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PART I

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PART III

PART I

DECODING ENVIRONMENTAL SCORES: DIVERGENCE ACROSS DATA PROVIDERS

RESUMEN EJECUTIVO

Las calificaciones medioambientales (E) son una piedra angular de la inversión basada en criterios ESG, pero a menudo ofrecen visiones contradictorias sobre la misma empresa. Nuestro estudio analiza las razones de esta paradoja y explica por qué las calificaciones medioambientales de una misma empresa por parte de los diferentes proveedores difieren y cuáles son las implicaciones de esto para los inversores, los gestores y los reguladores. Documentamos cómo el desempeño medioambiental es inherentemente complejo, ya que abarca las emisiones, las estrategias climáticas y el uso de recursos, sin que exista un solo factor que vincule todas las calificaciones. Esta naturaleza multidimensional crea una variedad de interpretaciones, ocasionando problemas de fiabilidad a los usuarios de dichas calificaciones.

Nuestra investigación muestra que los desacuerdos en las calificaciones medioambientales no son aleatorios. Las empresas más grandes, las que poseen abundantes activos intangibles (como marcas, patentes o talento), las empresas con calificaciones crediticias establecidas y las ubicadas en regiones con más conciencia ecológica (como por ejemplo los estados de tendencia demócrata en EE. UU.) presentan mayores disparidades en las calificaciones. ¿Por qué? Porque la mayor cantidad de información y un escrutinio público más intenso amplifican las diferencias en la forma en que las agencias sopesan los factores medioambientales. Por otro lado, las empresas altamente rentables disfrutan de calificaciones más consistentes, ya que sus señales financieras reducen la ambigüedad. En resumen, son los intangibles, y no los activos físicos, los que explican gran parte de la divergencia en las calificaciones.

***Recomendaciones para los inversores:* Caveat Emptor**

Los inversores, tanto en los mercados de renta variable como de deuda, deberían tratar las calificaciones E(SG) como direccionales en lugar de definitivas. No es una buena idea tomar las calificaciones ESG a valor facial. Es más apropiado usarlas como un punto de partida, mezclando múltiples fuentes para capturar una imagen más completa del perfil de la empresa. Las empresas con alta visibilidad o activos intangibles pueden mostrar mayor discrepancia en las calificaciones de los distintos proveedores. Por lo tanto, los inversores deben tener en cuenta este hecho a la hora de desarrollar sus modelos de inversión y riesgo. Más allá de los números, es prudente considerar pistas cualitativas, como por ejemplo la seriedad con la que la gerencia aborda los riesgos climáticos en las comunicaciones con los inversores, para afinar las decisiones de inversión.

Para los gerentes de las empresas: pulir la narrativa

Las calificaciones ESG varían en función de cómo los directivos de las empresas presentan los datos a las empresas de calificación. La presentación de informes transparentes y coherentes sobre los intangibles relacionados con el clima puede reducir las diferencias entre las calificaciones. Interactúe con las agencias para comprender sus métodos y abordar las discrepancias. Una comunicación transparente en materia de ESG genera confianza en los inversores y refuerza la reputación de la empresa.

Para los reguladores: promover la claridad

Estandarizar la estructura y contenido de los informes ambientales puede ayudar a nivelar el campo de juego. Impulsar metodologías de calificación ESG transparentes y apoyar bases de datos de acceso abierto para reducir la dependencia de calificaciones comerciales inconsistentes es una vía a considerar. Al fomentar la equidad y la comparabilidad, los reguladores pueden ayudar a los mercados para que tomen decisiones informadas y sostenibles.

EXECUTIVE SUMMARY

Environmental (E) ratings are a cornerstone of ESG investing, yet they often tell conflicting stories about the same company. Our study dives into this puzzle, revealing why ratings from different providers diverge and what it means for investors, managers, and regulators. We uncover that environmental performance is inherently complex, spanning emissions, climate strategies, and resource use, with no single factor tying all ratings together. This multi-dimensional nature creates a kaleidoscope of scores, challenging those who rely on them.

Our research highlights that rating disagreements are not random. Larger firms, those rich in intangible assets (such as brands, patents, or talent), companies with established credit ratings, and those located in eco-conscious regions (like Democratic-leaning states) tend to face greater rating disparities. Why? More data and public scrutiny amplify differences in how agencies weigh environmental factors. On the flip side, highly profitable firms enjoy more consistent ratings, as their clear financial signals reduce ambiguity. Notably, intangibles, not physical assets, drive much of this divergence.

Recommendations For Investors: Navigate with Confidence

Investors in both equity and debt markets should treat ESG ratings as directional rather than definitive. Do not treat ESG ratings as gospel. Use them as a starting point, blending multiple sources to capture the complete environmental picture. Firms with high visibility or intangible assets may show wider rating swings. Therefore, investors should consider this fact when developing their risk models. Beyond numbers, tune in to qualitative clues, such as how seriously management addresses climate risks in earnings calls, to sharpen your investment decisions.

For Firm Managers: Shape the Narrative

ESG ratings vary based on how the firms' managers present data. Transparent and consistent reporting on climate-related intangibles can bridge the gaps between ratings. Engage with agencies to understand their methods and address discrepancies. Transparent ESG communication builds investor trust and strengthens the firm's reputation.

For Regulators: Pave the Way for Clarity

Standardize environmental reporting to level the playing field. Push for transparent ESG rating methodologies and support open-access databases to reduce reliance on inconsistent commercial ratings. By fostering fairness and comparability, regulators can empower markets to make informed, sustainable choices.

Decoding Environmental Scores: Divergence Across Data Providers

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ABSTRACT

This study reveals that environmental performance is inherently multi-dimensional, challenging the notion of a single dominant factor driving E ratings provided by different raters. The autocorrelation within ratings and the correlation between rates fluctuate in most cases, underscoring measurement divergence. Larger firms and those with more intangible assets, expected strong future performance credit ratings, and headquarters in Democratic-leaning states experience higher rating discrepancies, likely due to greater data availability and reporting pressure, while more profitable firms see lower disagreement. The factors correlated to internal and external discrepancies differ in the direction and nature of their impact. These findings highlight the need for investors to scrutinize E methodologies, firms to manage E narratives strategically, and regulators to enhance reporting standardization to improve rating consistency and market trust.

Keywords: Environmental scores, rating discrepancies, sustainability metrics, data providers.

JEL classification: D83, G32, M14, Q56.

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1. INTRODUCTION

The global financial environment is experiencing increasing attention towards Environmental, Social, and Governance (ESG) factors as key elements for the valuation of companies. Investors, regulators, and the general public have been increasingly concerned about how companies address environmental, social, and governance issues, which has led to increased pressure on companies to improve their performance in those areas and, presumably, their ESG ratings (Gibson *et al.,* 2022). As a result of this pressure, one of the most significant changes in financial markets in recent years has been the integration of ESG ratings into investment decisions. In 2022, 43% of investors integrated ESG ratings and data into investment strategies, while only 12% considered ESG ratings in 2018 (Wong *et al.,* 2023). Besides, growing regulatory pressure on companies to integrate ESG standards incentives that ratings are more widely used than ever. However, investors and companies show growing concerns about the accuracy and utility of ESG ratings (Wong *et al.,* 2023) and demand more transparent and consistent ESG ratings.

Theory and evidence (Pedersen *et al.,* 2021) suggest that the impacts on several firm value measures of separate E, S, and G or ESG may differ. For instance, G ratings correlate positively with equity value, S ratings correlate negatively, and E ratings present mixed results. This paper focuses on the E dimension for several reasons. First, the E-dimension is directly linked to observable factors such as carbon emissions and water usage, allowing for a more objective and measurable assessment of Environmental Performance compared to Social or Governance[1] performance (Gibson *et al.,* 2021). Second, the increasing global emphasis on environmental sustainability, as reflected in international agreements like the Paris Climate Agreement, has heightened the importance of E-related disclosures and performance metrics. Third, compared to the social dimension, which encompasses a broad and diverse set of factors–such as labor rights, diversity, and community impact–E is a more narrowly defined measure, facilitating better comparability across firms. In this paper, we investigate what firm characteristics are associated with the discrepancy of the E ratings among different raters (*i.e.,* E-Score external discrepancy) and the discrepancy over different E dimensions within a specific rater (*e.g.,* LSEG).

[1] When it comes to S and G, providers usually have less agreement on the most important issues and, as a result, a worse understanding of how to quantify these issues.

The motivation for this paper stems from the results of several studies documenting a lack of consistency between the ESG rankings provided by the different providers. Chatterji *et al.* (2016) use ESG ratings and a subset of the underlying indicators that make up them and find considerable disagreement among the six top data providers. Using the complete set of underlying indicators, Berg *et al.* (2022) document that the divergence in ESG ratings across six data providers is primarily due to differences in measurement (*i.e.,* rating agencies measure the same attribute using different indicators), followed by scope (*i.e.,* ratings are based on different sets of attributes), while weight divergence (*i.e.,* rating agencies take different views on the relative importance of attributes) is less relevant.[2] As a result, ESG rating divergence reflects fundamental disagreement about the underlying data,[3] and thus, it is not easy to resolve. Besides, raters give a company similar scores across categories. The lack of agreement in the literature on the level of informative quality of ESG ratings presents a challenge to their usefulness and harms financial markets.

While differences in ratings on similar dimensions have been documented (*e.g.,* Chatterji *et al.,* 2016; Gibson *et al.,* 2021), we know much less about the drivers of such differences. Gibson *et al.* (2021) document ESG rating disagreement between seven raters, especially in the E (environmental) dimension, and find that stock returns are positively related to ESG rating disagreement. Disagreement is higher for the largest firms, firms that do not have credit ratings, and firms in the consumer durables and telecommunications industries. In contrast, more profitable firms tend to have lower ESG rating disagreements. In addition, Christensen *et al.* (2022) present evidence that companies that provide more information about their ESG factors are the ones that show the most significant disagreement and variation in their ESG ratings. Huber and Comstock (2017) underline that the providers' methodology, scope, and coverage of reports and ratings vary significantly. Regarding consequences, Avramov *et al.* (2022) posit that ESG rating is negatively associated with future stock performance only for low-ESG-disagreement stocks. In addition, Serafeim and Yoon (2023) suggest that ESG rating disagreement hinders incorporating value-relevant ESG news into stock prices.

This paper's novelty is documenting the extent to which a common element explains the E ratings of the various providers. Existing studies on ESG rating disagreement focus on the causes of this divergence (Berg *et al.,* 2022; Christensen

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[2] ESG ratings present several aggregation levels. At the highest level, the rating usually has three dimensions (E, S, and G). Below this level, there are between one and three levels of more granular sub- categories. At the lowest level, and depending on the rater, between thirty and three-hundred indicators are considered which often relate to similar underlying attributes. As a result, divergence results from (i) two raters considering a different set of attributes (what an ESG rating intends to measure), (ii) two raters using different indicators to measure the same attribute (how it is measured), and (iii) two raters aggregating the same indicators using different weights.

[3] Not all categories present similar disagreement level. Measurement divergence is most influential in the categories Climate Risk Management, Product Safety, Corporate Governance, Corruption, and Environmental Management System.

et al., 2022) and the reaction of the capital market to it (Avramov *et al.,* 2022; Serafeim and Yoon, 2022; Gibson *et al.,* 2021), but none of them explore the question studied in this paper. The first contribution of this paper is to document that environmental performance is inherently multi-dimensional. Thus, no single common factor explains the E ratings of the various providers. Compared to previous studies that focus on commercial ratings, we look at the consistency between commercial ratings on the one hand and non-commercial data constructed by Sautner *et al.* (2023) based on the attention paid by earnings call participants to firms' climate change exposures on the other hand. The second novelty of this paper lies in showing how the degree of disagreement across E ratings (*i.e.,* the E-Score External discrepancy, measured by the volatility of the deviations from the common trend) depends on systematic factors. The third contribution of this paper is showing that large firms, firms with more intangible assets and expected strong future performance, firms with credit ratings, and those in Democratic-leaning states experience higher rating discrepancies, likely due to greater data availability and reporting pressure.

In contrast, more profitable firms see lower disagreement. Moreover, the covariation between tangibility and disagreement is insignificant, contrasting to Gibson *et al.* (2021), but the covariation between intangibility and disagreement is significant. In addition, while internal and external discrepancies are related to similar factors, the direction and nature of their association differ, highlighting the complexity of factors driving rating disagreements.

The rest of the paper is structured as follows: Section 2 discusses related literature, Section 3 outlines the methodology, and Section 4 details the database. Section 5 discusses the empirical results, and Section 6 concludes.

2. RELATED LITERATURE

Chatterji *et al.* (2016) show considerable disagreement among the ESG ratings of the top data providers. Huber and Comstock (2017) underline that the providers' methodology, scope, and coverage of reports and ratings vary significantly. Christensen *et al.* (2021) present evidence that companies that provide more information about their ESG factors are the ones that show the most significant disagreement (or variation) in their ESG ratings. In addition, the greater the disagreement between ESG ratings, the higher the volatility of equity returns and the lower the likelihood of resorting to external financing. Therefore, this indicates that more disclosure of ESG data increases disagreement in ESG ratings rather than decreases it. Interestingly, the most significant disagreement occurs in categories E and S, while the degree of agreement across raters is higher in category G. One possible reason for these results is that more information increases the likelihood of different interpretations. This issue is important because, without agreement on

what constitutes good ESG performance, it is doubtful that ESG ratings will provide relevant information for investment decisions.

In addition, the industry of agencies that publish ESG ratings presents controversial situations, such as possible conflicts of interest and possible *greenwashing*. Kotsantonis and Serafeim (2019) indicate that the most significant obstacle to using ESG data in investment decisions is the lack of comparability of ESG metrics across companies and over time. Avramov *et al.* (2022) show that demand for equities decreases, and market risk increases if there is uncertainty in ESG ratings. Billio *et al.* (2021) find that the disagreement in the scores provided by the rating agencies disperses the effect of preferences of ESG investors on asset prices to the point that the rating does not impact financial performance. Berg *et al.* (2022) introduce the concept of "aggregate confusion," referring to the divergence in ESG ratings due to varying methodologies and definitions among rating agencies. They document the rating divergence and decompose it into scope, measurement, and weight contributions.

3. METHODOLOGY

This paper expands and adapts the methodology of Mayordomo *et al.* (2014). The principal analysis of the data is based on testable hypotheses. These hypotheses and the methodology employed to perform the empirical tests are detailed in this section.

Hypothesis 1a: There is a common dominant factor in the Environmental ratings from different data sources. In other words, a single common factor should explain a sizeable proportion of the variation across Environmental ratings. The test of Hypothesis 1a is based on a correlation analysis and a principal components analysis in which the variable of interest is the E score of firms i on year t reported by the different data sources, denoted by $(E)_{i,t}$.

Hypotheses 1b: The degree of correlation of average scores of the data providers is consistent over time. The test of Hypothesis 1b is based on computing the correlation of $(E)_{i,t}$ ratings over time and testing its stability.

Hypothesis 2: The E-Score external discrepancy (volatility of the deviations from the common trend) of the scores provided by the different environmental data sources does not depend on systematic factors. It is random.

In other words, large deviations (in absolute value) from the common trend appear randomly among databases and are unrelated to observable firm-level financial and accounting characteristics, industry sector, risk, and other factors (global

or idiosyncratic). The test of Hypothesis 2 is based on an Ordinary Least Squares (OLS) regression model in which the dependent variable (the E-Score external discrepancy) is the logarithm of the standard deviation of the E ratings reported by the different data sources, which is denoted by $\log(sd(E))_{i,t}$. This variable is computed with the available E score quoted by the data provider j for a given underlying firm i in a given year t as follows:

$$log(sd(E))_{i,t} = log((1/n\sum_{j=1}^{n}[E_{j,i,t} - (1/n\sum_{j=1}^{n}[E_{j,i,t})]^2)^{0.5}), \quad [1]$$

where n is the number of data sources. Using Equation [1] as the dependent variable,[4] we concentrate on the deviations across data providers. The regression equation is as follows:

$$log\,(sd\,(E))_{i,t} = \alpha + \beta' X_{k,i,t} + u_{i,t} \quad [2]$$

where the vector $X_{k,i,t}$ includes k explanatory variables potentially relevant as suggested by previous literature. Gibson *et al.* (2021) report that the higher the tangibility, defined as property, plant, and equipment divided by total assets (PPE henceforth), the lower the Discrepancy among E ratings. Besides this variable, model [2] also includes balance sheet-related variables such as (i) the firm's size, (ii) its profitability, and (iii) its leverage. Investor transparency variables, such as whether the firm has a credit rating, are also considered. Model [2] also includes growth opportunities and asset intangibility measured by Tobin's Q, governance-related variables such as board independence and CEO duality, and market-based variables such as stock return volatility. Motivated by results in Di Giuli and Kostovetsky (2014) that firms score higher on CSR when headquartered in Democratic rather than Republican-leaning states, model [2] includes a proxy for the political color of the state where the firms are incorporated.

The vector β' includes the regression coefficients corresponding to these k variables while the parameter α is the intercept of the regression. The residual term is denoted by $u_{i,t}$. Pooled panel regressions are applied to [2], where the rating disagreement measures [1] is the dependent variable. Model [2] also included industry and year-fixed effects. Standard errors were clustered at the firm level and robust to heteroskedasticity. The variable [1] presents significant inertia, and to deal with first-order autocorrelation, the lagged variable of the dependent variable was included as an explanatory variable. Under the null hypothesis, no significant coefficients should be found in Equation [2] because differences in rating dispersion between databases should be purely random.

