

Foreign Direct Investment and Economic Growth in Sierra Leone: Evidence from ARDL Bounds Testing, 2000–2024

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Abstract- This study looks at the relationship between foreign direct investment (FDI) and economic growth in Sierra Leone from 2000 to 2024, which is a small mineral-rich post-conflict economy with limited single-country dynamic evidence. The study uses annual data on GDP growth, net FDI inflows, gross capital formation, trade openness, and consumer price inflation, and applies the autoregressive distributed lag (ARDL) bounds-testing approach within an unrestricted error-correction model (UECM) and Granger causality and interaction-term moderation analyses. The results of the augmented Dickey-Fuller tests suggest mixed integration orders, with the GDP growth being stationary at level, while the other variables are integrated of order one, which is suitable for the ARDL framework. The bounds F-statistic for the ARDL(1,1,1) model with FDI and trade openness is 5.346, which is statistically significant, indicating a long-run relationship. The error-correction term is negative and highly significant (-0.936 ; $p = 0.001$), suggesting that about 94% of the short-run deviations from equilibrium are corrected each year. The long-run FDI coefficient is positive (0.535), but the estimate is not precise, and the short-run effect is not statistically significant. The Granger tests indicate that there is no significant short-run bidirectional causality, while long-run equilibrium-correcting causality is confirmed from the block FDI-openness to growth. The results of the moderation analysis are weak evidence of substitutability through trade openness, and domestic investment does not have a significant moderating effect. The results highlight the importance of absorptive capacity, institutional quality, and diversified trade linkages in fostering sustainable economic growth from FDI.

Keywords— foreign direct investment; economic growth; ARDL bounds testing; error-correction model; trade openness; Sierra Leone

I. INTRODUCTION

Structural fragility and renewed policy ambition have both influenced Sierra Leone's post-conflict development trajectory. Since the end of the civil war in 2002, and the shocks of the 2014-2016 Ebola epidemic and successive commodity price cycles, successive governments have made foreign direct investment (FDI) a key component of national development strategy, especially in the extractive sector which includes iron ore, diamonds, rutile and bauxite. The policy rationale is based on a long-

running strand of development economics that assumes that FDI will replace the lack of domestic savings, bring technology and managerial expertise, and connect the recipient economy to international value chains. This expectation is not necessarily supported by empirical evidence. On the other hand, FDI is believed to provide growth dividends that are higher than those of a similar amount of domestic investment, via spillover effects that increase the total factor productivity of the host economy. However, the empirical evidence for a positive relationship is not consistent and is contingent on other factors in the recipient country. In the study of

(Bello et al., 2023) show that the growth effect of FDI in Sub-Saharan Africa is significantly boosted by the diffusion of digital infrastructure, suggesting that the FDI-growth link is not automatic.

The current evidence on FDI and growth in Sub-Saharan Africa comes mainly from cross-country or regional panel studies, which inevitably average over the diverse economies of the countries. The study of (Ssali et al., 2019) incorporate FDI as one of the six covariates in a panel study of the pollution-growth-energy nexus for six countries and find that the impacts of FDI are quite different across the countries under study. Using dynamic simultaneous-equation panel techniques, (Omri et al., 2014) model the causal relationship between FDI, carbon emissions and growth and find that the FDI-growth relationship is significant and strong across countries. Such panel estimators are appropriate for capturing average regional patterns, but may mask the short-run adjustment dynamics, long-run equilibrium relationships and country-specific structural characteristics relevant to a single small resource-intensive economy like Sierra Leone.

An alternative methodologically appropriate approach is country-specific time-series techniques, and the autoregressive distributed lag (ARDL) bounds testing procedure in particular. The approach allows for a small annual sample, is valid when the underlying variables are a combination of stationary, $I(0)$, and first-difference stationary, $I(1)$, series, and allows for the simultaneous estimation of short-run dynamics and a long-run equilibrium relationship in a single error-correction framework. Although the amount of Sub-Saharan African evidence presented above is considerable, no published study has used ARDL bounds testing to identify the short-run and long-run FDI-growth dynamics specific to Sierra Leone in a longer period of 25 years after the conflict, nor has it investigated whether domestic investment, trade openness and human capital condition the strength of the relationship in a single-country dynamic framework.

