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Resource endowment, environmental innovation, and foreign direct investment in Africa: The role of financial development

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Abstract: This paper investigates the moderating role of financial development on the relationship between natural resource endowment, environmental innovation, and FDI inflows across 54 African countries from 1990 to 2023. Using panel data, PCSE, and quantile regression methods, results indicate that resource endowment positively affects FDI, whereas environmental innovation negatively affects it. Crucially, financial development improves the resource effect, suggesting financial deepening may limit resource-curse dynamics. The negative environmental innovation effect becomes insignificant when moderated by financial development, suggesting that well-functioning financial markets can absorb the costs of green regulation. Quantile regressions show heterogeneity across FDI levels. Financial development is not a universal FDI-enhancer in resource-rich Africa; integrated resource governance, green innovation, and financial-sector reforms are required.

Keywords: foreign direct investment; natural resources; environmental innovation; financial development; Africa; quantile regression

JEL Codes: F4, F42, O11

1. Introduction

Foreign direct investment (FDI) is widely recognised as an important driver of economic growth through capital accumulation, technology transfer, productivity improvements, and employment creation, particularly in developing economies (Adewuyi & Awodumi, 2017; Chen & Lei, 2018). Although Africa has experienced a steady increase in FDI inflows over the past three decades, the continent continues to face environmental degradation, resource depletion, and climate-related challenges arising from increased production and extractive activities (Oduola et al., 2021; Sun & Yao, 2023). While abundant natural resources have traditionally attracted multinational enterprises seeking access to raw materials, excessive dependence on resource extraction may undermine sustainable investment by exacerbating environmental degradation, weakening institutional quality, and limiting economic diversification, a phenomenon commonly referred to as the resource curse (Sachs & Warner, 2001; Van der Ploeg, 2011). At the same time, environmental innovation, through the development and adoption of cleaner technologies and environmentally friendly production processes, has become an increasingly important determinant of investment attractiveness in the global economy (Porter & Van der Linde, 1995; Kemp & Oltra, 2011; Hsu et al., 2021).

The growing emphasis on sustainable investment motivates the need to understand how natural resource endowment and environmental innovation jointly influence FDI inflows in Africa. Existing studies have predominantly examined either the relationship between FDI and innovation, particularly research and development (R&D) and patent activities (Erdal & Göçer, 2015; Ning et al., 2016; Law et al., 2018), or the effects of FDI on environmental quality (Demena & Afesorgbor, 2020; Wang et al., 2020; Opoku et al., 2021). However, evidence remains limited on whether financial development shapes the effects

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of natural resource endowment and environmental innovation on FDI, especially within the African context. This omission is important because financial development enhances capital allocation, improves access to finance, facilitates technological adoption, and supports the financing of green innovation, thereby influencing both investment decisions and sustainable economic development (Yang & Ni, 2022).

To address this gap, this study investigates the effects of natural resource endowment and environmental innovation on FDI inflows across 54 African countries over the period 1990–2023. Specifically, it examines whether financial development moderates the relationships between natural resource endowment, environmental innovation, and FDI. The study employs dynamic panel econometric techniques that account for endogeneity, unobserved heterogeneity, and interaction effects, yielding more reliable estimates of FDI determinants than conventional panel estimation methods.

The empirical findings indicate that natural resource endowment significantly increases FDI inflows, confirming the resource-seeking motive of multinational enterprises (Poelhekke & Van der Ploeg, 2013). In contrast, environmental innovation exerts a significant negative effect on FDI inflows over the study period. Financial development plays a significant moderating role in both relationships, reversing the positive effect of natural resource endowment and mitigating the negative effect of environmental innovation on FDI. These findings demonstrate that the quality of financial systems plays a pivotal role in determining how resource abundance and environmental innovation translate into foreign investment.

This study contributes to the literature in several important respects. First, it extends the natural resource–FDI literature by jointly examining natural resource endowment, environmental innovation, and financial development within a unified empirical framework, whereas previous studies have largely considered these relationships separately (Poelhekke & Van der Ploeg, 2013; Demena & Afesorgbor, 2020). Second, unlike studies that primarily use pollution indicators as proxies for environmental sustainability, this study employs green patent intensity to capture environmental innovation, thereby focusing on innovation-driven competitiveness rather than environmental degradation (Hsu et al., 2021; Qamruzzaman & Karim, 2024). Third, it advances the literature by conceptualising financial development as a moderating mechanism through which natural resources and environmental innovation influence FDI, thereby extending Dunning's Eclectic (OLI) paradigm to incorporate financial system development as a structural determinant of location-specific investment advantages. Finally, by employing dynamic panel estimation techniques with interaction effects across a comprehensive panel of African countries, the study provides robust and region-specific evidence on the determinants of sustainable FDI in resource-rich developing economies.

The remainder of the paper is organised as follows. Section 2 reviews the relevant literature and develops the study hypotheses. Section 3 describes the data, variables, and empirical methodology. Section 4 presents and discusses the empirical results, while Section 5 concludes the paper with policy implications and recommendations for future research.

2. Literature Review

2.1. Theoretical review

This research draws upon three complementary theoretical frameworks: Dunning's Eclectic (OLI) Paradigm, Endogenous Growth Theory, and the Environmental Kuznets Curve (EKC). Collectively, they provide a comprehensive foundation for analysing how natural resource endowments, environmental innovation, and FINDEV shape FDI inflows in Africa.

2.1.1. Eclectic paradigm

The Eclectic Paradigm, introduced by John Dunning (1977, 1998), remains a central framework for analysing the determinants of FDI. According to this paradigm, foreign firms engage in international production when three conditions are satisfied: (i) ownership-specific advantages (O), which include firm-specific assets such as technology, brands, or managerial expertise; (ii) location-specific advantages (L), referring to host country attributes such as natural resources, market size, or infrastructure; and (iii) internalisation advantages (I), which are the benefits of retaining operations within the firm rather than licensing or outsourcing (Dunning, 2000; Wagner, 2020).

Within Africa, natural resource endowments constitute a traditional location advantage that attracts resource-seeking FDI, particularly in extractive industries (Poelhekke & Van Der Ploeg, 2013). Environmental innovation capacity, often measured by green patent intensity, can be regarded as an emerging location advantage, reflecting regulatory quality, technological readiness, and alignment with global Environmental, Social, and Governance (ESG) standards (Porter & Van der Linde, 1995). Despite its widespread use, the OLI framework has been criticised for its static perspective and its limited ability to incorporate dynamic factors such as financial system development (Narula & Pineli, 2019). Although FINDEV is not explicitly included in Dunning's original typology, it influences both location advantages, by affecting the ease of doing business, and internalisation advantages, by shaping transaction costs. This study extends the OLI framework by conceptualising FINDEV as a moderating factor that amplifies or diminishes the effects of natural resources and environmental innovation on FDI.

2.1.2. Endogenous growth theory

Endogenous Growth Theory, as developed by Romer (1990) and Lucas (1988), posits that long-term economic growth is primarily driven by internal factors such as human capital, R&D, knowledge spillovers, and innovation. In contrast to neoclassical models, which treat technological progress as exogenous, endogenous growth models demonstrate that policy interventions, including investment in education and R&D subsidies, can have a lasting impact on growth rates (Aghion & Howitt, 1992).