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[4] In contrast to other studies, for example Christensen *et al.* (2022), this paper takes logs to induce the data to meet the assumptions of the regression method that is to be applied. Many statistical tests and confidence intervals rely on the assumption of normally distributed residuals. Log transformation can help meet this assumption. The distribution of $sd(E)_{i,t}$ is strongly right skewed and leptokurtic. The skewness of the original series is 3.79 while the skewness of the log series (1) is -0.87 and the kurtosis of the original series is 35.10 while the kurtosis of the log series (1) is 5.99.

Hypothesis 3: The degree of internal discrepancy is meaningful over time.

This hypothesis posits that the degree of internal discrepancy of each database is high over time, which can be reflected in two dimensions. First, we are interested in the consistency of the ratings provided for the same firm from the given data provider over time, *i.e.,* the serial correlation. Given that environmental performance generally reflects adoption policies and long-term investments, we expect high levels of serial correlation. Second, we examine whether the factors that determine the E-Score internal discrepancy within a database are the same as those that determine the E-Score external discrepancy across databases. The Environmental performance measure by LSEG is based on three distinct subdimensions, which allows us to explore the relevance of the internal discrepancy. Therefore, the test of Hypothesis 3 is based on computing (i) the first-order autocorrelation of the scores within each data provider and testing its consistency over time and (ii) studying within a specific data provider (*i.e.,* LSEG) whether the factors determining the discrepancy at the aggregate external level apply.

4. DATA

4.1. Data on Environmental Performance

This paper uses a sample based on information from three databases from 2002 to 2019 from US-listed companies to extract environmental performance measures. The sample includes, as a novelty in comparison to extant literature, a database focusing explicitly on the environmental dimension and constructed by Sautner *et al.* (2023) and two commercial providers, LSEG Data & Analytics (previously known as Refinitiv or Asset4) and MSCI ESG Research, whose data has been widely used in many academic studies. We consider all firms for which data is available for all three ratings from 2002 to 2019. The final sample includes 15,553 firm-year observations from 3,244 firms.

Our first data source provides a commercial ESG rating by LSEG Data & Analytics, a financial data company owned by the London Stock Exchange Group (LSEG). Its environmental performance scores assess firms on various sustainability criteria, including resource use, environmental innovation, and climate-related disclosures. Our second source is another commercial ESG rating provided by the MSCI ESG Research database, initially developed by KLD Research & Analytics, Inc., and later acquired by MSCI (Morgan Stanley Capital International). This rating provider focuses on several ESG dimensions, strengths, and concerns. This database is a long-established and detailed repository of ESG indicators, particularly within the U.S. market. Our focus is on the Environmental strengths and concerns, which include corporate environmental practices such as pollution, renewable energy use, and compliance with environmental regulations.

Our third non-commercial data source is the climate change exposure constructed by Sautner *et al.* (2023). To construct this measure, Sautner *et al.* (2023) focus on corporate quarterly earnings calls to assess firms' risks and opportunities related to climate change. They capture a firm's exposure to a topic by measuring the proportion of the conversation during earnings calls dedicated to that subject (Hassan *et al.,* 2019). Compared to the commercial Environmental ratings, this measure provides an alternative perspective by focusing on the attention financial analysts and management devote to climate change topics during conference calls.

Table 1 provides further information about ESG data providers, the firms and period they cover selection, and the number of firms and rating scales.

Table 1
ESG DATA PROVIDERS

Data provider	Country	Rating scale	Period covered	Number of firms	Pillars	Rating style
LSEG	95 countries	0-100	2002-2024	11,672	E, S, G, Total	Index
MSCI	141 countries	0-10	Jan. 1999-Dec. 2024	29,167	E, S, G, Total	Index
Sautner *et al.* (2023)	88 countries	[0-0.075]%	2001-2023	15,198	E	Proportion

Note: This Table presents information on ESG data providers. Our sample is from 2002 to 2019.
Source: Own elaboration.

4.2. Financial Statement Data

Firms' financial and accounting data (*e.g.,* total assets, leverage, capital expenditure, or cash holdings) are from Compustat North America.

4.3. Stock prices, volatility, board characteristics, and credit rating data

Data on stock price volatility comes from CRSP. We also retrieve data on board characteristics and Moody's credit ratings from LSEG.

4.4. Variables construction

To construct the average environmental performance score and a measure of discrepancy, we build on the following three measures: Sautner's Climate Change Exposure, LSEG- Environmental Performance Score, and Net MSCI Environmental Pillar score.

The LSEG-Environmental Performance Score is a comprehensive measure that evaluates a company's performance in addressing environmental issues and managing sustainability-related risks and opportunities. The Environmental Performance Score is the average score of the following three environmental categories: (i) resource use, (ii) emissions, and (iii) product innovation benefiting the environment. LSEG builds its assessment for each category around objective key performance indicators (KPIs) from numerous sources such as stock exchange filings, CSR and annual reports, nongovernmental organizations' websites, and news sites. Each KPI is scored against the company peers, and the relative weight of each KPI is based on several factors, such as the relevance of the KPI in the industry, whether it is derived from independent information content or the objective measurability of the KPI. The obtained weighted average scores for each category are normalized and adjusted for skewness and the differential between the mean and the median, then fitted to a bell curve to derive ratings for each category between 0 and 100 for each company.

The MSCI Environmental Pillar Score assesses how well a company manages risks and opportunities related to environmental factors such as climate change, natural resource use, pollution, and waste. The MSCI Environmental Pillar Score is calculated by evaluating how well a company manages its industry's most relevant environmental risks and opportunities. MSCI first identifies key environmental issues that could have a material impact on a company's financial performance, such as carbon emissions, water stress, or waste management. For each issue, MSCI assesses the company's exposure to the risk and how effectively it manages that risk through policies, programs, and performance. Each issue is scored on a scale from 0 to 10, and these scores are combined using a weighted average, where the weights reflect the importance of each issue to the company's industry. The result is a single Environmental Pillar Score that reflects the company's overall environmental performance. The score typically ranges from 0 to 10, with higher values indicating stronger environmental performance.

Climate Change Exposure is the firm-level climate exposure measured by Sautner *et al.* (2023). For constructing the firm-level climate change exposure index, Sautner *et al.* (2023) developed a new method that adapts a keyword discovery algorithm that identifies different climate change-related bigram sets. Those bigrams are then used to create firm– level measures equal to the frequency of climate change-related bigrams adjusted for the total number of bigrams in the conversation– and reflect the attention paid by participants to these topics during earnings calls.

In order to compare the three measures, this paper first standardizes each measure yearly and obtains the variables MSCI E-score, LSEG E-score, and Climate Change Exposure (Sautner). Then, the following two measures are computed. The Average Environmental Performance is the score obtained over the three environmental performance measures. The standard deviation over the three environmental performance measures is the E-Score external discrepancy.

To assess the internal discrepancy of the LSEG-Environmental Performance Score, we calculate the E-Score internal discrepancy as the standard deviation between LSEG's three Environmental sub pillars: resource use, emissions, and product innovation benefiting the environment.

5. RESULTS

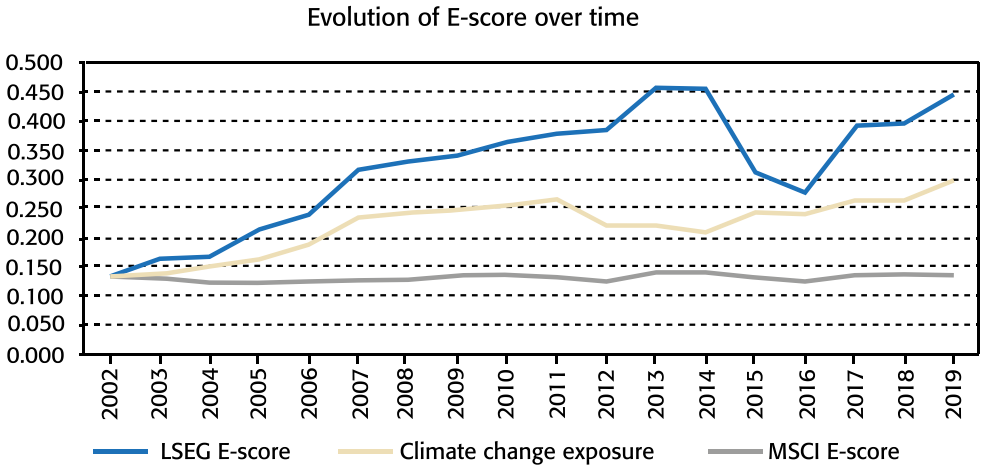
This section presents the empirical results of testing the different hypotheses presented in section three.

5.1. Hypothesis 1a and 1b

This section presents empirical evidence for testing hypotheses 1a and 1b. Hypothesis 1a posits that a common factor largely explains the variation across environmental ratings. As a result, the correlations between the three standardized environmental performance measures should be close to one. Figure 1 shows the time series of the three measures of average environmental performance. The variable of interest is the E score of firm i on year t reported by the different data sources, denoted by $(E)_{i,t}$. These variables are computed with the j available E scores ($j = 1,..,3$ where 1 = LSEG, 2 = MSCI, 3 = Sautner).

Figure 1

AVERAGE ENVIRONMENTAL SCORES



Note: This Figure presents a time series of standardized environmental performance E-measures based on MSCI, LSEG, and Sautner databases. The sample is from 2002 to 2019. The variables are denoted Refinitiv E-score, Climate Change Exposure (Sautner), and MSCI E-score.

Sources: Own elaboration based on MSCI, LSEG, and Sautner databases.

We may see that the LSEG measure presents higher volatility than the others, with a significant increase in the average score around 2015-2016 due to adding new firms to sample coverage. The MSCI measure shows a very stable pattern over time, whereas the Sautner measure increases until 2011, then decreases, and from 2015, increases again. It is unclear whether a common trend exists in the three series. The correlations are in Table 2.

Table 2

CORRELATIONS

	MSCI_Env_stand	LSEG_Env_stand	Sautner Climate
MSCI_Env_stand	1.00		
LSEG_Env_stand	0.29	1.00	
Sautner Climate Change_Stand	0.02	0.12	1.00
Average Pairwise	0.14		

Note: This Table presents correlations between the three standardized environmental performance measures. The sample is from 2002 to 2019, and the sample size is 15,553 observations.

Source: Own elaboration.

Note that the average pairwise correlation for the overall E ratings in Table 2 is 0.14, much lower than the average correlation between credit ratings, which typically exceeds 0.99 (Berg *et al.,* 2020). The correlation is 0.29 between MSCI and LSEG-based measures. In contrast, the correlation of Sautner's Climate Change with the other measures is 0.02 (MSCI) and 0.13 (LSEG), which suggests that although the MSCI and LSEG metrics capture a moderately similar aspect of environmental performance, Sautner's measure appears to reflect a distinctly different dimension of corporate climate change engagement. This divergence implies that Sautner's

Table 3

PCA RESULTS

Principal components/correlation			Number of obs.	15619
			Number of comps.	3
			Trace	3
Rotation: (unrotated = principal)			Rho	1
Component	Eigenvalue	difference	Proportion	Cumulative
Comp1	1.3222	.337097	0.44	0.44
Comp2	.0.985107	.292419	0.33	0.77
Comp3	.692688	.	0.31	1.00

Note: This Table presents the results of the model PCA for Hypothesis 1a. The sample is from 2002 to 2019.

Source: Own elaboration.

Climate Change indicator may capture alternative elements (*e.g.,* specific risk exposures or strategic responses to climate challenges) not fully addressed by the traditional environmental performance metrics. Consequently, researchers and practitioners should be cautious when using these measures interchangeably, and it may be beneficial to consider them as complementary tools that provide a more comprehensive view of corporate climate-related performance. Additional evidence of the validity of Hypothesis 1a is provided by the Principal Component Analysis (PCA) results in Table 3.

The first factor only explains 44% of the total variation, the second factor 33%, and the last factor the remaining 31%. Therefore, these findings indicate that environmental performance is inherently multi-dimensional; thus, each rating

Table 4

CORRELATIONS OVER TIME: ENTIRE SAMPLE

Year	Sample size	MSCI_LSEG	MSCI_Saut	LSEG_Saut
2002	112	0.28	-0.04	0.04
2003	158	0.46	0.02	0.05
2004	191	0.41	0.11	0.06
2005	261	0.37	0.14	0.07
2006	294	0.50	0.12	0.08
2007	332	0.53	0.07	0.09
2008	348	0.49	0.02	0.09
2009	362	0.48	0.04	0.11
2010	371	0.44	-0.01	0.12
2011	370	0.36	-0.07	0.13
2012	573	0.23	-0.09	0.14
2013	1,204	0.28	-0.08	0.14
2014	1,230	0.23	0.00	0.15
2015	971	0.28	-0.02	0.15
2016	1,267	0.26	0.04	0.15
2017	2,365	0.28	0.05	0.16
2018	2,711	0.25	0.05	0.17
2019	2,499	0.24	0.04	0.18
Average	868	0.35	0.02	0.12
Z-Score		12.73	1.39	11.25
P-Value		0.00	0.18	0.00
Chi-Square		215.82	40.19	32.66
P-value		0.00	0.00	0.01

Note: This Table presents correlations of the three standardized environmental performance measures MSCI, LSEG, and Sautner (Saut) from 2002 to 2019, the Z-score and p-value of the average zero correlation test, and the Chi-Square and p-value of Raghunathan (2003) correlation equality test. The sample size varies yearly; the entire sample is 15,553 firm-year observations.

Source: Own elaboration.

appears to capture distinct aspects of environmental impact. As a result, relying on a single aggregated measure may overlook important nuances, and the data does not support Hypothesis 1a. Next, empirical evidence on Hypotheses 1b, positing that the correlation of average scores of the data providers is consistent over time, is shown. Table 4 presents the correlations over time and tests of average zero and equal correlation.

The correlation between MSCI and LSEG is, on average, 0.35 but shows a lack of stability over time, ranging from 0.23 to 0.53. The Z-score test rejects the null hypothesis of zero average correlation. The high value of the Chi-square statistics and the corresponding low p-value suggest rejection of the null hypotheses of equality across correlation coefficients. The average correlation between MSCI and

Table 5

CORRELATIONS OVER TIME: TYPICAL SAMPLE

Year	Sample size	MSCI_LSEG	MSCI_Saut	LSEG_Saut
2002	112	0.28	-0.04	0.18
2003	148	0.47	0	0.16
2004	179	0.41	0.1	0.07
2005	239	0.32	0.13	0.06
2006	269	0.48	0.11	0.11
2007	306	0.51	0.06	0.13
2008	325	0.49	0.01	0.16
2009	348	0.47	0.02	0.14
2010	362	0.44	-0.02	0.04
2011	364	0.35	-0.08	0.04
2012	573	0.23	-0.09	0.09
2013	530	0.24	-0.1	0.12
2014	538	0.22	-0.02	0.07
2015	543	0.24	-0.03	0.08
2016	527	0.25	0.02	0.13
2017	526	0.26	0.03	0.11
2018	531	0.24	0.02	0.11
2019	486	0.2	0.01	0.07
Average	384	0.34	0.01	0.10
Z-Score		11.71	0.47	10.52
P-Value		0.00	0.64	0.00
Chi-Square		109.40	25.47	8.77
P-value		0.00	0.08	0.95

Note: This Table presents correlations of the three standardized environmental performance measures MSCI, LSEG, and Sautner (Saut) from 2002 to 2019, the Z-score and p-value of the average zero correlation test, and the Chi-Square and p-value of Raghunathan (2003) correlation equality test. The sample size corresponds to a similar sample size each year; the sample is 8698 firm-year observations.

Source: Own elaboration.

Sautner is 0.02 and not different from zero at a 1% significance level. It ranges from -0.09 to 0.14, and the Chi-Square test statistic results indicate rejection of the equality hypotheses. On the other hand, the correlation between LSEG and Sautner is low, 0.12, on average, but statistically significant and more stable, ranging from 0.04 to 0.18. The value of the Chi-square statistics and the corresponding p-value near 0.01 do not strongly support rejecting the null hypotheses of equality across correlation coefficients.

Notice that sample sizes and the number of firms employed in computing results in Table 4 vary over time. To rule out that the changes in correlations over time are driven by sample adjustments, we next present the correlations based on the sample firms in the year 2011 (the middle of our sample period). The results in Table 5 confirm that sample adjustments do not drive the changes in correlations.

The results are similar to the ones obtained from Table 4. The average correlation between MSCI and LSEG is positive (0.34) but unstable. The correlation with Sautner is very low (0.01) and stable over time. On the other hand, the average correlation between LSEG and Sautner is positive and low (0.10) but stable and statistically significant.

In summary, although the correlations between MSCI and LSEG are positive and significant, they are unstable over time. MSCI and Sautner are largely uncorrelated. On the other hand, the correlations between LSEG and Sautner are low, but they look stable. Therefore, data provides partial and weak support to Hypothesis 1b. Furthermore, the findings suggest that environmental performance ratings do not fully converge, meaning that different metrics capture complementary but distinct aspects of corporate environmental responsibility.