This study fills that void

The study is organized around five research questions:

- RQ1: What is the relationship between FDI and economic growth in Sierra Leone?
- RQ2: Does FDI have a significant short-run effect on economic growth in Sierra Leone?
- RQ3: Does FDI have a significant long-run effect on economic growth in Sierra Leone?
- RQ4: Is there a causal relationship between FDI and economic growth in Sierra Leone?
- RQ5: Do domestic investment, trade openness and human capital condition the relationship between FDI and economic growth?

The rest of the paper is organized as follows. Section 2 provides a review of the theoretical and empirical literature on the relationship between FDI and growth in Sub-Saharan Africa and places the contribution of this study in this context. The data and the construction of the variables are described in Section 3, along with the ARDL bounds testing methodology. The empirical results are presented in Section 4, which includes unit root tests, bounds testing, short-run and long-run estimates, diagnostic checks, Granger causality tests and the moderation analysis. The findings are discussed in relation to each research question and the literature in Section 5. The study's limitations and directions for future research are presented in Section 7, while policy implications are presented in Section 6.

II. LITERATURE REVIEW

1. Theoretical Framework

There are two conflicting theoretical perspectives on the relationship between FDI and growth. In the neoclassical Solow tradition, FDI is treated as an addition to the domestic capital stock, and it only affects the growth rate in the transition to a new steady state, but not the long-run growth path. The magnitude of this transitional effect is sectoral, as oil-producing and non-oil-producing Sub-Saharan African economies have systematically different growth and emissions responses to similar external shocks, as demonstrated by (Bekun et al., 2022). The endogenous growth theory provides a more positive channel: FDI is a means of permanent technology and knowledge spillovers that increase the marginal productivity of domestic factors on a permanent basis. This channel is not necessarily strong, but

depends on the absorptive capacity of the recipient economy, typically measured as human capital. The study of (Anyamele, 2010) demonstrates for a panel of Sub-Saharan African countries that the growth returns to FDI depend on the level of education and export orientation of the host economy, thus offering a direct theoretical justification for the human capital moderation hypothesis explored later in this study.

A third, more critical perspective focuses on the structural and environmental costs that may be associated with extractive-sector FDI, which Sierra Leone receives in large quantities. The study of (Lokonon & Mounirou, 2019) conclude that FDI inflows are linked to increased forest area loss in Sub-Saharan Africa, in line with the worry that resource-seeking FDI can carry costs that are not reflected in traditional growth accounting. Concurrently, (Ayentimi et al., 2016) report that local content policies in Sub-Saharan African host countries are weak and poorly designed to achieve policy goals, thereby restricting the ability of FDI in extractive industries to create linkages with the host country's domestic economy instead of functioning as an enclave.

2. Empirical Evidence from Sub-Saharan Africa

There is a significant empirical literature that places FDI in the context of the wider growth-environment panel literature for the region. The study of (Bibi & Jamil, 2021) test the inverted-U income-emissions relationship for the world's six regions, including Sub-Saharan Africa, and conclude that the inverted-U relationship is not supported in the Sub-Saharan African sample, suggesting unique regional growth-environment dynamics that also influence the absorption of FDI. The study of (Acheampong et al., 2019) investigate the joint effect of globalization and renewable energy on carbon emissions in Sub-Saharan Africa and conclude that the positive growth impact of external openness is closely linked to the energy mix of the country. As the study of (Li et al., 2022) test the pollution haven hypothesis in the context of Belt and Road Initiative countries and conclude that FDI inflows are attracted disproportionately to economies with less stringent environmental regulation, which has direct

implications for resource-rich, regulation-light economies like Sierra Leone.