Within the FDI literature, Endogenous Growth Theory suggests that host countries possessing robust innovation systems and high levels of human capital are more likely to attract high-value, knowledge-intensive FDI (Akkas & Altiparmak, 2023). Perugini et al. (2008) contend that while FDI contributes to economic growth, its effectiveness is contingent upon a country's absorptive capacity, defined as the ability to recognise, assimilate, and utilise external knowledge. Environmental innovation represents a distinct form of technological progress that simultaneously reduces the ecological footprint of production and enhances competitiveness (Aghion et al., 2016). FINDEV facilitates this process by allocating resources to innovative firms, mitigating information asymmetries, and promoting the dissemination of green technologies (Levine, 1997; Yang & Ni, 2022). Consequently, Endogenous Growth Theory provides a theoretical basis for considering both environmental innovation and FINDEV as key determinants of FDI, especially in economies aiming to achieve sustainable growth.

2.1.3. The Environmental Kuznets Curve

The Environmental Kuznets Curve (EKC) hypothesis, initially examined by Grossman and Krueger (1991) and subsequently formalised by Arrow et al. (1995), posits an inverted U-shaped relationship between per capita income and environmental degradation. At lower income levels, economic growth tends to increase pollution and resource depletion. Once a threshold income is reached, societal demand for cleaner environments rises, regulatory frameworks become more stringent, and investment in green technologies mitigates environmental harm (Stern, 2004; Mishra, 2020).

The relevance of the EKC to FDI is twofold. First, the EKC suggests that environmental regulation intensifies as economies develop, which may deter pollution-intensive (‘dirty’) FDI, known as the "pollution haven" effect, while potentially attracting

environmentally oriented FDI if the host country possesses green innovation capacity (Cole et al., 2006; Ahmad & Ali, 2022). Second, progression along the EKC is not automatic; it depends on the presence of supportive institutions, including a developed financial system capable of financing green infrastructure and innovation (Tamazian et al., 2009). In SSA, many countries remain on the upward-sloping segment of the EKC, where environmental degradation is increasing. Some, however, are nearing or have surpassed the turning point, positioning them as potential destinations for sustainable FDI. The EKC thus provides context for the environmental dimension of this study, indicating that the impact of environmental innovation on FDI may depend on the stage of economic development and the maturity of financial markets. Together, these frameworks underpin the empirical investigation of how natural resource endowment, environmental innovation, and FINDEV interact to shape FDI flows in this study. The following section presents empirical evidence for each of these relationships and leads to a detailed specification of the empirical model.

2.2. Empirical review

2.2.1. Natural resource endowment and FDI nexus

Empirical studies on the relationship between natural resource endowment and FDI inflows yield mixed and context-dependent results. Research indicates that countries with abundant natural resources often attract substantial FDI, particularly in extractive industries. Asiedu (2006) found that natural resource richness significantly increases FDI inflows in Africa, especially in countries with underexploited mineral reserves. Similarly, Djokoto (2021) demonstrated a positive correlation among natural resources, economic growth, and FDI in the Southern African Development Community. However, this positive relationship is not universal. Several scholars contend that resource wealth does not necessarily result in increased or sustainable FDI. In countries with weak institutional frameworks, abundant resources may foster rent-seeking, corruption, and conflict, a phenomenon commonly referred to as the "resource curse," which can impede long-term investment. Floerkemeier et al. (2021) emphasise that institutional weaknesses can negate the locational advantages of resource-rich countries. Similarly, Manu et al. (2024) highlight the critical role of national institutions in shaping the relationship between natural resource wealth and FDI. Their analysis of data from African and Latin American countries indicates that resource-rich nations attract significantly more FDI when they possess strong property rights, transparent licensing procedures, and stable macroeconomic policies.

These findings suggest that natural resources alone are insufficient to attract investors. Rather, the overall quality of governance and financial systems determines whether resource wealth functions as an advantage or a barrier. Thus, while natural resources may increase a country’s appeal to foreign investors, the effectiveness and reliability of its institutional and financial frameworks are critical for converting this potential into actual investment. The Eclectic Paradigm posits that a country's natural resources play a pivotal role in attracting FDI (Batschauer da Cruz et al., 2022; Wang & Sun, 2024). Building on these insights, this study tests the following hypothesis:

H1: Natural resource endowment has a positive effect on FDI.

2.2.2. Environmental innovation and foreign direct investment

Environmental innovation is a significant determinant of FDI, particularly as global concerns regarding climate change, sustainability, and compliance with Environmental, Social, and Governance (ESG) criteria increasingly shape investment decisions. Empirical research indicates that countries investing in green technologies and sustainable practices are more likely to attract green FDI. Uche et al. (2023) demonstrate, through a cross-country analysis, that higher investment in renewable energy and increased green patent activity are closely associated with greater FDI inflows, particularly in energy-intensive and technology-driven sectors. Similarly, Satoğlu and Salmon (2024) report that nations

with robust environmental regulations and high environmental performance scores tend to attract multinational corporations seeking to align with sustainability objectives and reduce long-term risks. The literature further suggests that FDI inflows promote environmental innovation by enhancing resource efficiency, particularly by reducing greenhouse gas emission intensity and the carbon intensity of energy (Awodumi, 2022; Yu et al., 2023; Zhang et al., 2025).

Empirical evidence supports the Environmental Kuznets Curve (EKC), particularly in middle-income economies undergoing structural transformation (Mishra, 2020; Ahmad & Ali, 2022). In the context of FDI, the EKC suggests that countries demonstrating environmental innovation are likely to become attractive destinations for sustainable FDI aligned with low-carbon technologies and ESG standards. Pisani et al. (2019) emphasise that foreign investors favour markets where environmental policies demonstrate stability and a clear strategic direction, especially in sectors such as renewable energy, clean manufacturing, and sustainable infrastructure. However, the relationship between environmental innovation and FDI is complex. Stringent environmental regulations may increase operational costs and compliance requirements, potentially deterring investment in pollution-intensive or cost-sensitive industries. Dean et al. (2009) discuss the "pollution haven" hypothesis, which posits that firms may relocate operations to countries with more lenient environmental regulations to reduce production costs. Bialek and Weichenrieder (2021) further show that, in OECD countries, stricter green regulations can reduce FDI in traditional manufacturing and fossil-fuel sectors. Therefore, the impact of environmental innovation on FDI is nuanced and sector-specific: sustainable industries may benefit, while resource-intensive sectors could encounter short-term challenges. Consistent with the EKC theory, this study posits the following hypothesis:

H2: Environmental innovation positively influences FDI.

2.2.3. The moderating role of financial development in these relationships

FINDEV plays a crucial role in amplifying or mitigating the effects of natural-resource endowments and environmental innovation on FDI. According to endogenous growth theory, a well-developed financial system enables efficient capital allocation, reduces transaction and borrowing costs, and strengthens the domestic economy's capacity to absorb and utilise foreign capital. Therefore, FD not only directly affects FDI inflows but also moderates the relationship between structural economic factors and foreign investment. In the African context, where many economies possess abundant natural resources but have underdeveloped financial systems, assessing the moderating influence of FD is particularly relevant. FINDEV enhances the host economy's absorptive capacity, enabling resource-seeking FDI to operate more effectively by providing essential credit and banking services for project implementation. As global investors increasingly prioritise Environmental, Social, and Governance (ESG) criteria, environmental innovation becomes a key factor in attracting FDI. In this context, FD serves as a critical moderator, facilitating the flow of capital toward environmentally sustainable investments.

