Macroeconomic Determinants of Private Sector Credit in Sierra Leone: The Role of Exchange Rate Volatility

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Abstract

This study examines the determinants of private sector credit in Sierra Leone, emphasizing the role of exchange rate volatility. Using monthly data from 2011–2024 within an Autoregressive Distributed Lag (ARDL) framework, the findings indicate that exchange rate volatility has a negative long-run effect on private sector credit, with a one-standard-deviation increase reducing lending by about 7 percent, on average. The error correction term is negative and significant, showing that approximately 12 percent of deviations from long-run equilibrium are corrected each month, highlighting gradual adjustment dynamics. Other factors, including government borrowing and lending rates, play complementary roles in shaping credit outcomes. Policy implications point to the importance of exchange rate stabilization, the development of hedging instruments, and coordinated fiscal–monetary policies to foster financial deepening in Sierra Leone.

Keywords: *private sector credit, exchange rate volatility, ARDL model, error correction, monetary policy, Sierra Leone*

JEL Codes: *E44, E51, E52, G21, O55*

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1. Introduction

Bank credit to the private sector is widely recognized as a key engine for economic transformation, facilitating investment, consumption smoothing, and the efficient allocation of resources. In many low-income countries, however, the expansion of credit to the private sector has been persistently sluggish, undermined by financial repression, underdeveloped markets, and macroeconomic volatility. Sierra Leone presents a stark illustration of this problem. According to the International Monetary Fund (2024), credit to the private sector in Sierra Leone grew by approximately 21 percent, year-on-year in 2024, down from 25 percent in 2023, despite a projected moderate economic growth of about 4.0 percent in 2024. Prior IMF reports revealed that private sector credit made up just 5 to 6 percent of GDP in 2021, a figure that also represented less than 6 percent of total banking sector assets (IMF, 2022). These ratios fall far below the global average of over 60 percent of GDP and even the Sub-Saharan African average of about 30 percent (World Bank, 2023), highlighting the shallow nature of Sierra Leone's credit intermediation.

Several structural and macro-financial factors have been identified as impediments to private sector credit growth in the country. Chief among them is the banking sector's preference for risk-free government securities, driven by limited credit infrastructure, high levels of nonperforming loans, and weak institutional enforcement (IMF, 2016). Dollarization and underdeveloped foreign exchange markets have further complicated financial intermediation by introducing exchange rate-related risks that discourage long-term lending. In this context, both lenders and borrowers face heightened uncertainty, limiting their willingness to participate in credit contracts and thereby exacerbating financial exclusion.

While a large body of literature has analysed the roles of macroeconomic stability, interest rates, output growth, and financial innovation in explaining credit growth, a relatively underexplored determinant in the context of Sierra Leone is exchange rate volatility. Studies in larger emerging markets have shown that foreign exchange instability can depress credit by increasing credit risk premiums, prompting greater risk aversion among banks, and lowering borrowers' ability to repay (Mbutor, 2014; Fofanah, 2022; Eklou, 2023). In small open economies with limited hedging options and shallow capital markets, this effect may be even more pronounced. Yet, no empirical analysis has systematically examined this relationship in Sierra Leone.

This study addresses that gap by investigating the determinants of bank credit to the private sector in Sierra Leone, introducing exchange rate volatility as a novel explanatory variable within a dynamic autoregressive distributed lag (ARDL) framework. This modelling approach captures both the short-run and long-run relationships between credit and its macroeconomic drivers. By extending traditional frameworks to account for exchange rate fluctuations, the study aims to offer fresh insights into the behaviour of banks and borrowers in response to macroeconomic uncertainty. In doing so, it contributes not only to the empirical literature on credit dynamics in frontier economies but also to policy efforts aimed at deepening financial intermediation in high-risk, low-capacity environments.

