

The FDI Effect of Sovereign ESG in Belt and Road Countries: Institutional Quality, Dimensional Heterogeneity, and Regional Differences

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ABSTRACT

Against the dual backdrop of the deepening Belt and Road Initiative (BRI) and the advancing global sustainable development agenda, sovereign ESG performance has become a key factor influencing international capital flows. Using panel data from 76 Belt and Road partner countries over 2001–2024, this study examines the impact, mechanisms, and boundary conditions of sovereign environmental, social, and governance (ESG) performance on foreign direct investment (FDI). The findings reveal that sovereign ESG exerts a significant promoting effect on FDI inflows, exhibiting dimensional heterogeneity in the order of social > governance > environmental performance. Mechanism analysis shows that trade openness, social inclusion, and human capital are three important transmission channels. Further analysis reveals a single threshold based on institutional quality: sovereign ESG primarily functions as an institutional compensatory advantage, exerting a significant effect in countries with weak institutions, while its marginal utility diminishes in countries with mature institutions. This effect is prominent in countries with a colonial history and in East and Southeast Asia, but exhibits an inhibitory effect in South Asia and Central and Eastern Europe due to institutional and regulatory frictions. These findings empirically define the effectiveness boundary of sovereign ESG in attracting FDI, providing empirical evidence for Belt and Road countries to formulate differentiated ESG strategies for investment attraction and expanding the understanding of the economic consequences of sovereign ESG from an institutional compensation perspective.

1. Introduction

As the 15th Five-Year Plan period approaches, the deep integration of Chinese-style modernization with global sustainable development goals is entering a new historical juncture. Driven by the deepening advancement of the dual-carbon goals and the paradigm shift in global ESG investment, the logic governing international capital flows is being redefined. Traditional foreign direct investment (FDI) location theories have long focused on economic variables such as market size, factor costs, and resource endowments. However, in the post-Paris Agreement era, particularly in the face of new green trade barriers such as the European Union's Carbon Border Adjustment Mechanism (CBAM), a country's sovereign performance in environmental sustainability, social inclusivity, and governance effectiveness (ESG) has evolved from a soft ethical constraint into a hard threshold affecting the risk pricing and long-term returns of cross-border capital. During the 15th Five-Year Plan period, promoting the upgrade of the Belt and Road

Initiative (BRI) from hard infrastructure connectivity to soft rules and standards connectivity systematically enhancing the sovereign ESG competitiveness of partner countries is not only crucial to the quality of the Initiative's high-quality development but also serves as a strategic breakthrough to counter the so-called "debt trap" narrative and build China's discursive power.

Belt and Road partner countries are currently characterized by significant heterogeneity in development stages, institutional environments, and resource endowments. This paradigm shift poses a crucial practical issue for the BRI, which is at a critical stage of transitioning toward high-quality cooperation, while the deepening global sustainable development agenda further requires the Initiative to achieve higher standards of practice in areas such as climate response, ecological protection, and social inclusion. Against this dual backdrop, sovereign ESG performance, a composite indicator encompassing a country's core competitiveness in climate change response, social inclusivity, and

institutional effectiveness not only affects the implementation outcomes of the Initiative's sustainable development goals but also directly influences its attractiveness to high-quality global capital. As the Initiative itself emphasizes its transition toward high-quality development, partner countries face the question of whether and how they can translate their sovereign ESG performance into substantive competitive advantages for attracting high-quality FDI. Therefore, systematically examining the impact, mechanisms, and boundary conditions of sovereign ESG on foreign direct investment within the unique context of the BRI characterized by institutional diversity and divergent development priorities—holds significant theoretical importance. Against this backdrop, as the 15th Five-Year Plan emphasizes the need to coordinate high-quality development with high-level security and to advance the construction of a green and digital Silk Road within the Belt and Road framework, a question that demands attention emerges: how does sovereign ESG performance influence FDI inflows across Belt and Road countries, characterized by institutional diversity, varying development stages, and complex geopolitical contexts? Moreover, as the initiator of the Initiative, how should China formulate differentiated ESG empowerment strategies tailored to partner countries with distinct institutional quality and regional characteristics? Building on the above context, this study utilizes panel data from 76 Belt and Road partner countries spanning the period 2001 to 2024 to systematically examine the impact of sovereign ESG performance on FDI inflows from the sovereign level, a novel undertaking and to deepen theoretical understanding and practical implications across three dimensions upon which commercial relationships depend.

1.1 Measurement and Macroeconomic Effects of Sovereign ESG

Existing research on the measurement and macroeconomic effects of sovereign ESG has primarily been conducted from two perspectives. With respect to measurement systems, sovereign ESG—as an extension of the corporate ESG concept to the national level—aims to systematically assess a country's comprehensive performance in environmental sustainability, social inclusivity, and governance effectiveness (Gratcheva et al., 2021). Although its conceptual framework originates from the United Nations Sustainable Development Goals and has been progressively systematized under the impetus of the global ESG investment wave (Gratcheva et al., 2021), existing measurement systems exhibit significant divergence. The sovereign ESG ratings developed by international rating agencies such as MSCI, Sustainalytics, and Refinitiv each employ distinct approaches in indicator selection, weighting, and data sources, posing substantial challenges for cross-country comparisons (Arsh et al., 2023) (Zavadskas et al., 2025). This measurement heterogeneity not only reflects the inherent multiplicity of the ESG concept but also reveals the methodological challenges facing current sovereign ESG research: MSCI emphasizes long-term risk

management capabilities, whereas Refinitiv focuses more on actual performance outcomes (Baker et al., 2022), a discrepancy that directly constrains the generalizability and comparability of research conclusions (Berg et al., 2022).

At the level of macroeconomic effects, existing research confirms that sovereign ESG influences economic performance through multiple channels. In financial markets, superior ESG performance significantly reduces sovereign credit risk and compresses financing costs. Studies based on OECD countries indicate that countries with better ESG performance exhibit lower average sovereign bond spreads, a finding primarily attributable to contributions from the social and governance dimensions, while the contribution of the environmental dimension is relatively limited (Crifo et al., 2017). This finding has been further validated in the credit default swap market, where countries with strong ESG performance not only exhibit lower CDS spreads but also have flatter credit term structures, suggesting that the risk-mitigating effects are long-term in nature (Zhao, 2025). At the level of economic growth, panel cointegration analysis reveals a long-run equilibrium relationship between ESG and GDP per capita, although the short-term effect is not significant, implying that the realization of economic benefits requires an accumulation process (Diaye et al., 2021). Cross-country studies further reveal that improvements in national ESG performance promote economic growth through channels such as enhancing energy efficiency and fostering human capital accumulation, and this effect exhibits significant cross-country heterogeneity (Wang et al., 2023). Notably, the moderating role of institutional context in the economic effects of ESG cannot be overlooked, as country-level factors such as political systems and financial institutions profoundly shape ESG performance and its effectiveness (Ioannou & Serafeim, 2022). However, existing research has paid insufficient attention to developing countries, particularly regarding the intermediate mechanisms and boundary conditions through which sovereign ESG affects economic development.

1.2. The Mechanisms Linking Sovereign ESG and International Capital

Sovereign ESG performance plays an increasingly significant role in international capital allocation by influencing risk premia and investor preferences. The theoretical foundation for this relationship stems from frontier developments in asset pricing theory; the ESG-efficient frontier model proposed by Pedersen et al. systematically incorporates ESG factors into the portfolio construction framework, establishing the theoretical basis for sovereign ESG in asset allocation (Albert et al., 2023) (Cui et al., 2025) (Pedersen et al., 2020). Guided by this theory, empirical research has made substantial progress across different capital markets. Evidence from equity markets shows a stable negative relationship between country-level ESG ratings and IPO underpricing, indicating that superior ESG performance effectively enhances market pricing efficiency by reducing

information asymmetry (Baker et al., 2021). Bond market research reveals more complex mechanisms: although ESG integration has become an important paradigm in sovereign debt investment, its pricing efficiency remains constrained by data quality and standard harmonization (Gratcheva & Gurhy, 2024) (UN-PRI, 2019). The influence of sovereign ESG has extended beyond traditional equity and bond markets into the domain of exchange rate pricing, where the predictive power of country-level ESG ratings for exchange rate movements suggests that its systemic importance in global asset allocation is steadily increasing (Ilias & T, 2021) (Shipeng et al., 2021).

