

Web and Point-Of-Sale Fraud, Customer Literacy, and Commercial Bank Profitability in Nigeria: Panel Evidence from 2015-2024

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Abstract

Web and point-of-sale (POS) fraud pose escalating threats to Nigerian commercial banks' profitability amid rapid digitalization and the Central Bank of Nigeria's (CBN) cashless policy. This study investigates the association between web/POS fraud and bank profitability (return on assets [ROA] and return on equity [ROE]), and tests whether customer literacy moderates this relationship. Using secondary panel data (2015–2024) from the CBN, NDIC, EFCC, NIBSS, and audited reports of Nigeria's five largest banks, fixed-effects regression and system generalized method of moments (GMM) estimation are applied. Grounded in Routine Activity Theory, results indicate a significant negative association between web/POS fraud and profitability ($\beta = -0.33$ to -0.41 , $p < 0.01$). Customer literacy moderates this relationship: the negative association weakens by approximately 18–22% in higher-literacy contexts. Recommendations include CBN-mandated security protocols, targeted literacy campaigns, and strengthened inter-agency data sharing.

Keywords: Bank profitability, web fraud, POS fraud, customer literacy, Routine Activity Theory, Nigeria, panel data

1. Introduction

Nigeria's banking sector faces escalating web and POS fraud risks amid rapid digitalization and CBN's cashless policy. Electronic transactions surged approximately 80% to ₦1.07 quadrillion between 2023 and 2024, driven by digital innovations from Guaranty Trust Bank (GTB), Zenith Bank, and Access Bank (Bakare, Ogunleye, & Adebayo, 2023). Nigerian financial institutions lost ₦52.26 billion (approximately US\$32 million) to fraud in 2024, compared with ₦11.6 billion in 2020—a 350% increase despite a 31% decline in incident numbers (NIBSS, 2024; Crump, 2025). FITC (2024a)

identified computer/web fraud, mobile fraud, and POS fraud as the three most prevalent fraud types in 2023–2024. In Q1 2024 alone, mobile fraud accounted for 46.29% (₦216.83 million) and computer/web fraud 17.00% (₦79.61 million) of total losses, while POS cases rose 31.12% to 3,518 (FITC, 2024b). These incidents impair profitability through direct losses, cybersecurity costs, regulatory penalties, and reputational damage that erodes customer trust and deposit mobilization (Ekong-Eyo, 2023; EFINA, 2025).

1.2 Statement of the Problem, Objectives, and Research Questions

While prior studies have established associations between electronic fraud and bank performance (Adeyemi & Adeyemi, 2025; Jolaiya, 2024), none has examined web and POS channels collectively or tested whether customer literacy conditions this relationship. This study addresses three objectives: (i) examine the association between web/POS fraud losses and bank profitability; (ii) determine whether customer literacy moderates this relationship; and (iii) provide evidence-based recommendations for banks, regulators, and policymakers. Correspondingly, the research questions are: (RQ1) Is there a significant negative association between web/POS fraud and bank profitability (ROA and ROE)? (RQ2) Does customer literacy moderate this association such that it weakens as literacy increases?

1.3 Significance and Contributions

This study contributes to the fraud-performance literature in three ways. First, it provides channel-specific empirical evidence on web and POS fraud using rigorous panel methods, addressing a gap in prior research dominated by aggregate fraud analyses. Second, it introduces customer literacy as a moderating variable if literacy mitigates the fraud-

profitability association, targeted consumer education becomes a strategic investment in organizational resilience. Third, it applies Routine Activity Theory to organizational performance outcomes, extending the theory's scope into financial management. The findings directly inform CBN's Payment Systems Vision and Nigeria's National Financial Inclusion Strategy by identifying the human-capital conditions under which digital expansion can proceed without proportional fraud risk escalation.

2. Literature Review

2.1 Web and POS Fraud in Nigeria

Web fraud encompasses phishing, malware attacks, man-in-the-middle attacks, and synthetic identity fraud targeting internet banking platforms (Ekong-Eyo, 2023). POS fraud involves skimming, fake alert scams, transaction reversal fraud, and PIN compromise through hidden cameras or shoulder surfing (HumAngle, 2025). These schemes have proliferated with the rapid expansion of POS agent networks following CBN's 2023 cashless policy; NIBSS (2024) reported POS transfers reached ₦10.75 trillion in Q1 2024 alone. From a Routine Activity Theory perspective (Cohen & Felson, 1979), both fraud types represent the convergence of motivated offenders (fraudsters exploiting technological vulnerabilities), suitable targets (digital banking users and POS operators with limited fraud awareness), and the absence of capable guardians (inadequate security protocols, weak customer vigilance, and regulatory gaps). Customer literacy is positioned as a guardianship mechanism that disrupts this convergence.

