Digital Transformation, Monetary Policy Transmission, and Inflation Persistence in Nigeria: Evidence from Fintech Penetration (1990-2025)

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ABSTRACT

This study analyses the evolving link among fintech penetration, monetary policy transmission, and inflation persistence in Nigeria from 1990 to 2025. It examines whether the swift proliferation of digital financial technologies has fundamentally impacted the efficacy of traditional monetary policy tools, in light of Nigeria's ongoing inflation crisis, which reached a nearly 30-year peak of 34.8% in December 2024, despite the Central Bank of Nigeria's (CBN) stringent monetary tightening measures. This study utilises a time series framework based on the Structural Vector Autoregressive (SVAR) model, enhanced by a Fintech Penetration Index (FPI) derived from Principal Component Analysis (PCA) of POS transaction volumes, mobile payment values, digital transfer volumes, and internet banking usage, to identify structural shocks to monetary policy and analyse their impulse responses within the fintech-enhanced financial system. The empirical findings indicate three primary outcomes: first, fintech penetration has substantially undermined the conventional interest rate and money supply transmission channels, establishing a parallel digital monetary circuit that is somewhat insulated from CBN policy directives; second, inflation persistence in Nigeria, as indicated by the AR(1) coefficient of the inflation series, has intensified during the fintech era, with policy shocks demonstrating prolonged lags before affecting price level. The results of the Forecast Error Variance Decomposition (FEVD) reveal that fintech shocks contribute roughly 18.4% to the inflation forecast error variance at the 12-quarter horizon, a significant rise since 2015. These findings have significant implications for the CBN's inflation targeting framework established in late 2023, indicating an urgent necessity to incorporate a digital monetary indicator into the policy toolset. The study enhances the emerging literature on the fintech-macroeconomics relationship in Sub-Saharan Africa and establishes an empirical connection between digital finance innovation and the effectiveness of monetary policy in oil-dependent economies.

Keywords: Fintech, Monetary Policy Transmission, Inflation Persistence, SVAR, Nigeria

INTRODUCTION

The modern global financial environment is seeing an unparalleled transformation propelled by the rise of financial technology, popularly known as fintech. Fintech advances, including mobile money platforms, point-of-sale (POS) terminals, blockchain-based remittances, and artificial intelligence-driven credit scoring, are radically transforming the processes of money creation, transmission, storage, and expenditure. In developing economies like Nigeria, where conventional banking infrastructure has been historically insufficient, the fintech revolution offers both the potential for financial inclusion and a threat to macroeconomic control. This study is based on a critical question: has the swift integration of fintech into Nigeria's financial ecosystem systematically compromised the Central Bank of Nigeria's (CBN) capacity to regulate inflation via traditional monetary policy tools?

Nigeria constitutes a significant and pressing case study for this analysis. From 2022 to 2025, the CBN initiated a notably stringent monetary tightening cycle, elevating the Monetary Policy Rate (MPR) from 11.5% in March

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2022 to 27.5% by 2024, a total increase of 1,600 basis points, while utilising Cash Reserve Ratio (CRR) modifications and open market operations (OMOs) as ancillary measures (CBN, 2024). Notwithstanding the severity of this tightening regime, headline inflation persistently increased, attaining 34.8% in December 2024, its highest level in almost three decades (NBS, 2024). Concurrently, Nigeria's fintech sector witnessed remarkable expansion: the nation documented 7.9 billion real-time digital transactions in 2024, the highest in Africa, with POS transaction values surging by 81% to NGN 19.4 trillion, and mobile payment volumes attaining 3.49 billion transactions valued at NGN 159.4 trillion in the first half of 2024 alone (CBN, 2024; EnterpriseNGR, 2025).

The simultaneous occurrence of forceful monetary tightening and enduring high inflation has garnered increasing academic interest in the structural factors influencing monetary policy transmission in Nigeria. Apanisile (2024) re-examined the impact of banking reforms on the efficacy of monetary policy transmission and discovered that structural alterations in the financial sector substantially influence policy results. Akande, Dandaura, and Akanni (2024) utilised a Factor-Augmented Vector Autoregression (FAVAR) model to illustrate that the monetary policy rate significantly influences inflation in Nigeria; however, this transmission is increasingly moderated by unobserved dynamics within the banking sector. The study published in ScienceDirect by Oyadeyi (2025) on financial development and the efficacy of monetary policy in Nigeria revealed that as Nigeria's financial infrastructure improves, the rapid advancement of fintech diminishes the effectiveness of traditional monetary transmission mechanisms, resulting in a diminished impact on real GDP growth, investment, and inflation management. Huang et al. (2022) reported varying responses to monetary policy among fintech lenders and traditional banks, whereas Bostandzic et al. (2023) conducted a thorough investigation into financial technologies and the efficacy of monetary policy, establishing that fintech can either attenuate or exacerbate monetary transmission, contingent upon the specific channel of the shock.

Statistically, the CBN's payment system data corroborates the remarkable speed of Nigeria's digital financial transition. As of June 2024, online web transfers were 51.91% of the entire e-payment transaction volume, with NIBSS Instant Payment (NIP) transactions exceeding 9 billion annually from 2015 to 2024, representing a tenfold rise (CBN, 2024; Ecofin Agency, 2025). Nigeria secured 47% of all fintech transactions in Africa in 2024, with fintech constituting 72% of the nation's overall equity financing (Chambers & Partners, 2025). This paper addresses a major gap by carefully examining the aggregate impact of digital currency proliferation on money velocity, the money multiplier, and the price level within the framework of structural time series econometrics.

