

ERASMUS UNIVERSITY ROTTERDAM
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**From Sustainability to Growth:
The Role of Sovereign ESG Performance in Economic Development**

In this study, the relationship between sovereign Environmental, Social, and Governance (ESG) performance and economic growth is examined. The primary research question explores whether countries with higher sovereign ESG performance experience enhanced economic growth. To investigate this relationship, a dataset covering 136 countries and spanning from 1990 to 2020 was utilized. From this dataset, a comprehensive sovereign ESG index was constructed, comprising 40 sovereign ESG indicators. Through fixed effects and dynamic Arellano-Bond estimator analyses, the study found a positive relationship between the sovereign ESG performance and economic growth. However, the strength and significance of this relationship vary depending on the statistical models used, as well as the different time horizons and income groups analysed. Specifically, the fixed effects analyses revealed that the economic benefits of improved sovereign ESG performance were more pronounced in the short- and medium-term, and particularly among middle-income countries. The results underscore the importance of integrating sovereign ESG practices into policy frameworks, suggesting that investing in sovereign ESG performance can lead to both immediate and sustained economic benefits. This study contributes to literature by providing an extensive analysis of the relationship between sovereign ESG performance and economic growth across different timeframes and contexts.

Author:	S.K. Kreecke
Student number:	683412
Thesis supervisor:	Ruben de Blik
Second reader:	Sjoerd van den Hauwe
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1. Introduction

In recent years, ESG factors have become pivotal in the global financial landscape, significantly influencing investment decisions, corporate strategies, and regulatory frameworks. While the integration of these factors is extensively discussed within corporate contexts, the impact of sovereign ESG practices on broader economic dynamics remains a subject of growing interest and debate. Sovereign ESG performance reflects a nation's capacity to ensure the well-being of future generations by persevering the environment and fostering a broad array of social and governance objectives (Diaye et al., 2021). Addressing environmental challenges, social inequalities, and governance issues holds promise for generating positive externalities, such as long-term resilience and growth. Governments, which play a central role in setting regulatory frameworks, often pursue economic growth. Therefore, examining whether sovereign ESG practices positively influence economic growth can provide valuable insights for policymakers and governments. Furthermore, understanding this relationship can incentivize countries to enhance their sustainability efforts by informing governments about practices that might promote both economic prosperity and sustainability.

The precise nature and magnitude of the impact of sovereign ESG performance on economic growth are still topics of academic debate. As a relatively new area of study, research findings remain limited and varied. Diaye et al. (2021) examine the economic effect of sovereign ESG performance for 29 OECD countries over the 1996-2014 period. They found a positive long-term relationship between sovereign ESG and Gross Domestic Product (GDP) per capita. However, this relationship is not evident in the short run. Similarly, Ghazali et al. (2023) analyse sovereign ESG performance and its influence on economic growth, finding mixed effects. They utilized annual data from 1990 to 2020 for five countries. Some results indicated a positive correlation between sovereign ESG and economic growth, while others indicated no significant or even negative effects. Additionally, Ho et al. (2019) explored causality between sovereign ESG performance and economic growth across 118 countries from 1999-2015. Their study reveals bidirectional relationships between environmental and social performance and economic growth, with a unidirectional link from governance to economic growth. Not all literature supports the positive impact of sovereign ESG practices on economic growth. For instance, Schneider et al. (2010) argue that enhancing sovereign ESG practices may promote a downscaling in consumption and production, potentially contracting economic growth. Hence, the literature does not present a definitive consensus regarding the relationship between the two variables. This research seeks to address the existing gap in the literature by re-evaluating the link between sovereign ESG performance and economic growth. This study distinguishes itself by utilizing a current and comprehensive dataset. It covers a broad and current time span and contains a sovereign ESG index that consists of a detailed set of indicators. This thorough sovereign ESG index provides a more complete picture of sovereign ESG performance and therefore contributes valuable insights.

Furthermore, this study employs an approach that analyses both short-term and long-term effects of sovereign ESG performance, alongside variations across different income groups. Together, the comprehensive dataset and methodologies expand and deepen the knowledge base within the existing literature. This study aims to validate or challenge previous findings, thereby enhancing the credibility and robustness of knowledge in this field, addressing the research gap, and contributing to existing literature.

To identify the relationship between sovereign ESG performance and economic growth a sample of 136 countries for the 1990 - 2020 period is utilized. GDP per capita is selected as a proxy for economic growth and the explanatory variable is sovereign ESG performance. Due to the absence of a universal methodology to assess sovereign ESG performance, a sovereign ESG index is carefully constructed with the use of a comprehensive methodology. The sovereign ESG index is constructed using a broad dataset from the Sovereign ESG Data Portal of the World Bank and consists of 40 sovereign ESG indicators. This broad range of indicators allows for an accurate measure of sovereign ESG performance.

Furthermore, to gain a thorough understanding of the relationship between sovereign ESG performance and economic growth fixed effects and Arellano-Bond estimator analyses are employed. It is crucial to examine temporal impacts of sovereign ESG performance as the effects may manifest differently over various time horizons due to the varying durations required for the full realization of sovereign ESG practices. Additionally, the initial investments and immediate costs associated with implementing sovereign ESG practices may obscure their positive impacts on economic growth. The temporal analysis allows for an evaluation of the potential trade-offs and synergies between sovereign ESG practices and economic growth. This is essential for policymakers in crafting effective sovereign ESG strategies that address both immediate needs and future goals. Additionally, it is essential to consider the varying impact across different economic contexts. Namely, high-income countries typically have robust regulatory frameworks, ample financial resources, and advanced technological capabilities. This is likely to facilitate the effective integration of sovereign ESG practices. In contrast, low-income countries often lack these foundational elements, resulting in less effective sovereign ESG integration. This income-specific approach not only enriches the analysis by acknowledging economic diversity but could also guide policymakers and governments by creating tailored strategies that address the unique challenges and opportunities of different income groups. In total, this framework offers a comprehensive understanding of the relationship between sovereign ESG performance and economic growth across varying timespans and economic contexts.

It is hypothesized that higher levels of sovereign ESG performance positively correlate with economic growth. Countries with better sovereign ESG performance contribute to better resource management, social cohesion, and effective governance. Theoretical perspectives outlined in Chapter 2 suggest that this can lead to improved management of economic shocks, the correction of market inefficiencies, and foster a self-sustaining growth environment. Thereby creating an environment

which promotes economic expansion and long-term prosperity. This should be visible in the significant positive effect of the sovereign ESG index on GDP per capita. However, the relationship between sovereign ESG performance is complex and multifaceted. Trade-offs and synergies between different sovereign ESG indicators and economic growth may exist. Also, initial investments and costs and the manifestation time of sovereign ESG practices can create differences in short- and long-term impacts. Furthermore, the impact can vary depending on contextual factors such as income level.

In conclusion, this study aims to provide an in-depth understanding of the relationship between sovereign ESG performance and economic growth. By constructing a sovereign ESG index that contains a rich set of measuring items, this study provides a complete picture of sovereign ESG performance. Investigating short- and long-term as well as income-specific impacts of sovereign ESG performance will contribute to an in-depth understanding of the relationship between the two variables. The findings of this study show a positive relationship between sovereign ESG performance and GDP per capita. However, the strength and significance of this relationship vary depending on the statistical models used, as well as the different time horizons and income groups analyzed. The effects are particularly significant in the fixed effects analyses. With the economic benefits of improved sovereign ESG performance more pronounced in the short- and medium-term, and among middle-income countries. This provides valuable insights for policymakers and governments and offers them an incentive to contribute to sustainability while still pursuing their goals for economic growth.

The remainder of this paper is organized as follows: Chapter 2 provides the theoretical framework and lays the foundation for understanding the interplay between sovereign ESG performance and economic growth. Chapter 3 details the data used in this study, including the construction of the comprehensive ESG index and the selection of control variables. Chapter 4 describes the methodology employed, focusing on the econometric techniques used to analyse the data. Chapter 5 presents the results of the analyses and examines the effects of sovereign ESG performance on economic growth across different time horizons and income levels. Chapter 6 summarizes the key findings and discusses the findings in the context of the constructed hypotheses and existing literature. Finally, Chapter 7 concludes by highlighting the main points, identifying potential limitations of the study, emphasizing the key lessons and implications, and suggesting directions for future research.

2. Theoretical Framework

2.1. ESG Framework

The ESG framework comprises criteria that extend beyond traditional financial metrics to assess the financial performance, sustainability and societal impact of organizations. According to Li et al. (2021), the framework originates from responsible investment practices as defined by the Principles for Responsible Investment (PRI). PRI integrates the ESG framework into investment decisions, serving as a guide for evaluating sustainable development and as a standard for investors to assess corporate behaviour and future financial performance. ESG factors are fundamental considerations in investment analysis and decision-making processes as they embody a value of sustainable and coordinated development (Li et al., 2021). The environmental factor evaluates efforts to mitigate ecological footprints. The social factor focuses on interactions with various stakeholders, such as employees, customers, communities, and society at large. The governance factors assesses the effectiveness of leadership, structures, and policies in ensuring transparency, accountability, and ethical conduct (*What Is ESG?*, n.d.).

The ESG framework aims to capture additional dimensions not revealed in accounting data as it is argued that financial statements inadequately convey the value of reputation, quality, brand equity, safety, workplace culture, strategies, know-how, and numerous other assets (Bassen and Kovács, 2020). Initially, non-financial data like ESG disclosures were limited and primarily sourced from annual reports. However, growing stakeholder pressure is prompting organizations to provide real-time non-financial data (Tarmuji et al., 2016). This increase in the availability of non-financial data provides a comprehensive framework for assessing an organization's sustainability, resilience, and long-term viability.

The academic literature extensively discusses the significance of the ESG framework, demonstrating its impact and relevance in various contexts such as finance, corporate governance, and sustainability (Tarmuji et al., 2016). Organizations with strong ESG performance are often perceived as better positioned for long-term success, potentially attracting more investment capital. Indeed, Friede et al. (2015) find in their study on 2,200 individual ESG studies that roughly 90% of studies show a nonnegative relation between ESG and Corporate Financial Performance (CFP), suggesting a stable positive impact of ESG over time.

2.2. ESG and Corporate Financial Performance

A significant portion of extant research in the ESG domain concentrates on ESG's implications within corporate spheres. Generally, there is an anticipation of a positive relationship between ESG performance and Corporate Financial Performance (CFP). Empirical studies have

extensively investigated this relationship, yet its consistency remains a subject of ongoing debate among practitioners and academics.

Recent studies have placed considerable focus on the individual aspects of ESG performance. Most research examining the correlation between corporate environmental performance and CFP indicates a positive relationship. For instance, Feltham and Xie (1994) concluded that environmental controls can increase operational efficiency without increasing environmental management costs, thereby enhancing CFP. Similarly, Sharfman and Fernando (2008) found that enterprises' efforts to mitigate environmental risks can effectively lower their debt costs, resulting in improved CFP. However, contrasting findings also exist. Stanwick and Stanwick (1998), for example, noted a negative correlation between corporate environmental performance and CFP.

Whether corporate social responsibility enhances CFP is also widely discussed in research. Most findings indicate a positive correlation. Inoue and Lee (2011) categorized social performance into employee relations, community relations, and diversity, all of which exhibited a positive impact on CFP. Similarly, Maqbool and Zameer (2018) found a positive impact of social responsibility on the CFP of banks. However, studies like Lin et al. (2019) suggest that while firms with better CFP tend to engage more in social responsibility, improved social responsibility does not necessarily translate to better CFP. McWilliams and Siegel (2000) even argue that fulfilling social obligations could impede free market competition and reduce a company's investment in areas other than social responsibility, thereby negatively affecting CFP.

Furthermore, numerous studies have extensively explored the relationship between corporate governance performance and CFP. Holderness et al. (1999) found a correlation between a company's ownership structure and its CFP. Lefort and Urzúa (2008) discovered that companies with more independent boards tend to exhibit better CFP. Zhaka (2006) demonstrated a causal and positive relationship between corporate governance quality and firm performance. However, Mak and Kusnadi (2005) found little evidence of relationships between most corporate governance mechanisms and CFP, and Bauer et al. (2004) observed a negative relationship between governance performance and CFP.

While numerous studies showcase positive relationships between the separate ESG factors and CFP, researchers often still note ambiguity, inconclusiveness, or contradictions in the results. Therefore, academia and practitioners remain undecided regarding the overall ESG impact, including its measurement and durability. To obtain a more thorough understanding of the relationship, Friede et al. (2015) synthesized approximately 2,200 individual studies and found that roughly 90% of them reported a nonnegative relation between corporate ESG performance and CFP, with the majority indicating positive findings. Furthermore, they found the positive impact of corporate ESG on CFP to be stable over time, underscoring the robust empirical basis for the business case of ESG investing.

Theoretical explanations for how corporate ESG performance can impact financial performance include the theory of sustainable development, the resource-based theory, the theory of

information asymmetry, and stakeholder theory (Zhou et al., 2022). The theory of sustainable development suggests that companies committed to sustainable growth prioritize enhancing their corporate ESG performance. By investing in ESG practices, these companies improve their production efficiency and reduce firm risk thereby boosting their financial performance. The resource-based theory views corporate ESG performance as a crucial strategic resource that enhances operational outputs, efficiency and competitiveness. It strengthens a company's foundational capabilities, and thus improves financial performance. The theory of information asymmetry considers corporate ESG performance as a unique and difficult-to-imitate resource that meets public and societal expectations. By effectively managing and reporting on corporate ESG initiatives, companies can reduce information asymmetry between themselves and their stakeholders, increasing trust and reputation, which in turn can enhance operating income and profitability. Conversely, stakeholder theory explains negative correlations by arguing that companies may incur low-return costs to enhance their corporate ESG performance, potentially conflicting with profit-maximization goals of stakeholders and hindering financial performance.

2.3. Sovereign ESG Framework

While corporate ESG is well-discussed, sovereign ESG is a relatively new emerging area of research. Sovereign ESG assesses the sustainability and ethical performance of a country's government and its policies. It considers factors such as environmental protection, social equality, and governance practices on a country level. Like corporate ESG, sovereign ESG is increasingly integrated into value assessments of sovereign entities, complementing standard financial indicators. The metric is typically generated by analysing various indicators related to a country's performance in ESG areas. Over the past decade, the number of data providers has grown, each developing methodologies to provide sovereign ESG scores (Bouyé & Menville, 2020). However, there is currently no global standard for assessing sovereign ESG performance due to differences in the specific content of sovereign ESG frameworks and index calculation methods among different institutions (Capelle et al., 2019).

