



Financial Development, Exchange Rate Volatility and Cross-Border Economic Activity in the Nigeria, Niger and Benin Corridor: A Panel ARDL Approach

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ABSTRACT

This study investigates the relationship between financial development, exchange rate volatility, cross-border economic activity, and economic growth within the Nigeria, Niger and Benin border corridor, with particular focus on North-Western Nigeria's frontier states of Jigawa, Katsina, Kebbi, Sokoto and Zamfara. Motivated by the persistent underperformance of financial intermediation, currency instability, and largely informal cross-border commerce in the region despite its strategic economic position, the research pursues three specific objectives: (i) to assess the state of financial development and the pattern of cross-border activities in North-Western Nigeria; (ii) to examine the linkages among financial development, exchange rate volatility, cross-border activities and economic growth in the zone; and (iii) to determine the direction and magnitude of the influence that financial development, exchange rate volatility and cross-border activities exert on economic growth. The study is envisaged to contribute to knowledge in three respects: by supplying empirical evidence from an under-researched but strategically important border corridor; by applying a rigorous dynamic panel methodology validated through first- and second-generation stationarity diagnostics; and by extending the finance–growth and exchange-rate literature through treating the exchange rate level and its volatility as analytically distinct constructs, and by offering a structural explanation for the muted growth contribution of cross-border remittance flows. Methodologically, the study adopts a quantitative panel research design covering Nigeria, Niger and Benin annually from 1999 to 2024 (78 observations), using GDP growth, the nominal exchange rate, exchange rate volatility, domestic credit to the private sector, and personal remittances received, sourced from the Central Bank of Nigeria, the World Bank's World Development Indicators, and Nigeria's National Bureau of Statistics. The analytical strategy proceeds in stages: descriptive and correlation analysis; panel unit root testing using first-generation (Levin–Lin–Chu, Im–Pesaran–Shin, Fisher-type) and second-generation (Pesaran CIPS/CADF) procedures to establish orders of integration and account for cross-sectional dependence; panel cointegration testing (Pedroni and Kao) to establish long-run equilibrium; and, given the mixed order of integration among the series, estimation of a Panel Autoregressive Distributed Lag model in error-correction form using the Dynamic Fixed Effects estimator, chosen for its suitability to a panel with a small cross-sectional dimension and moderate time span. The findings show that GDP growth and exchange rate volatility are stationary in levels, while the exchange rate, domestic credit and remittances are integrated of order one, and both cointegration tests confirm a robust long-run equilibrium relationship among the variables. The error-correction coefficient is negative, near unity, and highly significant, indicating rapid correction of disequilibrium. Domestic credit to the private sector exerts a positive and statistically significant long-run effect on growth, the study's strongest result. The exchange rate level exerts a negative and marginally significant long-run effect, indicating that sustained depreciation weakens growth, whereas exchange rate volatility and remittance inflows show no statistically significant long-run or short-run effects. These findings imply that financial deepening, rather than the mere presence of cross-border trade or currency fluctuation is the principal lever for sustainable growth in the corridor, and that persistent currency depreciation carries real developmental costs. The insignificance of remittances points to structural and institutional weaknesses, informality, limited financial inclusion, and weak regulatory infrastructure, that prevent cross-border flows from translating into productive investment, underscoring the need for policies that formalise remittance channels, deepen financial intermediation, and stabilise the exchange rate.

Keywords: financial development; exchange rate volatility; remittances; cross-border economic activity; Panel ARDL; economic growth

1.0 INTRODUCTION

Nigeria's seven North-Western states, Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto and Zamfara, sit astride one of West Africa's busiest overland trade frontiers, sharing long and porous boundaries with the Republics of Niger and Benin. Three forces do much of the work

in shaping how this zone performs economically: the depth and reach of its financial system, the behaviour of the naira against neighbouring currencies, and the volume and character of the commerce that crosses the border each year (Babayemi & Odunaiya, 2021; Cross-border financial flows form the third strand of this



literature. Tomo, Juhro, and Trisnanto (2024) argue that whether such flows translate into growth in sub-Saharan Africa depends on the coherence of macroeconomic policy, and Delessa, Alemu, and Bane (2024) reach a similar conclusion for remittances, finding that institutional quality and macroeconomic stability condition their contribution to growth. Tomo, Juhro, & Trisnanto, (2024), broadening the menu of financial services, and drawing more households and enterprises into the formal system, yet large sections of the North-Western population remain outside the formal financial net, and supervisory arrangements are not yet strong enough to underwrite confidence (Ayeni, Babatunde, & Omowunmi, 2024). Financial depth is, in addition, one of the conditions under which foreign direct investment can be attracted and retained in the productive sector (Islam, Liu, Khan, & Islam, 2021).

