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ESG Performance and Economic Growth in BRICS Countries: A Dynamic ARDL Panel Approach

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Abstract

This study investigates the relationship between ESG performance and economic growth in BRICS nations from 2000 to 2020, aiming to understand how ESG practices influence development trajectories. By integrating economic theories with relevant conceptual frameworks, this study provides a comprehensive analysis of ESG dynamics in emerging economies. The purpose of this study is to determine how the economic growth of the BRICS countries between 2000 and 2020 was impacted by ESG performance at the national level. This work contributes to the body of knowledge by offering a fresh macroeconomic examination of the connection between economic growth and ESG performance in the BRICS nations, a topic that is still relatively unexplored in comparison to firm-level research. A significant knowledge gap on how developing economies strike a balance between rapid economic expansion and environmental and social sustainability is filled by the research's use of a thorough national-level ESG framework. The study employed a dynamic panel auto regressive distributed lag (ARDL) model, utilising a dynamic pooled mean group (PMG) ARDL econometric technique for both short- and long-term estimates. The findings reveal a short-term negative relationship between ESG performance and economic growth in the BRICS countries, which implies that there are high transitional effects involved in sustainable growth solutions. It also highlights the structural and developmental heterogeneity among BRICS countries. Moreover, the study highlights that carbon emissions positively influence short-term economic growth, underscoring the challenge of balancing sustainability with the continued reliance on fossil fuels in these economies. However, the long-term results show that strong ESG practices ultimately positively affect economic growth, reinforcing the importance of investing in sustainable development for achieving high-quality, long-term prosperity. This conclusion emphasises that, while short-term trade-offs may exist, robust ESG frameworks are crucial for fostering enduring economic and environmental well-being.

Keywords: sustainable development; developing countries; GDP per capita; ESG; ARDL

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1. Introduction

Unsustainable production practices and consumption patterns drive the global challenge of climate change, yet the least responsible countries are disproportionately impacted [1]. In response to this imbalance, responsible investment (RI) has emerged as a critical component of twenty-first-century development [2]. The United Nations Principles for Responsible Investment (UNPRI) emphasise the importance of incorporating environmental, social, and governance (ESG) factors into investment decisions [3]. This shift is particularly significant in emerging economies, where investment decisions are pivotal in shaping economic growth. Increasingly, investors recognise that long-term returns are linked to how current investments impact society [4,5]. As a result, responsible investment is defined not just by financial return but also by integrating ESG considerations into risk and return assessments. Others further assert that sustainable development encompasses protecting environmental resources, strengthening social systems, and effective institutional governance [6]. Consequently, there is a growing focus on development models that promote equitable, socially inclusive, and low-carbon economic growth—models that safeguard environmental, social, and economic assets for future generations [7]. This shift underscores the importance of responsible investment practices in achieving long-term, sustainable development that benefits current and future generations.

In response to the growing importance of sustainable development, many nations have introduced internal regulations addressing key ESG issues, such as measuring ESG impacts, collecting relevant data, ensuring comprehensive reporting, and promoting transparency in the disclosure of risks and outcomes [8,9]. It is reported that the BRICS countries—Brazil, Russia, India, China, and South Africa—collectively represent approximately 41% of the global population [10]. These countries have also demonstrated some of the world's most rapid economic growth, with a combined nominal GDP of US$18.6 trillion, roughly 23.2% of global GDP, and foreign reserves totalling an estimated US$4.46 trillion. In addition, the BRICS' share of global GDP (measured in 2011 international dollars) rose significantly by 14.9 percentage points, from 17.6% in 1995 to 32.5% in 2018 [10]. The World Bank also reported that, between 2000 and 2005, BRICS countries contributed 28% of global economic growth and 15% of global trade [11]. These statistics underscore the growing economic significance of the BRICS nations and their increasing role in shaping global sustainability and ESG-focused policies.

The rapid pace of economic growth in the BRICS nations is pivotal for their national economies and has significant implications for regional and global environmental sustainability [12]. Even while the BRICS nations have had impressive growth rates in recent years, they also share several ESG-related concerns. These challenges underscore the importance of addressing environmental, social, and governance issues to ensure sustainable and inclusive development across these nations. However, there is growing pressure on BRICS nations to adopt more unconventional development models that integrate ESG principles into their economic agendas. Given their shared development challenges and similar environmental and socio-economic issues, the future trajectory of BRICS countries' economic growth is closely linked to their commitment to sustainability [13].

Accordingly, the strong economic foundations of these emerging economies, coupled with the increasing importance of ESG factors, present a unique opportunity to promote sustainable development strategies, because countries with robust ESG practices tend to experience faster implementation of social and economic policies, more efficient use of natural resources, and higher rates of long-term economic growth [10]. Diaye et al. [6] claim that nations with strong ESG practices typically see speedier social and economic policy implementation, more productive use of natural resources, and greater rates of economic growth. Research studies on governance performance [14–17], environmental sustainability [18–20], and social performance [21,22] all support this hypothesis. However, depending on the sustainability measures and sample of nations examined, some research has yielded inconsistent results [23]. For instance, empirical studies support the notion that ESG performance inhibits economic growth, as does the degrowth hypothesis and the social comparison and envy theory [24–27]. Despite the growing interest in ESG, empirical research specifically focused on BRICS countries at the macro-level is still limited. Most studies concentrate on developed and developing countries in general, while other empirical studies concentrate on a single component of ESG [14,28,29]. This study attempts to fill the significant vacuum in research caused by the limited BRICS-focused empirical analysis. In addition, there is also a need to assess ESG impacts at a more precise national level to gain insights in order to capture unique country-specific dynamics and policy effectiveness [30–32]. Therefore, this study empirically examines the effect of ESG performance at the country level on economic growth in the BRICS countries.

By empirically investigating the macroeconomic effects of ESG indicators on economic growth in the BRICS nations—an area that has been mainly overlooked in favour of firm-level analyses—this study significantly adds to the body of literature. The study answers the open question of whether and to what degree developing economies give ESG considerations top priority throughout their growth cycles by using a more comprehensive, national-level definition of sustainability that incorporates environmental, social, and governance aspects. To determine whether ESG-driven sustainability and long-term growth in emerging countries are compatible, it also investigates whether the environmental Kuznets curve (EKC) hypothesis is valid within the context of the BRICS. In doing so, this research seeks to respond to three main questions: (1) Does the BRICS countries' economic growth depend on ESG performance? (2) Does this relationship differ in the short- and long-term? and (3) Can the environmental dynamics of growth in developing economies be explained by the EKC hypothesis?