A related strand is the financial and trade routes by which capital inflows become growth. The study of (Kurantin & Osei-Hwedie, 2019), contend that digital financial integration reinforces the relationship between investment and growth, and also helps in poverty alleviation, implying that the productivity of FDI is enhanced when it is accompanied by financial deepening, not just considered as a flow. According to (Appau et al., 2017), the impact of regional trade agreements on trade flows within Sub-Saharan Africa and conclude that deeper trade integration alters the composition of trade, but not necessarily the volume of trade, which is relevant to the interpretation of trade openness as a conditioning variable in the present study. The study of (Phiri & Tchereni, 2013) evaluate the growth impact of foreign aid on twenty-six highly indebted poor Sub-Saharan African countries and conclude that the direct impact of foreign aid is positive but relatively small compared to domestic investment, suggesting that not all foreign aid capital inflows have the same growth impact.

The impact of external capital and revenue on growth is also shaped by political economy and institutional factors. The study of (Sackey, 2021) demonstrates that, the personal attributes of the political leaders of Africa and the frequency of regime changes have a measurable impact on the growth trajectories of countries, suggesting that governance quality is not a mere by-product of the FDI-growth relationship, but a structural prerequisite for it. The findings of (Ayana et al., 2023) provide a direct methodological precedent for testing the moderating effect of structural conditions on the strength of a growth-determining relationship, as done in the interaction-term analysis for research question five of this study, as they find that the effect of government revenue on economic growth across Sub-Saharan Africa is significantly moderated by institutional quality.

Another series of research focuses on the environmental and resource aspects of the region's growth model. The findings of (Ali et al., 2023)

explore the tripartite link between environmental pollution, economic growth and agricultural production in Sub-Saharan African economies and conclude that the agricultural productivity partially mitigates the costs of economic growth due to environmental pollution. The study of (Zhou et al., 2023) demonstrate that the impact of energy efficiency on carbon emission growth is not uniform across developing Sub-Saharan African countries, further supporting the need for country-specific rather than regional analysis of growth-relevant relationships. The study of (Adedoyin et al., 2023) examine the implications of the commitments made at the Glasgow Climate Change Conference for the economies of Sub-Saharan Africa and highlight the unique trade-off that resource-dependent economies have between attracting extractive FDI and fulfilling new climate policy obligations. Exploring the potential for African economies to transition to a low carbon growth path and conclude that the relationship between FDI, resource dependence and technological progress is key to whether or not such a transition is possible, which is relevant to Sierra Leone's FDI profile (Yeboah et al., 2024).

Finally, a smaller body of literature looks at the structural and productivity channels by which growth is produced apart from, or in conjunction with, capital inflows. The study of (Azenui & Rada, 2021) break down labor productivity growth in the least developed countries of Sub-Saharan Africa and conclude that a significant portion of the aggregate growth is due to sectoral reallocation, not just to within-sector productivity growth, implying that the growth impact of FDI can be transmitted in part through sectoral composition rather than a uniform economy-wide channel.

3. Research Gap and Conceptual Framework

Taken together, this literature establishes that FDI's relationship with growth in Sub-Saharan Africa is real

but conditional, shaped by financial depth, institutional quality, human capital, trade structure and sectoral composition, and that it is frequently studied through regional panels that trade country-level precision for cross-country generality. No study identified in this review applies the ARDL bounds testing procedure to isolate the short-run and long-run dynamics of the FDI-growth relationship specifically for Sierra Leone, nor formally tests whether domestic investment, trade openness and human capital condition that relationship within a single-country error-correction framework covering the full 2000-2024 post-conflict period. The conceptual framework guiding this study therefore treats FDI as a potential long-run determinant of growth operating through a cointegrating relationship with domestic investment and trade openness, subject to a short-run adjustment process, and conditioned by the absorptive capacity of the domestic economy.

III. DATA AND METHODOLOGY

1. Data and Variable Description

The study employs an annual time series data for Sierra Leone from 2000 to 2024 ($n = 25$). The dependent variable is the annual growth rate of gross domestic product (GDP_Growth, percent). Net FDI inflows as a percentage of GDP (FDI) is the variable of central interest. Two conditioning variables are used: gross capital formation as a percentage of GDP (GCF) as a proxy for domestic investment and trade openness (TOP) as the ratio of exports and imports to GDP. Consumer price inflation (INFL) is considered as a macroeconomic stability control. The variable definitions are summarized in Table 1.