2.3.1. Environment Factor

The first component of the sovereign ESG framework is the environment factor. This factor evaluates a country's sustainability performance in terms of its natural resource endowment and management, and resilience to climate change and other natural hazards. It emphasizes the importance of internalizing environmental externalities from economic activities and considers factors such as access to sustainable energy and food security, which are essential for sustainability (*Sovereign ESG Data Portal*, n.d.). Key environmental indicators recognized by institutions like The World Bank

include emissions and pollution, energy use and security, climate risk and resilience, food security, and natural capital endowment and management.

These environmental themes significantly influence a country's economic trajectory. For instance, Paoli et al. (2010) demonstrates the interconnection between ecological sustainability and economic activities. Their study argues that the alarming rate of deforestation not only threatens biodiversity but also disrupts water cycles and soil stability, which are critical for agriculture and other economic activities. Focusing solely on economic gain without considering environmental impacts threatens biodiversity and ecosystems, potentially compromising long-term viability (Spears, 1985). Therefore, protecting biodiversity through initiatives like reducing deforestation is crucial for fostering a healthy economy (Aich et al., 2021). Furthermore, effective waste management and pollution control are governmental responsibilities. Addressing the challenge of increasing material turnover, as noted by Bernstein (1993), can promote sustainability and resource efficiency, thereby contributing to economic resilience (Brunner & Rechberger, 2015). For example, recycling and waste reduction initiatives can lower production costs and reduce the economic burden of landfills. Moreover, human activities such as burning fossil fuels contribute to rising greenhouse gas (GHG) concentrations. This accelerates global warming and threatens ecosystems (De Boer et al., 2011). Managing and reducing GHG emissions is critical for sustainability and maintaining a healthy economy (Aich et al., 2021).

2.3.2. Social Factor

The social factor, the second component of the sovereign ESG framework, evaluates a country's sustainability based on its ability to meet fundamental population needs, reduce poverty, manage social equity, and invest in human capital and productivity. It encompasses demographic criteria crucial for ensuring sustainability (Sovereign ESG Data Portal, n.d.). Various social themes recognized by institutions such as The World Bank include access to services, demography, education and skills, employment, health and nutrition, and poverty and inequality.

These themes significantly impact a country's economic trajectory. For instance, research by Bloemer and Odekerken-Schröder (2006) highlights the correlation between employee satisfaction and productivity. A happier workforce tends to be more productive and thus contributes positively to a company's reputation and attractiveness to investors (Tsui & Wu, 2005), which benefits the economy. Additionally, the quality of education and access to skills development are critical for building a competent workforce that can drive innovation. Furthermore, a healthy population is more productive and incurs lower healthcare costs, contributing to economic stability. Effective social policies that address education and health can reduce poverty and inequality, fostering a more inclusive economy (OECD, 2023)

2.3.3. Governance Factor

The governance factor, the third component of the ESG framework, evaluates a country's sustainability by assessing its institutional capacity to support long-term stability, growth, and poverty reduction. It encompasses the strength of political, financial, and legal systems, as well as a country's ability to address environmental and social risks (*Sovereign ESG Data Portal*, n.d.). Various governance themes acknowledged by institutions like The World Bank include economic environment, gender equality, government effectiveness, human rights, innovation, and stability and rule of law.

These themes significantly influence a country's economic trajectory. For example, good governance, as highlighted by Aich et al. (2021), plays a pivotal role in ensuring financial stability, minimizing corruption, and fulfilling societal needs, thereby creating an environment conducive to economic activity. Political stability and non-violence, government efficiency, adherence to laws, and corruption minimization are all essential components of good governance (Mengistu & Adhikary, 2011). Furthermore, adherence to human rights, as emphasized by Aich et al. (2021), enhances profitability and attracts investment. Adherent countries achieve better productivity and are more likely to achieve their objectives (Blanton & Blanton, 2007), thereby contributing to a healthy economy. Moreover, corporate policies and governance significantly influence investor decisions and shape the economic landscape (Sparkes & Cowton, 2004). Corporate policies determine the types of companies that can operate within a country and influence investor decisions based on the stringency or leniency of these policies. This, in turn, impacts the overall economy of the nation.

2.4. Sovereign ESG and Economic Performance

Given the positive relationship between corporate ESG performance and CFP, there is an expectation of a similar association between sovereign ESG performance and economic performance. Multiple studies have already indicated that different sovereign ESG indicators can impact the sustainability and, therefore, the economic trajectory of a country. Consequently, there is considerable academic interest in exploring the relationship between sovereign ESG performance and economic growth.

Numerous studies focus on the individual factors of sovereign ESG and their impact on economic growth. Research on sovereign environmental performance largely supports the perspective of a positive relationship between sovereign environmental performance and economic growth. For example, Jacobs (2013) argues for the long-term economic benefits of environmental protection and asserts that environmental policy can serve as a growth driver. His research identifies the contribution made to economic growth by investment in natural capital and the correction of various market failures via environmental policy. Moreover, studies on sovereign social performance and economic growth generally find a positive relationship between the two variables. Boozer et al. (2011), for

instance, demonstrate that social development directly impacts economic growth, with social development levels playing a crucial role in shaping growth paths. Policies aimed at enhancing social development are deemed essential for transitioning economies into virtuous cycles of growth. Regarding sovereign governance performance and economic growth, it is argued that efficient government institutions foster economic growth. Alam et al. (2017) find a positive effect of government effectiveness on economic growth. Their study emphasizes the role of effective governance in boosting market efficiency by enforcing property rights, thereby supporting the private sector to drive economic growth. Effective governance can also complement the private sector's role in economic growth by accelerating capital accumulation, directing resources to the right sectors, and assisting in the adoption and learning of new technologies to ensure productivity growth.

While the individual roles of sovereign ESG factors are widely acknowledged, empirical evidence does not consistently support their overall positive impact on economic growth. Some studies provide evidence that strong sovereign ESG performance promotes economic growth, while others do not. For instance, Diaye et al. (2021) employed panel regression models to analyze the economic impact of sovereign ESG performance across 29 OECD countries during the period from 1996 to 2014. By utilizing a set of 18 sovereign ESG indicators, their study revealed a positive long-term relationship between sovereign ESG performance and GDP per capita, although this relationship was not evident in the short term. Similarly, Ho et al. (2019) explored the causality between sovereign ESG performance and economic growth. Their study employed the Granger causality test, to examine the relationship between sovereign ESG performance and economic growth for 118 countries over the period 1999-2015. They focused on three main indicators: CO2 emissions, life expectancy at birth, and the control of corruption index, revealing bidirectional relationships between the variables. Moreover, Ghazali et al. (2023) analyse sovereign ESG performance and its influence on economic growth, finding mixed effects. Their study constructed the ESG index at the country level by employing frequency statistics of text mining and factor analysis for each country over time. They utilized annual data from 1990 to 2020 for five countries and applied the ARDL method to establish the relationship between sovereign ESG performance and economic growth. Some results indicated a positive correlation between sovereign ESG and economic growth, while others indicated no significant or even negative effects. The researchers attribute these findings to differences in sovereign ESG policies among countries.

The empirical evidence suggests that sovereign ESG performance may play a significant role in explaining variations in economic growth rates among countries. Several theories propose mechanisms through which sovereign ESG performance influences economic growth. The first theory, based on work by Capelle-Blancard et al. (2019), posits that effective sovereign ESG performance demonstrates a country's ability to manage output volatility and economic shocks. This theory suggests that a nation's natural and social resources, if managed well under a sovereign ESG framework, can serve as a buffer against economic downturns. This capacity to mitigate shocks not

only stabilizes the economy but can also drive growth by maintaining essential economic functions during crises. The second theoretical perspective, drawn from the work of Crifo & Forget (2015), focuses on the role of sovereign ESG practices in addressing market failures. This theory argues that incorporating sovereign ESG practices into macroeconomic policies, such as environmental taxation, antitrust measures, and regulatory reforms, helps correct market inefficiencies that traditional market operations fail to resolve. These policies are vital for long-term sustainability and economic growth. The third theory relates to the endogenous growth model. According to this model, as elaborated by Diaye et al. (2021), investments in sovereign ESG indicators such as knowledge, human capital, research and development, and infrastructure, expand the traditional concept of capital. By incorporating these sovereign ESG practices, such investments foster a growth environment that is self-sustaining and less reliant on external economic conditions. From these perspectives and theories, there are compelling reasons to believe that sovereign ESG performance can have positive effects on economic growth.

However, the relationship between the two variables is likely to not be straightforward. For instance, sovereign ESG practices manifests differently over short- and long-term periods (Diaye et al., 2021). Therefore, the effect of sovereign ESG performance on economic growth is likely to vary depending on the temporal scale. In the short-term, the impact of sovereign ESG performance is not immediately apparent due to the duration required for the full realization of sovereign ESG practices. Implementations and effects often involve a time lag. For example, policies aimed at reducing carbon emissions may take years to be fully implemented and to show their economic benefits. Additionally, the inherently long-term orientation of sovereign ESG practices contrasts with the more immediate costs of economic growth. Sovereign ESG practices often require initial investments and structural changes, which may not yield immediate economic benefits. Over the long-term, however, the benefits of sustained sovereign ESG practices become evident as impacts on economic growth materialize over extended periods. For instance, long-term investments in renewable energy infrastructure can lead to reduced energy costs and enhanced energy security, fostering economic growth.

Furthermore, the economic impact of sovereign ESG performance is likely to vary with a country's income level. High-income countries are typically more effective in harmonizing sovereign ESG practices with their economic growth. This effectiveness is attributed to the presence of necessary foundational elements such as robust regulatory frameworks, financial resources, and advanced technological capabilities. These elements facilitate the integration and positive interaction between sovereign ESG practices and economic growth. For example, countries like Germany and Sweden have successfully integrated sovereign ESG practices into their economic policies, leading to sustainable growth and higher standards of living. In contrast, low-income countries often lack these essential conditions. This absence results in a lack of synergy between sovereign ESG practices and economic growth, leading to less impactful or disconnected outcomes in these regions. For instance, many developing countries struggle with basic infrastructure and governance issues, which impede the

effective implementation of sovereign ESG practices. Additionally, these countries might prioritize immediate economic needs over long-term sustainability goals, influencing the relationship between sovereign ESG performance and economic growth. This phenomenon aligns with the Environmental Kuznets Curve, which suggests that environmental degradation initially increases with income but decreases after surpassing a certain economic threshold (Ho et al., 2019).

This paper expects to find a positive relationship between sovereign ESG performance and economic growth. Specifically, the following hypotheses are constructed:

Hypothesis I: Countries demonstrating high sovereign ESG performance will experience enhanced economic growth. This positive relationship is based on the assumption that higher sovereign ESG performance contributes to better resource management, social cohesion, and effective governance. Theoretical perspectives suggest that this can lead to better management of economic shocks, the correction of market inefficiencies, and the fostering of a self-sustaining growth environment. Consequently, a robust sovereign ESG framework is expected to foster economic growth.

Hypothesis II: The impact of sovereign ESG performance on economic growth will exhibit distinct characteristics over different time horizons. In the short-term, the impact of ESG is minimal due to the indirect and delayed effects of sovereign ESG practices and the initial costs associated with their implementation. Over the long-term, the benefits of sustained ESG practices become evident, leading to significant positive impacts on economic growth. This long-term impact is due to the time lag in policy implementation and the inherent long-term orientation of sovereign ESG practices.

Hypothesis III: The impact of sovereign ESG performance on economic growth will exhibit distinct characteristics for different income groups. High-income countries are hypothesized to possess the necessary regulatory, financial, and technological elements to effectively integrate sovereign ESG practices into their policies, thereby enhancing their economic performance. In low-income countries, the expected benefits of sovereign ESG performance may be less pronounced due to the lack of these foundational elements and the prioritization of immediate economic needs. This could lead to weaker and less consistent impacts on economic growth.

3. Data

3.1. Sample

This study aims to identify the relationship between sovereign ESG performance and economic growth using data from the World Bank. For data on sovereign ESG performance, the World Bank's Sovereign ESG Database is utilized. The World Bank has developed an extensive framework for sovereign ESG and provides a comprehensive set of observational panel data for 194 countries from 1960 to 2020. This database is selected because it allows for an extensive analysis due to its broad coverage and systematic approach to quantifying sovereign ESG indicators. The database encompasses 3 categories: environmental, social and governance, and addresses 17 core sustainability themes which consist of 71 indicators. In the database, some countries, indicators and years exhibit substantial missing data. After considering the significance and availability of the data on these countries, indicators, and years, those with significant data gaps are removed to ensure the robustness and reliability of the results. Ultimately, a sovereign ESG framework is established that comprises 136 countries, 40 indicators and spans from 1990 to 2020. The specific countries, themes, and indicators are detailed in Appendix A and Appendix B.

3.2. Main Variables

The relationship between sovereign ESG performance and economic growth is explored with the use of two primary variables: GDP per capita and a sovereign ESG index. These variables serve as the key indicators to analyze the impact of sovereign ESG practices on economic growth.

3.2.1. Economic Growth

For economic growth data, this study employs annual GDP per capita (constant 2015 US\$) figures. GDP per capita is defined as the gross domestic product divided by the midyear population. It reflects the average economic output per person and provides a clear picture of the economic performance of a country. Using this variable is in line with customary practice in the field of economics. It is widely used in economic research due to its ability to capture the overall economic health and standard of living within a nation. Using constant 2015 US dollars allows for comparisons across countries and over time. The data for this variable is sourced from the World Development Indicators DataBank from The World Bank.

3.2.2. Sovereign ESG Performance

To measure sovereign ESG performance a sovereign ESG index is constructed. This comprehensive index aggregates 40 different indicators from the World Bank's Sovereign ESG Database, ensuring a balanced representation of each sovereign ESG factor. The inclusion of such a wide array of sustainability practices and social and governance measures makes the index highly

comprehensive and reliable and provides a robust and in-depth measure for sovereign ESG performance. The process of constructing the sovereign ESG index involves harmonizing and integrating the diverse range of indicators. This will be done according to three primary steps: normalization, weighting, and index calculation.