2. Literature Review

2.1. Theoretical Framework

Bank credit to the private sector is shaped by simultaneous supply-side and demand-side forces, grounded in well-established financial and macroeconomic theories. On the supply side, the

financial accelerator model posits that bank lending is amplified by borrowers' net worth and collateral values, causing macroeconomic shocks to be transmitted through credit channels (Bernanke, Gertler, and Gilchrist, 1996). This framework highlights how tighter collateral constraints or weaker bank balance sheets can constrain credit availability. From the demand perspective, life-cycle and permanent income models (Modigliani and Brumberg, 1954) explain that households and businesses borrow to smooth consumption and investment when internal funds fall short. Furthermore, credit view of monetary policy emphasizes how central bank actions influence bankers' willingness to lend (Bernanke and Blinder, 1988). In open economy settings, exchange rate volatility introduces an additional dimension: Dornbusch's (1976) overshooting model illustrates how currency fluctuations, interacting with sticky prices, generate macroeconomic uncertainty, while Calvo and Reinhart (2002) show how countries fearing inflation pass-through may actively manage exchange rate volatility. These strands of theory collectively support the intuition that exchange rate uncertainty can induce both lenders and borrowers to adopt more cautious behaviour, potentially reducing bank credit extension.

2.2. Empirical Evidence

Guo and Stepanyan (2011) analyse a wide set of emerging economies and identify real GDP growth, real interest rates, inflation, and capital inflows as persistent drivers of private credit growth. Hofmann's (2005) work in industrialized contexts emphasizes property prices acting as collateral as powerful predictors of credit growth. Al-Shammari and El-Sakka (2016) extend this view in OECD countries, adding institutional quality and policy credibility into the set of long-run determinants.

More recent research acknowledges that exchange rate volatility can compromise credit flow by raising credit risk and increasing banks' uncertainty. For instance, Mamonov et al. (2024) find that exposure to foreign currency operations diminishes bank efficiency and tightens credit supply in Russia's regional banks. Meanwhile, other authors bring the concept into frontier markets through studies like Mbutor (2014) in Nigeria, which demonstrates a negative relationship between exchange rate volatility and bank lending. Eklou (2023) further reveals that FX volatility dampens firm investment, especially among those with fragile balance sheets in emerging market economies.

Empirical work at the regional level corroborates the importance of macroeconomic stability and financial innovation. Nampewo et al. (2021) show that mobile money platforms enhanced financial inclusion and credit uptake in Uganda. Assefa (2014) identifies broad money supply, real output, and lending rates as key supply-side constraints in Ethiopia. Akani and Onyema (2021) find in Nigeria that fluctuations in output, interest rates, inflation, and exchange rates jointly explain credit variability.

In Ghana, Baoko et al. (2020) utilize an ARDL bounds test to establish long-run cointegrating relationships among credit and macro variables, stressing the need for stable inflation and credible monetary policy. Funyina (2020) in Zambia adds depositor behaviour, liquidity management, and growth to the explanatory mix, offering a more holistic model that includes bank-level variables.

Gozgor (2018) highlights the interdependence of institutional and macroeconomic variables by emphasizing that political risk interacts with macroeconomic uncertainty to shape domestic credit flows. Ademi (2017) extends this to Central, Eastern, and Southeastern Europe, identifying inflation, foreign liabilities, and interest rate spreads as critical drivers, and implying that external sector volatility—including exchange rate movements—might also play a role.

Despite burgeoning theory, empirical inclusion of exchange rate volatility in credit models remains limited. In West Africa, Fofanah (2022) demonstrates a contractionary effect of real exchange rate volatility on economic growth and attributes partial mitigation to financial sector depth. Mbutor's (2014) study on Nigeria aligns with this finding, showing that exchange rate turbulence heightens bank conservatism in lending. Mamonov et al. (2024) examine the effect more directly at the bank level, illustrating how currency volatility erodes lending efficiency and tightens credit conditions in emerging markets .

These emerging strands underline the study's novelty: by explicitly incorporating exchange rate volatility into the Sierra Leonean context, this research fills a gap in both theoretical and empirical literature. It extends supply-side models by accounting for FX risk, capturing how private borrowers and banks react to macro-financial instability in small-ticket open economies where hedge markets are weak or absent.

3. Methodology

3.1. Data Description

This study utilizes monthly data from January 2011 to December 2024. The primary data sources are the Bank of Sierra Leone (BSL) and the World Bank's Commodity Prices Database ("Pink Sheet"). All nominal variables were converted to real terms using Sierra Leone's Consumer Price Index (CPI), published by Statistics Sierra Leone, with 2021 as the base year.

The key variables, their sources, and construction are detailed in Table 1.