Against this background, this study suggests the following hypotheses:

H1. *The impact of individual ESG dimensions on economic growth varies by country in the BRICS bloc.*

H2. *In the long term, ESG performance positively influences GDP growth in the BRICS countries.*

2. Literature Review

2.1. Theoretical Perspective and Framework

Economic growth theory, a central element of macroeconomics, seeks to explain how production factors contribute to long-term increases in real GDP per capita while maintaining dynamic equilibrium [33]. Rooted in neoclassical theory, early models by Solow and Swan in 1996 emphasised labour, capital, and technology as key growth drivers, with technological progress viewed as exogenous and economies expected to converge to a steady-state equilibrium [34]. However, the endogenous growth theory emerged to address limitations of diminishing returns, incorporating knowledge accumulation and innovation as internal components of growth [35,36]. Technological advancement is seen as driven by investment decisions, learning-by-doing, and research and development [37], allowing for sustained growth without depleting resources, which aligns with the Sustainable Development Goals.

Evolutionary economics adds another layer, emphasising the socio-economic context of technological change [38]. This approach supports the environmental Kuznets curve (EKC) hypothesis, which posits an inverted U-shaped relationship between economic growth and environmental degradation [39,40]. Early-stage growth may strain the environment, but improvements in income and policy eventually lead to environmental recovery.

Within this context, ESG (environmental, social, and governance) considerations are increasingly relevant. Although ESG policies may entail short-term costs [32,41], their long-term benefits—such as improved institutional quality, reduced inequality, and better environmental outcomes—enhance growth prospects [42,43]. Poor ESG performance, including high corruption or inequality, is linked to weaker long-term growth [44–46].

Social and institutional factors—including governance [47], demography [48], and social capital [49]—also influence growth trajectories. These non-economic dimensions are integral to understanding the macroeconomic impacts of ESG performance. For example, improved air quality enhances productivity [50], and inequality's effects on growth evolve over time [51].

Therefore, integrating ESG considerations into macroeconomic analysis is vital. ESG performance may serve as a buffer against economic shocks [52], support long-term productivity, and promote sustainable development. Given the growing importance of ESG in shaping institutional and structural policy, this study examines whether ESG performance influences long-term economic growth in BRICS countries. It also explores whether elements of the EKC hypothesis apply and identifies key ESG drivers behind growth patterns in these emerging economies.

2.2. Previous Empirical Literature

There are concerns regarding the sustainability of this trajectory and its wider effects on social and environmental systems due to the BRICS countries' rapid economic expansion. Addressing the issues of sustainable development in these economies requires an understanding of the relationship between ESG performance and economic growth [53]. The pursuit of sustainable growth presents both opportunities and challenges due to the BRICS countries' inconsistent adoption of ESG frameworks, despite their solid economic foundations [54].

There is usually a positive correlation between macroeconomic development and strong ESG performance, according to empirical studies conducted in emerging markets. For example, nations with strong ESG frameworks typically have more effective social and economic policies, make better use of natural resources, and have higher levels of sustainable growth [55,56]. The conclusions from these studies were based on panel data cross-country regression studies that showed statistically significant positive relationships between GDP per capita and ESG scores.

Empirical research has assessed the environmental Kuznets curve (EKC) hypothesis on the environmental component, including studies by [57–60]. According to these studies, environmental deterioration (such as CO_2 emissions) and economic expansion have an inverted U connection. However, the BRICS countries have yet to precisely identify the point at which growth starts to mitigate environmental harm, raising questions about the EKC's suitability for high-growth, resource-dependent economies. For instance, [59,60] discovered that although China and India are showing indications of decoupling, South Africa and Brazil are still largely dependent on fossil fuels, which is slowing down the environmental shift

Studies on the social dimension have connected improved long-term growth prospects with more government spending on health and education [61,62]. These studies frequently isolate the impacts of social investment on economic indicators using dynamic panel GMM models or panel cointegration techniques. However, the literature is still limited and dispersed for the BRICS nations. Other studies have demonstrated that social inequality might reduce the economic gains from social policy initiatives, particularly in South Africa and Brazil [63,64].

One particularly significant driver in the relationship between ESG and growth has been found to be governance. According to empirical studies, strong institutional performance—in particular, the rule of law, anti-corruption, and regulatory quality—supports long-term economic growth by fostering a stable environment for social development and investment [65,66]. However, empirical research in the BRICS setting indicates conflicting findings, with governance scores falling short of economic performance, particularly in South Africa and Russia [67,68].

It is also important to note that other empirical research offers conflicting data, indicating that ESG priorities can impede the growth of the global economy in emerging nations. The degrowth literature, for instance, contends that robust environmental commitments limit industrial productivity, particularly in economies with high carbon emissions [69,70]. Furthermore, social comparison and envy-based theories argue that stagnation and social discontent might result from growing social expectations without true economic inclusion [71,72]. Research, such as that by Becchetti and others, which found a negative short-term link between GDP growth in emerging nations and ESG stringency, supports these viewpoints [73]. Table 1 outlines the principal themes emerging from the literature, highlighting distinct perspectives on each dimension of ESG.

Table 1. Summary of key literature themes.

ESG Dimension	Representative Studies	Main Findings
Environment	[57,59,60]	EKC observed in parts of BRICS; decoupling is not uniform
Social	[61,63]	Social investments support growth, but inequality moderate effects
Governance	[66,67]	Strong institutions enhance growth; BRICS show uneven governance performance
Counterarguments	[69,71,73]	ESG stringency may constrain growth in the short term

Source: Authors' computation.

2.3. ESG Developments in BRICS Countries

The BRICS countries have been particularly proactive in incorporating the ESG agenda into their national economic strategies due to climate change. This has become a critical concern in BRICS, driven by the urgent environmental, economic, and social pressures created by their current development patterns. Therefore, integrating ESG practices is not just an opportunity but a necessity for ensuring their economies' long-term stability and resilience. This section examines ESG developments in BRICS countries to identify the main factors influencing ESG performance in each of these nations.

2.3.1. Brazil

Brazil's ESG landscape reflects a dual challenge: managing global environmental responsibility while addressing deep-rooted social inequalities. Environmental concerns include illegal deforestation in the Amazon and emissions from agriculture and mining, despite Brazil's ambitious climate commitments under the Paris Agreement [74,75]. Socially, Brazil struggles with high levels of inequality, forced labour, and one of the worst gender gaps in Latin America [76,77]. Governance remains mixed, and even though strategic planning is institutionally supported through Pluriannual Plans and transparency portals, implementation lags behind due to bureaucratic fragmentation [78,79]. ESG consciousness is increasing among consumers and corporations, driving demands for stronger ESG integration across sectors [80,81].