Normalization is necessary to make the different indicators comparable. The Min-Max normalization technique is employed. This technique scales each indicator to a range between 0 and 1, thereby ensuring that all indicators, despite their varying units and magnitudes, can be aggregated. First, indicators are subjectively categorized into positive and negative groups based on their impact on sovereign ESG performance. After this, positive indicators, where higher values represent more favorable outcomes (such as renewable energy consumption or literacy rates), are normalized using the formula:

$$P_{i,j,t} = \frac{x_{i,j,t} - x_{min,i,j,t}}{x_{max,i,j,t} - x_{min,i,j,t}}$$

Where $P_{i,j,t}$ is the normalized value for indicator i , country j , and year t

Negative indicators, where lower values indicate more favorable outcomes (such as CO2 emissions or unemployment rates), are normalized by:

$$P_{i,j,t} = \frac{x_{min,i,j,t} - x_{i,j,t}}{x_{min,i,j,t} - x_{max,i,j,t}}$$

This ensures that a lower actual value yields a higher normalized score, reflecting a positive impact on sovereign ESG performance. Lastly, a minimal bias is incorporated into the normalization process to prevent potential issues arising from zero values, ensuring all normalized scores fall within the [0,1] range.

After normalization, each indicator is assigned a weight. To calculate these weights, Principal Component Analysis (PCA) is performed on the dataset. Although PCA is used for weighting, the normalization step ensures that all indicators are on the same scale, preventing variables with larger magnitudes from dominating the principal components. PCA is a statistical method that transforms a set of correlated variables into uncorrelated principal components. These principal components capture the maximum variance in the data, providing a basis for determining the importance of each indicator. The weighting process involves several steps to ensure that the weights reflect the importance of each indicator as determined by the PCA. First, the loadings, which represent the correlation between the original indicators and the principal components, are squared to determine the contribution of each indicator:

$$Squared\ Loading_{i,p} = (Loading_{i,p})^2$$

Next, to account for the importance of each principal component, the squared loadings are multiplied by the explained variance of the corresponding principal component. This step emphasizes the principal components that capture more variance in the data:

$$Weighted\ Squared\ Loading_{i,p} = Squared\ Loading_{i,p} \times Explained\ Variance_p$$

Finally, the weighted squared loadings for each indicator are summed across all principal components to obtain a total contribution score for each indicator. These scores are then normalized so that the sum of all weights equals 1. This process ensures that each indicator's weight is proportionate to its overall contribution to the variance in the dataset.

$$Weight_i = \frac{\sum_i Weighted\ Squared\ Loading_i}{\sum_{i,p} Weighted\ Squared\ Loading_{i,p}}$$

The final weights are used to aggregate the normalized values of the indicators into the sovereign ESG index for each country and year.

$$ESG_{j,t} = \sum_j Weight_i P_{i,j,t}$$

This formula integrates the indicator values into a single index, reflecting the country's overall performance across sovereign ESG factors. The mean sovereign ESG performance per country are shown in Appendix A and the weights for each indicator are detailed in Appendix B.

In conclusion, the use of GDP per capita and the sovereign ESG index as primary variables provides a reliable approach to understanding the relationship between sovereign ESG performance and economic growth. By employing a well-established economic metric like GDP per capita alongside a robust and extensive sovereign ESG index constructed from 40 diverse indicators, a thorough analysis can be conducted. The detailed normalization and weighting processes involved in creating the sovereign ESG index further enhances its reliability and comparability across different countries. Therefore, these variables can offer insights into how sovereign ESG performance influences economic growth.

3.3. Control Variables

To ensure an extensive understanding of the relationship between sovereign ESG performance and economic growth, control variables are utilized in the analysis. Using control variables aims to isolate the effect of the sovereign ESG index by accounting for other factors that influence economic growth. Common control variables in the literature on economic growth include human capital, physical capital, government expenditure, technological innovation, and institutional quality. However, given that the sovereign ESG index encompasses a wide range of indicators, many of these variables are already included in the index. It is crucial to select control variables that do not overlap with the sovereign ESG indicators. Therefore, the chosen control variables focus on economic and financial aspects and are thus clearly distinct from the sovereign ESG index. The data for the control variables are sourced from the World Development Indicators DataBank from The World Bank.

3.3.1. Inflation

Inflation measures the rate at which the general level of prices for goods and services is rising. It is a fundamental macroeconomic indicator that impacts consumer spending, business investment,

and overall economic stability. By including Inflation, the effects of price level changes on economic growth can be controlled for. Inflation is a macroeconomic variable that does not directly relate to the sovereign ESG factors and is therefore not already included in the sovereign ESG index. The inflation rate is measured by consumer prices (annual %).

3.3.2. Interest Rate

Interest Rate reflects the cost of borrowing money in the economy. Lower interest rates can stimulate investment and consumption, while higher rates can restrain economic activities. This control variable helps isolate the effect of borrowing costs on GDP per capita. Interest Rates is a macroeconomic tool used to manage the economy and is thus not directly covered by the metrics in the sovereign ESG index. It is measured as the real interest rate (%).

3.3.3. Investment

Investment represents the total value of a country's investment in physical assets such as infrastructure, machinery, and buildings. This variable captures the impact of investment levels on economic growth, reflecting the capacity for economic development and expansion. By including Investment, the analysis can account for the influence of capital accumulation on GDP per capita. Investment is an economic measure that is not directly incorporated in the sovereign ESG. This variable is measured by gross fixed capital formation (constant 2015 US\$).

3.3.4. Trade

Trade includes the exports and imports of goods and services. Trade can lead to greater economic growth by providing access to larger markets and diverse resources. Controlling for Trade ensures that the analysis accounts for the influence of international economic integration on GDP per capita. The ESG index does not directly measure trade volumes or trade policies, making trade a distinct and necessary control variable. Trade is measured as the sum of exports and imports of goods and services (constant 2015 US\$).

By carefully selecting these control variables, the analysis aims to account for various economic factors. These control variables are distinct from the sovereign ESG indicators, this ensures that the analysis remains focused and avoids redundancy.

3.4. Imputation and Transformation

Ensuring the completeness and reliability of the data is crucial for a robust analysis. For the sovereign ESG index, the dataset initially contains missing values across various countries, indicators and years. To address this issue, a comprehensive imputation strategy is employed that comprises multiple steps to fill these gaps effectively. Linear interpolation is the first method applied to estimate the missing values. This method is suitable for time series data, as it assumes that the missing value lie

on a straight line between two known values. The data is grouped by country and indicator to ensure that the interpolation is performed within each country and indicator's time series. To address any remaining gaps after linear interpolation, forward and backward filling methods are employed. These methods are also performed by grouping the data by country and indicator, ensuring that the imputation is contextually appropriate. The other variables also exhibit missing values across various countries and years. To address this, linear interpolation and forward-backward filling methods are employed to account for temporal patterns in the data, this is done grouped by country. Any remaining gaps are then filled using overall mean values, which is calculated grouped by year. This last approach is necessary because the remaining missing values are due to a complete lack of data for certain countries on specific variables.

After imputation, to address the issue of multicollinearity between variables, Investment and Trade are combined. Additionally, logarithmic transformations are applied to GDP per capita and Investment and Trade. The log transformation helps to stabilize the variance and normalize the distribution of these variables. This facilitates a more accurate and linear relationship. This transformation is useful in managing heteroscedasticity and reduces multicollinearity among the variables. This allows for more accurate comparisons across countries and over time.

To ensure that the variables in the regression model are on a common scale, particularly given the different units and scales of measurements for inflation and interest rates, the variables are standardized using z-scores. This involves transforming the data so that each variable has a mean of 0 and a standard deviation of 1. The decision to standardize the variables is mainly made to address multicollinearity and to facilitate a clearer interpretation of the regression coefficients.

These steps ensure that the dataset is robust and comprehensive. Addressing missing values, normalizing data, and standardizing variables facilitates accurate exploration of how sovereign ESG performance impacts economic growth.

3.5. Descriptive statistics

Table 1 and Table 2 provide the descriptive statistics for GDP per capita, the sovereign ESG index, and the control variables. The tables summarize the number of observations, means, standard deviations, and minimum and maximum values for each variable before imputation and standardization.

Variable	Obs	Mean	Std. Dev.	Min	Max
GDP per Capita	4117	8.413	1.539	5.112	11.630
ESG Index	4216	0.412	0.074	0.241	0.628

Table 1. Descriptive Statistics log GDP per Capita and Sovereign ESG Index

The mean log GDP per capita across the sample is 8.413 with a standard deviation of 1.539. The minimum log GDP per capita recorded is 5.112, approximately \$165.27 in original scale, while the maximum is 11.630, approximately \$112,407.85 in original scale. This reflects a wide economic disparity among the countries in the sample. The mean sovereign ESG index is 0.412 with a standard deviation of 0.074. The sovereign ESG index ranges from 0.241 to 0.628. Therefore, there is moderate variation in sovereign ESG performance across the countries.

Variable	Obs	Mean	Std. Dev.	Min	Max
Inflation	3877	24.034	216.952	-11.686	7481.664
Interest Rate	2478	6.683	13.114	-97.693	93.915
Investment	3256	23.414	2.115	15.175	29.169
Trade	3331	24.457	2.053	18.601	29.351
Investment Trade	3252	24.823	2.056	19.164	29.930

Table 2. Descriptive Statistics Control Variables

The descriptive statistics for the control variables reveal that Inflation has a mean of 24.034% with a high standard deviation of 216.952%. This indicates extreme variability in the dataset. The extreme values are primarily due to specific countries experiencing hyperinflation. For instance, Peru recorded an inflation rate of 7481.664% in 1990 due to severe economic mismanagement, external debt, and political instability, which led to the collapse of its currency. Similarly, Ukraine experienced an inflation rate of 4734.914% in 1993 following the dissolution of the Soviet Union, leading to economic chaos and hyperinflation.

Interest rate has a mean of 6.683% with a standard deviation of 13.114%, ranging from -97.693% to 93.915%, which includes some extreme values. These extreme values are mainly due to countries experiencing very high or very low interest rates. For example, Uruguay experienced an interest rate of 93.915% in 2002 as a measure to combat severe inflation and stabilize the currency

during its economic crisis. Another notable example is Brazil, which faced interest rates as high as 77.617% in 1990 due to hyperinflation and efforts by the central bank to control the economic situation. On the other end of the spectrum, Nicaragua had an extreme negative interest rate of -97.693% in 1988, resulting from an economic strategy aimed at reversing hyperinflation and encouraging investment during a period of severe economic distress.

Log Investment shows a mean of 23.414 with a standard deviation of 2.115. The minimum Log Investment recorded is 15.175, approximately -\$38.73 million in original scale, while the maximum is 29.169, approximately \$4.656 trillion in original scale. This, again, indicates significant variability in investment levels across countries. For instance, China recorded a Log Investment value of 29.169 in 2019, reflecting substantial investments in infrastructure and industrial capacity. Conversely, Sierra Leone had a Log Investment value of 15.175 in 1999, indicating very low levels of investment likely due to political instability and economic challenges during that period.

Log Trade shows a mean of 24.457 with a standard deviation of 2.053. The minimum Log Trade recorded is 18.601, approximately \$119.72 million in original scale, while the maximum is 29.351, approximately \$5.582 trillion in original scale. Therefore, also indicating high variability in trade volumes across the countries. The United States recorded a Log Trade value of 29.351 in 2019, reflecting its extensive international trade activities. On the other end, Burundi had a Log Trade value of 18.601 in 1993, likely due to its landlocked geography, limited industrial base, and political instability.

Log Investment Trade has a mean of 24.823 with a standard deviation of 2.056. The minimum Log Investment Trade recorded is 19.164, approximately \$210.37 million in original scale, while the maximum is 29.930, approximately \$9.962 trillion in original scale. This variable reflects the overall economic activity related to both investment and trade

In summary, the descriptive statistics indicate substantial variation across all variables, highlighting the diverse economic conditions and sovereign ESG performances of countries within the sample.

4. Method

The methodology employed in this study is designed to rigorously analyze the impact of sovereign ESG performance on economic growth. In the first part of the analysis fixed effects regressions are estimated to assess the impact of sovereign ESG performance in general, temporal, and income-specific analyses. The fixed effects model is chosen for its ability to control for unobserved heterogeneity, ensuring that the estimated effects of sovereign ESG performance are not biased by time-invariant country-specific characteristics. These unobserved characteristics can include cultural factors, geographical location, and other country-specific variables that do not change over the period of study. To confirm the appropriateness of a fixed effects model over a random effects model, a Hausman test is conducted. For the fixed effects model to be valid, it is crucial that the null hypothesis of no systematic difference in coefficients is rejected.

While the fixed effects analyses provide insights into the general, temporal, and income effects of sovereign ESG performance on economic growth, they do not fully address endogeneity and serial correlation issues. Therefore, the Arellano-Bond estimator is utilized to ensure the validity of the relationship between sovereign ESG performance while addressing potential data issues. Endogeneity issues are particularly relevant in this study due to the possibility that past values of GDP per capita and sovereign ESG performance may influence current values, creating feedback loops and persistence in economic outcomes. Additionally, the sovereign ESG index itself may be influenced by past economic performance, which necessitates addressing endogeneity to avoid biased estimates. Therefore, to tackle these concerns, a dynamic panel data model is employed using the Arellano-Bond estimator. To ensure the robustness of the Arellano-Bond model, a diagnostic test is performed. The Arellano-Bond test for serial correlation is used to test for the absence of second-order serial correlation in the first-differenced residuals. While the presence of first-order autocorrelation is expected, it is crucial for the validity of the instruments that there is no second-order autocorrelation. In total, this methodology provides a comprehensive understanding of the influence of the sovereign ESG index on GDP per capita.

4.1. General Analysis

The general analysis evaluates the overall impact of sovereign ESG performance on economic growth using fixed effects regression models.

4.1.1. Primary Analysis

To establish a baseline relationship, the impact of sovereign ESG performance on GDP per capita is estimated without control variables. This initial analysis helps to understand the general impact of the sovereign ESG index on GDP per Capita. The primary model is detailed as follows:

$$GDP_{j,t} = \alpha_j + \beta_1 ESG_{j,t} + \epsilon_{j,t}$$

Where, $GDP_{j,t}$ is log GDP per capita for country j at time t , $ESG_{j,t}$ represent the sovereign ESG index, α_j represent country-specific effects, and $\epsilon_{j,t}$ is the error term.

4.1.2. Extended Analysis

To provide a more robust understanding of the relationship between the sovereign ESG Index and GDP per capita, several control variables are incorporated into the fixed effects model. These control variables include inflation, interest rate, and investment and trade. Including these controls helps in isolating the effect of the sovereign ESG index by accounting for other factors that influence GDP per capita. The extended model is presented by:

$$GDP_{j,t} = \alpha_j + \beta_1 ESG_{j,t} + \beta_2 \mathbf{Control\ Variables}_{j,t} + \epsilon_{j,t}$$

Where $\mathbf{Control\ Variables}_{j,t}$ represents Inflation, Interest Rate, and log Investment and Trade.