Table 1: Model variables and description

Variable	Source	Construction
Real Private Sector Credit	BSL	Total credit extended by commercial banks to private entities, deflated by CPI.
Exchange Rate Volatility	BSL	Calculated as the conditional standard deviation from a GARCH model of the nominal exchange rate.
Real Average Lending Rate	BSL	The average lending rate offered by commercial banks on new loans, deflated by CPI.
Real Net Bank Lending to Government	BSL	The net flow of credit from commercial banks to the public sector, deflated by CPI.
Real Trade Balance	BSL	The difference between the value of exports and imports, expressed in local currency and deflated by CPI.
Minerals Price Index	World Bank	A weighted composite index of international prices for key mineral commodities.

3.2. Model Specification

To investigate the macroeconomic determinants of bank credit to the private sector (BCP) in Sierra Leone, this study specifies a baseline linear model in levels as follows:

$$BCP_t = \alpha_0 + \alpha_1 ExrVolatility_t + \alpha_2 LendR_t + \alpha_3 NLGovt_t + \alpha_4 Minerals_t + \alpha_5 TradeBal_t + \lambda_t \quad (1)$$

where BCP_t denotes the logarithm of real bank credit to the private sector at time t, $ExrVolatility_t$ captures exchange rate volatility, $LendR_t$ is the average real lending interest rate, $NLGovt_t$ represents the logarithm of net real bank lending to government, $Minerals_t$ reflects the global mineral prices index, and $TradeBal_t$ is the logarithm of the real trade balance.

Exchange rate volatility is included as uncertainty in exchange rate movements can adversely affect lending decisions by banks, particularly in economies with shallow financial markets and limited hedging mechanisms (Reinhart, 2002; Klein & Olivei, 2008). High volatility may lead to portfolio reallocation away from risky lending. The average lending rate is a critical cost-of-credit variable. According to the neoclassical theory of investment and credit supply, higher lending rates increase borrowing costs and discourage private sector demand for credit (Jaffee & Modigliani, 1969). In supply terms, banks may restrict credit if they perceive lending rates as reflective of higher borrower default risk. Net lending to government represents the crowding-out hypothesis, where increased lending to the government may limit credit available to the private sector due to resource constraints (Afonso & Sousa, 2012). In the Sierra Leonean context, where government borrowing is significant, this variable is particularly relevant. The mineral production index is included to account for sectoral output shocks. Given Sierra Leone's dependence on mineral exports, production cycles can influence credit demand through investment needs and supply through income and liquidity effects (IMF, 2017). The trade balance serves as a proxy for external competitiveness and foreign exchange liquidity. Improvements in trade balance can stimulate domestic production, income, and creditworthiness, thereby facilitating credit expansion (Beck, 2008).

Recognising the potential dynamic interactions among the variables and the possibility of mixed orders of integration, the study adopts the Autoregressive Distributed Lag (ARDL) modelling framework. The ARDL specification is expressed as:

$$BCP_t = \gamma_0 + \sum_{i=1}^{m} \gamma_{1i} BCP_{t-i} + \sum_{k=0}^{q_1} \gamma_{2k}\, ExrVolatility_{t-k} + \sum_{k=0}^{q_2} \gamma_{3k}\, LendR_{t-k} + \sum_{k=0}^{q_3} \gamma_{4k}\, NLGovt_{t-k} + \sum_{k=0}^{q_4} \gamma_{5k}\, Minerals_{t-k} + \sum_{k=0}^{q_5} \gamma_{6k}\, TradeBal_{t-k} + \varepsilon_t \qquad (2)$$

This formulation allows for variables that are integrated of order zero [I(0)] and order one [I(1)], provided that none is integrated of order two [I(2)].

3.3. Stationarity Tests

Prior to estimation, the time series properties of all variables are tested to determine their order of integration. The study employs the Dickey-Fuller Generalised Least Squares (DF-GLS) test proposed by Elliott et al. (1996) as a more powerful alternative to the traditional Augmented Dickey-Fuller (ADF) test. The DF-GLS test improves power in small samples by transforming the series through GLS detrending before conducting the unit root test.