2.3.2. Russia

Russia's ESG profile is shaped by its dependency on fossil fuels, leading to high emissions and exposure to climate risks such as permafrost thawing and extreme weather [75,82]. Despite a legacy of social welfare from the Soviet era, present-day challenges include demographic decline and regional inequality [83,84]. Although institutional governance reform has gained momentum through open government initiatives and anti-corruption measures, the country still struggles with policy coherence and strategic planning [84,85]. Russia's climate and energy strategies, including its INDCs and long-term environmental policies, indicate gradual alignment with global ESG standards [86,87].

2.3.3. India

India faces complex ESG challenges, including high poverty rates, gender inequality, and environmental degradation due to rapid industrialisation and climate vulnerability [88,89]. Nonetheless, it has launched various policies addressing ESG dimensions, including the National Electric Mobility Mission, the Cooling Action Plan, and robust CSR mandates that reflect its commitment to environmental and social governance [90,91]. India's governance reforms, such as the Aspirational Districts Programme and Right to Information Act, enhance transparency and accountability [92,93]. Its gradual, equity-driven approach to the net-zero transition balances growth aspirations with ESG integration [75,94].

2.3.4. China

China's ESG performance mirrors the trade-offs of fast-paced growth: record-high emissions and worsening inequality despite poverty reduction and infrastructure investment [95,96]. It is the world's top CO_2 emitter, yet it has committed to peaking emissions by 2030 and achieving carbon neutrality before 2060 [97]. Socially, progress includes expanded social protection, improved education access, and rural pension coverage [98,99]. Governance reform has been marked by anti-corruption efforts, the rise of plural governance through civil society, and the creation of institutions such as the Asian Infrastructure Investment Bank (AIIB) to promote ESG-aligned investments [100–102].

2.3.5. South Africa

South Africa's ESG context is characterised by acute inequality, fossil fuel dependence, and institutional weaknesses rooted in apartheid-era legacies [103,104]. Its fair transition framework aims to balance decarbonisation with social equity through renewable energy policies, carbon taxation, and inclusive economic planning [104,105]. Social policy is anchored in an extensive social grant system and education reform, contributing to resilience and poverty reduction [106,107]. Governance reform has progressed via transparency tools and climate accountability structures, although challenges remain in eradicating corruption and enhancing strategic capacity [85,108].

2.4. ESG Performance Indicators in BRICS

A further analysis of the ESG performance indicators in each BRICS country was also conducted. The primary proxies for each of the ESG dimensions were based on the literature and relevance to this study. For the environmental "E" pillar, carbon (CO_2) emissions and the output of renewable energy were used; inequality, health, and education were analysed under the social "S" pillar; and corruption and the rule of law represented the governance "G" pillar.

The analysis revealed the heterogeneity in the main drivers of growth in each of the BRICS countries. China's sustained growth was found to be largely attributed to its gradualist approach, where resources are directed toward higher productive sectors. China's structural shift from low-productivity rural employment to high-productivity manufacturing not only accelerated economic growth but also reinforced environmental pressures, consistent with the environmental Kuznets curve [57]. On the other hand, Russia's growth was primarily driven by its energy and natural resource sectors. India's economic expansion was attributed to its strengths in IT, pharmaceuticals, and the automobile industries. The growth in these sectors has improved social outcomes such as healthcare access [109]. South Africa's growth was found to be propelled by its financial services sector and strategic position within Africa, while Brazil's investments in the commodities value chain and pro-poor policies largely influenced its economic growth. South Africa and Brazil's heavy investments in education and social protection reflect stronger social ESG performance despite persistent inequality [110]. However, across the bloc, weak governance—evidenced by low scores on corruption control—remains a systemic constraint on sustained and inclusive growth [111].

The analysis also showed that three of the BRICS countries—Russia, China, and South Africa—have generally high CO_2 emissions. This is largely because they are largely dependent on fossil fuel energy consumption. Therefore, CO_2 emissions affected the environmental dimension in these BRICS countries. Additionally, poverty and inequality emerged as significant common factors affecting BRICS countries within the social dimension. The analysis identified social challenges as a primary focus across all BRICS nations, with better performance observed in the social dimension relative to the environmental and governance aspects. Corruption was identified as a major concern across all BRICS countries within the governance sphere. Concerted efforts have been made to address this challenge through the implementation of anti-corruption policies and the establishment of clear governance structures aimed at promoting transparency and accountability.

These country-specific nuances show that while ESG pillars influence growth in interconnected ways, their impact pathways differ based on national development priorities, institutional capacity, and sectoral structures, underscoring the need for tailored, multi-dimensional policy strategies to meet sustainable development goals [112]. This analysis confirms the first hypothesis that the impact of individual ESG dimensions on economic growth varies by country, reflecting structural and policy-specific contexts across the BRICS bloc.

3. Materials and Methods

3.1. Data Collection Procedure

The study utilised a panel dataset covering the BRICS nations from 2000 to 2020. The World Bank provides an ESG framework detailing indicators that fall under each of the three dimensions in accordance with the Sustainable Development Goals (SDGs). The World Development Indicators (WDIs) served as the main source of the data. Where data for some indicators was not available for the period considered in the study, additional secondary sources were utilised, such as the OECD, IMF, and others, as detailed in Table 2 below. Economic growth theory and the literature were referred to in choosing the model variables. The secondary data collected for the study was quantitative in nature and analysed using the Stata 16 Statistical software. The summary of model variables and data sources is presented in Table 2.

Table 2. Summary of model variables.

Variable (Code)	Description	Source(s)	Expected Outcome
Real GDP per capita (GDPpc)	A measure of a country's economic output per person	World Development Indicators (WDIs)	
Country ESG score (ESG)	A measure of how well risks and concerns related to environmental, social, and governance issues are addressed in a country.	Organisation for Economic Co-operation and Development (OECD), Statistics South Africa (Stats SA), the Natural Resource Governance Institute (NRGI), the World Inequality Database (WID), the World Integrated Trade Solution (WITS), Vision of Humanity (VOH), Transparency International (TI)	Positive and negative
Carbon emissions (CO_2)	Carbon dioxide produced during the consumption of solid, liquid, and gas fuels and gas flaring	Climate Watch, World Development Indicators (WDIs), World Population Review	Positive and negative
Foreign direct investment (FDI)	An ownership stake in a foreign company or project from another country made by an investor, company, or government	World Development Indicators (WDIs), International Monetary Fund (IMF)	Positive and negative
Inflation (INFL)	The rate of increase in prices over a given period measured by the consumer price index.	World Development Indicators (WDIs), International Monetary Fund (IMF)	Positive and negative
Trade openness (OPEN)	The extent to which a country is engaged in the global trading system, measured as the sum of a country's exports and imports as a share of that country's GDP (in %).	World Development Indicators (WDIs)	Positive

Source: Authors' own compilation.