1.3. The Specificity of Sovereign ESG and FDI in the Belt and Road Context

Within the new international cooperation framework established by the BRI, the relationship between sovereign ESG and FDI exhibits unique theoretical implications and practical characteristics. The roots of this specificity lie in the shared development stage characteristics and institutional transition contexts facing partner countries, where prevalent pressures on ecological environments, governance challenges, and institutional capacity-building needs provide a realistic setting for the mechanisms of sovereign ESG that differs fundamentally from that of developed economies. In this particular context, institutional innovations promoted by China, such as the Green Investment Principles for the Belt and Road (Cheng, 2023), have established institutional linkages between ESG performance and investment access, injecting unique institutional impetus into the investment-attracting function of sovereign ESG. This mechanism has received indirect corroboration in research on capital market internationalization, where evidence suggests that institutional alignment under open economy conditions can promote ESG standard improvement through channels such as signaling and monitoring constraints (Hao et al., 2025), providing theoretical reference for understanding the relationship between sovereign ESG and FDI.

1.4. Literature Review and Research Gaps

However, existing research on the relationship between ESG and FDI exhibits a notable structural imbalance. Most studies focus on the impact of firm-level ESG behavior on investment decisions, while the mechanisms through which sovereign ESG operates—particularly within the Belt and Road region, characterized by diverse institutional environments and varied development stages remain underexplored. Theoretically, there is a debate between promotion and cost arguments regarding the impact of sovereign ESG on FDI. On one hand, superior ESG performance can attract high-quality FDI through channels such as enhancing trade openness, strengthening social inclusion, and accumulating human capital. On the other hand, excessively high ESG compliance costs may inhibit FDI inflows in the short term, creating a so-called green threshold effect. More critically, sovereign ESG is not a simple aggregation of corporate ESG; it encompasses country-specific issues such as climate

change response, gender equality, and the rule of law. Its effects on FDI exhibit more complex dimensional heterogeneity and regional dependence, necessitating the construction of an integrated analytical framework to clarify these dynamics. The marginal contributions of this study are primarily reflected in the following three aspects. First, at the research level, it systematically extends ESG research from the micro level of firms to the macro level of sovereigns, focusing on the unique context of the Belt and Road. Second, it constructs an integrated analytical framework encompassing mechanisms, thresholds, and heterogeneity, innovatively investigating the promoting effect of sovereign ESG on FDI, its dimensional heterogeneity across social, governance, and environmental aspects, and exploring whether the three transmission channels trade openness, social inclusion, and human capital can be identified. Third, from a theoretical perspective, it attempts to introduce the lens of institutional compensation, thereby deepening the understanding of the economic consequences of sovereign ESG.

2. Theoretical Mechanisms and Research Hypotheses

2.1. The Promoting Effect of Sovereign ESG on FDI Inflows

In international direct investment theory, the institutional quality of host countries has always been a decisive factor influencing FDI location choices. Traditional theories have primarily focused on economic factors such as market size and labor costs, as well as foundational aspects like the rule of law and government effectiveness. However, with the deepening of the global sustainable development agenda, particularly the reshaping of investment rules by international frameworks such as the Paris Agreement, the importance of sovereign ESG as a comprehensive and forward-looking signal of institutional quality has become increasingly prominent (Bannour & Abdelkawy, 2024). Superior sovereign ESG performance conveys positive information to international markets regarding a country's long-term development potential, environmental and social risk management, and governance reliability, thereby effectively mitigating the lemons market problem arising from information asymmetry in cross-border investment. Drawing on signaling theory, sovereign ESG performance can be understood as a high-quality institutional signal issued by host countries. When host countries demonstrate excellence in environmental management, social inclusivity, and governance effectiveness, they send clear signals to international investors regarding long-term policy stability, lower compliance risks, and higher resource utilization efficiency. Such signals are particularly valuable in Belt and Road countries, where institutional environments are more complex and information transparency is often limited, as they help responsible investors identify investment opportunities and reduce upfront due diligence costs.

From the perspective of institutional complementarity, sovereign ESG is not independent of traditional economic factors but rather forms multidimensional synergies with them (Ioannou & Serafeim, 2022). Improvements in environmental performance not only reduce the green barriers and carbon tariff risks faced by foreign investors but also enhance resource utilization efficiency. Optimization of social performance fosters a high-quality and stable labor force through investment in education and healthcare, thereby reducing labor–capital conflicts. Strengthening governance performance ensures the effective enforcement of contracts and the predictability of policies, lowering political risks. This comprehensive institutional advantage, particularly for institutional investors that prioritize long-term value and reputation, is expected to exert a significant net promoting effect on FDI inflows into Belt and Road countries. Furthermore, sovereign ESG provides a safer investment environment for international capital through its risk-mitigating function. According to modern portfolio theory, international investors systematically assess various risks in host countries when making asset allocation decisions. Superior ESG performance significantly reduces the risks of policy changes, environmental non-compliance, and social unrest faced by foreign investors, thereby lowering the investment risk premium and enhancing risk-adjusted return expectations. Accordingly, the following hypothesis is proposed:

H1: Sovereign ESG performance exerts a significant promoting effect on FDI inflows into Belt and Road countries.

2.2. The Mechanisms Linking Sovereign ESG to FDI

The promoting effect of sovereign ESG on FDI operates primarily through three highly intertwined transmission channels. First, the trade openness channel. From the perspective of transaction costs in new institutional economics (North, 1990) (Williamson, 1985), sovereign ESG performance—particularly improvements in governance performance implies more transparent rules, more efficient administrative services, and more reliable contract enforcement, which directly reduce the institutional transaction costs faced by foreign-invested enterprises. Simultaneously, improvements in environmental performance, such as the adoption of international environmental standards, help host-country enterprises integrate into global green value chains and reduce green trade barriers arising from differences in environmental regulations. The combined effect of these factors substantially enhances host countries' trade facilitation and market accessibility, thereby creating a more favorable business environment, particularly for market-seeking and efficiency-seeking investments.

Second, the social inclusion channel. According to social conflict theory, a society characterized by high inequality and a lack of inclusion harbors greater risks of instability (Okara, 2023). The social performance dimension of sovereign ESG, through improvements in gender equality, social security, and public services, can effectively enhance social cohesion and stability. This

provides foreign-invested enterprises with a predictable operational environment characterized by low conflict risk, significantly reducing the non-productive operational risks they face. Moreover, the income growth and expansion of consumer markets resulting from inclusive growth offer a broader hinterland for market-seeking FDI.

Third, the human capital channel. According to endogenous growth theory (Lucas, 1988), human capital is the core driver of technological progress and economic growth. The emphasis of sovereign ESG on social equity and public governance naturally leads to sustained investment in education and health. The resulting high-quality, healthy labor force not only directly enhances the production efficiency of foreign-invested enterprises but also strengthens their capacity for technology absorption and innovation. For technology-intensive and innovation-driven FDI, this constitutes a critical locational advantage, forming a virtuous cycle of ESG investment → human capital accumulation → inflows of high-skill FDI. Under the overarching framework of sovereign ESG, these three pathways reinforce one another: trade openness provides the economic foundation for social inclusion, social inclusion creates stable conditions for human capital accumulation, and human capital in turn supplies intellectual support for the deepening of trade openness and industrial upgrading. Accordingly, the following hypothesis is proposed:

H2: Sovereign ESG indirectly promotes FDI inflows through multiple channels, namely enhancing trade openness, strengthening social inclusion, and accumulating human capital.