To account for potential structural breaks in the series, the Perron-Vogelsang (1992) test is conducted. This test endogenously determines a single break in either the intercept, trend, or both, thereby providing a more accurate inference regarding stationarity under the presence of structural shifts. However, given that macroeconomic series may also be subject to multiple structural breaks, the Clemente-Montañés-Reyes (1998) test is also used. This test allows for two structural breaks in the mean or in both the mean and trend of the series.

3.4. ARDL and Bounds Testing Approach

The ARDL bounds testing methodology developed by Pesaran et al. (2001) is employed to assess the existence of a long-run relationship among the variables. This involves estimating an unrestricted error correction model (UECM) of the following form:

$$\Delta BCP_t = \beta_0 + \sum_{i=1}^{m-1} \beta_{1i}\, \Delta BCP_{t-i} + \sum_{k=0}^{q_1-1} \beta_{2k}\, \Delta \mathrm{Exr}Volatility_{t-k} + \sum_{k=0}^{q_2-1} \beta_{3k}\, \Delta LendR_{t-k} + \sum_{k=0}^{q_3-1} \beta_{4k}\, \Delta NLGovt_{t-k} + \sum_{k=0}^{q_4-1} \beta_{5k}\, \Delta Minerals_{t-k} + \sum_{k=0}^{q_5-1} \beta_{6k}\, \Delta TradeBal_{t-k} + \delta_1 BCP_{t-1} + \delta_2 Volatility_{t-1} + \delta_3 LendR_{t-1} + \delta_4 NLGovt_{t-1} + \delta_5 Minerals_{t-1} + \delta_6 TradeBal_{t-1} + U_t \quad (3)$$

The null hypothesis of no cointegration is tested as:

$$H_0: \delta_1 = \delta_2 = \cdots = \delta_6 = 0$$

against the alternative that at least one $\delta_i \neq 0$. An F-statistic is computed for the joint significance of the lagged level variables and compared against the critical bounds provided by Pesaran et al. (2001). If the F-statistic exceeds the upper bound, the null is rejected, implying the existence of a long-run relationship. If it falls below the lower bound, the null cannot be rejected. If it lies between the bounds, the test result is inconclusive.

In addition to the F-test, a t-test on the coefficient of the lagged dependent variable is computed as a supplementary indicator of cointegration. A sufficiently large negative and statistically significant t-statistic further supports the presence of a long-run equilibrium relationship.

3.5. Diagnostic and Stability Tests

Following the ARDL estimation, post-estimation diagnostic tests are conducted to ensure the reliability and validity of the model. These include tests for autocorrelation, heteroskedasticity, normality of residuals, and parameter stability.

Autocorrelation is assessed using the Breusch-Godfrey LM test. If residuals are serially correlated, the Newey-West heteroskedasticity and autocorrelation consistent (HAC) standard errors are applied to correct for bias in standard errors, especially in the short-run dynamics. Heteroskedasticity is examined using both the White test and the Breusch-Pagan-Godfrey test. In the presence of heteroskedasticity, robust standard errors are used to ensure efficient estimation. The normality of the residuals is tested using the Jarque-Bera test. Though normality is not a strict requirement for consistency, it is useful in evaluating the reliability of hypothesis testing in small samples. The Ramsey regression equation specification error test (RESET) is also conducted to assess model specification and detect potential omitted variable bias or functional form misspecification. Finally, the structural stability of the model is evaluated through the recursive Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMSQ) tests. These graphical tests detect potential structural shifts over the sample period. If the recursive residual plots remain within the 5 percent confidence bounds, the model is deemed to be stable.

4. Results and Discussion

Table 2 reports the descriptive statistics of the variables. Private sector credit displays relatively low dispersion, reflecting the slow-moving nature of bank lending, whereas exchange rate volatility is episodic and highly variable, consistent with the shallow and thinly traded foreign exchange market. Lending rates show wide fluctuations after deflation, at times producing negative real values, which suggests that credit pricing has been influenced by episodes of

exceptionally high inflation rather than by fundamental shifts in nominal rates. Net commercial bank lending to government and the trade balance also exhibit substantial variation, highlighting the volatility of macroeconomic conditions over the sample period. These features underscore the importance of adopting an econometric framework capable of capturing both short-run dynamics and long-run equilibrium relationships.