5.2. Hypothesis 2

Hypothesis 2 posits that the E-Score external discrepancy (volatility of the deviations from the common trend) of the scores provided by the different Environmental data sources is random and, therefore, unrelated to systematic factors. To test this hypothesis when fitting Equation [2], we control for the following characteristics that may influence firms' environmental performance: (i) Firm size is the natural logarithm of total assets; (ii) Profitability is measured by return on assets; (iii) Volatility is the standard deviation of a firm's monthly stock price returns over a year times the square root of 12; (iv) Credit Rating is a dummy variable equal to one if a firm has a Moody's rating in year t and zero otherwise; (v) Tobin's Q measures the firm's growth opportunities and asset intangibility; (vi) PPE is a tangibility measure calculated as the firm's property, plant, and equipment scaled by total assets; (vii) Leverage is the ratio of firm debt to total assets; (viii) Board Independence measures the number of independent directors on the Board; (ix) Duality is a dummy variable equal to one if the CEO is the chairman of the Board and zero otherwise; (x) Allred is a dummy variable equal to one if the firm is headquartered in a Republican-

leaning state and zero otherwise, and (xi) Allblue is a dummy variable equal to one if the firm is headquartered in a Democratic-leaning state and zero otherwise. We define a state as Democratic leaning, where the democratic candidate received the highest votes in the last five presidential elections. We use LSEG's industry classifications for the industry fixed effect.[5]

The results of fitting Equation [2] to the data are in Table 6.

Table 6

	External discrepancy (Random effects)	External discrepancy (Fixed effects)
Firm size	0.021*** (0.003)	0.024*** (0.004)
Lag_1 Discrepancy	0.679*** (0.012)	0.606*** (0.012)
Profitability	-0.230*** (0.040)	-0.137*** (0.042)
Volatility	-0.060* (0.032)	0.006 (0.036)
Credit Ratings	0.075*** (0.019)	0.038** (0.019)
Tobin's Q	0.015*** (0.003)	0.010*** (0.004)
PPE	0.151*** (0.028)	0.010 (0.042)
Leverage	-0.011 (0.022)	-0.042 (0.026)
Board Independence	0.0002 (0.0004)	0.0001 (0.0005)
CEO Duality	-0.022** (0.011)	-0.021* (0.011)
Allred	-0.010 (0.016)	0.007 (0.018)
Allblue	0.036*** (0.012)	0.031** (0.013)
Number of Obs.	7,774	7,771
Industry Fixed Effect	No	Yes
Year Fixed Effect	No	Yes
Autocorrelation Test (F-statistic)	0.935	0.144
Hausman Test (Chi-squared statistic)	286.57	

Note: This Table presents associations between the external discrepancy of E ratings (*i.e.,* discrepancy across data providers), measured by the logarithm of the standard deviation of those ratings in Equation (1), and firm characteristics. Robust standard errors are included in parenthesis. Both coefficients and robust standard errors (in parentheses) are reported. Standard errors are clustered at the firm level. We show results with both the random effect and the fixed effect estimation.

***, ** and * denote statistical significance at 1%, 5% and 10% level.

Source: Own elaboration.

Table 6 reports results for the Random-Effects (RE) and Fixed-Effects (FE) specifications. The Hausman test statistic has a value of 286.57, so using a chi-square distribution with 12 degrees of freedom, the p-value is extremely small. Since the test statistics are huge and the p-value is nearly zero, the RE estimator is inconsistent,

[5] The merged sample from the three ESG raters includes 15,553 observations. All of them are included in results of tables 1 to 4. However, after we incorporate data from Compustat and CRSP, as well as controlling for the lagged consistency measures, the sample contains 7,771 observations and 1,371 unique firms. In terms of E-Scores from LSEG, there are 9,180 observations and 1,496 unique firms.

likely due to the correlation between the explanatory variables and the unobserved individual effects. Therefore, the fixed effects FE model is the appropriate choice for estimation. We control the one-period lagged external discrepancy to mitigate the time series autocorrelation problem. The F-statistics of the two models indicate no statistically significant autocorrelation problems.

Essentially, Table 6 shows that balance sheet, political-color-related, and financial variables play a role in explaining rating discrepancies, thus rejecting Hypothesis 2. Regarding the explanatory variables that present the most meaningful impacts, the larger the firm, the higher the discrepancy. The intuition is that large firms are more complex, more data on the firm's performance regarding the E pillar is available, and they are likely to be analyzed more thoroughly by ESG data providers. In addition, larger international firms may report under multiple sustainability frameworks and are more likely to revise and update environmental disclosures frequently, which can lead to discrepancies in how different data providers incorporate and interpret these updates. The results support Christensen *et al.* (2021) claim that companies that provide more information about their ESG factors are the ones that show the most significant disagreement in their ESG ratings. Second, the more profitable the firm, the lower the E rating disagreement. Profitable firms may have more resources to invest in high-quality ESG reporting systems and prioritize sustainability reporting to strengthen investor confidence. In addition, they may feel less pressure to engage in impression management, reducing the likelihood of reporting inconsistencies. Firms headquartered in Democratic-leaning states present significantly higher discrepancies than those in Republican-leaning states. The intuition is that firms in "Blue" states are subject to more pressure to report their environmental performance vis-a-vis those in "Red" (or swing) states. Firms in "Blue" states may also be required to report additional environmental metrics to comply with state laws, leading to variation in reporting depth and content across different ESG frameworks. In addition, some ESG data providers may incorporate state-level regulatory compliance into their assessments, while others may focus more on voluntary disclosures, contributing to discrepancies. As a result, the former firms publish more information, thus giving rise to a similar situation as the one reported by Christensen *et al.* (2021), meaning that the more information a company provides about its E factors, the highest the disagreement in their E ratings.

The evidence also suggests that the higher Tobin's Q, the higher the discrepancy. The intuition justifying this result stems from the role of E ratings as long-term firm value drivers, Edmans (2023). Tobin's Q is a ratio comparing a firm's market value to the replacement cost of its assets. A higher Tobin's Q indicates that the market values the firm's assets more than their replacement cost, often reflecting expectations of (i) strong future performance or, (ii) intangible assets like brand reputation. Regarding point (i), reasonable people can disagree on how relevant an environmental sustainability characteristic is for a company's long-term success. Regarding point (ii), firms with high Tobin's Q often possess significant intangible assets, such as intellectual property, brand value, or innovation capabilities, which are difficult to quantify.

Therefore, the result that a more significant Tobin's Q implies wider rating discrepancies concurs with the observation that having different views on a firm's future performance and the quality of a company's intangibles is expected. Besides, environmental performance is similarly intangible and complex to measure, leading to greater subjectivity and variability in ratings.

Public firms with credit ratings exhibit higher E rating disagreement than those without credit ratings. Several factors contribute to this phenomenon. Firms with credit ratings are typically larger and have more intricate organizational structures. This complexity can lead to diverse interpretations of their environmental performance by different rating agencies, resulting in more significant E rating discrepancies. Rated firms are often more prominent and subject to increased public and regulatory scrutiny. This heightened attention can lead to more extensive and varied evaluations by rating agencies, amplifying the potential for disagreement in ESG assessments. Larger firms with credit ratings may have varied environmental disclosure practices across regions and subsidiaries. This inconsistency can cause rating agencies to interpret and assess their environmental performance differently, leading to more significant rating divergence.

Christensen *et al.* (2022) present evidence that companies that provide more information about their ESG factors are the ones that show the most significant disagreement and variation in their ESG ratings.

Firms where the CEO also serves as chair of the Board of Directors, *i.e.,* CEO duality, also show lower external discrepancy. Finally, note that ESG rating discrepancy is orthogonal to stock returns volatility, tangibility, and leverage.

In summary, larger firms and those in Democratic-leaning states experience higher discrepancies, likely due to greater data availability and reporting pressure, while more profitable firms and firms with CEO duality see lower disagreement. Additionally, firms with higher Tobin's Q and credit ratings tend to have more significant rating discrepancies.

5.3. Hypothesis 3

This hypothesis posits that the internal discrepancy of each database is high over time, meaning that (i) the ratings provided for the same firm from the given data provider over time do not vary randomly, and (ii) the factors determining the E-Score internal discrepancy are the same that determine the agreement across databases (*i.e.,* E-Score external discrepancy). The test of Hypothesis 3 is based on two counts. First, it is based on computing the first-order autocorrelation of the scores within each data provider. If a given rater presents high internal discrepancy, the first-order autocorrelation coefficient between year t and year t-1 ratings should be close to one. On the other hand, a lack of consistency would imply low or even negative values for the first-order autocorrelation coefficient. Table 7 shows the first-order

autocorrelations for MSCI, LSEG, and Sautner (Saut) from 2002 to 2019 and the zero autocorrelation and autocorrelation equality tests. Second, we examine which factors determine the E-Score internal discrepancy within the different environmental performance pillars of the LSEG Environmental performance score.

Table 7

FIRST-ORDER AUTOCORRELATIONS OVER TIME: ENTIRE SAMPLE

Year	Sample size	MSCI	LSEG	Saut
2003	110	0.79	0.85	0.84
2004	150	0.91	0.84	0.83
2005	195	0.71	0.79	0.9
2006	256	0.79	0.87	0.75
2007	291	0.82	0.75	0.89
2008	319	0.85	0.9	0.94
2009	335	0.8	0.93	0.93
2010	342	0.73	0.94	0.92
2011	347	0.51	0.94	0.92
2012	406	0.51	0.95	0.92
2013	548	0.81	0.98	0.93
2014	1,112	0.87	0.96	0.9
2015	607	0.88	0.95	0.94
2016	931	0.82	0.96	0.96
2017	1,827	0.86	0.94	0.91
2018	2,344	0.95	0.96	0.92
2019	2,251	0.94	0.94	0.92
Average	728	0.80	0.91	0.90
Z-Score		14.13	18.85	27.31
P-Value		0.00	0.00	0.00
Chi- Square		2,148.71	1,030.57	354.90
P-value		0.00	0.00	0.00

Note: This Table presents the first-order autocorrelations for the three standardized environmental performance measures MSCI, LSEG, and Sautner (Saut) from 2002 to 2019, the Z-score and p-value of average zero autocorrelation test, and the Chi-Square and p-value of Raghunathan (2003) autocorrelation equality test. The sample size varies yearly, and the total sample is 12,295 firm- year observations.

Source: Own elaboration.

The first-order autocorrelation coefficients for the three data providers vary between 0.51 and 0.96, significantly different from zero, suggesting considerable inertia in the ratings. However, they are not stable over time. Table 8 presents the results of a typical sample as a robustness test to rule out that changes in the sample

composition drive the results. Results are similar to Table 7, thus reinforcing the evidence of high but unstable first- order serial correlation.

Table 8

FIRST-ORDER AUTOCORRELATIONS OVER TIME: FIXED SAMPLE

Year	Sample size	MSCI	Ref	Saut
2003	110	0.79	0.88	0.83
2004	143	0.91	0.83	0.86
2005	178	0.73	0.81	0.91
2006	236	0.79	0.86	0.77
2007	271	0.82	0.75	0.88
2008	302	0.85	0.9	0.95
2009	321	0.79	0.93	0.93
2010	330	0.73	0.94	0.93
2011	342	0.51	0.95	0.92
2012	367	0.54	0.95	0.92
2013	530	0.82	0.98	0.93
2014	538	0.85	0.96	0.92
2015	543	0.88	0.95	0.94
2016	527	0.83	0.96	0.94
2017	525	0.92	0.95	0.95
2018	531	0.96	0.95	0.96
2019	484	0.96	0.93	0.94
Average	369	0.80	0.91	0.91
Z-Score		13.01	19.37	26.89
P-Value		0.00	0.00	0.00
Chi- Square		986.80	662.08	278.18
P-value		0.00	0.00	0.00

Note: This Table presents first-order autocorrelations of the three standardized environmental performance measures MSCI, LSEG, and Sautner (Saut) from 2002 to 2019, the Z-score and p-value of average zero autocorrelation test, and the Chi-Square and p-value of Raghunathan (2003) autocorrelation equality test. We limit the sample to those companies for which data is available in 2012, which is in the middle of our sample period. For those 537 companies, we report the autocorrections over time. The full sample contains 4,817 firm-year observations.

Source: Own elaboration.

In summary, the autocorrelations analysis points to a high degree of consistency between year-to-year E-ratings within each provider, but the degree of that consistency varies over time.

Second, we analyze internal discrepancy by studying whether the factors determining the discrepancy across different providers of E-scores (*e.g.,* firm size), combining the three databases are also significant when the dependent variable is computed using different measures for the Environmental component within the single database that contains alternative measures of the E pillar (*i.e.,* LSEG). The results are in Table 9.

Table 9

	Internal discrepancy (Random effects)	Internal discrepancy (Fixed effects)
Firm size	0.049*** (0.006)	0.072*** (0.007)
Lag internal discrepancy	0.764*** (0.008)	0.769*** (0.008)
Profitability	0.369*** (0.072)	0.177** (0.072)
Volatility	-0.014 (0.044)	-0.076 (0.050)
Credit ratings	-0.088*** (0.026)	-0.063** (0.026)
Tobin's Q	0.001 (0.006)	0.003 (0.006)
PPE	0.214*** (0.037)	0.178*** (0.060)
Leverage	0.083** (0.037)	0.001 (0.038)
Board independence	0.003*** (0.001)	0.002** (0.001)
CEO duality	-0.017 (0.017)	-0.011 (0.016)
Allred	-0.017 (0.026)	-0.009 (0.025)
Allblue	0.010 (0.018)	0.011 (0.017)
Number of obs.	9,183	9,180
Industry fixed effect	No	Yes
Year fixed effect	No	Yes
Autocorrelation Test (F-statistic)	2.464	1.542
Hausman Test (Chi-squared statistic)	70.05	

Note: This Table presents associations between the E-Score Internal discrepancy of ratings, measured by the logarithm of the standard deviation of the LSEG scores, and firm characteristics. Robust standard errors are included in parenthesis. Both coefficients and robust standard errors (in parentheses) are reported. Standard errors are clustered at the firm level. We show results with both the random effect and the fixed effect estimation. ***, ** and * denote statistical significance at 1%, 5% and 10% level.

Source: Own elaboration.

The Hausman test statistic suggests that the RE estimator is inconsistent; therefore, the fixed effects FE model is the appropriate choice for estimation.

Based on LSEG data, the results of the internal discrepancy test in Table 9 reveal that larger, more profitable firms, those with more tangible assets, and firms with more independent directors tend to experience more substantial internal discrepancies. In contrast, firms with credit ratings exhibit lower levels of

internal discrepancy. Interestingly, factors such as stock return volatility, Tobin's Q, leverage, duality, and the location of headquarters in either "Red" or "Blue" states do not appear to be associated with internal discrepancies.

On the other hand, the external discrepancy test presents a different picture, as shown in Table 6. It suggests that larger firms and those headquartered in Democratic-leaning states face more significant external discrepancies than those headquartered in Republican-leaning states. Contrary to internal discrepancies, more profitable firms experience lower levels of external disagreement. Additionally, firms with higher Tobin's Q and credit ratings are associated with more significant external rating discrepancies. Regarding board characteristics, CEO duality is related to lower external discrepancy, while more independent directors are associated with higher internal discrepancy.

In summary, while internal and external discrepancies are related to firm size and profitability, the direction and nature of their impact differ. Credit ratings and board characteristics present a contrasting influence on internal and external discrepancies, highlighting the complexity of factors driving rating disagreements.

6. CONCLUSIONS

Our findings challenge the notion of a single, dominant dimension driving variations in environmental ratings across rating providers. Instead, environmental performance emerges as a multi-faceted construct, where different ESG rating providers capture distinct, often complementary aspects of corporate environmental responsibility. This complexity underscores the limitations of relying on any single rating as a definitive measure of a firm's environmental impact.

Regarding the rating consistency across data providers, while the correlation between LSEG and Sautner appears stable over time, the relationship between MSCI and the other two fluctuates, offering only weak support for convergence among E ratings. This fragmentation has profound implications: researchers and practitioners should exercise caution when using these measures interchangeably, as they do not offer a uniform or holistic view of environmental performance.

Beyond measurement discrepancies, our findings reveal that systematic factors significantly shape E rating divergence. Larger firms, firms with more intangible assets and expected strong future performance, firms with credit ratings, and those in Democratic-leaning states experience higher rating discrepancies, likely due to greater data availability and reporting pressure. In contrast, more profitable firms see lower disagreement. CEO Duality leads to lower divergences.

Whereas internal and external discrepancies are related to firm size, profitability, and tangible assets, the direction and nature of their impact differ. Credit ratings

and board characteristics present a contrasting influence on internal and external discrepancies, highlighting the complexity of factors driving rating disagreements.

This paper's results are relevant to E rating users, investors, and regulators. Users of E ratings are well advised to diversify data sources, be wary of high-divergence firms (*e.g.,* Tesla), prioritize transparency and direct disclosures, and adjust for industry (*e.g.,* tech, energy) and regional (*e.g.,* Democratic *vs.* Republican-leaning states) biases.

Investors should use multiple ESG data providers to mitigate bias, especially for firms prone to high divergence (large firms, intangible-heavy firms, or those in politically charged regions), and be skeptical of E ratings for firms with high growth expectations, as disagreements may reflect uncertainty about future E risks. Also, they should supplement ratings with direct disclosures (*e.g.,* sustainability reports and SEC filings) to form an independent view. However, they may consider profitability an indirect signal of E reliability but avoid overreliance.

Finally, regulators should harmonize disclosure rules to improve comparability and increase oversight of ESG rates to prevent misleading scores, especially for high- complexity firms (*e.g.,* larger firms, firms with extensive intangible assets). At the same time, they should promote investor education on ESG rating limitations. In summary, their aim should be to ensure ESG ratings reflect actual sustainability performance, not just financial health or reporting convenience.