Appiah et al. (2024) demonstrate that FD significantly strengthens the positive relationship between natural resource endowment and FDI, particularly when financial institutions are inclusive, accessible, and efficient. Their analysis of emerging African economies indicates that the availability of credit, capital market development, and financial intermediation support the reinvestment of resource revenues in infrastructure and industrial growth, thereby attracting additional investment. Similarly, Kaur et al. (2013) find that increased financial sector depth, measured by domestic credit to the private sector, boosts FDI inflows by easing funding constraints for both domestic and foreign firms. Khan and Khan (2019) confirm this result, indicating that FD lowers investment risk and enables foreign investors to operate in volatile or high-risk environments. Conversely, financial instability, characterised by unpredictable capital markets, restricted access to credit, and inadequate regulatory oversight, erodes investor

confidence. Prasad (2024) observes that countries with underdeveloped financial systems, even those with abundant natural resources, often face challenges in attracting sustained FDI due to capital market uncertainties and increased financing risks. Sofiyan (2024) also finds that financial fragility reduces the positive impact of environmental innovation, as firms struggle to secure funding for clean technologies or comply with green regulatory standards. Collectively, the literature indicates that FD is a critical moderator, shaping the effects of structural factors such as natural resource wealth and environmental innovation on investment flows. Based on these findings, the following hypotheses are proposed:

H3: Financial development enhances the positive relationship between natural resource endowment and FDI.

H4: Financial development moderates the impact of environmental innovation on FDI.

3. Data and Methodology

3.1. Data sources

This research employs a descriptive-explanatory panel data design to estimate the relationships among natural resource endowment, environmental innovation, and FDI, and to assess the moderating effect of FINDEV. The panel data structure enables control for time-invariant unobserved heterogeneity. Therefore, the results are interpreted as robust correlations rather than definitive causal effects due to potential endogeneity. Annual panel data for 54 countries from 1990 to 2023 are utilised. The selection of variables is grounded in economic theory and supported by prior research. Data are sourced from established international organisations, including the World Development Indicators (WDI), the Global Innovation Index (GII), Green Patent Databases, the Worldwide Governance Indicators (WGI), and the International Monetary Fund (IMF). Table 1 summarises all variables, including their definitions, measurement methods, and data sources.

3.2. Model specification

The objective of this study is clarified by verifying the aforementioned variables to examine their relationships and the causal pathway of FDI in SSA countries. To empirically investigate the direct and moderating effects outlined in the research objectives, the following baseline panel data regression model is specified and estimated:

$$\mathrm{FDI}_{it} = \varphi_0 + \varphi_1 \mathrm{NATRES}_{it} + \varphi_2 \mathrm{ENVINNOV}_{it} + \varphi_3 \mathrm{FINDEV}_{it} + \varphi_4 \mathrm{GDPG}_{it} + \varphi_5 \mathrm{OPEN}_{it} + \varphi_6 \mathrm{INFL}_{it} + \varphi_7 \mathrm{PS}_{it} + \varphi_8 \mathrm{URBRATE}_{it} + \varphi_9 \mathrm{NATRES}_{it}\#\mathrm{FINDEV} + \varphi_{10} \mathrm{ENVINNOV}_{it}\#\mathrm{FINDEV} + \mu_i + \eta_t + \varepsilon_{it} \quad (1)$$

where, for country *i* at time *t*:

- FDI_{it} : Foreign direct investment inflows
- NATRES_{it} : Natural resource endowment.
- $\mathrm{ENVINNON}_{it}$: Environmental innovation.
- FINDEV_{it}: Financial development.
- GDPG_{it}: GDP growth.
- OPEN_{it} : Market openness
- INFL_{it} : Inflation
- PS_{it}: Political stability.
- $\mathrm{URBRATE}_{it}$: Urbanisation rate.
- μ_i: Additional control for country fixed-effects
- η_t: Additional control for time fixed-effects
- ε_{it} : The error term

Table 1. Variable description, measurement and sources

Variable	Description	Measurement	Source
Foreign Direct Investment (FDI)	Net inflows of investment by foreign entities aiming for a lasting interest and significant control in enterprises operating in a host country.	Foreign direct investment, net inflows (% of GDP)	WDI
Environmental Innovation (ENVINNOV)	Technological and policy advancements aimed at reducing environmental degradation and promoting sustainability.	Green patent filings; renewable energy production (MWh)	WDI, Global Innovation Index
Natural Resource Endowment (NATRES)	The sum of natural resource rents from oil, gas, minerals, forests, and coal reflects the economic value derived from natural resources.	Total natural resources rents (% of GDP); mineral exports (% of total exports)	WDI
Financial Development (FINDEV)	Access to credit and financial services that support private sector investment and economic growth.	Domestic credit to the private sector (% of GDP); IMF Financial Development Index	WDI, IMF
Gross Domestic Product Growth Rate (GDPG)	Annual growth rate of real GDP, reflecting a country's overall economic performance and output growth.	GDP growth (annual %)	WDI
Trade Openness (OPEN)	The degree to which a country is open to international trade, capturing integration with global markets.	Sum of exports and imports (% of GDP)	WDI
Inflation Rate (INFL)	The rate at which the general price level of goods and services rises affects purchasing power and macroeconomic stability.	Annual percentage change in Consumer Price Index (CPI)	WDI
Political Stability (PS)	Reflects the likelihood of political unrest, violence, or instability that could negatively impact the investment climate.	Political Stability and Absence of Violence/Terrorism Index	Worldwide Governance Indicators
Urbanisation Rate (URBRATE)	Proportion of the total population residing in urban areas, which often correlates with industrialisation, infrastructure, and market size.	Urban population (% of total population)	WDI

Notes. WDI refers to the World Development Indicators database of the World Bank; IMF denotes the International Monetary Fund; the Global Innovation Index provides data on green innovation indicators; and the Worldwide Governance Indicators (WGI) provide governance measures, including political stability. All variables are annual country-level observations for African countries over the study period. Variable definitions and measurements follow the respective source databases. *Source.* Author's Construct, 2026.

To achieve its objectives, the study estimates five distinct models based on the baseline model, each designed to address a specific objective and test the corresponding hypothesis. To ensure methodological transparency and facilitate replication, this study explicitly documents the baseline measures, alternative robustness measures, and units of measurement for all variables. The baseline measures are employed in the primary estimates, whereas alternative proxies are used in robustness analyses to assess the sensitivity of the results to different variable operationalisations. Reporting the units of measurement further enables precise interpretation of the regression coefficients and marginal effects, while enhancing the comparability and reliability of the empirical findings. Table 2 shows the baseline measure, robustness measure and units.

Table 2. Baseline measure, separate robustness measures, and clear units

Variable	Baseline Measure	Unit	Robustness Measure	Unit	Source	Justification
FDI	FDI net inflows	% of GDP	FDI stock	% of GDP	World Bank	Baseline captures annual inflows; robustness assesses accumulated investment.
Natural Resource Endowment	Total natural resource rents	% of GDP	Mineral exports	% of merchandise exports	World Bank	Baseline reflects overall resource dependence; robustness focuses on export specialisation.
Environmental Innovation	Green patent applications	Number (or per million population)	Renewable energy production	% of total electricity generation or energy output	OECD/WIPO/World Bank	Baseline measures innovation output; robustness reflects technological adoption.
Financial Development	Domestic credit to private sector	% of GDP	IMF/World Bank	Index (0–1)	IMF Financial Development Index	Baseline focuses on banking-sector depth; robustness captures multidimensional financial development.