Table 2: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Ln_Bank credit to private sector	168	7.885	.084	7.655	8.055
Exchange rate volatility	168	.016	.02	.004	.147
Lending rate	168	5.734	13.209	-34.145	19.819
Ln_Net comm. bank lending to government	168	8.16	.483	6.909	8.754
Minerals	167	-.089	4.156	-15.639	10.47
Ln_Trade balance	168	-17.478	10.162	-21.961	20.695

Source: Authors' computation using Stata 17

Table 3 presents the results of the unit root tests using the Dicky-Fuller Generalised Least Squares Test, the Perron-Vogelsang one structural break test, and the two-break Clemente-Montañés-Reyes test. These results confirm that the variables are integrated of mixed orders, with some stationary in levels and others stationary only after first differencing. The minerals variable, which attains stationarity only after second differencing, is differenced once in the model so that it enters as an I(1) process. This outcome validates the use of the ARDL bounds testing framework, which accommodates such mixed integration properties while ensuring that long-run relationships, if present, are properly identified.

Table 3: Stationarity Tests on Model Variables

Variable	**DF-GLS**	**PV**	**CMR**	**Conclusion**
Ln_ Bank credit to private sector	I(0)	I(K)	I(0)	I(0)
Exchange rate volatility	I(0)	I(1)	I(1)	I(0)
Lending rate	I(1)	I(1)	I(1)	I(1)
Ln_Net comm. bank lending to government	I(1)	I(1)	I(1)	I(1)
Minerals	I(K)	I(K)	I(2)	I(2)
Ln_Trade balance	I(0)	I(0)	I(0)	I(0)
DF-GLS: Dicky-Fuller Generalized Least Squares test for stationarity **PV:** Perron-Vogelsang test for stationarity **CMR:** Clemente-Montañés-Reyes test for stationarity				

Source: Authors' computation using Stata 17

The bounds testing results in Table 4 establish the presence of cointegration: the calculated F-statistic exceeds the upper bound of the critical values at the 5 percent significance level. Even though the significance of the supplementary t-statistic on the lagged dependent variable is inconclusive, the significant and negative error correction term reported in Table 6 further validates cointegration and supports the existence of a stable long-run equilibrium relationship among the variables. This evidence justifies the estimation of both long-run coefficients and the associated error-correction model.

Table 4: Bounds Test Results

Statistic	Value	5% CV I(0)	5% CV I(1)
F-statistic	4.185	2.644	3.883
t-statistic	-3.280	-2.841	-4.174

Source: Authors' computation using Stata 17

The long-run coefficients reported in Table 5 provide the central findings of the study. Exchange rate volatility exerts a negative and marginally significant effect on bank credit to the private sector, with a coefficient of –3.513. Interpreting this effect in economically meaningful terms, a one–standard deviation increase in volatility (approximately 0.02) reduces private sector credit by about 7 percent. This finding supports the hypothesis that persistent exchange rate uncertainty amplifies credit risk perceptions and discourages bank lending, consistent with the financial accelerator mechanism and with empirical evidence from other frontier and emerging markets. The implication for Sierra Leone is that an unstable foreign exchange environment constitutes a structural barrier to credit deepening, deterring banks from extending long-term credit to private borrowers.

Table 5: Long-run Model

Dependent Variable: Ln_Bank credit to private sector

Variable	Coefficient	Std. Error	t-Statistic
Exchange rate volatility	-3.513*	2.041	-1.72
Lending rate	0.005**	0.002	2.22
Ln_Net comm. bank lending to government	0.144***	0.052	2.75
Minerals	-0.013*	0.008	-1.69
Ln_Trade balance	-0.004	0.003	-1.55
Observations: 165			
R-Squared: 0.21			
Root Mean Squared Error: 0.03			

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Source: Authors' computation using Stata 17

Other macroeconomic determinants also play important roles. The lending rate is positively associated with private credit in the long run, a result that runs counter to conventional expectation but may reflect periods of stronger credit demand or cyclical expansions rather than binding price rationing. Net commercial bank lending to government enters positively and significantly, suggesting that public sector borrowing has not crowded out private credit but instead may have supported bank liquidity and intermediation capacity. The mineral price index is negatively related to private credit at the 10 percent level, reflecting the vulnerability of the domestic economy to external shocks: swings in mineral export earnings tend to transmit uncertainty into the domestic financial system and dampen lending. The trade balance, though negative, is statistically insignificant, indicating limited direct influence on credit outcomes once other variables are accounted for.