2.3. Boundary Conditions of the Sovereign ESG Effect

A critical boundary condition for the promoting effect of sovereign ESG on FDI may lie in the institutional quality of host countries. According to institutional substitution theory, in countries with low institutional quality, the absence of formal institutions creates substantial information asymmetry and investment risk (Zheng et al., 2024). Under such circumstances, strong sovereign ESG performance can serve as an efficient and visible signaling mechanism, potentially compensating for deficiencies in hard institutions by providing investors with an alternative framework for assessing country risk, thereby exerting a strong attraction for FDI. Conversely, in countries with high institutional quality, where well-established rule of law and efficient government are already the norm, the signals conveyed by sovereign ESG largely overlap with existing institutional signals, and its marginal utility necessarily diminishes. Based on the above logic, it is tentatively proposed that the role of sovereign ESG essentially manifests as an institutional compensation mechanism.

Second, a country's colonial history and the regional regulatory environment constitute another important boundary condition (Acemoglu & Robinson, 2022). For countries with a colonial history, institutional development often exhibits path dependence, and strong ESG performance serves as a powerful tool for reshaping

international image and overcoming historical institutional disadvantages. In different regions along the Belt and Road, due to variations in existing institutional traditions, development stages, and geopolitical contexts, global ESG rules and regional cooperation initiatives may produce either synergistic or competitive effects. In East and Southeast Asia, where institutional compatibility is relatively high, arrangements such as the China–ASEAN Free Trade Area tend to create synergistic effects with ESG rules, amplifying their positive impact. In contrast, in South Asia and Central and Eastern Europe, friction between rules and standards renders ESG compliance costs more pronounced, potentially even suppressing certain types of FDI in the short term. Based on the above analysis, the following hypothesis is proposed:

H3: The promoting effect of sovereign ESG on FDI is moderated by host country institutional quality and regional characteristics, with its influence exhibiting significant boundary conditions.

3. Research Design

3.1. Model Specification

To examine the impact of sovereign ESG on FDI, based on Dunning's eclectic paradigm (OLI) of international direct investment (Foss, 2024), this study treats sovereign ESG as a key component of host country location advantages and constructs the following two-way fixed effects model:

$$FDI_{it} = \beta_0 + \beta_1 ESG_Component_{it} + \gamma X_{it} + \alpha_i + \lambda_t + \varepsilon_{it} \quad (1)$$

where the subscripts i and t denote country and year, respectively. The core explanatory variable $ESG_Component_{it}$ represents a series of sovereign ESG indicators, which will be substituted in subsequent regressions as: (1) the sovereign ESG composite index; (2) the environmental performance score; (3) the social performance score; and (4) the governance performance score. The coefficient β_1 is the key parameter of interest, whose significance and direction reflect the net effect of sovereign ESG on FDI. β_0 is the intercept term, γ represents the coefficients of the control variables, and X_{it} is the vector of control variables, included to mitigate omitted variable bias. The model also incorporates country fixed effects (α_i) and year fixed effects (λ_t) to capture time-invariant country heterogeneity and macro-level shocks that are constant across individuals, respectively. All estimations employ robust standard errors clustered at the country level to address potential within-group autocorrelation and heteroskedasticity.

3.2. Variable Description

Dependent variable. FDI inflows (fdi_gdp) are measured as net foreign direct investment inflows as a percentage of GDP. This relative measure eliminates the influence of economic scale and more accurately reflects a country's attractiveness to foreign capital. Using the ratio of net FDI inflows to GDP as the dependent variable effectively avoids measurement bias arising from differences in economic size and more authentically captures the host

country's relative attractiveness to foreign investment (Alfaro et al., 2010).

Core explanatory variables. The sovereign ESG composite index ($sovereign_esg$) and its dimensional indices, including environmental performance (env_perf), social performance (soc_perf), and governance performance (gov_perf). The sovereign ESG composite index is constructed by applying min–max normalization to transform the raw indicators of the three dimensions into the $[0, 1]$ interval, followed by equally weighted averaging. This construction method follows mainstream practices in international sovereign ESG assessment (Gratcheva et al., 2021), and equally weighted averaging avoids measurement bias arising from subjective weighting (Capelle-Blancard et al., 2019). Environmental performance is measured using the Yale Environmental Performance Index (EPI), which is widely used in cross-country comparative studies of environmental performance (Wang et al., 2023). Social performance is measured based on the social dimension indicators of the United Nations Human Development Index, encompassing core dimensions such as life expectancy and educational attainment. Governance performance is measured as the average of government effectiveness, rule of law, and control of corruption from the World Bank's Worldwide Governance Indicators, three indicators that effectively capture the core essence of national governance quality (Kaufmann & Kraay, 2023).

Control variables. To mitigate the impact of omitted variable bias on the estimation results, the following control variables are selected: economic development level ($\ln_gdp_pc$), measured as the natural logarithm of GDP per capita, to control for the attraction effect of market size on FDI; infrastructure conditions ($internet$), measured as the percentage of internet users in the total population, reflecting the host country's level of digitalization and transaction convenience; macroeconomic stability ($inflation$), measured by the inflation rate, to capture the impact of price fluctuations on the investment environment; and resource endowment (nat_res_gdp), measured as natural resource rents as a percentage of GDP, to control for the influence of resource-seeking FDI. In addition, two policy dummy variables are constructed: Belt and Road cooperation depth (bri_depth), which takes the value of 1 for countries that signed cooperation documents before the end of 2015; and global ESG rule strength (esg_rule), which takes the value of 1 for years from 2016 onward, to control for the structural impact of the tightening of global ESG regulations following the entry into force of the Paris Agreement.

Mechanism and threshold variables. For the mechanism variables, proxy indicators for the three transmission channels are selected: trade openness ($trade_gdp$), measured as the sum of imports and exports as a percentage of GDP, reflecting the host country's degree of integration into global markets; social inclusion (gdi), measured using the United Nations Gender Development Index, which comprehensively reflects levels of gender

equality and social inclusion; and human capital (avg_edu), measured by average years of schooling. The threshold variable is institutional quality (inst_quality), proxied by the rule of law indicator from the World Bank's Worldwide Governance Indicators, which is widely used in cross-country comparative studies of institutional quality.

3.3. Sample Selection and Data Sources

The data for this study are sourced from authoritative databases including the World Bank's World Development Indicators (WDI) and Worldwide

Governance Indicators (WGI), the Yale Environmental Performance Index (EPI), the United Nations Development Programme (UNDP) Human Development Report, and the International Country Risk Guide (ICRG). The sample covers 76 Belt and Road partner countries spanning the period from 2001 to 2024 (see Appendix for the list of countries). To ensure data quality, missing values were imputed and outliers were addressed, with all continuous variables winsorized at the 1% level to mitigate the influence of extreme values. Table 1 presents the descriptive statistics of the variables

Table 1. High-level meetings of heads of state during the period of 2010–2025

Variable	Symbol	Observations	Mean	Std. Dev.	Min	Max
FDI level	fdi_gdp	1900	4.172	6.050	-4.461	43.916
sovereign ESG composite index	sovereign_esg_equal	1900	0.495	0.339	0.112	0.822
Environmental performance score	env_perf	1900	0.499	0.116	0.225	0.803
Social performance score	soc_perf	1900	0.705	0.129	0.38	0.911
Governance performance score	gov_perf	1900	0.281	0.213	-0.194	0.752
GDP per capita	ln_gdp_pc	1900	10.397	0.888	7.950	12.075
Internet penetration	internet_gdp	1900	39.550	31.512	0.078	99.7
Inflation rate	inflation	1900	201747.82	1749768.78	16.60	15985497.62
Natural resource rents	nat_res_gdp	1900	8.629	12.001	0.002	51.789
Belt and Road cooperation depth	bri_depth	1900	0.224	0.417	0	1
ESG rule strength	esg_rule	1900	0.360	0.480	0	1
Country risk index	risk	1900	68.187	6.860	50.037	85.133
Social inclusion	gdi	1900	0.928	0.082	0.634	1.039
Trade openness	trade_gdp	1900	85.799	37.454	26.268	186.111

Source: own editing based on from the World Bank's Worldwide Governance Indicators.