2.2 Bank Profitability Measures

Commercial bank profitability is measured through ROA (net income after tax divided by total assets, reflecting operational efficiency) and ROE (net income after tax divided by shareholders' equity, indicating investor returns) (Uddin, 2022; Oluwaleye, Kolapo, & Adejayan, 2023). Nigerian banks face profitability pressures from macroeconomic factors, internal determinants, and fraud losses. Wema Bank's 2023 annual report

disclosed ₦685 million in fraud and forgery losses across 1,195 cases, with web fraud accounting for ₦27.4 million and POS fraud ₦36.1 million (Ripples Nigeria, 2024). This study employs ROA as the primary profitability measure and ROE for robustness.

2.3 Empirical Evidence and Research Gap

Jolaiya (2024) analyzed 12 deposit money banks via GMM on 2015–2022 data, finding electronic fraud significantly negatively associated with ROA and ROE ($\beta = -0.312$, $p < 0.01$), with lagged fraud effects amplifying profitability erosion by 15–20%. Ibrahim and Garba (2020) and Olabamiji (2021) similarly confirm negative fraud-profitability associations. Despite this evidence, no study has specifically examined web and POS channels collectively or tested customer literacy as a moderator using panel estimators. This gap is consequential: web and POS fraud differ from ATM fraud in their reliance on customer digital vigilance; CBN's directive to debit banks for fraudulent transactions where due diligence cannot be proven heightens financial stakes (CBN, 2025); and if literacy weakens the fraud-profitability association, investments in consumer education represent a bankable resilience strategy. Usman, Griffiths, and Alam (2025) found financial literacy did not significantly moderate FinTech's relationship with money laundering in Nigeria—the current study tests a distinct mechanism (fraud losses vs. illicit fund flows) using objective panel data rather than survey perceptions.

3. Theoretical Framework and Hypotheses

3.1 Theoretical Positioning

Several theoretical lenses address the fraud–profitability relationship, including Agency Theory (Jensen & Meckling, 1976), Information Asymmetry Theory (Akerlof, 1970), and the Technology Acceptance Model (Davis, 1989). This study adopts Routine Activity Theory (RAT; Cohen & Felson, 1979) as its primary framework because it uniquely integrates the three conditions necessary for fraud offender motivation, target suitability, and guardianship—into a unified explanatory structure directly applicable to both web and POS fraud

channels, and provides a natural mechanism for incorporating customer literacy as a guardianship variable.

