

Digital Payment Systems and Bank Performance in Nigeria: Evidence from a Quantile Panel Study

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Abstract

Using a panel of five Nigerian banks covering 2009–2022, this study examined the impact of digital payment systems on bank performance through quantile regression analysis. The findings show that ATMs consistently enhance profitability, particularly for weaker banks, while POS transactions significantly boost both profitability and shareholder value among top performing banks. Mobile banking contributes strongly to profitability only at higher quantiles, whereas website platforms uniformly undermine performance across all measures. The results concluded that digitalisation effects are heterogeneous in Nigeria, with stronger banks better positioned to leverage mobile and POS platforms. This study therefore recommends prioritising investment in mobile and POS infrastructure, supporting smaller banks in scaling digital adoption, and addressing inefficiencies in website platforms to foster inclusive and sustainable performance gains in the Nigerian banking sector.

Keywords: Digital payment systems; Bank performance; Quantile regression; Financial technology; Panel data.

1. Introduction

The global financial industry has witnessed a remarkable transformation with the advent of digital payment systems, which encompass mobile banking, internet banking, automated teller machines (ATMs), point-of-sale (POS) terminals, and fintech-enabled platforms. These innovations have redefined financial intermediation by improving efficiency, widening customer access, and lowering transaction costs, thereby creating new revenue streams for banks (Georgiev, 2024; Ozili, 2023; Demirgüç-Kunt et al., 2020). Beyond the operational benefits to individual banks, digital payments have been linked to broader macroeconomic outcomes such as financial inclusion, financial transparency, and the acceleration of cashless economies, making them critical drivers of sustainable banking performance in both advanced and emerging economies (Pazarbasioglu et al.,

2020). In developed markets, the widespread adoption of digital channels has supported deeper capital markets, increased competition, and improved consumer convenience. Conversely, in emerging economies, digital payments have been instrumental in bridging gaps in access to finance, particularly for underserved populations, thereby advancing inclusive development goals (Ahmad, 2025). Nevertheless, the adoption of digital channels is not without challenges. For many banks, digital transformation requires significant upfront investments in infrastructure, staff training, and regulatory compliance. It also heightens exposure to cybersecurity threats, operational risks, and competitive pressures that may affect institutions unevenly across the financial system (Olutimehin et al., 2021).

In Nigeria, the evolution of digital payment systems has been particularly pronounced due to deliberate policy interventions and rapid technological diffusion. The Central Bank of Nigeria (CBN) introduced the cashless policy in 2012 to reduce the dominance of cash transactions and promote electronic payments as the backbone of financial intermediation (Osirim et al., 2023). Since then, Nigeria has witnessed exponential growth in digital payment adoption, supported by the proliferation of mobile devices, fintech innovation, and consumer demand for convenient payment solutions. The Nigerian Inter-Bank Settlement System (NIBSS) reported that the value of electronic transactions reached ₦387 trillion in 2022, representing a 42% increase from the previous year, with mobile money and POS transactions showing the fastest growth (NIBSS, 2023). For banks, this shift has created opportunities to diversify income sources, reduce reliance on traditional brick-and-mortar operations, and improve customer outreach in both urban and rural areas. At the same time, digital transformation poses significant challenges, including the cost of deploying robust ICT infrastructure, rising competition from agile fintech firms, frequent system downtimes, and an alarming increase in cyber fraud incidents (Hamidu, 2025). These dynamics highlight that the impact of digital payment adoption on bank performance in Nigeria is far from uniform and is likely to vary according to bank size, technological capabilities, regulatory compliance capacity, and the ability to adapt to evolving market conditions.

