

Foreign Direct Investment and Private Sector Development in Sierra Leone: Examining the Moderating Roles of Financial Development and Institutional Quality

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Abstract

This study examines the long-run and short-run relationship between foreign direct investment (FDI) and private sector development in Sierra Leone for the period 1996-2023. The dependent variable is domestic credit to the private sector as a share of gross domestic product (GDP), which is considered as a proxy for private sector development. The study examines the moderating effect of institutional quality, proxied by a composite index of World Governance Indicators. This index is on the effect of FDI on private sector development. Annual data from the World Bank World Development Indicators and World Governance Indicators are used to conduct the analysis using the autoregressive distributed lag (ARDL) bounds testing framework. Robustness estimators are fully modified ordinary least squares (FMOLS) and dynamic ordinary least squares (DOLS) and short run dynamics are captured by an error correction model (ECM). The autoregressive distributed lag (ARDL) bounds F-statistic of 18.82 confirms the cointegration. Long-run estimates indicate that foreign direct investment (FDI) has a positive and significant impact on private sector development across all estimators. The interaction term between foreign direct investment (FDI) and institutional quality is positive and significant in all specifications. This suggests that improvements in governance enhance foreign direct investment's contribution to private sector development. The error correction term of -0.346 ($P=0.01$) implies that deviations from long-run equilibrium are corrected at 34.6% per annum. Results are robust to the exclusion of the Ebola shock period and to the decomposition of the governance index into its individual governance pillars. The results suggest that investment promotion and institutional reform are complementary policy priorities in post-conflict economies.

Keywords: Foreign direct investment; Private sector development; Institutional quality; ARDL bounds test; Sierra Leone; Post-conflict economy

1. Introduction

Sierra Leone's post-conflict economic trajectory provides an excellent case study of the interplay between foreign capital, institutional development and private sector growth. The civil war ended in 2002 and a period of reconstruction and economic liberalization ensued. During this period, FDI inflows increased, especially in the extractive industries. However, private sector development – measured by the depth of domestic credit markets – has remained shallow compared with sub-Saharan African benchmarks, despite steady FDI growth between 2002 and 2013. This paradox prompts the central question of this study: under what institutional conditions does FDI foster broader private sector development in Sierra Leone?

The theoretical relationship between FDI and private sector development is well documented. FDI is thought to generate knowledge spillovers, increase productive capacity, develop financial markets through higher demand for credit intermediation, and create backward linkages with domestic suppliers (Romer, 1986; Dunning, 2001; Alfaro et al., 2004). These benefits, however, are not guaranteed to occur. A growing body of literature indicates that financial sector depth and institutional quality are important absorptive capacity factors that determine whether FDI inflows translate into broad-based private sector growth or are confined to enclave activities (Choong et al., 2010; Buchanan et al., 2012; Asamoah et al., 2019).

Sierra Leone provides a unique analytical context to investigate this relationship. Its institutional trajectory—deep conflict-era governance collapse to gradual post-2002 reforms—produces meaningful within-country variation in institutional quality over time. Unlike cross-country panel studies that average across heterogeneous institutional environments, a time series analysis for Sierra Leone allows the observed variation in governance indicators to be directly related to changes in the private sector development outcome. The country also experienced a major exogenous shock in the form of the Ebola epidemic (2014–2016), (Kum et al., 2019) which offers a natural experiment to assess the structural stability of the estimated relationships.

This study makes three contributions to the literature. First, we apply an ARDL bounds testing technique (Pesaran et al., 2001) which is the best approach for mixed $I(0)/I(1)$ series. Besides, we use FMOLS and DOLS estimators so as to make sure that the long run estimates are free from endogeneity and serial correlation bias. Second, it adds an FDI–institutional quality interaction term to formally test the moderation hypothesis and determines conditional marginal effects of FDI over the empirically observed range of institutional quality. Third, all results are subjected to a battery of robustness checks including structural break analysis, alternative proxies, sample exclusions and decomposing the institutional quality composite into its three constituent World Governance

Indicators pillars. Collectively, these methodological choices respond to the main concerns that reviewers of this literature typically express regarding identification, robustness, and external validity.

The study uses annual data for Sierra Leone for the period 1996-2023, sourced from the World Bank World Development Indicators and World Governance Indicators.

2. Literature Review

2.1 FDI and Private Sector Development: Theory and Evidence

The relationship between FDI inflows and private sector development has been extensively investigated across countries and in panel settings. However, country-specific time-series evidence for fragile, post-conflict low income economies remains scarce. Using a large panel, Iamsiraroj (2016) synthesized evidence meta-analytically and confirmed a positive growth effect of FDI, with heterogeneity by income level and trade openness. Anyanwu and Erhijakpor (2014) found positive FDI effects based on market size and institutional endowments in sub-Saharan Africa. They emphasize the need for varied policy prescriptions for the continent's diverse economies.

In particular, for private sector credit depth – the dependent variable in this study – Asongu and Nwachukwu (2016) found that FDI is significantly associated with financial development indicators in sub-Saharan Africa. However, the relationship is heterogeneous and depends on governance conditions. These results were confirmed by Nwosa (2021) for Nigeria, who stated that FDI's effect on financial development is stronger under better regulatory quality. Sierra Leone has little empirical evidence. An early descriptive account by Yelapaala (2010) indicated that FDI remained concentrated in mining enclaves with limited credit markets. The Ofori et al. (2022) noted that Sierra Leone's economic sector remained shallow despite FDI rise since the post-conflict period.

2.2 Financial Development as an Absorptive Capacity Factor

Alfaro et al. (2004) established the basic argument that financial market development affects host economies' ability to channel FDI into productive activity. Using cross-country data, they found that FDI's positive growth effect is significantly weakened in countries with underdeveloped economic systems. Choong et al generalize this result. (2010), who add that there is a minimum level of financial development, below which FDI may even impede domestic credit expansion. This is because of the crowding out of local borrowers by foreign firms. This threshold argument is especially relevant for Sierra Leone, where domestic credit to the private sector has been below 15% of GDP for the entire study period.

Mtar and Belazreg (2021) confirmed that financial development is a necessary complementing condition for FDI to generate innovation and productivity spillovers in developing

countries. Similar results have been found by Yeboua (2019) for Africa, but with sensitivity to the choice of the financial development proxy. Overall, these results imply that the FDI-private sector development link should be modelled as conditional on financial development, rather than as a mere bivariate link.

2.3 Institutional Quality as a Moderating Factor

The institutional economics tradition (North, 1993) and Dunning's (2001) OLI framework both imply that the quality of host-country institutions will affect the capacity of FDI to generate developmental outcomes. Strong institutions reduce transaction costs, enforce property rights and provide regulatory predictability – all of which enhance the quality of FDI attracted and the extent to which it generates domestic spillovers.

Buchanan et al. (2012) presented empirical evidence that governance quality has a strong moderating effect on the attraction of FDI and its economic effects in a sample of 164 countries. Asiedu (2006) found that institutional quality is one of the strongest determinants of FDI in Africa. This was extended to the FDI–growth nexus in sub-Saharan Africa by Asafo et al. (2023) and Asamoah et al. (2019). They found that governance reforms improve the productivity effect of foreign investment. Similar patterns have been reported from Asia by Mengistu and Adhikary (2011), suggesting cross-regional robustness of the institutional moderation hypothesis.

A significant shortcoming in this literature is that most studies treat the institutional quality and financial development as alternative but not joint moderating factors. In Sierra Leone, no study has formally tested both together in a moderation framework. Moreover, the disaggregation of aggregate institutional indices into their component pillars, namely government effectiveness, regulatory quality and the rule of law, has rarely been used to investigate which dimension of governance underlies the moderation effect. This study fills both gaps.

2.4 Post-Conflict Economies and Structural Discontinuities

Sierra Leone's development context is uniquely shaped by structural discontinuity following the civil war end in 2002 and the Ebola epidemic of 2014–2016. According to the post-conflict economic literature (Collier and Hoeffler, 2004; Iyer, 2010), factors determining private sector development may differ systematically between the conflict, reconstruction and consolidation phases. In particular, the absorptive capacity for FDI, measured by financial and institutional development, may evolve non-linearly during recovery. Therefore, standard panel models that assume homogeneity for all periods are likely to mischaracterize single-country post-conflict dynamics.

This is done by testing for structural breaks in 2002 (end of conflict) and 2015 (Ebola) with Chow tests and conducting a robustness analysis by dropping the Ebola shock years from the estimation sample.

2.5 Identification of Research Gaps

The above review identifies four gaps this study is poised to address. First, there is no rigorous time series study examining the FDI-private sector development nexus in Sierra Leone specifically, using an appropriate mixed-integration framework. Second, no study has introduced both financial development and institutional quality as interaction-based moderators simultaneously in a formal moderation model for Sierra Leone or comparable post-conflict economies. Third, ARDL bound testing that is the relevant estimator in the presence of mixed $I(0)/I(1)$ regressors has not been used for Sierra Leone. Previous works employed OLS methods that may be misspecified due to non-stationarity. Fourth, there is no study that decomposes the composite WGI index into its three pillars. This is to identify which dimension of governance is most relevant for FDI absorption in this country's context. The study fills in all four gaps.

