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The Link Between Corporate ESG Performance and Economic Development: A Panel Analysis of G20 Countries

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Abstract

This study examines how Environmental, Social, and Governance (ESG) performance, as reported through different corporate reporting channels, affects economic development, measured by GDP per capita. This study uses secondary data from 19 G20 countries from 2005 to 2024, yielding 340 observations. Drawing on the Porter Hypothesis and the Solow Growth Model, the study uses a fixed-effects model with macroeconomic controls. Descriptive statistics show that, although G20 countries are, on average, high-income, their aggregated corporate ESG performance averages a C, indicating satisfactory transparency and moderate ESG reporting. Meanwhile, the panel data regression results indicate that environmental performance positively affects economic development, suggesting that environmentally responsible corporate practices support innovation and long-term productivity. In contrast, social performance shows a negative effect, implying short-term trade-offs between social responsibility initiatives and economic output. Governance performance is statistically insignificant, indicating limited direct influence on economic development during the study period. The findings highlight ESG's varied economic effects. This study contributes to the literature by showing that ESG dimensions do not uniformly influence economic development; instead, they produce different, sometimes contrasting, effects, offering a more nuanced extension of traditional models. From a practical perspective, the findings suggest that policymakers should place greater emphasis on environmental innovation while ensuring social and governance initiatives better align with long-term economic productivity and growth. Policy recommendations include fostering green innovation, aligning social initiatives with long-term growth objectives, and strengthening governance frameworks. Future research should explore causal relationships and sector-specific dynamics.

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Introduction

In recent years, the integration of Environmental, Social, and Governance (ESG) considerations into economic activity and decision-making has gained considerable traction in the global economy. Between 2010 and 2021, the share of S&P 500 companies issuing ESG reports rose notably, from 35% to 86%. Furthermore, following the adoption of voluntary standards, there was an 11% boost in the quantity of pertinent information disclosed (Rouen et al., 2022). This expanding interest reflects a shift in measuring corporate performance, where traditional financial metrics are no longer perceived as the sole determinants of success. Instead, a holistic approach that encompasses the wider impacts of business endeavors has emerged as a pivotal consideration for investors, policymakers, and stakeholders alike.

The increase in ESG considerations in finance is emblematic of a broader societal awakening to the interconnectedness between economic prosperity, environmental sustainability, and social equity (Leach et

al., 2018). With an increasing awareness of the long-term risks posed by climate change, social inequalities, and corporate malfeasance, investors are increasingly scrutinizing companies' ESG practices as indicators of resilience and long-term viability (Starks et al., 2017). This trend is underscored by the abundance of ESG rating agencies, sustainability indices, and reporting standards, reflecting a growing consensus within the financial community regarding the importance of ESG factors.

ESG practices encompass a spectrum of activities aimed at fostering sustainable development, ethical conduct, and stakeholder engagement (DeLucia et al., 2020). From promoting diversity in the labour force and reducing carbon emissions to enhancing corporate governance structures, ESG initiatives are predicated on the notion that businesses have a broader responsibility beyond maximizing shareholder value (Li et al., 2021).

The adoption of ESG practices can bring benefits for firms, ranging from cost savings and operational efficiencies to enhanced access to capital and improved employee morale (Chen et al., 2023; Li et al., 2024; Tahmid et al., 2022). However, the extent to which ESG considerations can be turned into tangible financial outcomes remains a subject of debate, necessitating rigorous empirical analysis to elucidate the causal mechanisms underlying this relationship (Mendonça et al., 2025).

Beyond the firm level, the ramifications of ESG practices extend to the macroeconomic domain, with profound implications for national competitiveness, economic growth, and societal well-being (Chen, 2023; Škare & Golja, 2014; Wang et al., 2023; Zhou et al., 2020). By promoting sustainable development and social inclusion, countries can cultivate an environment conducive to innovation, entrepreneurship, and human capital formation. Moreover, some studies find that involving ESG factors within financial institutions' policies makes financial systems more sustainable (Ziolo et al., 2019). From a socio-economic perspective, countries that prioritize ESG goals are likely to experience higher levels of social cohesion, public health, and quality of life, thereby fostering resilient and inclusive societies (Li et al., 2021).

Moreover, firm-level ESG performance can affect macroeconomic performance through its effects on firm productivity and economic outcomes. ESG practices can strengthen resource efficiency, innovation, stakeholder relations, and risk management, thereby enhancing firms' total factor productivity (Piserà et al., 2024). As these firm-level effects accumulate across firms and industries, they can contribute to aggregate productivity and economic output. Consistent with this micro-to-macro perspective, Biju et al. (2024) find a positive and statistically significant association between firms' ESG performance and GDP per capita as a proxy for economic development in India. Thus, the ESG-economic development relationship can be understood as an indirect transmission from firm-level ESG practices to firm productivity and performance, and ultimately to aggregate economic activity.

While the literature on ESG and firm-level performance is flourishing, relatively few studies have systematically examined the macroeconomic implications of ESG practices at the country level (Skouloudis et al., 2016; Zhou et al., 2020). This research seeks to address this gap by providing a comprehensive analysis of the relationship between ESG and economic development. Using panel regression of data from 19 G20 countries with large, growing economies from 2005-2024, this study aims to explore the channels through which ESG practices by firms influence economic development. Moreover, by incorporating cross-country comparisons and time-series analyses, this research aims to provide actionable insights for policymakers, investors, and other stakeholders seeking to build a more sustainable and inclusive global economy.

To finish, the integration of ESG considerations into financial decision-making shows a big shift in how we conceptualize and evaluate corporate performance. By transcending traditional notions of profit maximization and embracing a stakeholder-centric approach, ESG practices hold the potential to reshape the economic landscape and foster sustainable development at both the firm and country levels. Through rigorous empirical analysis and interdisciplinary collaboration, this research seeks to contribute to a deeper understanding of ESG factors and economic development, thereby informing evidence-based policy interventions and investment strategies with the goals of a more equitable and sustainable future.

Literature Review

Environmental, Social, and Governance (ESG)

ESG was initially introduced in a 2004 report by the United Nations (UN) Global Compact titled "Who Cares Wins" (UN Global Compact, 2004). It is a multidimensional framework for assessing how firms manage their interactions with the natural environment, society, and their governance systems, and how they respond to environmental, social, and governance-related risks and impacts. Each ESG dimension encompasses different concerns and reflects firms' capacity to integrate sustainability considerations into their strategies and operations (OECD, 2020). Despite its significance, ESG did not gain widespread attention until recently, when it began to rise as a major topic (Zhang et al., 2024). Lately, ESG considerations have emerged as a critical aspect of contemporary financial analysis, reflecting a broader recognition of the interrelation between corporate practices, societal welfare, and sustainability.

A growing body of literature has sought to spotlight the real-world impacts of ESG adoption, as shown in a bibliometric analysis by Zhang et al. (2024). Notably, studies often focus on ESG adoption at the firm and industry level and its impact on firm performance. Research by Singh et al. (2025) provides broad evidence through a meta-analysis of 102 studies covering 556 effect sizes and found a "strong positive relationship" between environmental, social, and governance dimensions of corporate sustainability and firm performance. Most of these studies use third-party databases such as KLD and Thomson Reuters ASSET 4. These databases utilize a system of expert scoring on key aspects of the ESG performance of firms, establishing some of the most complete datasets for the most developed nations (Li et al., 2021).

Only a handful of studies have sought to move the scope of firm-level ESG impact to a macroeconomic scale, such as economic development. Additionally, most studies that aim to analyze the impact of ESG at a national level utilize a mix of country-level data sets, such as greenhouse emissions, equality indicators, and corruption levels, as proxies for individual environmental, social, and governance factors (Angelidis et al., 2024; Comes & Oneț, 2025a; J. Wang et al., 2023). Because ESG is usually evaluated at the firm level, aggregating corporate ESG across firms in a country could provide a useful basis for evaluating its macroeconomic implications. Firm-level ESG practices reflect companies' efforts to address environmental, social, and governance issues, while aggregation across firms at the country level captures the corporate sector's collective sustainability performance. Corporate sustainability can become relevant at the macro level when individual firm performance is aggregated across the corporate sector. Studies such as Simone et al. (2024) and Zhou et al. (2020) show that country-level ESG measures can be constructed from firm-level data, yielding aggregate country-level firm ESG performance.