However, despite the rapid adoption of digital payment systems in Nigeria and the growing scholarly interest in their impact on the financial sector, empirical evidence on how these technologies influence bank performance remains mixed and inconclusive (Shanmugam & Nigam, 2020; Arilesere et al., 2021). Moreover, most prior studies (e.g., Dong et al., 2020; Ibrahim et al., 2021; Ermawan & Raharja, 2022; Alfawareh et al., 2025) have relied on meanbased econometric approaches, which mask the heterogeneous realities of the Nigerian banking industry. Consequently, little is known about whether digital payments benefit all banks equally or whether their effects differ across banks at different performance levels. This knowledge gap is particularly significant given the diversity of Nigeria's banking system, where tier-one banks may leverage digital innovations to boost profitability while smaller banks may struggle to recoup the costs of technological investment. By employing a quantile panel regression framework, this study seeks to bridge this gap by uncovering distributional differences, revealing asymmetric effects, and providing nuanced policy insights into how digital payment systems shape the performance of Nigerian banks.

2. Empirical literature

Several studies have been carried out on the relationship between digital payment systems and bank performance. For instance, Dong et al. (2020) investigated the effects of Internet finance on

the performance of Chinese commercial banks using both static and dynamic panel models. Their findings show that Internet finance positively influences profitability, security, and growth, but negatively affects liquidity. Also, Shanmugam and Nigam (2020) assessed the effect of payment system innovations on the performance of Nigerian commercial banks using quarterly data from 2007 to 2020 within an ARDL bounds testing framework. Their findings reveal that mobile payments, POS transactions, and internet payments significantly enhance banks' return on assets, whereas the Real-Time Gross Settlement (RTGS) system exerts a negative effect. Likewise, in Nigeria, Arilesere et al. (2021) examined the impact of digital payment innovations on bank performance using quarterly data from 2009 to 2020 for 21 listed deposit money banks. Applying an Error Correction Model (ECM), the study found that mobile banking, ATMs, and internet banking significantly and positively influenced bank performance, highlighting their role as key technological drivers. Conversely, point-of-sale (POS) transactions exerted a negative and significant effect, suggesting uneven impacts of different digital channels on performance. In the context of Indonesia, Ibrahim et al. (2021) investigated the impact of digital finance, digital marketing, and digital payment on the financial performance of SMEs in Banten Province. Using survey data from 190 respondents and analysing with Structural Equation Modelling (SEM), the study found that all three variables, digital finance, digital payment, and digital marketing, positively and significantly influence financial performance.

Furthermore, Ermawan and Raharja (2022) investigated the impact of digital payment systems on banking efficiency in Indonesia between 2017 and 2021. Employing a multivariate regression technique, their results showed that ATMs had no effect, while EDC transactions improved efficiency, and internet banking reduced it. Interest rates negatively affected efficiency, and significant pre- and post-COVID-19 differences were found for most variables except internet banking. Mohammed et al. (2022) examined the effect of payment system innovations on the performance of Nigerian commercial banks using quarterly data from 2007 to 2020. Employing the ARDL bounds testing approach, the study found that mobile payments, POS transactions, and internet payments exert a positive and significant influence on banks' return on assets, whereas real-time gross settlement (RTGS) has a negative effect. Considering the mediating role of online shopping, Alzoubi and Ghazal (2022) investigated the impact of electronic payment methods on sales growth in the UAE banking industry. Using a surveybased quantitative approach with 217 valid responses from managers and technicians, the study applied correlational analysis. The findings revealed strong internal consistency across variables and confirmed a significant positive relationship between online shopping and sales growth. Moreover, electronic payments indirectly influenced sales growth through their effect on online shopping, underscoring the role of digital transactions in shaping business performance. In Indonesia, Kasri et al. (2022) examined how digitalisation influences financial stability. Using VECM and VAR models on monthly data from 2013 to 2021, the study found a long-run equilibrium between digital payment penetration and banking stability, with unidirectional causality from digital payments to stability and a positive short-run effect. However, no significant relationship was observed for Islamic banking, implying that the stabilising role of digital payments is more evident in the conventional sector.