4.2. Temporal Analysis

The temporal analysis distinguishes between short-term and long-term effects of sovereign ESG performance on economic growth using fixed effects regression models. This approach is essential because the impacts of sovereign ESG practices may vary significantly over different time horizons due to the time lag of the realization of the full effects of the practices and due to initial investments and costs. Therefore, to comprehensively understand the relationship, the influence of sovereign ESG performance on GDP per capita is examined across both short-term and long-term periods. The inclusion of lagged variables, moving averages, and cumulative sums in the model will provide a holistic view of how sovereign ESG performance influences GDP per capita across different temporal scales.

4.2.1. Short-Term Analysis

For the short-term analysis, a one-year lagged sovereign ESG index is used. The lagged model helps to understand how slightly delayed sovereign ESG performance influences current economic growth. The model is specified as:

$$GDP_{j,t} = \alpha_j + \beta_1 ESG_{j,t-1} + \beta_2 \mathbf{Control\ Variables}_{j,t} + \epsilon_{j,t}$$

Where $ESG_{j,t-1}$ is the 1-year lagged sovereign ESG index.

By incorporating the lagged ESG index, the impact of sovereign ESG performance from the previous year is captured. This allows to estimate short-term influences.

4.2.2. Long-Term Analysis

For the long-term analysis, moving averages and cumulative sums of the sovereign ESG index are utilized over different time horizons (3, 5, 7, and 10 years). These periods are chosen to reflect different stages of policy implementation and economic cycles. Shorter periods, such as 3 years, reflect more medium-term policy outcomes, whereas longer periods, like 10 years, reveal sustained

impacts and the full realization of long-term sovereign ESG practices. Analyzing the coefficients for moving averages and cumulative sums together provides a comprehensive understanding of the long-term impact of sovereign ESG performance. The moving average coefficients smooth out short-term fluctuations and reveal the underlying trend. This approach helps in understanding the steady and consistent average influence of sovereign ESG performance on economic growth. In contrast, the cumulative sum coefficients reveal the impact of sustained aggregated sovereign ESG practices over multiple years. This emphasizes the total influence of these practices over the long term. This dual analysis is useful because the moving averages can show how regular, ongoing sovereign ESG practices contribute to economic growth, while the cumulative sums can illustrate the compounded benefits of these practices over longer periods.

The moving average model captures the annualized average effect of sovereign ESG performance over a specified period. The formula for the moving average is:

$$ESG MA_{j,t} = \frac{1}{k} \sum_{i=1}^k ESG_{j,t-i}$$

Where $ESG MA_{j,t}$ is the moving average of the sovereign ESG index over k years, and $ESG_{j,t-i}$ represents the lagged values of the sovereign ESG index. The moving average model is then represented as follows:

$$GDP_{j,t} = \alpha_j + \beta_1 ESG MA_{j,t} + \beta_2 \mathbf{Control Variables}_{j,t} + \epsilon_{j,t}$$

The cumulative sum model emphasizes the total accumulated sovereign ESG performance over a specified period. The formula for the cumulative sum is:

$$ESG CS_{j,t} = \sum_{i=1}^k ESG_{j,t-i}$$

Where $ESG CS_{j,t}$ is the cumulative sum of the sovereign ESG index over k years, and $ESG_{j,t-i}$ represents the lagged values of the sovereign ESG index. The cumulative model is then specified as follows:

$$GDP_{j,t} = \alpha_j + \beta_1 ESG CS_{j,t} + \beta_2 \mathbf{Control Variables}_{j,t} + \epsilon_{j,t}$$

By distinguishing between short-term and long-term effects using lagged models, moving averages, and cumulative sums, the temporal analysis methodology provides a detailed understanding of how sovereign ESG practices influence economic growth over different time horizons. This approach accounts for the initial investments and costs and time lags associated with the implementation of sovereign ESG practices, allowing for an evaluation of the potential trade-offs and synergies between sovereign ESG practices and economic growth. The analysis offers insights into both the short-, medium-term and sustained impacts on economic growth.

4.3. Income Analysis

Although the general and temporal analyses provide a broad understanding of the relationship between sovereign ESG performance and economic growth, they do not account for variations across different economic contexts. To address this, the relationship is further explored by categorizing countries into different income groups based on the World Bank's classification of high-, middle-, and low-income countries. This allows to discern whether income levels influence the relationship between sovereign ESG performance and economic growth. Fixed effects regression models are applied to each group separately:

$$GDP_{g,t} = \alpha_g + \beta_1 ESG_{g,t} + \beta_2 \mathbf{Control\ Variables}_{g,t} + \epsilon_{g,t}$$

Comparing the results of each income group reveals whether the impact of sovereign ESG performance varies with income levels, offering an understanding across different economic contexts.

4.4. Dynamic Analysis

To further confirm the relationship between sovereign ESG performance and economic growth, a dynamic panel data model is employed utilizing the Arellano-Bond estimator. This estimator is specifically designed to handle situations where there may be endogeneity in the variables, such as for GDP per capita and the ESG index, and where there may be serial correlation in the error terms. The Arellano-Bond estimator uses lagged levels of the endogenous variables GDP per capita and the sovereign ESG index as instruments for the differenced equation. The contemporaneous control variables are included in the model but are assumed to be exogenous for the purposes of this analysis, acknowledging that this assumption is an empirical consideration. By utilizing lagged levels of GDP per capita and the sovereign ESG as instruments, this method provides a more robust analysis of the dynamic relationship between sovereign ESG performance and economic growth. The model specification is as follows:

$$\Delta GDP_{j,t} = \alpha \Delta GDP_{j,t-1} + \beta_1 \Delta ESG_{j,t-1} + \beta_2 \Delta ESG_{j,t} + \beta_3 \mathbf{Control\ Variables}_{j,t} + \Delta \epsilon_{j,t}$$

Where $GDP_{j,t-1}$ is the 1-year lagged log GDP per capita.

The dynamic analysis helps in understanding how current and short-term values of sovereign ESG performance influence current economic growth. The inclusion of lagged GDP per capita allows for the persistence in economic growth to be accounted for, providing a comprehensive view of the dynamics involved. This dynamic approach enhances the analysis by addressing endogeneity issues. By using this estimator, the dynamic nature of the data is more appropriately captured and the estimated effects of sovereign ESG performance are more reliable.

5. Results

5.1. Preliminary Analysis

The preliminary analysis aims to provide an initial understanding of the relationship between the sovereign ESG index and GDP per capita. The correlation coefficient is strong and positive, $r(4216) = 0.754$, $p < .001$, indicating that higher sovereign ESG performance is associated with higher GDP per capita.

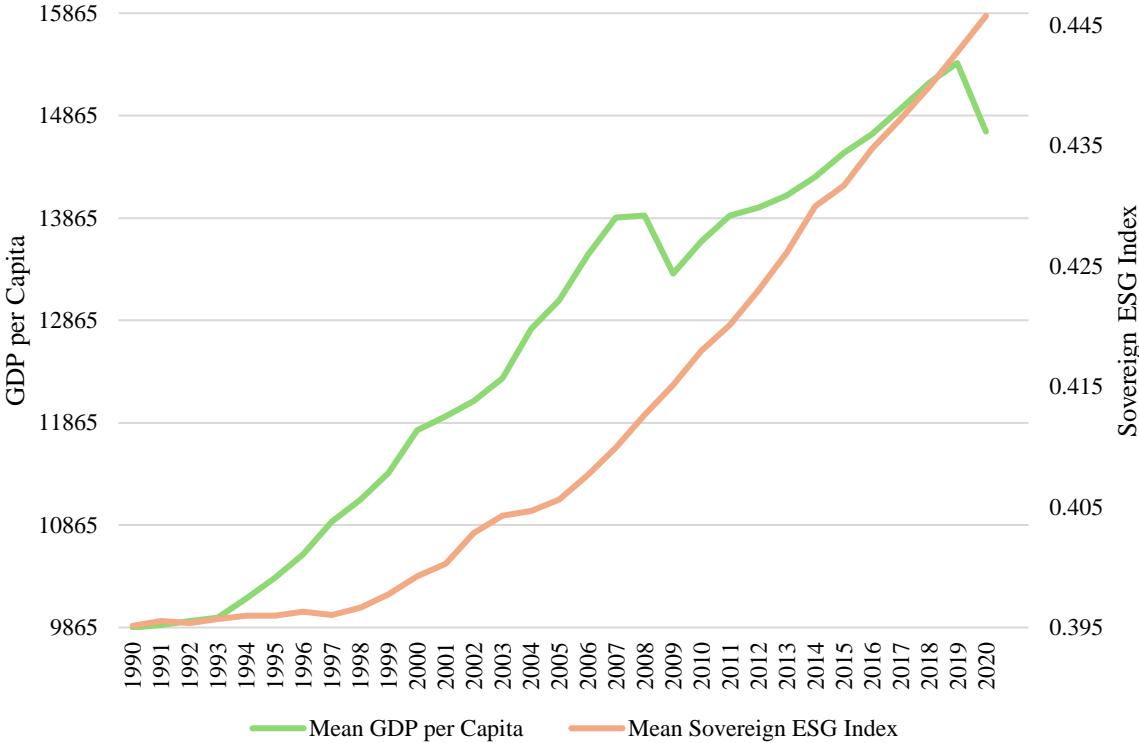


Figure 1. Mean GDP per Capita and Mean Sovereign ESG Score Over Time

Figure 1 provides a visual overview of how GDP per capita and the Sovereign ESG Index have trended from 1990 to 2020. The mean GDP per capita shows a general upward trend, reflecting economic growth over the years. Similarly, the mean sovereign ESG index also shows an increasing trend, suggesting improvements in sovereign ESG performance over time. This observation indicates that both sovereign ESG performance and economic growth have been improving.

These preliminary analyses provide an initial indication of a positive relationship between the sovereign ESG index and GDP per capita. The strong positive correlation and upward trends in means over time suggest that countries with better sovereign ESG performance tend to have enhanced economic growth.

5.2. General Analysis

The general analysis delves into the fixed effects regression results to quantify the impact of sovereign ESG performance on GDP per capita. First, the results of the Hausman test confirm the appropriateness of a fixed effects model over a random effects model with a significant chi-square statistic ($\chi^2 = 197.28$, $p = 0.000$), indicating systematic differences in coefficients.

	(Primary) GDP per Capita	(Extended) GDP per Capita
ESG Index	0.529*** (12.18)	0.225*** (3.77)
Inflation		0.00101 (0.09)
Interest Rate		0.00236 (0.21)
Investment and Trade		0.660*** (9.31)
Constant	8.405*** (9.10×10^{10})	8.405*** (8.13×10^{10})
R-squared	0.299	0.491
F-test	1743.639	94.972
Prob > F	0.000	0.000
N	4216	4216

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3. General Fixed Effects Regression Results

Table 3 present the general fixed effects regression results. The primary regression shows a significant positive relationship between the sovereign ESG index and GDP per capita, with a coefficient of 0.529 ($p < 0.001$). This suggests that an increase in the ESG index by 0.01 corresponds to an approximate 7.142% increase in GDP per capita. This model explains approximately 29.9% of the variation in GDP per capita (R-squared = 0.299), and the overall model is statistically significant (F-test = 1,743.639, $p < 0.001$).

The extended regression results also show a significant positive relationship between the sovereign ESG index and GDP per capita, with a coefficient of 0.225 ($p < 0.001$). The coefficient for the sovereign ESG index is reduced but remains significant. Concretely, an increase in the ESG index by 0.01 corresponds to an approximate 3.036% increase in GDP per capita. This suggests that while sovereign ESG performance has a direct positive impact on GDP per capita, other factors such as investment and trade also play crucial roles in driving economic growth. In this model, Inflation and

Interest Rate are not significant. The insignificance of these variables may imply that their effects are either minimal in this context, or adequately controlled for by the fixed effects model. Investment and Trade is a significant positive determinant of GDP per capita with a coefficient of 0.66 ($p < 0.001$). This model explains approximately 49.1% of the variation in GDP per capita ($R\text{-squared} = 0.491$), and the overall model is statistically significant ($F\text{-test} = 94.972$, $p < 0.001$). The inclusion of control variables improves the explanatory power of the model, as indicated by the higher $R\text{-squared}$ value.

In conclusion, the general analysis confirms that sovereign ESG performance has a significant and positive impact on economic growth, even when accounting for other economic factors.

5.3. Temporal Analysis

The temporal analysis investigates the short- and long-term influence of sovereign ESG performance on economic growth with the use of fixed effects regression models.

	(ST)	(MA3)	(MA5)	(MA7)	(MA10)	(CS3)	(CS5)	(CS7)	(CS10)
	GDP per Capita	GDP per Capita	GDP per Capita	GDP per Capita	GDP per Capita	GDP per Capita	GDP per Capita	GDP per Capita	GDP per Capita
Lagged ESG	0.218*** (3.64)								
ESG MA3		0.221*** (3.61)							
ESG MA5			0.215*** (3.76)						
ESG MA7				0.211*** (4.10)					
ESG MA10					0.189*** (4.09)				
ESG CS3						0.0738*** (3.61)			
ESG CS5							0.0431*** (3.76)		
ESG CS7								0.0302*** (4.10)	
ESG CS10									0.0189*** (4.09)
Inflation	0.00188 (0.16)	0.00223 (0.21)	-0.0628 (-1.90)	-0.169 (-0.63)	-0.0229 (-0.12)	0.00223 (0.21)	-0.0628 (-1.90)	-0.169 (-0.63)	-0.0229 (-0.12)
Interest Rate	0.00332 (0.28)	0.00238 (0.18)	-0.0120 (-0.86)	-0.0120 (-0.80)	-0.00489 (-0.41)	0.00238 (0.18)	0.0120 (-0.86)	-0.0120 (-0.80)	-0.00489 (-0.41)
Investment and Trade	0.680*** (9.73)	0.695*** (9.83)	0.698*** (9.84)	0.694*** (10.74)	0.722*** (13.43)	0.695*** (9.83)	0.698*** (9.84)	0.694*** (10.74)	0.722*** (13.43)
Constant	8.411*** (5689.33)	8.418*** (2552.49)	8.424*** (1594.27)	8.426*** (406.07)	8.447*** (513.21)	8.418*** (2552.49)	8.424*** (1594.27)	8.426*** (406.07)	8.447*** (513.21)
R-squared	0.497	0.5147	0.5321	0.5485	0.5583	0.5147	0.5321	0.5485	0.5583
F-test	92.394	85.61	68.65	66.76	78.00	85.61	68.65	66.76	78.00
Prob > F	0.000	0.000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000
N	4080	3808	3536	3264	2856	3808	3536	3264	2856

t statistics in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Table 4. Temporal Fixed Effects Regression Results

Table 4 presents the temporal fixed effects regression results. For the short-term regression, the coefficient for the one-year lagged sovereign ESG index is 0.218 ($p < 0.001$). This significant coefficient indicates that improvements in sovereign ESG performance from the previous year contribute to increased GDP per capita in the current year. Concretely, an increase in the lagged sovereign ESG index by 0.01 corresponds to an approximate 2.943% increase in GDP per capita. In

this model, Inflation and Interest Rate are not significant, implying that their immediate effects on GDP per capita are negligible or adequately captured by the fixed effects. Investment and Trade are significant positive determinants of GDP per capita, with a coefficient of 0.68 ($p < 0.001$), underscoring the critical role of investment and trade in driving economic growth. The model explains approximately 49.7% of the variation in GDP per capita ($R\text{-squared} = 0.497$), indicating a robust fit. The overall model is statistically significant ($F\text{-test} = 92.394$, $p < 0.001$).