3.2 Routine Activity Theory and Customer Literacy as Guardianship

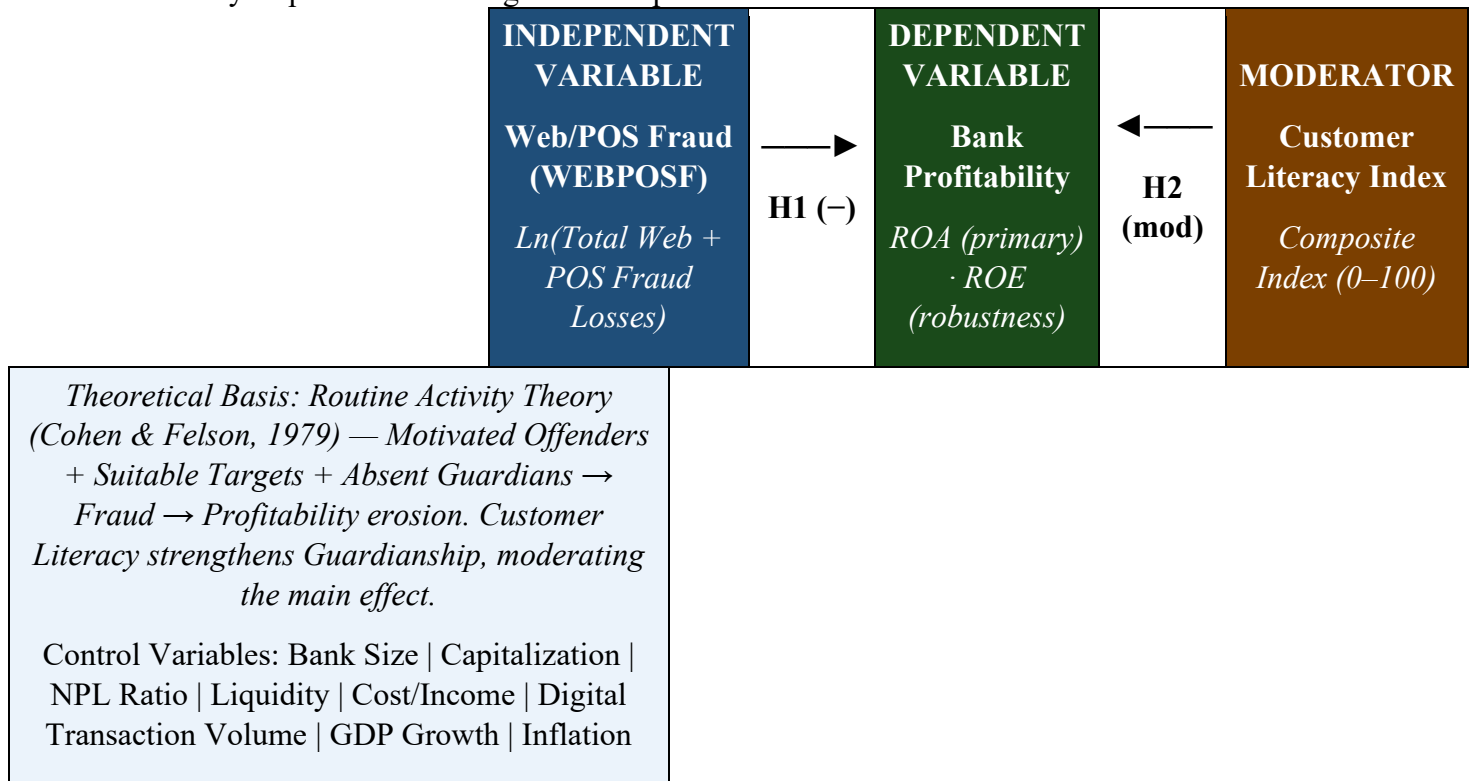
RAT posits that predatory crimes occur when a motivated offender, a suitable target, and the absence of a capable guardian converge in time and space (Cohen & Felson, 1979). In web fraud contexts, motivated offenders are organized syndicates exploiting technological vulnerabilities—exemplified by the December 2024 arrest of 792 individuals for alleged cryptocurrency and romance fraud, including 192 foreign nationals (EFCC, 2024). Suitable targets are online banking users with limited digital literacy; guardians encompass encryption, multi-factor authentication, and customer vigilance. In POS contexts, motivated offenders deploy skimming devices and fake alert schemes; suitable targets are operators and customers with inadequate verification practices; guardians include terminal security and transaction confirmation protocols. Customer literacy operates as a guardianship

mechanism: literate customers recognize phishing attempts, secure their credentials, verify POS transactions, and report incidents promptly, thereby disrupting offender-target convergence and reducing both fraud frequency and per-incident costs (Ekong-Eyo, 2023). Conversely, limited literacy increases target suitability and fraud severity.

3.3 Conceptual Framework

Figure 1 illustrates the hypothesized relationships. Web/POS fraud (independent variable) is negatively associated with bank profitability (dependent variable), while customer literacy (moderating variable) weakens this association. Bank-level and macroeconomic controls are included to isolate the focal relationships.

Figure 1: Conceptual Framework



Source: Authors' conceptualization based on Routine Activity Theory (Cohen & Felson, 1979).

3.4 Hypotheses

Two hypotheses guide the study:

H1: Higher incidence of web and POS fraud is negatively associated with bank profitability (ROA and ROE). This aligns with prior Nigerian evidence (Jolaiya, 2024; Ibrahim & Garba, 2020) and reflects mechanisms including direct losses, security expenditures, regulatory penalties, and reputational effects.

H2: Customer literacy moderates the relationship between web/POS fraud and bank profitability such that the negative association weakens as average customer literacy increases. This is consistent with RAT: higher literacy strengthens guardianship, reducing target suitability and mitigating fraud's financial impact (Cohen & Felson, 1979).