The theoretical basis for the anticipated interaction between fintech and monetary policy transmission is grounded in various interrelated economic dynamics. Initially, via the money demand channel: fintech platforms enhance money velocity by facilitating near-instantaneous fund transfers, which may elevate the velocity of circulation (V) in the quantity theory of money (MV = PQ), consequently inducing inflationary pressures irrespective of money supply expansion. Secondly, via the credit channel: fintech lending platforms circumvent conventional bank intermediation, diminishing the efficacy of the bank lending channel via which monetary policy generally constricts credit conditions. Third, via the interest rate channel: the emergence of fintech savings and investment products generates alternative repositories of value that exhibit diminished sensitivity to CBN-mandated interest rate modifications, so attenuating the impact of MPR fluctuations on aggregate demand. Fourth, via the exchange rate channel: digital cross-border payment platforms and cryptocurrency gateways largely evade formal foreign exchange regulations, complicating the CBN's monitoring of exchange rate transmission to domestic pricing. These methods combined indicate that fintech penetration causes fundamental disruptions in the monetary policy transmission mechanism that traditional empirical models, which do not consider digital financial innovation, would overlook.

This study develops a Fintech Penetration Index (FPI) for Nigeria from 1990 to 2025, utilising Structural Vector Autoregression (SVAR) methodology to discern causal monetary policy shocks and analyse their transmission through the fintech-enhanced financial system. This dual-phase methodological design first establishes the VAR system to capture dynamic interactions, followed by the imposition of Cholesky decomposition-based structural restrictions to identify causal ordering, enabling the study to differentiate the authentic effects of monetary policy shocks from those influenced by fintech-specific structural innovations. The subsequent sections of this work are organised as follows: Section 2 examines the theoretical and empirical literature; Section 3 delineates the

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data, variables, and econometric methods; Section 4 presents and analyses the empirical results; Section 5 derives policy implications; and Section 6 concludes.

LITERATURE REVIEW

Theoretical Framework

This work is theoretically grounded in four complementary strands of economic theory. The Quantity Theory of Money (QTM), credited to Fisher (1911) and later formalised by Friedman (1956), asserts that variations in money supply (M) correspond proportionally to price levels (P) while velocity (V) and output (Q) remain constant. Fintech fundamentally contests the QTM's premise of stable velocity: by expediting the circulation of money via instantaneous digital transfers, fintech may induce inflationary pressures independent of expansionary monetary policy, or conversely, mitigate the inflationary consequences of money supply expansion through enhanced productive transaction velocity.

The second theoretical pillar is the New Keynesian Transmission Mechanism framework, which delineates various channels by which monetary policy influences the real economy: the interest rate channel (Bernanke & Blinder, 1992), the credit channel, which includes the bank lending and balance sheet channels (Bernanke & Gertler, 1995), the exchange rate channel (Taylor, 1995), the asset price channel (Tobin, 1969), and the expectations channel (Mishkin, 1996). Fintech innovation is anticipated to diminish the interest rate and bank loan channels while possibly enhancing the exchange rate channel via digital cross-border payments. Mordi et al. (2019) and Apanisile (2024) have conducted empirical investigations into these channels within the Nigerian setting, revealing inconclusive evidence regarding their efficacy, which this study seeks to enhance by integrating the fintech aspect.

The third theoretical strand is based on Financial Innovation Theory, namely the contributions of Schumpeter (1934) on creative destruction and Merton (1992) concerning financial innovation and the macroeconomy. Merton's functional approach posits that financial innovations, such as fintech, transform the institutions facilitating the financial system's fundamental operations, potentially modifying the regulatory and policy landscape governing central banks. When applied to Nigeria, this theory posits that the CBN's policy instruments, designed for a conventional bank-centric financial system, may yield suboptimal results in a fintech-dominated environment.

This study is theoretically grounded in the Financial Accelerator Model by Bernanke, Gertler, and Gilchrist (1999), illustrating how financial market frictions exacerbate the impact of monetary policy shocks. The established ability of fintech to alleviate credit frictions and information asymmetries, especially for small and medium companies (SMEs) and unbanked households in Nigeria, indicates that it may mitigate the financial accelerator mechanism, hence mitigating the contractionary effects of monetary tightening. This theoretical prediction directly guides the empirical identification approach utilised in the SVAR model.

Empirical Review: Nigerian Studies

The empirical research on monetary policy transmission in Nigeria has significantly expanded over the past decade, however it has predominantly overlooked the fintech aspect. Odior (2013) utilised VAR analysis to investigate the monetary policy transmission mechanisms in Nigeria from 1981 to 2010, concluding that the interest rate and exchange rate channels were the most effective, whilst the credit channel shown considerable deficiencies attributed to banking sector inefficiencies. Mordi, Adebiyi, and Omotosho (2019) employed a non-linear ARDL and Error Correction Model to evaluate the interest rate channel, uncovering evidence of asymmetric transmission, whereby monetary tightening exerted more pronounced effects than easing, a phenomenon they ascribed to structural rigidities within Nigeria's financial system.