3.3. Estimation technique

Panel-Corrected Standard Errors (PCSE) were employed to obtain efficient and unbiased coefficient estimates in the presence of heteroskedasticity and contemporaneous cross-sectional correlation (Beck & Katz, 1995). PCSE is a generalised least squares (GLS)-based technique that addresses common challenges in panel data analysis, including heteroskedasticity, cross-sectional dependence, and autocorrelation. To ensure robustness, alternative model specifications were estimated using the Driscoll-Kraay Estimator (DKE) and Quantile Regression. The DKE, developed by Driscoll and Kraay in 1998, is a nonparametric method that provides reliable standard errors when cross-sectional dependence, serial correlation, and heteroskedasticity are present. Quantile Regression, introduced by Koenker and Bassett in 1978, is a semi-parametric approach that extends traditional regression by estimating the conditional median or other quantiles of the dependent variable, rather than only the mean. This method is particularly valuable when the relationship between predictors and the outcome varies across different points in the distribution of FDI inflows. In this study, Quantile Regression is used to identify potential differences in the effects of natural resource endowment, environmental innovation, and FINDEV on FDI across levels, including countries with low and high FDI inflows.

3.4. Diagnostic test results and model validity

Prior to estimating and interpreting the main econometric models, a series of diagnostic tests was performed to assess the robustness and validity of the panel data models. These tests assess key assumptions underlying panel regression, such as heteroskedasticity, serial correlation, cross-sectional dependence, and endogeneity. The presence of these econometric issues may bias parameter estimates, compromise standard errors, and undermine the reliability of statistical inference. Table 3 presents the results of these diagnostic tests for the fully specified model, which incorporates all independent, moderating, and control variables.

Table 3. Model diagnostics

Test	Test Statistic	Interpretation
Modified Wald Test for Group-wise Heteroskedasticity	2117.31***	Heteroskedasticity is present across panels.
Wooldridge Test for Serial Correlation	9.678***	First-order autocorrelation is present.
Pesaran Test for Cross-sectional Dependence	0.042**	Evidence of cross-sectional dependence.
Durbin-Wu-Hausman (DWH) Test of Endogeneity	14.6916 (p > 0.05)	No significant endogeneity detected in the model.

Notes. The diagnostic battery reveals violations of homoskedasticity (Modified Wald), no serial correlation (Wooldridge), and cross-sectional independence (Pesaran). To ensure unbiased inference despite these panel-level irregularities, we employ Driscoll-Kraay (1998) robust standard errors in our primary estimations. The DWH test confirms that endogeneity is not a significant issue (p > 0.05), so all coefficient estimates remain consistent and are interpreted as unbiased causal associations. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively. *Source.* Output from Stata

4. Empirical Results and Discussion

This section presents and interprets the principal findings from an econometric analysis of the relationships among natural resource endowment, environmental innovation, FINDEV, and FDI across a panel of African countries. The study employs multiple estimation techniques, including Panel-Corrected Standard Errors (PCSE), Driscoll-Kraay Estimators (DKE), and Quantile Regression, to ensure robustness and validity of results. The analysis identifies both direct and moderating effects, elucidating the complex interactions among these variables.

Table 4. Descriptive statistics of study variables, VIF coefficients, and normality test statistics

	(1)	(2)	(3)	(4)	(5)	VIF	Normality
VARIABLES	N	Mean	SD	Min	Max	Coef.	Test (Prob>z)
FDI	1,529	0.1804	2.1631	-15.5769	5.1200		0.00000
NATRES	1,825	1.8844	1.6011	-7.6782	6.1609	1.62	0.00000
ENVINNOV	763	6.8645	3.8360	-0.3365	18.000	2.34	0.00000
FINDEV	1,775	2.4785	1.3885	-6.9205	9.4343	2.69	0.00000
GDPG	1,542	1.4114	0.8857	-4.3065	5.0105	1.09	0.00000
OPEN	1,654	6.8110	1.1939	0.41426	11.9483	2.12	0.00000
INFL	1,593	1.9021	1.3035	-3.30544	10.0763	1.41	0.00000
PS	1,836	-0.6228	1.0751	-7.1790	1.97465	2.59	0.00000
URBRATE	1,836	3.5957	0.4986	1.6894	4.5112	2.31	0.00000

Notes. FDI, NATRES, ENVINNOV, FINDEV, GDPG, OPEN, INFL, PS, and URBRATE denote Foreign Direct Investment, Natural Resources, Environmental Innovation, Financial Development, GDP Growth, Trade Openness, Inflation, Political Stability, and Urbanisation Rate, respectively. The number of observations (N) varies across variables due to differences in data availability across countries and years within the panel dataset. *Source.* Output from Stata

The descriptive statistics, as shown in Table 4, indicate substantial variation across countries and time periods for all main variables. For example, FDI inflows display significant variability, with a mean of 0.18% of GDP, a standard deviation of 2.16%, and a range from -15.58% to 5.12%. This range reflects both large inflows and outflows in certain countries. Natural resource endowment (NATRES) also demonstrates considerable dispersion, with a mean of 1.88% of GDP and values spanning from negative (attributable to statistical adjustments or deficits) to over 6%. This highlights the diversity of resource availability across countries. Environmental innovation (ENVINNOV) and FINDEV similarly exhibit high variability, suggesting differing levels of green innovation and financial-sector maturity. Variance inflation factor (VIF) values for all variables remain below the commonly accepted threshold of 10, indicating no serious multicollinearity in

the regression models. Furthermore, the normality test results (Prob > z = 0.000) for all variables confirm non-normality, a typical characteristic of macroeconomic panel data. This finding supports the use of robust estimation methods, such as panel-corrected standard errors (PCSE) and the Driscoll-Kraay estimators.

4.1. Pairwise correlation analysis

Correlation analysis evaluates the strength and direction of linear relationships between key variables and identifies potential multicollinearity. Table 5 presents the pairwise correlation coefficients for all variables included in the models.

Table 5. Pairwise Correlation

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) FDI	1.000								
(2) NATRES	-0.078	1.000							
(3) ENVINNOV	-0.067	0.051	1.000						
(4) FINDEV	0.043	-0.279	0.155	1.000					
(5) GDPG	0.178	0.123	-0.186	-0.141	1.000				
(6) OPEN	0.292	-0.142	-0.154	0.287	0.054	1.000			
(7) INFL	-0.093	0.143	-0.008	-0.260	0.008	-0.147	1.000		
(8) PS	0.223	-0.438	-0.239	0.290	-0.014	0.350	-0.289	1.000	
(9) URBRATE	0.230	-0.101	0.383	0.186	-0.050	0.443	-0.208	0.282	1.000

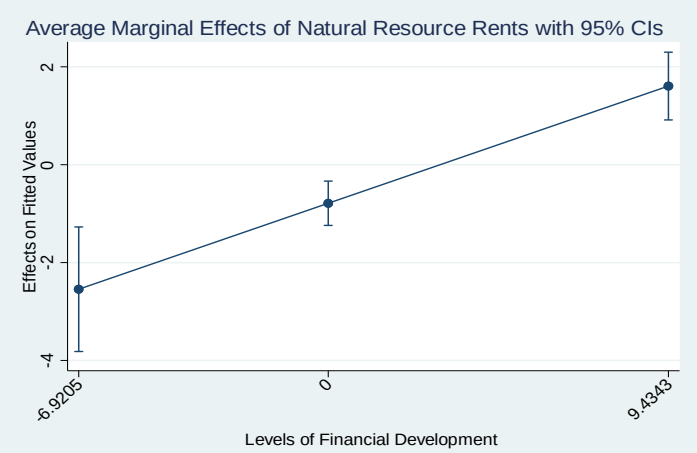
Notes. FDI = Foreign Direct Investment, NATRES = Natural Resources, ENVINNOV = Environmental Innovation, FINDEV = Financial Development, GDPG = GDP Growth, OPEN = Trade Openness, INFL = Inflation, PS = Political Stability, URBRATE = Urbanisation Rate. All correlation coefficients are below the 0.80 threshold, suggesting that multicollinearity is unlikely to bias the regression estimates, consistent with the VIF diagnostics reported in Table 4. The strongest positive association is observed between OPEN and URBRATE (r = 0.443), while the strongest negative association is between NATRES and PS (r = -0.438).