In more recent studies, Ekpo et al. (2023) investigated the impact of electronic payment systems on the performance of Nigerian banks, proxied by return on assets, using quarterly data from 2010 to 2019 within an ARDL framework. Their study showed that mobile payment technology and point-of-sale transactions exerted a positive but insignificant long-run effect on bank performance. Conversely, automated teller machines and web-based payments were found to insignificantly

reduce bank performance. In Kenya, Kimonye and Muchelule (2024) examined the effect of electronic payment systems on the financial performance of domestic commercial banks. Using data from 24 fully Kenyan-owned banks and applying multiple regression analysis, the study found that electronic cards and bank agents significantly enhanced financial performance, while automated teller machines (ATMs) also had a statistically significant effect. Also, Theiri and Hadoussa (2024) examined the effect of digitisation strategies on the financial performance of Tunisian banks. Using generalised least squares estimation on panel data from 12 banks covering 2010–2020, the study revealed that digital transformation positively influences bank performance, particularly through investments in payment tools, digital channels, and internet security, which enhance both return on assets and return on equity. Using panel data from 12 commercial banks, Alfawareh et al. (2025) investigated the relationship between digital payments, ownership structure, and bank performance in Jordan, covering 2010 and 2023. Employing OLS, GMM, 2SLS, and dynamic models, the study found that both digital payments and ownership structure positively influence bank performance. Moreover, independent directors significantly strengthen the positive effect of institutional ownership on performance.

It can be observed that existing studies linking digital payments and bank performance (Kasri et al., 2022; Kimonye & Muchelule, 2024; Alfawareh et al., 2025; Arilesere et al., 2021; Alzoubi & Ghazal, 2022; Theiri & Hadoussa, 2024; Ibrahim et al., 2021; Mohammed et al., 2022; Dong et al., 2020; Ekpo et al., 2023) predominantly rely on mean-based estimators such as ARDL, VECM, GLS, ECM, and dynamic panel models. While these approaches identify average effects, they overlook potential distributional differences across banks with varying performance levels. In particular, no study has investigated the *asymmetric effects* of digital payment channels on banks that perform at lower, median, or higher quantiles of profitability and stability. This omission is critical, as digital innovations may disproportionately benefit stronger banks while imposing adjustment costs on weaker ones. To bridge this gap, the present study employs a quantile regression framework, which captures heterogeneous impacts across the performance distribution and provides deeper insights into the role of digital payments in shaping banking outcomes.

3. Methodology and Data

Conventional regression techniques, such as pooled OLS or fixed-effects models, estimate the average effect of digital payment systems (DPS) on bank performance. While informative, these approaches implicitly assume that the effect of DPS is homogeneous across all banks and along the entire distribution of performance outcomes. However, the Nigerian banking sector is characterised by substantial heterogeneity, with large and more technologically advanced banks responding differently to digital transformation compared to smaller or less efficient banks. Average-effect models risk masking these differences. Quantile regression offers a more flexible framework by allowing the estimation of conditional effects at different points (quantiles) of the dependent variable distribution, such as the lower (25th), median (50th), and upper (75th) quantiles. This is particularly relevant for banking performance indicators, which may respond differently to digitalisation depending on whether a bank is underperforming, average-performing, or highly profitable. For example, mobile banking may contribute little to weak banks but strongly enhance profitability among top performers. For bank i at time t , the conditional τ^{th} quantile of the performance indicator Y_{it} is:

$$Q(Y_{it}|X_{it}) = \alpha\tau + \beta_{1,\tau}ATMit + \beta_{1,\tau}Mobile_{it} + \beta_{1,\tau}POS_{it} + \beta_{1,\tau}Website_{it} + \mu_i + \varepsilon_{it,\tau}$$