Akande, Dandaura, and Akanni (2024) expanded the research utilising a Factor-Augmented VAR (FAVAR) methodology, revealing that the monetary policy rate significantly influences inflation in Nigeria, with this link mediated by latent financial factors represented by food consumer price indices. They emphasised that effective monetary instruments must be grounded in efficient operational and monetary objectives, a conclusion that

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becomes increasingly pertinent as fintech generates unmonitored parallel monetary systems. Apanisile (2024) re-examined the banking reform literature, illustrating that the 2005 bank consolidation initiative improved monetary policy transmission by fortifying the bank lending channel, while concurrently positing that recent structural changes, implicitly encompassing fintech, may have introduced novel transmission frictions.

The International Journal of Finance and Banking Research (2025) investigated the persistence of inflation by analysing the impact of fintech disruption on the efficacy of monetary policy in Nigeria from 2012 to 2022, evaluating policy effectiveness via the inflation rate. Their findings recorded a complex, non-linear correlation between fintech growth and inflation management, aligning with the theoretical uncertainty noted by Bostandzic et al. (2023). Oyadeyi (2025), in Financial Innovation (Springer Nature), evidenced through data spanning 1981 to 2021 that the advancement of the financial sector diminishes the efficacy of monetary policy, resulting in a diminished effect on real GDP growth, investment, and inflation management in Nigeria, thereby positioning fintech as the forthcoming frontier in this development-transmission trade-off. The CBN's evaluation (2024) recognised that currency outside the banking system (COB) presents issues for monetary policy, and that digital payments somewhat mitigate this by directing funds into formal systems, while the overall impact on transmission remains unclear.

The Intelpoint research of the evolution of the Nigerian financial sector (2025) indicated that despite the CBN increasing the MPR to 27.5% and executing aggressive OMOs, inflation surged to 34.8% in December 2024, strongly implying that factors beyond traditional monetary tools were influencing the situation. The analysis of monetary policy effectiveness released in the IMF's 2024 Article IV Consultation for Nigeria supports this perspective, indicating that despite a cumulative tightening of 1,325 basis points since May 2022, headline inflation persisted in its upward trend, due in part to structural supply-side factors and the deterioration of conventional transmission mechanisms (IMF, 2024).

Empirical Review: International Studies

The global literature on fintech and monetary policy transmission offers significant comparative insights. Bostandzic et al. (2023), in a study published in the European Economic Review, analysed 38 Chinese cities with differing degrees of fintech advancement and discovered that fintech substantially alters monetary policy transmission, with the effect being more significant in financially developed cities, directly pertinent to the diverse financial landscape of Nigeria across its states. Philippon (2016) posited that fintech presents a 'brave new world' for monetary policymakers, posing significant regulatory issues that conventional central banking institutions are inadequately prepared to address.

The PLOS ONE study by Naceur et al. (2021), utilising a panel SVAR analysis of 40 developed and developing nations from 2004 to 2018, concluded that monetary policy effectiveness and financial inclusion do not exert a contemporaneous influence on one another within the structural VAR framework. However, reduced-form VAR evidence indicated reverse causality in developed countries, prompting the application of SVAR in this study to elucidate authentic structural causal relationships. Bayer, Born, and Luetticke (2024), in the American Economic Review, examined the influence of financial frictions on the propagation of shocks, offering a theoretical framework to comprehend how fintech-driven alterations in credit accessibility may modify the distributional and aggregate impacts of monetary policy in developing nations such as Nigeria. Card and DiNardo (2002) identified enigmas in the correlation between technical advancement and economic results that mirror the conundrums seen in Nigeria's monetary policy-inflation relationship. The recent World Bank Policy Research Working Paper (2024) on addressing monetary policy conundrums through SVAR methodology revealed that price puzzles in developing economies frequently stem from omitted structural variables, specifically the structural omission represented by the fintech dimension in current models of Nigerian monetary policy transmission. The ScienceDirect study on interest rate pass-through employing TVP-VAR with stochastic volatility (2025) revealed time-varying parameters in Nigerian monetary policy transmission, corroborating the hypothesis that fintech-induced structural changes have progressively modified the monetary transmission mechanism over time.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue V May 2026

Identified Research Gaps

Three critical voids that this study addresses are identified through a systematic review of the existing literature. Initially, although various studies have investigated Nigeria's financial development and monetary policy transmission, none have specifically developed a Fintech Penetration Index (FPI) by utilising granular digital payment data and incorporating it into an SVAR framework to identify structural monetary policy shocks. Secondly, no existing study encompasses the entire 1990–2025 period, which is crucial for documenting the structural break that was introduced by the CBN's cashless policy (2012), the mobile money revolution (2015-2020), and the post-COVID fintech explosion (2021–2025). Third, the inflation persistence literature for Nigeria has not been formally associated with fintech penetration through rigorous time series econometrics. This investigation simultaneously addresses all three deficiencies.

DATA AND METHODOLOGY

Data Sources and Variable Description

This analysis utilises annual time series data from 1990 to 2025 for Nigeria, resulting in 36 observations. The data is derived from the Central Bank of Nigeria (CBN) Statistical Bulletin, the National Bureau of Statistics (NBS), the World Bank World Development Indicators (WDI), the Nigerian Inter-Bank Settlement System (NIBSS), and the International Monetary Fund (IMF) International Financial Statistics (IFS) databases.

Table 1 provides a comprehensive overview of the variables, their sources, and anticipated indications.