3.1.1. MSCI Framework for Computing ESG Country-Level Scores

The Morgan Stanley Capital International (MSCI) ESG framework was employed to compute the ESG country-level scores [113]. The process starts with the broad classification of ESG indicators into two categories, i.e., ESG risk exposure and ESG risk management. When determining a country's ESG risk exposure, its resources (natural capital, human capital, and financial resources) are taken into consideration as prerequisites for its development and performance. This is because different nations have different proportions of these resources, which gives them a natural edge or disadvantage when it comes to turning these assets into useful goods and services. Conversely, data on proven performance in ESG domains, including environmental sustainability, standard of living, safety, and freedom, is used to gauge a nation's ESG risk management.

To produce the final ESG country-level ratings, weights are allocated to each ESG pillar and its underlying risk factors. These weights are constant across the board and are not influenced by a nation's level of economic development or MSCI market classification. These MSCI weights have been at their current levels for a number of years, though they may be reassessed on a regular basis (MSCI, 2023) [113]. Currently, MSCI evaluates the impact intensity of each ESG pillar on competitiveness across short-, medium-, and long-term horizons to ascertain their respective weights. According to the findings of the weight-determining tool, the governance (G) pillar is therefore given a higher weight (50%) than the environmental (E) and social (S) pillars (25% each) (MSCI, 2023) [113]. As per the MSCI, deficiencies in governance might yield noteworthy consequences and gain national significance within a relatively brief duration. Its greater weight in comparison to other pillars comes from the idea that a country's progress in other domains, such as social or environmental advancement, may be hampered by a weak governance environment.

3.1.2. The MSCI Scoring Procedure

Ratings are calculated using the MSCI framework by assigning a score between 0 and 10 to the actual data point values. The greatest value represents the highest risk exposure, while the lowest value shows the lowest. This is how the risk exposure data points are scored numerically: the top-performing value is given a score of zero (0), while the bottom-performing value is given a score of ten (10). Alternatively, in terms of risk management data points, the risk management that is strongest is indicated by the highest value, and the riskiest is shown by the lowest value. A score of 10 is assigned to the value that is best in class, while a score of zero (0) is assigned to the value that is poorest in class.

The method by which the ratings at the lowest level are added together to get the rating at the top level is shown in Figure 1. To determine the nation's ESG risk management score or ESG risk exposure score, a five-step procedure is followed.

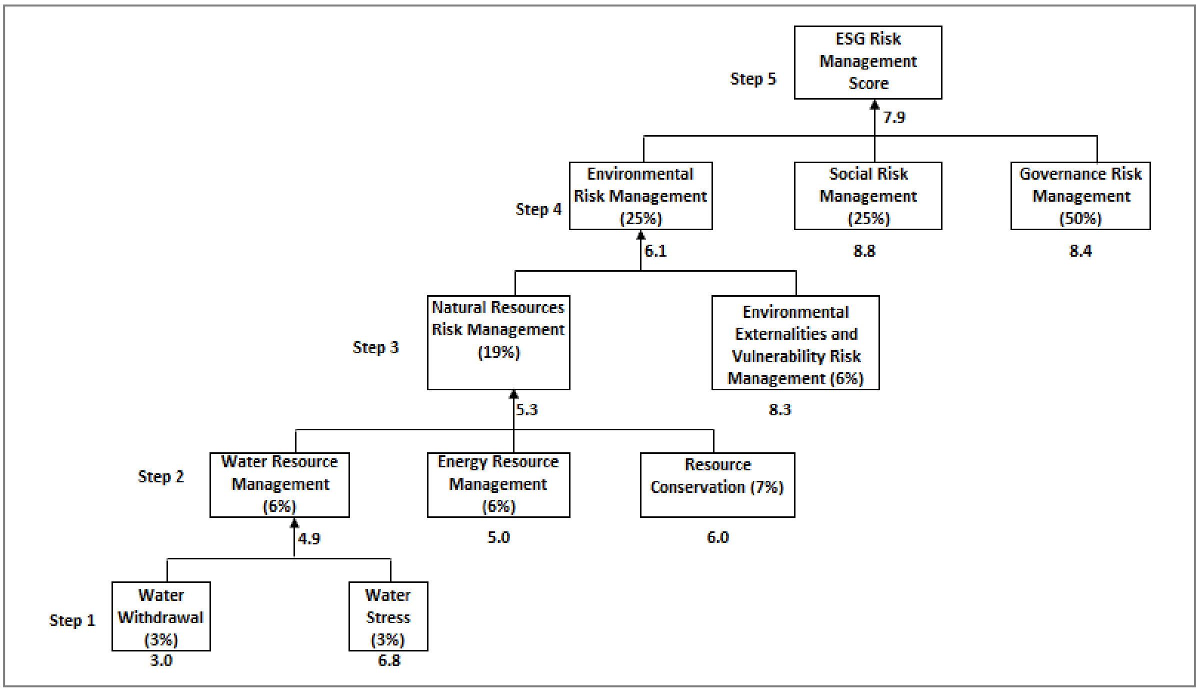

Figure 1. Illustration of MSCI scoring methodology. Source: MSCI (2023) [113].

In the country illustration highlighted in Figure 1, the following steps are undertaken to arrive at the ESG risk management score:

- Step 1: Water resource management: There are two indicators that constitute the 6% weight in total, namely water withdrawal (3%) and water stress (3%). The respective weights are then multiplied by the value of water withdrawal and water stress for a particular country in a given period (e.g., year) as provided in the database indicators available. For illustrative purposes, it is assumed that the weighted numeric score for water withdrawal (which should lie between 0 and 10) is 3.0 and that of water stress is 6.8, as shown in Figure 1.

- Step 2: The water resource management sub-factor score, which is 4.9, is determined by taking the simple average of these two scores under Step 1. Similar calculations are made for the numerical scores for the other sub-factors, i.e., resource conservation (6.0) and energy resource management (5.0).
- Step 3: The weighted average score of the three sub-factors (resource conservation, water resource management, and energy resource management) yields a score of 5.3 for the risk factor management score, or in this case, natural resources risk management. The environmental externalities and vulnerability risk is another risk factor within the environmental pillar, and its risk factor management score is computed in a similar manner (8.3).
- Step 4: The weighted average of the environmental externalities and vulnerability risk score with the natural resource risk management score yields the environmental risk management score of 6.1. Similar calculations are used to produce the social risk management score (8.8) and the governance risk management score (8.4).
- Step 5: The ultimate ESG risk management score (7.9) is computed as the weighted average of the environmental risk management, social risk management, and governance risk management scores.