Economic Development

Economic development refers to the assessment of an economy's overall functioning and health, evaluated through a variety of economic indicators and metrics (Cutler et al., 1991). It is an overall improvement in an economy's ability to produce and in its standard of living, reflected in expanded economic activity. Gross Domestic Product (GDP) captures this total level of economic activity by calculating the total value of goods and services produced in a country.

According to Cutler et al. (1991), GDP is a pivotal indicator of a nation's economic performance and standard of living. It broadly indicates a nation's economic health by measuring the total value of all final goods and services produced over a period. GDP can be calculated in two ways: nominal GDP and real GDP. Nominal GDP measures economic output using current prices, so it includes the effects of inflation. Real GDP is an inflation-adjusted measure that reflects the real sum of the goods and services produced, with prices held constant from a base year. Real GDP is considered a superior measure for assessing long-term national economic performance because it isolates output trends from price changes, providing a clearer view of actual growth.

For analyzing economic development across countries, GDP per capita provides a more meaningful measure, as it translates the aggregate output of economic activity reflected in GDP into an average-person measure. GDP per capita is measured by dividing GDP by the population.

Empirical research has demonstrated a strong correlation between GDP and various indicators of economic and social well-being (Leogrande & Costantiello, 2023; Zhou et al., 2020). Countries with higher GDP per capita tend to have better health outcomes, higher educational attainment, and more developed infrastructure. However, the relationship between GDP and overall societal welfare is complex and mediated by factors such as governance quality, institutional frameworks, and social policies.

Linking Between ESG and Economic Development: The Porter Hypothesis

One useful basis to start looking at the correlation of ESG performance on economic development is a theory proposed by Michael Porter in 1991, which suggested that well-designed environmental regulations can push for innovation within companies, potentially leading to increased competitiveness and productivity, rather than simply increasing costs (Ambec & Barla, 2002; Porter & van der Linde, 1995). It was later better known as the Porter Hypothesis.

The Porter Hypothesis sought to dispel the traditional notion that environmental laws hinder company growth. The traditional view saw that businesses are often hindered by increasing costs in order to comply with environmental regulations, thus possibly reducing overall competitiveness (Porter, 1991). In stark contrast, Porter argued that well-crafted environmental standards can stimulate innovation, potentially offsetting or even exceeding compliance costs (Ambec et al., 2013). Well-designed environmental standards are regulations that are developed with a strict but flexible approach. They are sufficiently stringent to create credible incentives for firms to internalize environmental costs and improve environmental performance, yet flexible enough to let firms choose the most efficient means of compliance. This concept is explored through a schematic illustration presented in Figure 1. It suggests the possibility of "win-win situations," where both societal welfare (through enhanced environmental protection) and private net benefits (through increased firm profits and competitiveness) can be achieved simultaneously (Ambec et al., 2013; Ambec & Barla, 2002).

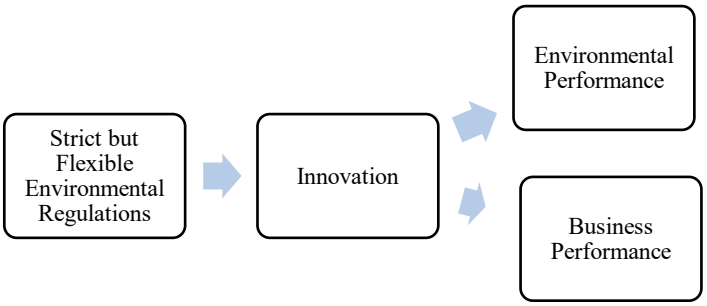


Figure 1. Visual Representation of the Porter Hypothesis

To date, only a few academic studies have attempted to scale firm-level ESG performance to the national level or relate it to economic development. However, notable research on the relationship between ESG performance and macroeconomic development could still be used to support this study (Diaye et al., 2022; Fu & Otmane, 2022; Hassani & Bahini, 2022; Leogrande & Costantiello, 2023; Škare & Golja, 2014; Wang et al., 2023; Zhou et al., 2020).

Diaye et al. (2022) found that, in the long run, country-level ESG performance has a significant, positive effect on GDP per capita. The study investigated the economic impact of ESG performance in OECD countries from 1996 to 2014, employing panel cointegration techniques. Several studies on country-level ESG performance and its impact on GDP find a significant positive correlation (Azam et al., 2016; Chen, 2023; Cracolici et al., 2010; Ho et al., 2023; Leogrande & Costantiello, 2023; Zhou et al., 2020). However, the lack of a widely used standard for country-level ESG evaluation highlights a limitation of current ESG research (Li et al., 2021).

In lieu of this, research by Zhou et al. (2020) laid the groundwork for this study as the first empirical study to examine the link between firm-level ESG practices and economic development. Using available firm-level ESG reporting from 2002-2017, the study found that higher micro-ESG performance can improve living standards, as measured by GDP per capita. This study was subsequently enhanced by findings from Angelidis et al. (2024) that aggregated firm-level ESG scores to construct an aggregate (market-level) world-based ESG index. Their findings suggest that ESG policies globally impede short-term economic growth but improve the global economy in the long term.

Theoretical discussions have also explored the possibilities of correlation between firm-level ESG policies and macroeconomic development indicators (Albrizio et al., 2017; Cohen & Tubb, 2018; Dechezleprêtre & Sato, 2017; Kordalska & Olczyk, 2016; Porter & Kramer, 2006). The prevailing discussion explains the role of firm-level ESG policies in innovation, bolstering country-wide competitive advantage (Kordalska & Olczyk, 2016; Porter & Kramer, 2006). Studies support that firms investing in ESG-aligned innovation generate new technologies and processes that reduce resource misallocation and improve productive efficiency (Cabaleiro-Cerviño & Mendi, 2024; Xing et al., 2025; 정 & 김, 2022).

Economic Development and the Control Variables

Researchers have widely studied the determinants of economic development, often proxied by GDP. It highlights that while physical capital accumulation drives short-term economic growth, technological progress, considered an external factor, is the key determinant of long-term growth. An important extension of this model incorporates human capital stock as a key driver of economic growth alongside physical capital accumulation.

At the heart of the Solow Growth Model is the aggregate production function, which represents an economy's total output (GDP) as a function of its inputs: capital (K), labour (L), and technology (A). The production function typically takes the Cobb-Douglas form (Solow, 1956) presented in Equation 1.

$$Y(L,K) = AL^{\beta}K^{\alpha} \quad \text{..... (1)}$$

where Y is the total output, A is the level of technology or total factor productivity (TFP), K is the capital stock at time t, and L is the labour input.

Equation 1 assumes constant returns to scale (if you double the inputs, you double the output) and diminishing marginal returns to each factor of production (adding an additional unit of capital or labour results in progressively smaller increases in output). Although the Solow framework does not explicitly identify the source of technology, ESG policy that fosters innovation and improves ESG performance could drive technological progress, aligning with the Porter hypothesis.

Furthermore, to support the validity of this research, it is paramount to include control variables. Control variables account for factors that affect macroeconomic performance beyond the observed variables (ESG performance). While there is general agreement that state factors like the accumulation of physical capital (investment) and human capital stock, as well as productivity factors (technological growth), are crucial macroeconomic determinants of economic growth in nearly any country (Solow, 1956), some experts posit that the efficiency of savings and investment is also a significant determinant in influencing economic growth (Chirwa & Odhiambo, 2016). Thus, the researchers control for a selection of macro-factors associated with national economic growth. Following previous literature (Mohd Daud et al., 2024; Wang et al., 2023; Zhou et al., 2020), this study employs total consumption, FDI, inflation, gross capital formation, and labour as control variables.

Theoretical Framework and Hypotheses Formulation

Environmental Performance on Economic Development

The environmental dimension of ESG refers to a company's impact on the environment. It includes a wide array of factors such as energy use, waste management, pollution, natural resource conservation, and animal welfare (Trahan & Jantz, 2023). More critically, it addresses how a company mitigates environmental risks and capitalizes on opportunities associated with environmental impacts.

Research on the effects of environmental performance at the country level on GDP shows varied results. While Acheampong (2018) and Lazăr et al. (2019) found that the impact of environmental degradation shows a positive significant correlation with macroeconomic performance, indicating that a bad environment somehow has a better impact on macroeconomic performance; some studies on the relationship between a country's Environmental Performance Index (EPI) and economic development show a positive correlation (Chang & Hao, 2017; Neagu et al., 2017). At the firm level, studies show a positive effect of firm-level environmental performance, such as environmental management and decreased carbon output, on financial performance (Elsayed & Paton, 2005; Lundgren & Zhou, 2017; Makhdalena & Zulvina, 2024). The Porter Hypothesis provides a theoretical foundation for this expectation, arguing that effective environmental management could drive innovation, boost efficiency, and strengthen competitiveness, ultimately resulting in greater productivity and, over time, increasing country-level competitiveness (Ambec et al., 2013; Cohen & Tubb, 2018). A meta-analysis of previous research supports this link, finding that environmental regulations induce firm-level innovation and, over time, increase national competitiveness (Cohen & Tubb, 2018). Based on the discussion of the relationship between environmental performance and economic development, the study's first hypothesis is formulated as follows.