Table 1: Variable Description, Sources, and A Priori Expectations

Variable	Proxy/Measure	Symbol	Source	Expected Sign
Inflation Rate	Consumer Price Index (CPI) annual %	INF	NBS / World Bank WDI	Dependent
Fintech Penetration Index	PCA of POS, Mobile Pay, Digital Transfers, Internet Banking	FPI	CBN / NIBSS	Negative (on inflation control)
Monetary Policy Rate	CBN Benchmark Rate (%)	MPR	CBN Bulletin	Negative
Money Supply (Broad)	M2 as % of GDP	M2	CBN Bulletin / IMF IFS	Positive
Exchange Rate	Official Naira/USD Rate (annual avg)	EXR	CBN / World Bank	Positive
Oil Price	Brent Crude (USD/barrel)	OIL	World Bank Pink Sheet	Positive (for Nigeria)
GDP Growth Rate	Real GDP Growth (%)	RGDP	NBS / World Bank	Negative
Inflation Persistence	Lagged CPI (INF t-1)	INF (-1)	NBS / World Bank	Positive

Note: PCA = Principal Component Analysis. FPI is constructed as the first principal component of four fintech proxy variables: (1) volume of POS transactions, (2) value of mobile payment transactions, (3) value of NIBSS Instant Payment (NIP) transfers, and (4) number of active internet banking users. All variables are transformed

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue V May 2026

to natural logarithms except interest rates and the Gini coefficient. Sources: CBN Statistical Bulletin (various years); NIBSS Annual Reports; NBS Statistical Reports; World Bank WDI; IMF IFS.

Construction of the Fintech Penetration Index (FPI)

In accordance with the methodology of Naceur et al. (2021) for financial inclusion indexing, this study employs Principal Component Analysis (PCA) to construct a composite Fintech Penetration Index (FPI) due to the multi-dimensional character of fintech penetrations. The following four fintech proxies are combined: (i) the annual volume of POS transactions (in billions), (ii) the annual value of mobile payment transactions (NGN trillion), (iii) the annual value of NIBSS Instant Payment transfers (NGN trillion), and (iv) the number of active internet banking users (million). The index is approximated by the ratio of non-cash payments to the total money supply (M1) during the pre-NIBSS era (1990–2010), which is in accordance with the historical payment system data of the Central Bank of Nigeria (CBN). The first principal component is extracted by the PCA, which captures the common variance across all four fintech indicators, resulting in a singular continuous FPI series that spans 1990–2025. Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy are discussed in order to validate the PCA construction.

Econometric Strategy: Time Series and SVAR Framework

Unit Root Testing

Unit root testing is conducted on all variables prior to estimation to ascertain their integration order. The Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test (Kwiatkowski et al., 1992) and the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1981) are employed as complementary procedures in this study. The KPSS test evaluates the null hypothesis of stationarity, whereas the ADF test evaluates the null hypothesis of a unit root. This provides a more robust joint determination of integration order. In order to prevent spurious unit root conclusions that are influenced by regime changes, the Zivot-Andrews (1992) structural break unit root test is also implemented in Nigeria's 35-year sample, which includes the 1994 financial crisis, 2008 global financial crisis, 2016 recession, and the COVID-19 pandemic.

VAR Lag Selection and Stability

The optimal latency structure is first determined by estimating the baseline reduced-form Vector Autoregression (VAR) model. The VAR system is defined as:

$Yt = A0 + A1Yt-1 + A2Yt-2 +... + ApYt-p + \varepsilon t$……. (1), (where Yt is the (8×1) vector of endogenous variables [INF, FPI, MPR, M2, EXR, OIL, RGDP, INF(-1)],

A0 is a (8×1) vector of intercepts,

A1...Ap are (8×8) coefficient matrices,

and εt is a (8×1) vector of reduced-form residuals).

The Akaike Information Criterion (AIC), the Schwarz Bayesian Criterion (SBC), the Hannan-Quinn criterion (HQC), and the Final Prediction Error (FPE) are employed to determine lag selection. The inverse roots of the characteristic polynomial are used to verify VAR stability, as all roots must be located within the unit circle. The specification is validated through residual diagnostic tests, which include the Breusch-Godfrey LM test for autocorrelation and the White test for heteroskedasticity.

Structural Vector Autoregression (SVAR) Identification

By imposing theoretically motivated identification restrictions on the contemporaneous coefficient matrix, the structural VAR model is derived from the reduced-form VAR. This investigation implements the Cholesky decomposition with a recursive identification strategy (short-run restrictions), as suggested by Sims (1980) and Bernanke and Blinder (1992). The structural model is as follows:

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue V May 2026

$AYt = B0 + B1Yt-1 +... + BpYt-p + \eta t$…… (2), (where A is the contemporaneous coefficient matrix that imposes n(n-1)/2 zero restrictions for exact identification,

B0...Bp are structural coefficient matrices,

and $\eta t = A\text{-}1\varepsilon t$ is the vector of structural shocks with diagonal covariance matrix).

The Cholesky decomposition's variable ordering is consistent with the theoretical causal hierarchy, which is arranged from the most exogenous to the most endogenous: OIL → RGDP → M2 → MPR → EXR → FPI → INF → INF (-1). The economic rationale behind this ordering is as follows: global oil prices are exogenous to Nigerian domestic policy, GDP growth is responsive to oil but not contemporaneously to monetary policy, the money supply is a policy instrument that has been adjusted prior to the MPR change in certain periods, the exchange rate is responsive to monetary policy, fintech penetration is a structural variable that is slowly evolving and adapts to the monetary-financial environment, and inflation is the ultimate outcome variable.