Table 6 presents the short-run dynamics from the error correction model. Exchange rate volatility does not exert a significant contemporaneous effect on credit flows, though its lagged

value is weakly positive, suggesting that banks adjust gradually to changes in foreign exchange conditions. This slow adjustment is consistent with the contractual nature of credit, where loan supply decisions are not revised month to month but instead reflect cumulative expectations of risk. Mineral prices exert a small and negative short-run effect, underscoring the short-lived but tangible impact of commodity cycles on financial intermediation. The error correction term is negative and highly significant, with a coefficient of –0.119, indicating that about 12 percent of any deviation from the long-run equilibrium is corrected each month. This implies a half-life of roughly five to six months, highlighting the persistence of disequilibria in Sierra Leone's credit market.

Table 6: Error Correction Model

Dependent Variable: Ln_Bank credit to private sector

Variable	Coefficient	Std. Error	t-Statistic
Error Correction Term	-0.119***	0.036	-3.28
L1_Ln_Bank credit to private sector	0.031	0.083	0.37
Exchange rate volatility	-0.108	0.163	-0.66
L1_ Exchange rate volatility	0.248	0.163	1.52
Lending rate	0.002	0.002	1.06
L1_ Lending rate	-0.002	0.002	-1.04
Ln_Net comm. bank lending to government	0.028	0.049	0.56
L1_ Ln_Net comm. bank lending to government	-0.021	0.048	-0.44
Minerals	-0.001*	0.001	-1.84
L1_ Minerals	0.0003	0.001	0.66
Ln_Trade balance	-0.0002	0.00023	-0.86
L1_ Ln_Trade balance	0.00005	0.00023	0.20

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Source: Authors' computation using Stata 17

Post-estimation diagnostic and stability tests confirm the robustness of the results. The residuals show no evidence of autocorrelation or heteroskedasticity, while the recursive CUSUM and CUSUMSQ tests indicate parameter stability over the sample period. Although the residuals fail the normality test, this is not a major concern given the relatively large sample size. The Ramsey RESET test fails to reject the null hypothesis, suggesting that the model is correctly specified with no evidence of omitted variables or functional form misspecification. The full set of diagnostics are reported in the appendices.

These results indicate that persistent volatility in the foreign exchange market constitutes a significant long-run impediment to credit expansion. Policies aimed at reducing exchange rate uncertainty, through credible exchange rate management and the development of hedging instruments, are essential for improving the risk environment faced by banks and borrowers. The positive association between net government borrowing and private credit suggests that fiscal operations, if well managed, can complement rather than crowd out intermediation. Meanwhile, the sensitivity of credit to external commodity shocks calls for stronger

macroprudential frameworks to dampen the procyclical effects of mineral dependence on domestic credit conditions.

5. Conclusion

This study investigated the determinants of private sector credit in Sierra Leone, focusing on exchange rate volatility within an ARDL framework. The results show that persistent volatility in the foreign exchange market exerts a significant long-run contractionary effect on credit, while government borrowing and lending rates play complementary roles. Adjustment to long run equilibrium is slow, highlighting structural rigidities in the financial system.

The findings underscore important monetary policy implications. Exchange rate stabilization should be a central objective for the Bank of Sierra Leone, as excessive volatility undermines credit intermediation and weakens the monetary transmission mechanism. Strengthening the credibility of exchange rate management, alongside the gradual development of hedging instruments, would reduce risk perceptions and support private sector lending. Careful coordination between fiscal and monetary policy is also essential to ensure that government borrowing bolsters banking system liquidity without jeopardizing debt sustainability. Future research should incorporate bank-level data to capture heterogeneity in lending responses, and further explore the interaction between exchange rate volatility, inflation dynamics, and capital flows.