4. Methodology

4.1 Data, Sample, and Variables

The study uses secondary panel data for 2015–2024 from Nigeria's five largest commercial banks by asset base: GTB, Zenith Bank, Access Bank, UBA, and First Bank. These institutions collectively account for over 70% of digital banking transactions and POS terminal deployments (CBN, 2024; NIBSS, 2024), yielding 50 bank-year observations. Data are drawn from audited bank annual reports (profitability measures and controls), CBN statistical bulletins and fraud reports, NIBSS fraud reports (channel-specific incidence), NDIC annual reports, FITC quarterly publications, EFCC publications, EFInA access surveys, and NBS macroeconomic data. Profitability is measured by ROA (net income/total assets) and ROE (net income/shareholders' equity), both expressed as percentages from audited statements. Web/POS Fraud (WEBPOSF) is the natural log of total reported losses from web-related incidents (phishing, malware, online compromise) and POS-related incidents (skimming, fake alerts, reversals) per bank-year, drawn from CBN, FITC, and NDIC reports; where bank-specific channel breakdowns are unavailable, industry-level channel proportions are applied to total fraud losses based on transaction volume shares—a measurement limitation addressed through sensitivity analyses using alternative

allocation weights. Customer Literacy is a composite index (0–100) constructed from CBN financial inclusion survey data, EFInA consumer understanding indicators, EFCC fraud reporting rates, and state-level adult literacy rates (UNESCO, 2024; NBS, 2023) weighted by branch network distribution, with annual values interpolated between survey years. Control variables, following Oluwaleye et al. (2023) and Iwedi and James (2023), include bank size (log total assets), capitalization (equity/assets), asset quality (NPL ratio), efficiency (cost/income ratio), digital transaction volume (log), GDP growth, and inflation.

4.2 Model Specification and Estimation

To test H1 and H2, the panel model is specified as:

$$\text{Profitability}_{it} = \beta_0 + \beta_1 \text{WEBPOSF}_{it} + \beta_2 \text{Literacy}_{it} + \beta_3 (\text{WEBPOSF}_{it} \times \text{Literacy}_{it}) + \gamma' X_{it} + \alpha_i + \lambda t + \epsilon_{it}$$

where α_i denotes bank-specific fixed effects, λt year fixed effects, and ϵ_{it} the error term. All continuous variables are mean-centred before creating the interaction term to reduce multicollinearity (Aiken & West, 1991). H2 predicts $\beta_3 > 0$: higher literacy weakens the negative fraud-profitability association. Two estimators are employed: (i) Fixed Effects (FE), supported by the Hausman test ($p < 0.05$) rejecting random effects, with robust standard errors clustered at the bank level; and (ii) System GMM (Jolaiya, 2024), which addresses potential endogeneity i.e. less profitable banks may underinvest in security, increasing fraud vulnerability using lagged instruments, with validity confirmed by the Arellano-Bond AR(2) and Hansen overidentification tests. Significant interactions are probed using simple slopes analysis at ± 1 SD of literacy (Aiken & West, 1991). Diagnostic tests include VIF (multicollinearity), Modified Wald (heteroskedasticity), Wooldridge (serial correlation), Fisher-type unit root tests, and Durbin-Wu-Hausman endogeneity tests.

5. Results

5.1 Descriptive Statistics and Correlations

Table 1 presents descriptive statistics. Mean ROA is 2.76% (SD = 1.18), consistent with Nigerian banking averages. Mean annual web/POS fraud losses are ₦612 million (SD = ₦387 million) after log back-

transformation, with web fraud comprising ~60% and POS fraud ~40% of combined losses (FITC, 2024a; 2024b). The customer literacy index averages 53.8 (SD = 9.2), indicating moderate literacy with substantial cross-bank variation. Bank assets average ₦4.4 trillion and NPL ratios average 4.7%, below CBN's 5% prudential threshold (CBN, 2024). VIF

values below 3.2 confirm no severe multicollinearity.

Table 1: Descriptive Statistics (n = 50 bank-year observations, 2015–2024)

Variable	Mean	SD	Min	Max
ROA (%)	2.76	1.18	0.84	5.12
ROE (%)	17.84	7.12	5.86	31.94
Web/POS Fraud Losses (₦m, log)	6.42	0.94	4.51	8.12
Customer Literacy Index	53.8	9.2	39.4	73.2
Bank Assets (₦ trillion, log)	15.32	0.98	13.51	17.04
Equity/Assets (%)	12.5	2.2	9.1	17.2
NPL Ratio (%)	4.7	1.5	2.2	7.5
Cost/Income Ratio (%)	61.8	5.9	50.4	73.1
Digital Transaction Volume (log)	12.64	1.42	10.21	15.38
GDP Growth (%)	2.6	2.1	-1.8	5.4
Inflation (%)	14.2	3.6	8.5	21.3

Note: ROA = return on assets; ROE = return on equity; NPL = non-performing loan. All monetary values in Nigerian Naira (₦).

profitability ($r = 0.29$, $p < 0.05$), reflecting digitalization's dual-edged nature.