Similarly, the ESG risk exposure score is calculated in the same format (Steps 1 to 5). The next step is to determine the country rating or the overall ESG score after calculating the two scores. This formula applied to calculate the overall ESG score is as follows (see Equation (1)):

$$ESG\ Score : Min\{(Risk\ Management\ Score\ + 1), Average(10 \\ - Risk\ Exposure\ Score, Risk\ Management\ Score)\} \tag{1}$$

With this method, a country's total ESG score is constrained by its risk management score in cases where its overall risk management is inadequate, as demonstrated by Equation (1). This formula, with a minimal management threshold, reflects the MSCI's view that a country with insufficient risk management may not be able to fully utilise its resources, even in the event of a wealth of resources. Below is an illustrative example of how the overall ESG score for Country X is estimated.

Country X has the following scores in year 1: The ESG risk management score is 7.031, and the ESG risk exposure score is 2.091. Using Equation (1), the overall ESG score is calculated as follows:

$$Overall\ ESG\ Score = Min\{(7.031 + 1), Average(10 - 2.091, 7.031)\} \tag{2}$$

$$Overall\ ESG\ Score = Min\{8.031, Average(7.909, 7.031)\} \tag{3}$$

$$Overall\ ESG\ Score = Min(8.031, 7.470) \tag{4}$$

$$Overall\ ESG\ Score = 7.470 \tag{5}$$

The obtained overall ESG score, as highlighted in Equation (5), represents the country-level ESG for a country at a given point in time. This resultant ESG score is then used to determine country-level ESG thresholds on a scale ranging from 0, representing worst-in-class (CCC), up to 10, for the best-in-class (AAA) ratings (MSCI, 2023) [113]. The rating categorisation of the country-level ESG scores is highlighted in Table 3 below.

Table 3. Classification of ESG score rating zones.

ESG Rating	Country ESG Score Zone
AAA	$8.19 \leq ESG\ Score \leq 10.00$
AA	$7.15 \leq ESG\ Score < 8.19$
A	$6.12 \leq ESG\ Score < 7.15$
BBB	$5.08 \leq ESG\ Score < 6.12$
BB	$4.04 \leq ESG\ Score < 5.08$
B	$3.00 \leq ESG\ Score < 4.04$
CCC	$0.00 \leq ESG\ Score < 3.00$

Source: MSCI (2023) [113].

3.2. The Empirical Model

A review of static and dynamic panels was also undertaken, showing the advantages and limitations of each method given the scope of the study. According to Baltagi [114], the pooled OLS, fixed effects, and random effects estimators are biassed and inconsistent due to the association between the lagged dependent variable and the overall error disturbance terms. As such, it is not recommended to use the fixed/random effects on dynamic models. Based on earlier research [6,115], this study evaluated the dynamic panel data model, which is described as follows:

$$GDPpc_{it} = \alpha_0 + \alpha_1 GDPpc_{i,t-1} + \alpha_2 ESG_{i,t} + \alpha_3 X_{i.t} + \mu_i + \varepsilon_{i,t} \quad (6)$$

where $GDPpc$ is the value of the natural log of GDP per capita for the country i at year t; ESG is a country-level score; i = 1, 2,. . ., 5 (BRICS countries); t = 1, 2. . .T (periods); X is a vector of control variables for macroeconomic variables, namely trade openness, inflation, and foreign direct investment (FDI) that have been linked to economic growth [116,117]; and μ_i is the country-specific effect.

As a result, a dynamic panel ARDL model was chosen to account for endogeneity and country-specific effects and to provide short-run and long-run estimates. This study employed the pooled mean group autoregressive distributed lags (PMG-ARDL) approach for estimating the effect of ESG performance on economic growth in BRICS countries. This approach restricts long-run equilibrium from becoming homogeneous across the cross-sectional units while permitting heterogeneity for short-run associations [118,119]. The short-run relationship emphasises the country-specific heterogeneity that could be influenced by factors such as stabilisation policy responses, economic shocks, macroeconomic uncertainties, and business and political risks [120]. However, the long-term homogeneity assumed by the ARDL and PMG techniques may not adequately represent the structural and institutional differences among the BRICS nations, despite the fact that they provide flexibility in managing short- and long-term dynamics across heterogeneous panels. The ARDL model was suitable for this study, given the small cross-section (N = 5) and the relatively large time series dimension (T = 21) [121–123]. When T > N, as in this study, an autoregressive distributed lag (ARDL) cointegration technique would be the most appropriate dynamic model to produce consistent short-run and long-run estimates [122,123]. According to Pesaran and Shin, the long-run parameters are super consistent even with a small sample size [124].

The following ARDL dynamic specification was adopted for this study:

$$\Delta lnGDPpc_{it} = \alpha_0 + \sum_{j=1}^{p-1} \alpha_{1j} \Delta lnGDPpc_{i,t-j} + \sum_{j=1}^{p-1} \alpha_{2j} \Delta ESG_{i,t-j} + \sum_{j=1}^{p-1} \alpha_{3j} \Delta CO2_{i,t-j} + \sum_{j=1}^{p-1} \alpha_{4j} \Delta INFL_{i,t-j} + \sum_{j=1}^{p-1} \alpha_{5j} \Delta FDI_{i,t-j} + \sum_{j=1}^{p-1} \alpha_{6j} \Delta OPEN_{i,t-j} + \beta_{1i} lnGDPpc_{i,t-j} + \beta_{2i} ESG_{i,t-j} + \beta_{3i} CO2_{i,t-j} + \beta_{4i} INFL_{i,t-j} + \beta_{5i} FDI_{i,t-j} + \beta_{6i} OPEN_{i,t-j} + \varepsilon_{i,t} \tag{7}$$

where

$lnGDPpc_{it}$ denotes the log of real GDP per capita for country i at year t;
$ESG_{i,t}$ represents the ESG country score for country i at year t;
$CO2_{i,t}$ represents the carbon emissions (CO_2) score in metric tons per capita, serving an environmental proxy for country i at year t;
$INFL_{i.t}$ is the annual percentage inflation rate (consumer prices) for country i at year t;
$FDI_{i.t}$ represents net inflows of foreign direct investment (FDI) as a percentage of GDP for country i at year t;
$OPEN_{i.t}$ is the trade (sum of exports and imports over GDP) for country i at year t;
α_0 represents the error correction term (ECT) or drift term, variables with coefficients α_1 to α_6, are the model's short-run coefficients, while β_1 to β_6 are the long-run coefficients.

4. Results

The model's empirical estimation investigated the connection between BRICS nations' economic growth and their environmental, social, and governance (ESG) performance. Several crucial diagnostic tests were conducted to determine whether the data was appropriate for the suggested model before moving further with the model estimation. These tests were created to ensure the data satisfied the presumptions and requirements listed below for a credible and reliable analysis.

