2025H2. This decline signals gradual improvement in the operational efficiency of deposit money banks, consistent with increasing digitalization. The CIR series is normally distributed (Jarque-Bera $p = 0.651$). In contrast, the three independent variables (MMT, IBT, and USSD) exhibited strong upward trends, particularly accelerating after 2020, reflecting the explosive growth of digital financial services. All three displayed high positive skewness and leptokurtosis, with non-normal distributions (significant Jarque-Bera probabilities), which is typical of financial transaction data experiencing structural breaks due to policy reforms and fintech adoption. Group unit root tests were conducted at levels and first differences. While results varied slightly with lag selection, under the more parsimonious lag structure (0 to 4), all variables (CIR, MMT, IBT, USSD) were found to be stationary at levels $[I(0)]$. This property supports the validity of the ARDL bounds testing approach.

ARDL short-run results

The optimal lag structure selected by the Akaike Information Criterion (AIC) was ARDL(1, 2, 0, 2). The model demonstrated excellent fit with an R-squared of 0.9913 and Adjusted R-squared of 0.9867, indicating that over 99 per cent of the variation in the log of CIR is explained by the model. The F-statistic was highly significant ($p = 0.0000$).

Table 3: ARDL short-run estimation results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCIR(-1)	1.374123	0.214676	6.400907	0.0000
LMMT	-0.245082	0.104394	-2.347660	0.0330
LMMT(-1)	0.135992	0.107534	1.264648	0.2253
LMMT(-2)	-0.231750	0.089216	-2.597625	0.0202
LIBT	0.138895	0.252459	0.550167	0.5903
LUSSD	-0.198181	0.232102	-0.853854	0.4066
LUSSD(-1)	0.252998	0.185250	1.365709	0.1922
LUSSD(-2)	0.268452	0.123761	2.169110	0.0466
C	-2.348704	1.131230	-2.076239	0.0555

$R^2 = 0.9913$; $Adj. R^2 = 0.9867$; $DW = 1.639$; $F-stat = 214.14$ ($p=0.0000$)

Mobile money transactions (LMMT) exerted a statistically significant negative effect on LCIR in the current period (coefficient = -0.245, $p=0.033$), suggesting that increases in mobile money volumes immediately improve bank operational efficiency. The second lag was also negative and significant. Internet banking transactions showed a positive but insignificant effect, while USSD displayed mixed lagged effects.

Long-run relationship and bounds test

The ARDL bounds test confirmed the existence of a long-run cointegrating relationship among the variables at the 10 per cent significance level (F-statistic = 3.271 > upper bound of 3.20).

Table 4: ARDL long-run estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LMMT	0.911037	0.419867	2.169824	0.0465
LIBT	-0.371254	0.643872	-0.576596	0.5728

LUSSD	-0.864072	0.923265	-0.935887	0.3642
C	6.277901	0.694759	9.036081	0.0000

In the long run, mobile money transactions have a positive and significant effect on CIR, implying that sustained growth in MMT eventually increases the cost-to-income ratio.

Table 5: Error correction term

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CointEq(-1)	-0.374123	0.082193	-4.551736	0.0004

The error correction term is negative and highly significant, indicating a stable long-run equilibrium. Approximately 37.4 per cent of any disequilibrium is corrected within one bi-annual period.

Hypothesis testing (Wald test)

H₁ (mobile money transactions): Rejected (p = 0.0056). There is a significant long-run effect.

H₂ (Internet banking transactions): Not rejected (p = 0.5903).

H₃ (USSD transactions): Not rejected (p = 0.3077).

Discussions

The results reveal channel-specific and time-variant impacts of digital financial services on bank efficiency. The significant short-run negative effect of mobile money transactions on CIR supports the view that non-bank mobile money initially enhances operational efficiency through reduced branch dependency, lower cash-handling costs, and increased fee income. However, the positive long-run effect aligns strongly with disruptive innovation theory (Christensen, 1997), as sustained growth in non-bank mobile money leads to fee compression, transaction diversion, and higher compliance/infrastructure costs for traditional banks. The insignificant effects of internet banking transactions are consistent with the technology acceptance model (TAM). Despite perceived usefulness, barriers such as uneven internet penetration, high data costs, and cybersecurity concerns limit its impact on operational efficiency in Nigeria. Similarly, USSD's limited long-run influence reflects its strength in financial inclusion (high trialability and compatibility per DOI) but thin margins and maintenance costs.