H1. Environmental performance has a positive effect on economic development.

Social Performance on Economic Development

The social dimension of ESG includes a company's relationships with its customers, employees, suppliers, and the communities (Cho, 2023). At the macro level, social performance relates to equality, development, and education. Previous research, both theoretical and empirical, has sought to find the relationship between these factors and economic development indicators, with inconsistent results (Gylfason & Zoega, 2003; López-Arceiz et al., 2018; Ullmann, 1985).

The Porter Hypothesis suggests that well-designed environmental regulations can enhance innovation and competitiveness (Ambec et al., 2013). This hypothesis also loosely extends to CSR policies, as explained in Porter's later work in a widely cited business article (Porter & Kramer, 2006). Their argument is structurally analogous to the Porter hypothesis, which states that social engagement, like environmental regulation, can create value rather than destroy it. Chen et al. (2022) support the argument by testing the Porter hypothesis using Chinese SME data. They found that resources allocated to social responsibilities (both internal and external) contributed to firm profitability, alongside the expected environmental regulation effects. Similarly, Hermundsdottir and Aspelund (2022), studying Norwegian manufacturers, found that sustainability strategies drove both environmental and social innovations, though social innovations yielded more mixed performance effects than environmental ones.

A separate theoretical avenue is the development of human capital. The human capital and GDP relationship is one of the most extensively studied links in economic development (Bloom et al., 2021). Connecting this to ESG specifically, Kotsantonis & Serafeim (2020) argue that human capital development is a key ESG consideration whose importance is magnified by rapid technological change and uncertain future-of-work dynamics. At the firm level, Bernstein & Beeferman (2015) surveyed 92 empirical studies on HR policies and financial outcomes, concluding there's sufficient evidence of human capital materiality to financial performance to warrant inclusion in standard investment analysis. To date, only two studies, mentioned here in prior discussion, have sought to scale up firm-level social performance to macro-level economic development, both finding a significant positive relationship between the two variables (Angelidis et al., 2024; Zhou et al., 2020). Following the discussion of the relationship between social performance and economic development, this study formulates the second hypothesis.

H2. Social performance has a positive effect on economic development.

Governance Performance on Economic Development

Governance dimensions of ESG pertain to the frameworks and procedures for guiding and overseeing companies (Rouen et al., 2022). It encompasses board composition and operations, executive compensation, shareholder rights, transparency, and ethical conduct. Though this framework is more associated with companies, the majority of previous research has only focused on country-level governance performance in relation to GDP (Nikzad, 2021; Schiehll & Martins, 2016).

At the firm level, effective governance such as board oversight, managerial accountability, transparency, shareholder protection, ethical conduct enforcement, and robust internal control can reduce agency conflict, asymmetric information, and inefficient use of resources, improving firms' efficiency, productivity, and innovation. When such governance is widely adopted by companies in a certain country, its cumulative effect can produce an aggregate improvement that strengthens the country's economy. Hence, aggregate improvements in firm-level governance can boost economic productivity and investment efficiency, providing a plausible micro-to-macro pathway through which firm-level governance influences economic development.

An early study by Rivera-Batiz (2002) laid both empirical and theoretical groundwork for discussing governance and economic development by modelling endogenous growth. Similar to the Porter Hypothesis, Rivera-Batiz posited that governance-improving democracy enhances the incentives for capital formation, thereby fostering innovation, improving returns on investment, and elevating the long-run equilibrium growth trajectory of the economy (Rivera-Batiz, 2002). Consecutive studies have supported this and found that governance effectiveness and regulatory quality positively impact economic growth (Gani, 2011; Huynh & Jacho-Chávez, 2009; Inekwe et al., 2021; Jalilian et al., 2007; Leogrande & Costantiello, 2023; Ugur, 2014).

Research extends to firm-level outcomes. Júnior et al. (2023) examined 2,511 firms across nine countries (15,981 firm-year observations) and found that country governance affects firm performance. Additionally, Almaqtari et al. (2026) studied 8,094 firms across Europe, Asia, and America, examining governance's effect on sustainability performance, and Almogbali et al. (2025) linked governance to sustainability performance in the GCC countries. Building on the discussion of the relationship between governance and economic development, this study formulates the third hypothesis.

H3. Governance performance has a positive effect on economic development.

Research Method

Research Approach

This study utilizes a quantitative approach relying on panel data analysis that combines cross-sectional and time-series data. This approach allows for controlling unobserved heterogeneity and captures both temporal and cross-country variation. To capture a large pool of both advanced and growing economies, this research uses secondary panel data from 19 G20 countries, annually from 2005–2024, resulting in 340 observations. The 19 G20 member countries are Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, Russia, Saudi Arabia, South Africa, South Korea, Turkey, the United Kingdom, and the United States.

The group of countries was selected as a relevant setting for this study for two reasons. Firstly, the 19 G20 members accounted for around 85% of global GDP and 75% of world trade, while representing about two-thirds of the world's population (World Trade Organization, 2024). Secondly, the G-20 shows substantial heterogeneity in economic development, institutional environments, and corporate ESG performance, allowing for greater variation in the analysis (Soufiene et al., 2025).

Variables and their Measurements

As this study aims to investigate the effect of ESG on economic development, it uses a dependent variable and three independent variables. Furthermore, to support the validity of this study, it also includes control

variables. The dependent variable of this study is economic development. Building upon previous literature, it employs GDP per capita to measure the variable. The data were primarily obtained from the World Bank.

For the independent variables, which are environmental performance, social performance, and governance performance, they are derived from firm-level ESG performance aggregated at the country level. Following Zhou *et al.* (2020), each independent variable was measured using aggregate country-level firm environmental, social, and governance scores constructed from firm-level Refinitiv ESG scores provided by Thomson Reuters within the Refinitiv Eikon index. The index utilizes the following considerations for ESG reporting. Firstly, the environmental scores cover three main areas: resource utilization, emissions, and innovation. Secondly, the social scores cover four categories: workforce, human rights, community, and product responsibility. Thirdly, the governance scores are divided into three categories: management, shareholders, and CSR strategy. Thomson Reuters gathered the data from publicly available corporate reporting, such as annual reports, CSR reports, sustainability reports, company websites, and international media outlets. For the control variables, building on Solow's growth theory and previous studies such as Mohd Daud et al. (2024), Wang et al. (2023) and Zhou et al. (2020), this study uses total consumption, FDI, inflation, gross capital formation, and labour.

Data Analysis Methods

This research uses descriptive statistics to describe the data and panel data regression to test the hypotheses on the effect of environmental, social, and governance performance on economic development. Panel data regression extends linear regression using the Ordinary Least Squares (OLS) method, tailored to data types and analytical goals. It explores variation in characteristics among individuals across periods within the research context. As panel data regression can be estimated using three models, which are the Common, Fixed, and Random Effects models, a specification test needs to be performed first to identify the most appropriate model (Baltagi, 2021). Furthermore, a series of classical assumption tests was also undertaken to justify the robustness of the regression model. Equation 2 presents the panel regression model proposed in this study.

$$GDPC = \alpha + \beta_1 Env + \beta_2 Soc + \beta_3 Gov + \beta_4 Control + \varepsilon \quad \text{..... (2)}$$

where GDPC is GDP per Capita, Env is Environmental Performance, Soc is Social Performance, Gov is Governance Performance, and Control is Total consumption (Cons), FDI, Gross capital formation (GrossCap), Labour, and Inflation.

Results and Discussion

Descriptive Statistics

Prior to selecting the appropriate model, testing the classical assumptions, and conducting further data analysis, a preliminary examination was carried out using descriptive statistics to describe the data from the selected sample countries. Table 1 presents descriptive statistics, showing 340 common observations for each variable included in this study.