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Appendices

Appendix Table A1: Dicky-Fuller Generalized Least Squares Stationarity Test

Variable	Form	Lag Length	Test Statistic	Stationarity Conclusion
Ln_Bank credit to private sector	L	1	-2.026	I(0)
Exchange rate volatility	L	1	-4.358	I(0)
Lending rate	L	2	-1.411	I(1)
	1D	1	-4.607	
Ln_Net comm. bank lending to government	L	1	-0.696	I(1)
	1D	2	-3.243	
Minerals	L	1	-1.141	I(K)
	1D	9	-1.169	
	2D	10	-0.376	
Ln_Trade balance	L	1	-6.032	I(0)

Source: Authors' computation using Stata 17

Appendix Table A2: Perron-Vogelsang Single Break Unit Root Test Results

Variable	Form	Additive Outlier			Innovative Outlier			Conclusion
		Break Date	P-Value	Statistic	Break Date	P-Value	Statistic	
Ln_Bank credit to private sector	L	2023m1	0.000	-3.080	2022m8	0.035	-3.976	I(K)
	1D	2020m9	0.774	-6.664	2020m10	0.380	-12.799	
	2D	2012m10	0.859	-11.100	2012m11	0.609	-6.936	
Exchange rate volatility	L	2022m9	0.000	-2.591	2022m3	0.068	-3.309	I(1)
	1D	2022m9	0.862	-4.432	2022m10	0.000	-7.232	
Lending rate	L	2023m3	0.000	-2.002	2021m8	0.026	-2.549	I(1)
	1D	2023m11	0.000	-1.866	2023m11	0.001	-4.771	
Ln_Net comm. bank lending to government	L	2023m6	0.000	-2.580	2013m4	0.042	-3.323	I(1)
	1D	2014m11	0.021	-13.580	2020m10	0.031	-5.734	
Minerals	L	2021m3	0.000	-3.341	2020m3	0.001	-3.886	I(K)
	1D	2022m5	0.512	-2.761	2022m6	0.810	-3.105	
	2D	2022m3	0.692	-8.559	2022m4	0.983	-9.779	
Ln_Trade balance	L	2013m12	0.081	-2.527	2014m1	0.028	-9.424	I(0)
5% Critical Values		**-3.560**			**-4.270**			

Source: Authors' computation using Stata 17

Appendix Table A3: Clemente-Montañés-Reyes unit-root test with double mean shifts

Panel A: Additive Outlier (AO)							
Variable	Form	**First Break**		**Second Break**		**Statistic**	Stationarity Conclusion
		Break Date 1	**P-Value**	**Break Date 2**	**P-Value**		
Ln_Bank credit to private sector	L	2018m10	0.000	2023m1	0.000	-4.401	I(K)
	1D	2012m10	0.455	2020m9	0.929	-7.059	
	2D	2012m10	0.860	2017m2	0.969	-11.058	
Exchange rate volatility	L	2022m7	0.000	2023m7	0.000	-2.046	I(K)
	1D	2015m8	0.836	2022m9	0.819	-3.296	
	2D	2022m9	0.808	2023m1	0.691	-5.933	
Lending rate	L	2016m4	0.000	2022m7	0.000	-4.659	I(K)
	1D	2021m7	0.000	2023m11	0.000	-3.282	
	2D	2020m11	0.763	2023m6	0.672	-5.210	
Ln_Net comm. bank lending to government	L	2013m10	0.000	2019m3	0.000	-4.255	I(1)
	1D	2014m11	0.061	2020m9	0.568	-5.970	
Minerals	L	2014m5	0.000	2021m1	0.000	-3.265	I(K)
	1D	2020m2	0.011	2022m5	0.030	-2.882	
	2D	2022m3	0.050	2022m6	0.052	-8.381	
Ln_Trade balance	L	2013m10	0.000	2013m12	0.000	-3.619	I(K)
	1D	2014m1	0.515	2024m1	0.868	-5.826	
	2D	2013m2	0.865	2016m11	0.728	-3.869	
5% Critical Value	-5.490						
Panel B: Innovative Outlier (IO)							
Ln_Bank credit to private sector	L	2018m5	0.000	2022m8	0.000	-5.541	I(0)
Exchange rate volatility	L	2022m3	0.000	2023m8	0.000	-5.019	I(1)
	1D	2022m10	0.306	2023m6	0.094	-7.031	
Lending rate	L	2016m1	0.001	2022m1	0.000	-4.322	I(1)
	1D	2021m8	0.000	2023m11	0.000	-7.399	
Ln_Net comm. bank lending to government	L	2013m5	0.003	2017m4	0.035	-4.042	I(1)
	1D	2014m6	0.067	2020m10	0.119	-6.139	
Minerals	L	2020m9	0.000	2022m2	0.001	-4.180	I(2)
	1D	2022m2	0.002	2022m6	0.002	-3.117	
	2D	2022m2	0.000	2022m7	0.000	-9.597	
Ln_Trade balance	L	2013m8	0.000	2014m1	0.000	-13.022	I(0)
5% Critical Value	-5.490						