4.1. Descriptive Statistics

To provide a concise understanding of the dataset's characteristics, a descriptive analysis was conducted before delving into further data analysis. The measures presented include minimum, maximum, median, and mean values to offer insights into the range and central tendency of the data. In addition, the skewness, kurtosis, and Jarque–Bera for testing the normal distribution of the data were also conducted. The following outlines the descriptive analysis of the research variables:

Table 4 shows the effect of log transformation on the GDP per capita descriptive statistics. The dependent variable, GDPpc, was transformed into a logarithmic form (lnGDPpc) to reduce the variability in this data and to allow for the application of semi-elasticities on the interpretation of results after estimation of the model [125,126]. The lnGDPpc descriptive statistics show a mean of 8.47 and a very small variance of 0.58. The results also show a negatively skewed distribution of −1.13, while the kurtosis indicates a near normal distribution. The rest of the results are as described in Table 4; the Jarque–Bera test gave a Chi(2) of 0.16, which is greater than the 0.05 critical value, implying a normal distribution of the data.

Table 4. Summary statistics of BRICS countries, log-level model.

Descriptive Statistics	lnGDPpc	ESG	CO_2	INFL	FDI	OPEN
Observations	105	105	105	105	105	105
Min	6.63	3.26	0.883	−0.732	0.205	22.11
Max	9.25	6.17	11.88	21.48	5.37	68.09
Median	8.73	4.72	6.08	5.18	2.07	46.52
Mean	8.47	4.71	5.60	5.98	2.29	44.25
Std. dev	0.761	0.672	3.79	4.04	1.24	11.99
Variance	0.579	0.452	14.36	16.28	1.55	143.7
Skewness	−1.133	−0.174	0.246	1.38	0.308	−0.313
Kurtosis	2.93	2.72	1.59	5.72	2.15	2.04
Jarque–Bera Chi(2)				3.625 0.1632		

Source: Authors' computation.

4.2. Correlation Analysis

The correlation analysis is conducted to illustrate the extent to which two variables relate to each other. The correlation coefficient value varies between + 1 and −1. A correlation coefficient value close to +1 implies a stronger positive relationship between variables, while a value close to −1 suggests a negative relationship between two variables [127]. A correlation coefficient value $> \pm 0.8$ may indicate the presence of a linear relationship. The pairwise correlation of the variables is shown in Table 5 as follows:

Table 5. The pairwise correlation matrix.

Variables	lnGDPpc	ESG	CO_2	INFL	FDI	OPEN
lnGDPpc	1.0000					
ESG	−0.6336 ***	1.0000				
CO_2	0.5950 ***	−0.3252 ***	1.0000			
INFL	0.0634	0.1549	0.2527 ***	1.0000		
FDI	0.1927 **	−0.0760	−0.1769 *	−0.0552	1.0000	
OPEN	−0.0506	0.1015	0.5914 ***	0.2762 ***	−0.1699 *	1.0000

Note: Significance level: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Source: Authors' computation.

The results shown in Table 5 suggest no evidence of a perfect linear relationship among regressors, which helps alleviate multicollinearity concerns. The included variables appear relatively independent and can be effectively utilised in regression modelling without significant issues arising from multicollinearity.

4.3. Panel Unit Root Tests

Dynamic panel models are often ineffective in correctly identifying the relationships between variables in time series data that may contain a unit root, leading to spurious correlations. It is crucial to individually test for the presence of a unit root in the model variables. If a unit root is detected in the data at the levels [I(0)], modelling in first differences [I(1)] is employed as a solution. The Levin–Lin–Chu (LLC) unit-root test, which assumes homogeneity of slopes, was employed to assess the stationarity of all variables in the model. This test allows for variation in intercepts and different lag lengths across individual cross-sections of the panel. The Im, Pesaran, and Shin (IPS) test was also conducted to confirm the results [128]. The IPS assumes that random errors exhibit serial correlation with varying properties and variances across each cross-sectional unit.

Table 6 shows that all the variables exhibit either zero-order stationarity (in levels) or first-order integration (in first difference), which is consistent with the application of the ARDL model to investigate relationships and dynamics within the dataset [129].

Table 6. The panel unit root tests.

Variables	Level	LLC		IPS	
		t-Statistic	*p*-Value	t-Statistic	*p*-Value
lnGDPpc	I(0)	−4.8504	0.0001	−2.6389	0.0042
ESG	I(1)	−5.4599	0.0000	−5.6897	0.0000
CO_2	I(1)	−2.2814	0.0113	−2.6083	0.0045
INFL	I(0)	−3.1436	0.0008	−2.8737	0.0020
FDI	I(0)	−1.9351	0.0265	−2.0843	0.0186
OPEN	I(1)	−2.865	0.0021	−3.6849	0.0001

Source: Authors' computation.

4.4. Cointegration Test

In addition to confirming the stationarity of the variables in the unit root test, this study further examined the potential cointegration among the variables of interest using the Pedroni panel cointegration test. The Westerlund panel cointegration test validated the findings. Cointegration is proven by the error correction term and the statistical significance of the long-run coefficients [130,131]. A long-term relationship is shown by cointegration, usually shown by joint significance in the levels equation.

The Pedroni test accommodates heterogeneity in panel data [130], allowing researchers to analyse the long-term relationships within the panel while acknowledging that short-term dynamics and fixed effects can differ among panel members. The methodology proposed by Pedroni makes use of the estimated residuals from the hypothesised long-run regression.

The null hypothesis test of no cointegration is tested based on whether residuals (errors) e_{it} are stationary processes or not. Therefore, $\rho_i = 1$ given

$$\widehat{e}_{it} = \rho_i \widehat{e}_{it-1} + v_{it} \tag{8}$$

Since this model may encounter the autocorrelation problem, the lagged values of the model-dependent variable are added as the explanatory variable, as shown in the following equation:

$$\varepsilon_{it} = \rho_i \varepsilon_{i,t-1} + \sum_{j=1}^{p_i} \psi_{ij} \Delta \varepsilon_{i,t-j} + v_{i,t} \tag{9}$$

Hypotheses of the Pedroni panel cointegration test:

H0. $|\rho_i| = 1$ *signifies no cointegration between the series.*

H1. $|\rho_i| < 1$ *signifies cointegrtion between the series.*

The results presented in Table 7 indicate statistically significant results from the Pedroni and Westerlund panel cointegration tests. Specifically, the Pedroni test's modified Phillips–Perron t-statistic rejects the alternative hypothesis that there is no cointegration and supports the cointegration of lnGDPpc, ESG, CO_2, INFL, FDI, and OPEN. Similarly, the Westerlund test's variance ratio (VR) test statistic supports the alternative hypothesis that at least some panels are cointegrated, while rejecting the null hypothesis that there is no cointegration. These findings support the presence of a long-term relationship between the variables in the empirical model, pointing to a solid and significant association that endures throughout time.