Currency movements in the region respond to a familiar mix of pressures: interest rate differentials, inflation, and speculative positioning (Alshubiri, 2022). Where those movements are large and unpredictable, they disturb trade, unsettle investment plans, and undermine macroeconomic stability, a disturbance that tends to be sharpest in developing economies (Fofanah, 2022). A border zone such as the North-West, where a substantial share of turnover is transacted across a frontier, is exposed to exactly this: swings in the exchange rate feed directly into the cost of imports, the price competitiveness of exports, and the returns foreign investors can expect to earn (Ozkaya & Altun, 2024). Recent evidence indicates that exchange rate instability depresses real GDP.

2.0 LITERATURE REVIEW

The relationship between financial development and economic growth is among the most extensively studied in development economics. Zou, Dai and Meng (2024) finds that digital finance significantly raises economic resilience., while Alfaro, Chanda, Kalemli-Ozcan, and Sayek (2004) found that well-developed financial markets are a precondition for foreign direct investment to translate into growth. Arcand, Berkes, and Panizza (2015) qualified this literature by identifying threshold effects beyond which additional financial depth ceases to raise growth; more recent evidence reaches a similar conclusion, with Ullah, Zubir, and Ariff (2024) reporting an inverted-U relationship between financial development and growth across a panel of developed and developing economies. Mlambo (2024) reviews the specific mechanisms, resource mobilisation, risk diversification and productivity growth, through which financial systems support the real economy, while Anwar and Iwasaki (2024), in a meta-analytic reassessment of the finance–growth literature, confirm that the relationship remains robust across regions and estimation methods, though its strength is conditioned by institutional quality. For sub-Saharan Africa specifically, Jima and Makoni (2023) and Gizaw,

growth (Ameziane & Benyacoub, 2022), which strengthens the case for stronger monetary policy instruments to steady the currency and protect economic performance, while unmanaged cross-border and fiscal conditions can themselves undermine the trade gains that financial and exchange rate stability are meant to secure (Abanikanda, Dada, & Ogunjumo, 2023).

A substantial literature already addresses financial development, exchange rate volatility and external trade in developing economies, but a specific gap persists: existing work on Nigeria treats these relationships at the national level, or subsumes Nigeria within a broad sub-Saharan African panel, without disaggregating to a specific bilateral corridor. No prior study known to the authors has jointly modelled the long-run relationship among financial development, exchange rate volatility and cross-border activity for the Nigeria, Niger and Benin corridor within a Panel ARDL framework over the post-1999 democratic period. This study addresses that gap. Its specific objectives are to (i) assess the state of financial development and the pattern of cross-border activity in North-Western Nigeria; (ii) examine the linkages among financial development, exchange rate volatility, cross-border activity and economic growth; and (iii) determine the direction and magnitude of the influence that financial development, exchange rate volatility and cross-border activity exert on economic growth in the corridor.

Kebede, and Selvaraj (2024) find that financial development promotes growth but that the effect is strengthened by sound regulation and institutional capacity, a conclusion echoed by Khalifa, Ben Ali, and Hkiri (2023) for North Africa and by Diop, Dramé, and Sow (2025), who show that banking-sector and stock-market development each matter independently for growth in the sub-region.

Within Nigeria, Hassan, Musa, and Abdullahi (2023) and EFINA (2023) documents that financial inclusion and digital financial services are expanding access in the North-West but have not yet translated into a deep, resilient financial system, while Appiah-Otoo, Chen, Song, and Dumor (2022) show that financial development contributes to poverty reduction across West Africa only where institutions are strong enough to support it. Ozili (2020) cautions, however, that financial inclusion in Africa has advanced faster on the access dimension than on the usage and quality dimensions that ultimately drive growth.