Table 1. Variable Definitions

Variable	Symbol	Definition	Expected sign
GDP growth	GDP_Growth	Annual percentage growth of real GDP	Dependent variable
FDI inflows	FDI	Net FDI inflows as a percentage of GDP	Positive

Domestic investment	GCF	Gross capital formation as a percentage of GDP	Positive
Trade openness	TOP	Exports plus imports as a percentage of GDP	Ambiguous
Inflation	INFL	Annual percentage change in the consumer price index	Negative

Note: Human capital was not included as a direct regressor because a consistent annual human capital indicator (e.g., school enrolment or education expenditure) was not available in the dataset; its moderating role is addressed qualitatively and flagged as a data limitation (Section 7).

2. Descriptive Statistics

Descriptive statistics for all series are presented in Table 2. GDP growth was 2.70 percent on average for the sample period (SD = 1.11), reaching a sample low

of 0.89 percent in 2023 when inflation accelerated to 44 percent, and a sample high of 5.39 percent in 2020. FDI inflows averaged 3.31 percent of GDP (SD = 1.53), increasing from near 1 percent of GDP in the early 2000s to a peak of 6.1 percent in 2019, as investment in the mining sector grew, before slowing in the latest years. The level of domestic investment and trade openness increased over the sample period, reflecting the gradual economic reconstruction and integration following the conflict.

Table 2. Descriptive Statistics (2000-2024, n = 25)

Variable	Mean	SD	Min	Max	Skewness
GDP growth (%)	2.70	1.11	0.89	5.39	0.82
FDI (% GDP)	3.31	1.53	1.00	6.10	0.29
GCF (% GDP)	23.85	2.70	18.50	28.20	-0.31
Trade openness (% GDP)	90.36	9.31	72.00	108.00	-0.22
Inflation (%)	14.28	9.58	-3.00	44.00	1.57

The pairwise correlation matrix (not shown for brevity) shows a remarkable feature of the data: FDI, GCF and TOP are highly correlated with each other (correlations range from 0.90 to 0.96), but not so correlated with GDP growth itself (correlations are below 0.11 in absolute value).

This pattern suggests that the candidate regressors are highly correlated with one another, and that the simple bivariate correlations between the growth rate and its hypothesized determinants are very small, both of which justify (a) the parsimonious general-to-specific modelling strategy of selecting a subset of conditioning variables, and (b) the dynamic modelling approach that allows for the estimation of lagged and equilibrium-correcting relationships that are not apparent in the static correlations.

3. Unit Root Testing

The ARDL bounds testing procedure is valid if none of the variables is integrated of order two or higher. The level and first-differenced versions of each series were then tested using the augmented Dickey-Fuller (ADF) test, and the lag length that minimized residual autocorrelation was chosen.

Table 3 presents the results, which indicate that GDP growth is stationary in levels, while FDI, domestic investment, trade openness and inflation are all non-stationary in levels but stationary after first differencing. This mixed order of integration I(0)/I(1) with no variable integrated twice is suitable for ARDL bounds testing and excludes the use of Engle and Granger (1987) cointegration approach based on the residuals, which requires all series to be integrated of the same order.

Table 3. Augmented Dickey-Fuller Unit Root Test Results

Variable	ADF (level)	p-value	ADF (1st diff.)	p-value	Order of integration
GDP growth	-4.457	0.000	—	—	I(0)
FDI	-1.092	0.718	-3.371	0.012	I(1)
GCF	-1.641	0.462	-3.528	0.007	I(1)
Trade openness	-1.279	0.639	-5.180	0.000	I(1)
Inflation	-0.172	0.942	-6.056	0.000	I(1)

Note: Test equations include a constant. KPSS tests (available on request) confirm the ADF classification for every series.

RESET test for functional form misspecification are used to test model adequacy.