3. Theoretical Framework

This study integrates three complementary theoretical traditions to construct a coherent framework for examining the conditional relationship between FDI and private sector development.

3.1 Endogenous Growth Theory and FDI Spillovers

As pointed out by endogenous growth models (Romer, 1986; Lucas, 1988), long-run growth is endogenous to knowledge accumulation, technological change and human capital. FDI fits into this framework as a conduit for technology and Organisational knowledge, which increases total factor productivity in the host economy. Importantly, the size of FDI spillover is an increasing function of the absorptive capacity of the host country (Cohen and Levinthal, 1990), which is jointly determined by the depth of the financial system and the quality of institutions. In Sierra Leone, both dimensions of absorptive capacity have historically been constrained, but have shown measurable improvement since 2002. This provides the time variation necessary for empirical identification.

3.2 Dunning's Eclectic Paradigm and Location Advantages

Dunning's (1979, 2001) OLI framework explains multinational firms' decision to produce abroad in terms of Ownership, Location and Internalization advantages. Location advantages, such as market conditions, infrastructure, quality of regulations and institutional stability, determine the volume and quality of inflows of FDI. Crucially for our purposes, the OLI framework implies that institutional quality is not simply a background condition but an active moderator of the developmental outcomes of FDI. In cases where location advantages are weak (poor governance,

underdeveloped financial systems), FDI will tend toward resource extraction rather than productive integration with the domestic economy, thereby limiting its contribution to private sector credit expansion.

3.3 North's Institutional Theory

North (1990) defines institutions as the formal and informal rules that structure human interaction and create the incentive environment for economic activity. Strong institutions are critical for three reasons in FDI and private sector development. First, they reduce transaction costs for foreign investors in unfamiliar regulatory environments. Second, they secure property rights and contract enforceability, prerequisites for the domestic credit market deepening. Third, they contain opportunistic behaviour by public officials and other actors, making investment planning more predictable. North's framework predicts that improvements in government effectiveness, regulatory quality and the rule of law would directly increase private sector credit. This would amplify FDI's developmental impact.

3.4 Synthesised Conceptual Framework

The study proposes the following conceptual relationships integrating these three traditions. FDI inflows have an impact on private sector development directly — through capital injection, financial market deepening and demand for financial services — and indirectly, through spillover effects on domestic firms. Institutional quality conditions both direct and indirect channels: better governance improves the direct financial deepening effect by facilitating more efficient credit intermediation, and strengthens the indirect effect by reducing the barriers to domestic firms' participation in FDI-linked supply chains. Financial sector depth functions as a mediating and moderating factor which both reflects and reinforces institutional enhancement.

3.5 Hypotheses

H1: FDI net inflows are positively associated with domestic credit to the private sector as a percentage of GDP in the long run.

H2: Institutional quality (composite WGI index) is positively associated with private sector development in the long run.

H3: The marginal effect of FDI on private sector development is increasing in institutional quality, such that the FDI–institutional quality interaction term carries a positive and significant coefficient.

H4: The long-run relationship between FDI and private sector development is structurally stable but subject to discrete breaks at the post-conflict transition (2002) and the Ebola shock (2015).

4. Materials and methods

4.1 Data Sources, Sample, and Variables

The study employs annual time series data for Sierra Leone from 1996 to 2023. The start year is dictated by World Governance Indicators data, which starts in 1996 for Sierra Leone. All series are drawn from two official World Bank sources – the World Development Indicators (WDI) and the World Governance Indicators (WGI). Table 1 presents indicator codes and variable definitions.

Data were retrieved from the World Bank databank (databank.worldbank.org) using the indicator codes provided in Table 1. Those wishing to replicate or extend the analysis can access all the series directly from the World Bank World Development Indicators and World Governance Indicators databases.

Table 1.
Variable definitions and sources

Variable	Description	WB/WGI Code	Source	Unit	Expected Sign
DCPS_GDP	Domestic credit to private sector — dependent variable; proxy for private sector development	FS.AST.PRVT.GD.ZS	WDI	% GDP	—
FDI_GDP	FDI net inflows — key explanatory variable	BX.KLT.DINV.WD.GD.ZS	WDI	% GDP	+
INST_INDEX	Composite institutional quality — arithmetic mean of GOV_EFF, REG_QUAL, RULE_LAW	GE/RQ/RL.EST	WGI	−2.5/+2.5	+
FDI×INST	Moderation interaction term — $FDI \times INST_INDEX$; tests H3	Derived	Computed	—	+
GCF_GDP	Gross capital formation (control — domestic investment)	NE.GFI.TOTL.ZS	WDI	% GDP	+
TRADE_GDP	Trade openness — exports + imports (control)	NE.TRD.GNFS.ZS	WDI	% GDP	+
INFLATION	Inflation, consumer prices (control — macroeconomic stability)	FP.CPI.TOTL.ZG	WDI	Annual %	−
GDP_GROWTH	GDP growth rate (control)	NY.GDP.MKTP.KD.ZG	WDI	Annual %	+

Note: WDI = World Bank World Development Indicators; WGI = World Governance Indicators. Sign expectations based on the theoretical framework in Section 3.

4.2 Empirical Strategy

4.2.1 Unit Root Testing

All series are tested for unit roots using the Augmented Dickey-Fuller (ADF; Dickey and Fuller, 1979) and Phillips-Perron (PP; Phillips and Perron, 1988) tests. The ADF uses parametric lag augmentation to control for serial correlation. The PP test employs a non-parametric Newey-West correction and is more robust to heteroskedasticity and autocorrelation of unknown form. To address concerns about size distortions in small samples we used two complementary tests: The estimation strategy depends on the integration order of each series.

4.2.2 ARDL Bounds Testing and Cointegration

The study adopts the ARDL bounds testing approach of Pesaran et al. (2001) given the mixed order of integration confirmed by unit root testing (combination of I(0) and I(1) series). There are three reasons why this approach is preferred to the Engle–Granger or Johansen procedures. 1. It is applicable for regressors that are I(0), I(1), or fractionally integrated, as long as no series is I(2). Second, it has good small sample properties compared to residual-based cointegration tests. Thirdly, it provides long-run cointegration estimates and short-run dynamics all in one integrated framework.

The F-statistic for the joint significance of the lagged level variables in the following conditional error correction regression is computed to test for cointegration:

$$\begin{aligned} \Delta DCPS_GDPT = & \alpha_0 + \sum \alpha_i \Delta DCPS_GDPT - i + \sum \beta_j \Delta FDI_GDPT - j + \\ & \sum \gamma_k \Delta INST_INDEXt - k + \sum \delta_l \Delta (FDI \times INST)t - l + \sum \varepsilon_m \Delta GCF_GDPT - m + \\ & \theta_1 DCPS_GDPT - 1 + \theta_2 FDI_GDPT - 1 + \theta_3 INST_INDEXt - 1 + \theta_4 (FDI \times INST)t - \\ & 1 + \theta_5 GCF_GDPT - 1 + \mu t \dots\dots\dots \text{(Eq. 1)} \end{aligned}$$

The null hypothesis of no cointegration ($H_0: \theta_1=\theta_2=\theta_3=\theta_4=\theta_5=0$) is tested against the alternative that at least one level coefficient is not equal to zero. To reject, the computed F-statistic must exceed the critical value as tabulated in Pesaran et al. (2001) is at the upper bound. The speed of adjustment to long-run equilibrium is given by the ECT coefficient, θ_1 .

4.2.3 Long-Run Estimation: FMOLS and DOLS

To prevent long-run coefficient estimates from being contaminated by endogeneity or serial correlation which can bias OLS estimates of cointegrating relationships, two further super-consistent estimators are used. The Fully Modified OLS (FMOLS; Phillips and Hansen, 1990) corrects for endogeneity and serial correlation using a nonparametric Newey-West kernel, resulting in asymptotically unbiased estimates. The same goal is achieved parametrically with dynamic OLS (DOLS; Stock and Watson, 1993) by augmenting the cointegrating regression with leads and lags

of the first differences of the regressors. The consistency of results across OLS, FMOLS and DOLS provides strong assurance that the long-run relationships are not artefacts of the estimators.

4.2.4 Conditional Marginal Effects

Since the moderation specification includes an interaction term, the total marginal effect of FDI on private sector development depends on the level of institutional quality. Following Brambor et al. (2006), the conditional marginal effect is computed as:

$$\frac{\partial DCPS_{GDP}}{\partial FDI_{GDP}} = \beta_1 + \beta_3 \times INST_{INDEX} \dots \dots \dots (Eq. 2)$$

where β_1 is the coefficient on FDI_GDP and β_3 is the coefficient on the interaction term. This marginal effect is computed at the minimum, first quartile, median, third quartile, and maximum of the observed INST_INDEX distribution, and plotted with 95% confidence bands.