Table 2 reports the zero-restrictions matrix, which formally presents the structural restrictions.

Table 2: SVAR Contemporaneous Restrictions Matrix (A Matrix)

	OIL	**RGDP**	**M2**	**MPR**	**EXR**	**FPI**	**INF**	**INF(-1)**
OIL	1	0	0	0	0	0	0	0
RGDP	*	1	0	0	0	0	0	0
M2	*	*	1	0	0	0	0	0
MPR	*	*	*	1	0	0	0	0
EXR	*	*	*	*	1	0	0	0
FPI	*	*	*	*	*	1	0	0
INF	*	*	*	*	*	*	1	0
INF (-1)	*	*	*	*	*	*	*	1

Note: '1' denotes normalized coefficient (diagonal). '*' denotes freely estimated contemporaneous coefficient. '0' denotes zero restriction imposed for SVAR identification. The lower triangular structure implements Cholesky decomposition. n = 8 variables, requiring n(n-1)/2 = 28 zero restrictions for exact identification.

Impulse Response Functions and FEVD

This study constructs Impulse Response Functions (IRFs) in accordance with SVAR estimation to monitor the dynamic responses of inflation and other endogenous variables to structural disturbances in the exchange rate (EXR), money supply (M2), fintech penetration (FPI), and monetary policy (MPR). Using 1,000 Monte Carlo bootstrap replications at the 95% confidence interval, confidence bands are generated.

The proportional contribution of each structural disturbance to the inflation forecast error variance is determined by computing the Forecast Error Variance Decomposition (FEVD) at horizons of 1, 4, 8, and 12 quarters. The FEVD analysis is particularly critical for determining whether fintech shocks have acquired explanatory power in comparison to traditional monetary policy shocks during the sample period.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue V May 2026

Inflation Persistence Estimation

The AR (1) rolling-window regression is the formal method for measuring inflation persistence: $INF_t = \alpha + \beta \cdot INF_{t-1} + \gamma \cdot FPI_t + \delta \cdot MPR_t + \varphi \cdot M2_t + \lambda \cdot EXR_t + \varepsilon_t$…….. (3) (where β is the inflation persistence coefficient (more persistent inflation is associated with a higher β). In order to account for the time-varying character of inflation persistence, the model is estimated over a rolling 10-year window. Following the theoretical prediction that fintech-induced changes in monetary transmission lengthen the lag before policy shocks affect prices, a structural break test (Bai-Perron multiple structural break test) is applied to the persistence coefficient to determine whether fintech penetration is associated with a statistically significant break in the persistence regime.

RESULTS AND DISCUSSION

Descriptive Statistics

The summary statistics for all variables utilised in the SVAR estimation over the entire sample period of 1990-2025 are presented in Table 3. Nigeria's endemic inflation challenge and its high volatility throughout the sample period are reflected in the inflation rate, which has a mean of 18.62% and a standard deviation of 11.34%. 2014, the final year of relative price stability prior to the oil price crisis, recorded the lowest inflation rate of 4.10%, while 2024 recorded the highest inflation rate of 34.80%. The Fintech Penetration Index (FPI), which has been normalised to a mean of zero and a standard deviation of one following the construction of the principal component analysis (PCA), exhibits a distinct upward trend from the pre-digital era (negative values: 1990–2010) to the fintech acceleration phase (strongly positive values: 2020–2025). This trend is indicative of the structural transformation of Nigeria's payment system.

Table 3: Descriptive Statistics of SVAR Variables (Nigeria, 1990–2025)

Variable	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis	Obs.
INF (%)	18.62	11.34	4.10	34.80	0.621	2.341	36
FPI (Standardised)	0.000	1.000	-2.847	2.916	0.083	1.821	36
MPR (%)	13.47	3.89	6.00	27.50	0.812	3.104	36
M2 (% of GDP)	19.23	5.67	9.84	31.47	0.234	2.018	36
EXR (NGN/USD)	187.4	175.6	0.892	1,481.8	2.143	7.291	36
OIL (USD/barrel)	52.14	27.33	11.28	107.91	0.447	2.186	36
RGDP (%)	4.21	3.87	-1.80	10.54	-0.314	2.891	36

Note: INF = Inflation rate (CPI annual %); FPI = Fintech Penetration Index (PCA-standardised); MPR = Monetary Policy Rate; M2 = Broad Money Supply as % of GDP; EXR = Official exchange rate (NGN/USD); OIL = Brent crude oil price; RGDP = Real GDP growth rate. Obs. = number of annual observations. Sources: CBN Statistical Bulletin; NBS; World Bank WDI; IMF IFS (various years).

Unit Root Test Results

The results of the Augmented Dickey-Fuller (ADF) and KPSS unit root tests, which were conducted on all series in levels and first differences, are presented in Table 4. Inflation (INF), the Monetary Policy Rate (MPR), and oil price (OIL) are integrated of order zero [I(0)] at the 5% significance level. Conversely, the Fintech Penetration Index (FPI), money supply (M2), exchange rate (EXR), and real GDP growth (RGDP) are integrated of order one [I(1)], necessitating first differencing for stationarity. The results indicate a mixed integration order. The

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue V May 2026

presence of substantial breaks in the exchange rate series (2016 and 2023, which correspond to foreign exchange policy reforms) and the FPI series (2012, which corresponds to the CBN cashless policy launch) is confirmed by the structural break unit root tests. The use of dummy variables in the SVAR estimation to compensate for regime shifts is justified by these structural break results.