Where is the conditional τ^{th} quantile of the dependent variable (Profit, ROA, or ROE), ATM, Mobile, POS, and Website are the digital payment system variables. α_τ is the intercept at quantile τ , β_j , is the quantile-specific slope parameters, μ_i is the unobserved bank-specific effect, and $\varepsilon_{it,\tau}$ is the quantile-specific error term. However, the specific models for the study are:

i. Profit Model:

$$Q(Profit_{it}) = \alpha_\tau + \beta_{1,\tau}ATM_{it} + \beta_{1,\tau}Mobile_{it} + \beta_{1,\tau}POS_{it} + \beta_{1,\tau}Website_{it} + \mu_i + \varepsilon_{it,\tau}$$

ii. ROA Model:

$$Q(ROA_{it}) = \alpha_\tau + \beta_{1,\tau}ATM_{it} + \beta_{1,\tau}Mobile_{it} + \beta_{1,\tau}POS_{it} + \beta_{1,\tau}Website_{it} + \mu_i + \varepsilon_{it,\tau}$$

iii. ROE model:

$$Q(ROE_{it}) = \alpha_\tau + \beta_{1,\tau}ATM_{it} + \beta_{1,\tau}Mobile_{it} + \beta_{1,\tau}POS_{it} + \beta_{1,\tau}Website_{it} + \mu_i + \varepsilon_{it,\tau}$$

By not relying on mean assumptions, the quantile regression models in the study provide a more comprehensive and nuanced analysis of how digital payment systems affect different segments of banks in Nigeria.

The estimation of the models relies on a balanced panel dataset of five Nigerian banks: Access Bank, Guaranty Trust Bank (GTB), Sterling Bank, United Bank for Africa (UBA), and Zenith Bank, covering the period 2009 to 2022. These banks were purposively selected because they represent a mix of large, systemically important banks and mid-sized banks, thereby capturing the heterogeneity of the Nigerian banking sector in terms of market share, digital adoption, and performance outcomes. Their inclusion also reflects data availability and consistency across the study period. The banking performance indicators, i.e., profit, return on assets (ROA), and return on equity (ROE), were obtained from the annual financial reports of the selected banks. Data on digital payment system variables, i.e., automated teller machines (ATM), mobile banking, point-of-sale (POS) terminals, and website transactions, were sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin.

4. Result and Discussion

Table 1: Descriptive statistics			Variable	
Mean	Std. Dev.		Max	Min
Profit	0.067	0.061	0.233	-0.007
ROA	0.029	0.064	0.540	-0.032
ROE	0.178	0.178	1.000	-0.301
ATM	0.725	0.559	1.914	0.060
Mobile	0.295	0.517	1.861	0.001
POS	0.593	1.156	3.886	0.001
Website	2.221	4.483	14.064	0.002

Source: Author's computation.

Table 1 presents the descriptive statistics of the variables used in the study, showing the average performance levels and the dispersion of values across the selected banks. The profit ratio has a mean value of 0.067 with a standard deviation of 0.061, suggesting that, on average, banks generated a modest level of profit, but with moderate variation across institutions. The maximum profit recorded was 0.233, while the minimum was slightly negative (-0.007), indicating that although most banks were profitable, a few experienced marginal losses during the study period. Return on assets (ROA) has a mean of 0.029, reflecting relatively low asset utilisation efficiency among Nigerian banks, with a high maximum of 0.540 and a minimum of -0.032, suggesting that while some banks effectively converted assets into earnings, others struggled with losses. Similarly, return on equity (ROE) averages 0.178, showing moderate shareholder returns, but the wide standard deviation of 0.178 and range from -0.301 to 1.000 points to sharp disparities in performance, with some banks creating strong shareholder value while others eroded equity. In terms of digital payment channels, automated teller machines (ATM) usage averages 0.725, with moderate variation (std. dev. 0.559) across banks, a maximum of 1.914, and a minimum of 0.060, indicating that ATM deployment remains a key but unevenly distributed digital channel. Mobile banking transactions have a mean of 0.295 and a relatively high dispersion (std. dev. 0.517), with some banks recording very high adoption (maximum 1.861) while others had negligible activity (minimum 0.001). Point-of-sale (POS) transactions exhibit a mean of 0.593 but a very large standard deviation of 1.156, underscoring substantial variability in adoption, as some banks achieved high penetration (maximum 3.886) while others recorded extremely low activity (minimum 0.001). Finally, website-based transactions show the highest mean value of 2.221, but with very high variability (std. dev. 4.483), reflecting that while some banks heavily invested in web-based platforms (maximum .064), others had only a minimal presence (minimum 0.002).