Table 7. Panel cointegration test.

Pedroni Test			Westerlund Test		
Test	**Statistic**	***p*-Value**	**Hypothesis**	**Statistic**	***p*-Value**
Modified Phillips–Perron t	2.5920 ***	0.0048	H_a : Some panels are cointegrated	2.1082 **	0.0175
Phillips–Perron t	1.0064	0.1571	H_a: All panels are cointegrated	1.0562	0.1454
Augmented Dickey–Fuller t	1.0163	0.1547			

Note: Significance level: ** $p < 0.05$, *** $p < 0.01$. Source: Authors' computation.

4.5. Optimal Lag Length

Lag order selection criteria were employed in the study to ascertain the ideal lag duration for the model. Problems, including loss of degrees of freedom, multicollinearity, serial correlation in error terms, and misspecification errors, can result from including an excessive number of delays. The suggested number of lags for annual data is usually one or two (usually not more than that) [132]. Therefore, this step was critical because using sub-optimal lags can result in inaccurate estimation outcomes.

To address this issue, a lag-length criteria check was introduced using Stata's Bayesian information criterion (BIC) for model selection. According to Schwarz, the Akaike information criterion (AIC) and the BIC are closely connected [133]. The BIC incorporates the probability function. Increasing the parameters in a model's fit can make it more likely, but it can also cause overfitting. Raftery claims that the BIC penalises overfitting by including a component related to the model's parameter count [134]. Because BIC's penalty term is bigger than AIC's, it offers a more reliable approach to model selection.

Therefore, the unrestricted model and the BIC were used to determine the ideal lag, which, in turn, determined the lag duration for each variable in the panel among the five BRICS countries. The most common lag for each variable was considered to represent the lags for the empirical autoregressive distributed lag (ARDL) model. The maximum lag applied in the restricted model was one (1) to minimise the loss of degrees of freedom.

Table 8 shows that the optimal lag length of panel ARDL (1, 0, 0, 0, 1, 0) was chosen for estimating the empirical model based on the BIC. This optimal lag also minimises the loss of degrees of freedom in the model [121].

Table 8. Optimal lag length determination.

```
forval i = 1/5 {
ardl lnGDPpc ESG CO2 INFL FDI OPEN if (cy == 'i'), maxlag(1 1 1 1 1 1)
matrix list e(lags)
di
}
```

Results	lnGDPpc	ESG	CO_2	INFL	FDI	OPEN
Country 1	1	1	1	0	1	0
Country 2	1	0	0	0	1	1
Country 3	1	0	0	0	1	0
Country 4	1	0	0	1	0	1
Country 5	1	0	0	0	1	0
Optimal lag	1	0	0	0	1	0

Source: Authors' computation.

4.6. Estimation of the ARDL Model

The results of the short-run and long-run effects of ESG performance on economic growth in BRICS are highlighted in Table 9 for the PMG-ARDL method. The short-run and the long-run coefficients were estimated in terms of the effect of the independent variables on the dependent variables as specified in Equation (7).

Table 9. The short-run and the long-run PMG-ARDL results.

Variable	Coefficient	Standard Error
	Long-run	
ESG	0.167 **	0.0657
CO_2	0.126 **	0.0569
INFL	−0.0303 ***	0.00897
FDI	0.00747	0.0182
OPEN	0.0131 *	0.00729
	Short-run	
ECT	−0.105 ***	0.0296
D1.ESG	−0.00518 *	0.00283
D1.CO_2	0.0735 **	0.0364
D1.INFL	0.00108	0.00174
D1.FDI	0.00180	0.00485
D1.OPEN	−0.000432	0.000784
Intercept	0.754 ***	0.232
Countries	5	
Observations	100	

Note: Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The top panel shows long-run effects while the bottom panel reports both short-run effects (SR) and the speed of adjustment (ECM). (PMG/ARDL: 1, 0, 0, 0, 1, 0). Dependent variable: lnGDPpc. NB: The number of observations was reduced by five due to the first differencing of explanatory variables. Source: Authors' computation.

In the long run, the study finds that BRICS countries' economic growth is greatly boosted by ESG performance over the long term; a one-unit gain in ESG scores results in a 0.17% increase in lnGDPpc (economic growth) at the 5% level of significance. Similarly, CO_2 emissions are positively correlated with growth, with a 0.13% increase in GDP per capita for every additional metric tonne. On the other hand, inflation (INFL) hinders growth; a one-unit increase lowers GDP by 0.03%. A one-unit increase in the trade-to-GDP ratio results in a 0.013% increase in economic production, demonstrating that trade openness (OPEN) also promotes long-term growth, albeit weakly.

In the short run, the study finds that ESG negatively impacted economic growth at the 10% significance level. This finding suggests that a one-unit increase in country-level ESG scores in BRICS nations could decrease economic growth by 0.0052%. The finding suggests that a one metric ton increase in carbon emissions per capita in BRICS countries results in a 0.074% increase in economic growth.

In an ARDL model, the error correction term (ECT) shows the rate of adjustment from short-run disequilibrium to long-run equilibrium. The ECT parameter should be significant and negative to provide robust statistical evidence that the variables are cointegrated, thereby validating the use of the ARDL model to estimate long-run relationships [134,135]. The results reveal a statistically significant ECT at the 1% level with a PMG estimate of −0.11. Therefore, it can be inferred that the speed of adjustment towards equilibrium for the

PMG, transitioning from short-term disequilibrium to long-term equilibrium, experiences an annual correction of 11% across the BRICS countries. This lower coefficient suggests a slower adjustment process to return to equilibrium in cases of disequilibrium.

5. Discussion

The findings show that national ESG performance has a favourable long-term effect on economic growth. The results validate the hypothesis derived from the literature suggesting a positive correlation between economic growth and country-level environmental, social, and governance (ESG) performance. This implies that BRICS countries would have implemented more effective mechanisms to manage economic shocks and output volatility over the long term [136,137]. This involves the proper management of natural and social resources and fully integrating ESG considerations into macroeconomic policies to address market failures, including environmental taxes, competition policy regulation, financial sector regulation, redistributive control measures, and regulation of network industries [43,138].

However, the negative and statistically significant short-term impact implies that ESG investments may require time to manifest benefits, a consistent conclusion with other studies [6,30–32]. This could be attributed to transitional effects, including high initial implementation costs, regulatory adjustments, and capital reallocation in the short term. In addition, the short-term results also indicate the structural and developmental heterogeneity among BRICS economies. The observed short-term negative relationship between ESG performance and economic growth in the BRICS countries aligns with findings in other developing economies, such as the MINT nations (Mexico, Indonesia, Nigeria, and Turkey), where initial ESG investments have been shown to divert resources from immediate output-driven sectors, leading to short-term economic slowdowns [139]. Similarly to BRICS, studies on G20 emerging members indicate that carbon emissions continue to positively drive short-term economic growth due to their heavy reliance on fossil fuels and resource-intensive industries [140].