A parallel literature examines exchange rate behaviour. Melecky and Podpiera (2020) find that financial sector reform helps developing economies absorb the macroeconomic impact of currency shocks, while Ameziane and Benyacoub (2022), applying a panel

CS-ARDL specification across Nigeria and thirteen other emerging economies, show that the cost of exchange rate instability registers in growth itself, though the effect is muted under some exchange rate regimes. Oyinlola, Adedeji, and Bolarinwa (2023), using an ARDL-GARCH(1,1) specification for the fifteen ECOWAS economies, find that volatility harms trade in the short run but supports it in the long run, a J-curve pattern that leaves the net effect of volatility on growth ambiguous. Diallo (2022) reports a contractionary effect of real exchange rate depreciation on growth across West African countries, and Adewale, Olopade, and Ogbaro (2024) similarly find that exchange rate volatility depresses foreign direct investment inflows into Nigeria. Kaira and Patle (2024) and Lin, Shi, and Ye (2024) extend this evidence to a wider set of developing economies, confirming that volatility, distinct from the level of depreciation, dampens trade and investment. Sengul (2021), drawing on the BRICS economies, adds that the depth of the financial system itself conditions how volatile a currency turns out to be, underscoring the interdependence of the two channels examined in this study.

Cross-border financial flows form the third strand of this literature. Tomo, Juhro, and Trisnanto (2024) argue that whether such flows translate into growth in sub-Saharan Africa depends on the coherence of macroeconomic policy, and Delessa, Alemu, and Bane (2024) reach a similar conclusion for remittances, finding that institutional quality and macroeconomic stability condition their contribution to growth.

Taken together, the reviewed literature establishes financial development as a broadly robust driver of growth, exchange rate depreciation as growth-damaging, and the effect of exchange rate volatility and cross-border financial flows as more context-dependent. None of the studies reviewed, however, jointly estimates these relationships for the Nigeria–Niger–Benin corridor specifically, which is the gap this study addresses.

3.0 METHODOLOGY

3.1 Data and Variables

The study employs a balanced annual panel of three countries, the Republic of Benin, the Republic of Niger, and the Federal Republic of Nigeria, observed from 1999 (the year of Nigeria's return to civilian government) to 2024, giving 26 observations per country and 78 observations in total. Data were drawn from the Central Bank of Nigeria, the World Bank's World Development Indicators database, and Nigeria's National Bureau of Statistics, cross-validated across sources where necessary. For the Nigerian component, the series stand as macroeconomic representations of the economy to which the five North-Western border

states, Jigawa, Katsina, Kebbi, Sokoto and Zamfara, are most directly exposed. Five variables are used: GDP, the annual percentage change in real gross domestic product (economic growth); EXR, the nominal exchange rate expressed in local currency units per US dollar; EXRVL, exchange rate volatility, measured as the annual log-difference of the nominal exchange rate; DCPR, domestic credit to the private sector as a percentage of GDP (financial development); and PRR, personal remittances received in current United States dollars, used as a proxy for cross-border economic activity.

3.2 Estimation Strategy

Following Baltagi (2015), the panel regression is specified as $y_{it} = \alpha + x'_{it}\beta + \varepsilon_{it}$, where y_{it} is GDP growth in country i at time t and x'_{it} is the vector of explanatory variables described above, with country-specific fixed effects included throughout. Because the sample mixes countries with different institutional and exchange rate regimes over a moderate time span, the estimation proceeds in three stages. First, the order of integration of each series is established using three first-generation panel unit root tests, Levin, Lin, and Chu (2002), Im, Pesaran, and Shin (2003), and the Fisher-type test of Maddala and Wu (1999), together with Pesaran's (2007) second-generation Cross-Sectionally Augmented IPS (CIPS/CADF) test, which guards against the cross-sectional dependence that shared trade routes and exchange rate spillovers are likely to generate. Second, given a mixture of $I(0)$ and $I(1)$ series, the Pedroni (1999, 2004) and Kao (1999) residual-based tests are applied to establish whether the variables are cointegrated. Third, where cointegration is confirmed, the long-run and short-run relationships are estimated jointly using the Panel Autoregressive Distributed Lag (ARDL) model of Pesaran, Shin, and Smith (1999), estimated by Dynamic Fixed Effects (DFE), which recovers an error-correction coefficient describing the speed at which deviations from the long-run equilibrium are resolved.