Table 1. Descriptive Statistics Results

Statistic	Unit of measurements	Mean	Maximum	Minimum	Std. Dev.
GDPC	$	27,679.49	85,810	993	19,563.33
Env	%	41.01	87.82	6.90	13.42
Soc	%	46.38	87.89	7.01	12.82
Gov	%	49.58	71.67	43.33	2.72
Cons	Millions of $	2,543,714	23,742,028	201,807	3,690,391
FDI	Millions of $	338.88	21,832	-217,958	61,741.68
GrossCap	%	25.11	46.27	12.35	6.89
Labour	Millions of people	116.62	781.20	7.50	194.81
Inflation	%	1.83	4.32	-0.09	0.48

Source: Secondary data processed (2026)

Table 1 shows that the dependent variable, economic development measured using GDP per capita (GDPC), averages $27,679.49 across all G20 countries included in the study. It shows that, on average, the G20 countries can be classified as high-income. According to the World Bank, GDP per capita above $13,845 is classified as high income. The highest GDP per capita is the United States at $85,810, while the lowest is India at $993. The US is classified as a high-income country, whereas India is classified as a low-income country (less than $1,135). This finding, together with the high value of the standard deviation, shows considerable variation in GDP per capita among G20 member countries, confirming the greater variation in data across G20 countries previously observed by Soufiene et al. (2025).

The three main explanatory (independent) variables employed in this study, which are environmental performance (Env), social performance (Soc), and governance performance (Gov), hold quite similar average scores, which are 41.01, 46.38, and 49.58, respectively. As the Thomson Reuters ESG score is a percentile ranking between 0 and 100, these scores indicate that, on average, companies in the G20 countries have below-average (less than 50) ESG performance across the three pillars. Following Thomson's system, scores between 25 and 50 map directly to a C grade, suggesting that, on average, the G20 countries' aggregated ESG performance was satisfactory. The scores also imply a moderate level of transparency in ESG reporting, with room for improvement.

Referring to Table 1, Turkey has the highest environmental score at 87.815, placing it in an A grade and indicating that Turkish companies show a high degree of transparency in their environmental reporting. Surprisingly, the lowest environmental score is held by the US at 6.899, putting the country in a D grade and indicating insufficient transparency and poor public reporting related to environmental issues. For social performance, Turkey also achieved the highest social score of 87.89 (A grade), confirming a high degree of transparency in corporate social reporting. By contrast, Saudi Arabia has the lowest score at a D grade, suggesting insufficient transparency and weak public social reporting. Finally, Japan has the highest governance score at an A grade, indicating excellent transparency and governance reporting. Meanwhile, the UK and the US hold the lowest governance score at a C grade, showing that companies in those countries have satisfactory transparency and governance reporting.

Among the three ESG scores, governance is highest, suggesting that companies in G20 countries tend to be more transparent in reporting their governance performance. Environmental performance, which has the lowest average score, also has the highest standard deviation among the three dimensions. It shows considerable variation in environmental corporate reporting across the G20 countries.

Choosing the Model

As stated in the research method section, this study uses panel data regression to test the three hypotheses. According to Baltagi (2021), panel data regression can be estimated using three models: Common Effects, Fixed Effects, and Random Effects (CEM, FEM, and REM). To identify the most appropriate model, a specification model test was conducted using the Chow Test and the Hausman Test.

Panel data analysis often uses variable-intercept models to account for heterogeneity across individuals and time (Hsiao, 2003). These models assume omitted variables are influenced by factors that are constant across time for each individual, constant across individuals for each period, or vary across both individuals and time (Hsiao, 2003). However, when coefficients vary across units or time, variable-coefficient models may be more appropriate (Hsiao, 2003). This assumption limits its ability to account for heterogeneity, address heteroskedasticity or serial correlation, and effectively uncover causal relationships. Therefore, the CEM was excluded from further analysis. The exclusion of CEM is also supported by the Chow test results. The Chow test results show that the cross-section simultaneous test p-value is significant at the 1% confidence level 0.000 < 0.05, suggesting that the FEM model is preferable. Similarly, the Hausman test yields a p-value of 0.000 (< 0.05), indicating that FEM is preferable and leading to the rejection of REM. Therefore, the FEM is the most suitable model.

Classical Assumptions Testing

Panel data analysis presents unique challenges and advantages compared with traditional cross-sectional or time-series approaches. According to Gujarati & Porter (2009), statistical theory indicates that as the sample size grows, OLS estimators generally converge toward a normal distribution. According to the Central Limit Theorem (CLT), when the explanatory variables are considered stochastic and jointly follow a normal distribution, it is still valid to apply F-tests and t-tests even if the error terms deviate from normality. As the sample size grows large, the estimators' distribution tends to approximate a normal distribution, since the binomial distribution gradually converges to the normal distribution in the limit (Gujarati & Porter, 2009; Malinvaud, 1970).

While normality tests may be unnecessary for large samples (Alejo et al., 2015), other assumptions require careful consideration. Garba et al. (2013) found that Feasible Generalized Least Squares (FGLS) estimators perform well under severe heteroscedasticity, regardless of autocorrelation and multicollinearity levels. Given these considerations, this research employs FEM with a Generalized Least Squares model with cross-sectional weights to address heteroscedasticity. Additionally, a Multicollinearity test was also performed. Tables 2 and 3 present the multicollinearity and heteroscedasticity test results using the Variance Inflation Factor and the Glejser test, respectively. All variables were expressed in natural logarithmic form throughout the analyses to mitigate potential heteroscedasticity.

Table 2. Variance Inflation Factors

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.189483	129759.6	NA
Env	0.000115	1049.893	2.746270
Soc	0.000216	2121.816	3.141384
Gov	0.001532	15973.28	1.421315
Cons	5.86E-05	8115.091	1.826809
FDI	0.001300	1447.19	1.421284
GrossCap	0.000352	2455.261	1.365808
Labour	0.001171	12590.19	2.565207
Inflation	2.26E-05	52.81063	1.212229

Table 2 shows that the centered VIF value for each test variable is far below 10. Our main explanatory variables, Env, Soc, and Gov, have centered VIF values less than 10. Thus, we can assume no high linear dependency among the explanatory variables, and the model is free of Multicollinearity. Furthermore, Table 3 indicates that each independent variable, including all control variables, has a p-value greater than 0.05 for the residuals. Therefore, this research model shows no heteroscedasticity.

Table 3. The Glejser Test Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.343504	1.495254	0.898512	0.3802
Env	-0.085784	0.043895	-1.954307	0.0655
Soc	0.087453	0.042489	2.058225	0.0536
Gov	0.006523	0.095556	0.068265	0.9463
FDI	-0.037432	0.123614	-0.302817	0.7653
Cons	-0.082876	0.062383	-1.328498	0.1998
GrossCap	0.085006	0.056226	1.511854	0.1470
Labour	0.017663	0.116988	0.150981	0.8816
Inflation	0.017029	0.015288	1.113857	0.2792

Dependent Variable: Absolute Residuals (ABS_RES)
Source: Secondary Data Processed (2026)

Hypothesis Testing

The coefficient determination test shows an R-squared value of 0.999557 and an Adjusted R-squared value of 0.999521. This result indicates that the independent variables (environmental, social, and governance performance) and the control variables (total consumption, FDI, gross capital formation, labour, and inflation) explain approximately 99.96% of the variation in the dependent variable (economic development). The remaining 0.04% of the variation is attributable to other factors not captured in the model, random disturbances, or measurement errors.

The very high R-squared and adjusted R-squared values suggest an excellent model fit, meaning the independent variables collectively account for nearly all variation in economic development within the sample. However, this kind of predictive power should be interpreted with caution, as it may indicate overfitting, especially if the dataset is small or multicollinearity is present. Nonetheless, given the strong statistical significance of most variables, the results suggest that the chosen model and variables are highly relevant for explaining economic development in the G20 countries.

Regarding the goodness-of-fit test, Table 4 presents an F-test probability value of 0.0000 (< 0.05), indicating that the regression model is fit for estimation. The model is considered a good fit because at least one independent variable significantly affects economic development.

Table 4. Simultaneous F-test Results

Statistic	Value
F-statistic	28307.93
Prob (F-statistic)	0.000000

Source: Processed Data Results, 2026

As the regression model meets the goodness-of-fit criteria, a t-test was conducted to test the hypotheses and determine whether each independent variable affects economic development. Again, all variables were transformed into their natural logarithmic form to meet the classical assumptions as stated in the previous subsection. Table 5 presents the t-test results for testing the hypotheses.