Table 4 also presents the long-term fixed effects regression results, highlighting the impact of sovereign ESG performance on GDP per capita over different periods: 3, 5, 7, and 10 years. The long-term moving average results are first presented. The 3-year moving average of the sovereign ESG index has a coefficient of 0.221 ($p < 0.001$). Concretely, an increase of 0.01 in the 3-year averaged sovereign ESG index is associated with an approximate 2.984% increase in GDP per capita.. The significance and magnitude of this coefficient suggest that maintaining high sovereign ESG performance over a three-year period has a strong and positive impact on economic growth over the medium-term. The coefficient for the 5-year moving average of the sovereign ESG index is 0.215 ($p < 0.001$). This means that an increase of 0.01 in the 5-year averaged sovereign ESG index is associated with an approximate 2.903% annualized increase in GDP per capita. While slightly lower than the 3-year average, this still indicates a substantial positive effect. The slight decrease suggests that while the positive impact of sovereign ESG performance remains robust, it may diminish slightly as the time horizon extends. With a coefficient of 0.211 ($p < 0.001$), the 7-year moving average of the sovereign ESG index supports the notion that sovereign ESG performance positively influences GDP per capita over the long term. Concretely, an increase of 0.01 in the 7-year averaged sovereign ESG index is associated with an approximate 2.849% annualized increase in GDP per capita. The consistency in the positive and significant coefficients across different periods highlights the sustained benefits of sovereign ESG practices. The coefficient for the 10-year moving average of the sovereign ESG index is 0.189 ($p < 0.001$). This holds that an increase of 0.01 in the 10-year averaged sovereign ESG index is associated with an approximate 2.552% annualized increase in GDP per capita. Although there is a further slight decline, the impact remains significant. The gradual reduction over longer periods may reflect the dilution of immediate benefits, as the economic effects of sovereign ESG practices become more diffused over time. This trend suggests that the influence of sovereign ESG performance tends to stabilize over longer horizons.

Lastly, table 4 shows the long-term cumulative sum regression results. The coefficients represent the effect of the accumulated sovereign ESG performance over the specified periods. The 3-year cumulative sum shows a coefficient of 0.0738 ($p < 0.001$). This means that an increase of 0.01 in the 3-year accumulated sovereign ESG index is associated with an approximate 0.996% increase in GDP per capita. This reflects the impact of sovereign ESG performance over three years, suggesting a positive relationship between cumulative sovereign ESG practices and GDP per capita over this period. With a coefficient of 0.0431 ($p < 0.001$), the 5-year cumulative sum indicates that an increase

of 0.01 in the 5-year accumulated sovereign ESG index is associated with an approximate 0.5819% increase in GDP per capita. This result continues to show a positive relationship, although weaker than the 3-year sum. This indicates that the benefits of sovereign ESG performance over five years are significant but become less intense as the period extends. The 7-year cumulative sum has a coefficient of 0.0302 ($p < 0.001$). An increase of 0.01 in the 7-year accumulated sovereign ESG index is associated with an approximate 0.4077% increase in GDP per capita. This further reduction underscores the trend that the total impact of cumulated ESG performance diminishes over longer periods, though it remains positive. The 10-year cumulative sum coefficient is 0.0189 ($p < 0.001$). An increase of 0.01 in the sovereign 10-year accumulated ESG index is associated with an approximate 0.2552% increase in GDP per capita. This is the smallest total impact among the periods analyzed, suggesting that while the accumulated sovereign ESG practices are still beneficial, their effect becomes less pronounced over a decade. The decrease in coefficients over longer periods suggests that while the economic benefits of overall sovereign ESG practices over time remain positive, their intensity slightly diminishes. This pattern could indicate that the influence of sovereign ESG performance tends to become more stable over longer durations.

In these long-term models, Inflation and Interest Rate are generally not significant, suggesting their negligible effects on GDP per capita in this context or adequate capturing by the fixed effects. Investment and Trade consistently show significant positive effects on GDP per capita, highlighting their critical role in economic growth. The models exhibit robust fits, explaining substantial portions of the variation in GDP per capita, with overall model significance indicated by high F-test values ($p < 0.001$). The long-term analysis indicates that sovereign ESG performance has a sustained positive impact on economic growth, as evidenced by both moving averages and cumulative sums results. The moving averages highlight the consistent annual benefits of sovereign ESG practices, while the cumulative sums reflect the total impact over multiple years.

Overall, the temporal analysis reveals that sovereign ESG performance consistently has a significant positive impact on GDP per capita across various time horizons. The benefits are most pronounced in the short- and medium-term, as shown by the higher coefficients in the one-year and the three-year models. As the analysis extends into longer periods, the moving averages indicate a persistent positive impact, though with slightly diminishing intensity. The 3-year period shows the strongest positive impact, which gradually decreases for the 5-, 7-, and 10-year periods. The cumulative sums confirm that while the effect of total sovereign ESG performance over extended periods remains beneficial, it becomes less pronounced when viewed cumulatively over 3, 5, 7, and 10 years. This pattern suggests that the economic benefits of sovereign ESG performance are substantial and persistent, although the magnitude of the impact tends to stabilize rather than diminish drastically over longer horizons.

5.6. Income Analysis

The income analysis examines whether the relationship between sovereign ESG performance and GDP per capita varies across different income groups, utilizing fixed effects regression models for high-income, middle-income, and low-income countries.

	(High) GDP per Capita	(Middle) GDP per Capita	(Low) GDP per Capita
ESG Index	0.0669 (1.33)	0.287** (3.10)	0.0670 (0.43)
Inflation	-0.0805* (-2.45)	-0.0235 (-1.35)	0.0115*** (4.89)
Interest Rate	-0.00903 (-0.63)	0.00124 (0.10)	-0.0331 (-0.92)
Investment and Trade	0.796*** (7.05)	0.753*** (8.97)	0.438** (3.13)
Constant	9.516*** (177.84)	8.090*** (277.49)	6.672*** (43.28)
R-squared	0.711	0.490	0.327
F-test	58.423	87.473	6276.188
Prob > F	0.000	0.000	0.000
N	1457	2232	(43.28)

t statistics in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Table 5. Income-Specific Fixed Effects Regression Results

Table 5 presents the fixed effects regression results for high-income, middle-income, and low-income countries. For high-income countries, the coefficient for the sovereign ESG index is 0.069 ($p = 0.189$), indicating that the immediate impact of sovereign ESG performance on GDP growth is not statistically significant in these countries. Specifically, an increase in the sovereign ESG index by 0.01 corresponds to an approximate 0.903% increase in GDP per capita. This suggests that while there may be some positive association, it is not strong enough to be conclusive in this model. The coefficient for Inflation is -0.0805 ($p < 0.05$), indicating a negative and significant impact on GDP per capita. This implies that higher inflation rates are associated with reduced economic growth in high-income countries. Interest Rate does not show a significant effect in this model. This implies that variations in interest rates do not have a substantial impact on GDP per capita in these countries, or their impact is captured by the fixed effects. Investment and Trade, however, exhibit a significant positive impact on GDP per capita, with a coefficient of 0.796 ($p < 0.001$), underscoring the critical role of these factors

in driving economic growth. This model explains approximately 71.1% of the variation in GDP per capita ($R\text{-squared} = 0.711$) and is statistically significant ($F\text{-test} = 58.423$, $p < 0.001$).

In the case of middle-income countries, the coefficient for the sovereign ESG index is 0.287 ($p < 0.01$), indicating a strong and statistically significant positive impact on GDP per capita. Here, an increase in the sovereign ESG index by 0.01 corresponds to an approximate 3.875% increase in GDP per capita. These results highlight the importance of ESG improvements in driving economic growth in middle-income countries. The coefficients for Inflation and Interest Rate are not significant in this model. This implies that their immediate effects on GDP per capita are negligible for these countries, or adequately captured by the fixed effects. Investment and Trade, however, remain significant positive determinants of GDP per capita, with a coefficient of 0.753 ($p < 0.001$). This model explains approximately 49.0% of the variation in GDP per capita ($R\text{-squared} = 0.490$) and is statistically significant ($F\text{-test} = 87.473$, $p < 0.001$).

For low-income countries, the coefficient for the sovereign ESG index is 0.067 ($p = 0.672$), suggesting that the immediate impact of sovereign ESG performance on GDP per capita is not statistically significant. In practical terms, an increase in the sovereign ESG index by 0.01 corresponds to an approximate 0.905% increase in GDP per capita. This suggests that while there may be some positive association, it is not strong enough to be conclusive in this model. Interestingly, Inflation has a positive and significant impact on GDP per capita, with a coefficient of 0.011 ($p < 0.001$), indicating that higher inflation rates are associated with increases in GDP per capita in these economies. This implies that, in low-income countries, moderate inflation may encourage spending and investment, leading to economic growth. Interest Rate does not show a significant effect in this model. This suggests that variations in interest rates do not have a substantial impact on GDP per capita in these countries, or their impact is captured by the fixed effects. Investment and trade again demonstrate significant positive impacts on GDP per capita, with a coefficient of 0.438 ($p = 0.006$). This model explains approximately 32.7% of the variation in GDP per capita ($R\text{-squared} = 0.327$) and is statistically significant ($F\text{-test} = 6276.188$, $p < 0.001$).

In summary, the impact of sovereign ESG performance on GDP per capita varies significantly across different income groups. Middle-income countries show a strong positive impact, while the effect is not significant in high- and low-income countries. Inflation negatively affects GDP per capita in high-income countries but has a positive impact in low-income countries. Investment and trade consistently demonstrate significant positive impacts on GDP per capita across all income groups.

5.4. Dynamic Analysis

To improve the robustness of the of the relationship between sovereign ESG performance and economic, the dynamic analysis utilizes the Arellano-Bond estimator to explore the dynamic relationship between sovereign ESG practices and economic growth. This estimator addresses potential endogeneity and serial correlation issues. First, the results of the Arellano-Bond test for zero autocorrelation confirm the robustness of the dynamic model with a significant AR(1) test statistic ($z = -4.192$, $p = 0.000$) indicating expected first-order autocorrelation, and a non-significant AR(2) test statistic ($z = -1.880$, $p = 0.60$) indicating the absence of second-order autocorrelation.

	(Dynamic) GDP per Capita
Lagged GDP	0.696*** (20.54)
Lagged ESG Index	0.0229 (1.27)
ESG Index	0.00648 (0.35)
Inflation	-0.00785 (-0.94)
Interest Rate	0.00844* (2.43)
Log Investment and Trade	0.273*** (9.32)
Constant	2.568*** (9.01)
Chi-Square	2632.51
N	3944

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6. Dynamic Arellano-Bond Regression Results

Table 6 presents the dynamic model results using the Arellano-Bond Estimator. The lagged GDP per capita has a strong positive coefficient of 0.696 ($p < 0.001$), indicating that past GDP levels are a strong predictor of current GDP levels. And suggesting significant persistence in economic performance. The coefficient for the lagged sovereign ESG index is 0.0229, but it is not statistically significant ($p = 0.203$). Specifically, an increase in the lagged sovereign ESG index by 0.01 corresponds to an approximate 0.309% increase in GDP per capita. This suggests that while sovereign ESG performance has a slightly delayed positive effect on GDP per capita, the effect is not strong

enough to be considered statistically significant in this model. The current sovereign ESG index has a positive coefficient of 0.00648, but it is also not statistically significant ($p = 0.730$). An increase in the current sovereign ESG index by 0.01 corresponds to an approximate 0.0874% increase in GDP per capita. This indicates that the immediate impact of the current sovereign ESG index on economic growth is minimal. In this model, Inflation has a negative coefficient of -0.00785, but it is not statistically significant ($p = 0.350$). Notably, Interest Rate has a positive and significant coefficient of 0.00844 ($p < 0.05$), indicating that higher interest rates are associated with an increase in GDP per capita. This could be explained by higher interest rates reflecting stronger economic conditions or attracting foreign investment, which can boost economic growth. Investment and Trade remain significant positive determinants of GDP per capita, with a coefficient of 0.273 ($p < 0.001$). This reinforces the importance of these economic activities in driving growth. This model explains a substantial portion of the variation in GDP per capita, as reflected by the chi-square statistic ($\chi^2 = 2632.51$, $p < 0.001$), indicating an appropriate fit.

In summary, the Arellano-Bond analysis reveals that while there is a slightly delayed positive effect of past sovereign ESG performance on current GDP per capita, this effect is not statistically significant. Additionally, the immediate impact of sovereign ESG performance on economic growth is minimal. The analysis highlights the significant persistence in economic growth, driven largely by past GDP per capita levels and the critical roles of investment and trade. The findings suggest that while sovereign ESG performance may have potential benefits, these are not strongly evidenced in the dynamics captured by this model.

For a clear overview of the variations in significance and magnitude of the relationship between sovereign ESG performance and economic growth across the different analyses, Appendix C summarizes the coefficients of the sovereign ESG Index from each regression.

6. Discussion

6.1. Summary of the Results

The analysis in this study reveals that sovereign ESG performance generally has a positive impact on economic growth, though the significance and strength of this relationship vary across statistical model, time horizons, and income group. In the general analysis, the primary regression model indicates a significant positive effect of sovereign ESG performance on GDP per capita. This positive relationship remains robust after accounting for control variables. This general pattern suggests that countries with stronger sovereign ESG performance are likely to experience improved economic growth.