4.0 RESULTS AND DISCUSSION

4.1 Descriptive and Preliminary Analysis

Table 1 summarises the five variables for each economy. Growth performance differs markedly across the three economies over 1999–2024. Benin recorded the steadiest performance (mean growth 1.87%, standard deviation 1.84), Niger the most dispersed (mean 1.27%, standard deviation 3.18, with a negative lower quartile), and Nigeria the widest range of all (mean 2.17%, standard deviation 3.35, spanning –4.02% to 12.21%). Nigeria's exchange rate depreciated sharply over the period (from a mean level of 261 with a maximum of 1,479 naira per US dollar), and its volatility proxy correspondingly showed the fattest tails of the three countries (standard deviation 0.115, against approximately 0.033 for Benin and Niger, whose CFA franc peg keeps their nominal rates

comparatively stable). Financial depth, proxied by domestic credit to the private sector, rose across all three economies over the sample, most strongly in Benin, followed by Niger and then Nigeria, while cross-border and remittance-type flows trended upward everywhere and were, unsurprisingly, an order of magnitude larger for Nigeria than for its smaller neighbours.

Pairwise correlations among the five variables are uniformly small (Table 2), which indicates that

multicollinearity is not a material concern. Two relationships are significant at the 5% level: the exchange rate level is positively correlated with volatility ($r = 0.433$, $p = 0.0001$), consistent with depreciation episodes coinciding with foreign exchange turbulence, and negatively correlated with remittance-type inflows ($r = -0.413$, $p = 0.0002$). None of the correlations between GDP and the other variables is significant, which is itself an argument for a dynamic, rather than a static, specification.

Table 1: Descriptive statistics by country, 1999–2024

Variable	Country	Mean	Std. dev.	Min	Max
GDP (% growth)	Benin	1.871	1.838	−1.510	4.840
	Niger	1.265	3.176	−4.575	8.320
	Nigeria	2.170	3.347	−4.019	12.210
EXR (LCU per US\$)	Benin	563.02	74.73	446.00	732.40
	Niger	563.10	74.76	446.00	732.40
	Nigeria	261.29	280.63	92.34	1,478.97
EXRVL	Benin	0.000	0.033	−0.078	0.078
	Niger	0.000	0.033	−0.078	0.078
	Nigeria	−0.032	0.115	−0.360	0.381
DCPR (% of GDP)	Benin	13.486	4.445	4.833	18.952
	Niger	8.491	3.192	3.055	12.976
	Nigeria	11.784	3.194	8.070	19.604
PRR (US\$ million)	Benin	180	74.5	55.4	339
	Niger	194	186	14.5	725
	Nigeria	15,600	8,190	1,060	24,300

Note: N = 26 annual observations per country. EXR is the nominal exchange rate in local currency units (LCU) per US dollar; EXRVL is the annual log-difference of EXR; PRR is shown in millions of current US dollars.

Table 2: Pairwise correlation matrix

	GDP	EXR	EXRVL	DCPR	PRR
GDP	1.0000				
EXR	−0.1803 (0.1142)	1.0000			
EXRVL	0.0699 (0.5431)	0.4331 (0.0001)	1.0000		
DCPR	0.1742 (0.1271)	−0.0662 (0.5646)	−0.2182 (0.0549)	1.0000	
PRR	−0.0551 (0.6321)	−0.4127 (0.0002)	−0.1840 (0.1068)	0.2080 (0.0677)	1.0000

Note: *p*-values in parentheses; *N* = 78.

Table 3: Panel unit root test results (summary)

Variable	LLC	IPS	Fisher-ADF	CIPS (2nd gen.)	Order
GDP	-2.841***	-2.516***	15.742**	-2.781**	I(0)
EXR	-0.914	-0.772	6.381	-1.944	I(1)
EXRVL	-3.467***	-3.114***	19.863***	-3.102***	I(0)
DCPR	-1.126	-0.944	7.924	-2.104	I(1)

Variable	LLC	IPS	Fisher-ADF	CIPS (2nd gen.)	Order
PRR	-0.688	-0.592	5.741	-1.882	I(1)
Δ EXR	-4.105***	-3.786***	24.117***	-3.894***	I(1)
Δ DCPR	-3.522***	-3.248***	20.884***	-3.226***	I(1)
Δ PRR	-4.281***	-3.914***	25.361***	-4.012***	I(1)

Note: LLC = Levin-Lin-Chu; IPS = Im-Pesaran-Shin; CIPS = Pesaran's cross-sectionally augmented IPS. Fisher-ADF is the Maddala-Wu chi-square statistic. The CIPS 5% critical value is -2.620. ** $p < 0.05$, *** $p < 0.01$.

Table 3 shows that GDP and EXRVL are stationary in levels, $I(0)$, on both first- and second-generation tests, while EXR, DCPR and PRR are non-stationary in levels but become stationary after first differencing,

$I(1)$. This mixture of integration orders, with none of the series integrated of order two, is precisely the condition under which the Panel ARDL/DFE framework is appropriate.