Table 5. Hypothesis Testing based on T-test

Variable	Hypothesis sign	Coefficient	t-Statistic	Prob.	Note
C		-2.318402	-5.326030	0.0000	
Env	(+)	0.026375	2.461457	0.0144	H1 supported
Soc	(+)	-0.031567	-2.150045	0.0323	H2 not supported
Gov	(+)	-0.008775	-0.224202	0.8227	H3 not supported
Cons		0.922407	120.4793	0.0000	
FDI		0.055905	1.550535	0.1220	
GrossCap		0.208042	11.08281	0.0000	
Labour		-0.579765	-16.93919	0.0000	
Inflation		0.006863	1.444249	0.1497	

Source: Processed Data Results, 2026

Table 5 presents the panel regression results, showing that environmental performance positively affects economic development, whereas social performance has a negative effect. Unfortunately, governance performance shows no statistically significant impact on economic development. Among the control variables, total consumption and gross capital formation positively affect economic development, while labour has a negative effect. The table also shows that the control variables FDI and inflation have insignificant effects. Based on these results, the final regression model resulting from the analysis is presented in Equation 3.

$$GDPC_{it} = -2.32 + 0.03\ Env_{it} - 0.03\ Soc_{it} + 0.92\ Cons_{it} + 0.21\ GrossCap_{it} - 0.58\ Labour_{it} + \varepsilon_{it} \quad \text{..... (3)}$$

Effect of Environmental Performance on Economic Development

The regression output presented in Table 5 indicates that the environmental variable has a positive, statistically significant effect on economic development, measured by GDP per capita, with a coefficient of 0.026375 and a p-value of 0.0144. Because the p-value is below the 0.05 threshold, the result is statistically significant at the 5% level. Therefore, the study's first hypothesis (H1) is supported.

This finding suggests that, within the countries in the sample, a 1% increase in environmental performance is associated with a 0.026375% increase in GDP per capita, holding all else constant. The positive coefficient indicates a beneficial relationship between environmental sustainability and economic output, reinforcing the idea that stronger environmental practices can support, rather than hinder, economic development. Environmental scores show a positive increase within the sampled countries. As more companies consider the environmental performance of their business undertakings, more innovation will be introduced into the market, leading to a more efficient and productive economy.

This result is aligned with the Porter Hypothesis, which argues that well-designed environmental regulations can stimulate innovation and improve efficiency, ultimately enhancing competitiveness and economic growth (Ambec et al., 2013; Porter & van der Linde, 1995). Moreover, investments in renewable energy, resource efficiency, and pollution control can lead to cost savings, job creation in green industries, and improved public health outcomes, all of which may contribute to increased productivity and GDP per capita over time (Lyeonov et al., 2019).

Several empirical studies support this view, showing that environmental performance and economic growth are not mutually exclusive. For example, sustainable environmental policies have been linked to improvements in energy efficiency, innovation capacity, and long-term economic resilience (Costantini & Mazzanti, 2012). Additionally, countries that proactively manage environmental risks may be more attractive to foreign investors and multinational corporations that prioritize ESG performance in their decision-making.

However, while the relationship is statistically significant, the effect remains modest, suggesting that environmental improvements contribute incrementally rather than drastically to economic growth. Furthermore, this analysis alone cannot definitively establish the direction of causality. Higher GDP per capita may enable countries to invest more in environmental initiatives, rather than environmental performance being the sole driver of economic gains.

Nonetheless, this result offers important policy implications. It provides empirical support for the notion that countries can pursue environmental sustainability and economic prosperity simultaneously. Governments and institutions in developing and emerging economies, particularly within the G20 region, may find that enhancing environmental governance not only addresses ecological challenges but also supports their broader development goals.

Effect of Social Performance on Economic Development

The regression results in Table 5 show that the social performance variable has a p-value of 0.0323 and a coefficient of -0.0316, confirming that social performance has a negative significant effect on economic development. Although the p-value is below the conventional 5% significance threshold, the result is not strong enough to support the second hypothesis (H2), which previously hypothesized that social performance has a positive effect on economic development.

This finding suggests that a 1% increase in ESG social scores is associated with a 0.0316% decrease in GDP per capita, holding other factors constant. This result contrasts with the research hypothesis and prior theory. The Porter Hypothesis proposes that well-crafted environmental regulations can stimulate innovation, which may offset, partially or even entirely, the costs associated with compliance (Ambec et al., 2013). In support of that, some studies find that CSR policies can enhance labour productivity and efficiency, particularly through internal factors like product quality, innovation, and employee care (Sánchez & Benito-Hernández, 2015; T. Wang & Bansal, 2012).

In this study, the negative coefficient may imply a trade-off between social responsibility efforts and short-term economic output in the sampled countries. CSR may also lead to a transfer of wealth from shareholders to stakeholders, with increased sales per employee but reduced returns on equity (Becchetti et al., 2005; Inyang et al., 2023). For new ventures, a long-term orientation can help counteract the liability of newness and generate positive economic returns from CSR activities (Nguyen et al., 2020; Shiu & Yang, 2017; T. Wang & Bansal, 2012). These findings suggest that while CSR can incur short-term costs, it may also contribute to long-term value creation and competitiveness, particularly when aligned with a company's strategic orientation and internal practices. It may reflect the economic costs of implementing socially responsible policies, such as labour protections, diversity initiatives, or community engagement, which may not yield immediate economic returns and could affect short-run profitability and productivity.

While the relationship is statistically significant, the effect size is relatively small, and other variables not included in the model may mediate or moderate this relationship. Additionally, this analysis alone cannot firmly establish the direction of causality, and further investigation is needed to determine whether higher social scores lead to lower GDP per capita or whether lower-income countries are more inclined to adopt strong social standards.

Across the observed sample countries, social performance shows a gradual increase as more firms and companies adopt ESG scoring and consider success metrics beyond profitability. In conjunction with these results, higher social score ratings may lead to lower macro-level GDP performance. However, the limitations of this research mean that this assumption cannot be fully substantiated. Short- and Long-term regressions need to be taken into consideration in order to draw a meaningful interpretation.

Effect of Governance Performance on Economic Development

The regression results in Table 5 show that the governance performance variable has no statistically significant effect on economic development, with a coefficient of 0.008775 and a p-value of 0.8227. Because the p-value exceeds the conventional thresholds of 0.05 and 0.10, the result does not support the third hypothesis (H3), which states that governance performance has a positive effect on economic development. Therefore, governance scores are not significantly related to economic performance in the countries in the sample.

This finding implies that changes in ESG governance performance, as measured through the governance pillar of ESG ratings, do not exhibit a measurable impact on GDP per capita. In other words, improvements or declines in governance-related ESG factors, such as board structure, audit quality, anti-corruption measures, or shareholder rights, do not statistically affect economic output per individual in the sample countries.

This result diverges from parts of the existing literature that suggest strong governance mechanisms can enhance institutional quality, attract investment, and promote economic growth. At the firm level, effective governance practices are linked to lower costs of capital, higher returns on equity, greater efficiency, and increased firm value (Angwaomaodoko, 2025; Claessens & Yurtoglu, 2012; N et al., 2023; Zhu, 2014). Such benefits tend to be greater in nations with robust legal frameworks and comprehensive disclosure practices (Zhu, 2014). At the national level, improved governance quality correlates with higher GDP growth, increased productivity, and a better-developed financial system (Claessens & Yurtoglu, 2012).

However, the insignificance of the governance performance variable in this study may be attributed to several factors. First, variation in governance scores across the sample countries may be insufficient to produce a noticeable economic effect within the observed period. It is supported by the descriptive statistics in Table 1, which show that the standard deviation of the governance performance variable is only 2.72, far below its mean of 49.58. It suggests that governance performance data across companies in the G20 countries were relatively homogeneous. Second, governance improvements may require longer time horizons to influence macroeconomic indicators like GDP per capita, particularly in institutional contexts where reforms take time to implement and translate into tangible results (Earle & Scott, 2010; Nikzad,

2021). Third, it may also be the case that other dimensions of ESG, such as social or environmental performance, play a more immediate or direct role in shaping economic output, while governance acts more as an enabling condition rather than a standalone driver of growth (Comes & Oneț, 2025b).

Similarly, governance performance in the sample countries shows an upward trend throughout the sampled period. However, this trend does not reflect that governance scores in the future will have insignificant or no effect on economic development, as these results show, since the effect may have long-term effects (Nikzad, 2021).