The correlation matrix indicates that FDI is positively associated with GDP growth (0.178), trade openness (0.292), political stability (0.223), and the urbanisation rate (0.230). These findings suggest that countries exhibiting dynamic economies, stable political environments, and urban development are more likely to attract FDI. In contrast, FDI demonstrates a negative correlation with natural resource endowment (-0.078), supporting the resource curse hypothesis by implying that excessive reliance on natural resources may deter investment. Environmental innovation (ENVINNOV) is negatively correlated with both FDI (-0.067) and political stability, suggesting that higher levels of green innovation discourage traditional investment, potentially due to increased compliance costs. FINDEV is positively correlated with FDI (0.043), environmental innovation (0.155), and urbanisation (0.186), underscoring its role in facilitating capital mobility and enhancing innovation capacity. The generally modest correlation coefficients, together with low variance inflation factor (VIF) values, suggest that multicollinearity is not a significant concern. The next section shows the marginal effects of natural resource rents across different levels of FINDEV.

Figure 1 presents the average marginal effects of natural resource rents across different levels of FINDEV, together with 95% confidence intervals. The results show that the marginal effect of natural resource rents increases monotonically with FINDEV. At low levels of FINDEV, natural resource rents exert a statistically significant negative effect on the dependent variable, indicating that economies with underdeveloped financial systems are unable to efficiently transform resource wealth into productive economic outcomes. At average levels of FINDEV, the negative effect persists but becomes substantially smaller, suggesting that improvements in financial sector development mitigate the adverse consequences of resource dependence. At high levels of FINDEV, the marginal effect becomes positive and statistically significant, implying that well-

developed financial systems enable countries to channel natural resource revenues into productive investments, thereby enhancing the outcome variable. Since the confidence intervals at all three levels do not cross zero, the marginal effects remain statistically significant throughout. Overall, the figure provides strong evidence that FINDEV positively moderates the relationship between natural resource rents and the dependent variable, supporting the argument that stronger financial systems can transform the economic effects of natural resource wealth from negative to positive.

Figure 1. Plot of marginal effects of natural resource rents at different levels of financial development with 95% CI



Note. The figure plots the conditional marginal effects of natural resource rents on FDI across the observed range of financial development. The solid line represents the estimated marginal effect, and the shaded region (or dashed lines) represents the 95% confidence interval.

4.2. Natural resource endowment and FDI

Table 6 presents the results of the regression analysis. The results indicate that natural resource endowment exerts a positive and statistically significant effect on FDI inflows, confirming hypothesis 1. This finding supports the theoretical expectation that countries abundant in natural resources, as measured by resource rents or the share of mineral exports, tend to attract foreign investment, particularly in extractive sectors (Sandoval, Egan & Weinberg, 2025). Resource-rich environments provide low-cost access to valuable commodities, incentivising multinational enterprises seeking resource security and high returns on capital (Poelhekke & van der Ploeg, 2013). However, when FINDEV is included as a moderating variable, the coefficient for natural resource endowment becomes negative and statistically significant. This reversal suggests that in financially developed economies, excessive reliance on natural resources may deter FDI. The negative coefficient for natural resource endowment suggests that greater dependence on natural resources is associated with lower FDI inflows in Africa, holding other factors constant. This finding is consistent with the resource curse hypothesis, which argues that excessive reliance on natural resources may discourage diversified investment by weakening institutional quality, increasing economic volatility, and reducing incentives for innovation and productive investment.

In contexts where financial systems are robust and capital allocation is efficient, foreign investors may prefer diversified, innovation-driven sectors over resource-dependent economies that are vulnerable to price volatility, governance challenges, and the "resource curse" (Brunnschweiler & Bulte, 2008). This outcome implies a threshold effect, whereby the marginal benefit of resource wealth in attracting FDI diminishes or becomes negative as FINDEV advances. This result aligns with both classical and empirical literature, which posits that resource-rich countries attract foreign investors,

especially in extractive industries such as oil, gas, and mining (Asiedu, 2006; Poelhekke & van der Ploeg, 2013). The availability of abundant natural resources offers cost advantages and reduces input uncertainty for multinational corporations seeking secure access to raw materials. When FINDEV is introduced as a moderating variable, the interaction term between natural resource endowment and FINDEV becomes negative and statistically significant. This indicates that in economies with well-developed financial systems, the attractiveness of natural resource wealth as a driver of FDI is reduced. This finding is consistent with the "resource curse" hypothesis (Sachs & Warner, 2001; Van der Ploeg, 2011), which posits that overreliance on natural resources, particularly in the absence of institutional checks and economic diversification, may deter sustainable investment. In these contexts, foreign investors may favour economies with stronger innovation ecosystems and less dependence on volatile commodity markets.

Table 6. Baseline regression analysis of the effect of natural resource endowment, environmental innovation and financial development on FDI (using the PCSE estimator)

	(1)	(2)	(3)	(4)	(5)
VARIABLES	PCSE Estimator Model 1	PCSE Estimator Model 2	PCSE Estimator Model 3	PCSE Estimator Model 4	PCSE Estimator Model 5
NATRES	0.128***		-0.233*		-0.788***
	(0.0423)		(0.137)		(0.231)
FINDEV			-0.351***	-0.351	-0.631**
			(0.0938)	(0.274)	(0.260)
NATRES#FINDEV			0.111***		0.254***
			(0.0384)		(0.0609)
GDPG	0.0990**	0.105	0.0920*	0.0957	0.101
	(0.0479)	(0.0746)	(0.0479)	(0.0737)	(0.0745)
OPEN	0.492***	0.386***	0.620***	0.413***	0.535***
	(0.0664)	(0.114)	(0.0716)	(0.120)	(0.116)
INFL	0.0421	0.0512	0.0298	0.0399	0.0494
	(0.0430)	(0.0760)	(0.0445)	(0.0803)	(0.0818)
PS	0.477***	0.192	0.412***	0.239*	0.278**
	(0.0921)	(0.119)	(0.0968)	(0.142)	(0.138)
URBRATE	0.0655	0.0338	-0.0464	0.0141	-0.109
	(0.202)	(0.340)	(0.207)	(0.344)	(0.328)
ENVINNOV		-0.0476*		-0.169	-0.0442
		(0.0273)		(0.107)	(0.110)
ENVINNOV#FINDEV				0.0389	0.00434
				(0.0314)	(0.0316)
Constant	-133.9***	-158.2***	-139.1***	-161.9***	-160.8***
	(16.21)	(25.36)	(16.18)	(26.17)	(24.83)
Country effect	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes
Observations	1,066	501	1,054	501	501
R-squared	0.174	0.166	0.184	0.164	0.205
Number of id	47	27	47	27	27
Wald chi2	198.00***	80.98***	212.08***	82.09***	114.51***