The temporal analysis distinguishes the effects over different time horizons. In the short-term, a one-year lagged sovereign ESG index demonstrates a significant positive impact on GDP per capita. The long-term effects, captured through moving averages and cumulative sums, also show consistent positive impacts. The 3-year moving average is slightly higher than the one-year lagged effect, indicating that the effects of sovereign ESG performance are most pronounced in the medium-term. Positive impacts are also observed in the 5-, 7- and 10-year moving averages and cumulative sum models. Although, in both models the impact shows a diminishing trend over longer periods. This suggests a stabilizing impact of sovereign ESG practices. These temporal findings demonstrate the immediate and sustained importance of sovereign ESG practices in promoting economic growth.

The income analysis uncovers variations across different economic contexts. For middle-income countries, sovereign ESG performance has a strong positive impact on GDP per capita, while in high-income and low-income countries, the impact is not statistically significant. This suggests that the economic benefits of ESG practices may be more critical for countries in the middle-income bracket, possibly due to their room for ongoing development and greater sensitivity to improvements in sovereign ESG practices.

The dynamic analysis using the Arellano-Bond estimator confirms the persistence of economic performance, with the lagged GDP per capita showing a strong positive coefficient. While the impact of the current and lagged sovereign ESG indices on GDP per capita is positive, it is not statistically significant. This highlights the importance of considering that the relationship between sovereign ESG performance and economic growth is likely complex and influenced by additional factors.

To conclude, the fixed effects analyses demonstrate that countries enhancing their sovereign ESG performance are likely to achieve economic gains. The findings highlight that while sovereign ESG performance generally supports economic growth, its impact is more pronounced and statistically significant over short to medium-term periods and is most evident in middle-income countries. Moreover, the positive effects of sustained sovereign ESG performance, as evidenced by both moving averages and cumulative sums, suggest that continuous commitment to sovereign ESG practices can

lead to better economic outcomes. Nonetheless, the dynamic nature of this relationship requires careful interpretation. The insignificance of the dynamic analysis implies that the relationship between sovereign ESG performance and economic growth may be more complex and subject to other influencing factors.

6.2. Hypothesis I

Hypothesis I posited that countries demonstrating strong sovereign ESG performance would experience enhanced economic growth. The findings of this study generally support this hypothesis, particularly in the fixed effects analyses. Across the general, temporal, and income-specific analyses, there were consistent significant positive relationships between the sovereign ESG index and GDP per capita. The general analysis showed that sovereign ESG performance positively affects GDP per capita, even after controlling for variables such as inflation, interest rates, investment, and trade. This suggests that sovereign ESG performance plays a role in promoting economic growth independent of traditional economic drivers. Furthermore, both the temporal and income-specific analyses found positive effects of sovereign ESG performance on economic growth, with particularly pronounced benefits in the medium-term and for middle-income countries. In line with Hypothesis I, this overall trend indicates that countries with higher sovereign ESG performance tend to achieve better economic growth. However, it is essential to consider the nuances presented by the dynamic analysis using the Arellano-Bond estimator, which did not find statistically significant impacts of current and lagged sovereign ESG indices on GDP per capita. This implies that while there are observable positive trends, the relationship between sovereign ESG performance and economic growth may be influenced by other factors and complexities not fully captured in this study.

This positive relationship aligns with previous research, such as Diaye et al. (2021), who also reported a positive relationship between sovereign ESG performance and GDP per capita. Ho et al. (2019) also supported these findings, observing that sovereign ESG performance positively impacts economic growth. These studies both suggest that robust sovereign ESG practices contribute to sustained economic development. Additionally, Ghazali et al. (2023) found mixed impacts of ESG on economic growth across. Their study emphasizes the importance of country-specific contexts and the maturity of sovereign ESG practices. This supports the dynamic observation that the relationship between ESG performance and economic growth is complex and influenced by various factors.

The general consistency of positive findings across several analyses strengthens the argument that strong ESG performance can be a crucial driver of economic growth. While the fixed effects analyses provide evidence supporting the positive impact of sovereign ESG performance on economic growth, particularly in middle-income countries and over medium-term periods, the Arellano-Bond analysis suggests a need for cautious interpretation. In conclusion, the positive impact observed in the indicates that countries improving their sovereign ESG performance are likely to experience economic

benefits. However, the complex and multifaceted nature of this relationship warrants cautious interpretation.

6.3. Hypothesis II

Hypothesis II suggested that the impact of sovereign ESG performance on economic growth would exhibit distinct characteristics over different time horizons. Specifically, it anticipated minimal short-term impact due to initial costs and the delayed effects of sovereign ESG practices and a strong positive correlation over the long term. The temporal fixed effects analyses do not fully support this hypothesis. The short-term analysis indicated a positive and significant impact of the previous year's sovereign ESG performance on GDP per capita. The long-term analysis using moving averages and cumulative sums demonstrated that sovereign ESG performance positively influences economic growth over various periods. The most pronounced impact was observed in the medium term. Although, the magnitude of the impact of sovereign ESG performance tends to decrease over longer horizons, it remains positive and significant. This pattern suggests that while the economic benefits of sovereign ESG performance are substantial and persistent, the intensity of the impact tends to stabilize and diminish slightly over extended periods. Therefore, in contrast to Hypothesis II, the findings highlight that the benefits of sovereign ESG practices are most pronounced in the short- and medium term, gradually diminishing over longer periods while remaining sustained.

In comparison with previous research, Diaye et al. (2021) found a positive long-term relationship but noted no significant short-term impact, which contrasts this study's findings. Ho et al. (2019) observed that while there is a relationship between sovereign ESG performance and economic growth, the effects are more pronounced over longer periods, particularly for environmental and social factors. Ghazali et al. (2023) do not specifically examine temporal impacts. However, the variability in the results of Ghazali et al. (2023) suggests that the impacts of sovereign ESG practices can differ based on the maturity of sovereign ESG practices implementation.

Several factors might explain the divergence between the anticipated and observed results. Namely, this study's short-term impacts might be attributed to the use of a broader range of indicators in the dataset. Previous studies, such as Diaye et al. (2021) and Ho et al. (2019), have used a narrower set of indicators which may not capture the immediate and tangible effects of sovereign ESG practices as comprehensively as this study does. Diaye et al. (2021) used a set of 18 indicators. Most of their indicators, such as air quality, renewable energy consumption, and governance measures like regulatory quality, typically manifest over longer periods. This focus on indicators which take time to translate into economic outcomes could explain why they found a positive long-term relationship but no significant short-term impact. Ho et al. (2019) employed three main indicators: CO2 emissions, life expectancy at birth, and the control of corruption index. These indicators, while relevant, provide a more restricted view of sovereign ESG performance and are likely to show their effects over a more

extended period, aligning with their findings of significant long-term impacts but limited short-term effects. Conversely, this study uses a comprehensive sovereign ESG index that includes 40 indicators. This broader range captures more immediate and tangible effects of sovereign ESG practices on economic performance. For example, renewable electricity output can rapidly improve energy efficiency and reduce costs, directly benefiting economic growth. Also, the labour force participation rate can have immediate impacts on economic development by increasing the available workforce. Furthermore, indicators like political stability and absence of violence/terrorism, can immediately boost investor confidence and economic stability. Thus, the comprehensive sovereign ESG index also captures the more immediate benefits of sovereign ESG performance.

Additionally, the economic context during the period of study could influence the results. This study used data from more recent years (1990-2020), which could capture the recent evolving significance and awareness of sovereign ESG factors. This is contrary to Diaye et al. (2021) who examined data from 1996 to 2014, and Ho et al. (2019), who analysed data from 1999 to 2015. The increasing global focus on and awareness of sovereign ESG in recent years may have led to more immediate market responses to sovereign ESG practices. Investors and stakeholders are now more attuned to sovereign ESG practices, potentially resulting in quicker economic adaptation. This increase in recognition and integration could explain the strong short-term effects observed in this study. Moreover, an increase in policy changes and government initiatives aimed at promoting sustainable practices could have accelerated the impact of sovereign ESG practices. Governments around the world have been increasingly implementing policies and providing incentives for better sustainability. This might result in quicker economic gains of sovereign ESG practices as they can be better leveraged. The more recent data used in this study may reflect the recent accelerated importance of sovereign ESG practices in the last decade.

In summary, while the initial hypothesis anticipated minimal short-term impact and strong long-term benefits, the study's findings suggest more pronounced short-term and medium-term benefits of sovereign ESG performance with a gradual reduction in impact over time. The results highlight the short-term as well as sustained relevance of sovereign ESG practices in driving economic growth.

6.4. Hypothesis III

Hypothesis III stated that the impact of sovereign ESG performance on economic growth would differ across income groups. Specifically, it anticipated that high-income countries would experience a more substantial positive impact due to their advanced regulatory, financial, and technological frameworks, whereas lower-income countries might exhibit weaker effects due to a lack of these foundational elements. In contrast, this study finds that for high-income countries, the impact of sovereign ESG performance on GDP per capita is not statistically significant. This suggests that

while these countries possess the resources to integrate sovereign ESG practices effectively, the direct economic benefits are not immediately apparent. Conversely, in middle-income countries, the findings show a strong positive relationship between sovereign ESG performance and economic growth, indicating that middle-income countries benefit more noticeably from enhanced sovereign ESG practices. For low-income countries, in line with Hypothesis 3, the immediate benefits of sovereign ESG performance are less evident. This indicates that factors such as limited resources, inadequate regulatory frameworks, and technological gaps likely hinder these countries from fully leveraging sovereign ESG practices. These findings partly support Hypothesis 3, indicating that the influence of sovereign ESG performance on economic growth indeed varies by income group. However, the results diverge from the hypothesis in showing that high-income countries do not exhibit a significant positive impact, whereas middle-income countries demonstrate the most pronounced benefits.

In comparison with previous research, Ho et al. (2019) conclude that the income level of a country significantly affects the causality relationship between sovereign ESG performance and economic growth. Thus, both studies emphasize the importance of considering income levels when analysing the relationship between economic growth and other factors. However, Ho et al. (2019) argue that high-income countries can better couple sovereign ESG performance with economic growth, while low-income countries face challenges in linking economic growth with sovereign ESG practices. This contrasts with this study's findings, which show that high-income countries do not experience more pronounced impacts from sovereign ESG performance. While Ghazali et al. (2023) do not specifically research income effects, the variability in their results suggests that the impacts of sovereign ESG practices can differ based on specific country contexts.

Several factors could explain the divergence between the anticipated and observed results. The lack of significant impact in high-income countries could imply that these nations have already maximized many benefits from their advanced systems and having already integrated sovereign ESG practices in their policies, making additional immediate gains from sovereign ESG practices less noticeable. For middle-income countries, the pronounced effect of improvements in sovereign ESG practices on economic growth could be attributed to the unique position these countries occupy. Middle-income countries often find themselves in a transition phase where they are developing regulatory frameworks, financial resources, and advanced technological capabilities. Unlike high-income countries, they have not yet fully matured in these areas. Therefore, there is more room to still integrate sovereign ESG practices in their policies and significant potential for improvements. Enhancing sovereign ESG performance can help address this potential for improvements leading to more substantial economic gains. For low-income countries, factors such as limited resources, inadequate regulatory frameworks, and technological gaps likely hinder them from fully leveraging sovereign ESG practices. Also, these countries might prioritize immediate economic needs. The lack of significant impact in these countries suggests that they may require more time and additional support to realize the economic benefits of sovereign ESG practices.

In summary, while the initial hypothesis anticipated significant impacts in high-income countries and weaker effects in low-income countries, the study's findings suggest strong positive impacts of sovereign ESG performance in middle-income countries, with less immediate impact in high-income and low-income countries. These results highlight the varying influence of sovereign ESG practices in different income groups.

6.5. Robustness

To improve the validity of the relationship between sovereign ESG performance and economic growth, the Arellano-Bond analysis was conducted. This approach addresses potential endogeneity issues and serial correlation in the data. The Arellano-Bond analysis revealed non-significant results for the impact of both current and lagged sovereign ESG performance on GDP per capita. This suggests that, within the dynamic framework, the immediate and slightly delayed positive effects of sovereign ESG performance are not strong enough to be considered statistically significant. While the fixed effects analyses show significant positive relationships, the dynamic context does not confirm these effects. This highlights the complexity of the relationship between sovereign ESG performance and economic growth. Factors such as time lag effects, varying economic contexts, and feedback loops between sovereign ESG performance and economic growth contribute to this complexity, necessitating a dynamic and comprehensive analytical approach. This might indicate the need for a more comprehensive view of the enduring effects of sovereign ESG practices over time in a dynamic context.

Nevertheless, this study generally reveals a positive relationship between sovereign ESG performance and economic growth, with significant positive correlations observed in all fixed effects analyses. The findings highlight that while there is a consistent positive relationship between the two variables, the magnitude and immediacy of these impacts can vary across different contexts. The varying impacts across different time horizons and income groups underscore the importance of considering both temporal and economic contexts when evaluating the benefits of sovereign ESG practices. The dynamic analysis highlights the need for caution in interpreting these results, suggesting that the relationship is complex and multifaceted. Overall, the results emphasize the relevance of sovereign ESG practices in driving economic growth.

7. Conclusion

The purpose of this study was to examine the relationship between sovereign ESG performance and economic growth. The motivation behind this research stemmed from the increasing emphasis on ESG factors within the global financial landscape and the relatively underexplored impact of sovereign ESG practices on broader economic dynamics. By investigating whether countries with higher sovereign ESG performance experience enhanced economic growth, the study aimed to provide valuable insights for policymakers and governments, thereby also providing an incentive to invest in sovereign ESG practices. Employing an extensive methodology and a comprehensive dataset, this study offers detailed insights into how ESG practices influence economic outcomes, particularly across different time periods and income groups. The findings both confirm existing literature as well as ad new insights to the academic literature

The study utilized a comprehensive dataset covering 136 countries from 1990 to 2020 and a thorough sovereign ESG index was constructed from 40 indicators. Fixed effects regression models were employed to analyse both short-term and long-term impacts. Additionally, income-specific studies were conducted to identify variations across different economic contexts. The strength of the relationship was further tested with a dynamic model using the Arellano-Bond estimator.