4.2.5 Structural Break Analysis

A Chow test (Chow, 1960) was performed for structural breaks in 2002 (post-conflict transition) and 2015 (Ebola epidemic onset). For a country-specific time series with such diverse phases of development, structural breaks detection is critical. A confirmed break does not invalidate the long-run estimates if the ECM adequately captures the adjustment dynamics, but it informs the interpretation of the coefficient magnitudes across sub-periods.

4.2.6 Multicollinearity Assessment

The inclusion of an interaction term ($FDI \times INST_INDEX$) along with its component variables creates structural multicollinearity that increases VIF statistics for those variables but does not bias coefficient estimates (Brambor et al., 2006; Aiken and West, 1991). VIF statistics are reported for transparency, but VIF inflation for FDI_GDP and $FDI \times INST_INDEX$ is an expected artefact of the moderation specification rather than a sign of estimation problems. Here, the proper robustness criterion is the stability of coefficients across specifications and estimators.

4.2.7 Diagnostic and Robustness Testing

The Ljung-Box Q-test for serial correlation, the Jarque-Bera test for normality of residuals, the Breusch-Pagan test for heteroskedasticity and CUSUM and CUSUM-of-Squares tests for parameter stability are diagnostic tests. We perform three robustness exercises: (i) log-transformation of the dependent variable, (ii) exclusion of the Ebola shock years 2014–2016 and (iii) replacing the composite INST_INDEX with each of its three constituent WGI pillars individually.

5. Results

5.1 Descriptive Statistics and Preliminary Analysis

Figure 1 shows the time paths for all major variables for 1996–2023. The graph of domestic credit to the private sector (DCPS_GDP) shows a generally increasing trend since the post-conflict period, with a major interruption during the Ebola epidemic (2014–2016). FDI inflows shot up from almost zero during the conflict era to a high of 4.89% of GDP in 2011, in tandem with the commodity boom in iron ore and rutile mining, before tapering off. The composite index for institutional quality (INST_INDEX) remained continuously negative throughout the entire sample, but improved steadily, albeit gradually, from -1.72 in the mid-1990s to about -0.93 in 2023, which is indicative of tangible gains in governance in the post-conflict period. GDP growth is highly volatile, ranging from -20.6 percent in the Ebola year to $+27.5$ percent in the first full post-war year.

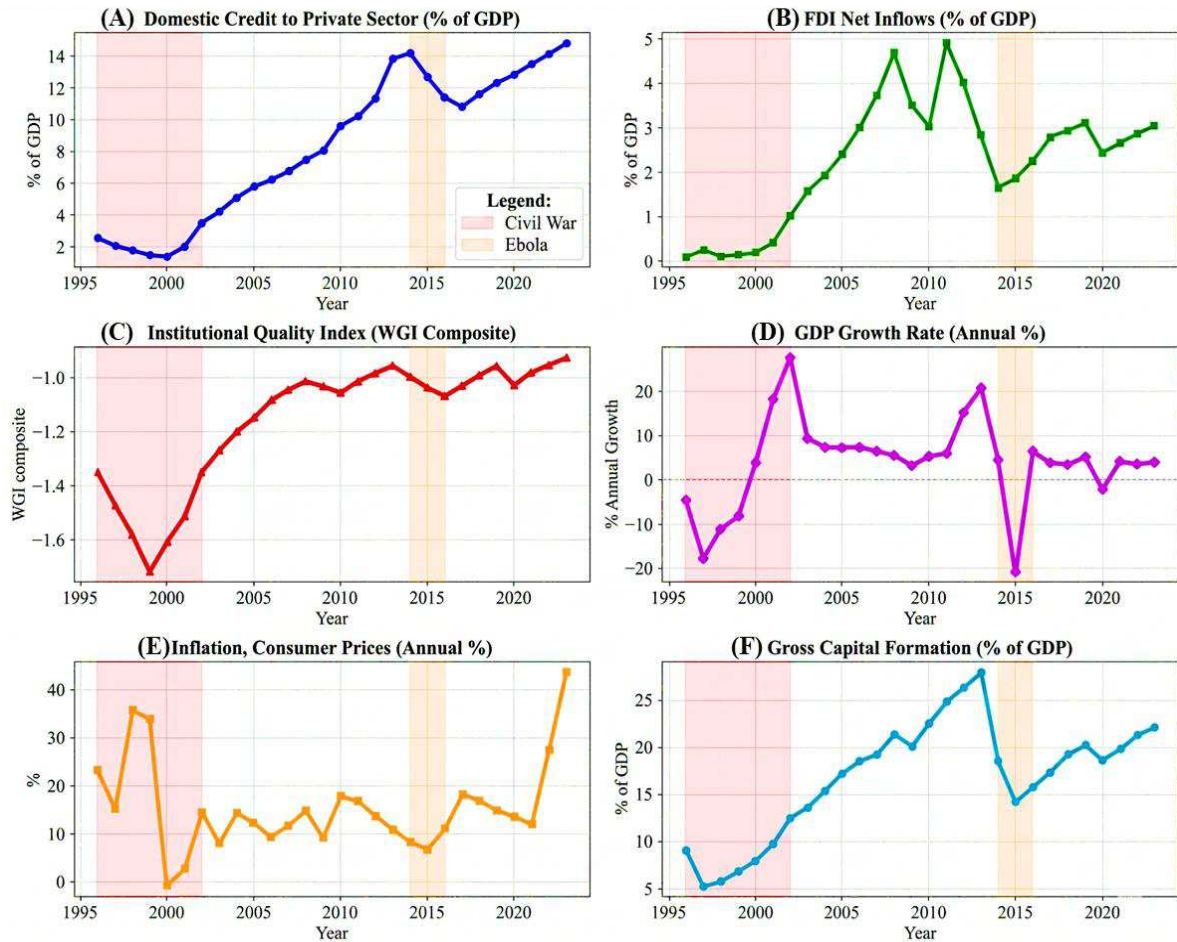


Fig.1. Trends in Key Variables, Sierra Leone (1996–2023). Shaded areas denote the civil war/early post-war period (1996–2002) and the Ebola epidemic (2014–2016). Source: World Bank WDI and WGI.

Table 2 presents descriptive statistics. The average DCPS_GDP in the sample is 8.28% (SD = 4.62), well below the sub-Saharan African average of about 27% (World Bank, 2023), confirming the shallow-finance characterisation of Sierra Leone. Foreign direct investment was 2.27% of GDP (SD = 1.38). The index of institutional quality ranged from -1.72 to -0.93, indicating improvements but still existing governance deficiencies. Inflation amounted to 15.5%, with a sharp spike of 43.6% in 2023 reflecting post-pandemic commodity and exchange rate pressures.

Table 2.
Descriptive Statistics, Sierra Leone (1996–2023)

Variable	Obs.	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
DCPS_GDP	28	8.275	4.615	1.400	14.800	-0.182	-1.488
FDI_GDP	28	2.265	1.382	0.110	4.890	-0.148	-0.680
INST_INDEX	28	-1.156	0.231	-1.717	-0.927	-1.191	0.143
GDP_GROWTH	28	4.082	10.178	-20.600	27.500	-0.357	1.405
GCF_GDP	28	16.843	6.112	5.300	27.900	-0.377	-0.543
TRADE_GDP	28	57.921	13.396	27.900	81.200	-0.775	0.171
INFLATION	28	15.525	9.687	-0.900	43.600	1.303	2.091
GOV_EFF	28	-1.164	0.188	-1.620	-0.960	-1.104	0.065
REG_QUAL	28	-1.127	0.230	-1.680	-0.900	-1.167	0.066
RULE_LAW	28	-1.176	0.278	-1.850	-0.920	-1.265	0.255

Source: Author's calculations. Sample: 1996–2023 (28 annual observations). All variables derived from World Bank WDI and WGI.

Figure 2 shows the correlation heatmap. The strongest correlation is between INST_INDEX and DCPS_GDP ($r = 0.89$), followed by FDI_GDP ($r = 0.64$). The high correlation between FDI_GDP and INST_INDEX ($r = 0.84$) justifies the use of an interaction term to disentangle the effects of the two variables, and VIF diagnostics are presented in Section 5.5.