Furthermore, in the long run, the BRICS countries may also benefit from the endogenous growth hypothesis, as consistent infrastructure, research and development, and human capital expenditures are predicted to boost economic growth. Furthermore, institutional elements such as sound governance may favourably influence how ESG affects long-term economic growth [141]. These results are consistent with recent studies by [6,23,30–32,141]. These studies also found a significant positive long-run relationship between ESG performance and economic growth in different countries, including BRICS. This is also consistent with evidence from the MINT and broader G20 group that also suggests that sustained investments in ESG-related initiatives, such as clean energy, institutional reform, and social inclusion, enhance long-run growth potential by improving resilience, reducing inequality, and fostering innovation [62,142]. These comparisons reinforce the conclusion that while ESG commitments may pose short-term trade-offs, particularly in resource-dependent economies, they are instrumental in achieving sustainable and inclusive growth over time.

The study also finds that the positive influence of CO_2 emissions on economic growth in BRICS countries might be attributed to increased industrial activities within these nations, often conducted without the adoption of environmentally friendly policies aimed at improving environmental quality. It is also important to note that the long-run CO_2 emissions coefficient is higher than that observed in the short-run PMG estimates. The environmental Kuznets curve (EKC) theory is not supported by the data. Narayan and Narayan [143] state that comparing the short- and long-term income elasticities can be used to evaluate the EKC. According to Narayan and Narayan, a nation should cut its CO_2 emissions as its revenue rises if the long-run estimate is lower than the short-run estimate [143]. The long-term positive effect of CO_2 emissions on economic growth within the context of the BRICS nations suggests that there is an urgent need to address environmental harm by lowering CO_2 emission levels, pollution, and the depletion of natural resources while maintaining GDP growth. Massive investments in green technologies could be part of this decoupling effect, changing their development paths. In order to reduce any potential negative long-term repercussions on economic growth, it is imperative that policy measures targeted at enhancing energy efficiency in the BRICS nations be steadily strengthened.

The findings also reveal that inflation (INFL) has a negative impact on GDP in BRICS countries at the 1% level of significance. According to the PMG estimates, a one-unit increase in the inflation rate corresponds to a 0.03% decrease in economic growth over the long term for BRICS nations. This underscores that high inflation disrupts economic stability and undermines the achievement of long-term development goals by reducing purchasing power, increasing the cost of living, and eroding the value of savings and investments [144]. Similar conclusions have been reached by other studies regarding the detrimental effect of inflation on economic growth [145–148]. According to [149], inflation has a disproportionate effect on lower socioeconomic groups, leading to a heightened pressure on natural resources for survival and diverting attention from sustainable resource management. Therefore, controlling inflationary pressures is imperative for BRICS countries to ensure the sustainability of economic development in the long term.

Trade openness (OPEN) was found to have a positive impact on GDP for BRICS countries at the 10% level of significance. The PMG calculations indicate that a one-unit rise in the trade-to-GDP ratio over the long term leads to a 0.013% boost in economic growth. This result is consistent with the well-established theory that open economies gain from chances for specialisation, economies of scale, and technology diffusion, all of which lead to increased production [150]. Similar findings have been made by other researchers [151–154]. Trade openness has a favourable impact on long-term economic growth. Therefore, the growth of BRICS countries can be attributed in part to their openness to international trade and engagement in the global market. Findings by Huchet and colleagues [155] suggest that countries exporting novel and higher-quality commodities experience faster economic expansion. The significance that trade in services plays in propelling economic growth in the BRICS nations is also highlighted by Burange and colleagues [153]. They specifically stress the growth-led trade in the services hypothesis for India and the export- and import-led growth hypothesis for China and South Africa. The significance of trade openness for economic growth underscores the importance of each BRICS country fostering an environment conducive to global trade as a means to promote sustainable development. Encouraging trade-friendly policies and initiatives can facilitate economic diversification, technology transfer, and productivity enhancement, ultimately contributing to sustained and inclusive growth across the BRICS nations.

6. Conclusions and Limitations

This study examined the impact of country-level ESG performance on economic growth among BRICS countries from 2000 to 2020. Examining ESG developments and economic growth in the BRICS countries revealed a concerted effort to enhance performance in response to climate change, social issues, and governance objectives. While progress has been made across all dimensions, the BRICS have demonstrated stronger performance in the social dimension compared to the environmental and governance aspects. This discrepancy is largely attributed to the alignment of social initiatives with national priorities within each country, highlighting the structural and developmental heterogeneity among BRICS economies.

These results validate the hypothesis that in the long term, ESG performance positively influences GDP growth in BRICS countries. This suggests that sustained ESG practices contribute to stable economic development by fostering sustainable investments, better social policies, and enhancing institutional trust. Therefore, initiatives focused on bolstering ESG standards can positively impact economic growth over extended periods, reflecting the importance of adopting a comprehensive approach that integrates environmental sustainability, social responsibility, and effective governance practices into policymaking and business strategies. This finding reflects the importance of the ESG drive, as it promotes sustainable development and the pursuit of high-quality growth in countries. Such endeavours indicate a holistic and forward-thinking strategy to promote sustainable development and foster resilient, inclusive economic growth. However, to better account for this heterogeneity, future studies should use models that incorporate structural breaks or long-term dynamics unique to each country.

The major limitation of the study is the availability of country-level ESG scores data on public platforms. This makes it difficult to compare whether the scores obtained from calculations based on the MSCI formula are within the common ranges from other data sources. In addition, the literature has it that ESG is still a greenfield area wherein acceptable indicators and methodologies are still being tested. Therefore, the formula adopted to come up with country-level ESG scores for the BRICS countries might still be subject to debate. Some countries do not have updated data on certain indicators that could have been used in calculating the ESG scores over the period considered. This implied that the scoring system was based primarily on indicators that had full data across the years under study for the BRICS countries. The other challenge was to ascertain all the necessary ESG-related policy initiatives being undertaken across all the BRICS countries, since this is still a current policy initiative with much work still needed within the public domain. This compromised the depth of the country-level analysis conducted in this study. Lastly, the long-term homogeneity assumed by the ARDL and PMG techniques may not adequately represent the structural and institutional differences among the BRICS nations. As a result, the stability and interpretation of long-term linkages may be impacted by the distinctions between more resource-dependent countries like South Africa, Brazil, and Russia, and big, diverse economies like China and India. These differences may limit the applicability of findings and highlight the need for caution when extrapolating conclusions regarding cross-national policy ramifications. Incorporating structural heterogeneity into the analysis could make future research more reliable.

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