Ultimately, our research underscores a critical reality: ESG ratings are not neutral, objective truths but constructed measures shaped by underlying data choices, firm characteristics, and external pressures. Recognizing this complexity is key to making informed decisions in the ever-evolving landscape of sustainable finance.

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PART II

POLICY UNCERTAINTY, SHOCKS, AND ESG RISK: IMPLICATIONS FOR THE COST OF EQUITY

RESUMEN EJECUTIVO

Este estudio ofrece una perspectiva rigurosa sobre la relevancia financiera de las calificaciones ESG. Nuestro análisis de más de 8.000 observaciones de empresas estadounidenses entre 2017 y 2023 revela una conclusión clara: si bien las calificaciones ambientales (E) afectan el costo del capital propio (COE) de las empresas, su impacto es modesto en comparación con los factores con impacto económico sustancial: la incertidumbre de la política económica (por ejemplo, regulaciones poco claras, cambios fiscales repentinos o estancamiento político), el riesgo de mercado y la calidad de gobernanza de la empresa.

Los factores de riesgo primordiales son:

1. El coste del capital propio del año anterior. Si el coste del capital propio de la empresa fue alto el año pasado, es probable que siga siendo alto al año siguiente, lo que resulta en un impacto del 18 % en el coste del capital del año en curso. Este resultado subraya la importancia de la persistencia.
2. Incertidumbre de la política económica (EPU). El nivel de ruido en la política económica es muy importante. Cuando la EPU aumenta en una cantidad típica, el coste del capital propio de la empresa aumenta en aproximadamente un 17 %.
3. Beta y volatilidad. La percepción del riesgo de mercado es importante. Las empresas con mayor riesgo de mercado (Beta) y volatilidad de la rentabilidad de las acciones tienden a aumentar los costes de capital propio un 8,6 % y un 3,3 %, respectivamente.
4. Independencia de la junta directiva. Las empresas con mayor número de consejeros independientes se benefician de costes de capital propio más bajos, especialmente en entornos volátiles. Una mayor independencia del consejo de administración se asocia sistemáticamente con un coste del capital propio un 5,65 % menor.

Si comparamos lo anterior con el impacto de las métricas medioambientales:

- ¿Puntuaciones E más altas? Encontramos un reducido *aumento* de los costes de capital propio, apenas un 3,0 %. A modo de comparación, el impacto de la EPU es casi *seis* veces mayor.

- ¿Mayor dispersión en las puntuaciones E? Los datos indican un mínimo *descenso* de los costes de capital, un modesto 2,1 %. A modo de comparación, el impacto de la Beta es cuatro veces mayor y el impacto de la independencia de la junta es más del doble.

¿En conclusión? Si bien los factores ESG desempeñan un papel, son actores secundarios frente a los primeros actores financieros y macroeconómicos. Son necesarios cambios inusualmente extremos en las calificaciones ESG para impactar significativamente los costes del capital propio. ¿Es probable que una empresa suba o baje 40 puntos en su puntuación E cuando las puntuaciones oscilan entre cero y cien? Improbable. Del mismo modo, la dispersión de la calificación ESG está parcialmente bajo el control de una empresa y es poco probable que cambie drásticamente. Hasta que la medición de las calificaciones ESG mejore y sea consistente entre proveedores, su relevancia práctica para la financiación sigue siendo limitada.

Recomendaciones para los inversores

1. Concéntrese en los fundamentos financieros. La Beta, la volatilidad y la exposición de la empresa al riesgo de incertidumbre de la política económica son los factores cruciales.
2. Tenga cuidado a la hora de confiar en los efectos halo de ESG. Si una empresa tiene una puntuación E muy alta, y una gobernanza deficiente o una alta exposición al riesgo de mercado, la consecuencia será costes de capital propio más altos y, por lo tanto, los inversores requerirán rendimientos esperados más altos.
3. La gobernanza importa. El alto grado de independencia en el consejo de administración está sistemáticamente asociado con la reducción en el coste del capital propio, especialmente en tiempos de incertidumbre política.

Recomendaciones para los gerentes de empresas

1. No persiga altas puntuaciones E de forma irreflexiva. El mercado no premia de forma significativa las puntuaciones E altas, sino que lo que es crucial es una buena gestión del riesgo.
2. Utilice la flexibilidad ESG de forma estratégica. La dispersión en las calificaciones puede ser beneficiosa si la empresa mantiene narrativas de sostenibilidad adaptables y creíbles.
3. Fortalecer la independencia del consejo de administración de la empresa. Los consejeros independientes no solo aumentan la credibilidad, sino que también reducen los costes de financiación, especialmente cuando surge la incertidumbre.

Recomendaciones para los reguladores

1. No imponga estándares ESG rígidos. Deje espacio para que las empresas experimenten y se adapten, porque la flexibilidad puede reducir el riesgo percibido.
2. Mejorar la previsibilidad de las políticas. Para ayudar a las empresas a reducir los costos de capital, los reguladores deben tratar de reducir la incertidumbre política a nivel macro.

Entonces, ¿es ESG el plato fuerte o una simple guarnición?

En la actualidad es más bien una guarnición, al menos en lo que respecta a los costes del capital propio. Añade sabor, pero los ingredientes principales siguen siendo la incertidumbre de la política económica, el riesgo de mercado y la gobernanza de la empresa. En la actualidad, los criterios ESG desempeñan un papel complementario, y no central, en la determinación de los costes de capital propio.

EXECUTIVE SUMMARY

This paper offers a grounded perspective on the financial relevance of ESG ratings. Our analysis of over 8,000 U.S. firm-year observations from 2017 to 2023 reveals a clear takeaway: while environmental (E) ratings do affect firms' cost of equity capital (COE), their impact is modest compared to the real heavyweights: economic policy uncertainty (*e.g.,* unclear regulations, sudden tax changes, or political gridlock), market risk, and firm governance.

The risk factors that move the needle are:

- Lagged COE: If the firm's cost of equity capital was high last year, it is likely still high, resulting in an 18% impact on the current year's cost of equity. That is persistence.
- Economic Policy Uncertainty (EPU): Policy noise matters significantly. When EPU increases by a typical amount, the firm's cost of equity capital increases by about 17%.
- Beta and Volatility: Market risk perception matters. Firms with higher market risk (Beta) and stock return volatility see capital costs rise by 8.6% and 3.3%, respectively.
- Board Independence: Firms with independent boards consistently benefit from lower capital costs, especially in volatile environments. Stronger board independence is consistently associated with a 5.65% lower cost of equity capital.

Now compare that with the impact of environmental metrics:

- Higher E scores? Slight increase in capital costs, just 3.0%. As a comparison, the EPU impact is almost six times higher.
- Wider dispersion in E scores? Slight decrease in capital costs, a modest 2.1%. For comparison, the Beta impact is four times higher, and the board independence impact is more than twice as high.

Bottom line? While ESG factors do play a role, they are secondary to core financial and macroeconomic drivers. Unusually high ESG changes are necessary to reduce equity capital costs meaningfully. Is a firm likely to jump or fall 40 points in its E score when the scores range from zero to one hundred? Unlikely. Similarly, ESG

rating dispersion is partially under a firm's control and unlikely to shift dramatically. Until ESG measurement improves and aligns, its practical relevance for financing remains limited.

Recommendations for Investors

- Focus on fundamentals. Beta, volatility, and economic policy uncertainty risk still dominate.
- Be cautious about relying solely on ESG's halo effects. If a firm has a stellar E score but poor governance or high market risk exposure, it can expect higher capital costs, and therefore, investors will require higher expected returns.
- Governance matters. Independent boards can dampen COE, especially during times of policy uncertainty.

Recommendations for Firm Managers

- Do not chase ESG scores unthinkingly. The market does not reward high E scores as much as sound risk management.
- Use ESG flexibility strategically. Dispersion in ratings can be beneficial if the firm maintains adaptive and credible sustainability narratives.
- Strengthen the firm's board. Independent oversight not only boosts credibility but also lowers financing costs, especially when uncertainty arises.

Recommendations for Regulators

- Do not force rigid ESG standards. Allow room for firms to experiment and adapt, because flexibility may reduce perceived risk.
- Improve policy predictability. To help firms in lowering capital costs, regulators should aim to reduce macro-level policy uncertainty.

So, Is ESG a Side Dish?

At present, yes, at least when it comes to capital costs. It adds flavor, but the main ingredients remain the uncertainty of economic policy, market risk, and firm governance. Currently, ESG plays a complementary rather than a central role in determining equity capital costs.

Policy Uncertainty, Shocks, and ESG Risk: Implications for the Cost of Equity

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ABSTRACT

This study finds that environmental (E) ratings and their dispersion influence firms' cost of equity (COE) in context-dependent ways. Higher E ratings are associated with higher COE, especially under high economic policy uncertainty (EPU), while greater rating dispersion reduces COE in stable environments, suggesting strategic flexibility. Board independence consistently lowers COE and strengthens E-related effects during uncertainty. The results challenge the assumption that E improvements uniformly reduce capital costs, underscoring the importance of interaction effects. Contextual shocks (*e.g.,* Trump presidency, COVID-19) yield significant, transitory impacts, underscoring the importance of political environments in financial outcomes.

Keywords: Cost of equity, economic policy uncertainty, environmental scores, rating dispersion, sustainability metrics.

JEL classification: D80, D83, E22, G18, G32, M14, Q56.

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1. INTRODUCTION

In an era of heightened environmental consciousness and regulatory scrutiny, firms increasingly face the strategic challenge of balancing sustainability investments with financial performance (Flammer, 2015; Delmas and Burbano, 2011). While the business case for environmental sustainability has gained substantial theoretical and empirical support (Hart and Dowell, 2011; Eccles *et al.,* 2014), the relationship between environmental performance and cost of capital remains complex and context dependent. Furthermore, dispersion about ESG measures has led to growing concerns among investors and companies regarding the accuracy and utility of ESG ratings (Wong *et al.,* 2023). In a recent paper, Peña *et al.* (2025) document that larger firms, those with more intangible assets, and those with expected strong future performance, higher credit ratings, and those headquartered in Democratic-leaning states experience higher rating dispersion than otherwise comparable firms. It is essential to acknowledge that this complexity is further exacerbated during periods of economic policy uncertainty, when firms must navigate both environmental pressures and macroeconomic volatility in their strategic decision-making and resource allocation (Pástor and Veronesi, 2012; Bonaime *et al.,* 2018).

This study examines how firms' environmental (E) ratings and the dispersion surrounding these ratings influence their cost of equity capital, particularly during periods of heightened economic policy uncertainty (EPU) and major external shocks. The analysis in this paper builds on the existing literature, such as Pastor and Veronesi (2012), Chatterji *et al.* (2016), Pastor *et al.* (2021), and Avramov *et al.* (2022), which explores the influence of economic policy uncertainty (EPU) and the level and dispersion of E ratings on investment decisions and access to credit.

Our research contributes to literature in three main ways. First, we advance our understanding of how environmental strategy translates into financial outcomes by examining the cost of equity capital implications of E ratings and their associated dispersion. While previous research has established links between environmental performance and various financial metrics (King and Lenox, 2001; Konar and Cohen, 2001), the relationship with cost of equity, a critical determinant of firm valuation and strategic investment capacity, remains largely underexplored.

Second, we investigate how economic policy uncertainty influences the relationship between environmental performance and the cost of equity capital.

Research has recognized the importance of environmental context in shaping firm performance outcomes (Peng *et al.,* 2008; Oliver, 1991), yet limited attention has been paid to how macroeconomic policy uncertainty affects the value implications of environmental capabilities. Our findings suggest that the value of environmental performance is contingent upon the broader policy environment, with implications for how firms should time and structure their sustainability investments.

Third, we contribute to the growing literature on responses to external shocks by examining firm behavior during major disruptions: the COVID-19 pandemic, the Russia-Ukraine conflict, and the political uncertainty surrounding U.S. presidential elections (Wenzel *et al.,* 2020; Kraus *et al.,* 2020). These events provide natural experiments for understanding how environmental strategy interacts with crisis management and capital allocation decisions during periods of extreme uncertainty. In summary, this study advances scholarship by examining the complex interplay between corporate sustainability, economic policy uncertainty, and capital allocation.

Using panel regression analysis, this study examines the impact of environmental (E) ratings and their dispersion on the cost of equity capital (COE) of U.S. firms from 2017 to 2023, with a focus on the moderating role of economic policy uncertainty (EPU) and external shocks. Using panel regression analysis on 8,150 firm-year observations, the empirical analysis reveals robust relationships between the cost of equity (COE) and a range of explanatory variables, with a focus on economic policy uncertainty (EPU), environmental ratings (E), and corporate governance characteristics. To describe the effects, we use the Economic Impact (EI) measure. The EI illustrates the percentage impact on the dependent variable of a typical variation in the explanatory variable. Lagged COE exhibits the most substantial economic impact with an EI measure of 18%, indicating temporal persistence. EPU follows closely with an EI of 17%, confirming its role as a significant macro-level determinant: heightened uncertainty is associated with elevated capital costs for firms.

Among ESG indicators, higher E ratings are significantly associated with higher COE (EI 3.03%), corroborating prior findings (*e.g.,* Galluzzi *et al.,* 2023). Surprisingly greater dispersion in E ratings predicts lower COE (EI 2.13%). These opposing effects suggest that E ratings embed complex signals: while higher scores may imply more costly sustainability efforts, dispersion may reflect strategic flexibility that reduces perceived risk. Other firm-level fundamentals behave as expected: higher beta (EI 8.62%), volatility (EI 3.33%), and leverage (EI 1.43%) are linked to higher COE. Stronger board independence is consistently associated with lower COE (EI 5.65%).

Interaction analyses reveal that the E rating–COE relationship intensifies under high EPU (EI 5.51% *vs.* 3.03%), while its significance vanishes in low-EPU years. Conversely, E dispersion only matters when EPU is low. This asymmetry suggests that rating dispersion may signal adaptive E strategies, which are valuable in stable environments.

Board independence further modulates these effects: under high EPU, it strengthens the negative relationship between E ratings and COE (EI 5.65%), underscoring its importance in mitigating E-related capital costs during periods of volatility. Temporal dummies highlight a nuanced policy effect. While the first Trump-era and COVID periods individually raised COE, the overlapping period paradoxically reduced it, hinting at complex risk pricing dynamics. Overall, the results underscore the context-dependent and interaction-sensitive nature of E metrics in determining capital costs.

The findings have three key implications. For academics, the results underscore the importance of modeling the joint effects of ESG and policy uncertainty, as environmental ratings and their dispersion impact capital costs in context-specific ways. Practitioners should consider that higher E ratings can increase the cost of equity, particularly under high economic policy uncertainty, while rating dispersion may signal valuable strategic flexibility. For regulators, the results underscore the complexity of ESG signaling and the importance of transparency in ESG assessments. Clearer ESG rating standards and guidance on governance practices could help reduce capital market frictions and promote efficient risk pricing.

The remainder of this paper proceeds as follows. Section 2 develops the theoretical framework by reviewing relevant literature on environmental strategy, cost of capital, and economic policy uncertainty. Section 3 presents the hypotheses and empirical model. Section 4 describes the construction of data and variables. Section 5 presents empirical findings. Section 6 concludes with suggestions for future research.

2. RELATED LITERATURE AND THEORETICAL POSITIONING

Our theoretical foundation rests on the understanding that firms navigate increasingly complex institutional environments, where multiple stakeholders, including regulators, investors, and rating agencies, create competing and often contradictory expectations (Greenwood *et al.,* 2011). Within this context, ESG performance transcends mere operational excellence to become a strategic signaling mechanism that fundamentally shapes firms' access to critical resources and institutional legitimacy (Chatterji *et al.,* 2016; Christensen *et al.,* 2022).

The value of sustainability signals, however, depends critically on their interpretive clarity. Despite intentions to standardize sustainability assessments, ESG ratings exhibit substantial divergence across providers. The divergence can be due to pure noise or to a situation that we define as of "strategic ambiguity," (Eisenberg, 1984) a condition where firm actions become susceptible to multiple, often conflicting interpretations that can undermine the capital advantages typically associated with sustainability investments (Berg *et al.,* 2022; Gibson *et al.,* 2021). This phenomenon is particularly pronounced given Christensen *et al.* (2022) counterintuitive finding

that firms providing more comprehensive ESG disclosures paradoxically experience greater rating dispersion, suggesting that increased transparency may amplify interpretive differences rather than resolve them.

The consequences of this rating divergence are far-reaching. Research indicates that ESG dispersion is associated with higher capital costs, increased volatility in equity returns, and a reduced likelihood of accessing external financing (Dong *et al.,* 2025; Zhang *et al.,* 2025). Berg *et al.* (2022) introduce the concept of "aggregate confusion," decomposing rating divergence into methodological differences in scope, measurement, and weighting that collectively disperse ESG investor preferences and dilute their impact on asset pricing (Billio *et al.,* 2021). This fragmentation is most pronounced in environmental and social categories, while governance ratings show greater convergence, potentially reflecting the more standardized nature of corporate governance metrics.

Parallel to these developments, mounting evidence suggests that economic policy uncertainty fundamentally alters the strategic decision-making landscape. EPU elevates risk premiums, compresses planning horizons, and can destabilize long-term strategic commitments, particularly those requiring sustained investment, such as sustainability initiatives (Pastor & Veronesi, 2012; Xu, 2020; Chen *et al.,* 2024). The strategic implications extend beyond individual firm decisions, as policy uncertainty creates systemic effects that propagate across markets and borders (Al-Thaqeb *et al.,* 2019).