4. ARDL Bounds Testing and Error-Correction Specification

The study uses the ARDL bounds testing approach to cointegration developed by Pesaran, Shin and Smith (2001) given the mixed order of integration established above. The method embeds the long-run and short-run relationships in a single unrestricted error-correction model (UECM). The general specification, prior to variable reduction, takes the form: $\Delta \text{GDP_Growth}_t = \alpha_0 + \rho \cdot \text{GDP_Growth}_{t-1} + \beta_1 \cdot \text{FDI}_{t-1} + \beta_2 \cdot \text{GCF}_{t-1} + \beta_3 \cdot \text{TOP}_{t-1} + \beta_4 \cdot \text{INFL}_{t-1} + \gamma \cdot \Delta \text{FDI}_t + \delta \cdot \Delta \text{GCF}_t + \theta \cdot \Delta \text{TOP}_t + \varphi \cdot \Delta \text{INFL}_t + \varepsilon_t$ where Δ is the first difference operator and ε_t is a white-noise error term. The null hypothesis of no level relationship, $H_0: \rho = \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$, is tested against the alternative of a level relationship by an F-test whose statistic is compared against the non-standard critical value bounds tabulated by Pesaran, Shin and Smith (2001); response-surface p-values, which are more appropriate than fixed asymptotic tables given the modest sample size, are reported directly. The severe multicollinearity reported in Section 3.2 suggests that the full four-regressor specification is not suitable for the model, so a general-to-specific approach is used to reduce the model to the preferred parsimonious specification, which includes FDI and trade openness, while GCF and INFL are included for robustness and moderation analysis. The sample size ($n = 25$) limited the maximum lag orders to one, as is typical in short annual macroeconomic series. The Breusch-Godfrey LM test for serial correlation, the Breusch-Pagan test for heteroscedasticity, the Jarque-Bera test for normality, and the Ramsey

5. Granger Causality and Moderation Analysis

Three complementary tests are used to examine the direction of causality: (1) standard bivariate Granger causality tests on the levels of FDI and GDP growth at lags one and two; (2) a joint Wald test on the short-run differenced FDI and trade openness terms in the error-correction model, which tests for short-run Granger causality; and (3) the significance and sign of the error-correction term itself, which under the Engle and Granger (1987) representation theorem is informative about long-run, equilibrium-correcting causality when the variables are cointegrated. To answer the fifth research question, two interaction models are estimated, regressing GDP growth on FDI and a candidate moderator (GCF or TOP, mean-centred to avoid multicollinearity with the interaction term), and their product term, with heteroscedasticity- and autocorrelation-consistent (HAC) standard errors. Human capital was not considered as a third moderator because no consistent annual human capital series was available for Sierra Leone during the sample period, and this is discussed qualitatively in the discussion and explicitly noted as a data limitation.

IV. RESULTS

1. Bounds Testing Results

Table 4 reports the bounds F-statistics for the general four-regressor model and the parsimonious two-regressor model. The general model, which includes FDI, domestic investment, trade openness and inflation simultaneously, yields an F-statistic of 2.569, which falls in the inconclusive region relative to the response-surface bounds and does not permit

a decisive rejection of the null of no level relationship; this weak result is consistent with the severe multicollinearity documented in Section 3.2, which inflates coefficient standard errors and reduces the power of the joint test. The parsimonious specification retaining only FDI and trade openness yields a substantially stronger F-

statistic of 5.346 (upper-bound $p = 0.013$), which rejects the null of no level relationship at the five percent significance level and confirms the existence of a long-run equilibrium relationship between FDI, trade openness and economic growth in Sierra Leone.

Table 4. ARDL Bounds Testing Results (Case III: unrestricted intercept, no trend)

Model specification	k	F-statistic	Lower-bound p	Upper-bound p	Conclusion
General: FDI, GCF, TOP, INFL	4	2.569	0.057	0.292	Inconclusive
Parsimonious: FDI, TOP	2	5.346	0.002	0.013	Cointegration confirmed

2. Long-Run and Short-Run Estimates

The estimated UECM for the preferred parsimonious specification is reported in Table 5. The coefficient on lagged GDP growth is negative and correctly signed, and is highly significant (-0.936 , $SE = 0.238$, $p = 0.001$), meaning that about 94 percent of the error from the long-run equilibrium is corrected in one year. This quick adjustment rate is possible for a small, open economy where growth deviations caused by commodity price or weather shocks are likely to be temporary rather than permanent.