4. Empirical Analysis

4.1. Baseline Regression Results

To control for unobserved individual heterogeneity and common time trends, a two-way fixed effects model is employed for estimation. Table 2 presents the baseline regression results of the impact of sovereign ESG on FDI. Column (1) examines the effect of the ESG composite index, while columns (2) through (4) respectively test the independent effects of the environmental, social, and governance dimensions.

As shown in column (1) of Table 2, the estimated coefficient of the sovereign ESG composite index is 0.091 and is statistically significant at the 5% level, supporting Hypothesis H1 and indicating that sovereign ESG performance exerts a significant promoting effect on FDI inflows. Examining the dimensional regression results, the effects across dimensions exhibit clear heterogeneity, characterized by the ordering “social performance > governance performance > environmental performance.” Specifically, social performance exhibits the strongest promoting effect, reflecting the central role of social stability and inclusivity in attracting foreign investment. Governance performance also demonstrates a significant positive effect, suggesting that improvements

in the rule of law and government effectiveness help reduce institutional transaction costs. Although the coefficient for environmental performance is relatively small, it remains significantly positive, indicating that environmental compliance has become a basic consideration in foreign investment decisions, albeit with a relatively limited marginal effect within the sample countries.

The estimation results for the control variables are generally consistent with theoretical expectations. The internet penetration rate is significantly positive, reflecting the importance of digital infrastructure in reducing information costs. The Belt and Road cooperation depth is significantly positive, indicating that the Initiative effectively promotes FDI inflows through policy coordination. The global ESG rule strength is significantly negative, reflecting that some countries may face short-term FDI suppression in response to rising ESG compliance costs. The coefficient for GDP per capita is significantly negative in most models, which deviates from the market size hypothesis in traditional FDI theory. This phenomenon reveals the particularity of FDI structure along the Belt and Road: within the FDI flowing into the sample countries, resource-seeking and efficiency-seeking investments still account for a

relatively large proportion, and these investments are sensitive to labor costs and factor prices, and may be suppressed by the cost increases associated with rising GDP per capita. This result also indirectly suggests that

many Belt and Road countries at the initial stage of industrialization are experiencing a gradual erosion of their traditional cost advantages and facing urgent pressures for transformation.

Table 2. Baseline regression results

	(1)	(2)	(3)	(4)
sovereign_esg_equal	0.091** (0.04)			
env_perf		0.029** (0.01)		
soc_perf			23.338*** (2.68)	
gov_perf				4.825*** (0.94)
ln_gdp_pc	-0.566** (0.24)	-0.554** (0.24)	-2.800*** (0.39)	-1.075*** (0.28)
internet_gdp	0.029*** (0.01)	0.029*** (0.01)	-0.002 (0.01)	0.021*** (0.01)
inflation	0.000 (0.00)	0.000 (0.00)	0.000*** (0.00)	0.000 (0.00)
nat_res_gdp	-0.023 (0.01)	-0.023 (0.01)	0.012 (0.02)	-0.016 (0.01)
bri_depth	0.968*** (0.37)	0.968*** (0.37)	0.382 (0.38)	1.022*** (0.37)
esg_rule	-2.087*** (0.42)	-2.098*** (0.42)	-1.511*** (0.40)	-1.738*** (0.40)
Country fixed effects	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
N	1900	1900	1900	1900
R2	0.328	0.325	0.360	0.341

Source: own editing based on from the World Bank's Worldwide Governance Indicators.

Note: Robust standard errors are reported in parentheses; ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The same applies to subsequent tables.

In summary, sovereign ESG exerts a significant promoting effect on FDI in Belt and Road countries, exhibiting a pattern of dimensional heterogeneity in the order of social > governance > environmental performance. This finding suggests that, in the Belt and Road context, investors place greater emphasis on host countries' social development and governance quality, while environmental performance—though playing a relatively limited role has become an indispensable institutional signal.

4.2. Endogeneity Treatment

The baseline regression results initially reveal the association between sovereign ESG and FDI. However, endogeneity issues such as reverse causality and omitted

variables may lead to estimation bias. To obtain more consistent causal inferences, the two-period lagged values of each ESG dimension variable (L2_ESG_var) are used as instrumental variables for themselves. Meanwhile, considering the dynamic continuity of FDI, a system GMM model is constructed for endogeneity treatment as follows:

$$FDI_{it} = \beta_0 + \beta_1 FDI_{i,t-1} + \beta_2 ESG_{it} + \beta_3 Controls_{it} + \alpha_i + \lambda_t + \varepsilon_{it} \quad (2)$$

Where ESG_{it} is substituted by the sovereign ESG composite index, environmental performance, social performance, and governance performance respectively, yielding four models. Table 3 presents the estimation results of the above two methods.

Table 3. Endogeneity treatment regression results

Variable	2SLS instrumental variable method			GMM estimation			
sovereign_esg_equal				0.032 (0.03)			
fdi_L1				0.727*** (0.06)	0.727*** (0.06)	0.714*** (0.06)	
env_perf	0.045** (0.02)				0.010 (0.01)		
soc_perf		25.305*** (3.08)				7.549*** (1.90)	0.723*** (0.06)
gov_perf			6.130*** (1.21)				1.582*** (0.59)
controls	YES	YES	YES	YES	YES	YES	YES

Country fixed effects	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES
N	1748	1748	1748	1824	1824	1824	1824
R2	0.354	0.396	0.313	0.431	0.396	0.355	0.434

Source: own editing based on from the World Bank's Worldwide Governance Indicators.

Note: Robust standard errors are reported in parentheses; ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The same applies to subsequent tables.

4.3. Robustness Tests

(1) Variable Substitution

To enhance the robustness of the conclusions, an ESG index based on correlation weighting (with weights of 0.262, 0.369, and 0.369 for environmental, social, and governance dimensions, respectively) and an ESG index extracted via principal component analysis are constructed. The following substitution tests are then conducted: (1) the dependent variable is replaced with the natural logarithm of FDI absolute values; (2) the core explanatory variable is replaced with the two alternative ESG indices described above. The results are presented in Table 4.

Analysis of Table 4 shows that the core findings remain robust after employing different variable measurement approaches. First, in column (1), when the dependent variable is replaced with the logarithm of FDI absolute values, the coefficient of the core explanatory variable—the sovereign ESG composite index—is not significant, but the signs and significance of the control variables are largely consistent with the baseline model, indicating overall stability of the model specification. The insignificance of the core variable arises from subtle differences in the economic meaning of the variables: FDI absolute values place greater emphasis on scale, whereas the ratio to GDP measures relative importance within the economy. In columns (2) and (3), when the core explanatory variable is replaced with the weighted ESG index and the PCA-based ESG index respectively, the coefficients of both are significantly positive at the 5% level. This finding is consistent with the positive effect of the sovereign ESG composite index in the baseline regression, demonstrating that the core conclusion—that sovereign ESG performance promotes FDI inflows—does not depend on any particular method of constructing the ESG index. Whether based on theoretically informed equal weighting or data-driven principal component analysis or correlation weighting, the resulting composite indices all point to the same economic regularity.