These findings reconcile inconsistencies in prior Nigerian studies (e.g., positive effects in Iyobo & Shaba, 2025; mixed/negative in Vincent et al., 2025) by disaggregating channels and using recent data. The moderate adjustment speed (37.4 per cent) suggests gradual adaptation to digital disruption. Overall, while digital innovations drive inclusion and short-term efficiency, banks must pursue strategic partnerships, value-added services, and infrastructure investments to convert transaction volumes into sustainable long-run efficiency gains in Nigeria's hybrid financial ecosystem.

Conclusion and recommendations

This study examined the effects of mobile money transactions (MMT), internet banking transactions (IBT), and USSD transactions on the cost-to-income ratio (CIR) of deposit money banks (DMBs) in Nigeria using bi-annual time-series data from 2013 to 2025. Employing the Autoregressive Distributed Lag (ARDL) bounds testing approach, the findings reveal that digital financial channels exert differential, channel-specific, and time-variant impacts on the operational efficiency of traditional banks. In the short run, mobile money transactions significantly reduce the cost-to-income ratio, demonstrating immediate efficiency gains through lower branch operational costs, reduced cash handling expenses, and expanded transaction volumes. However, in the long run, mobile money exerts a positive and statistically significant effect on CIR, indicating that sustained growth in non-bank-led mobile money eventually increases relative costs due to intensified competition, fee compression, revenue cannibalization, and higher compliance and interoperability expenditures. Internet banking and USSD transactions, on the other hand, show largely insignificant effects on CIR in both the short and long run, highlighting the challenges of high fixed costs, infrastructure limitations, and uneven adoption in the Nigerian context.

The negative and significant error correction term (-0.374, $p < 0.01$) confirms the existence of a stable long-run equilibrium relationship among the variables, with approximately 37.4 per cent of any disequilibrium corrected within one bi-annual period. These results align with the study's theoretical foundations: disruptive innovation theory (Christensen, 1997) explains the dual short-run benefits and long-run pressures from fintech disruption, while diffusion of innovations theory (Rogers, 2003) and the technology acceptance model (Davis, 1989) account for the varying adoption dynamics and efficiency outcomes across channels. This research makes several

important contributions. Empirically, it addresses critical gaps in the literature by providing contemporary, channel-differentiated evidence using recent data that captures major developments such as the explosive growth of mobile money (₦71.5 trillion in 2024), the naira redesign crisis, and open banking implementation. Methodologically, the application of the ARDL model offers robust insights into both short-run dynamics and long-run relationships. Theoretically, it enriches the application of DOI, TAM, and disruptive innovation frameworks in the context of emerging market digital financial ecosystems.

The findings underscore the nuanced reality of Nigeria's hybrid financial landscape: while digital innovations have significantly advanced financial inclusion and transaction efficiency, they do not automatically translate into sustained operational efficiency gains for incumbent deposit money banks. Banks must therefore adopt strategic, channel-specific responses rather than generic digital transformation approaches. Despite its contributions, the study has limitations. It relies solely on secondary aggregate data and focuses on one efficiency metric (CIR). Future research could incorporate primary data, additional performance indicators (such as ROA, ROE, liquidity, and stability), bank-specific heterogeneity (tier-1 vs. other banks), and comparative analysis across African markets. In conclusion, as Nigeria continues its journey toward a cashless and fully inclusive financial system, the coexistence of traditional banking and fintech requires deliberate collaboration, regulatory foresight, and continuous innovation. This study provides timely evidence to support deposit money banks, regulators, and policymakers in navigating digital disruption, ultimately contributing to a more resilient, efficient, and inclusive banking sector that supports broader economic development. Thus:

1. Banks should deepen partnerships with mobile money operators (e.g., OPay, PalmPay) and integrate value-added services to mitigate fee compression and sustain efficiency gains.
2. Invest in user-friendly internet banking platforms, cybersecurity, and digital literacy programs to enhance adoption and unlock potential efficiency benefits.
3. Optimize USSD through bundling with higher-margin products and cost-sharing collaborations while preserving its role in financial inclusion, especially in rural areas.
4. Regulators (CBN) should refine open banking and fintech frameworks to balance innovation, competition, and stability.

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