Conclusion

This study investigated the effect of Environmental, Social, and Governance (ESG) performance on economic development, specifically GDP per capita, across 19 G20 countries from 2005 to 2024. Using aggregated country-level ESG firm performance scores from Thomson Reuters Refinitiv and GDP per capita from the World Bank database, 340 data observations were analyzed using panel data regression with a Fixed-Effects Model. The analysis produced mixed findings. First, environmental performance had a positive and statistically significant effect on economic development. This result supports the idea that environmentally responsible business practices, such as energy efficiency, pollution reduction, and resource management, can contribute positively to economic performance, likely by enhancing innovation and long-term productivity (Ambec et al., 2013; Lyeonov et al., 2019; Porter & van der Linde, 1995). Second, the social performance demonstrated a negative and statistically significant effect on economic development. This outcome contradicts initial expectations and highlights a possible short-term trade-off between investing in socially responsible initiatives (such as fair labour practices, diversity programs, or community engagement) and economic output (Becchetti et al., 2005; T. Wang & Bansal, 2012). While such initiatives may yield long-term benefits, they may also impose near-term costs that dampen short-run growth. Lastly, governance performance had no statistically significant effect on economic development, suggesting that corporate governance mechanisms, at least as measured in ESG frameworks, do not directly or immediately influence national economic performance. It may reflect the delayed impact of governance reforms or a disconnect between firm-level governance practices and broader institutional quality.

This study contributes to the literature by showing that ESG dimensions affect economic development differently, challenging the assumption that their contributions are uniformly positive or consistent. By highlighting the distinct and potentially divergent effects of each ESG dimension, the study offers a more nuanced view of the relationship between sustainability and economic development and extends conventional analytical frameworks. From a policy perspective, the findings underscore the importance of promoting environmental innovation as a driver of sustainable economic progress, while ensuring social interventions and governance mechanisms align strategically with long-term productivity and growth objectives. Accordingly, policymakers should prioritize green innovation, improve the economic effectiveness of social policies, and strengthen governance institutions to foster more sustainable, inclusive economic development.

As with other findings in this study, omitted variables, endogeneity, or sample limitations may still influence the results. Future research could explore this relationship further by incorporating institutional quality indicators, longitudinal governance trends, or interaction effects between governance and other ESG dimensions. Future studies could also expand the sample beyond G20 countries to include emerging and developing economies, enabling a more comprehensive comparison of ESG–GDP relationships across economic contexts. Incorporating alternative ESG data sources or firm-level metrics could help capture sectoral variations and improve measurement accuracy. Additionally, adopting dynamic panel models or time-lagged variables may provide deeper insights into the short-term and long-term effects of ESG performance on economic growth. This adoption may also help explain the inflated R-squared value found in this research by observing specific moments within the regression, as observed in a similar study (Zhou et al., 2020). Future research could also integrate non-linear modeling approaches to explore potential threshold effects or diminishing returns in ESG's contribution to GDP per capita. Lastly, expanding the set

of control variables to include innovation, education quality, and environmental policy stringency may yield a more nuanced understanding of the mechanisms linking ESG dimensions to macroeconomic performance.

References

Acheampong, A. O. (2018). Economic growth, CO2 emissions and energy consumption: What causes what and where? *Energy Economics*, *74*, 677–692. https://doi.org/10.1016/j.eneco.2018.07.022

Albrizio, S., Kozluk, T., & Zipperer, V. (2017). Environmental policies and productivity growth: Evidence across industries and firms. *Journal of Environmental Economics and Management*, *81*, 209–226. https://doi.org/10.1016/j.jeem.2016.06.002

Alejo, J., Galvao, A., Montes-Rojas, G., & Sosa-Escudero, W. (2015). Tests for normality in linear panel-data models. *The Stata Journal: Promoting Communications on Statistics and Stata*, *15*(3), 822–832. https://doi.org/10.1177/1536867X1501500314

Almaqtari, F.A., Noman, S., Chabbi, T., Hashim, U.J., & Elsheikh, T. (2026). Board leadership attributes and sustainability performance: the role of unitary, two-tier and mixed board structures in a cross-country context. *Leadership & Organization Development Journal,* 47(6), 1025-1056. https://doi.org/10.1108/LODJ-04-2025-0254.

Almogbali, M., Almaqtari, F.A., Elmashtawy, A., & Almasria, N.A. (2025). The moderating role of social responsibility committee on the relationship between board characteristics and sustainability performance in the GCC countries. *Discover Sustainability,* 6(1015). https://doi.org/10.1007/s43621-025-01674-z

Ambec, S., & Barla, P. (2002). A theoretical foundation of the Porter hypothesis. *Economics Letters*, *75*(3), 355–360. https://doi.orsg/10.1016/S0165-1765(02)00005-8

Ambec, S., Cohen, M. A., Elgie, S., & Lanoie, P. (2013). The Porter Hypothesis at 20: Can environmental regulation enhance innovation and competitiveness? *Review of Environmental Economics and Policy*, *7*(1), 2–22. https://doi.org/10.1093/reep/res016

Angelidis, T., Michairinas, A., & Sakkas, A. (2024). World ESG performance and economic activity. *Journal of International Financial Markets, Institutions and Money*, *93*, 101996. https://doi.org/10.1016/j.intfin.2024.101996

Angwaomaodoko, E. A. (2025). Corporate governance and firm performance: Investigating the impact of governance structures on economic outcome. *Path of Science*, *10*(12), 1001–1011. https://doi.org/10.22178/pos.112-1

Azam, M., Khan, A. Q., Abdullah, H. B., & Qureshi, M. E. (2016). The impact of CO2 emissions on economic growth: Evidence from selected higher CO2 emissions economies. *Environmental Science and Pollution Research*, *23*(7), 6376–6389. https://doi.org/10.1007/s11356-015-5817-4

Baltagi, B. H. (2021). *Econometric analysis of panel data* (6th ed.). Springer. https://doi.org/10.1007/978-3-030-53953-5

Becchetti, L., Vergata, T., Giacomo, S. D., Alford, H., Bagella, M., Hasan, I., Lothian, J., Marzano, F., Nucci, F., & Pozzolo, A. (2005). *The impact of Social Responsibility on productivity and efficiency of US listed companies*. https://www.semanticscholar.org/paper/The-impact-of-Social-Responsibility-on-productivity-Becchetti-Vergata/514287e1e754ca6b367d5d7c9f66297bb5055c50

Bernstein, A., & Beeferman, L. (2015). *The materiality of human capital to corporate financial performance* (SSRN Scholarly Paper No. 2605640). Social Science Research Network. https://doi.org/10.2139/ssrn.2605640

Biju, A. V. N., Jayachandran, A., Thomas, A. S., & Sasidharan, A. (2024). Is national economic growth associated with environmental social and governance performance of firms? *Business Strategy & Development, 7*(3), e70009. https://doi.org/10.1002/bsd2.70009

Bloom, D. E., Khoury, A., Kufenko, V., & Prettner, K. (2021). Spurring economic growth through human development: Research results and guidance for policymakers. *Population and Development Review*, *47*(2), 377–409. https://doi.org/10.1111/padr.12389

Cabaleiro-Cerviño, G., & Mendi, P. (2024). ESG-driven innovation strategy and firm performance. *Eurasian Business Review*, *14*(1), 137–185. https://doi.org/10.1007/s40821-024-00254-x

Chang, C.-P., & Hao, Y. (2017). Environmental performance, corruption and economic growth: Global evidence using a new data set. *Applied Economics*, *49*(5), 498–514. https://doi.org/10.1080/00036846.2016.1200186

Chen, J. (2023). *The relationships among ESG, FDI and economic growth in CEE countries*.

Chen, S., Song, Y., & Gao, P. (2023). Environmental, social, and governance (ESG) performance and financial outcomes: Analyzing the impact of ESG on financial performance. *Journal of Environmental Management*, *345*, 118829. https://doi.org/10.1016/j.jenvman.2023.118829

Chen, Y. P. (Vincent), Zhuo, Z., Huang, Z., & Li, W. (2022). Environmental regulation and ESG of SMEs in China: Porter hypothesis re-tested. *Science of The Total Environment*, *850*, 157967. https://doi.org/10.1016/j.scitotenv.2022.157967

Chirwa, T. G., & Odhiambo, N. M. (2016). Macroeconomic determinants of economic growth: A review of international literature. *South East European Journal of Economics and Business*, *11*(2), 33–47. https://doi.org/10.1515/jeb-2016-0009

Cho, D. (2023). Environmental, Social, and Governance (ESG): Where has it come from, and where will it go? In *The Competitiveness of Nations 2: Government Policies and Business Strategies for Environmental, Social, and Governance (ESG)* (pp. 103–121). World Scientific.