The findings of this study indicate that generally there is a positive correlation between the sovereign ESG index and GDP per capita. Therefore, suggesting that higher sovereign ESG performance tends to be associated with increased economic growth. Temporal analyses reveal that the benefits of enhanced sovereign ESG performance are most evident in the short- and medium-term, with the strongest effects observed at around three years. The sovereign ESG impact remains sustained in in the long-term, with it slightly decreasing over longer time horizons. Furthermore, income analyses show that the relationship is most pronounced in middle-income countries. Nevertheless, the dynamic analysis suggests that while the immediate and short-term impacts are positive, they are not statistically significant, emphasizing the complexity of the relationship between sovereign ESG performance and economic growth.

Despite the extensive methodology and comprehensive dataset used in this study, several limitations should be acknowledged. First, the study relies on data from the World Bank's Sovereign ESG Database and World Development Indicators Data Bank. Some countries and indicators exhibited significant data gaps, which required imputation and transformation. This potentially introduces biases. Imputation methods, while necessary, may lead to inaccuracies that could affect the reliability of the results. Furthermore, the time frame of the study means that the analysis may not fully capture the impacts of very recent developments in sovereign ESG practices. The analysis distinguishes between short-term and long-term effects, but the rapidly evolving nature of sovereign ESG practices and their impacts on economic growth may not be entirely reflected. Additionally, despite including several control variables, there may be other unobserved factors influencing the

relationship, such as cultural factors, technological advancements, and geopolitical influences. Moreover, the construction of the sovereign ESG index involves subjective decision-making in the selection and weighting of indicators. PCA helps in objectively identifying the most important indicators, yet the initial selection and categorization of indicators included in the analysis and the interpretation of principal components still carry some level of subjectivity. Therefore, although PCA was employed to derive the weights and construct the index, alternative methodologies could potentially lead to different outcomes. Lastly, the use of fixed effects models is effective in controlling for unobserved heterogeneity, yet these models do not fully address potential endogeneity issues and the dynamic nature of the relationship between sovereign ESG performance and economic growth. The Arellano-Bond estimator addresses some of these concerns, yet it still has limitations. The dynamic analysis focuses on short-term effects, this leaves a gap for examining long-term impacts in a dynamic context to fully understand the enduring benefits of sovereign ESG practices. A broader long-term perspective on the persistent effects of sovereign ESG practices over time in a dynamic context might result in stronger findings in the dynamic analysis.

Although the results from this study should be cautiously interpreted, several key lessons can still be drawn from this research. Firstly, sovereign ESG practices can yield both immediate and sustained economic benefits. The short-term analysis showed significant positive impacts, while medium-term benefits were the most pronounced, and long-term impacts, though diminishing, remained significant. This means that sovereign ESG performance benefits countries over different time horizons. This provides valuable insights for policymakers as, first, these results imply that prioritizing sovereign ESG practices can not only promote sustainability but also create a conducive environment for economic growth. Policies that advance ESG performance therefore become even more crucial. Second, investing in sovereign ESG initiatives can yield both immediate and long-term economic benefits, potentially allowing initial costs to be recovered earlier than expected. This creates a strong incentive for policymakers to prioritize sovereign ESG performance as it allows them to contribute to sustainability while still pursuing their goals for economic growth

A second key lessons that can be drawn from this study is that the impact of sovereign ESG practices varies across different income groups, with middle-income countries benefiting the most. High-income countries, despite having the resources and frameworks to integrate ESG practices, do not exhibit significant economic benefits, possibly due to already optimized systems. Low-income countries face challenges such as limited resources and inadequate regulatory frameworks, hindering their ability to fully leverage ESG practices for economic gains. In contrast, middle-income countries, which are in a transition phase with more room for improvement, experience the most noticeable economic benefits from enhanced sovereign ESG practices. These findings provide valuable insights for policymakers because they imply income-specific policy strategies. For governments in high-income countries, the focus should be on maintaining current sovereign ESG frameworks to ensure long-term sustained economic impact. In middle-income countries, there is a significant opportunity to

drive economic growth by strengthening sovereign ESG practices. There, in these countries the focus should be on increasing sovereign ESG practices. By implementing policies that support advancements in sovereign ESG performance, middle-income countries can capitalize on their transitional phase, enhancing regulatory frameworks, financial resources, and advanced technological capabilities. For low-income countries, international support and investment are essential to build the necessary frameworks and resources to effectively implement and benefit from sovereign ESG practices.

To gain a more comprehensive understanding of the relationship between sovereign ESG performance and economic growth, future studies could consider further focusing on specific regions or different country groups. The varying impacts across different income groups observed in this study highlight the need for further exploration into how sovereign ESG practices affect countries at different stages of economic development. Investigating the unique challenges and opportunities faced by high-income, middle-income, and low-income countries can provide insights and support the development of income-specific sovereign ESG practices and investment strategies. Additionally, research focusing on other specific regions or different country groups could provide deeper insights into the context-specific impacts of sovereign ESG performance on economic growth. Regional studies could account for localized factors, such as regional governance structures, cultural norms, and economic integration levels, offering more tailored policy recommendations. Moreover, given the contrasting results found in this study regarding temporal impacts, further research should investigate the distinct effects of sovereign ESG practices over different time horizons. Understanding the mechanisms that drive short-term benefits compared to those that lead to long-term sustainable growth can help policymakers and governments design strategies that maximize both immediate and enduring economic gains. To better capture, short-term effects, future studies could consider incorporating more recent data to capture the latest trends and effects of sovereign ESG practices. With the growing emphasis on sustainability and sovereign ESG performance globally, more up-to-date data would provide insights into the current landscape and emerging short-term patterns. For the long-term impacts, employing longitudinal dynamic studies to track the evolution of sovereign ESG practices over time could provide a dynamic perspective on how these practices influence economic growth across different phases of implementation and development. Furthermore, future research should delve into the specific factors within the sovereign ESG framework to determine precisely how each component contributes to economic growth. Analyzing the individual indicators could uncover the underlying ways in which sovereign ESG performance impacts economic growth. Isolating the effects of individual sovereign ESG factors, can reveal which areas have the most significant impact and why. This way, more targeted recommendations for policymakers and governments can be provided. This could facilitate more effective and efficient sovereign ESG strategies that drive economic development.

In conclusion, this study underscores the role of sovereign ESG practices in promoting economic development. By improving sovereign ESG performance countries can foster both immediate and long-term economic development. This highlights an incentive for integrating sovereign ESG practices into policy frameworks. Furthermore, the findings can also serve as a valuable guide for developing effective policies that drive economic growth as the study highlights the varying impacts across different time horizons and income groups, thereby recognizing the necessity of a tailored approach to sovereign ESG practices. Overall, this study provides a foundation for policymaking in the realms of economic and sustainable development. It emphasizes that by prioritizing sovereign ESG performance, countries can achieve substantial and sustained economic growth while also contributing to a more sustainable world.

References

- Aich, S., Thakur, A., Nanda, D., Tripathy, S. C., & Kim, H. C. (2021). Factors Affecting ESG towards Impact on Investment: A Structural Approach. *Sustainability*, 13(19), 10868. <https://doi.org/10.3390/su131910868>
- Alam, M. R., Kitenge, E., & Bedane, B. (2017). Government effectiveness and economic growth. In *Economics Bulletin* (Vols. 37–37, Issue 1, pp. 222–227). <http://www.accessecon.com/Pubs/EB/2017/Volume37/EB-17-V37-I1-P21.pdf>
- Banerjee, A., & Carrion-i-Silvestre, J. L. (2017). Testing for panel cointegration using common correlated effects estimators. *Journal of Time Series Analysis*, 38(4), 610–636. <https://doi.org/10.1111/jtsa.12234>
- Bassen, A., & Kovács, A. M. (2020). Environmental, Social and Governance Key Performance Indicators from a Capital Market Perspective. In *Springer eBooks* (pp. 809–820). https://doi.org/10.1007/978-3-658-16205-4_66
- Bauer, R., Guenster, N., & Otten, R. (2004). Empirical evidence on corporate governance in Europe: The effect on stock returns, firm value and performance. *Journal of Asset Management*, 5(2), 91–104. <https://doi.org/10.1057/palgrave.jam.2240131>
- Bernstein, J. D. (1993). *Alternative approaches to pollution control and waste management*. <https://doi.org/10.1596/0-8213-2344-x>
- Blanton, S. L., & Blanton, R. G. (2007). What attracts foreign investors? An examination of human rights and foreign direct investment. *The Journal of Politics*, 69(1), 143–155. <https://doi.org/10.1111/j.1468-2508.2007.00500.x>
- Bloemer, J., & Odekerken-Schröder, G. (2006). The role of employee relationship proneness in creating employee loyalty. *International Journal of Bank Marketing*, 24(4), 252–264. <https://doi.org/10.1108/02652320610671342>
- Boozer, M. A., Ranis, G., Stewart, F., & Suri, T. (2011). Paths to success: The relationship between human development and economic growth. *World Development*, 39(4), 506–522. <https://doi.org/10.1016/j.worlddev.2010.08.020>
- Bouyé, É., & Menville, D. (2020). The convergence of sovereign ESG ratings. *Social Science Research Network*. <https://doi.org/10.2139/ssrn.3568547>
- Brunner, P. H., & Rechberger, H. (2015). Waste to energy – key element for sustainable waste management. *Waste Management*, 37, 3–12. <https://doi.org/10.1016/j.wasman.2014.02.003>
- Capelle-Blancard, G., Crifo, P., Diaye, M., Oueghlissi, R., & Scholtens, B. (2019). Sovereign bond yield spreads and sustainability: An empirical analysis of OECD countries. *Journal of Banking and Finance*, 98, 156–169. <https://doi.org/10.1016/j.jbankfin.2018.11.011> *Strategic Management Journal*, 35(1), 1–23. <https://doi.org/10.1002/smj.2131>

- Cheng, B., Ioannou, I., & Serafeim, G. (2013). Corporate social responsibility and access to finance. *Strategic Management Journal*, 35(1), 1–23. <https://doi.org/10.1002/smj.2131>
- Crifo, P., & Forget, V. (2014). The Economics of Corporate Social Responsibility: a Firm-Level Perspective Survey. *Journal of Economic Surveys*, 29(1), 112–130. <https://doi.org/10.1111/joes.12055>
- Davidson, R. H., Dey, A., & Smith, A. J. (2018). CEO materialism and corporate social responsibility. *the Accounting Review*, 94(1), 101–126. <https://doi.org/10.2308/accr-52079>
- De Boer, I., Cederberg, C., Eady, S., Gollnow, S., Kristensen, T., MacLeod, M., Meul, M., Nemecek, T., Phong, L. H., Thoma, G., Van Der Werf, H. M., Williams, A., & Ma, Z. (2011). Greenhouse gas mitigation in animal production: towards an integrated life cycle sustainability assessment. *Current Opinion in Environmental Sustainability*, 3(5), 423–431. <https://doi.org/10.1016/j.cosust.2011.08.007>
- Diaye, M., Ho, S., & Oueghlissi, R. (2021). ESG performance and economic growth: a panel co-integration analysis. *Empirica*, 49(1), 99–122. <https://doi.org/10.1007/s10663-021-09508-7>
- Feltham, G. A., & Xie, J. (1994). Performance measure congruity and diversity in Multi-Task Principal/Agent relations. *The Accounting Review*, 69(3), 429–453. <https://www.jstor.org/stable/248233>
- Flammer, C., Hong, B., & Minor, D. (2019). Corporate governance and the rise of integrating corporate social responsibility criteria in executive compensation: Effectiveness and implications for firm outcomes. *Strategic Management Journal*, 40(7), 1097–1122. <https://doi.org/10.1002/smj.3018>
- Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance & Investment*, 5(4), 210–233. <https://doi.org/10.1080/20430795.2015.1118917>
- Ghazali, N. S., Daud, S. N. M., & Ismail, N. (2023). The Impact of Environmental, Social, and Governance (ESG) on the Economic Growth of ASEAN-5 Countries. <https://www.semanticscholar.org/paper/THE-IMPACT-OF-ENVIRONMENTAL%2C-SOCIAL%2C-AND-GOVERNANCE-Ghazali-Daud/3a648df4d5e4cd7342be408e444ace922f2fc6a3>
- Ho, S. H., Oueghlissi, R., & El Ferktaji, R. (2019). The dynamic causality between ESG and economic growth: Evidence from panel causality analysis. *Munich Personal RePEc Archive*. https://mpra.ub.uni-muenchen.de/95390/1/MPPRA_paper_95390.pdf
- Holderness, C. G., Kroszner, R. S., & Sheehan, D. P. (1999). Were the good old days that good? Changes in managerial stock ownership since the Great Depression. *The Journal of Finance*, 54(2), 435–469. <https://doi.org/10.1111/0022-1082.00114>
- Inoue, Y., & Lee, S. (2011). Effects of different dimensions of corporate social responsibility on corporate financial performance in tourism-related industries. *Tourism Management*, 32(4), 790–804. <https://doi.org/10.1016/j.tourman.2010.06.019>

- Jacobs, M. (2013). Green Growth. In *The handbook of global climate and environment policy* (pp. 197–214). <https://doi.org/10.1002/9781118326213.ch12>
- Jiang, P., Guo, F., & Yang, H. (2022). New measurement of sovereign ESG index. *Innovation and Green Development, 1*(2), 100009. <https://doi.org/10.1016/j.igd.2022.100009>
- Kao, C. (1999). Spurious regression and residual-based tests for cointegration in panel data. *Journal of Econometrics, 90*(1), 1–44. [https://doi.org/10.1016/s0304-4076\(98\)00023-2](https://doi.org/10.1016/s0304-4076(98)00023-2)
- Lefort, F., & Urzúa, I. F. (2008). Board independence, firm performance and ownership concentration: Evidence from Chile. *Journal of Business Research, 61*(6), 615–622. <https://doi.org/10.1016/j.jbusres.2007.06.036>
- Li, T., Wang, K., Sueyoshi, T., & Wang, D. (2021). ESG: Research progress and Future Prospects. *Sustainability, 13*(21), 11663. <https://doi.org/10.3390/su132111663>
- Lin, W. L., Law, S. H., Ho, J. A., & Sambasivan, M. (2019). The causality direction of the corporate social responsibility – Corporate financial performance Nexus: Application of Panel Vector Autoregression approach. *The North American Journal of Economics and Finance, 48*, 401–418. <https://doi.org/10.1016/j.najef.2019.03.004>
- Mak, Y. T., & Kusnadi, Y. (2005). Size really matters: Further evidence on the negative relationship between board size and firm value. *Pacific-basin Finance Journal, 13*(3), 301–318. <https://doi.org/10.1016/j.pacfin.2004.09.002>
- Maqbool, S., & Zameer, M. N. (2018). Corporate social responsibility and financial performance: An empirical analysis of Indian banks. *Future Business Journal, 4*(1), 84–93. <https://doi.org/10.1016/j.fbj.2017.12.002>
- Matsumura, E. M., Prakash, R., & Vera-Muñoz, S. C. (2013). Firm-Value effects of carbon emissions and carbon disclosures. *the Accounting Review, 89*(2), 695–724. <https://doi.org/10.2308/accr-50629>
- McWilliams, A., & Siegel, D. (2000). Corporate social responsibility and financial performance: correlation or misspecification? *Wiley Online Library*. [https://doi.org/10.1002/\(SICI\)1097-0266\(200005\)21:5](https://doi.org/10.1002/(SICI)1097-0266(200005)21:5)
- Mengistu, A. A., & Adhikary, B. K. (2011). Does good governance matter for FDI inflows? Evidence from Asian economies. *Asia Pacific Business Review, 17*(3), 281–299. <https://doi.org/10.1080/13602381003755765>
- OECD, Borgonovi, F., & Seitz, H. (2023). *OECD Skills Outlook 2023: Skills for a Resilient Green and Digital Transition*. OECD Publishing, Paris. <https://www.oecd-ilibrary.org/docserver/27452f29-en.pdf?expires=1719528532&id=id&accname=guest&checksum=83645E28433FA12D492947745196624F>
- Paiva, P. F. P. R., De Lourdes Pinheiro Ruivo, M., Da Silva, O. M., De Nazaré Martins Maciel, M., Braga, T. G. M., De Andrade, M. M. N., Santos, P. C. D., Da Rocha, E. S., De Freitas, T.