Note. The table reports Panel-Corrected Standard Errors (PCSE) regression estimates of the effect of natural resource endowment, environmental innovation, and financial development on foreign direct investment (FDI). Standard errors are reported in parentheses. All models include country and year fixed effects. NATRES × FINDEV and ENVINNOV × FINDEV denote interaction terms used to examine the moderating role of financial development. NATRES = Natural Resource

Endowment; ENVINNOV = Environmental Innovation; FINDEV = Financial Development; GDPG = Gross Domestic Product Growth; OPEN = Trade Openness; INFL = Inflation; PS = Political Stability; URBRATE = Urbanisation Rate. Wald χ^2 reports the overall significance of each model. Differences in the number of observations across models stem from missing data on environmental innovation. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

This finding advances the literature by demonstrating that the relationship between natural resources and FDI is conditional rather than linear. In financially underdeveloped economies, foreign investors dominate resource extraction due to limited domestic financing capacity. As financial systems mature, domestic firms gain greater access to capital, increasing competition and reducing reliance on foreign investors. FINDEV also promotes economic diversification, shifting FDI from resource-seeking to efficiency- and market-seeking motives. The Eclectic Paradigm explains this transition as a shift in location advantages, in which natural resources become less central in financially mature economies. Endogenous Growth Theory further supports this shift by highlighting the role of financial systems in fostering innovation and structural transformation. This result also aligns with the broader resource curse argument, indicating that as economies develop, dependence on natural resources declines in favour of more diversified and sustainable growth drivers.

4.3. Environmental innovation and FDI

The baseline results indicate that environmental innovation has a negative and significant effect on FDI inflows, suggesting that economies investing substantially in green technologies and sustainable practices may initially deter foreign investment. The result disconfirms hypothesis 2. This outcome is consistent with the pollution haven hypothesis, which posits that multinational firms tend to avoid countries with stringent environmental regulations or high compliance costs (Akpilic, 2026; Cole & Elliott, 2003). Green innovation may signal regulatory tightening and increased long-term operating costs, prompting some foreign firms to seek jurisdictions with more lenient standards.

When FINDEV is considered as a moderating factor, the negative effect of environmental innovation on FDI becomes statistically insignificant. This suggests that FINDEV mitigates the adverse effects of green innovation on FDI, potentially by reducing financing barriers for environmentally compliant firms and promoting ESG-aligned investments. Although FINDEV does not significantly increase the attractiveness of green innovation, it serves as a buffer against its disincentive effects. This finding underscores the importance of complementary policies to align green innovation with investor incentives in sustainable finance markets. This result supports previous empirical work suggesting that stringent environmental policies and green regulations may impose higher compliance and production costs, leading pollution-intensive or cost-sensitive firms to relocate to less regulated jurisdictions (Dean et al., 2009; Bialek & Weichenrieder, 2021). Thus, countries pursuing aggressive environmental innovation agendas may initially experience reduced FDI inflows, especially in industries that are not aligned with environmental sustainability.

Interestingly, the moderating effect of FINDEV on this relationship is statistically insignificant. This finding implies that a robust financial sector does not significantly alter the impact of environmental innovation on FDI. One possible explanation is that FINDEV alone may not be sufficient to attract green FDI unless it is supported by complementary institutional factors such as environmental governance, green financing mechanisms, and incentives for sustainable investment (Porter & Van der Linde, 1995). Therefore, institutional quality and regulatory coordination may play a more decisive role than FINDEV in mitigating the disincentives associated with environmental innovation. This finding is consistent with the pollution haven argument, which posits that multinational firms prefer locations with relatively lax environmental standards. From a theoretical perspective, environmental innovation may reduce location attractiveness under the Eclectic Paradigm by increasing operational costs. In the short run, this is also consistent

with the Environmental Kuznets Curve, where early stages of environmental regulation and innovation may constrain investment.

This finding indicates that FINDEV serves a buffering function by improving access to finance, reducing the cost burden of environmental compliance, and enabling firms to invest in cleaner technologies. Consequently, environmental innovation ceases to deter foreign investment. According to Endogenous Growth Theory, FINDEV supports innovation-led growth by facilitating technological advancement and knowledge diffusion. Similarly, within the Environmental Kuznets Curve framework, FINDEV helps economies transition to a stage where environmental sustainability and investment attractiveness coexist. The Eclectic Paradigm also suggests that enhanced financial systems improve location advantages by offsetting the costs of environmental innovation. The large negative constant represents the predicted level of FDI when all explanatory variables are equal to zero. Because variables such as natural resource rents, environmental innovation, and FINDEV cannot realistically be zero simultaneously, the intercept has limited economic interpretation and primarily serves as a statistical parameter that positions the regression plane. Consequently, the discussion focuses on the estimated coefficients of the explanatory variables and their interactions rather than the magnitude of the constant.

4.4. The moderating effects of financial development

The results confirm significant moderating effects of FINDEV on the relationships between natural resource endowment and environmental innovation, as well as between FDI and environmental innovation. The interaction term between natural resource endowment and FINDEV is positive and significant, indicating that FINDEV enhances the positive impact of natural resources on FDI. This result confirms hypothesis 3. Specifically, improvements in FINDEV increase the marginal effect of natural resource endowment on FDI. This finding suggests that well-developed financial systems enable resource-rich economies to attract more foreign investment by reducing financing constraints, enhancing financial intermediation, and increasing investor confidence. Therefore, FINDEV mitigates the adverse effects associated with the resource curse and strengthens the investment-enhancing role of natural resources. In contrast, the interaction between environmental innovation and FINDEV is positive but statistically insignificant. The finding failed to support hypothesis 4, suggesting that while FINDEV may mitigate the deterrent effect of environmental innovation, it does not substantially enhance the country's appeal to green-oriented foreign investors. These findings imply that financial-sector reforms alone are insufficient to promote green FDI without explicit environmental investment incentives or targeted sustainability frameworks. Table 6 presents the results of the study's baseline estimation.

4.5. Robustness diagnostic tests

To ensure the validity, reliability, and consistency of the econometric findings, this study implements a series of diagnostic and robustness checks. These procedures are designed to identify common econometric issues, including endogeneity, heteroskedasticity, autocorrelation, cross-sectional dependence, and multicollinearity. Unaddressed, these problems can distort results, produce biased estimates, and lead to unreliable conclusions. The robustness checks applied include Instrumental Variable (IV) regression for endogeneity, the Modified Wald test for heteroskedasticity, the Wooldridge test for autocorrelation, the Pesaran test for cross-sectional dependence, and the Variance Inflation Factor (VIF) for multicollinearity. Employing these rigorous tests enhances the credibility and accuracy of the empirical results.

The study demonstrates that natural resource endowment generally exerts a positive influence on FDI. However, this effect turns negative when moderated by FINDEV, suggesting diminishing returns or resource overreliance in financially advanced contexts.