Claessens, S., & Yurtoglu, B. (2012). *Corporate Governance and Development*. International Finance Corporation, Washington, DC. https://doi.org/10.1596/26874

Cohen, M. A., & Tubb, A. (2018). The impact of environmental regulation on firm and country competitiveness: A meta-analysis of the Porter Hypothesis. *Journal of the Association of Environmental and Resource Economists*, *5*(2), 371–399. https://doi.org/10.1086/695613

Comes, C.-A., & Oneț, P. (2025). The Impact of ESG performance on economic growth: global and regional cases. *Acta Marisiensis. Seria Oeconomica*, *19*(1), 35–50. https://doi.org/10.62838/amso-2025-0004

Cracolici, M. F., Cuffaro, M., & Nijkamp, P. (2010). The measurement of economic, social and environmental performance of countries: A novel approach. *Social Indicators Research*, *95*(2), 339–356. https://doi.org/10.1007/s11205-009-9464-3

Cutler, D. M., Katz, L. F., Card, D., & Hall, R. E. (1991). Macroeconomic performance and the disadvantaged. *Brookings Papers on Economic Activity*, *1991*(2), 1–74. https://doi.org/10.2307/2534589

DeLucia, C., Pazienza, P., & Bartlett, M. (2020). Does good ESG lead to better financial performances by firms? Machine learning and logistic regression models of public enterprises in Europe. *Sustainability*, *12*(13), 5317. https://doi.org/10.3390/su12135317

Dechezleprêtre, A., & Sato, M. (2017). The impacts of environmental regulations on competitiveness. *Review of Environmental Economics and Policy*, *11*(2), 183–206. https://doi.org/10.1093/reep/rex013

Diaye, M.-A., Ho, S.-H., & Oueghlissi, R. (2022). ESG performance and economic growth: A panel co-integration analysis. *Empirica*, *49*(1), 99–122. https://doi.org/10.1007/s10663-021-09508-7

Earle, L., & Scott, Z. (2010). *Assessing the evidence of the impact of governance on development outcomes and poverty reduction*. https://www.semanticscholar.org/paper/Assessing-the-Evidence-of-the-Impact-of-Governance-Earle-Scott/f06222f5eaa6055bb0914b26bebd7e0a3e1f12ce

Elsayed, K., & Paton, D. (2005). The impact of environmental performance on firm performance: Static and dynamic panel data evidence. *Structural Change and Economic Dynamics, The Economics of Corporate Social Responsibility*, *16*(3), 395–412. https://doi.org/10.1016/j.strueco.2004.04.004

Fu, G., & Otmane, A.L. (2022). ESG performance and economic growth: A panel co-integration analysis of North African countries and CEMAC sub-regions. *International Journal of Recent Research in Commerce, Economics and Management (IJRRCEM), 9*(2)30-36. https://doi.org/10.5281/ZENODO.6469967

Gani, A. (2011). Governance and growth in developing countries. *Journal of Economic Issues*, *45*(1), 19–39. https://www.jstor.org/stable/25800752

Garba, M. K., Oyejola, B. A., & Yahya, W. B. (2013). Investigations of certain estimators for modeling panel data under violations of some basic assumptions. *Mathematical Theory and Modelling,* 3(10), 47-54. https://www.iiste.org/Journals/index.php/MTM/article/view/7083/7312

Gujarati, D. N., & Porter, D. C. (2009). *Basic Econometrics*. McGraw-Hill Irwin.

Gylfason, T., & Zoega, G. (2003). Education, social equality and economic growth: A view of the landscape. *CESifo Economic Studies*, *49*(4), 557–579. https://doi.org/10.1093/cesifo/49.4.557

Hassani, B. K., & Bahini, Y. (2022). Relationships between ESG disclosure and economic growth: A critical review. *Journal of Risk and Financial Management*, *15*(11), 538. https://doi.org/10.3390/jrfm15110538

Hermundsdottir, F., & Aspelund, A. (2022). Competitive sustainable manufacturing—Sustainability strategies, environmental and social innovations, and their effects on firm performance. *Journal of Cleaner Production*, *370*, 133474. https://doi.org/10.1016/j.jclepro.2022.133474

Ho, S.-H., Oueghlissi, R., & Ferktaji, R. E. (2023). Testing for causality between economic growth and environmental, social, and governance performance: New evidence from a global sample. *Journal of the Knowledge Economy*. https://doi.org/10.1007/s13132-023-01406-6

Huynh, K. P., & Jacho-Chávez, D. T. (2009). A nonparametric quantile analysis of growth and governance. In Q. Li & J. S. Racine (Eds.), *Advances in Econometrics*, 25, 193–221). Emerald Group Publishing Limited. https://doi.org/10.1108/S0731-9053(2009)0000025009

Inekwe, M., Hashim, F., & Yahya, S. B. (2021). CSR in developing countries – the importance of good governance and economic growth: Evidence from Africa. *Social Responsibility Journal*, *17*(2), 226–242. https://doi.org/10.1108/SRJ-10-2019-0336

Inyang, W. S., Joel, E. E., Obeten, O. I., Orok, A. B., Ubi, I. U., & Mbu-Ogar, G. B. (2023). Corporate social responsibility and shareholders' wealth of industrial goods producing companies listed on the Exchange Group PLC of Nigeria. *International Journal of Professional Business Review*, *8*(6), e02476–e02476. https://doi.org/10.26668/businessreview/2023.v8i6.2476

Jalilian, H., Kirkpatrick, C., & Parker, D. (2007). The impact of regulation on economic growth in developing countries: A cross-country analysis. *World Development*, *35*(1), 87–103. https://doi.org/10.1016/j.worlddev.2006.09.005

Junior, D.M.B., Junior, A.P., & Carvallo, L. (2023). The effect of country governance on firm performance: The moderating role of culture. *Revista Catarinense da Ciência Contábil*, 22(e3362), 1-20. https://doi.org/10.16930/2237-7662202333622

Kordalska, A. K., & Olczyk, M. (2016). Global competitiveness and economic growth: A one-way or two-way relationship? *Equilibrium. Quarterly Journal of Economics and Economic Policy*, *11*(1), 121–142. https://doi.org/10.12775/EQUIL.2016.006

Kotsantonis, S., & Serafeim, G. (2020). Human capital and the future of work: Implications for investors and ESG integration. *Journal of Financial Transformation*, 51, 115-130. https://api.semanticscholar.org/CorpusID:213177850

Lazăr, D., Minea, A., & Purcel, A.-A. (2019). Pollution and economic growth: Evidence from Central and Eastern European countries. *Energy Economics*, *81*, 1121–1131. https://doi.org/10.1016/j.eneco.2019.05.011

Leach, M., Reyers, B., Bai, X., Brondizio, E. S., Cook, C., Díaz, S., Espindola, G., Scobie, M., Stafford-Smith, M., & Subramanian, S. M. (2018). Equity and sustainability in the Anthropocene: A social–

ecological systems perspective on their intertwined futures. *Global Sustainability*, *1*, e13. https://doi.org/10.1017/sus.2018.12

Leogrande, A., & Costantiello, A. (2023). The role of GDP growth in the ESG approach at world level. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4434206

Li, T.-T., Wang, K., Sueyoshi, T., & Wang, D. D. (2021). ESG: Research progress and future prospects. *Sustainability*, *13*(21), 11663. https://doi.org/10.3390/su132111663

Li, X., Saat, M. M., Khatib, S. F. A., & Liu, Y. (2024). Sustainable development and firm value: How ESG performance shapes corporate success—a systematic literature review. *Business Strategy & Development*, *7*(4), e70026. https://doi.org/10.1002/bsd2.70026

López-Arceiz, F. J., Bellostas, A. J., & Rivera, P. (2018). Twenty years of research on the relationship between economic and social performance: A meta-analysis approach. *Social Indicators Research*, *140*(2), 453–484. https://doi.org/10.1007/s11205-017-1791-1

Lundgren, T., & Zhou, W. (2017). Firm performance and the role of environmental management. *Journal of Environmental Management*, *203*, 330–341. https://doi.org/10.1016/j.jenvman.2017.07.053

Lyeonov, S., Pimonenko, T., Bilan, Y., Štreimikienė, D., & Mentel, G. (2019). Assessment of green investments' impact on sustainable development: linking Gross Domestic Product per Capita, greenhouse gas emissions and renewable energy. *Energies*, *12*(20), 3891. https://doi.org/10.3390/en12203891

Makhdalena, M., & Zulvina, D. (2024). Environmental and firm performance: Evidence from Indonesia. *Indonesian Journal of Sustainability Accounting and Management*, *8*(2), 527–538. https://doi.org/10.28992/ijsam.v8i2.1004

Malinvaud, E. (1970). *Statistical Methods of Econometrics*. North-Holland Publishing Company.