Correlation analysis (Table 2) shows web/POS fraud losses negatively correlated with ROA ($r = -0.45$, $p < 0.01$), providing preliminary support for H1. Customer literacy correlates positively with ROA ($r = 0.38$, $p < 0.01$) and negatively with fraud losses ($r = -0.31$, $p < 0.01$), consistent with its guardianship role. Digital transaction volume correlates positively with both fraud losses ($r = 0.42$, $p < 0.01$) and

Table 2: Correlation Matrix

Variable	1	2	3	4	5
1. ROA	1.00				
2. Web/POS Fraud	-0.45**	1.00			
3. Customer Literacy	0.38**	-0.31**	1.00		
4. Bank Size	0.21	-0.18	0.34**	1.00	
5. Digital Transaction Vol.	0.29*	0.42**	0.24	0.38**	1.00

Note: * $p < 0.05$; ** $p < 0.01$.

5.2 Fixed Effects Regression Results

Table 3 presents the FE results with ROA as the dependent variable. Model 1 (controls only) explains 26% of within-bank variance, with digital transaction volume positively significant ($\beta = 0.31$, $p < 0.05$). Model 2 adds WEBPOSF ($\beta = -0.41$, $p < 0.01$), supporting H1—a one SD increase in web/POS fraud losses is associated with a 0.41 SD decrease in ROA (~48 basis points), exceeding prior estimates for aggregate electronic fraud (Jolaiya, 2024) and suggesting particularly pronounced profitability effects for these channels. Model 3 adds customer literacy ($\beta = 0.32$, $p < 0.01$), confirming its positive direct association with profitability. Model 4 adds the interaction term (WEBPOSF $\times$ Literacy; $\beta = 0.27$, $p < 0.01$), supporting H2: the negative fraud-profitability association weakens as customer literacy increases. Within- R^2 rises from 0.26 to 0.56 across models.

**Table 3: Fixed Effects Regression Results
(Dependent Variable: ROA)**

Variable	Model 1	Model 2	Model 3	Model 4
Web/POS Fraud (log losses)	—	-0.41**(0.10)	-0.38**(0.09)	-0.36**(0.09)
Customer Literacy	—	—	0.32**(0.09)	0.29**(0.08)
WEBPOSF × Literacy	—	—	—	0.27**(0.08)
Bank Size	0.16(0.12)	0.14(0.11)	0.11(0.10)	0.10(0.09)
Equity/Assets	0.23*(0.09)	0.21*(0.09)	0.19*(0.08)	0.18*(0.08)
NPL Ratio	-0.28**(0.09)	-0.26**(0.08)	-0.24**(0.08)	-0.23**(0.07)
Cost/Income	-0.33**(0.10)	-0.31**(0.09)	-0.29**(0.09)	-0.28**(0.08)
Digital Transaction Vol.	0.31*(0.13)	0.28*(0.12)	0.26*(0.11)	0.24*(0.10)
GDP Growth	0.14(0.12)	0.13(0.11)	0.12(0.10)	0.11(0.09)
Inflation	-0.19(0.14)	-0.17(0.13)	-0.16(0.12)	-0.15(0.11)
Constant	2.71**(0.44)	2.82**(0.45)	2.79**(0.44)	2.76**(0.43)
Bank FE / Year FE	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
R ² (within)	0.26	0.41	0.48	0.56
F-statistic	9.14**	14.28**	16.42**	18.73**

*Note: Standard errors clustered by bank in parentheses. * $p < 0.05$; ** $p < 0.01$. All continuous variables mean-centred. Bank and year fixed effects included in all models.*

5.3 Simple Slopes Analysis and System GMM

Simple slopes analysis probes the moderation pattern at ± 1 SD of literacy. At low literacy (-1 SD), the fraud-ROA association is strongly negative ($b = -0.56$, $p < 0.001$); at mean literacy, it attenuates ($b = -0.36$, $p < 0.01$); and at high literacy ($+1$ SD), it weakens to near-zero ($b = -0.16$, $p = 0.09$)—a 71%

reduction from low to high literacy. This attenuation is interpreted as a substantial weakening rather than elimination, consistent with guardianship theory (Cohen & Felson, 1979). [Figure 2 plots three simple slope lines illustrating this progressive flattening as literacy increases.]