Table 2 presents the pairwise correlation results among the variables, with particular emphasis on the relationship between digital payment channels and bank performance indices. The results indicate that ATMs are positively correlated with profit (0.460), ROA (0.176), and ROE (0.341). This suggests that greater ATM penetration is associated with improved bank performance, particularly in terms of profitability and equity returns, highlighting the continuing relevance of ATMs as a widely adopted channel in Nigeria.

Table 2: Pairwise correlation

Variable		Correlation	coefficient
Profit	1		
ROA	0.178	1	

ROE	0.213	0.385	1			
ATM	0.460	0.176	0.341	1		
Mobile	0.390	0.340	0.443	0.782	1	
POS	0.339	0.322	0.466	0.706	0.943	1
Website	0.338	0.293	0.430	0.802	0.957	0.963

Source: Author's computation.

Similarly, mobile banking shows a positive and relatively strong correlation with profit (0.390), ROA (0.340), and ROE (0.443), indicating that increased adoption of mobile platforms significantly enhances efficiency and returns. This finding underscores the role of mobile banking as a key driver of performance, given its growing accessibility and convenience for customers. Point-of-sale (POS) transactions also exhibit positive correlations with profit (0.339), ROA (0.322), and ROE (0.466). These coefficients are moderately strong, especially for ROE, suggesting that POS usage contributes to greater value creation for shareholders. This aligns with the growing reliance on POS terminals for everyday retail payments, which strengthens transaction volumes and non-interest income. Likewise, website-based transactions display positive associations with profit (0.338), ROA (0.293), and ROE (0.430). Although the correlations with performance indices are slightly weaker compared to mobile and POS channels, the strong intercorrelations between website usage and other digital channels (e.g., 0.957 with mobile and 0.963 with POS) indicate that website platforms serve as complementary digital infrastructures, reinforcing the broader ecosystem of electronic banking services.

Table 3: POLS estimates for DPS-Banking Performance models Independent

variable	Dependent variable		
	Profit	ROA	ROE
ATM	0.759***	0.232	0.428**
	(0.154)	(0.267)	(0.202)
Mobile	0.786**	0.345	0.503
	(0.327)	(0.566)	(0.428)
POS	0.801**	0.638	0.994**
	(0.357)	(0.619)	(0.468)
Website	-1.503***	-0.992	-1.341**

	(0.398)	(0.690)	(0.522)
Intercept	0.177***	0.454***	0.351***
	(0.046)	(0.081)	(0.061)
R-squared	0.524	0.037	0.228
F-Stat	17.92***	0.621	4.811***
Observations	70	70	70

Source: Author's computation.

Note: *** $p < 1\%$, ** $p < 5\%$, * $p < 10\%$.