The intersection of EPU and ESG performance creates particularly complex dynamics. Bali *et al.* (2017) demonstrate that stocks exhibiting higher covariance with EPU indices command risk premiums, while Chen *et al.* (2024) reveal that policy shocks can simultaneously enhance ESG scores for sustainability leaders while penalizing laggards, creating non-zero covariance between ESG ratings and economic uncertainty.

The relationship between ESG performance and financial outcomes remains deeply contested, with evidence supporting multiple competing narratives. One strand of research documents the capital attraction power of high ESG ratings, with sustainable investment funds capturing significant capital flows despite failing to deliver superior risk-adjusted returns (Hartzmark and Sussman, 2019). This pattern suggests that ESG preferences may reflect non-financial investor motivations that come at a financial cost, consistent with arguments that ESG-focused portfolios sacrifice diversification benefits (Hong and Kacperczyk, 2009; Adler and Kritzman, 2008).

Conversely, substantial evidence supports the business case for sustainability, linking high ESG ratings to lower capital costs, enhanced valuations, superior returns, and reduced tail risk exposure (Giese *et al.,* 2019; Cheng *et al.,* 2014; Renneboog *et al.,* 2008). Several studies have also suggested that ESG produces insurance-like effects on a firm's stock and bond prices (Godfrey, 2005; Godfrey *et al.,* 2009; Shiu and Yang, 2017).

However, recent research reveals important temporal and sector-specific nuances, with environmental sustainability ratings showing negative correlations with stock performance despite positive impacts on operational metrics (Kranias *et al.,* 2024) and heavily polluting firms commanding significant risk premiums due to regulatory uncertainty (Hsu *et al.,* 2023).

Adding to this complexity, Alves *et al*. (2025) find no compelling evidence linking ESG ratings to global stock returns over a two-decade period, underscoring the conditional and context-dependent nature of sustainability-performance relationships. For the relationship between ESG and the cost of equity, prior literature has reported a negative (Albuquerque *et al.,* 2018; Chava, 2014; El Ghoul *et al.,* 2011, 2018; Husted *et al.,* 2016), positive (Desender *et al.,* 2020), and a non-significant (Humphrey *et al.,* 2012; Gregory *et al.,* 2016) relationship. These contradictory findings underscore the crucial need for theoretical frameworks that consider the boundary conditions governing the creation of ESG value.

3. EMPIRICAL STRATEGY AND HYPOTHESES

The empirical strategy is based on an econometric methodology employed for the empirical tests, and the corresponding testable hypotheses are detailed in this section. In financial markets, investors, rating agencies, and regulators are particularly influential stakeholders whose perceptions can significantly impact firms' access to capital and strategic flexibility.

We theorize that environmental (E) performance functions as a non-financial signal of alignment with stakeholder expectations around corporate responsibility, future risk management, and long-term orientation. However, the efficacy of this signal hinges on its credibility, which we operationalize through the level of dispersion among ESG ratings. Concurrently, we treat economic policy uncertainty (EPU) as a source of shifting stakeholder expectations, introducing volatility in institutional expectations and investor beliefs about future regulatory environments. This framework generates three core hypotheses: First, we examine whether high E ratings correlate with higher financing costs, particularly in stable policy environments. Second, we investigate whether the low dispersion of E ratings correlates with a higher cost of equity, especially under reduced EPU, when signal interpretation becomes less challenging. Third, we focus on the impact of exogenous shocks, including pandemics, geopolitical crises, and political transitions, which amplify these effects by disrupting investor expectations and altering institutional logic.

We test these hypotheses using a panel regression model, where the dependent variable is the firm's cost of equity (COE), a strategic financial outcome that is sensitive to both firm behavior and stakeholder perceptions.

3.1. The baseline model

The dependent variable is a measure of the firm's cost of equity capital (COE). The COE for Firm i in year t+1 is modeled in the baseline regression model as follows:

$$COE_{i,t+1} = \beta_0 + \phi_1 COE_{i,t} + \beta_1 E_{i,t} + \beta_2 E\_Dispersion_{i,t} + \beta_3 EPU_t + \sum \kappa_j (Controls_{i,t}) + \sum \delta_j (Event_t) + \alpha_i + \epsilon_{i,t} \quad [1]$$

Where:

- ($COE_{i,t+1}$): Cost of Equity Capital[1] for the firm (i) in the year (t+1).
- ($E_{i,t}$): Average E rating score for the firm (i) in the year (t).
- ($E\_Dispersion_{i,t}$): Standard deviation of E-scores across multiple rating agencies (i) in the year (t).
- (EPU_t): U.S. Economic Policy Uncertainty Index in the year (t). (Baker *et al.,* 2016). For a robustness check, we also measure political uncertainty using the Financial Regulation Uncertainty Index (FRU_t).
- Other Controls are:
- ($Size_{i,t}$): The natural logarithm of total assets is used to measure firm size.
- ($Leverage_{i,t}$): The Debt-to-equity ratio.
- ($Profitability_{i,t}$): Return on assets (ROA).
- ($TQ_{i,t}$): Tobin's Q.
- ($PPE_{i,t}$): Tangibility, defined as property, plant, and equipment divided by total assets.
- ($Volatility_{i,t}$): Volatility is the natural logarithm of the standard deviation of a firm's. monthly stock price returns over a year times the square root of 12.
- ($BoardIndependence_{i,t}$): Board Independence measures the percentage of independent directors on the Board.
- ($Goodgov_{i,t}$): The high and low board independence dummy is based on the variable of the board independence measure. Good governance is an indicator variable that equals one if the percentage of independent directors is higher than the sample median; otherwise, it equals zero.

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[1] The Cost of Equity (COE) is defined as the return a firm theoretically pays its equity investors. It is calculated by multiplying the equity risk premium of the market with the beta of the stock plus inflation adjusted risk free rate. Equity risk premium is expected market return minus inflation adjusted risk free rate. Refinitiv derives this from StarMine Models & Analytics.

- ($CR_{i,t}$): Credit Rating is an indicator variable equal to one if the firm has a credit rating by Moody's in a given year, and zero otherwise.

- ($BETA_{i,t}$): Firm i market beta for the relevant U.S. stock market index return (*e.g.,* S&P 500).

Event dummy variables are:

- ($D\_Trump1Only_t$): Dummy variable, 1 for 2017-2019, Trump's first presidency without COVID and zero otherwise.

- ($D\_Trump1COVIDOverlap_t$): Dummy variable, 1 for the year 2020; captures overlapping Trump and COVID pandemic effects.

- ($D\_COVIDOnly_t$): Dummy variable, 1 for 2021; captures exclusively COVID impact, post-Trump and pre-War.

- ($D\_COVIDWarOverlap_t$): Dummy variable, 1 for the year 2022; captures overlapping effects of COVID and the onset of the Ukrainian War.

- ($D\_WarOnly_t$): Dummy variable, 1 for 2023-2024; for the Ukrainian War period after COVID effects diminished.[2]

- (α_i): Industry-specific fixed effects.

- ($\epsilon_{i,t}$): The idiosyncratic error term.

To account for additional cross-effects among variables, we extend the baseline model to incorporate these effects. The extended baseline model, including interactions, is

$$COE_{i,t+1} = \beta_0 + \phi_1 COE_{i,t} + \beta_1 E_{i,t} + \beta_2 E\_Dispersion_{i,t} + \beta_3 EPU_t + \sum \kappa_j (Controls_{i,t}) + \sum \delta_j (Event_t) + \sum \eta_j (Event_t \times V_{i,t}) \alpha_i + \epsilon_{i,t} \quad [2]$$

Where:

- ($Event_t \times V_{i,t}$): Interaction terms between event dummies and several other explanatory variables, represented by the generic V variable. In the next section, we specify the hypotheses for the most relevant cases.

The estimation method for [1] and [2] is through a fixed effects panel regression to control for unobserved industry effects.[3] To obtain robust results, the estimation method clusters standard errors at the firm level to address heteroskedasticity and includes lagged dependent variables to control for autocorrelation.

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[2] The two dummies related to the war are dropped in most of the regressions due to multicollinearity.

[3] Fixed time effects are not included in [1] to avoid collinearity because the model already includes several time dummies.

Although the econometric framework employed in this paper does not allow claims of causality, three methodological points deserve attention. First, reverse effects. High COE may lead firms to change their ESG strategies and, therefore, their ratings $\mathrm{E}_{i,t}$ (*e.g.,* "greenwashing" to attract more capital). So, correlation could go both ways. To mitigate this concern, Equation (1) regresses $\mathrm{COE}_{i,t+1}$ on lagged E ratings $\mathrm{E}_{i,t}$. This specification examines whether past E scores correlate to the current cost of equity, thereby mitigating the concern that high COE is driving E. Lagging E ratings ensure that E is measured before COE. The pairwise correlations between $COE_{i,t}$ and $E_{i,t+1}$, $EPU_{i,t+1}$, and $E\_Dispersion_{i,t+1}$ are -0.012, -0.019, and -0.028, respectively, suggesting that reverse effects are unlikely. Second, the problem of simultaneity. E ratings and COE may be jointly determined in the same period. For example, capital market perceptions (COE) may shape E disclosures when firms formulate them. To deal with this concern, Equation [1] includes lagged COE ($\phi_1\ COE_{i,t}$) that helps control for dynamic persistence and partial adjustment, while lagged E ensures temporal precedence. Third, the omitted variable bias problem. There may be unobserved factors, such as differences in business models (*e.g.,* energy *vs.* tech), industry-wide ESG norms, sectoral risk profiles, and variable regulatory regimes across industries, that affect both E ratings and COE across industries. If omitted, the estimate of the slopes will be biased. To mitigate this problem, we use α_i, the industry-specific fixed effects. Industry fixed effects control for time-invariant unobservable factors related to the industry.[4]

3.2. Hypotheses: Explanatory Variables and Expected Impacts

This section presents the hypotheses associated with each explanatory variable, their expected impact on the dependent variable in terms of the sign of the corresponding regression coefficient in [1], and a brief rationale for the posited impact. Given the experimental design employed, the paper makes only covariation claims, not causality claims, which require additional methods (*e.g.,* instrumental variables, propensity score matching, difference-in-differences)

- E rating ($E_{i,t}$). *Hypothesis 1:* Recent research has explored the relationship between ESG and financial aspects, including investments, cost of capital, and corporate cash holdings. (*e.g.,* El Ghoul *et al.,* 2018). Some papers posit that higher E ratings reduce COE by signaling lower operational and reputational risks. It is worth noting that former results are based on data samples from the early 2000s. However, in the period analyzed in this paper (2017-2023), investor perceptions regarding the impact of ESG programs on financial performance have undergone significant changes, especially among young investors (*e.g.,* CRGI, 2022, 2023, 2024). Galluzzi *et al.* (2023) documents a positive correlation between ESG

[4] We are aware that unobserved firm-level factors (*e.g.,* managerial quality, unmeasured ESG efforts) could drive both E ratings and COE. However, firm-level fixed effects dummies are dropped in the STATA estimation because of severe collinearity.

ratings and COE in large firms and posits that to attain a favorable ESG rating, a firm must expend significant amounts in its ESG initiatives and in disclosing them. As the financial returns obtained from these activities are unclear, investors may demand higher returns on their investments, thus implying an increase in the firm's COE. Based on these recent findings, we posit in Hypothesis 1 that increases in E ratings are correlated with increases in COE, meaning $\beta_1 > 0$.

- E Rating Dispersion ($\mathrm{E\_Dispersion}_{i,t}$). *Hypothesis 2:* Greater divergence in ESG ratings across agencies increases COE by lowering investor confidence, and therefore, the expected regression coefficient sign is positive ($\beta_2 > 0$). The rationale is that inconsistent ESG scores create information asymmetry, leading to higher risk premiums. Dong *et al.* (2025) report a positive association between ESG rating divergence and the cost of equity, and Zhang *et al.* (2025) find that environmental, social, and governance (ESG) rating divergence increases the cost of debt.

- Economic Policy Uncertainty (EPU_t). *Hypothesis 3:* Higher EPU increases COE by elevating market volatility and risk premiums, and therefore, the expected regression coefficient sign is positive ($\beta_3 > 0$). The rationale is that EPU affects investment decisions and financial stability, increasing both the cost of equity and debt. Xu (2020) demonstrates that increased government economic policy uncertainty elevates firms weighted average cost of capital, primarily through a higher cost of equity, and Trung Tran (2021) finds that economic policy uncertainty increases the cost of debt across seventeen countries.

Next, we discuss the expected impacts on COE related to other control variables.

- Beta regarding U.S. stock market index return (S&P500) ($BETA_{i,t}$): The evidence suggesting that high market betas are positively correlated to higher COE is well-supported by theory and empirical evidence. Beta's role in CAPM and its spillover effects on debt pricing make it one of the strongest firm-level determinants of the cost of equity (COE). Therefore, the expected regression coefficient sign is positive ($\beta_5 > 0$).

- Firm Size ($\mathrm{Size}_{i,t}$). Larger firms have lower COE due to better access to capital markets and lower risk premiums, and therefore, the expected regression coefficient sign is negative ($\kappa_1 < 0$). The rationale is that larger firms benefit from structural advantages that lower their cost of capital, including better information transparency, economies of scale in financing, and diversified operations, which in turn lower both the cost of equity and debt, as shown in Rajan and Zingales (1995), among others.

- Leverage ($\mathrm{Leverage}_{i,t}$). Higher leverage increases COE due to elevated financial risk, and therefore, the expected regression coefficient sign is positive ($\kappa_2 > 0$). The rationale is that increased debt raises the risk of default and worsening financing costs. Dhaliwal *et al.* (2006) provide supporting evidence of the impact of leverage

on increasing equity capital costs for industrial firms, and Clark *et al.* (2023) report similar findings for financial institutions.

- Profitability ($\text{Profitability}_{i,t}$). More profitable firms have lower COE due to reduced risk profiles, and therefore, the expected regression coefficient sign is negative ($\kappa_3 < 0$). The rationale is that higher ROA signals financial health, lowering investor risk premiums. Fama and French (1992) report that firms with higher earnings relative to their assets tend to have lower expected stock returns, implying a lower cost of equity capital. Hou *et al.* (2015) find that firms with higher returns on assets (ROA) have lower expected returns, consistent with a lower cost of capital.

- Tobin's Q ($\text{TQ}_{i,t}$). Although the evidence is not uniform, most studies suggest that firms with high Tobin's Q tend to have lower COE due to lower perceived risk and better financing conditions. However, the relationship can vary based on capital structure choices and market conditions. Therefore, the expected regression coefficient sign is negative ($\kappa_4 < 0$).

- Tangibility ($\text{PPE}_{i,t}$). Most studies support the view that higher asset tangibility leads to a lower COE, primarily due to the lower cost of debt, because better collateral leads to reduced default risk. Additionally, a higher debt capacity, enabled by more tax shields, reduces the cost of equity (COE). Therefore, the expected regression coefficient sign is negative ($\kappa_5 < 0$).

- Stock return volatility ($\text{Volatility}_{i,t}$) The consensus in the literature is that firms with higher stock return volatility face a higher COE because of a higher cost of equity and debt and higher financial distress risk. Therefore, the expected regression coefficient sign is positive ($\kappa_6 > 0$).

- ($\text{BoardIndependence}_{i,t}$). The empirical evidence consistently suggests that firms with more independent boards tend to have a lower COE due to a lower cost of debt, as reduced agency risk leads to better credit terms. Also, there is a lower cost of equity because improved governance leads to lower risk premiums demanded by investors. Also, enhanced transparency and credibility reduce information asymmetry. Therefore, the expected regression coefficient sign is negative ($\kappa_7 < 0$).

- Credit Rating ($\text{CR}_{i,t}$). The empirical evidence broadly suggests that rated firms have significantly lower COE than non-rated firms because of better debt terms. The effect is more substantial the higher the credit rating is. Therefore, the expected regression coefficient sign is negative ($\kappa_8 < 0$).

Next, we discuss the expected impacts of events and external shocks represented by dummy variables.

Trump's first presidency before COVID (Dum_Trump1Only_t) a dummy variable capturing exclusively Trump's policy effects from 2017–2019. Trump's economic policies from 2017 to 2019 were epitomized by the Tax Cuts and Jobs Act (TCJA)

of 2017, which reduced the corporate tax rate from 35% to 21%, thereby increasing after-tax corporate earnings. This boost in profitability led to higher stock valuations, reducing the cost of equity for many firms. On the other hand, the TCJA introduced limitations on the deductibility of interest expenses, increasing the after-tax debt cost for some companies. As a result, the expected regression coefficient sign will be negative ($\delta_1 < 0$) for the cost of equity.

The overlapping effects of the Trump administration and the COVID-19 pandemic ($\mathrm{Dum\_Trump1COVIDOverlapt}$) span the year 2020. The joint effects of COVID-19 and the Trump administration's controversial management of the pandemic likely increased overall uncertainty and risk premiums, and therefore, financial risk. Thus, the expected regression coefficient sign is likely positive ($\delta_2 > 0$) for most industries. The rationale is that the pandemic-induced uncertainty increased equity market volatility. Investors demanded higher risk premiums, raising the cost of equity for firms. While the CARES Act supported businesses, equity financing became more expensive for many companies. The Paycheck Protection Program (PPP) and other lending facilities provided liquidity to businesses, reducing borrowing costs. However, the overall cost of debt remained elevated compared to pre-pandemic levels.