Table 4. Robustness test results

	(1)	(2)	(3)
sovereign_esg_equal	0.001 (0.01)		
sovereign_esg_weighted		0.117** (0.05)	
sovereign_esg_pca			0.029** (0.01)
controls	YES	YES	YES

Country fixed effects	YES	YES	YES
Year fixed effects	YES	YES	YES
N	1900	1900	1900
R2	0.439	0.328	0.336

Source: own editing based on from the World Bank's Worldwide Governance Indicators.

Note: Robust standard errors are reported in parentheses; ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The same applies to subsequent tables.

(2) Jackknife Test

To exclude the possibility that specific country samples exert undue influence on the baseline regression results and to ensure the general applicability of the core conclusions, a jackknife test is further employed for sample sensitivity analysis. Individual sample countries are sequentially excluded, and the remaining subsamples are used for repeated estimation. By observing the range and stability of the estimated coefficients of the core explanatory variable, it is determined whether the model is driven by outliers or specific observational units. The model specification is as follows:

$$FDI_{-c} = \beta_0 + \beta_1 \text{Sovereign_ESG}_{-c} + \beta_2 \text{Controls}_{-c} + \varepsilon_c \quad (3)$$

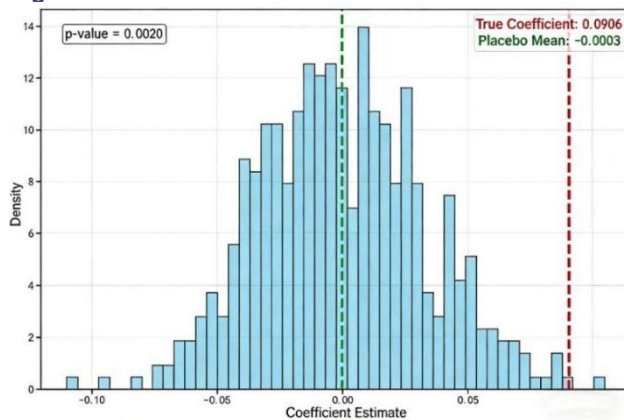
where the subscript $-c$ denotes the subsample after excluding country cc in each regression. The test results show that the mean coefficient of the sovereign ESG composite index is 0.092, close to the baseline regression result, and the estimated coefficients for all subsamples remain statistically significant at the 1% level. The coefficients exhibit extremely low volatility throughout the jackknife test, with standard errors stable around 0.039, confirming the high stability of the estimation results. The baseline regression finding that sovereign ESG has a significant promoting effect on FDI is not driven by any specific country or group of countries; the conclusion is insensitive to changes in sample composition and demonstrates strong robustness, further enhancing the reliability of the core empirical findings.

(3) Placebo Test

Finally, a placebo test is conducted to rule out the influence of unobserved confounding factors or randomness, with the results shown in Figure 1. A pseudo ESG index is randomly generated and used for estimation; the resulting coefficient is 0.0906 and is statistically significant ($p=0.0020$), corresponding to the baseline regression result. This finding indicates that the observed sovereign ESG effect is not driven by randomness or potential confounding factors, thereby strengthening the credibility of the causal inference. In summary, a series of

rigorous robustness tests consistently demonstrate that the core finding sovereign ESG performance, particularly social and governance performance, has a robust promoting effect on FDI inflows into Belt and Road partner countries is reliable.

Figure 1. Placebo test



Source: own editing based on from the World Bank's Worldwide Governance Indicators.

5. Extended Analysis: Mechanisms, Conditions, and Heterogeneity

Having established the significant promoting effect of sovereign ESG on FDI, this section further conducts an extended analysis from three dimensions mechanisms, boundary conditions, and group heterogeneity to systematically reveal the underlying transmission pathways, contextual conditions, and heterogeneous patterns.

5.1. Mechanism Analysis

Table 5. Mechanism analysis results

Mediation path	Bootstrap mediation analysis				Sobel mediation analysis	
	Mediation effect	Mediation proportion	Confidence interval	Significance	Mediation effect	Significance
Sovereign ESG → Human capital → FDI	0.060	66.426	[0.043, 0.081]	***	0.061	***
Sovereign ESG → Social inclusion → FDI	0.076	85.567	[0.059, 0.101]	***	0.077	***
Sovereign ESG → Trade openness → FDI	0.102	110.323	[0.072, 0.134]	***	0.102	***
Environmental performance → Human capital → FDI	0.020	68.717	[0.014, 0.027]	***	0.020	***
Environmental performance → Social inclusion → FDI	0.025	87.597	[0.019, 0.033]	***	0.025	***
Environmental performance → Trade openness → FDI	0.033	113.122	[0.024, 0.044]	***	0.033	***
Social performance → Human capital → FDI	3.636	15.611	[-1.209, 7.836]		3.637	
Social performance → Social inclusion → FDI	5.472	23.035	[0.741, 10.303]	***	5.332	**
Social performance → Trade openness → FDI	6.251	26.691	[4.683, 7.995]	***	6.243	***
Governance performance → Human capital → FDI	0.465	9.711	[0.207, 0.799]	***	0.467	***
Governance performance → Social inclusion → FDI	1.384	29.426	[1.005, 1.915]	***	1.403	***

The promoting effect of sovereign ESG on FDI has been validated by both baseline regression and robustness tests; however, the underlying transmission pathways remain unclear. Based on theoretical analysis, a triple mediation model incorporating human capital, social inclusion, and trade openness is constructed. Specifically, sovereign ESG may operate through the following three pathways: first, the human capital channel, which cultivates a high-quality labor force by enhancing education and health levels, thereby attracting technology-intensive investment; second, the social inclusion channel, which strengthens social stability by promoting gender equality and social security, thereby reducing operational risks for foreign investors; third, the trade openness channel, which lowers entry and transaction costs for foreign investment by improving governance effectiveness and aligning environmental standards with international rules. To empirically test the above mechanisms, a mediation effect model is employed, specified as follows:

$$\text{Stage 1: } M_{it} = \alpha_0 + \alpha_1 \text{Sovereign_ESG}_{it} + \text{Controls}_{it} + u_{it} \quad (4)$$

$$\text{Stage 2: } FDI_{it} = \beta_0 + \beta_1 \text{Sovereign_ESG}_{it} + \beta_2 M_{it} + \beta_3 \text{Controls}_{it} + \varepsilon_{it} \quad (5)$$

Where M_{it} represents the mediator variables, encompassing the three channels of human capital, social inclusion, and trade openness. α_1 denotes the coefficient of the effect of ESG on the mediator, β_2 denotes the coefficient of the effect of the mediator on FDI, and $\alpha_1 \times \beta_2$ represents the mediation effect. The Bootstrap mediation analysis (500 replications) and Sobel mediation analysis are jointly employed for validation, with the results presented in Table 5

Governance performance→Trade openness →FDI	3.189	66.755	[2.467, 4.085]	***	3.168	***
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Source: own editing based on from the World Bank's Worldwide Governance Indicators.

Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

The results show that the mediation effect of the trade openness pathway is highly significant at the 1% level, and its effect size ranks first among the three mechanisms, playing a central role in the process through which sovereign ESG promotes FDI. This empirically reveals that enhancing trade openness is a key pathway through which ESG empowers FDI. It demonstrates that increasing trade openness by reducing tariff and non-tariff barriers and optimizing the business environment constitutes the primary channel through which sovereign ESG attracts FDI, thereby empirically establishing the core logic of “improved governance and environmental standards → increased trade openness → increased FDI inflows.” However, the mediation proportion of the trade openness channel reaches 110.32%, exceeding the total effect. This typically indicates the presence of a suppression effect, meaning that while sovereign ESG exerts a positive mediation effect on FDI through the trade openness channel, it simultaneously triggers a competing negative process that partially masks its true total effect. Concurrently, deeper trade openness also implies more intense market competition and lower trade barriers. This leads to greater openness of the domestic market, enabling multinational enterprises to serve the host country market through trade exports rather than direct investment, thereby generating a substitution effect for some market-seeking FDI. Moreover, as host country domestic enterprises integrate into global markets and enhance their competitiveness, this also inhibits foreign investment entry to a certain extent.