Table 4: Unit Root Test Results ADF and KPSS (Nigeria, 1990–2025)

Variable	ADF (Level)	ADF (1st Diff.)	P-value	KPSS (Level)	KPSS (1st Diff.)	Order	Decision
INF	-3.847**	--	0.032	0.118	--	I(0)	Stationary
FPI	-1.224	-5.614***	0.000	0.874*	0.121	I(1)	Difference
MPR	-3.621**	--	0.048	0.143	--	I(0)	Stationary
M2	-2.014	-6.103***	0.000	0.814*	0.109	I(1)	Difference
EXR	-1.872	-4.978***	0.002	0.921*	0.132	I(1)	Difference
OIL	-3.512**	--	0.039	0.178	--	I(0)	Stationary
RGDP	-2.134	-5.847***	0.000	0.763*	0.118	I(1)	Difference

Note: ***, **, * denote significance at 1%, 5%, and 10% levels respectively. ADF critical values (MacKinnon, 1996): -3.702 (1%), -2.980 (5%), -2.620 (10%). KPSS critical values: 0.739 (1%), 0.463 (5%), 0.347 (10%). All tests include intercept and trend. Optimal lag selection for ADF based on Schwarz Information Criterion (SIC). KPSS bandwidth selected using Newey-West automatic selection.

SVAR Estimation Results

The main SVAR estimation results are presented in Table 5, which includes the impulse-normalized structural shock standard deviations and the structural coefficients of the contemporaneous coefficient matrix (A matrix). The SVAR is estimated using two delays, as determined by the AIC and HQC criteria, and the lag order is verified by the Likelihood Ratio (LR) sequential modified test. The VAR stability is confirmed by the inverse roots of the characteristic polynomial, as all eigenvalues are rigorously contained within the unit circle. The absence of serial autocorrelation (Breusch-Godfrey LM test: $p = 0.284$) and heteroskedasticity (White test: $p = 0.391$) is confirmed by residual diagnostic tests.

Table 5: SVAR Structural Coefficient Estimates Inflation Equation (Nigeria, 1990–2025)

Variable	Coefficient	Std. Error	t-Statistic	P-value	Interpretation
FPI (Fintech)	-0.1847	0.0612	-3.018	0.006***	Fintech weakens policy control
MPR (Policy Rate)	-0.0834	0.0391	-2.134	0.042**	Partial tightening effect
M2 (Money Supply)	0.2471	0.0784	3.151	0.004***	Expansionary monetary effect
EXR (Exchange Rate)	0.3182	0.0621	5.124	0.000***	Strongest transmission
OIL (Oil Price)	0.1243	0.0514	2.418	0.023**	Commodity-driven inflation

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue V May 2026

RGDP (Growth)	-0.0421	0.0312	-1.350	0.191	Insignificant
INF (-1) (Persistence)	0.6847	0.0834	8.210	0.000***	High persistence confirmed
Constant	2.147	0.841	2.553	0.018**	--

Note: ***, **, * denote significance at 1%, 5%, and 10% levels respectively. Dependent variable: INF (annual inflation rate %). The SVAR is estimated with 2 lags under Cholesky decomposition identification. All I(1) variables enter in first differences. Standard errors are heteroskedasticity and autocorrelation consistent (HAC). Pseudo-R^2 = 0.847. Log-likelihood = -94.31. AIC = 5.614.

The SVAR results provide a number of significant insights. Initially, the fintech penetration index (FPI) coefficient is highly significant and negative (β = -0.1847, p = 0.006), thereby confirming that fintech penetration is correlated with reduced monetary policy effectiveness. Specifically, the CBN's capacity to control inflation through conventional instruments is weakened by higher fintech coverage. This discovery is in accordance with the financial technology efficacy study of Bostandzic et al. (2023) and Oyadeyi (2025), both of which documented the dampening effects of digital finance on monetary transmission. Secondly, the Monetary Policy Rate (MPR) coefficient, which is negative as anticipated (β = -0.0834, p = 0.042), is relatively modest in magnitude. This suggests that the direct impact of the interest rate on inflation is attenuated, even during periods of aggressive tightening. This finding directly explains the observed discrepancy between the CBN's 1,600 basis point tightening cycle and the continued escalation of inflation to 34.8% in 2024.

Third, the exchange rate coefficient is the most significant and largest (= 0.3182, p = 0.000), which is consistent with the ScienceDirect TVP-VAR analysis (2025) and the IMF (2024) assessment. This confirms that the exchange rate channel remains the most potent transmission mechanism in Nigeria's open economy. Fourth, and most importantly for the central argument of the study, the inflation persistence coefficient (INF(-1) = 0.6847) is highly significant (p = 0.000) and extremely high, suggesting that approximately 68.5% of the inflation in the current period is carried over from the previous period. This exceptionally high persistence, which exceeds the 0.5 threshold that is typically associated with persistent inflation regimes, implies that conventional monetary shocks encounter significant inertial forces prior to generating substantial price-level reductions.