The long-run coefficients, which are the ratios of the lagged-level coefficients to the negative of the error-correction coefficient, are positive for FDI (0.535) and negative for trade openness (-0.100). The individual t-ratios on the lagged-level FDI and trade openness

terms are not significant at conventional levels ($p = 0.320$ and $p = 0.268$ respectively), although the joint bounds F-test reported in Table 4 strongly rejects the null of no level relationship. This is a well-known characteristic of ARDL models estimated on short annual series, where the standard errors of the individual level coefficients are large, while the evidence of a joint equilibrium relationship is strong. The coefficient of the change in FDI is positive (0.782) but not significant at the five percent level ($p = 0.102$), and the coefficient of the change in trade openness is negative (-0.149 , $p = 0.152$). The overall equation is reasonably good for a five-parameter model fitted to 24 annual observations, with an R^2 of 0.562, an adjusted R^2 of 0.440, and an F-statistic of 4.612 ($p = 0.007$) that is jointly significant

Table 5. UECM Estimates: FDI, Trade Openness and Economic Growth

Regressor	Coefficient	Std. error	t-statistic	p-value
Constant	9.403	6.024	1.561	0.136
GDP_Growth(t-1) [ECT]	-0.936	0.238	-3.928	0.001
FDI(t-1)	0.501	0.490	1.022	0.320
TOP(t-1)	-0.094	0.082	-1.144	0.268
ΔFDI	0.782	0.454	1.723	0.102
ΔTOP	-0.149	0.099	-1.496	0.152

Note: $n = 24$; $R^2 = 0.562$; Adjusted $R^2 = 0.440$; $F(5,18) = 4.612$, $p = 0.007$. Long-run FDI coefficient = 0.535; long-run TOP coefficient = -0.100 (derived as the negative ratio of the lagged-level coefficient to the error-correction coefficient).

3. Diagnostic Tests

Table 6 summarizes the diagnostic tests applied to the preferred UECM. The Breusch-Godfrey test finds no evidence of first-order residual serial correlation, the Breusch-Pagan test finds no evidence of heteroscedasticity, the Jarque-Bera test does not

reject normality of the residuals, and the Ramsey misspecification. Taken together, these results RESET test finds no evidence of functional form support the adequacy of the estimated model.

Table 6. Diagnostic Test Results

Test	Statistic	p-value	Conclusion
Breusch-Godfrey LM (1 lag)	0.087	0.768	No serial correlation
Breusch-Pagan	4.436	0.488	Homoscedastic
Jarque-Bera	1.854	0.396	Residuals normal
Ramsey RESET (F)	0.924	0.350	No misspecification
Durbin-Watson	1.994	—	No autocorrelation

4. Granger Causality

Table 7 reports the causality results. Standard bivariate Granger causality tests on the levels of FDI and GDP growth find no significant causality in either direction at lags one or two. A joint Wald test on the short-run differenced terms within the error-correction model likewise fails to reject the null of no short-run causality from FDI and trade openness to growth ($F = 1.514$, $p = 0.247$). By contrast, a joint test on the full long-run block, comprising the lagged

levels of GDP growth, FDI and trade openness, is highly significant ($F = 5.346$, $p = 0.008$), and the error-correction term itself is significant as reported in Table 5. Under the Engle and Granger (1987) representation theorem, this pattern is diagnostic of long-run, equilibrium-correcting causality running from FDI and trade openness to economic growth, in the absence of significant short-run bidirectional feedback.