The mediation effect of the social inclusion channel is 0.076, indicating that 85.57% of the promoting effect of sovereign ESG on FDI is realized through improvements in social inclusion indicators such as gender equality and social security. This is consistent with the baseline regression finding that social performance is a core driver, demonstrating that social stability and equity are important considerations for multinational capital in evaluating the investment environment. The mediation effect of the human capital channel is 0.060, with a mediation proportion of 66.43%, indicating that improvements in education levels constitute an important pathway through which ESG attracts FDI. Countries with superior ESG performance tend to place greater emphasis on human capital accumulation, while a high-quality labor force enhances the production efficiency of foreign-invested enterprises, forming a virtuous cycle of “ESG → educational investment → talent pool → FDI inflows.” Examining the mechanism decomposition results across the three ESG dimensions, the transmission pathways for environmental performance and governance performance are relatively focused and consistent. Specifically, all three mediation pathways for environmental performance are significant, with effect sizes ranked as “trade openness > social inclusion > human capital,” which is consistent with the findings for the composite index.

Further dimensional decomposition reveals heterogeneity in the mechanism effects. Both environmental performance and governance performance effectively promote FDI through all three channels, indicating that improvements in environmental performance not only attract green FDI through direct ecological improvements but also indirectly enhance FDI attractiveness by promoting upgrades in market rules and social standards. In addition to the trade openness channel, governance performance also exhibits significant effects through the social inclusion and human capital channels, reflecting the comprehensive effect of “improved governance quality → optimized institutional environment → synergistic improvements in social and human capital → FDI inflows,” thereby validating the central role of governance as an institutional foundation. Social performance demonstrates significant effects through the trade openness and social inclusion channels, but not through the human capital channel. This may be attributable to the long-term lag in the effect of social performance on human capital, which has not yet fully manifested within the sample period, as well as the fact that FDI in the Belt and Road context is more sensitive to immediate social stability than to long-term human capital quality.

In summary, sovereign ESG promotes FDI inflows into Belt and Road countries primarily through three channels: trade openness, social inclusion, and human capital—with significant dimensional heterogeneity. Among these, trade openness is the most central transmission mechanism, particularly prominent in the environmental and governance dimensions, highlighting the importance of aligning with international rules for attracting foreign investment. Social inclusion is the main pathway through which social performance influences FDI, confirming that social stability is a fundamental prerequisite for investment security. The effectiveness of the human capital channel is subject to dual constraints of dimension and time, and its long-term value warrants continued attention in future research. These empirical results systematically validate the proposed Hypothesis H2.

5.2. Threshold Effect Analysis

To test the threshold effect of institutional quality proposed in Hypothesis H3, the following panel threshold model is constructed:

$$FDI_{it} = \beta_0 + \beta_1 \text{Sovereign_ESG}_{it} I(\text{Inst_Open} \leq \gamma) + \beta_2 \text{Sovereign_ESG}_{it} I(\text{Inst_Quality} > \gamma) + \beta_3 \text{Controls}_{it} + \varepsilon_{it} \quad (6)$$

where inst_quality is the threshold variable, γ is the threshold value to be estimated, and $I(\cdot)$ is an indicator function. β_1 and β_2 represent the marginal effects of sovereign ESG on FDI in the low and high institutional quality regimes, respectively. The model estimation identifies an optimal single threshold value of 0.2462,

based on which the full sample is divided into two groups: low institutional quality and high institutional quality. Table 6 presents the grouped regression results, revealing a key non-linear relationship.

Table 6. Threshold effect analysis results

	Low institutional quality	High institutional quality
sovereign_esg_equal	0.157*** (0.02)	-0.011 (0.07)
controls	YES	YES
Country fixed effects	YES	YES
Year fixed effects	YES	YES
N	950	950
R2	0.441	0.335

Source: own editing based on from the World Bank's Worldwide Governance Indicators.

Note: Robust standard errors are reported in parentheses; ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

The threshold regression results in Table 6 indicate that the promoting effect of sovereign ESG on FDI exhibits significant institutional dependence. Specifically, in the group of countries with institutional quality below the threshold, the estimated coefficient of sovereign ESG is significantly positive at the 1% level, indicating that in economies with imperfect institutional environments, superior ESG performance can serve as an effective institutional compensatory advantage, compensating for deficiencies in formal institutions. However, in the group of countries with institutional quality above the threshold, this coefficient is no longer statistically significant, suggesting that once host countries have established mature institutional systems, the marginal attraction utility of sovereign ESG exhibits a diminishing trend, and foreign investment decisions are increasingly dominated by traditional economic factors. From a theoretical perspective, this clearly defines the boundary conditions within which sovereign ESG operates, revealing that it is not a universally applicable investment attraction tool but rather a strategic asset highly dependent on the institutional context. In summary, the threshold effect analysis not only validates the threshold effect in Hypothesis H3 but also deepens the understanding of the economic consequences of sovereign ESG from the perspective of institutional compensation.

5.3. Heterogeneity Analysis

The foregoing analysis reveals the average effect of sovereign ESG on FDI and its operating conditions; however, this effect may exhibit systematic differences across country groups with different characteristics. To this end, this subsection conducts heterogeneity tests from two dimensions—intrinsic country characteristics and geographic regions—to reveal the complex landscape of sovereign ESG's impact. First, group regressions are performed based on education level and historical colonial background, with the results presented in Table 7. Education level is divided into high and low groups using

the sample median as the cutoff, while colonial history is categorized according to the World Colonial Database.

(1) Grouping by Country Characteristics

Table 6. Threshold effect analysis results

	High education level	Low education level	With a colonial history	Without a colonial history
sovereign_esg_equal	7.596 (4.64)	0.015 (0.03)	0.294*** (0.05)	0.025 (0.04)
controls	YES	YES	YES	YES
Country fixed effects	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
N	947	953	525	1375
R2	0.201	0.31	0.534	0.298

Source: own editing based on from the World Bank's Worldwide Governance Indicators.

Note: Robust standard errors are reported in parentheses; ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

The heterogeneity analysis results in Table 7 reveal significant differences in the sovereign ESG effect across countries with different historical backgrounds. In the sample of countries with a colonial history, sovereign ESG exhibits a significant promoting effect on FDI, whereas this effect is not evident in countries without a colonial history. This finding indicates that for countries that have experienced colonial rule and exhibit path dependence in institutional development, enhancing sovereign ESG performance serves as an effective means to compensate for historical institutional deficiencies and reshape international image. Further heterogeneity tests show that differences in education level do not lead to significant differentiation in the sovereign ESG effect. Regardless of whether in the high or low education level country groups, the direct effect of sovereign ESG fails to pass significance tests. This result corroborates the mechanism analysis, indicating that education level primarily influences FDI indirectly through the human capital accumulation channel rather than directly moderating the relationship between sovereign ESG and FDI.

(2) Grouping by Region

Given the vast geographical coverage of Belt and Road partner countries and the substantial differences among them in terms of economic development stages, resource endowments, and cultural institutions, further group regressions by region are conducted. The results are presented in Table 8.