COVID impact, post-Trump, and pre-War ($\mathrm{Dum\_COVIDOnly}_t$) is a dummy variable reflecting COVID-specific effects for 2021. In 2021, many firms struggled with elevated capital costs due to the ongoing effects of the COVID-19 pandemic. The cost of equity rose as investors demanded higher returns for perceived risks (Ke, 2022). The cost of debt initially increased but later stabilized due to policy measures that ensured liquidity and credit availability. Thus, the expected regression coefficient sign is positive ($\delta_3 > 0$). The rationale is that COVID-19 increased the firms' capital costs, and this effect was more pronounced in firms with greater exposure to COVID-19 -related disruptions. The increased cost reflects heightened risk perceptions among investors due to the uncertain economic environment.

Overlapping effects of COVID and the Ukrainian War ($\mathrm{Dum\_COVIDWarOverlapt}_t$) that covers specific effects for the year 2022. Both the cost of equity and the cost of debt rose in 2022 due to overlapping shocks from COVID-19 (supply chain disruptions and inflation) and the Ukraine War (commodity price spikes and risk aversion). These factors tightened financial conditions, increasing firms' costs of equity (COE), as noted by the International Monetary Fund (IMF) (2022). The expected regression coefficient sign is likely positive ($\delta_4 > 0$) for most industries, indicating worsening financing conditions.

Ukrainian War only period ($\mathrm{D\_WarOnly}_t$) that covers specific effects for 2023-24. Both the cost of equity and debt rose because of the uncertainty associated with the Ukraine War (commodity spikes, risk aversion) and the growing involvement of other countries in the war effort. These factors heightened geopolitical risk and tightened financial conditions, thereby increasing firms' cost of equity (COE), according to the International Monetary Fund (IMF) (2022). The expected regression coefficient sign is likely positive ($\delta_6 > 0$) for most industries, indicating worsening financing conditions.

Next, we discuss expected impacts related to interaction terms. Interaction terms capture how external events amplify the effects of key variables.

— ($High\_EPU_t \times E_{i,t}$). Interaction between high levels of EPU and E ratings. Under policy uncertainty shocks of a given size (***e.g.,*** environmental regulations), the impact of E scores on COE may increase. Therefore, the expected regression coefficient sign is positive ($\beta_4 > 0$). Wang ***et al.*** (2025) highlight that economic policy uncertainty (EPU) influences ESG practices, but in a nonlinear manner, with the extent of this influence varying according to the level of EPU. In times of high economic uncertainty, the impact of E ratings on the cost of equity capital increases. In other words, the association between average E scores and cost of equity is sensitive to episodes of higher economic policy uncertainty.

— ($High\_EPU \times E\_Dispersion_{i,t}$). In times of high economic uncertainty, the impact of the dispersion of E ratings on the cost of equity capital may vary. In other words, the association between the volatility of E scores and the cost of equity is sensitive to episodes of higher economic policy uncertainty. The expected sign can be positive ($\eta_5 > 0$) or negative ($\eta_5 < 0$) depending on the specific impact conditions.

— ($goodgov_t \times E_{i,t}$). Interaction between high levels of board independence and E ratings.

— ($goodgov_t \times E\_Dispersion_{i,t}$). Interaction between high levels of board independence and dispersion in E ratings

— ($High\_EPU \times E_{i,t} \times Goodgov_{i,t}$). The interaction average score E, high economic policy uncertainty, and the high board independence dummy.

— ($High\_EPU \times E\_Dispersion_{i,t} \times Goodgov_{i,t}$). The interaction between dispersion in score E, high economic policy uncertainty, and the high board independence dummy.

— ($E_{i,t} \times Events_{i,t}$). The interaction between average E score and external events and shocks. The expected sign can be positive ($\eta_4 > 0$) or negative ($\eta_4 < 0$) depending on the specific events and impact conditions.

— ($E\_Dispersion_{i,t} \times Events_{i,t}$). The interaction between the dispersion of the E score and external events and shocks. The expected sign can be positive ($\eta_8 > 0$) or negative ($\eta_8 < 0$) depending on the specific events and impact conditions.

— ($\mathrm{E}_{i,t} \times D\_\mathrm{COVIDOnly}_t$). Firms with high E ratings may exhibit lower COE during COVID-19 due to resilience in sustainable practices. Therefore, the expected sign is negative ($\eta_9 > 0$) for most industries, indicating worsening financing conditions.

— $(E\_Dispersion_{i,t} \times D\_COVIDOnly_t)$. Firms with high dispersion in E ratings may exhibit higher COE during COVID-19 due to investors' growing concerns about the accuracy and utility of E ratings. Therefore, the expected sign is positive ($\eta_{10} > 0$) in most cases.

4. DATA AND CONSTRUCTION OF STAKEHOLDER-RELEVANT VARIABLES

4.1. Data on Environmental Performance

Our sample focuses on US-listed companies for which environmental performance measures are available from three data providers, covering the period from 2017 to 2023. The sample includes, as a novelty in comparison to extant literature, a recent database constructed by Sautner *et al.* (2023) focusing explicitly on the environmental dimension, as well as two commercial providers, LSEG Data & Analytics (previously known as Refinitiv or Asset4) and MSCI ESG Research, whose data have been widely used in many academic studies. We consider all firms for which data is available for all three ratings from 2017 to 2023. The final sample includes 8,150 firm-year observations from 1,874 firms.

Our first data source provides a commercial ESG rating by LSEG Data & Analytics, a financial data company owned by the London Stock Exchange Group (LSEG). The LSEG –Environmental Performance Score is a comprehensive measure that evaluates a company's performance in addressing environmental issues and managing sustainability– related risks and opportunities. The Environmental Performance Score is the average score of the following three environmental categories: (i) resource use, (ii) emissions, and (iii) product innovation benefiting the environment. LSEG constructs its assessment for each category around objective key performance indicators (KPIs) sourced from various sources, including stock exchange filings, corporate social responsibility (CSR) reports, annual reports, websites of non-governmental organizations, and news sites. Each KPI is scored against the company's peers, and the relative weight of each KPI is based on several factors, such as the relevance of the KPI in the industry and whether it is derived from independent information content or the objective measurability of the KPI. The obtained weighted average scores for each category are normalized and adjusted for skewness and the difference between the mean and the median. Then, they are fitted to a bell curve to derive ratings for each category, ranging from 0 to 100, for each company.

Our second source is another commercial ESG rating provided by the MSCI ESG Research database, which was initially developed by KLD Research & Analytics, Inc., and later acquired by MSCI (Morgan Stanley Capital International). The MSCI Environmental Pillar Score assesses a company's capacity to manage risks and

opportunities related to environmental factors, including climate change, natural resource utilization, pollution, and waste management. The MSCI Environmental Pillar Score is calculated by assessing a company's ability to manage its industry's most significant environmental risks and opportunities. MSCI first identifies key environmental issues that could have a material impact on a company's financial performance, such as carbon emissions, water stress, or waste management. For each issue, MSCI assesses the company's exposure to the risk and how effectively it manages it through policies, programs, and performance. Each issue is scored on a scale from 0 to 10, and these scores are combined using a weighted average, where the weights reflect the importance of each issue to the company's industry. The result is a single Environmental Pillar Score that reflects the company's overall environmental performance. The score typically ranges from 0 to 10, with higher values indicating stronger environmental performance.

Our third non-commercial data source is the climate change exposure constructed by Sautner *et al.* (2023). Climate Change Exposure refers to the firm-level climate exposure, as measured by Sautner *et al.* (2023). To construct the firm-level climate change exposure index, Sautner *et al.* (2023) developed a new method that utilizes a keyword discovery algorithm to identify distinct sets of bigrams related to climate change. Those bigrams are then used to create firm-level measures, which equal the frequency of climate change- related bigrams adjusted for the total number of bigrams in the conversation, reflecting the attention paid by participants to these topics during earnings calls. Compared to the commercial Environmental ratings, this measure provides an alternative perspective by focusing on the attention financial analysts and management devote to climate change topics during conference calls.

Table 1

ESG DATA PROVIDERS

Data provider	Rating scale	Period covered	Number of firms	Pillars	Rating style
LSEG	0-100	2002-2024	12,143	E, S, G, Total	Index
MSCI	0-10	Jan. 1999 Dec. 2024	46,445	E, S, G, Total	Index
Sautner *et al.* (2023)	[0-0.75]%	2001-2023	15,198	E	Proportion

Note: This Table provides additional information about ESG data providers, including the firms and periods they cover, as well as the number of firms and rating scales. Our sample is from 2017 to 2023.

Source: Own elaboration.

4.2. Financial Statement Data

Firms' financial and accounting data (*e.g.,* total assets, leverage, capital expenditures, or cash holdings) are from Compustat North America.

4.3. Cost of equity, stock prices, volatility, board characteristics, and credit rating data

Data on stock price volatility comes from CRSP. We also retrieve data on cost of equity, beta, board characteristics, and Moody's credit ratings from the London Stock Exchange Group (LSEG).

4.4. Uncertainty Index

Data on uncertainty indexes for the U.S. is sourced from the Economic Policy Uncertainty webpage (https://www.policyuncertainty.com/). The sample contains monthly data from January 2017 to December 2023, and we calculate the average index for a year. We focus on the following categories: (1) Economic Policy Uncertainty and (2) Financial Regulation Uncertainty.

4.5. Variable construction

To construct the average environmental performance score and a measure of dispersion, we build on the following three measures: Sautner's Climate Change Exposure, the LSEG Environmental Performance Score, and the Net MSCI Environmental Pillar score.

In order to compare the three measures, we standardize each measure yearly (the variable $E_{j,i,t}$), thus obtaining the MSCI E-score, LSEG E-score, and Climate Change Exposure (Sautner). Then, the following two measures are computed. The average E rating ($\mathrm{E}_{i,t}$) for firm i at time t, and it is the average score obtained over the three standardized environmental performance measures.

$$E_{i,t} = 1/n \sum_{j=1}^{n} E_{j,i,t} \quad [3]$$

The standard deviation of the three environmental performance measures, denoted as the E Rating Dispersion ($\mathrm{E\_Dispersion}_{i,t}$) is the standard deviation of the E ratings reported by the different data sources. This variable is computed with the available E score quoted by the data provider j for a given underlying firm i in a given year t as follows:

$$E\_Dispersion_{i,t} = (1/n \sum_{j=1}^{n} [E_{j,i,t} - (1/n \sum_{j=1}^{n} E_{j,i,t})]^2)0.5) \quad [4]$$

Where n is the number of E-Score data sources.

5. RESULTS: ESG SIGNALS, POLICY UNCERTAINTY, AND COST OF EQUITY

This section presents the empirical results of testing the hypotheses in Section 3.

5.1. Average ESG Scores, ESG Dispersion, and Political Uncertainty

We first run OLS regressions to test Equation [1], the baseline model without interaction terms. Table 2 illustrates the results. The first column contains the slope coefficients, the second their robust standard errors, and the third the EI measure. The Economic Impact (EI) measure for each explanatory variable Xi is defined as

$$EI(X_i) = \frac{\sigma(X_i)\beta_i}{\mu(Y)} \quad [5]$$

Where $\sigma(X_i)$ is the standard deviation of the explanatory variable X_i, β_i is its regression slope, and $\mu(Y)$ is the average of the dependent variable. The Economic Impact (EI) metric measures the practical influence one variable has on another. In other words, it illustrates the percentage impact on Y of a typical variation in X. The

Table 2

COE(t+1)				
Regressors	Betas	Robust_S.E.	t_statistic	EI (%)
COE(t)	**3.48E-01**	7.36E-04	12.81	18.23
E	**3.94E-03**	1.18E-06	3.63	3.03
E_Dispersion	**-3.89E-03**	9.68E-07	-3.95	2.13
EPU	**2.37E-04**	4.60E-09	3.50	17.00
Size	1.92E-04	1.41E-07	0.51	0.41
Profitability	-6.12E-03	1.51E-05	-1.57	1.05
Volatility	**5.53E-03**	1.23E-06	4.99	3.33
TQ	-2.50E-04	3.76E-08	-1.29	0.62
PPE	-1.12E-03	8.36E-06	-0.39	0.31
Leverage	**5.15E-03**	3.38E-06	2.80	1.43
BoardIndependence	**-2.29E-04**	1.41E-09	-6.10	5.65
BETA	**1.30E-02**	1.32E-06	11.29	8.62
CR	**-2.77E-03**	8.61E-07	-2.99	1.45
D_Trump1Only	**1.89E-02**	6.49E-06	7.41	10.63
D_Trump1COVIDOverlap	**-9.15E-02**	1.03E-04	-9.01	38.30
D_COVIDOnly	**3.68E-02**	3.73E-06	19.05	15.68
D_Trump1COVIDOverlap	**-9.42E-02**	1.04E-04	-9.25	39.46
D_COVIDOnly	**3.63E-02**	3.84E-06	18.51	15.45
Number of Obs.	8,150			
Industry Fixed Effect	Yes	R2 Adjusted	0.59	

Note: This Table presents the baseline model (without interactions) of the associations between the COE(t+1) (*i.e.,* cost of equity at t+1) and the explanatory variables in (1). Standard errors are clustered at the firm level. Parameters in *boldface* denote statistical significance at 1%. The first column contains estimated parameters, the second their robust standard errors, the third the robust t-statistic, and the fourth the EI measure. The sample contains U.S. firms from 2017 to 2023.

Source: Own elaboration.

higher the EI, the more relevant the explanatory variable is in explaining variations in the dependent variable. This metric helps prioritize which variables are most important for business decisions, policy changes, or resource allocation. A variable might be statistically significant but have a low economic impact, or vice versa.

The results in the Beta column of Table 2 suggest that lagged COE has significant explanatory power, with the highest EI (18.23%) among the stochastic regressors, indicating considerable time inertia in this variable. The second relevant variable in terms of economic impact is EPU (17%), suggesting that higher (lower) levels of economic policy uncertainty are associated with a higher (lower) future cost of equity, as expected. Moreover, higher E ratings are significant leading indicators for higher COE, in agreement with Hypothesis 1, although with an EI of 3.03%. This result aligns with recent findings that document increases in ESG ratings are linked to increases in a firm's COE (*e.g.,* Galluzzi *et al.,* 2023) and underscores the complex nature of E ratings. While they represent an important reputational asset and may help firms prepare for future climate-related challenges, they also may represent a significant strategic commitment of resources (with uncertain financial returns), potentially reducing flexibility in the short term.

On the contrary, higher E dispersion is associated with a lower future cost of equity, albeit with an EI of 2.13%, which contradicts Hypothesis 2. Greater dispersion may reflect either a more strategic approach towards environmental sustainability, known as "strategic ambiguity," or pure measurement noise, referred to as "plain noise." To distinguish between these two alternatives, we rely on the results presented in Peña *et al.* (2025). They document that larger firms, firms with more intangible assets, strong expected performance, higher credit ratings, and headquarters in Democratic-leaning states exhibit higher ESG rating dispersion. These results support the "strategic ambiguity" narrative, rather than the "plain noise" narrative. First, larger firms have greater resources and organizational capacity to manage disclosures, shape narratives, and engage selectively with ESG raters. These firms are more likely to intentionally craft multifaceted ESG messages that appeal to various stakeholders, including investors, regulators, and activists, each with distinct expectations and needs. Second, Firms with high intangible assets (*e.g.,* brand equity, R&D, human capital) operate in sectors where performance is harder to measure and disclosures are often narrative. As a result, ESG ratings in these contexts depend more on subjective interpretation than standardized metrics, thus creating room for intentional vagueness or framing. Third, firms with strong expected performance and high credit ratings typically enjoy greater investor attention and more intensive ESG scrutiny. Noise is more likely to correlate with weak fundamentals, rather than strong ones. Fourth, firms in Democratic-leaning states face more pressure to demonstrate environmental responsibility. They may simultaneously (i) signal ESG compliance to local or regional audiences, and (ii) avoid alienating broader and national investors with aggressive or partisan ESG stances. Thus, their findings support the interpretation that rating dispersion, at least in this subset of firms, reflects deliberate ambiguity and not accidental incoherence.

Higher betas, stock return volatility, and leverage imply a higher cost of equity (as expected), with EI of 8.62%, 3.33%, and 1.43%, respectively. On the other hand, the higher the degree of board independence, the lower the cost of equity, with EIs of 5.65% and 1.45%, respectively. Regarding the impact of the dummy variables, the period of the first Trump presidency, before the COVID-19 pandemic, saw an increase in the cost of equity, with an EI of 10.63% as was the case during the COVID-19 period after Trump, with an even higher EI of 15.68%. However, the period overlapping Trump's first mandate and the COVID-19 pandemic is associated with remarkable decreases in the cost of equity, with an EI of 38.30%.