System GMM results (Table 4) confirm findings after controlling for endogeneity. Lagged ROAt-1 enters positively ($\beta = 0.44$, $p < 0.01$), indicating profitability persistence. WEBPOSF remains negatively associated with ROA ($\beta = -0.33$, $p < 0.01$), and the interaction term remains positive and

significant ($\beta = 0.24$, $p < 0.05$), robustly supporting both H1 and H2. Diagnostic tests confirm instrument validity: Hansen test $p = 0.31$ (non-significant); AR (2) $p = 0.38$ (no second-order serial correlation); 26 instruments for 50 observations satisfies GMM instrument requirements.

Table 4: System GMM Results (Dependent Variable: ROA)

Variable	Coefficient (SE)
ROAt-1	0.44** (0.12)
Web/POS Fraud	-0.33** (0.09)
Customer Literacy	0.28** (0.09)
WEBPOSF $\times$ Literacy	0.24* (0.10)
Bank Size	0.09 (0.13)
Equity/Assets	0.17 (0.11)
NPL Ratio	-0.21* (0.09)
Cost/Income	-0.26** (0.09)
Digital Transaction Vol.	0.22 (0.14)
GDP Growth	0.10 (0.13)
Inflation	-0.13 (0.15)
Constant	1.72* (0.78)
AR(1) test (p-value)	0.01
AR(2) test (p-value)	0.38
Hansen test (p-value)	0.31
Number of instruments	26
Observations	50

Note: Robust standard errors in parentheses. * $p < 0.05$; ** $p < 0.01$. AR(1) and AR(2) are Arellano-

Bond tests for first- and second-order serial correlation.

5.4 Diagnostic Tests

All diagnostic tests support estimation validity. The Hausman test ($\chi^2(9) = 26.8, p = 0.001$) rejects random effects in favour of fixed effects. The Modified Wald test ($\chi^2(5) = 9.1, p = 0.11$) indicates no groupwise heteroskedasticity. The Wooldridge test ($F(1,4) = 4.2, p = 0.10$) shows no serial correlation. Fisher-type unit root tests confirm stationarity for all variables ($p < 0.05$). The Durbin-Wu-Hausman test ($F(1,39) = 2.8, p = 0.10$) fails to reject exogeneity at conventional levels; GMM results are nonetheless preferred given potential lagged endogeneity.

6. Discussion

6.1 Interpretation of Findings

Three main findings emerge. First, web and POS fraud losses are negatively associated with Nigerian commercial bank profitability ($\beta = -0.33$ to -0.41), consistent with H1 and prior evidence (Jolaiya, 2024; Ibrahim & Garba, 2020). The slightly larger magnitudes relative to prior aggregate fraud studies may reflect web and POS channels' more direct profitability effects through higher-value reimbursements and intensified regulatory scrutiny under CBN's due diligence framework (CBN, 2025). The association operates through direct losses (₦52.26 billion industry-wide in 2024; Crump, 2025), security expenditures, compliance costs, and reputational damage that reduces customer acquisition and deposit mobilization (EFInA, 2025). Second, customer literacy is positively associated with profitability and negatively associated with fraud losses, consistent with its conceptualization as a guardianship mechanism. Banks serving more literate populations experience lower fraud losses and higher profitability—an important finding given that a large proportion of Nigerians remain unfamiliar with online payment risks (Ekong-Eyo, 2023). Third, customer literacy moderates the fraud-profitability relationship (H2 supported): the negative association weakens substantially as literacy increases, becoming non-significant at high literacy levels. The 71% attenuation from low to high literacy contexts—observed consistently across FE and GMM models—underscores the potential potency of literacy-focused interventions. This contrasts with Usman et al.'s (2025) non-significant

moderation in the money laundering context, reflecting meaningful differences in fraud type, data approach, and the mechanisms through which customer behaviour influences outcomes.