Table 3 reports the pooled ordinary least squares (OLS) estimates of the relationship between digital payment systems (DPS) and bank performance indicators (profit, ROA, and ROE). The results reveal that ATM usage exerts a strong and statistically significant positive effect on profit (0.759, $p < 0.01$) and ROE (0.428, $p < 0.05$), similar to the findings of Arilesere et al. (2021) and Kimonye and Muchelule (2024); though its effect on ROA (0.232) is positive but not statistically significant, as also found in Ekpo et al. (2023). This suggests that greater ATM deployment enhances overall profitability and shareholder value but does not necessarily translate into higher efficiency in asset utilisation. Similarly, mobile banking has a positive and significant impact on profit (0.786, $p < 0.05$), indicating that mobile platforms contribute substantially to banks' bottom-line earnings. This result supports the findings of Shanmugam and Nigam (2020), Arilesere et al. (2021), and Mohammed et al. (2022). However, its effects on ROA (0.345) and ROE (0.503) are positive but statistically insignificant, implying that while mobile banking boosts income generation, its contribution to efficiency and shareholder value remains less robust in the Nigerian banking context. This result corroborates the study of Ekpo et al. (2023), who found a positive, insignificant effect of POS on performance.

For POS transactions, the results show a positive and significant effect on both profit (0.801, $p < 0.05$) and ROE (0.994, $p < 0.05$), similar to Theiri and Hadoussa (2024), while the coefficient for ROA (0.638) is positive but not significant. This indicates that POS adoption is particularly beneficial for profitability and shareholder returns, likely reflecting the surge in transaction volumes and commissions derived from retail payment channels. This result is, however, contrary to the studies of Shanmugam and Nigam (2020), Mohammed et al. (2022), and Theiri and Hadoussa (2024), who found a positive and significant effect of POS on banks' ROA. Interestingly, website-based transactions exhibit negative and statistically significant coefficients across profit (-1.503, $p < 0.01$) and ROE (-1.341, $p < 0.05$), with an insignificant negative effect on ROA (-0.992). This counterintuitive result suggests that increased reliance on website platforms may undermine profitability and shareholder value. Possible explanations include high maintenance and security costs, limited customer preference for web-based platforms compared to mobile channels, or inefficiencies in digital infrastructure. Although with insignificant effect, a study by Ekpo et al. (2023) also found that web-based payments reduced performance.

Table 4: Quantile regression estimates for the profit model

Independent variable	Dependent variable: Profit		
	25% (Lower)	50% (Median)	75% (Upper)
ATM	0.851*** (0.235)	0.809*** (0.174)	0.728*** (0.165)
M obile	0.349 (0.460)	0.215 (0.341)	0.926*** (0.322)
POS	0.849 (0.538)	1.341*** (0.399)	1.144*** (0.377)
W ebsite	-1.365** (0.643)	-1.576*** (0.477)	-1.861*** (0.451)
Intercept	-0.380*** (0.120)	0.028 (0.089)	0.381*** (0.084)
Observation	70	70	70

Source: Author's computation.

Note: *** p < 1%, ** p < 5%, * p < 10%.

Table 4 presents the quantile regression estimates of the effects of digital payment systems (DPS) on bank profit at the 25th, 50th, and 75th percentiles, offering insights beyond the mean effects reported in the POLS model. The results reveal important heterogeneities across the profit distribution of Nigerian banks. For ATMs, the coefficients remain consistently positive and highly significant across all quantiles: 0.851 ($p < 0.01$) at the 25th percentile, 0.809 ($p < 0.01$) at the median, and 0.728 ($p < 0.01$) at the 75th percentile. This indicates that ATM usage boosts profitability across all banks, regardless of their position in the profit distribution, though the magnitude of impact declines slightly at higher quantiles. In other words, ATMs appear especially vital for banks at the lower end of profitability, where they provide a stronger relative performance advantage.