Additionally, environmental innovation initially deters FDI, likely due to increased costs, but this deterrent effect is neutralised, rather than reversed, by FINDEV. Furthermore, FINDEV serves as a critical moderating factor, reducing reliance on natural resources and mitigating the disincentives to green innovation. Robustness tests confirm the validity of these findings, and quantile regression reveals significant distributional effects across different levels of FDI inflows. The results are largely the same using the Driscoll-Kraay Estimator and quantile regression techniques, as shown in the Appendices.

5. Conclusion and Recommendations

5.1. Conclusion

This paper examines the fundamental characteristics of FDI, natural resources, environmental innovation, and their interaction in emerging nations. Data were collected from WDI, and panel data analysis was conducted from 1990 to 2023. The results showed that natural resource endowment increases FDI inflows, whereas environmental innovation has a significant negative effect on FDI inflows. FINDEV reverses the positive effect of natural resources and neutralises the negative effect of environmental innovation. Altogether, the findings confirm the theoretical expectations derived from the Eclectic Paradigm, Environmental Kuznets Curve Hypothesis and Endogenous Growth theory, offering a coherent account of how natural resources, environmental innovation, and FINDEV jointly influence FDI. The insights generated contribute not only to the scholarly literature but also to ongoing policy and regulatory debates on natural resources in Africa. They indicate the importance of designing environmental policies and restructuring the financial systems to attract global investment into Africa. This study contributes to the literature by demonstrating that both natural resource endowment and environmental innovation have conditional effects on FDI, depending on the level of FINDEV. It highlights FINDEV's role as a transformative mechanism that shifts economies from resource-dependent, pollution-intensive investment patterns toward more diversified, sustainable growth trajectories.

5.2. Recommendations

The evidence generated by this study highlights an urgent need for Africans to pursue deliberate and strategic interventions to attract FDI. Countries with abundant natural resources should not rely exclusively on extractive industries to attract FDI. Governments are advised to broaden the investment landscape by supporting industrialisation and infrastructure development. Promoting investment in sectors such as energy, transportation, and manufacturing can reduce dependence on resource-based FDI.

Policymakers should not view natural resource management and financial sector development as separate policy silos. Instead, financial deepening should be pursued as a deliberate complement to resource extraction policies. Without simultaneous investment in banking infrastructure, credit markets, and regulatory frameworks, the continent risks perpetuating the resource curse, where resource wealth fails to translate into sustained foreign capital inflows. Policymakers should develop financial instruments and platforms that actively promote investment in emerging and underdeveloped sectors. These measures may include risk mitigation tools, sector-specific bonds or credit facilities, and financial innovations tailored to technology, manufacturing, renewable energy, and services. Governments are advised to implement targeted incentives to increase the attractiveness of environmentally sustainable investments for multinational firms. Potential measures include tax breaks for green technologies, subsidies for clean energy projects, access to green bonds, and public-private partnerships that reduce the risks associated with eco-friendly ventures. Additionally, clear and consistent environmental regulations can enhance investor confidence and stimulate FDI driven by green innovation.

Transparent, consistent, and predictable regulatory frameworks are essential for reassuring foreign investors and reducing perceived risks. Ongoing dialogue with the private sector and institutional reforms aimed at combating corruption and bureaucratic inefficiencies can further enhance the investment climate.

5.3. Limitations and future related research

This study relied on secondary data, which may include inconsistencies or measurement errors, particularly regarding proxies for environmental innovation. Although the analysis covers a broad panel of 54 countries, the findings may not fully capture country-specific institutional and economic factors that influence FINDEV. FINDEV was the sole moderator examined, while other institutional factors, such as legal frameworks and corruption levels, may also affect the relationship between FDI and FINDEV. Furthermore, despite the application of robustness checks, the study does not establish definitive causality between variables, as FINDEV decisions may be shaped by external shocks or firm-specific strategies. Future research should expand the moderation framework by examining how additional factors, such as institutional quality, governance effectiveness, and geopolitical risks, influence the relationships between resource endowment, FDI, and innovation. Analyses using firm-level data are recommended to provide micro-level insights into multinational corporations' investment decisions. Further, investigating sectoral responses, including mining, manufacturing, and renewable energy, to resource endowment and environmental innovation would yield more detailed policy guidance. Finally, employing advanced econometric techniques, such as panel threshold approaches or dynamic panel estimation (e.g., GMM), could improve the assessment of endogeneity and causal inference.

Ethical Approval: This study did not involve human participants, patent data, or any form of primary data collection. The study relied solely on open-access secondary datasets that were publicly available and contained no identifiable personal information. According to prevailing institutional and international guidelines, the use of publicly accessible secondary data does not require formal ethical approval. Nonetheless, the authors adhered to all ethical principles governing the responsible use, citation, and reporting of secondary data in research.

Consent to Participate: This study did not involve direct interaction with human participants but was exclusively on open-access secondary data available in the public domain. As such, no individual-level consent to participate was required.

Consent to Publish: The author has reviewed the final version of the manuscript and consents to its publication. The author affirms that the manuscript is original, has not been submitted elsewhere, and contains no material previously published without proper citation. The author accepts responsibility for the integrity and accuracy of the content and agrees to its submission for peer review and publication.

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Appendices

Appendix 2. Robustness test regression analysis of the effect of natural resource endowment, environmental innovation and financial development on FDI (using DKE Estimator)

	(1)	(2)	(3)	(4)	(5)
VARIABLES	DKE Estimator Model 1	DKE Estimator Model 2	DKE Estimator Model 3	DKE Estimator Model 4	DKE Estimator Model 5
NATRES	0.180***		-0.135		-0.552***
	(0.0312)		(0.153)		(0.114)
FINDEV			-0.316***	-0.687***	-0.631*
			(0.0958)	(0.246)	(0.320)
NATRES#FINDEV			0.0956**		0.199***
			(0.0418)		(0.0384)
GDPG	0.382***	0.429***	0.354***	0.417***	0.400***
	(0.0706)	(0.129)	(0.0762)	(0.144)	(0.134)
OPEN	0.452***	0.373***	0.605***	0.458***	0.579***
	(0.0766)	(0.0956)	(0.0762)	(0.107)	(0.121)
INFL	0.0676	0.250**	0.0478	0.201**	0.232**
	(0.0488)	(0.101)	(0.0486)	(0.0968)	(0.0949)
PS	0.459***	0.105	0.346***	0.193*	0.215**
	(0.0847)	(0.143)	(0.0869)	(0.0990)	(0.0899)
URBRATE	0.194	0.338	0.0537	0.244	0.156
	(0.224)	(0.391)	(0.188)	(0.332)	(0.351)
ENVINNOV		-0.0402		-0.274	-0.116
		(0.0250)		(0.171)	(0.179)
ENVINNOV#FINDEV				0.0753	0.0266
				(0.0484)	(0.0521)
Constant	-123.1***	-150.1***	-125.5***	-155.2***	-150.7***
	(27.62)	(36.08)	(27.96)	(35.64)	(35.22)
Country effects	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes
Observations	1,066	501	1,054	501	501
R-squared	0.290	0.278	0.310	0.292	0.335
Number of groups	47	27	47	27	27
F-statistic	13.86***	33.62***	15.50***	42.51***	39.46***

Note. Driscoll–Kraay Estimator (DKE) results are reported with robust standard errors in parentheses. All specifications include country and year fixed effects. NATRES × FINDEV and ENVINNOV × FINDEV represent interaction terms. NATRES = Natural Resource Endowment; ENVINNOV = Environmental Innovation; FINDEV = Financial Development; GDPG = Gross Domestic Product Growth; OPEN = Trade Openness; INFL = Inflation; PS = Political Stability; URBRATE = Urbanisation Rate. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Appendix 3. Additional test regression analysis of the effect of natural resource endowment, environmental innovation and financial development on FDI (using Quantile Regression at 0.50)