Source: Authors' computation using Stata 17

Appendix Box A1: Trends of Model Variables

Source: Authors' computation using Stata 17

Appendix Table A4. Diagnostic Tests

Test	Null Hypothesis (H_0)	Test Statistic	p-value	Conclusion
Skewness–Kurtosis (sktest)	Residuals are normally distributed	Adj. $\chi^2(2) = 18.31$	0.0001	Reject H_0
Jarque–Bera	Residuals are normally distributed	$\chi^2(2) = 82.31$	0.0000	Reject H_0
Breusch–Godfrey (Lag 1)	No serial correlation	$\chi^2 = 2.116$	0.1457	Fail to reject H_0
Breusch–Godfrey (Lag 2)	No serial correlation	$\chi^2 = 2.231$	0.3277	Fail to reject H_0
Breusch–Pagan/Cook–Weisberg	Constant variance	$\chi^2(1) = 0.06$	0.8014	Fail to reject H_0
White's Test	Homoskedasticity	$\chi^2(164) = 165.00$	0.4634	Fail to reject H_0
Cameron & Trivedi (Total)	No heteroskedasticity or non-normality	$\chi^2(182) = 186.07$	0.4027	Fail to reject H_0

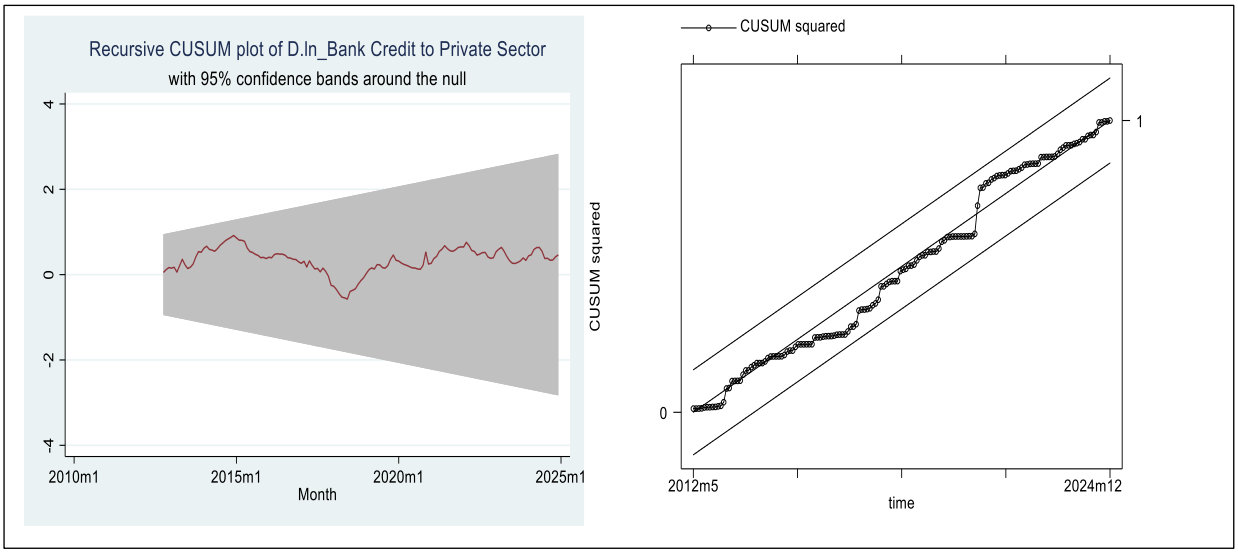
Source: Authors' computation using Stata 17

Appendix Table A5. Model Specification Test

Test	Null Hypothesis (H_0)	Test Statistic	p-value	Conclusion
Ramsey RESET Test	Model has no omitted variables	F(3,144) = 1.20	0.3137	Fail to reject H_0

Source: Authors' computation using Stata 17

Appendix Box A2. Model Stability Test



Source: Authors' computation using Stata 17