The regional heterogeneity analysis reveals a more complex pattern, with the sovereign ESG effect exhibiting distinct regional characteristics. The most positive effect is observed in East and Southeast Asia, where the coefficient of sovereign ESG is positive, although not statistically significant. This may be attributable to the region's deep integration into global

Table 8. Heterogeneity analysis results (2)

	East and Southeast Asia	South Asia	Central and West Asia	Central and Eastern Europe	Africa and Latin America
sovereign_esg_equal	0.048 (0.05)	-0.154*** (0.05)	-0.017 (0.07)	-0.190** (0.08)	-0.023 (0.09)
controls	YES	YES	YES	YES	YES
Country fixed effects	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES
N	225	200	450	500	325
R2	0.654	0.723	0.412	0.268	0.318

Source: own editing based on from the World Bank's Worldwide Governance Indicators.

Note: Robust standard errors are reported in parentheses; ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

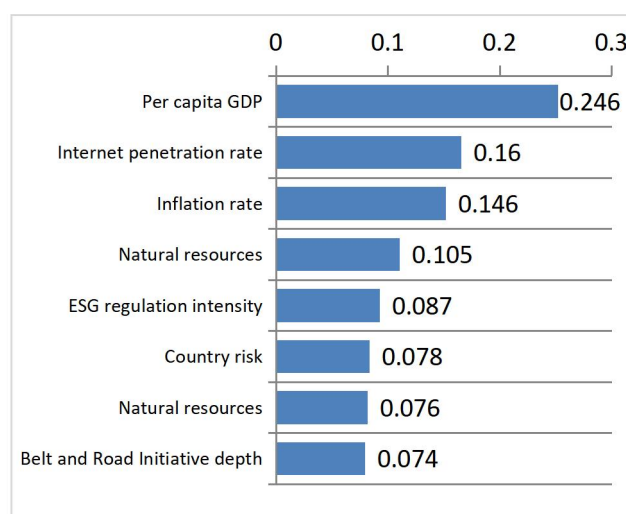
value chains and stable FDI inflows, which diminish the marginal signaling role of ESG, yet the positive sign still indicates a favorable trend. In stark contrast, in South Asia and Central and Eastern Europe, the coefficients of sovereign ESG are significantly negative. This provides compelling counterevidence for institutional compensation theory: when ESG rules are severely mismatched with local institutional practices and development stages, improvements in sovereign ESG are not interpreted as positive signals of institutional compensation but are instead perceived as premature compliance costs. This suggests that the effectiveness of the institutional compensation mechanism hinges on a crucial precondition: ESG standards must be effectively aligned with the local institutional environment and development stage. In Central and West Asia and the Africa–Latin America region, the coefficients are negative but not significant, indicating that in these regions, where resource endowments constitute the primary advantage, ESG performance has not yet become a core factor influencing foreign investment decisions.

Through the triple extended analysis of mechanisms, thresholds, and heterogeneity, this study comprehensively delineates the complex process through which sovereign ESG influences FDI. The findings reveal that the mechanisms operate primarily through enhancing social inclusion and trade openness, and exhibit significant threshold characteristics, being significant only in the group of countries with lower trade openness, thereby revealing the boundary conditions of its effect. The impact also displays strong heterogeneity, particularly significant in countries with a colonial history, presenting a positive trend in East and Southeast Asia, while exhibiting an unexpected negative effect in South Asia and Central and Eastern Europe.

(3) Causal Forest Analysis

Traditional methods struggle to capture the more complex patterns of heterogeneity arising from interactions among multiple variables. In contrast, the causal forest algorithm, as a machine learning-based approach, overcomes the subjective limitations of functional form selection and variable interaction specification inherent in traditional model settings, systematically accounts for complex interactions among variables, and thereby enables more precise estimation of the individual treatment effects of sovereign ESG on FDI while identifying the key characteristic variables driving effect heterogeneity. To

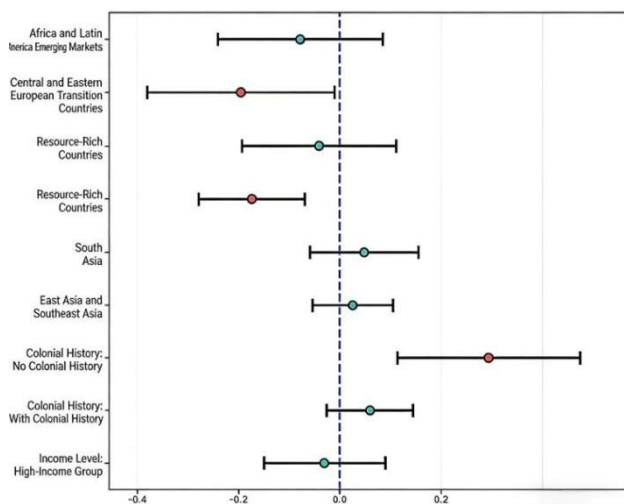
this end, a data-driven exploration of heterogeneity is further conducted.

Figure 2. Causal forest feature importance plot

Source: own editing based on from the World Bank's Worldwide Governance Indicators.

Figure 2 presents the variable importance ranking output from the causal forest model. The results show that GDP per capita is the most central factor driving heterogeneity in the sovereign ESG effect, with its importance score far exceeding that of other variables. This indicates that the economic development level of host countries constitutes the macro-level foundation upon which the investment attractiveness of sovereign ESG is realized, profoundly influencing the transmission efficiency of ESG signals. Internet penetration and the inflation rate, serving as proxy variables for infrastructure conditions and macroeconomic stability, also exhibit relatively high importance, highlighting the critical supporting role of a favorable business environment for the realization of ESG value. In contrast, the importance scores of institutional variables such as Belt and Road cooperation depth and global ESG rule strength are relatively low, suggesting that their influence is more universal rather than being the primary sources of effect heterogeneity.

Figure 3. Heterogeneity analysis forest plot



Source: own editing based on from the World Bank's *Worldwide Governance Indicators*.

Figure 3 further depicts, through a heterogeneity forest plot, the distribution of the conditional average treatment effect (CATE) of sovereign ESG across subgroups defined by different feature combinations. The results reveal significant heterogeneity in the individual treatment effects (ITE), confirming that the impact of sovereign ESG on FDI is not homogeneous. For the subset of countries characterized by colonial history and middle-income levels, sovereign ESG exhibits the strongest positive treatment effect. This finding corroborates the subgroup regression results, once again emphasizing the critical role of historical institutional legacies and specific stages of development in unlocking the positive effects of ESG. In contrast, in subgroups of high-income countries and those with relatively well-developed institutional environments, the point estimates of the treatment effect tend toward zero or even become negative. This pattern is internally consistent with the findings of the threshold effect analysis, suggesting that once a country's development surpasses a certain stage, the marginal utility of sovereign ESG in attracting FDI may diminish.

By introducing the cutting-edge causal forest method, this study not only validates the existence of heterogeneity in the sovereign ESG effect but also transcends the limitations of traditional subgroup tests, revealing a more complex heterogeneity landscape arising from the interplay of multidimensional characteristics such as economic development level and colonial history. These findings collectively constitute empirical support for Hypothesis H3, providing multidimensional empirical evidence for understanding the boundary conditions of the sovereign ESG effect.

6. Conclusions and Policy Implications

Through systematic empirical analysis, the following four conclusions are drawn. First, sovereign ESG overall exerts a significant promoting effect on FDI inflows into Belt and Road countries, yet its internal driving structure exhibits notable heterogeneity. Social performance and governance performance constitute the core pillars attracting foreign investment, while the independent

contribution of environmental performance is relatively limited. This suggests that, in the Belt and Road context, investors primarily view sovereign ESG as a risk management tool, placing particular emphasis on host countries' long-term operational security and institutional stability. Second, sovereign ESG indirectly influences FDI through three important channels. Among these, the trade openness channel exhibits the strongest mediation effect, highlighting the critical value of aligning with international rules; the social inclusion and human capital channels also play important roles. This finding reveals the transmission mechanism through which sovereign ESG enhances investment attractiveness by reducing institutional transaction costs and improving market accessibility. Third, the effectiveness of sovereign ESG is strictly contingent on host countries' institutional foundations. The study finds that its promoting effect is significant in the group of countries with low institutional quality, playing an important institutional compensation function, whereas its marginal utility markedly diminishes in countries with high institutional quality. This finding precisely delineates the value boundary of sovereign ESG as a substitutional advantage. Fourth, the FDI effect of sovereign ESG exhibits significant historical and geographical characteristics. Its effect is particularly prominent in countries with a colonial history, serving as an effective tool for breaking historical path dependence and reshaping international reputation; it exhibits a positive trend in East and Southeast Asia, while showing an inhibitory effect in South Asia and Central and Eastern Europe, reflecting the importance of aligning ESG standards with regional characteristics.