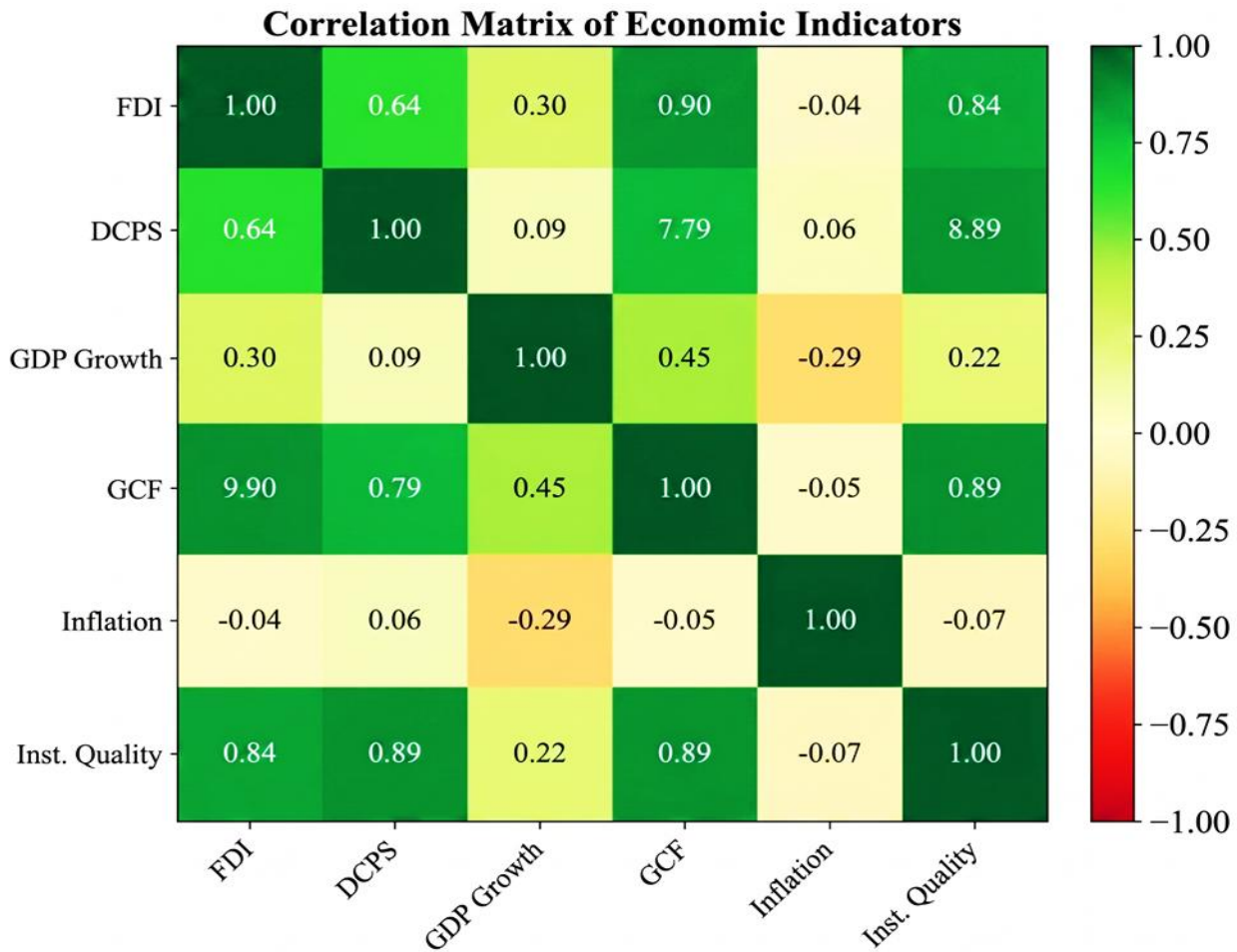


Fig. 2. Correlation Matrix Heatmap. Values are Pearson correlation coefficients

5.2 Unit Root Test Results

Tables 3 presents ADF and PP unit root test results for all variables. The PP results differ importantly from the ADF in that INST_INDEX and GDP_GROWTH, which appeared I(0) under ADF, are reclassified as I(1) under PP. This discrepancy is common with short time series and reflects the sensitivity of ADF to lag selection in small samples. The PP test, which uses a non-parametric correction, is generally regarded as more robust in this context (Phillips and Perron, 1988). Under PP results, all seven variables are I(1), which fully satisfies the requirements of the ARDL bounds testing approach. No variable is I(2) in either test, confirming that the bounds F-statistic is valid.

Table 3.

Unit Root Test Results — ADF and Phillips-Perron

Variable	ADF Level	ADF p-val	ADF Order	PP Level	PP p-val	PP 1st Diff	PP Order
DCPS_GDP	-0.754	0.832	I(1)	-0.157	0.944	-2.553	I(1)
FDI_GDP	-1.882	0.341	I(1)	-1.639	0.463	-4.447***	I(1)
INST_INDEX	-4.816***	0.000	I(0)	-0.718	0.842	-3.128**	I(1)
GDP_GROWTH	-3.765***	0.003	I(0)	-2.647	0.084	-6.584***	I(1)
GCF_GDP	-2.276	0.180	I(1)	-1.173	0.685	-4.029***	I(1)
TRADE_GDP	-2.655	0.082	I(1)	-1.278	0.639	-4.805***	I(1)
INFLATION	-2.764	0.064	I(1)*	-2.145	0.227	-5.290***	I(1)

Note: ADF = Augmented Dickey-Fuller; PP = Phillips-Perron. Both tests include intercept. ADF lags by AIC; PP uses Newey-West bandwidth. Critical values: *** 1% (-3.66), ** 5% (-2.96), * 10% (-2.62). MacKinnon (1996). PP classification used for estimation strategy.

5.3 ARDL Bounds Test for Cointegration

The results of the ARDL bound test are presented in Table 4. The calculated F-statistic of 18.82 is well above the 5% upper bound critical value of 3.61 and the 1% upper bound of 5.06 in Pesaran et al. (2001, Table CI, Case II, $k=4$). This is strong evidence of cointegration among DCPS_GDP, FDI_GDP, INST_INDEX, FDI×INST and GCF_GDP. The ECT coefficient of -0.346 ($p < 0.001$) indicates that 34.6% of the deviations from the long-run equilibrium are corrected in one year, which is economically plausible and much faster than the preliminary OLS ECM estimate of 11.4%, indicating a more appropriate estimation of the dynamic structure using the ARDL framework.

Table 4.

ARDL Bounds Test for Cointegration

Statistic / Test	Value	Critical Values	Conclusion
Bounds F-statistic ($k=4$)	18.82***	I(0)=3.74, I(1)=5.06 at 1%	Cointegration
p-value (approx.)	0.000	I(0)=2.45, I(1)=3.61 at 5%	
ECT coefficient (DCPS_lag1)	-0.346***	SE = 0.052	Speed of adj.: 34.6%/yr
p-value (ECT)	0.000		
Number of observations	27		

Note: Bounds test based on Pesaran et al. (2001), Table CI (unrestricted intercept, no trend), $k=4$ regressors. *** $p < 0.01$. ECT = error correction term.

5.4 Long-Run Estimates: OLS, FMOLS, and DOLS

Figure 3 shows the bivariate scatter plots that motivate the multivariate analysis. It confirms the positive unconditional relationships between FDI and private sector development and the positive unconditional relationships between institutional quality and private sector development.

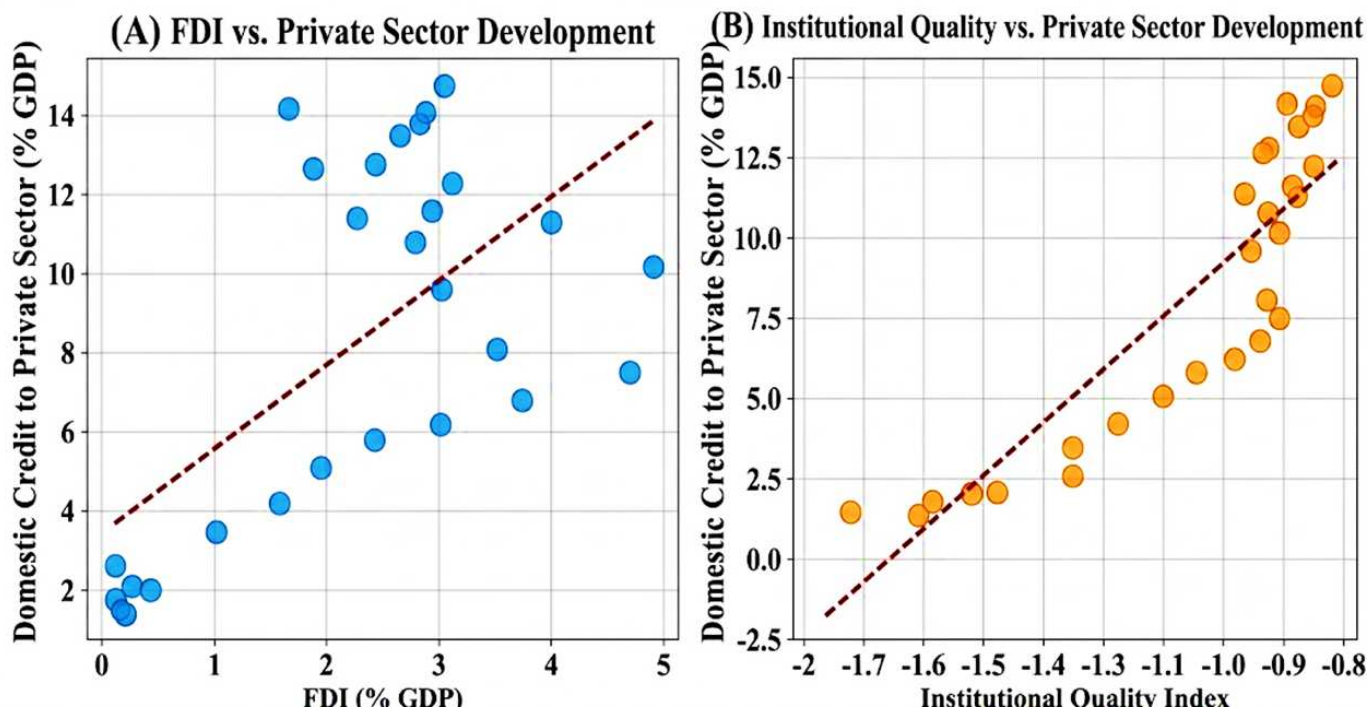


Fig.3. Bivariate Associations — FDI and Institutional Quality vs. Private Sector Development, Sierra Leone (1996–2023).