P. M., Da Silva Leite, T. V., Gama, L. H. O. M., De Sousa Santos, L., Da Silva, M. G., Silva, E. R. R., & Ferreira, B. M. (2019). Deforestation in protect areas in the Amazon: a threat to biodiversity.

Biodiversity and Conservation, 29(1), 19–38. <https://doi.org/10.1007/s10531-019-01867-9>

Paoli, G. D., Wells, P. L., Meijaard, E., Struebig, M. J., Marshall, A. J., Obidzinski, K., Tan, A., Rafiastanto, A., Yaap, B., Slik, J. W. F., Morel, A., Perumal, B., Wielaard, N., Husson, S. J., & D'Arcy, L. (2010). Biodiversity conservation in the REDD. *Carbon Balance and Management*, 5(1). <https://doi.org/10.1186/1750-0680-5-7>

Pedroni, P. (1999). Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors. *Oxford Bulletin of Economics and Statistics*, 61(s1), 653–670.

<https://doi.org/10.1111/1468-0084.0610s1653>

Schneider, F., Kallis, G., & Martinez-Alier, J. (2010). Crisis or opportunity? Economic degrowth for social equity and ecological sustainability. Introduction to this special issue. *Journal of cleaner production*, 18(6), 511-518.

Sharfman, M. P., & Fernando, C. S. (2008). Environmental risk management and the cost of capital. *Strategic Management Journal*, 29(6), 569–592. <https://doi.org/10.1002/smj.678>

Sovereign ESG Data Portal. (n.d.). <https://esgdata.worldbank.org/data/framework?lang=en>

Sparkes, R., & Cowton, C. J. (2004). The Maturing of Socially Responsible Investment: A Review of the Developing Link with Corporate Social Responsibility. *Journal of Business Ethics*, 52(1), 45–57. <https://doi.org/10.1023/b:busi.0000033106.43260.99>

Spears, J. (1985). Deforestation issues in developing countries the case for an accelerated investment programme. *The Commonwealth Forestry Review*, 64(4 (201)), 313-343. <http://www.jstor.org/stable/42606519>

Stanwick, P. A., & Stanwick, S. D. (1998). The Relationship Between Corporate Social Performance, and Organizational Size, Financial Performance, and Environmental Performance: An Empirical Examination. *Journal of Business Ethics*, 17(2), 195–204.

<https://doi.org/10.1023/a:1005784421547>

Tarmuji, I., Maelah, R., & Tarmuji, N. H. (2016). The Impact of Environmental, Social and Governance Practices (ESG) on Economic Performance: Evidence from ESG Score. *International Journal Trade, Economics and Finance*, 7(3), 67–74. <https://doi.org/10.18178/ijtef.2016.7.3.501>

Tsui, A. S., & Wu, J. B. (2005). The new employment relationship versus the mutual investment approach: Implications for human resource management. *Human Resource Management*, 44(2), 115–121. <https://doi.org/10.1002/hrm.20052>

What is ESG? (n.d.). Nordea <https://www.nordea.com/en/news/what-is-esg#:~:text=ESG%20stands%20for%20Environmental%2C%20Social,services%20contribute%20to%20sustainable%20development>.

World Development Indicators / DataBank. (n.d.). <https://databank.worldbank.org/source/world-development-indicators>

Zheka, V. (2006). Corporate governance and firm performance in Ukraine. *ideas.repec.org*.
<https://ideas.repec.org/p/hwe/certdp/0605.html>

Zhou, G., Liu, L., & Luo, S. (2022). Sustainable development, ESG performance and company market value: Mediating effect of financial performance. *Business Strategy and the Environment*, 31(7), 3371–3387. <https://doi.org/10.1002/bse.308>

Appendix A. Countries and Mean of Sovereign ESG Index

Country	Mean of ESG	Country	Mean of ESG	Country	Mean of ESG
New Zealand	0.601	Malaysia	0.431	Cabo Verde	0.375
Norway	0.589	Argentina	0.429	Cote d'Ivoire	0.375
Iceland	0.588	Peru	0.429	Kenya	0.373
Sweden	0.573	Mauritius	0.428	Senegal	0.370
Finland	0.556	Belize	0.428	Oman	0.369
Austria	0.553	Ghana	0.427	Lao PDR	0.367
Denmark	0.551	South Africa	0.427	China	0.364
Switzerland	0.548	St. Lucia	0.423	Burundi	0.364
Canada	0.547	Ecuador	0.417	Nicaragua	0.364
Australia	0.534	Kyrgyz Republic	0.416	Mali	0.362
Uruguay	0.534	Mexico	0.414	Madagascar	0.362
Germany	0.519	Brunei Darussalam	0.413	Congo, Dem. Rep.	0.361
United States	0.519	Guatemala	0.410	Guyana	0.361
United Kingdom	0.516	Bolivia	0.409	Azerbaijan	0.360
Luxembourg	0.512	Cameroon	0.409	Jordan	0.360
Netherlands	0.502	Botswana	0.409	India	0.360
Slovenia	0.497	Mozambique	0.406	Egypt, Arab Rep.	0.357
France	0.496	United Arab Emirates	0.406	Guinea	0.356
Portugal	0.494	Trinidad and Tobago	0.405	Philippines	0.351
Spain	0.494	Armenia	0.403	Mongolia	0.349
Ireland	0.494	Turkiye	0.402	Uzbekistan	0.347
Belgium	0.488	Tanzania	0.401	Sierra Leone	0.346
Chile	0.488	Uganda	0.401	Central African Republic	0.345

Estonia	0.484	Qatar	0.400	Burkina Faso	0.344
Brazil	0.483	Nepal	0.397	Sri Lanka	0.339
Lithuania	0.476	Malawi	0.396	Indonesia	0.339
Slovak Republic	0.474	Jamaica	0.396	Benin	0.338
Japan	0.472	Serbia	0.392	Sao Tome and Principe	0.335
Poland	0.470	Ukraine	0.390	Iran, Islamic Rep.	0.330
Czechia	0.470	Tajikistan	0.389	Cambodia	0.329
Croatia	0.469	Angola	0.388	Equatorial Guinea	0.329
Gabon	0.468	Tunisia	0.387	Pakistan	0.326
Hungary	0.461	Saudi Arabia	0.386	Algeria	0.325
Singapore	0.458	Morocco	0.386	Niger	0.324
Panama	0.457	Congo, Rep.	0.386	Gambia, The	0.321
Romania	0.455	Honduras	0.384	Maldives	0.321
Italy	0.452	Kazakhstan	0.384	Liberia	0.317
Colombia	0.448	Bahrain	0.383	Papua New Guinea	0.312
Greece	0.446	Russian Federation	0.383	Mauritania	0.304
Israel	0.445	Thailand	0.383	Myanmar	0.300
Namibia	0.442	Viet Nam	0.382	Afghanistan	0.300
Albania	0.441	Rwanda	0.379	Comoros	0.299
Paraguay	0.439	Ethiopia	0.378	Chad	0.291
Cyprus	0.437	Belarus	0.378	Bangladesh	0.285
Korea, Rep.	0.434	Zimbabwe	0.376	Timor-Leste	0.276
Georgia	0.432				

Appendix A provides the mean sovereign ESG index for each country included in the study. High mean scores indicate stronger sovereign ESG performance.

The sovereign ESG index numbers are constructed from 40 indicators over the period from 1990 to 2020. The indicator values are normalized and weighted to ensure comparability across countries.

Appendix B. Sovereign ESG Framework

Category	Theme	Indicator	Sign (±)	Weight
Environment (30.80%)	Emissions & Pollution (4)	CO2 emissions (metric tons per capita)	-1	0.8677%
		Methane emissions (metric tons of CO2 equivalent per capita)	-1	0.3006%
		Nitrous oxide emissions (metric tons of CO2 equivalent per capita)	-1	0.9914%
		PM2.5 air pollution, mean annual exposure (micrograms per cubic meter)	-1	2.0883%
	Natural capital endowment & management (6)	Adjusted savings: natural resources depletion (% of GNI)	-1	0.4229%
		Adjusted savings: net forest depletion (% of GNI)	-1	0.6713%
		Annual freshwater withdrawals, total (% of internal resources)	-1	0.5095%
		Forest area (% of land area)	1	3.2719%
		Mammal species, threatened	-1	0.9924%
	Energy use & security (3)	Terrestrial and marine protected areas (% of total territorial area)	1	2.0044%
		Energy intensity level of primary energy (MJ/\$2017 PPP GDP)	-1	0.7778%
		Renewable electricity output (% of total electricity output)	1	6.6301%
	Climate risk & resilience (1)	Renewable energy consumption (% of total final energy consumption)	1	5.5729%
		Population density (people per sq. km of land area)	-1	0.3051%
	Food security (3)	Agricultural land (% of land area)	1	3.5018%
		Agriculture, forestry, and fishing, value added (% of GDP)	1	0.3049
Food production index (2014-2016 = 100)		1	0.3049%	
Category	Theme	Indicator	Sign (±)	Weight
Social (38.83%)	Education & Skills (2)	Government expenditure on education, total (% of government expenditure)	1	1.1721%
		School enrollment, primary (% gross)	1	0.9991%
	Employment (2)	Labor force participation rate, total (% of total population ages 15-64) (modelled ILO estimate)	1	2.1010%
		Unemployment, total (% of total labour force) (modelled ILO estimate)	-1	1.5071%
	Demography (3)	Fertility rate, total (births per woman)	-1	3.4436%

		Life expectancy at birth, total (years)	1	1.0832%
		Population ages 65 and above (% of total population)	-1	1.9908%
	Health & nutrition (4)	Cause of death, by communicable diseases and maternal, prenatal and nutrition conditions (% of total)	-1	5.3746%
		Mortality rate, under-5 (per 1,000 live births)	-1	1.4313%
		Prevalence of overweight (% of adults)	-1	3.0753%
		Hospital beds (per 1,000 people)	1	1.2590%
	Access to services (2)	Access to clean fuels and technologies for cooking (% of population)	1	9.0647%
		Access to electricity (% of population)	1	6.3296%
Category	Theme	Indicator	Sign (±)	Weight
Governance (30.37%)	Human rights (2)	Strength of legal rights index (0=weak to 12=strong)	1	2.8380%
		Voice and Accountability: Estimate	1	3.2616%
	Government effectiveness (2)	Government Effectiveness: Estimate	1	2.5560%
		Regulatory Quality: Estimate	1	2.5161%
	Stability & rule of law (4)	Control of Corruption: Estimate	1	3.5328%
		Net migration	-1	0.1440%
		Political Stability and Absence of Violence/Terrorism: Estimate	1	2.1449%
		Rule of Law: Estimate	1	3.5023%
	Economic environment (1)	Individuals using the Internet (% of population)	1	5.1019%
	Gender (3)	Proportion of seats held by women in national parliaments (%)	1	1.7659%
		Ratio of female to male labour force participation rate (%) (modelled ILO estimate)	1	2.2548%
		School enrollment, primary and secondary (gross), gender parity index (GPI)	1	0.5111%
	Innovation (1)	Scientific and technical journal articles	1	0.2356%

Appendix B presents the sovereign ESG framework which is based on the World Bank's database. The sign (±) denotes the nature of each indicator. Indicators marked with a positive (+1) sign are positively correlated with the sovereign ESG index, indicating that higher values contribute positively to the sovereign ESG index. Conversely, indicators marked with a negative (-1) sign are negatively correlated with the sovereign ESG index, meaning higher values detract from the overall score. The weight assigned to each indicator is determined by using PCA and reflects its relative importance in the overall sovereign ESG index.

Appendix C. Overview Sovereign ESG Index Coefficients

	ESG Index
Primary Analysis	0.529*** (12.18)
Extended Analysis	0.225*** (3.77)
Short-Term Analysis	0.218*** (3.64)
Long-Term Analysis MA3	0.221*** (3.61)
Long-Term Analysis MA5	0.215*** (3.76)
Long-Term Analysis MA7	0.211*** (4.10)
Long-Term Analysis MA10	0.189*** (4.09)
Long-Term Analysis CS3	0.0738*** (3.61)
Long-Term Analysis CS5	0.0431*** (3.76)
Long-Term Analysis CS7	0.0302*** (4.10)
Long-Term Analysis CS10	0.0189*** (4.09)
High-Income Analysis	0.0669 (1.33)
Middle-Income Analysis	0.287** (3.10)
Low-Income Analysis	0.0670 (0.43)
Dynamic Analysis Lagged	0.0229 (1.27)
Dynamic Analysis	0.00648 (0.35)

t statistics in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Appendix C provides a summary of the coefficients associated with the sovereign ESG Index across all analyses. Given the log transformations for GDP per Capita and standardization of the variables, each coefficient reflects the impact of a one standard deviation increase in the sovereign ESG index on the log-transformed GDP per capita. For instance, a coefficient of 0.218 indicates that a one standard deviation increase in the sovereign ESG index results in approximately a 21.8% increase in GDP per capita.