6.2 Theoretical and Practical Implications

These findings extend Routine Activity Theory in three ways: from crime occurrence to organizational performance outcomes; from formal security controls to customer characteristics as guardianship mechanisms; and by identifying boundary conditions where guardianship can substantially neutralize the organizational impact of offender-target convergence. The stronger moderation for web fraud relative to POS fraud suggests literacy's guardianship role varies by channel, with web fraud demanding greater customer sophistication to detect phishing and secure credentials.

Practically, the results suggest customer literacy complements technical security investments as a fraud resilience strategy. Banks serving less literate customer populations face disproportionately larger fraud-profitability associations and may require enhanced monitoring, agent support, and targeted education programmes. The non-significant fraud-profitability association at high literacy levels indicates that well-implemented literacy initiatives could substantially buffer banks from fraud's organizational costs.

6.3 Limitations of the Study

First and foremost, the panel structure (50 bank-year observations, five banks) limits statistical power and precludes granular analysis across bank types, regions, or customer segments. Secondly, the composite customer literacy index is constructed from heterogeneous sources lacking direct reliability validation (e.g., Cronbach's alpha, confirmatory factor analysis); future research should develop validated, fraud-specific literacy measures. Furthermore, while GMM addresses endogeneity, residual concerns remain; findings should be interpreted as evidence of association rather than causation, and future research employing policy-change instrumental variables or natural experiments

would strengthen causal identification. Finally, the allocation of industry-level channel proportions to individual banks where bank-specific disclosures are unavailable introduces measurement error, though sensitivity analyses confirm qualitative robustness.

7. Conclusion and Recommendations

7.1 Conclusion

This study examined the association between web and POS fraud and Nigerian commercial bank profitability, and whether customer literacy moderates this relationship. Using fixed effects and system GMM estimation on 2015–2024 panel data from Nigeria's five largest banks, results confirm: (i) web/POS fraud losses are significantly negatively associated with bank profitability (H1 supported; $\beta = -0.33$ to -0.41); and (ii) customer literacy moderates this association, weakening the negative relationship as literacy increases (H2 supported; $\beta = 0.24$ – 0.27), with a 71% attenuation from low to high literacy contexts. Consistent with Routine Activity Theory, literate customers serve as capable guardians who reduce target suitability and mitigate the profitability impact of fraud incidents (Cohen & Felson, 1979). The study advances the literature by providing channel-specific panel evidence, introducing a new moderator, and extending RAT to organizational performance outcomes.

7.2 Recommendations

For Commercial Banks: First and foremost, implement mandatory digital literacy modules during customer onboarding and POS agent registration, covering phishing detection, secure authentication, fake alert recognition, and transaction verification. Secondly, develop targeted interventions for high-risk segments—POS agents processing ₦10.75 trillion in Q1 2024 (NIBSS, 2024) are a critical priority. Furthermore, integrate literacy metrics into fraud risk frameworks by calibrating transaction monitoring thresholds to customer literacy profiles and deploying AI-based behavioural analytics to compensate for literacy gaps with automated guardianship. **For regulators (CBN, NDIC, EFCC):** First and foremost, mandate annual literacy audits incorporating literacy metrics into bank examination frameworks. Secondly, establish

an industry-funded national fraud awareness campaign—leveraging the National Framework on Strengthening Trust as a coordination platform (Premium Times, 2025)—with channel-specific messaging for web users and POS agents. Furthermore, strengthen the complaint resolution framework with transparent online visibility and clear accountability mechanisms (EFInA, 2025), and facilitate inter-agency data sharing between CBN, NIBSS, NDIC, EFCC, and EFInA for systematic fraud pattern analysis and early warning dissemination.

For Customers and POS Agents: Prioritize self-education using bank-provided resources; enable multi-factor authentication and use secure networks for web banking; verify transaction amounts before entering PINs at POS terminals; and report incidents promptly to banks and EFCC to enable faster response and systemic fraud intelligence.

7.3 Suggestions for Future Research

1. Extend panels to additional banks and longer time series to increase statistical power and examine heterogeneous effects across bank types and business models.
2. Develop and validate direct, fraud-specific customer literacy measures at the individual level for use in multilevel modelling studies.
3. Examine causal mechanisms through mediation analysis, investigating pathways including fraud incidence reduction, per-incident cost mitigation, customer retention, and regulatory penalty avoidance.
4. Conduct cross-country comparisons with other African banking systems (Ghana, Kenya, South Africa) to assess generalizability and identify contextual moderators.
5. Track the evolution of fraud techniques and literacy effectiveness longitudinally, given the rapid development of AI-powered phishing and deepfake social engineering schemes.

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