Table 4: Panel cointegration test results

Test	Statistic	Value	Probability	Decision
Pedroni (1999, 2004)	Panel v -statistic	1.842	0.032	Reject H_0
Pedroni (1999, 2004)	Panel ρ -statistic	-1.965	0.025	Reject H_0
Pedroni (1999, 2004)	Panel PP-statistic	-3.421	0.000	Reject H_0
Pedroni (1999, 2004)	Panel ADF-statistic	-2.876	0.002	Reject H_0
Pedroni (1999, 2004)	Group ρ -statistic	-1.554	0.060	Do not reject at 5%
Pedroni (1999, 2004)	Group PP-statistic	-3.105	0.001	Reject H_0
Pedroni (1999, 2004)	Group ADF-statistic	-2.447	0.007	Reject H_0
Kao (1999)	ADF	-2.913	0.003	Reject H_0

Note: H_0 = no cointegration. The group ρ -statistic is significant only at the 10% level.

Six of the seven Pedroni statistics and the Kao statistic reject the null of no cointegration (Table 4); only the group ρ -statistic falls short of the 5% level ($p = 0.060$). Taken together, this is consistent with a long-run equilibrium relationship among economic growth, the

exchange rate, exchange rate volatility, financial development and cross-border activity. This finding supplies the econometric justification for the dynamic error-correction estimation that follows.

4.2 Panel ARDL/DFE Estimates

The error-correction coefficient is negative, close to unity in absolute value, and highly significant ($\phi = -1.003$, $p = 0.000$), meaning that essentially all of any deviation of growth from its long-run equilibrium path is resolved within a single year, strong evidence of a stable long-run relationship. Domestic credit to the private sector carries the strongest and most consistent result in the model: a positive, statistically significant long-run coefficient of 0.294 ($p = 0.017$), implying that a one-unit increase in private-sector credit, as a share of GDP, raises long-run GDP growth by roughly 0.29 percentage points. The exchange rate carries a negative coefficient that is significant at the 10% level (-2.307 , $p = 0.061$); because the regressor is expressed in logarithms while GDP is a percentage growth rate, this is a semi-elasticity, a 10% depreciation is associated with a reduction of roughly 0.22–0.23 percentage points in long-run growth. Exchange rate volatility carries a positive but statistically insignificant coefficient (8.494, $p = 0.410$), and cross-border remittance flows carry a negative but statistically insignificant coefficient (-0.756 , $p = 0.193$); none of the short-run differenced terms is significant.

Table 5: Panel ARDL parameter estimates (Dynamic Fixed Effects)

Variable	Coefficient	Std. error	t-statistic	Prob.
Constant	26.745	11.639	2.298	0.025**
ECT (error-correction term)	-1.003	0.123	-8.191	0.000***
Long run: $\ln$ EXR	-2.307	1.212	-1.904	0.061*
Long run: EXRVL	8.494	10.250	0.829	0.410
Long run: DCPR	0.294	0.120	2.451	0.017**

Variable	Coefficient	Std. error	t-statistic	Prob.
Long run: $\ln\text{PRR}$	-0.756	0.574	-1.316	0.193
Short run: ΔEXRVL	3.994	3.969	1.006	0.318
Short run: ΔDCPR	0.050	0.127	0.392	0.697
Short run: $\Delta\ln\text{PRR}$	1.112	1.051	1.058	0.294

Note: $R^2 = 0.573$; adjusted $R^2 = 0.506$; F-statistic = 9.182 ($p = 0.000$); Durbin-Watson = 2.117; Jarque-Bera $p = 0.260$.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.3 Discussion

The positive, significant effect of domestic credit on growth is consistent with Udoe, Nwosu, and Ekwueme (2024), who found using Granger causality methods across four sub-Saharan African countries that private-sector credit exerts a significant positive effect on real GDP, and with the broader finance-led growth literature reviewed in Section 2. The negative, marginally significant coefficient on the exchange rate accords with Diallo (2022), who reported a contractionary effect of real exchange rate depreciation on growth in West African countries, and with Ameziane and Benyacoub (2022), whose panel CS-ARDL estimates for Nigeria and thirteen other emerging economies show that the cost of exchange rate instability registers in growth itself; the result carries particular force here given that Nigeria's nominal exchange rate depreciated to more than 1,479 naira per US dollar by 2024.