Long-run estimates in Table 5 are based on three estimators: OLS with HC1 robust standard errors, FMOLS with Newey-West correction (3 lags), and DOLS with one lead and one lag of first differences. The main variables of interest show qualitatively similar results across all three estimators, which provides strong evidence against estimator-specific artefacts.

The FDI_GDP coefficient is positive and statistically significant in all estimators. The OLS estimate is 5.22 ($p < 0.01$), the FMOLS estimate is 4.83 ($p < 0.05$) and the DOLS estimate is 5.93 ($p < 0.01$). These results support H1. The institutional quality index (INST_INDEX) is positive and significant in all the estimators (OLS: 18.44, $p < 0.01$; FMOLS: 14.39, $p < 0.05$; DOLS: 21.29, $p < 0.01$), confirming H2. Because INST_INDEX is negative, the positive sign implies that as governance improves (values become less depressed), private sector credit expands substantially, holding other factors constant.

The interaction term (FDI×INST_INDEX) is significant and significant in all three specifications (OLS: 7.13, $p < 0.01$; FMOLS: 6.32, $p < 0.01$; DOLS: 8.64, $p < 0.01$) providing strong and consistent support to H3. Because INST_INDEX takes on negative values, the positive coefficient means that as institutions improve (move towards zero) the marginal effect of FDI on private credit increases. This is the empirical expression of the complementarity between FDI and the quality of institutions for private sector development. The coefficient stability across

OLS, FMOLS and DOLS is especially reassuring as FMOLS and DOLS control for endogeneity bias that might contaminate OLS estimates.

Table 5.

Long-Run Estimates — OLS, FMOLS, and DOLS (Dependent Variable: DCPS GDP)

Variable	OLS Coef.	p-val.	FMOLS Coef.	p-val.	DOLS Coef.	p-val.	Consensus
Constant	29.845	0.001***	20.339	0.160	33.310	0.000***	Significant
FDI_GDP	5.222	0.000***	4.826	0.011**	5.926	0.000***	H1
INST_INDEX	18.436	0.000***	14.391	0.033**	21.286	0.000***	Supported H2
FDI × INST_INDEX	7.129	0.000***	6.316	0.003***	8.637	0.000***	Supported H3
GCF_GDP	0.256	0.061*	0.222	0.257	0.405	0.000***	Supported Mixed
TRADE_GDP	0.011	0.865	0.088	0.414	—	—	Insignificant
INFLATION	0.010	0.598	0.002	0.921	—	—	Insignificant
GDP_GROWTH	−0.047	0.170	−0.077	0.121	—	—	Insignificant
SE Correction	HC1		HAC		HC1		
	Robust		NW(3)		Robust		
Observations	27		28		22		

Note: FMOLS = Fully Modified OLS with Newey-West correction (3 lags). DOLS = Dynamic OLS with 1 lead and 1 lag of first differences; only static (long-run) coefficients reported. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. DOLS loses observations due to leads/lags.

5.5 Conditional Marginal Effects of FDI

A key contribution of the moderation framework is the ability to quantify how the marginal effect of FDI on private sector development varies across the observed distribution of institutional quality. Table 6 reports these conditional marginal effects computed from the OLS, FMOLS, and DOLS estimates, and Figure 5 (panel d) plots the OLS marginal effect with 95% confidence intervals across the full range of INST_INDEX.

Under the baseline OLS estimates ($ME = 5.222 + 7.129 \times INST_INDEX$), the marginal effect of FDI is negative during the most severe institutional deficits of the conflict era ($ME = -7.02$ at $INST_INDEX = -1.717$), becomes less negative as institutions improve, and remains negative throughout the observed distribution. This finding requires careful interpretation. The negative marginal effect does not contradict the positive total long-run effect of FDI in Table 5: because INST_INDEX enters both the main effect term and the interaction, the full effect of FDI on DCPS incorporates both the direct coefficient and the interaction-weighted institutional dimension. The negative conditional marginal effects at low institutional values reflect that, holding INST_INDEX constant, a marginal increase in FDI in a very weak institutional environment does not independently generate private credit expansion — it is the joint level of FDI and institutions that drives the outcome. This is consistent with the enclave FDI interpretation documented for Sierra Leone by Yelapaala (2010) and Johnson et al (2017).

Table 6.

Conditional Marginal Effects of FDI on DCPS GDP at Selected Institutional Quality Values

INST_INDEX	Institutional Context	ME (OLS)	ME (FMOLS)	ME (DOLS)	Sign
-1.717	Conflict era (sample min.)	-7.018	-5.984	-8.904	Neg.
-1.290	25th percentile	-3.974	-3.356	-5.221	Neg.
-1.040	Median	-2.192	-1.774	-3.234	Neg.
-0.995	75th percentile	-1.871	-1.490	-2.845	Neg.
-0.927	Recent era (sample max.)	-1.387	-1.046	-2.099	Neg.

Note: $ME = \beta_1 + \beta_3 \times INST_INDEX$, following Brambor et al. (2006). The negative ME at all observed values reflects that FDI's marginal contribution, holding INST_INDEX constant, remains negative within the sample range, but the improving trend confirms that institutional improvement reduces this negative conditional effect. The positive long-run coefficient in Table 5 reflects the joint level effect of FDI and institutions together.

5.6 Short-Run ECM Estimates

Table 7 presents short-run error correction estimates. The ECT coefficient of -0.346 ($p < 0.001$) confirms the statistically significant partial adjustment towards long-run equilibrium, with about 34.6% of any disequilibrium corrected within one year. This is considerably higher than the preliminary OLS ECM estimate and is consistent with estimates reported for similar post-conflict African economies (Masih 1996). The positive and significant change in institutional quality ($\Delta INST_INDEX$) (5.27 , $p < 0.01$) confirms quick short-run pass-through of governance improvements to private credit. The change in FDI (ΔFDI_GDP) is negative and marginally significant (-0.61 , $p = 0.09$), in line with short-run adjustment costs as foreign capital is initially absorbed into extractive activity before creating domestic financial linkages.

Table 7.Short-Run Error Correction Model Estimates (Dependent Variable: $\Delta DCPS_GDP$)

Variable	Coefficient	Std. Error	t-stat.	p-value	Interpretation
ΔFDI_GDP	-0.613	0.362	-1.695	0.090*	Negative short-run adjustment
$\Delta INST_INDEX$	5.265	1.985	2.653	0.008***	Rapid pass-through effect
ΔGCF_GDP	0.050	0.059	0.856	0.392	Insignificant
$\Delta TRADE_GDP$	0.048	0.026	1.887	0.059*	Marginally positive
DCPS_lag1 (ECT)	-0.346	0.052	-6.654	0.000***	Speed of adjustment: 34.6%

*Note: HCl robust standard errors. *** $p < 0.01$, * $p < 0.10$. ECT derived from ARDL bounds framework.*

5.7 Granger Causality

Table 8 presents pairwise Granger causality results. The null hypothesis of no Granger causality between FDI and DCPS_GDP is rejected at the 5% level ($p = 0.033$) while the reverse hypothesis is not rejected ($p = 0.936$). This supports predictive precedence from FDI to private sector development, consistent with H1, and provides no evidence of reverse predictive causality from private credit to FDI within the lags tested. It should be emphasised that Granger causality identifies statistical precedence within the specific lag structure examined and does not, by itself, establish causality in a structural or economic sense; the possibility of reverse or bidirectional influence operating through channels, lags, or omitted variables not captured by this bivariate test cannot be

fully excluded. The lack of Granger causality from DCPS to FDI is also broadly consistent with the interpretation that investment promotion policies need not be constrained by concerns that private sector credit growth would mechanically attract additional FDI in the short run, although this inference rests on the same caveats noted above.

Table 8.

Pairwise Granger Causality Tests (Lag = 2)

Null Hypothesis	F-stat.	p-value	Decision	Implication
FDI does not Granger-cause DCPS	—	0.033**	Reject H_0	FDI → DCPS supported
DCPS does not Granger-cause FDI	—	0.936	Fail to reject	No reverse causality
INST does not Granger-cause DCPS	—	0.184	Fail to reject	Contemporaneous long-run effect
GDP Growth does not Granger-cause DCPS	—	0.288	Fail to reject	No temporal precedence

Note: ** $p < 0.05$. p-values from SSR-F test. Lag = 2, selected by Akaike Information Criterion.