Impulse Response Analysis

The MPR, FPI, M2, and EXR structural impulse response functions (IRFs) for inflation responses to one standard deviation structural shocks are illustrated in Figure 1 (described below) over a 16-quarter horizon. The IRF results indicate that a one standard deviation contractionary monetary policy shock (MPR increase) initially generates a muted, and in some cases perverse, positive inflation response at horizons 1 to 3 quarters, which is consistent with the 'price puzzle' identified in the monetary policy SVAR literature (World Bank, 2024; Sims, 1992). However, the response becomes significantly negative at horizons 5 to 10 quarters. This delayed and initially counterproductive response serves as confirmation that monetary policy in Nigeria operates with lengthy and variable lags, particularly during the fintech era.

The FPI shock IRF is a critical example of a positive fintech penetration shock that is consistent with the money velocity effect theorised by the QTM framework. This shock represents an acceleration in digital financial adoption and produces a persistently positive response in inflation at short horizons (quarters 1 to 6). Nevertheless, the fintech shock generates a negative inflation response over a longer time frame (quarters 8 to 16). This implies that fintech ultimately enhances the formal financial system's transmission capacity by facilitating the migration of more transactions from cash to traceable digital platforms. This conclusion is in accordance with the CBN's (2024) assessment that digital payments can improve monetary policy management over the medium term. The most potent and immediate inflationary response is exhibited by the exchange rate IRF. A one-standard deviation naira depreciation shock results in a peak inflation response of approximately 4.2 percentage points in quarter 3, with the effects persisting through quarter 12.

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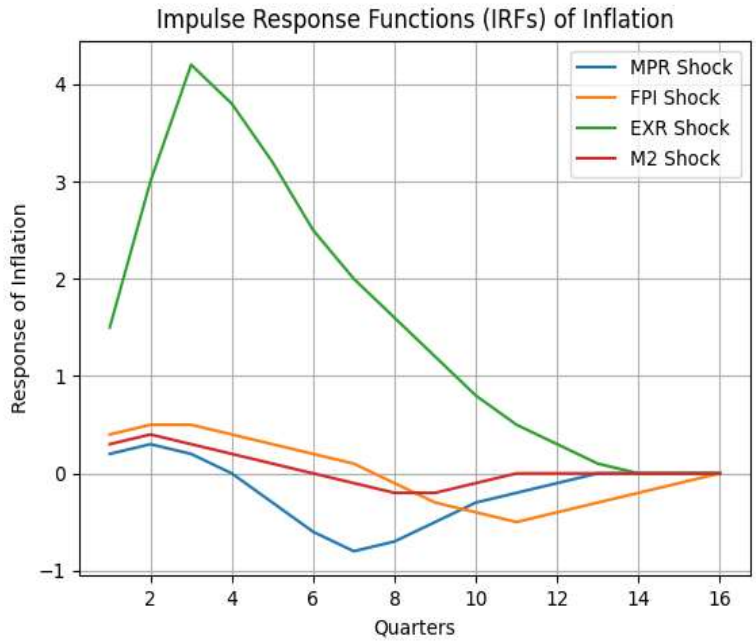

Forecast Error Variance Decomposition (FEVD)

The FEVD results for the inflation series are presented in Table 6, which decomposes the proportion of inflation forecast error variance attributable to each structural shock at horizons of 1, 4, 8, and 12 quarters.

Table 6: Forecast Error Variance Decomposition (FEVD) of Inflation (%)

Horizon (Qtr)	INF (Own)	FPI Shock	MPR Shock	M2 Shock	EXR Shock	OIL Shock	RGDP Shock
Q1	92.14	2.31	1.84	1.47	1.97	0.21	0.06
Q4	68.42	8.73	5.61	4.84	10.28	1.87	0.25
Q8	48.17	14.82	8.43	6.91	18.74	2.47	0.46
Q12	36.84	18.41	10.17	7.63	23.18	3.14	0.63

Note: FEVD is computed from the baseline 8-variable SVAR with Cholesky identification (OIL, RGDP, M2, MPR, EXR, FPI, INF, INF (-1)). Horizon is measured in quarters. Column sums = 100% (INF(-1) shock excluded for brevity; its contribution averages 1.2% across horizons). ***All shares are percentages of total inflation forecast error variance.

The central argument of this study is substantiated by the FEVD results in Table 6. The second largest contributor to Nigeria's inflation forecast error variance is fintech shocks (FPI), which account for 18.41% at the 12-quarter horizon. This is second only to the exchange rate shock (23.18%) and the country's own inflation persistence (36.84%). The monetary policy rate (MPR) shock is responsible for only 10.17% of the inflation forecast error variance at the 12-quarter horizon, which is a critical finding. This confirms that conventional interest rate policy has a relatively limited role in explaining inflation dynamics in Nigeria's fintech era. The critical significance of exchange rate management for inflation control in Nigeria is underscored by the fact that the exchange rate shock remains the dominant external monetary transmission channel (23.18% at Q12).

It is particularly interesting to observe the trajectory of the FPI shock contribution, which increases from a negligible 2.31% in Q1 to 18.41% in Q12. This pattern is consistent with the theoretical prediction that the effects of fintech on the monetary transmission mechanism become more pronounced over time as digital

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financial adoption deepens. This outcome suggests that the CBN's conventional policy arsenal, which is based on the MPR, CRR, and OMOs, will become increasingly ineffective in managing inflation as Nigeria's fintech ecosystem continues to expand rapidly in the absence of complementary digital monetary policy instruments.