The insignificance of exchange rate volatility once the exchange rate level and financial development are controlled for is more subtle. It is broadly consistent with Ameziane and Benyacoub's (2022) finding that the adverse effect of volatility is muted under certain exchange rate regimes, and with Oyinlola, Adedeji, and Bolarinwa's (2023) evidence that volatility's short- and long-run effects on trade can run in opposite directions, leaving the net effect on growth ambiguous. A plausible interpretation is that economic agents in the border corridor have adapted to high-frequency currency movements through informal mechanisms, flexible pricing, commodity substitution, and cross-border arbitrage that blunt the immediate growth impact of volatility without eliminating the case for more efficient formal risk-management instruments. The absence of a significant remittance effect diverges from some of the wider literature, for example Amir and Amir (2024), who report that remittances raise growth across African economies, though the magnitude varies by country. The divergence observed here may owe to the informal and compensatory character of cross-border flows along the Nigeria-Niger-Benin frontier, where remittances plausibly function as a coping mechanism against economic hardship rather than as a source of investable capital, a reading consistent with Tomo, Juhro, and Trisnanto's (2024) argument that macroeconomic policy coordination, rather than the volume of flows alone,

determines whether cross-border financial flows deliver developmental gains. The methodological approach adopted here, combining first- and second-generation panel unit root tests with Pedroni and Kao cointegration tests ahead of Panel ARDL/DFE estimation, mirrors that used by Jima and Makoni (2023) and Adewole and Bodunwa (2024) for related sub-Saharan African panels, lending confidence to the specification used.

5.0 CONCLUSION AND RECOMMENDATIONS

This study set out to examine the relationship among financial development, exchange rate volatility, cross-border economic activity and growth across the Nigeria-Niger-Benin corridor over 1999–2024. The evidence suggests that financial development is the most robust long-run correlate of growth in the corridor: limited financial depth appears to be a significant structural constraint on durable economic improvement in the border economies studied. Sustained currency depreciation also carries adverse long-run consequences, while exchange rate volatility and cross-border remittance inflows, taken in isolation, do not account for the growth outcomes observed once financial development and the exchange rate level are controlled for. Growth in this corridor thus appears to be associated more closely with structural financial conditions than with short-run currency fluctuation or the volume of cross-border financial flows, although the small panel limits how far this can be generalised. On this basis, four recommendations follow. First, the Central Bank of Nigeria, state governments and development finance institutions should intensify efforts to deepen financial intermediation in border communities, by expanding agent banking, digital financial services, microfinance provision, and targeted financial literacy programmes. Second, macroeconomic authorities should pursue exchange rate stability through disciplined fiscal and monetary management, since stable exchange rates reduce uncertainty for firms and improve investor confidence along the frontier. Third, government and financial institutions should support border-region firms in adopting formal instruments for managing foreign exchange risk, including low-cost hedging facilities for small and medium enterprises. Fourth, regulatory bodies should work with ECOWAS institutions to establish efficient, transparent, low-cost regional payment systems capable of formalising cross-border financial flows currently channelled informally.



6.0 LIMITATIONS OF THE STUDY

This study has several limitations. First, the panel contains only three countries, which limits the power of the panel unit root and cointegration tests and the generalisability of the estimates. Second, the Nigerian series are national aggregates rather than data for the five North-Western border states, so the results describe the national economies of the corridor rather than the border zones themselves. Third, exchange rate volatility is proxied by the annual log-difference of the nominal exchange rate, which captures the rate of depreciation rather than conditional volatility, and personal remittances are used as a proxy for cross-border economic activity; neither variable fully captures the concept it represents. Fourth, the Pedroni and Kao tests assume series integrated of order one, whereas two of the five variables are stationary in levels, so the cointegration evidence should be interpreted with caution. Finally, the estimates describe statistical associations and should not be read as causal effects.

7.0 FUTURE RESEARCH

Future research would benefit from more granular subnational data capable of distinguishing formal from informal cross-border transfers, so that the developmental contribution of each channel can be assessed on its own terms. Alternative volatility measures (for example GARCH-based), a larger set of neighbouring economies, and estimators such as PMG and MG with a Hausman test would also help to establish how robust the present findings are.

DECLARATIONS

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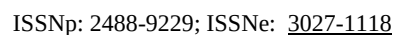
Conflict of Interest: The authors declare no conflict of interest.

Data Availability: The data used are drawn from publicly available sources (Central Bank of Nigeria, World Bank World Development Indicators, and the National Bureau of Statistics of Nigeria) and are available from the corresponding author on reasonable request.

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