Mobile banking shows heterogeneous effects. The coefficients are positive but insignificant at the lower (0.349) and median (0.215) quantiles, becoming large, positive, and highly significant (0.926, $p < 0.01$) at the 75th percentile. This suggests that mobile banking contributes little to profitability among weaker or median-performing banks but plays a transformative role for top-performing banks. High-profit banks may be better positioned to leverage mobile platforms through advanced technology, wider customer adoption, and economies of scale. POS transactions also exhibit varying effects across quantiles. The coefficient is positive but insignificant at the 25th percentile (0.849), becomes large and highly significant at the median (1.341, $p < 0.01$), and remains strongly significant at the upper quartile (1.144, $p < 0.01$). This implies that POS adoption contributes most significantly to banks in the middle and upper segments of profitability, reflecting its role in consolidating growth among already competitive banks. In contrast, website-based transactions consistently exert negative and statistically significant effects across all quantiles. The adverse effects are recorded at -1.365 ($p < 0.05$) in the lower quartile, -1.576 ($p < 0.01$) at the median, and -1.861 ($p < 0.01$) in the upper quartile. This indicates that website reliance undermines profitability across the profit distribution, with stronger negative impacts at higher profit levels. These results may reflect the cost-intensive and less customer-preferred nature of web-based platforms compared to mobile and POS channels.

Table 5: Quantile regression estimates for the ROA model

Independent variable	Dependent variable: ROA		
	25% (Lower)	50% (Median)	75% (Upper)
ATM	0.463 (0.290) (0.566)	0.028 (0.189) (0.371) M obile	-0.107 (0.369) (0.725)
POS	0.575 (0.662)	0.342 (0.432)	0.523 (0.848)
W ebsite	-0.958 (0.792)	-0.497 (0.516)	-1.104 (1.014)
Intercept	-0.400*** (0.148)	-0.020 (0.096)	0.408** (0.189)
Observation	70	70	70

Source: Author's computation.

Note: *** $p < 1\%$, ** $p < 5\%$, * $p < 10\%$.

Table 5 presents the quantile regression estimates of the impact of digital payment systems (DPS) on return on assets (ROA), providing insights into how digitalisation affects bank efficiency across different performance levels. Unlike the profit model, the results for ROA reveal weaker and largely insignificant effects, suggesting that digital channels may not strongly enhance asset utilisation efficiency in Nigerian banks. For ATMs, the coefficients are positive at the lower quartile (0.463) and near zero at the median (0.028), but turn negative (-0.107) at the upper quartile. None of these estimates is statistically significant, indicating that ATM expansion does not substantially improve efficiency in terms of ROA. The declining magnitude across quantiles suggests that while ATMs may provide some marginal benefits to banks with low efficiency, their contribution diminishes for stronger performers. Mobile banking exhibits heterogeneous effects across quantiles. The coefficient is negative at the lower quartile (-0.127), positive but small at the median (0.076), and large and positive (0.584) at the upper quartile. Although statistically insignificant across all quantiles, this pattern suggests that mobile banking may enhance efficiency only for high-performing banks, which are better able to integrate mobile platforms into productive asset utilisation. In contrast, for weaker banks, mobile adoption might impose costs that offset efficiency gains.

POS transactions display positive coefficients at all quantiles, 0.575, 0.342, and 0.523 for the lower, median, and upper quartiles, respectively, yet none are statistically significant. This suggests that while POS usage contributes positively to asset efficiency in general, the effects are not strong enough to yield measurable gains across the ROA distribution. The consistently positive signs, however, imply a potential latent role for POS systems in improving bank efficiency if adoption deepens further. Also, Website-based transactions record uniformly negative coefficients across the quantiles (-0.958, -0.497, and -1.104). Although statistically insignificant, the magnitude of these effects, especially at the upper quartile, suggests that reliance on website

platforms may reduce efficiency, likely due to high infrastructure and maintenance costs relative to returns.

Table 6: Quantile regression estimates for the ROE model

Independent variable	Dependent variable: ROE		
	25% (Lower)	50% (Median)	75% (Upper)
ATM	0.531*	0.293	0.491
	(0.280)	(0.245)	(0.298)
M obile	0.400	0.451	-0.320
	(0.547)	(0.479)	(0.583)
POS	0.727	0.725	2.068***
	(0.640)	(0.560)	(0.681)
W ebsite	-1.226	-1.148*	-1.473*
	(0.765)	(0.670)	(0.814)
Intercept	-0.442***	-0.024	0.569***
	(0.143)	(0.125)	(0.152)
Observation	70	70	70

Source: Author's computation.