	(1)		(2)	(3)	(4)
VARIABLES	Quantile Regression Model 1	Quantile Regression Model 2	Quantile Regression Model 3	Quantile Regression Model 4	Quantile Regression Model 5
NATRES	0.186***		-0.108		-0.287*
	(0.0332)		(0.101)		(0.169)
FINDEV			-0.262***	-0.482**	-0.134
			(0.0722)	(0.195)	(0.203)
NATRES#FINDEV			0.0847***		0.127***
			(0.0283)		(0.0429)
GDPG	0.333***	0.302***	0.279***	0.336***	0.292***
	(0.0590)	(0.0805)	(0.0565)	(0.0872)	(0.0765)
OPEN	0.417***	0.174**	0.464***	0.258***	0.365***
	(0.0487)	(0.0842)	(0.0498)	(0.0942)	(0.0843)
INFL	0.0911**	0.247***	0.0876**	0.191***	0.240***
	(0.0427)	(0.0575)	(0.0409)	(0.0665)	(0.0589)
PS	0.175***	-0.0943	0.120*	0.0226	0.0462
	(0.0630)	(0.0784)	(0.0621)	(0.102)	(0.0895)
URBRATE	0.201*	0.695***	0.189	0.545***	0.404**
	(0.121)	(0.175)	(0.115)	(0.193)	(0.170)
ENVINNOV		-0.0726***		-0.135*	0.0520
		(0.0188)		(0.0749)	(0.0691)
ENVINNOV#FINDEV				0.0309	-0.0264
				(0.0217)	(0.0202)
Constant	-90.36***	-81.52***	-93.50***	-93.19***	-94.92***
	(10.98)	(13.87)	(10.41)	(14.94)	(13.12)
Country effects	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes
Observations	1,066	501	1,054	501	501
Pseudo R2	0.1556	0.1485	0.1743	0.1578	0.2029

Note. The table reports quantile regression estimates at the median ($\tau = 0.50$). Standard errors are reported in parentheses. All models include country and year fixed effects. NATRES × FINDEV and ENVINNOV × FINDEV represent interaction terms. NATRES = Natural Resource Endowment; ENVINNOV = Environmental Innovation; FINDEV = Financial Development; GDPG = Gross Domestic Product Growth; OPEN = Trade Openness; INFL = Inflation; PS = Political Stability; URBRATE = Urbanisation Rate. Pseudo R^2 denotes the goodness-of-fit statistic. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Appendix 4. Additional test regression analysis of the effect of natural resource endowment, environmental innovation and financial development on FDI (using Quantile Regression at 0.25)

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Quantile Regression Model 1	Quantile Regression Model 2	Quantile Regression Model 3	Quantile Regression Model 4	Quantile Regression Model 5
NATRES	0.207***		-0.259*		-0.692***
	(0.0418)		(0.137)		(0.263)
FINDEV			-0.322***	-0.612**	-0.287
			(0.0987)	(0.240)	(0.315)
NATRES#FINDEV			0.124***		0.240***
			(0.0387)		(0.0665)
GDPG	0.260***	0.544***	0.323***	0.453***	0.344***
	(0.0744)	(0.113)	(0.0772)	(0.107)	(0.119)
OPEN	0.391***	0.0907	0.472***	0.170	0.315**
	(0.0613)	(0.118)	(0.0680)	(0.116)	(0.131)
INFL	-0.0597	0.216***	-0.0394	0.116	0.133
	(0.0539)	(0.0806)	(0.0559)	(0.0820)	(0.0915)
PS	0.602***	-0.0430	0.436***	0.0227	0.225
	(0.0793)	(0.110)	(0.0849)	(0.125)	(0.139)
URBRATE	0.216	0.951***	0.219	0.922***	0.425
	(0.153)	(0.245)	(0.157)	(0.238)	(0.264)
ENVINNOV		-0.0872***		-0.252***	0.0945
		(0.0264)		(0.0922)	(0.107)
ENVINNOV#FINDEV				0.0539**	-0.0399
				(0.0267)	(0.0313)
Constant	-127.8***	-125.0***	-128.0***	-123.1***	-125.6***
	(13.84)	(19.46)	(14.22)	(18.42)	(20.37)
Country effect	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes
Observations	1,066	501	1,054	501	501
Pseudo R2	0.2007	0.1833	0.2099	0.1981	0.2395

Note. The table reports quantile regression estimates at the 25th percentile ($\tau = 0.25$). Standard errors are reported in parentheses. All models include country and year fixed effects. NATRES × FINDEV and ENVINNOV × FINDEV represent interaction terms. NATRES = Natural Resource Endowment; ENVINNOV = Environmental Innovation; FINDEV = Financial Development; GDPG = Gross Domestic Product Growth; OPEN = Trade Openness; INFL = Inflation; PS = Political Stability; URBRATE = Urbanisation Rate. Pseudo R^2 denotes the goodness-of-fit statistic. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Appendix 5. Additional test regression analysis of the effect of natural resource endowment, Environmental Innovation and Financial Development on FDI (using Quantile Regression at 0.75)

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Quantile Regression Model 1	Quantile Regression Model 2	Quantile Regression Model 3	Quantile Regression Model 4	Quantile Regression Model 5
NATRES	0.226***		-0.0171		-0.102
	(0.0253)		(0.0895)		(0.159)
FINDEV			-0.237***	-0.211	-0.202
			(0.0643)	(0.164)	(0.191)
NATRES#FINDEV			0.0724***		0.0891**
			(0.0252)		(0.0404)
GDPG	0.331***	0.257***	0.335***	0.250***	0.191***
	(0.0450)	(0.0712)	(0.0503)	(0.0734)	(0.0721)
OPEN	0.465***	0.323***	0.537***	0.312***	0.401***
	(0.0371)	(0.0745)	(0.0443)	(0.0793)	(0.0794)
INFL	0.0760**	0.208***	0.0917**	0.177***	0.197***
	(0.0326)	(0.0508)	(0.0364)	(0.0560)	(0.0556)
PS	0.0846*	-0.0962	0.0428	0.0138	-0.0643
	(0.0480)	(0.0693)	(0.0553)	(0.0857)	(0.0843)
URBRATE	0.248***	0.358**	0.200*	0.336**	0.193
	(0.0924)	(0.154)	(0.103)	(0.163)	(0.160)
ENVINNOV		-0.0787***		-0.0941	-0.0680
		(0.0167)		(0.0630)	(0.0651)
ENVINNOV#FINDEV				0.0118	0.00326
				(0.0182)	(0.0190)
Constant	-75.51***	-73.93***	-78.66***	-72.79***	-51.94***
	(8.377)	(12.27)	(9.267)	(12.57)	(12.37)
Country effects	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes
Observations	1,066	501	1,054	501	501
Pseudo R2	0.1711	0.1385	0.1852	0.1426	0.1838

Notes. This table reports robustness estimates using the 0.75 quantile regression estimator. The dependent variable is FDI. Robust standard errors are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. All models include country and year fixed effects. NATRES#FINDEV and ENVINNOV#FINDEV represent interaction terms capturing the moderating role of financial development. Pseudo R^2 is reported as the goodness-of-fit measure.

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