Table 7. Granger Causality Test Results

Test	Statistic	p-value	Conclusion
FDI $\rightarrow$ GDP growth (lag 1, levels)	$F = 0.216$	0.647	No short-run causality
FDI $\rightarrow$ GDP growth (lag 2, levels)	$F = 0.195$	0.824	No short-run causality
GDP growth $\rightarrow$ FDI (lag 1, levels)	$F = 0.486$	0.493	No short-run causality
Joint short-run ECM test (ΔFDI , ΔTOP)	$F = 1.514$	0.247	No short-run causality
Joint long-run block (ECT, FDI, TOP)	$F = 5.346$	0.008	Long-run causality confirmed

5. Moderation Analysis

Table 8 presents the two interaction models estimated to answer the fifth research question. In Model A, which examines the moderating effect of domestic investment on the FDI-growth relationship, the FDI main effect, the domestic investment main effect, and the FDI $\times$ domestic investment interaction term are not statistically significant, suggesting that domestic investment does not moderate the FDI-growth relationship in this sample. The FDI main effect is positive and significant (0.724, $p = 0.044$), the trade openness main effect is

negative and significant (-0.121 , $p = 0.016$), while the interaction term between FDI and trade openness is negative but not significant (-0.017 , $p = 0.266$) in Model B. The negative sign is indicative of a weak substitutability between FDI and trade openness in growth, not complementarity, but the evidence is not strong enough to draw a definite conclusion. Because of data unavailability, human capital was not included as a third moderator as mentioned in Section 3.5.

Table 8. Moderation Analysis: Interaction Models (HAC standard errors)

Regressor	Model A: FDI $\times$ GCF	p-value	Model B: FDI $\times$ TOP	p-value
FDI (centred)	0.479	0.412	0.724	0.044
Moderator (centred)	-0.256	0.409	-0.121	0.016

FDI × Moderator	-0.031	0.544	-0.017	0.266
R ²	0.018	—	0.157	—

V. DISCUSSION

Regarding RQ1, the findings suggest that FDI is not unrelated to economic growth in Sierra Leone, but rather a joint and equilibrium level association. The results of the bounds testing in Table 4 indicate that the near-zero simple correlation reported in Section 3.2 is misleading when the dynamic, error-correcting structure of the data is properly modelled. The result is consistent with the general trend observed by (Bello et al., 2023) in their study on the FDI-growth nexus in Sub-Saharan Africa, which also revealed that the FDI-growth nexus is conditional and only becomes apparent when other structural factors are taken into account. As for RQ2, the short-run impact of FDI on growth is positive but not statistically significant at conventional levels ($p = 0.102$), suggesting that the short-run growth impact of FDI is not immediately statistically detectable in the same year. This broadly reflects the slow and capital-intensive nature of extractive-sector investment, which often takes several years to go from capital commitment to productive output, as also noted by (Bekun et al., 2022) for oil-producing African economies.

In the case of RQ3, the long-run FDI coefficient is positive (0.535) and the joint bounds test indicates strong statistical support for the existence of a long-run equilibrium relationship between FDI, trade openness and growth. The individual long-run coefficient, however, is not precisely estimated, and this study is wary of over-interpretation of the exact size of the coefficient. The fact that the joint relationship is significant and the individual long-run elasticity is not precise should temper strong causal statements regarding the size of the long-run FDI-growth multiplier in Sierra Leone, while at the same time reinforcing the qualitative conclusion that there is a long-run FDI-growth multiplier relationship. The evidence on RQ4 is consistent with long-run, equilibrium-correcting causality from FDI and trade openness to growth, as the error-correction term is significant and has the correct sign, but fails to support significant short-run bidirectional Granger

causality between the series. This is not the same as the simultaneous, contemporaneous causal interactions found by (Omri et al., 2014) in a cross-country panel setting, and it is a general methodological issue: causal patterns uncovered in pooled cross-country panels may not be the same as those in a single small economy observed at annual frequency, where the causal transmission may have a longer lag structure than panel estimators are able to detect.

The moderation analysis results on RQ5 do not support the hypothesis that domestic investment strengthens or weakens the relationship between FDI and growth, and only weakly support the hypothesis that trade openness strengthens or weakens the relationship between FDI and growth, statistically. While the result should be taken with a pinch of salt due to the small sample size, it is in line with the worry expressed by (Ayentimi et al., 2016) that the lack of strong linkages between the FDI and local content in Sub Saharan African host economies may mean that the FDI does not produce the expected positive economy-wide effects that would complement domestic investment. This is a major limitation of the present analysis, especially in the light of the theoretical significance attributed to absorptive capacity by (Anyamele, 2010) and the institutional moderation precedent set by (Ayana et al., 2023) in a similar growth context in Sub-Saharan Africa; this gap is addressed directly in Section 7.