In summary, the variables that present the highest economic effects and are most important for business decisions are the level of economic policy uncertainty (EPU), the degree of exposure to market risk, and board independence. Changes

Table 3

COE(t+1)				
Regressors	Betas	Robust_S.E.	t_statistic	EI (%)
COE	**3.42E-01**	7.54E-04	12.47	17.96
E	-1.37E-03	1.60E-06	-1.08	1.05
EPU	**2.56E-04**	4.65E-09	3.76	18.35
E*EPU_High	**8.97E-03**	1.30E-06	7.88	5.51
E_Dispersion	**-4.25E-03**	1.52E-06	-3.45	2.33
E_Dispersion*EPU_High	2.01E-03	2.41E-06	1.30	1.23
Size	2.53E-04	1.43E-07	0.67	0.54
Profitability	-6.41E-03	1.50E-05	-1.66	1.10
Volatility	**5.13E-03**	1.21E-06	4.66	3.09
TQ	-2.70E-04	3.78E-08	-1.39	0.67
PPE	-6.86E-04	8.43E-06	-0.24	0.19
Leverage	**5.50E-03**	3.43E-06	2.97	1.52
BoardIndependence	**-2.34E-04**	1.44E-09	-6.17	5.77
BETA	**1.34E-02**	1.37E-06	11.45	8.90
CR	**-3.71E-03**	9.04E-07	-3.91	1.94
D_Trump1Only	**1.92E-02**	8.40E-06	6.61	10.80
D_Trump1COVIDOverlap	**-9.42E-02**	1.04E-04	-9.25	39.46
D_COVIDOnly	**3.63E-02**	3.84E-06	18.51	15.45
Number of Obs.	8,150			
Industry Fixed Effect	Yes	R2 Adjusted	0.59	

Note: This Table presents the interaction terms model of associations between the COE (*i.e.,* cost of equity) at t+1 and average E scores, E scores standard deviation, and High Economic Policy Uncertainty at t. Standard errors are clustered at the firm level. Parameters in *boldface* denote statistical significance at 1%. The first column contains estimated parameters, the second their robust standard errors, the third robust t statistics, and the fourth the EI measure. The sample contains U.S. firms from 2017 to 2023.

Source: Own elaboration.

in typical amounts of E-rating-related variables, although statistically significant, are associated with modest changes in the cost of equity capital. On the other hand, external events (the Trump presidency, COVID-19) are associated with substantial, albeit temporary, impacts on the cost of equity capital. Next, we control the interaction terms between E ratings and High EPU, as well as the interaction between E dispersion and High EPU. Table 3 shows the results for the cross-effects coefficients.

Results in Table 3 indicate that the positive association between E ratings and the cost of equity reported in Table 2 is significant only in years with high EPU and presents a higher EI (5.51% *versus* 3.03%). In years with low EPU, E ratings do not have a statistically significant association with the cost of equity. In terms of E dispersion, higher dispersion about E ratings implies a lower future cost of equity in years with low EPU. In situations with high EPU, the impact of rating dispersion on the cost of equity capital is negligible.

As a result, the (negative) impact of dispersion of E ratings is relevant only when EPU is low. While the results may seem counterintuitive, they could potentially suggest an alternative explanation. In particular, dispersion in E ratings may reflect a firm's strategic resource allocation and its response to changing environmental priorities, while a lack of dispersion may indicate a less flexible approach towards environmental sustainability. While environmental initiatives have the potential to build stakeholder value over time, a generalist approach resulting in less dispersion may not always lead to lower risk. The effects of the other variables are similar to those in Table 2.

5.2. Firm Characteristics: Corporate Governance

Specific firm characteristics may influence the previously observed results. In this subsection, we focus on a firm characteristic: corporate governance level, measured by the percentage of independent directors on the firm's board. Table 4 presents the results of the interaction among E ratings, their dispersion, EPU, and the dummy variable indicating high versus low board independence. Table 4 shows the results for the cross-effects coefficients.

Higher board independence is significantly associated with lower cost of equity capital, although the economic impact is small (2.38%). However, when EPU is high and an additional effect appears, its size in terms of EI is 3.98%. Interestingly, for firms with higher board independence, higher E ratings are correlated with a lower cost of capital, and the EI of this effect is double (5.65%) that of the regular positive correlation. Therefore, firms with low board independence (*i.e.,* a low percentage of independent directors) and higher E ratings tend to present a higher cost of equity capital. However, when EPU is high and the firm has higher board independence, the positive correlation appears again.

Table 4

COE(t+1)				
Regressors	Betas	Robust_S.E.	t_statistic	EI (%)
COE	3.46E-01	7.41E-04	12.73	18.16
E	**6.96E-03**	2.05E-06	4.86	5.35
EPU	**2.52E-04**	4.67E-09	3.69	18.0
E*goodgov	**-9.40E-03**	2.11E-06	-6.46	5.65
EPU_High*goodgov	**-7.46E-03**	3.92E-06	-3.77	3.98
E*EPU_High*goodgov	**5.24E-03**	1.84E-06	3.86	2.35
E_Dispersion	**-5.13E-03**	3.40E-06	-2.79	2.81
E_Dispersion*goodgov	7.82E-04	3.92E-06	0.40	0.52
E_Dispersion*EPU_High*goodgov	**5.52E-03**	2.82E-06	3.28	2.99
Size	3.04E-04	1.44E-07	0.80	0.65
Profitability	-6.18E-03	1.54E-05	-1.58	1.06
Volatility	**5.45E-03**	1.22E-06	4.94	3.29
TQ	-2.79E-04	3.62E-08	-1.46	0.69
PPE	**-3.51E-05**	8.44E-06	-0.01	0.01
Leverage	**4.66E-03**	3.33E-06	2.55	1.29
goodgov	**-4.10E-03**	3.59E-06	-2.16	2.38
BETA	**1.30E-02**	1.34E-06	11.22	8.63
CR	**-3.24E-03**	8.92E-07	-3.43	1.69
D_Trump1Only	**1.73E-02**	7.17E-06	6.48	9.77
D_Trump1COVIDOverlap	**-9.37E-02**	1.04E-04	-9.17	39.22
D_COVIDOnly	**3.67E-02**	3.85E-06	18.72	15.65
Industry Fixed Effect	Yes	R2 Adjusted	0.59	
Number of Obs.	8,150			

Note: This Table presents associations between the COE (*i.e.,* cost of equity) at t+1 and the interaction among average E scores, Economic Policy Uncertainty, and firm characteristics, as well as among E scores standard deviation, Economic Policy Uncertainty, and firm characteristics. We use the high *vs.* low board independence dummy variable to capture firm characteristics. Standard errors are clustered at the firm level. Parameters in *boldface* denote statistical significance at 1%. The first column contains estimated parameters, the second their robust standard errors, the third the robust t-statistics, and the fourth the EI measure. The sample contains U.S. firms from 2017 to 2023.

Source: Own elaboration.

Regarding the interactions between ratings dispersion and board independence, they tend to decrease capital costs in average EPU situations. Nevertheless, they increase capital costs in situations of high economic policy uncertainty. The net effect in these situations is close to zero. It should be noted, however, that all effects discussed in this section present EIs between 1% and 5%.

5.3. Specific Events and ESG Scores

The association between E scores, E dispersion, and the cost of equity can also be influenced by significant events that occurred during the sample period. Table 5 shows the results.

Table 5

COE(t+1)				
Regressors	Betas	Robust_S.E.	t_statistic	EI (%)
COE	**3.59E-01**	7.51E-04	13.10	18.82
E	**3.13E-03**	1.16E-06	2.90	2.41
EPU	**2.67E-04**	4.64E-09	3.93	19.15
E_Dispersion	-6.99E-04	1.36E-06	-0.60	0.38
E*D_Trumponly	**-4.38E-03**	1.01E-06	-4.35	2.03
E*D_TrumpCOV	**1.57E-02**	3.18E-06	8.79	4.73
E*D_COVonly	-1.73E-03	9.08E-07	-1.81	0.54
E_Dispersion*D_Trumponly	**-3.47E-03**	1.82E-06	-2.57	1.95
E_Dispersion*D_TrumpCOV	-1.54E-03	6.11E-06	-0.62	0.61
E_Dispersion*D_COVonly	-3.02E-03	1.96E-06	-2.16	1.20
Size	2.68E-04	1.38E-07	0.72	0.58
Profitability	-5.69E-03	1.46E-05	-1.49	0.98
Volatility	**5.27E-03**	1.20E-06	4.81	3.18
TQ	-2.05E-04	3.64E-08	-1.07	0.51
PPE	-6.13E-04	8.20E-06	-0.21	0.17
Leverage	**5.38E-03**	3.28E-06	2.97	1.49
BoardIndependence	**-2.26E-04**	1.38E-09	-6.09	5.57
BETA	**1.28E-02**	1.36E-06	11.03	8.53
CR	**-3.83E-03**	8.73E-07	-4.10	2.00
D_Trump1Only	**2.15E-02**	7.98E-06	7.63	12.14
D_Trump1COVIDOverlap	**-9.20E-02**	1.07E-04	-8.92	38.53
D_COVIDOnly	**3.95E-02**	4.35E-06	18.95	16.83
Number of Obs.	8,150			
Industry Fixed Effect	Yes	R2 Adjusted	0.59	

Note: This Table presents the associations between the COE (*i.e.,* cost of equity) at t+1 and the interaction among average E scores, dispersion in E scores, and external events. Standard errors are clustered at the firm level. Parameters in *boldface* denote statistical significance at 1%. The first column contains estimated parameters, the second their robust standard errors, the third the robust t-statistics, and the fourth the EI measure. The sample contains U.S. firms from 2017 to 2023.

Source: Own elaboration.

The Trump-only period exhibits a negative correlation between E ratings and capital cost, with a small EI of 2.03%. The correlation changes sign during the overlapping period of the Trump presidency and the COVID-19 pandemic. The correlation is not meaningful in the COVID period after Trump's first presidency.

Regarding the correlation between dispersion in E ratings and the equity cost of capital, it is negative during the Trump period, as it was in the entire sample, but with a smaller EI of 1.95%. The other two interaction terms, corresponding to the overlapping period of Trump and COVID, as well as the COVID period afterwards, do not present meaningful impacts.

We run robustness tests using financial regulation uncertainty as a measure of political uncertainty. The results are similar to those in Tables 2-5 and are quantitatively and qualitatively comparable to the main results based on EPU.

6. CONCLUSIONS

This paper provides new evidence on the impact of environmental (E) ratings and their dispersion on firms' cost of equity capital (COE), highlighting the role of economic policy uncertainty (EPU) and corporate governance in shaping these relationships. Drawing on panel data covering 8,150 firm-year observations for U.S. firms from 2017 to 2023, we show that E-related metrics are far from unidimensional signals. Instead, they interact in complex and context-sensitive ways with macroeconomic and firm-level characteristics.

The study's key contribution lies in demonstrating that higher E ratings, while typically associated with stronger sustainability practices, are linked to a higher cost of equity (COE), especially during periods of elevated policy uncertainty. This finding challenges the prevailing narrative that ESG enhancements uniformly reduce capital costs. Instead, suggesting that market participants may interpret environmental performance as costly, particularly in uncertain economic climates. In contrast, greater dispersion in E ratings, a proxy for heterogeneity in assessments or firm strategy, predicts lower COE in low-EPU environments. This counterintuitive result supports the notion that dispersion may reflect strategic flexibility or differentiation rather than inconsistency or risk.

The analysis further reveals that the role of board independence is crucial. Firms with higher board independence exhibit lower overall COE, and this governance mechanism becomes especially effective when policy uncertainty is high, thereby mitigating the potentially adverse capital cost implications of environmental ratings. Interaction effects are also salient in interpreting the data. For instance, E ratings only correlate positively with COE under high EPU, while rating dispersion is only relevant when EPU is low. These asymmetric dynamics underscore the importance of modeling ESG variables not in isolation, but jointly with economic and institutional factors.

The inclusion of temporal policy dummies provides further nuance, revealing, for example, that the joint period of the Trump presidency and the COVID-19 pandemic was paradoxically associated with reduced COE, suggesting complex dynamics in how markets price uncertainty and policy risk.

Despite its contributions, the study has limitations. First, the analysis is limited to U.S. firms and may not generalize to other jurisdictions with different ESG reporting practices, regulatory environments, or market structures. Second, while the EI measure offers a useful comparative metric, it may mask non-linearities or threshold effects in the data. Third, the reliance on a single dimension of ESG (the E pillar) limits the scope of inference regarding social and governance factors, which may interact differently with capital market outcomes.

Future research could build on this work in several directions. First, expanding the analysis to a cross-country setting would help validate the external validity of our findings and identify institutional moderators. Second, disentangling the sources of E rating dispersion. Specifically, whether the dispersion is due to data quality issues, methodological differences, or strategic corporate behavior. Empirical evidence on these issues could offer more profound insight into its informational content. Third, investigating nonlinear relationships or regime-dependent effects could yield more refined estimates of E's influence on capital costs. Lastly, integrating forward-looking indicators, such as firms' climate commitments or scenario analyses, could enhance our understanding of how environmental strategy is priced in equity markets.

In summary, this paper emphasizes that E is not a monolithic construct and that its financial implications depend critically on the context. For academics, practitioners, and policymakers alike, the findings advocate for a more nuanced and dynamic approach to understanding the cost of capital in the era of ESG.

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PART III

WHEN FINANCE MEETS SUSTAINABILITY: ASSESSING THE ECONOMIC AND ENVIRONMENTAL RETURNS OF EU ESG REFORMS

RESUMEN EJECUTIVO

Este documento evalúa la eficacia de los instrumentos de financiación sostenible más emblemáticos de la Unión Europea: el Estándar de Bonos Verdes de la UE (EuGBS), el programa de bonos verdes *NextGenerationEU (NGEU)* y el Reglamento de 2024 sobre actividades de calificación ESG. El objetivo es evaluar si estas regulaciones han mejorado las condiciones de financiación de las empresas e impulsado un impacto ambiental real. En un contexto de mayores compromisos climáticos y un creciente escrutinio de los inversores, esas iniciativas tienen como objetivo alinear los mercados de capitales con los objetivos de sostenibilidad al reducir el costo del capital para los emisores de productos financieros verdes y mejorar la transparencia del mercado.

Basándose en datos de emisión de bonos, estimaciones de costes a nivel de empresa y una revisión de las metodologías de calificación ESG, este documento concluye que, si bien los instrumentos financieros con etiqueta verde ofrecen modestas ventajas de precios, particularmente para los emisores soberanos y de grado de inversión, estos beneficios a menudo se ven diluidos por los costes de certificación y cumplimiento de la normativa. Estos costes limitan el atractivo de estos productos y, por tanto, la participación de las pymes. La divergencia entre las calificaciones ESG sigue siendo significativa, lo que socava la comparabilidad y debilita el valor de señalización de las divulgaciones de sostenibilidad. La complejidad regulatoria, combinada con la incertidumbre de la política macroeconómica, disminuye aún más el incentivo financiero para emitir instrumentos financieros bajo el marco de EuGBS.

Estos resultados sugieren cuatro recomendaciones clave: (i) racionalizar los mecanismos de cumplimiento para las empresas más pequeñas, (ii) mejorar la verificación del impacto posterior a la emisión, (iii) armonizar las metodologías y divulgaciones de las calificaciones ESG, y (iv) vincular los incentivos financieros a resultados ambientales medibles. Si bien las políticas de finanzas verdes de la UE representan una base necesaria para la movilización de capital, su configuración actual no logra generar dividendos financieros o ambientales atractivos y consistentes para todos los participantes en el mercado.

El documento contribuye a la literatura al ofrecer un análisis integrado de las políticas y de cómo interactúan múltiples instrumentos de la UE para dar forma a la

dinámica de las finanzas sostenibles. También proporciona orientación práctica para inversores, emisores corporativos y reguladores que navegan por un panorama ESG cada vez más complejo. Los resultados sugieren que, sin más reformas, la agenda de finanzas sostenibles de Europa corre el riesgo de perder credibilidad e impulso, justo cuando se necesita con mayor urgencia una alineación efectiva del capital para cumplir con los objetivos de cero emisiones netas.

EXECUTIVE SUMMARY

This paper assesses the effectiveness of the European Union's flagship sustainable finance instruments, namely the EU Green Bond Standard (EuGBS), the NextGenerationEU (NGEU) green bond program, and the 2024 Regulation on ESG rating activities, in improving corporate financing conditions and driving real environmental impact. Against a backdrop of heightened climate commitments and mounting investor scrutiny, these initiatives aim to align capital markets with sustainability goals by lowering the cost of capital for green issuers and enhancing market transparency.

Drawing on bond-level issuance data, firm-level cost estimates, and a review of ESG rating methodologies, the paper finds that while green-labeled instruments do offer modest pricing advantages, particularly for sovereign and investment-grade issuers, these benefits are often offset by certification and reporting costs, thus making participation less attractive for SMEs. ESG rating divergence remains significant, undermining comparability and weakening the signaling value of sustainability disclosures. Regulatory complexity, combined with macroeconomic policy uncertainty, further diminishes the net financial incentive to issue under the EuGBS framework.

The findings suggest four key recommendations: streamline compliance mechanisms for smaller firms, enhance post-issuance impact verification, harmonize ESG rating methodologies and disclosures, and link financial incentives to measurable environmental outcomes. While EU green finance policies represent a necessary foundation for capital mobilization, their current configuration falls short of delivering consistent financial or environmental dividends across the market.

The paper contributes to the literature by offering an integrated, policy-aware analysis of how multiple EU instruments interact to shape sustainable finance dynamics. It also provides actionable guidance for investors, corporate issuers, and regulators navigating an increasingly complex ESG landscape. The results suggest that without further reform, Europe's sustainable finance agenda risks losing credibility and momentum, just when effective capital alignment is most urgently needed to meet net-zero objectives.