Mendonça, J. A., Roberto, F. R. A., Kai, D. A., & Benitez, G. B. (2025). The Lock-in effect on ESG and business performance relationship: A critical examination and meta-analysis. *Corporate Social Responsibility and Environmental Management*, *32*(5), 6912–6936. https://doi.org/10.1002/csr.70062

Mohd Daud, S. N., Ghazali, N. S., & Mohammad Ismail, N. H. (2024). ESG, innovation, and economic growth: An empirical evidence. *Studies in Economics and Finance*, 41 (4), 845–870. https://doi.org/10.1108/SEF-11-2023-0692

N, A., Deo, M., & Thiyagarajan, S. (2023). Effect of governance practice on firm value: Governance professionals' perception sdy. *Indian Journal of Corporate Governance*, *16*(1), 79–93. https://doi.org/10.1177/09746862231170425

Neagu, O., Ardelean, D. I., & Lazăr, V. (2017). How is environmental performance associated with economic growth? A world cross-country analysis. *Studia Universitatis „Vasile Goldis" Arad – Economics Series*, *27*(3), 15–32. https://doi.org/10.1515/sues-2017-0010

Nguyen, P.-A., Kecskés, A., & Mansi, S. (2020). Does corporate social responsibility create shareholder value? The importance of long-term investors. *Journal of Banking & Finance, Challenges to Global Financial Stability: Interconnections, Credit Risk, Business Cycle and the Role of Market Participants*, *112*, 105217. https://doi.org/10.1016/j.jbankfin.2017.09.013

Nikzad, R. (2021). Governance, institutions, and economic development. *International Journal of Innovation and Economic Development*, *7*(4), 7–22. https://doi.org/10.18775/ijied.1849-7551-7020.2015.74.2001

OECD. (2020). *ESG investing: Practice, progress and challenges.* OECD Publishing, Paris. https://doi.org/10.1787/b4f71091-en.

Piserà, S., Gandullia, L., & Girardone, C. (2024). Do responsible practices lead to higher firm productivity? Evidence from Europe. *International Journal of Finance & Economics, 30*(3), 2186–2214. https://doi.org/10.1002/ijfe.3011

Porter, M. E. (1991). America' green strategy. *Scientific American*. https://www.scientificamerican.com/article/essay-1991-04/

Porter, M. E., & Kramer, M. R. (2006). The link between competitive advantage and corporate social responsibility. *Harvard Business Review*. https://hazrevista.org/wp-content/uploads/strategy-society.pdf

Porter, M. E., & van der Linde, C. (1995). Toward a new conception of the environment-competitiveness relationship. *The Journal of Economic Perspectives*, *9*(4), 97–118. https://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.9.4.97

Rivera-Batiz, F. L. (2002). Democracy, governance, and economic growth: Theory and evidence. *Review of Development Economics*, *6*(2), 225–247. https://doi.org/10.1111/1467-9361.00151

Rouen, E., Sachdeva, K., & Yoon, A. (2022). The evolution of ESG reports and the role of voluntary standards. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4227934

Sánchez, P. E., & Benito-Hernández, S. (2015). CSR policies: Effects on labour productivity in Spanish micro and small manufacturing companies. *Journal of Business Ethics*, *128*(4), 705–724. https://doi.org/10.1007/s10551-013-1982-x

Schiehll, E., & Martins, H. C. (2016). Cross-national governance research: A systematic review and assessment. *Corporate Governance: An International Review*, *24*(3), 181–199. https://doi.org/10.1111/corg.12158

Shiu, Y.-M., & Yang, S.-L. (2017). Does engagement in corporate social responsibility provide strategic insurance-like effects? *Strategic Management Journal*, *38*(2), 455–470. https://doi.org/10.1002/smj.2494

Singh, N., Das, N., & Enam, M. (2025). Profit meets purpose: A meta-analysis of impact of corporate sustainability on firm performance. *Business Process Management Journal*, *32*(1), 344–370. https://doi.org/10.1108/BPMJ-10-2024-0961

Škare, M., & Golja, T. (2014). The impact of government CSR supporting policies on economic growth. *Journal of Policy Modeling*, *36*(3), 562–577. https://doi.org/10.1016/j.jpolmod.2014.01.008

Skouloudis, A., Isaac, D., & Evaggelinos, K. (2016). Revisiting the national corporate social responsibility index. *International Journal of Sustainable Development & World Ecology*. (world). https://www.tandfonline.com/doi/abs/10.1080/13504509.2015.1099121

Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics*, *70*(1), 65–94. https://doi.org/10.2307/1884513

Soufiene, A., Alvarado, R., Abid, M., Tillaguango, B., Shahbaz, M. (2025). The role of taxation in environmental sustainability in G-20 economies: A double dividend theoretical assessment. *Journal of Environmental Management,* 374, 123996. https://doi.org/10.1016/j.jenvman.2024.123996

Starks, L. T., Venkat, P., & Zhu, Q. (2017). *Corporate ESG profiles and investor Horizons* (SSRN Scholarly Paper No. 3049943). Social Science Research Network. https://doi.org/10.2139/ssrn.3049943

Tahmid, T., Hoque, M. N., Said, J., Saona, P., & Azad, Md. A. K. (2022). Does ESG initiatives yield greater firm value and performance? New evidence from European firms. *Cogent Business & Management*, *9*(1), 2144098. https://doi.org/10.1080/23311975.2022.2144098

Trahan, R. T., & Jantz, B. (2023). What is ESG? Rethinking the "E" pillar. *Business Strategy and the Environment*, *32*(7), 4382–4391. https://doi.org/10.1002/bse.3371

Ugur, M. (2014). Corruption's direct effects on per capita income growth: A meta-analysis. *Journal of Economic Surveys*, *28*(3), 472–490. https://doi.org/10.1111/joes.12035

Ullmann, A. A. (1985). Data in search of a theory: A critical examination of the relationships among social performance, social disclosure, and economic performance of U. S. Firms. *The Academy of Management Review*, *10*(3), 540–557. https://doi.org/10.2307/258135

UN Global Compact. (2004). *Who Cares Wins: Connecting Financial Markets to a Changing World*. United Nations Department of Public Information https://documents1.worldbank.org/curated/en/280911488968799581/pdf/113237-WP-WhoCaresWins-2004.pdf

Wang, J., Yu, J., & Zhong, R. (2023). Country environmental, social and governance performance and economic growth: The international evidence. *Accounting & Finance*, *63*(4), 3911–3941. https://doi.org/10.1111/acfi.13079

Wang, T., & Bansal, P. (2012). Social responsibility in new ventures: Profiting from a long-term orientation. *Strategic Management Journal*, *33*(10), 1135–1153. https://doi.org/10.1002/smj.1962

World Trade Organization. (2024). *Report on G20 Trade Measures (Mid-October 2023 to Mid-October 2024*. Retrieved from https://www.wto.org/english/news_e/news24_e/trdev_13nov24_wto_report_e.pdf

Xing, Z., Huang, J., & Fang, D. (2025). From compliance to competitiveness: Unpacking the impact of ESG performance on strategic innovation and market dynamics. *IEEE Transactions on Engineering Management*, *72*, 1297–1319. https://doi.org/10.1109/TEM.2025.3551742

Zhang, N., Yang, C., & Wang, S. (2024). Research progress and prospect of environmental, social and governance: A systematic literature review and bibliometric analysis. *Journal of Cleaner Production*, *447*, 141489. https://doi.org/10.1016/j.jclepro.2024.141489

Zhou, X., Caldecott, B., Harnett, E., & Schumacher, K. (2020). The Effect of firm-level ESG practices on macroeconomic performance. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3618748

Zhu, F. (2014). Corporate governance and the cost of Capital: An international study. *International Review of Finance*, *14*(3), 393–429. https://doi.org/10.1111/irfi.12034

Ziolo, Filipiak, Bąk, & Cheba. (2019). How to design more sustainable financial systems: The roles of environmental, social, and governance factors in the decision-making process. *Sustainability*, *11*(20), 5604. https://doi.org/10.3390/su11205604