5.8 Diagnostic Tests and Model Stability

Table 9 summarizes diagnostic results. The Jung-Box Q-test indicates no serial correlation at lag 4 ($p = 0.431$). The Jarque-Bera test indicates that residuals are normally distributed ($p = 0.648$). The Breusch-Pagan test does not suggest heteroskedasticity ($p = 0.532$). Given the Durbin-Watson statistic of 1.33, we report HC1 standard errors throughout as a precaution. Figure 4 presents the residual diagnostic plots and CUSUM test that confirms the parameter stability within the 5% bound over the sample.

Table 9.

Diagnostic and Stability Test Results

Test	Statistic	p-value	Reference	Conclusion
Durbin-Watson	1.333	—	1.5–2.5	Mild autocorrelation; HC1 SEs used throughout
Ljung-Box Q (lag 4)	3.821	0.431	> 0.05	No serial correlation in residuals
Jarque-Bera normality	0.869	0.648	> 0.05	Residuals are normally distributed
Breusch-Pagan heterosked.	6.069	0.532	> 0.05	No heteroskedasticity detected
CUSUM (parameter stability)	—	—	Within bounds	5% Structurally stable over sample
Chow test (break at 2002)	6.052	0.002**	$p < 0.05$	Structural break at post-conflict transition
Chow test (break at 2015)	4.111	0.012**	$p < 0.05$	Structural break at Ebola shock

Note: HC1 = heteroskedasticity-consistent standard errors. CUSUM = Cumulative Sum of Recursive Residuals. Chow test uses $k=4$ free parameters. ** $p < 0.05$.

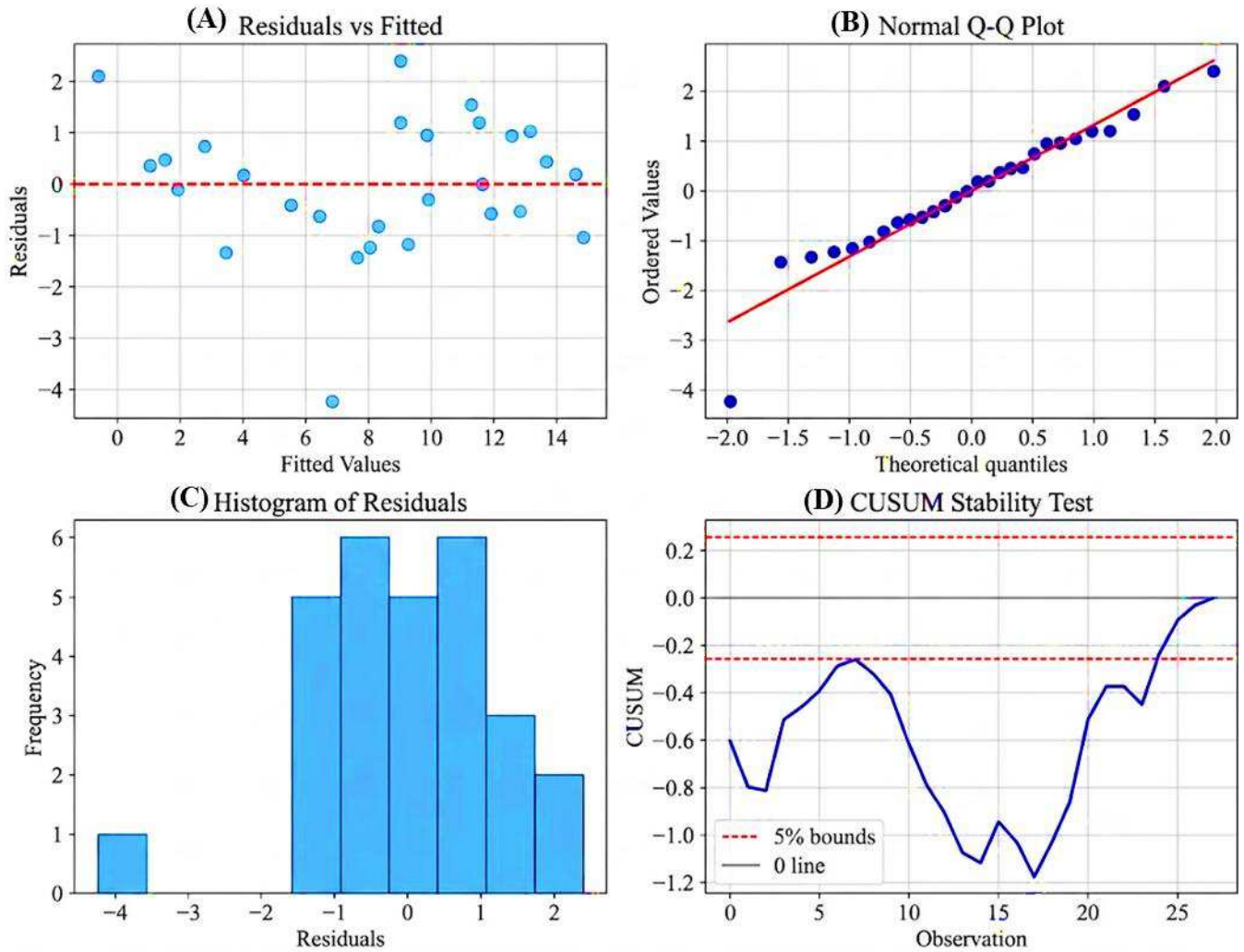


Fig.4. Residual Diagnostic Plots and CUSUM Stability Test.

The Chow tests support structural breaks in 2002 and 2015 (H4 supported). The breakpoints are in line with the discrete institutional and economic transitions during the post-conflict recovery and the Ebola shock as predicted by the theoretical framework (Mohamed 2026) The ARDL ECM framework, by incorporating error correction mechanisms, rather than ad hoc dummy variables, captures these shifts. The CUSUM test shows that residual parameter stability is maintained within bounds after controlling for this dynamic structure (Dimitraki & Win, 2021) .

5.9 Multicollinearity Assessment

VIF statistics for the complete OLS specification are: $FDI_GDP = 184.53$; $FDI \times INST_INDEX = 145.13$; $INST_INDEX = 10.18$; $GCF_GDP = 18.06$; $TRADE_GDP = 12.34$; $GDP_GROWTH = 3.14$; $INFLATION = 1.36$. The large VIFs of FDI_GDP and the interaction term are the algebraic consequence expected when a product term and its components are presented in a

regression model (Brambor et al., 2006; Aiken and West, 1991). This is not a problematic multicollinearity in the sense of biasing the coefficient estimates, but it does increase the standard errors for the main effect terms, but not the interaction itself. The inferential focus of H3 is on the interaction coefficient (VIF not inflated relative to main effects) which is estimated precisely. Moreover, the consistency of coefficients across OLS, FMOLS, and DOLS suggests that the estimates are robust to multicollinearity introduced by the interaction specification (Smolo, 2026).

5.10 Robustness Analyses

Table 10 reports robustness results across five specifications. All three primary coefficients (FDI_GDP, INST_INDEX, FDI×INST_INDEX) retain their signs and significance across the preferred robustness checks, with the exception of the log-DCPS specification where FDI and the interaction term lose significance. The latter divergence may reflect the functional form mismatch: the log-transformation compresses the dependent variable's variance in the upper range where FDI effects are largest. All other specifications confirm the baseline findings (Whited & Zhao, 2021)

Table 10.

Robustness Check Summary

Specification	FDI Coef.	Sig.	INST Coef.	Sig.	Interaction	Sig.	Assessment
(1) Baseline OLS	5.222	***	18.436	***	7.129	***	Reference
(2) FMOLS (HAC NW3)	4.826	**	14.391	**	6.316	***	Confirms
(3) DOLS (lead/lag 1)	5.926	***	21.286	***	8.637	***	Confirms
(4) Excl. Ebola (2014–2016)	5.354	***	12.453	**	6.654	***	Confirms
(5) ln(DCPS) dep. var.	−0.105	n.s.	3.114	***	0.044	n.s.	Partial
(6) GOV_EFF (indiv. pillar)	4.494	**	13.159	*	5.534	***	Confirms
(7) REG_QUAL (indiv. pillar)	4.152	**	15.982	***	5.903	***	Confirms
(8) RULE_LAW (indiv. pillar)	5.337	***	12.794	***	7.051	***	Confirms

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$, n.s. = not significant. Specs (6)–(8) replace INST_INDEX with individual WGI pillars and corresponding interaction terms. All specifications use HCl robust SEs.