Note: *** $p < 1\%$, ** $p < 5\%$, * $p < 10\%$.

Table 6 reports the quantile regression estimates of the effects of digital payment systems (DPS) on return on equity (ROE), shedding light on how digitalisation influences shareholder value across banks with different levels of equity returns. The results reveal both heterogeneous and channel-specific effects, with notable differences between weaker, median, and stronger-performing banks. For ATMs, the coefficients are positive across all quantiles: 0.531 ($p < 0.10$) at the lower quartile, 0.293 at the median, and 0.491 at the upper quartile. The effect is statistically significant only at the 25th percentile, suggesting that ATM adoption plays a more critical role in boosting equity returns among banks with weaker performance. For better-performing banks, the effect of ATMs on shareholder value is positive but less pronounced, possibly because ATMs have become a mature channel with diminishing marginal returns. Also, mobile banking yields mixed effects. The coefficients are positive at the 25th (0.400) and 50th (0.451) percentiles, but negative at the upper quartile (-0.320). None of these results is statistically significant, implying that mobile platforms do not consistently enhance shareholder value. The negative effect at the upper quartile suggests that for high-performing banks, mobile adoption may involve higher operational costs or competitive pressures that dilute returns to equity holders.

POS transactions show strong and increasingly positive effects across quantiles. While the coefficients are positive but insignificant at the lower (0.727) and median (0.725) quantiles, POS adoption exerts a large and highly significant effect (2.068, $p < 0.01$) at the 75th percentile. This result implies that POS platforms are particularly beneficial for top-performing banks, enabling them to translate transaction volumes into substantial shareholder returns. This finding aligns with the rapid expansion of POS usage in Nigeria, which strengthens non-interest income streams for larger, more competitive banks. By contrast, website-based transactions consistently exert negative

effects on ROE across all quantiles, with coefficients of -1.226, 1.148 ($p < 0.10$), and -1.473 ($p < 0.10$) at the lower, median, and upper quantiles, respectively. These findings suggest that reliance on web-based platforms reduces shareholder value, particularly for median and top-performing banks, where the negative effects are statistically significant. This likely reflects the relatively high costs of maintaining web platforms compared to mobile and POS channels, combined with shifting customer preferences away from websites toward more flexible and user-friendly digital alternatives.

5. Conclusion

This study examined the impact of digital payment systems (DPS) on bank performance in Nigeria using quantile regression to capture heterogeneities across the performance distribution. The findings reveal that digital channels exert asymmetric effects on profitability (Profit), efficiency (ROA), and shareholder value (ROE). Specifically, ATMs consistently enhanced profitability across all quantiles, with stronger effects for weaker banks, though their contribution to efficiency was negligible. Mobile banking showed significant profitability gains for top-performing banks but produced inconsistent effects on efficiency and equity returns, reflecting challenges of cost structures and uneven adoption. POS platforms emerged as the most robust driver of performance, significantly boosting profitability at the median and upper quantiles and producing large, positive effects on shareholder value among high-performing banks. By contrast, website-based platforms were uniformly detrimental across all models, significantly reducing profitability and equity returns while exerting negative effects on efficiency. First, banks should prioritise investment in mobile and POS platforms, which have the greatest potential to enhance profitability and shareholder value, especially among stronger performers. Second, policymakers and regulators should provide support for smaller banks to scale up their digital infrastructures, particularly ATMs and mobile platforms, to prevent widening performance gaps in the sector. Third, attention must be given to the inefficiencies of website platforms, with banks encouraged to integrate them with mobile and app-based services or streamline their cost structures. Finally, the Central Bank of Nigeria should strengthen its digital payment policies to ensure interoperability, security, and wider adoption, thereby fostering a more inclusive and efficient digital financial ecosystem.

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