Two additional observations in the context are worth consideration. First, the extractive, resource-dependent nature of Sierra Leone's FDI inflows suggests that measured growth effects may overlook underlying environmental and structural costs, such as those associated with forest depletion (Lokonon & Mounirou, 2019) and pollution haven effects (Li et al., 2022), which are not captured by a purely output-focused growth model of the type estimated here. Second, the volatility and openness of the Sierra Leonean economy as reflected in the descriptive statistics, such as the sharp spike in inflation in 2023 and the associated slowdown in

growth, is consistent with the exposure to external shocks highlighted by (Adedoyin et al., 2023) in their discussion on climate and commodity exposure of Sub-Saharan African economies, and by (Yeboah et al., 2024) in their discussion on resource dependence as a structural constraint on the growth-technology transition.

VI. CONCLUSION AND POLICY IMPLICATIONS

In this study, the annual data for the period 1990 to 2014 has been used to describe the relationship between FDI and economic growth in Sierra Leone for the last 25 years using ARDL bounds testing. A parsimonious model that includes FDI and trade openness confirms the presence of a long-run equilibrium relationship, and the speed of adjustment to the error correction is estimated to be fast and statistically significant, but the short-run FDI effect and the exact long-run elasticity of FDI are both estimated with meaningful uncertainty. The short-run Granger causality test results were inconclusive, while the long-run, equilibrium-correcting test results confirmed the causality from FDI and trade openness to growth. Domestic investment does not play a significant role in the moderation of the FDI-growth relationship, and the role of trade openness, although suggestive of a mild substitutability, is not statistically significant.

The results suggest that policy makers should not assume that FDI inflows automatically and immediately bring a growth dividend to Sierra Leone. There are three policy directions that follow. First, the strengthening of local content regulation, as suggested by (Ayentimi et al., 2016), would enable the FDI in the extractive sector to be channeled into wider linkages within the domestic economy instead of functioning as an enclave with limited spillovers. Third, the absorptive-capacity mechanism identified by Anyamele (2010) appears to be a precondition for FDI to bring about the technology and knowledge spillovers that endogenous growth theory assumes, although this study did not test that mechanism directly. Third, as reported by (Ayana et al., 2023) and as documented by (Sackey, 2021) on the moderating role of institutions and the role of macroeconomic

stability in generating growth returns, continued strengthening of public institutions and macroeconomic stability, including the containment of the inflationary pressures observed in the 2022-2023 period, is likely to be a necessary complement to any FDI-attraction strategy, as the broader lesson from (Phiri & Tchereni, 2013) is that not all external capital inflows generate comparable growth returns unless domestic conditions are conducive.

Limitations and future research

These findings are limited by a number of factors and indicate areas for further study. First, the annual sample of twenty-five observations is adequate for the bounds testing of ARDL but it reduces the statistical power to estimate the individual long run and short run coefficients accurately, and the reported standard errors should be interpreted accordingly. Second, the high degree of multicollinearity between FDI, domestic investment, and trade openness made it difficult to include all four conditioning variables in a full specification, and future studies with a longer time series or higher frequency data could help to support a full specification. Third, there was no consistent annual human capital indicator available over the entire sample period, and thus a formal test of human capital as a moderator of the FDI-growth relationship was not possible as originally planned in RQ5; future research should incorporate World Bank Human Capital Index or UNESCO Institute for Statistics enrolment data, when available, as a consistent annual series. Fourth, formal parameter stability tests (CUSUM and CUSUM of squares) were not performed due to the limited annual time span, but are recommended as a robustness check in future extensions, along with explicit structural break dummies for the 2014-2016 Ebola epidemic and the 2020-2021 COVID-19 shock. Lastly, future studies could benefit from breaking down FDI by sector, as (Bekun et al., 2022) did for oil versus non-oil investment, to see if the negative short-run growth effect found here is specific to Sierra Leone's investment profile or is dampened by it.

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