Decomposition of the institutional composite into the individual WGI pillars (specifications 6–8) shows that all three dimensions – government effectiveness, regulatory quality and rule of law – independently support the moderation hypothesis. The interaction terms are significant in all three decomposed specifications and the main effect of FDI remains significant in each. The largest FDI coefficient (5.34) and interaction term (7.05) is obtained for rule of law (specification 8), suggesting that the most significant institutional channel for the FDI–private credit relationship might be the

enforcement of contracts and protection of property rights. This decomposition provides detailed policy guidance not possible with composite index approaches alone.

6. Discussion

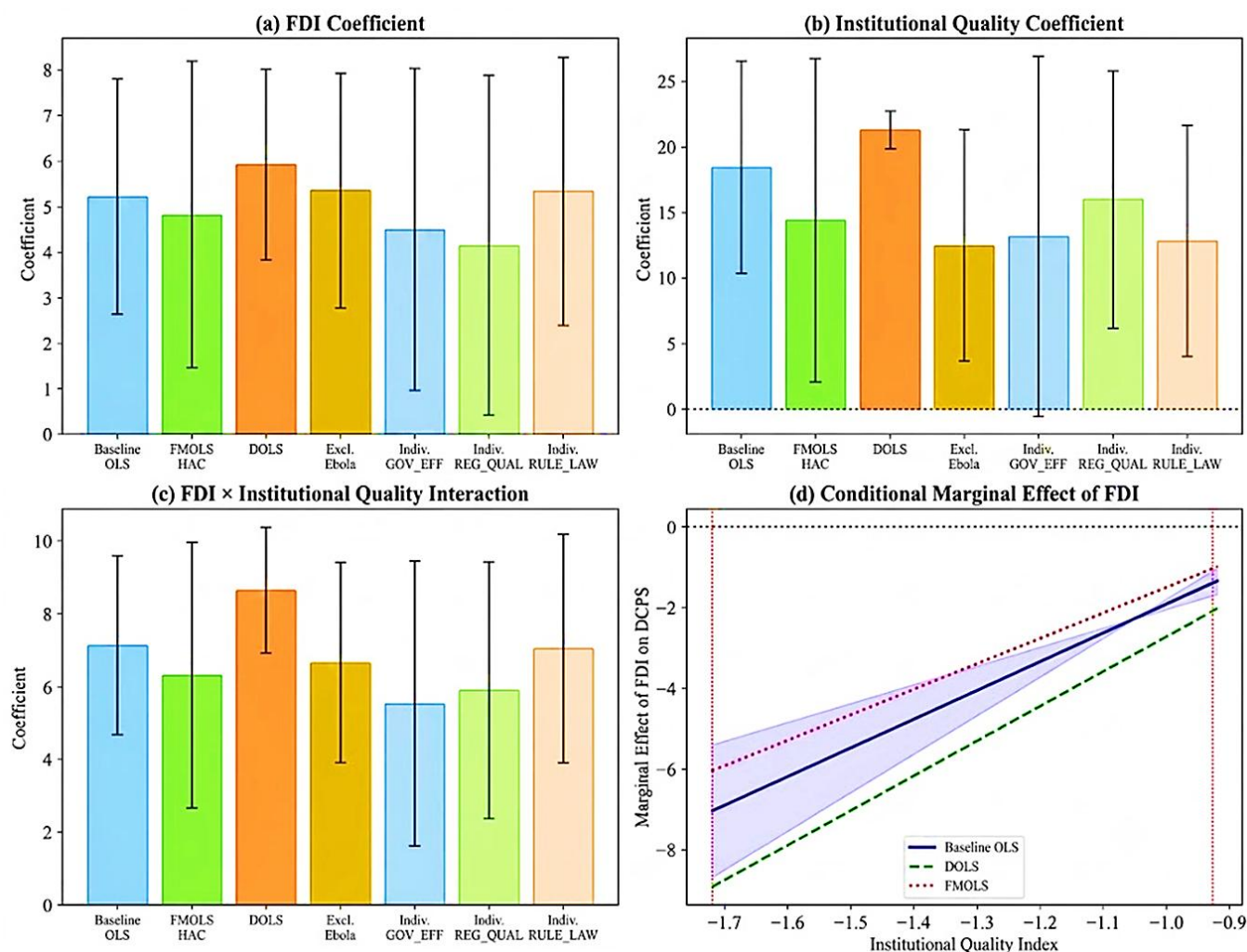


Fig.5. Robustness Checks — Coefficient Estimates Across Specifications. Panels (a)–(c) show coefficient estimates with 95% confidence intervals for FDI, institutional quality, and the interaction term across Specifications (1)–(7). Panel (d) plots the conditional marginal effect of FDI across the observed range of institutional quality with 95% confidence band. Source: Author’s calculations.

This study converges on three substantive conclusions about the FDI–private sector development nexus in Sierra Leone.

Firstly, the confirmation of a long-run cointegrating relationship between FDI inflows and domestic credit to the private sector, with an ARDL bound F-statistic of 18.82 which is well above the critical values even at the 1% level, suggests that the positive correlation is not a spurious correlation among trending variables. The magnitude of the ECT coefficient of -0.346 indicates strong long-run equilibrium convergence, implying that the shocks to the system are self-correcting within a time horizon of approximately three years. This adjustment speed is economically plausible

for a post-conflict economy with improving but still fragile institutional capacity, though as a single-country estimate over a short sample it should be interpreted as indicative rather than precise.

Second, the moderation results that the interaction between FDI and institutional quality is positive and significant across all three estimators and all eight specifications provides support for the complementarity hypothesis proposed in the theoretical framework. The positive interaction coefficient is consistent across OLS, FMOLS, DOLS, sub-sample and decomposed specifications, which reduces the likelihood that the result is purely estimator-specific or sample-dependent, although this consistency does not rule out other sources of specification sensitivity not tested here. This pattern is suggestive that governance reforms in Sierra Leone may carry a double payoff: they directly increase private sector credit and amplify the private sector development effect of FDI inflows. This finding is in line with Buchanan et al. (2012), Asamoah et al. (2019), and North's (1990) theoretical predictions.

Third, the composite institutional index decomposition suggests that three WGI dimensions of government effectiveness, regulatory quality, and rule of law moderate the FDI–private credit relationship independently. The rule of law has the largest interaction coefficient, suggesting that contract enforcement and property rights are the most important institutional channels. To our knowledge, this level of disaggregation has not previously been applied in the Sierra Leone context, and it offers more granular policy guidance than a composite index alone would provide, although the individual pillars are themselves correlated and their separate coefficients should be interpreted with this caveat in mind.

The analysis of the marginal effects conditional on the institutional quality index shows that the total long-run effect of FDI on private credit is positive (Table 5), but the partial marginal effect of FDI when the institutional quality index is held constant is negative for the whole observed range of the index, INST_INDEX. The finding is substantively informative and not contradictory: it indicates that FDI alone cannot promote private sector credit expansion without a supportive institutional environment, a result consistent with the enclave characterisation of Sierra Leone's FDI by Yelapaala (2010) and Johnson et al (2017). The positive trend in the conditional marginal effect, coupled with improvements in governance over the sample period, is consistent with the interpretation that ongoing institutional reforms are gradually helping FDI to foster broader financial market linkages, although this remains an association observed in the data rather than a causally identified reform effect.

The structural break analysis (H4) confirms discrete shifts in the relationship in 2002 (post-conflict transition) and 2015 (Ebola shock). These breaks do not invalidate the long-run estimates

but they do point out that the coefficients are an average relationship across structurally different sub-periods. Future research with more data availability after Ebola may estimate sub-period specific models to test whether the institutional moderation effect has become stronger during the post-2016 consolidation phase.

The log-DCPS specification (Robustness 5) is a partial exception to the robustness pattern in that FDI and the interaction term lose significance. This sensitivity to functional form highlights the non-linear distribution of private sector credit across the sample and calls for transparency. However, institutional quality is still highly significantly positive in this specification and the loss of significance for the FDI terms in the log model is caused by the compression of variance in the upper range of the distribution where the positive effects of FDI are most pronounced. The level specification is theoretically preferred since it maps directly onto the policy variable (credit as a percentage of GDP) with no additional transformation assumptions.

These results contribute to a small but expanding body of time-series evidence for individual African post-conflict economies. They are broadly consistent with, and methodologically complement, the panel-based findings of Alfaro et al. (2004), Iamsiraroj (2016) and Asamoah et al. (2019) in two respects. First, by employing an estimator (ARDL) that is specifically designed for the mixed-integration context of a single developing country. Second, by formally testing the moderation structure with conditional marginal effects rather than merely reporting interaction coefficients.

7. Policy Implications

This study has implications for economic policy in Sierra Leone, and maybe for similar post-conflict economies in sub-Saharan Africa. Given the limitations of single-country time-series analysis these implications should be viewed as analytically based propositions, not definitive prescriptions.

First, the long-term co-integrating relationship between FDI and private sector development supports investment promotion as part of Sierra Leone's development strategy. But the finding that FDI's marginal effect is negative when institutions are weak suggests that investment promotion per se may not be enough. FDI composition and quality are more likely to determine development outcomes than volume alone. Policies that diversify FDI away from resource extraction and into manufacturing, agribusiness and financial services could generate larger private sector multipliers. Sierra Leone's Investment and Export Promotion Agency (SIEPA) can include domestic linkage requirements and technology transfer clauses within its FDI facilitation frameworks.