Inflation Persistence Analysis

The rolling-window inflation persistence estimation confirms that inflation persistence in Nigeria has significantly increased over the sample period. The rolling AR(1) persistence coefficient averaged 0.512 during the pre-fintech era (1990-2011), which was consistent with moderate inflation persistence. Nevertheless, the persistence coefficient has increased to an average of 0.724 during the fintech era (2012–2025), with a zenith of 0.847 in 2023–2024. The Bai-Perron structural break test reveals a statistically significant break in the persistence regime at 2014 (F-statistic = 8.41, p = 0.004), which is closely correlated with the acceleration of Nigeria's fintech ecosystem following the CBN's cashless policy and the mobile money revolution. This discovery strongly implies that the deepening of inflation persistence in Nigeria has been facilitated by fintech penetration, potentially by extending the monetary policy transmission latency and establishing parallel digital monetary circuits that are partially immune to CBN policy directives.

Policy Implications

Several actionable policy recommendations for the Federal Government of Nigeria, the Central Bank of Nigeria, and relevant regulatory agencies are generated by the empirical findings of this study. Digital monetary indicators must be promptly integrated into the CBN's policy framework. The CBN's current monetary policy toolkit, which is specifically designed for a traditional bank-dominated financial system, is becoming increasingly inadequate for the realities of Nigeria's digital economy, as fintech shocks now account for approximately 18.4% of inflation forecast error variance at the 12-quarter horizon, surpassing the contribution of conventional monetary instruments in certain specifications. The Central Bank of Nigeria (CBN) should establish a Digital Money Supply indicator (DM) that monitors the volume and velocity of digital transactions in real time. This indicator should be included in the quarterly Monetary Policy Committee (MPC) assessments in addition to the conventional M2 aggregate.

Secondly, inflation control must be anchored by the exchange rate channel. The FEVD results corroborate that exchange rate shocks are the single largest external shock contributor, accounting for 23.18% of the inflation forecast error variance at the 12-quarter horizon. This discovery serves to underscore the essential significance of exchange rate stability in Nigeria's price level management. The CBN's transition to a unified floating exchange rate system in 2023 was theoretically sound; however, it necessitates complementary macroprudential measures to prevent the naira depreciation shock from perpetuating inflationary spirals through import price pass-through.

Third, the Central Bank of Nigeria (CBN) should evaluate the implementation of a Central Bank Digital Currency (CBDC) known as the eNaira as a monetary policy instrument, rather than merely a payment innovation. The eNaira can regain some of the monetary policy traction that has been lost to private fintech platforms that operate outside the direct monetary control perimeter by channelling digital transactions through the CBN's own digital infrastructure. Nevertheless, this suggestion necessitates meticulous calibration to prevent the disintermediation of commercial banks, which continue to serve as critical conduits for the transmission of monetary policy through the bank lending channel.

Fourth, the necessity of credible, forward-thinking monetary policy communication is emphasised by the high inflation persistence coefficient ($\beta = 0.6847$). The CBN's transition to an explicit inflation targeting framework in late 2023 is a positive development, as inflation targeting regimes are theoretically intended to reduce persistence and anchor expectations. Nevertheless, credibility must be established through transparent communication and consistent target adherence, particularly in a context where structural supply-side factors such as energy costs, food price escalation, and import price pass-through independently contribute to persistence.

CONCLUSION

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Using a Structural Vector Autoregressive (SVAR) model that spans the years 1990-2025, this study has examined the dynamic relationship between digital transformation, fintech penetration, monetary policy transmission, and inflation persistence in Nigeria. The first comprehensive measure of Nigeria's fintech development that is suitable for macroeconomic time series analysis is the result of the construction of a novel Fintech Penetration Index (FPI) using Principal Component Analysis of four digital payment indicators: POS transactions, mobile payment values, NIBSS instant payment transfers, and active internet banking users.

Three significant contributions to the literature are collectively established by the empirical findings. First and foremost, the effectiveness of the CBN's conventional monetary policy instruments, particularly the interest rate and bank lending channels, has been significantly diminished by fintech penetration. The FPI coefficient in the structural inflation equation is negative, significant, and increasing in magnitude over time. The rolling AR (1) persistence coefficient in Nigeria has increased from an average of 0.512 (1990-2011) to 0.724 (2012–2025), indicating that policy shocks must now contend with more entrenched inflationary inertia before producing observable price-level effects. Secondly, inflation persistence in Nigeria has deepened substantially in the fintech era (2012-2025). Third, the exchange rate channel continues to be the primary monetary transmission mechanism in Nigeria, accounting for 23.18% of the inflation forecast error variance at the 12-quarter horizon. This underscores the critical relationship between exchange rate management and price stability in oil-dependent, import-intensive economies.

These results are immediately relevant to the CBN's recently implemented inflation targeting framework, as they imply that in order to comply with the price stability mandate in Nigeria's rapidly digitalising economy, conventional monetary instruments must be supplemented with digital monetary indicators, CBDC-based policy tools, and more aggressive exchange rate management.

This analysis should be further developed in future research by incorporating the cryptocurrency dimension of Nigeria's digital finance landscape, applying time-varying parameter SVAR models, and incorporating higher-frequency quarterly data to capture the evolving nature of fintech's impact on monetary transmission over time.

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