Based on these findings, the following policy recommendations are proposed. First, for countries with weak institutions, a "ESG-first" compensation strategy should be implemented. Such countries should prioritize the allocation of limited administrative and fiscal resources to areas that can rapidly establish international trust: first, enhancing governance effectiveness, and second, improving social inclusion. The core objective is to construct a concise, transparent, and credible localized ESG framework, creating a distinctive institutional identity to compensate for traditional disadvantages in attracting investment. Concurrently, drawing on the experience of regional organizations such as ASEAN, they should formulate ESG standards aligned with their own development stages to avoid bearing excessive costs from pursuing overly ambitious standards.

Second, for countries with mature institutions, a value exploration strategy of ESG integration should be pursued. The strategy for such countries should transcend foundational infrastructure and shift toward deeply embedding existing ESG advantages into industrial development planning, focusing on creating ESG-oriented industrial clusters. Tax incentives, financing tools, and other policy instruments should be employed to guide foreign investment toward these high-value-added sectors, thereby promoting upward movement in global value chains while avoiding low-level competition over ESG metrics.

Third, differentiated empowerment and alignment strategies should be adopted for different regions. In East and Southeast Asia, where ESG foundations are relatively strong, efforts should focus on “ESG + digitalization” collaborative empowerment, promoting the deep integration of digital technologies in areas such as green infrastructure and smart government, thereby further enhancing investment efficiency and attractiveness. In contrast, in South Asia and Central and Eastern Europe, where regulatory frictions are pronounced, the policy task is rule alignment and cost management. Actively identifying the main friction points between global ESG rules and local realities, establishing flexible coordination mechanisms through transitional periods, technical assistance, and cost subsidies can help reduce compliance costs and transform barriers into opportunities.

Fourth, China’s role should evolve from “initiator” to “enabler and connector.” For partner countries with weak institutions, China can prioritize assistance in governance capacity building and environmental standard setting, helping them solidify their ESG foundations. For countries rich in human capital, efforts can focus on green technology transfer and joint research and development, facilitating the integration of Chinese enterprises’ green industry chains with host countries’ advantageous factors. Overall, efforts should be made to establish a set of “Belt and Road” ESG cooperation guidelines that seek common ground while reserving differences and promote gradual improvement, bridging divergences in a pragmatic manner and maximizing the overall positive benefits of ESG cooperation.

7. List of Abbreviations

Abbreviation	Full Form
BRI	Belt and Road Initiative
CBAM	Carbon Border Adjustment Mechanism
CDS	credit default swap
EPI	Environmental Performance Index
ESG	environmental, social, and governance
FDI	foreign direct investment
GMM	generalized method of moments
ICRG	International Country Risk Guide
OLI	eclectic paradigm (Ownership, Location, Internalization)
PCA	principal component analysis
2SLS	two-stage least squares
UNDP	United Nations Development Programme
WDI	World Development Indicators
WGI	Worldwide Governance Indicators

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Appendix

Table A1. Variable Descriptions and Data Sources

Variable	Data Source	Construction / Notes
Dependent Variable		
FDI level (fdi_gdp)	World Bank, World Development Indicators (WDI)	Net foreign direct investment inflows as a percentage of GDP
Core Explanatory Variables		
Sovereign ESG composite index (sovereign_esg_equal)	Yale Environmental Performance Index (EPI); United Nations Development Programme (UNDP) Human Development Report; World Bank Worldwide Governance Indicators (WGI)	Constructed by min–max normalization of environmental, social, and governance dimension scores into [0,1] interval, then equally weighted average
Environmental performance score (env_perf)	Yale Environmental Performance Index (EPI)	Raw EPI score, reflecting national environmental sustainability
Social performance score (soc_perf)	United Nations Development Programme (UNDP) Human Development Report	Social dimension indicators of the Human Development Index (life expectancy, educational attainment, etc.)
Governance performance score (gov_perf)	World Bank Worldwide Governance Indicators (WGI)	Average of government effectiveness, rule of law, and control of corruption
Control Variables		
GDP per capita (ln_gdp_pc)	World Bank, World Development Indicators (WDI)	Natural logarithm of real GDP per capita (constant US\$)
Internet penetration (internet_gdp)	World Bank, World Development Indicators (WDI)	Percentage of internet users in total population
Inflation rate (inflation)	World Bank, World Development Indicators (WDI)	Annual inflation rate (consumer prices, %)
Natural resource rents (nat_res_gdp)	World Bank, World Development Indicators (WDI)	Total natural resource rents as a percentage of GDP
Belt and Road cooperation depth (bri_depth)	Ministry of Commerce of China / official BRI documents	Dummy variable = 1 if country signed BRI cooperation document before the end of 2015
Global ESG rule strength (esg_rule)	Author's construction based on Paris Agreement	Dummy variable = 1 for years from 2016 onward (post-Paris Agreement)
Country risk index (risk)	International Country Risk Guide (ICRG)	Composite political risk rating
Mechanism Variables		
Trade openness (trade_gdp)	World Bank, World Development Indicators (WDI)	Sum of exports and imports as a percentage of GDP
Social inclusion (gdi)	United Nations Development Programme (UNDP)	Gender Development Index (ratio of female to male HDI values)
Human capital (avg_edu)	United Nations Development Programme (UNDP) / Barro-Lee dataset	Average years of schooling (age 15 and above)
Threshold Variable		
Institutional quality (inst_quality)	World Bank Worldwide Governance Indicators (WGI)	Rule of law indicator (ranges from approx. -2.5 to 2.5, normalized)

Note: The dataset covers 76 Belt and Road partner countries from 2001 to 2024. Missing values were imputed, and all continuous variables were winsorized at the 1% level to mitigate outlier effects. WDI refers to the World Bank's World Development Indicators; WGI refers to the Worldwide Governance Indicators; EPI refers to the Environmental Performance Index; UNDP refers to the United Nations Development Programme; ICRG refers to the International Country Risk Guide

Table A2. List of 76 Belt and Road Partner Countries by Region

Region	Countries (ISO Alpha-3 Codes)
Southeast Asia (9)	KHM, IDN, MYS, MMR, PHL, THA, BRN, LAO, VNM
South Asia (7)	BGD, IND, NPL, PAK, LKA, MDV, BTN
Central Asia (5)	KAZ, KGZ, TJK, TKM, UZB
West Asia and North Africa (17)	ARE, OMN, EGY, IRN, TUR, ISR, QAT, KWT, LBN, SAU, BHR, IRQ, JOR, YEM, SYR, PSE, AFG
Central and Eastern Europe and CIS (27)	ALB, AZE, EST, BLR, BGR, MKD, BIH, POL, RUS, CZE, HRV, LVA, LTU, ROU, MDA, MNE, SRB, SVK, SVN, UKR, HUN, ARM, GEO, MNG, CYP
Africa (10)	ETH, AGO, GHA, KEN, MAR, MOZ, NGA, ZAF, TZA, ZMB
Latin America (3)	ARG, PER, BOL

Note: CIS refers to the Commonwealth of Independent States. The list follows the current academic definition of Belt and Road partner countries.