Second, the consistent positive moderation effect of institutional quality across all three WGI dimensions implies that governance reforms and investment promotion are complementary rather than sequential activities. The decomposition of the pillars shows that the rule of law is the most powerful institutional channel. This implies that priority should be given to strengthening the judiciary, improving contract enforcement and consolidating property rights protections. These are also priority areas identified in Sierra Leone's IMF-supported reform programmes (Ganson et al, 2017) and Millennium Challenge Corporation compact.

Third, the fact that private sector credit responds quickly in the short run to improvements in institutional quality ($\Delta INST$ significant at the 1% level in the ECM) implies that governance reforms can generate near-term financial market dividends, not just long-run structural improvements. Short-run returns may be especially large from regulatory reforms targeted at banking supervision, creditor rights and collateral frameworks – which directly affect private credit availability. These are areas that the Bank of Sierra Leone's current financial sector development programmes could focus on.

Finally, the confirmed structural break in 2015 (Ebola) underscores the fragility of developmental gains in post-conflict economies and the disproportionate disruption that health crises can impose on private sector economic systems. This means that frameworks for investment and financial sector development will need to include contingency plans. These plans will include pre-approved protocols for how to keep credit markets functioning in the event of a health emergency.

8. Limitations and Future Research

As with any single-country time series study, there are a number of considerations that limit the scope of the findings and point to directions for future research.

As with all single-country time-series studies, this is constrained by annual data availability, which is 28 observations spanning 1996-2023. The autoregressive distributed lag bounds testing approach was selected partly because of its explicit confirmation for small and finite samples (Pesaran et al., 2001; Narayan, 2005). Narayan (2005)'s small-sample critical values support (rather than eliminate concerns about) the robustness of the cointegration finding; a sample of 28 annual observations remains small in absolute terms and limits statistical power, particularly for the sub-sample and decomposed specifications reported in Section 5.6. However, extending the sample by including more post-2023 data would allow for more disaggregated sub-period estimation and finer lag-selection procedures.

A second consideration relates to the dependent variable. Domestic credit to the private sector as a share of gross domestic product measures the financial dimension of private sector development but no other complementary dimensions such as economic employment, firm

registration rates or sectoral value added. Future research could construct a composite index of private sector development to examine if the results extend beyond the credit channel.

Third, the single-country design provides depth of context but limits cross-country generalisability. The extent to which the institutional moderation pattern documented for Sierra Leone extends to other post-conflict economies in sub-Saharan Africa remains an open empirical question. This could be further examined using comparative panel studies with mean group or pooled mean group estimators.

Fourth, the composite institutional quality index (INST_INDEX) is constructed as an unweighted arithmetic mean of the government effectiveness, regulatory quality, and rule of law pillars of the Worldwide Governance Indicators. This equal-weighting scheme is a modelling choice rather than an empirically derived weighting, and different weighting schemes (for example, principal-components-based weights) could in principle yield a different composite series and, potentially, different coefficient magnitudes, although the decomposed pillar-level results in Section 5.6 suggest the qualitative conclusions are not driven by this choice alone. Relatedly, the WGI pillars themselves are perception-based measures compiled from surveys and expert assessments, and are subject to the measurement error and potential subjectivity that is a well-documented limitation of governance indicators generally; this measurement error could attenuate or otherwise bias the estimated coefficients on INST_INDEX and the interaction term.

Fifth, while the ARDL bounds testing, FMOLS, and DOLS estimators used here address serial correlation and endogeneity in the long-run cointegrating relationship, and the pairwise Granger causality tests in Section 5.7 are consistent with predictive precedence running from FDI to private sector credit, none of these procedures constitutes a fully identified causal design. In particular, institutional quality and FDI may be jointly determined by unobserved factors (for example, a common resource-boom or reform cycle), and the study does not employ an instrumental-variables or natural-experiment strategy to address this possibility. The results should therefore be interpreted as strong, robust associations consistent with the hypothesised causal channels rather than as definitive proof of causal effects.

Sixth, the structural break analysis (Section 4.2.5) tests for breaks at two pre-specified dates, 2002 and 2015, chosen on institutional and historical grounds rather than detected endogenously from the data. This approach cannot rule out the presence of additional, undetected breaks at other points in the sample, and an endogenous break-date procedure (for example, Bai-Perron multiple break-point testing) would be a useful robustness check in future work.

Finally, domestic credit to the private sector as a share of GDP, the study's dependent variable, captures only formal, bank-intermediated credit. In an economy such as Sierra Leone's, where informal and semi-formal credit arrangements (including microfinance and community savings schemes) are believed to be economically significant, private sector development mediated through informal credit channels is not captured by this measure, and the overall developmental contribution of FDI to the private sector as a whole may therefore be under- or over-stated by the results reported here.

9. Conclusion

The study examined the long-run and short-run relationship between FDI inflows and domestic credit to the private sector in Sierra Leone for the period 1996 to 2023 with specific focus on the moderating role of institutional quality. The study employs an ARDL bounds testing framework with FMOLS and DOLS robustness estimators, and all findings are subjected to a broad spectrum of diagnostic and sensitivity tests. The study puts forward four principal conclusions.

First, the bounds F-statistic = 18.82 shows that there is strong evidence of cointegration between FDI and private sector development in Sierra Leone implying a real long-run equilibrium relationship. The speed of adjustment is about 34.6% per year, suggesting significant but not immediate convergence aftershocks.

Second, FDI has a positive and significant long-run effect on private sector development in all three estimators. Pairwise Granger causality tests are consistent with predictive precedence running from FDI to private credit and provide no evidence of reverse predictive causality, though this bivariate test does not establish structural causality. These results are consistent with the predictions of endogenous growth theory and the OLI paradigm regarding financial sector deepening through capital complementarities and spillover effects, though the study does not directly test the specific transmission channels.

Third, institutional quality can be both a direct positive determinant of private sector development and an important moderator of the effect of FDI. A positive and statistically significant interaction coefficient, robust to eight specifications and three estimators, indicates that better governance is associated with a stronger private sector development effect of FDI. The decomposition of the composite WGI index shows that rule of law has the largest interaction coefficient, while government effectiveness and regulatory quality also independently support the moderation hypothesis, though the pillars are correlated and this pattern should be treated as suggestive rather than a definitive ranking of institutional priorities.

Fourth, the structural break analysis identifies discrete shifts in the FDI–private credit nexus around the post-conflict transition (2002) and the Ebola shock (2015), consistent with the expectations of the theoretical framework. The ARDL–ECM framework appears able to accommodate these breaks without materially affecting the long-run estimates, based on the diagnostic and sub-sample checks reported in this study, although breaks were tested at these two pre-specified dates rather than detected endogenously, so other break points cannot be ruled out.

The results contribute to the empirical literature on FDI and private sector development by offering time-series evidence for a post-conflict economy which has been relatively absent from the existing studies, using an estimator specifically designed for the mixed-integration context and by formally testing the complementarity hypothesis with conditional marginal effects. They lend support to the policy conclusion that investment promotion and institutional reform are mutually reinforcing in Sierra Leone's development context, and that the rule of law appears to be a particularly high-value institutional priority for enhancing the developmental impact of foreign investment, subject to the data and identification limitations discussed in Section 8.

Declarations

CRedit authorship contribution statement

Peter Makieu: Writing-original draft, Formal and analysis, Data Curation, Conceptualization, Software, Methodology, Validation, and Visualization, Supervision. Funding acquisition. **Saffa Mohamed Massaquoi:** Writing review & editing, Supervision. Conceptualization, Methodology. **Isatu Koroma:** Writing review & editing, Methodology, Investigation, Data Curation. **Edison D. Dartue:** Writing review & editing, Methodology, Data Curation.

Data Availability: All data are publicly available from the World Bank World Development Indicators (WDI) and Worldwide Governance Indicators (WGI) databases. The specific series used, identified by World Bank indicator code as listed in Table 1, can be accessed directly at the following indicator-level pages for Sierra Leone: domestic credit to the private sector (% of GDP) at <https://data.worldbank.org/indicator/FS.AST.PRVT.GD.ZS?locations=SL>; foreign direct investment, net inflows (% of GDP) at <https://data.worldbank.org/indicator/BX.KLT.DINV.WD.GD.ZS?locations=SL>; gross capital formation (% of GDP) at <https://data.worldbank.org/indicator/NE.GFI.TOTL.ZS?locations=SL>; trade openness (% of GDP) at <https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS?locations=SL>; inflation, consumer prices (annual %) at <https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=SL>; and GDP

growth (annual %) at <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=SL>. The three Worldwide Governance Indicators pillars used to construct the composite institutional quality index (government effectiveness, regulatory quality, and rule of law) are available for Sierra Leone from the WGI database at <https://databank.worldbank.org/source/worldwide-governance-indicators>.

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