When Finance Meets Sustainability: Assessing the Economic and Environmental Returns of EU ESG Reforms

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ABSTRACT

This paper evaluates the effectiveness of green finance policies and ESG regulatory reforms in the European Union, focusing on their impact on corporate financing conditions. It analyzes key initiatives such as the EU Green Bond Standard and the NextGenerationEU program, assessing their ability to reduce funding costs, attract investment, and deliver measurable environmental outcomes. The findings reveal that while green bonds may offer modest (1-10 bps) cost advantages, especially for sovereign and highly rated corporate issuers, these benefits are often offset by the expenses associated with certification and compliance. Moreover, divergence in ESG ratings and regulatory complexity undermines investor confidence and raises implementation barriers, particularly for SMEs. The study highlights the conditional and context-dependent nature of ESG's financial impact, highlighting the need for streamlined regulation, better data, and stronger anti-greenwashing measures. For policymakers and investors alike, the paper offers evidence-based recommendations to strengthen the alignment between sustainability objectives and financial market incentives in an era of heightened policy uncertainty.

Keywords: Cost of equity, economic policy uncertainty, environmental scores, rating dispersion, sustainability metrics.

JEL classification: D80, D83, E22, G18, G32, M14, Q54, Q56.

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1. INTRODUCTION

Mobilizing private capital at the scale required for the European Green Deal depends on the belief that "doing well by doing good" can lower firms' funding costs while accelerating the green transition. Yet, empirical evidence on whether EU sustainable–finance initiatives deliver cheaper capital, reduced risk, or meaningful carbon abatement remains mixed. The recent rollout of the EU Green Bond Standard (EuGBS, hereafter), the NextGenerationEU (NGEU, hereafter) green bond programme, and Regulation (EU) 2024/3005 on Environmental, Social, and Governance (ESG, hereafter) rating activities provides a timely natural experiment. Together, they make the most ambitious effort to embed sustainability into Europe's financial architecture. Understanding where these instruments succeed and where challenges such as certification costs, rating divergence, and policy uncertainty diminish their impact is critical for investors allocating trillions in climate capital, managers balancing ESG commitments with shareholder returns, and regulators designing incentives to help close the annual green investment gap, estimated to range between €558 billion according to BloombergNEF (BNEF) to around €400 billion according to the International Energy Agency (IEA), Andersson *et al*. (2025).

While prior studies typically often examine either green bonds or ESG ratings in isolation, this paper offers the first integrated assessment of how the EU's three flagship instruments interact to shape corporate financing conditions. Leveraging bond-level issuance data, firm-level cost-of-capital estimates, and a comparative analysis of rating-provider methodologies, we disentangle economic from statistical significance by distinguishing the headline "greenium" (often <10 bps) from the less visible burden of certification and reporting overheads. We also exploit the staggered adoption of Regulation 2024/3005 to evaluate its potential to narrow rating dispersion, an angle largely neglected in the sovereign-bond and asset-pricing literatures. Finally, by embedding these findings within a policy-uncertainty framework, we demonstrate why benefits are highly contingent upon issuer size, sector, and macroeconomic regime. This insight extends mainstream finance research and informs strategic management debates on the financial materiality of ESG initiatives.

Based on a multi-dimensional analysis of green finance instruments and ESG regulation in the EU, this paper offers four main takeaways. First, cost advantages

from EU-labelled green bonds are statistically significant in some cases, but modest and concentrated among sovereign and A-rated corporates. For SMEs, the "greenium" is frequently offset by 1–5 bps in compliance fees. Second, ESG rating divergence, still averaging more than 25 percentage points, continues to dilute the signaling power of sustainability disclosures, dampening investor appetite and increasing equity risk premiums. Third, policy complexity and sequencing matter. Uncertainty over taxonomy criteria and Regulatory Technical Standards[1] (RTS, hereafter) timelines raise hurdle rates during rate-tightening cycles, undermining the financial attractiveness of long-dated green assets. Fourth, environmental impact remains uneven. For example, sovereign green bond proceeds are disproportionately allocated to rail infrastructure, while firm-level CO_2 reductions depend on the certification rigor and the project additionality. In short, Europe's sustainable finance toolkit is necessary but not yet sufficient to realign risk-adjusted returns with Paris-aligned objectives.

Building on the preceding analysis, this paper provides recommendations to investors, firm managers, and regulators. Investors should move beyond labels, benchmarking EuGBS instruments net of compliance costs, and integrate multiple rating sources or bespoke metrics to mitigate dispersion risk. Stress-testing portfolios against policy- uncertainty scenarios will further guard against green-premium compression. Firm managers should treat EuGBS and sustainability-linked loans as strategic, rather than opportunistic, capital structure choices. This approach involves proactively quantifying certification payoffs, aligning projects with high-impact taxonomy categories, and deploying robust internal carbon accounting to defend against greenwashing concerns. Early engagement with rating agencies to harmonize disclosed KPIs can narrow spreads by signaling credibility and transparency.

Regulators can amplify impact by: (i) streamlining taxonomy reporting for SMEs via proportional disclosure thresholds; (ii) fast-tracking ESMA technical standards and mandating post-issuance impact audits; (iii) introducing a variable compliance rebate that links EuGBS fees to verified emissions reductions; and (iv) establishing an EU-wide rating-comparison database to enhance market transparency. Together, these measures would sharpen price signals, crowd in private capital, and ensure Europe's sustainable finance agenda delivers both financial efficiency and measurable climate benefits. Taken together, these measures would sharpen market signals, attract greater volumes of private capital, and improve the alignment between Europe's financial infrastructure and its climate goals, thus delivering both financial efficiency and measurable environmental outcomes.

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[1] In the context of green investment in the EU, RTS stands for Regulatory Technical Standards. These are detailed, legally binding rules developed by European supervisory authorities, such as the European Securities and Markets Authority (ESMA), to specify, supplement, or implement aspects of EU legislation, particularly regulations relating to sustainable finance and green bonds.

The remainder of this paper proceeds as follows. Section 2 presents an evaluation of green finance policies in the European Union. Section 3 discusses the 2025 European Union regulatory framework on the comparability of (ESG) ratings. Section 4 explores the theory and evidence on the impact of ESG policies on financing costs. Section 5 examines the impact of ESG policies, tax incentives, and green financing on improving corporate financing conditions during economic crises. Section 6 concludes with suggestions for future research.

2. EVALUATION OF GREEN FINANCE POLICIES IN THE EUROPEAN UNION: IMPACTS, EFFECTIVENESS, AND FUTURE DIRECTIONS

The EU's sustainable finance framework, anchored in the European Green Deal, seeks to mobilize private and public capital to achieve climate neutrality by 2050. Central to this framework are the EuGBS, a voluntary framework aligning bond issuances with the EU Taxonomy, and the NGEU program, which includes a significant green bond component to fund post-COVID recovery and sustainability projects. These policies aim to lower financing costs for sustainable projects, attract institutional and retail investors, and reduce financial uncertainty by providing clear sustainability metrics. This section assesses their effectiveness, focusing on their impacts on business financing costs and their role in attracting sustainable investment. We present evidence of expected environmental and economic outcomes and make recommendations for policy enhancement.

2.1. EU Green Bond Standard

Introduced in November 2023, the EuGBS is a voluntary standard aimed at enhancing the credibility and transparency of green bonds.[2] It originated as a recommendation from the final report of the Commission's High-Level Expert Group on sustainable finance. The standard aligns with the EU Taxonomy for sustainable activities, requiring issuers to allocate proceeds to taxonomy-aligned projects, ensure transparency through pre- and post-issuance reporting, and undergo external reviews supervised by the European Securities and Markets Authority (ESMA, hereafter). The standard addresses greenwashing by mandating detailed disclosures and allowing a 15% "flexibility pocket" for non-taxonomy-aligned but environmentally beneficial projects. As such, the EuGBS aims to set a new benchmark for environmental integrity and investor confidence in the green bond market.

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[2] https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/european-green-bond-standard-supporting-transition_en

2.2. NextGenerationEU Green Bonds

The NGEU program, launched in 2021, aims to fund the EU's post-COVID recovery, with up to €250 billion (approximately 30% of total funds) allocated through green bonds. This initiative is expected to make the European Commission (EC, hereafter) the world's largest issuer of green bonds. The first issuance of an AAA-rated, 15-year bond in October 2021 raised €12 billion, marking the world's largest green bond transaction at the time. The 15-year bond carries a coupon of 0.40% and yields 0.453%, resulting in a negative spread of 8 basis points (bps) to mid-swaps in the primary market. The final order book exceeded €135 billion, indicating that the bond was oversubscribed by more than 11 times.[3]

Therefore, the estimated annual savings in funding costs of this first issuance are €9,600,000, and the total savings over the 15-year tenor are €144,000,000. In other words, the savings amount to 1.2% of the bond size issue. It is challenging to provide a precise percentage estimate for the certification and compliance costs for the €12 billion NGEU green bond issuance. The reasons are as follows:

1. *Lack of Public Disclosure of Specific Issuance Costs.* Issuers generally do not publicly break down the specific legal, auditing, certification, and other compliance costs per individual bond issuance as a percentage of the issue size. These are typically absorbed into broader operational or administrative budgets.

2. *Embedded Costs in Overall Green Bond Framework.* The EC developed a comprehensive NGEU Green Bond Framework, which involved significant upfront investment in legal, financial, and environmental expertise. The costs of setting up this framework, obtaining a Second Party Opinion (SPO), and establishing internal reporting and tracking mechanisms are substantial. These are more "fixed" costs associated with launching the entire program, rather than variable costs per bond. Subsequent issuances benefit from this established framework, resulting in lower marginal compliance costs.

3. *Nature of Green Bond Compliance Costs:*

   - *Framework Development:* These costs related to the design of the Green Bond Framework, ensuring alignment with the ICMA Green Bond Principles and the EU Taxonomy.

   - *Second Party Opinion (SPO):* An independent external review of the framework's alignment; for the NGEU program, the SPO was obtained from Sustainalytics.

[3] The data notes that green bonds are heavily oversubscribed. This evidence shows ample investor demand, and the bottleneck appears to lie on the supply side, not the demand side.

- *Ongoing Reporting and Assurance:* The EC committed to detailed allocation and impact reporting, requiring internal tracking, data collection, and likely external assurance/auditing of these reports. These are recurring costs over the program's life.

- *Legal and Advisory Fees:* Lawyers and financial advisors are involved in the structuring and issuance of any bond, with additional considerations for green bonds.

In the case of the entire €250 billion NGEU green bond program, it is also challenging to estimate certification and the following compliance costs.

- *Upfront Framework Costs:* Significant costs were incurred in developing the detailed NGEU Green Bond Framework, aligning it with the ICMA Green Bond Principles and, more importantly, with the complex and evolving EU Taxonomy. These costs included those associated with legal advice, consulting services, and extensive internal policy work.

- *Second Party Opinions (SPOs)*: An initial SPO for the framework is a one-time or infrequent cost for the overall program.

- *Ongoing Reporting and Assurance:* The EC commits to annual Allocation and Impact Reports. This reporting involves continuous data collection from Member States on green expenditures under their Recovery and Resilience Plans, internal aggregation and analysis, drafting reports, and potentially external assurance and auditing of these reports. This reporting has an ongoing operational cost for the program's duration.

- *Legal and Advisory:* Additional legal and financial advisory fees would be incurred to ensure all aspects of the green bond framework are legally sound and aligned with market best practices.

As a rough estimate, the total certification and compliance costs for the entire €250 billion NGEU green bond program over its lifespan would be approximately 1 to 5 basis points (bps) of the total issuance amount. This percentage would primarily represent the fixed or semi-fixed costs of establishing and maintaining the framework and reporting, which become diluted as the issuance volume increases.

These bonds finance projects aligned with the EU's environmental goals, such as renewable energy and energy efficiency, and are supported by a framework that ensures ESG coherence. The program enhances market liquidity and investor diversification while reinforcing the EU's leadership in sustainable finance.

2.3. Impact on Business Financing Costs

The literature does not agree on whether and to what extent Green Bonds provide lower, equal, or higher financing costs than conventional bonds (Hinsche, 2021). In other words, whether the price of Green Bonds is equal to comparable regular bonds (Larcker and Watts, 2020), or exhibits a positive premium, meaning lower prices and therefore higher interest rates, or a "greenium" (negative bond premium), meaning higher prices and lower interest rates.

Evidence of a "greenium" ranging from one to ten basis points (bps) has been observed in both primary and secondary markets. However, its magnitude varies depending on issuer sector, rating, currency, and other factors, and tends to decline over time (Kanamura, 2020). In a recent paper, Caramichael and Rapp (2022) report that green corporate bonds have a primary market credit spread that is eight basis points lower than that of conventional corporate bonds, reflecting a 5% reduction in funding costs. Still, this "greenium" favors large, rated European firms and does not necessarily reward high- quality green projects.

Moreover, when certification and compliance costs are considered, the net financing advantage often narrows or disappears. Estimates of certification costs for green bonds vary (Ehlers and Packer; 2017, Zirek and Unsal, 2023; Baket *et al.*, 2018), but typically range from 0.1 bps (CBI-specific fee) to 1 to 5 bps, depending on the certification scheme (*e.g.*, CBI, Moody's, or EuGBS requirements) and additional auditor fees. The EuGBS, introduced in 2024, may increase costs due to mandatory external reviews and alignment with the Taxonomy.

As a result, the borrowing cost advantage of green corporate bonds likely plays a limited role in incentivizing large-scale investment in climate change mitigation. Instead, the benefit of issuing a green bond may be an indirect signaling effect, improving the environmental credentials of the issuer.

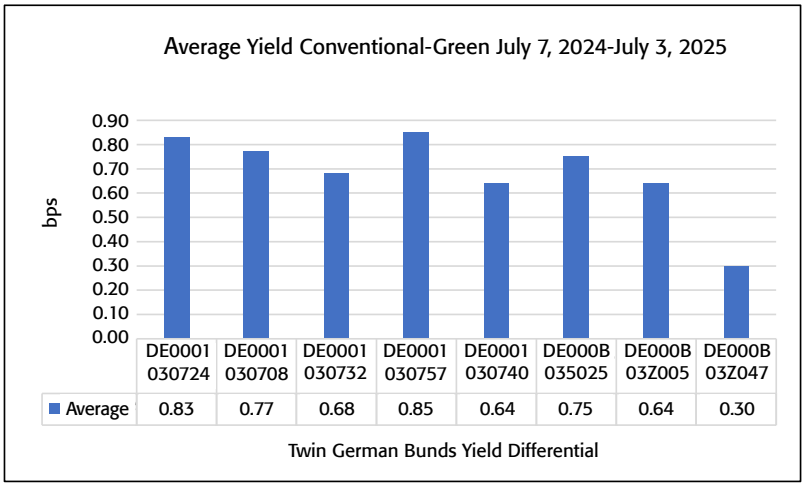
In the context of green sovereign bonds, Ando *et al.* (2023) find that green bonds are issued at a premium of 4 bps on average in Advanced Economies and 11 bps on average for Emerging Market Economies.

Other studies find no consistent greenium or even slightly positive premia. For instance, Karpf and Mandel (2018) report no pricing advantage. Recent evidence about "greenium" in the secondary market is based on the prices of eight green German Federal Government bonds, which were issued as twins to conventional bonds.[4] Figure 1 shows the average difference between the yield of these recent conventional bonds and green bonds. Taken together, the evidence suggests that while green bonds can reduce financing costs in some cases, their economic significance remains modest and highly context-dependent.

[4] https://www.deutsche-finanzagentur.de/en/federal-securities/types-of-federal-securities/green-federal-securities/twin-bond-concept

Figure 1

AVERAGE DIFFERENCE IN YIELD OF CONVENTIONAL BONDS AND GREEN BONDS



Source: Own elaboration.

We may see that the difference varies between 0.30 and 0.83 bps. Therefore, green bonds typically present a lower yield than conventional bonds. It is sometimes argued that even minor yield differences can be significant in large bond markets or for institutional investors. However, it is debatable whether this line of reasoning applies in the case of green bonds, given their niche situation and the fact that they constitute a minor segment of the total global bond market. As an illustration, Table 1 presents data on transaction volumes comparing EU Green Bonds with European Sovereign Bonds in 2024.

Table 1 shows that EU Green Bonds represented approximately 6.9% of total European sovereign bond issuance in 2024.[5] This relatively modest share highlights that, despite strong investor demand and the introduction of standards such as the EuGBS, green sovereign debt remains a niche product in the broader public finance landscape. To meet the EU's climate and energy transition goals, a substantially higher share of public debt must be aligned with green objectives. The 6.9% figure, therefore, highlights the current scaling gap, underscores the need to reduce compliance frictions for issuers, and emphasizes the importance of further regulatory or fiscal incentives to expand the share of green finance in sovereign budgets.

[5] Even after a decade of policy efforts, dedicated taxonomies, and investor interest, less than 1 in 14 euros of sovereign debt is labeled green. This highlights how green finance is still peripheral in fiscal policy and public borrowing strategies.

Table 1

2024 ISSUANCE VOLUMES (EUR BILLION)

Type of Bonds	Issuance Volume (EUR Billion)	Reference & Source Link
EU Green Bonds (Sovereign & Supranational)	20	Environmental Finance [1]
European Sovereign Bonds (EU Members) – Q4 2024 Only	892	AFME Government Bond Data Report [2]
European Sovereign Bonds (EU Members) – 2024 Full Year	3,568	AFME Government Bond Data Report [3]

Notes: [1] https://www.environmental-finance.com/content/news/european-sovereign-sustainable-bond-issuance- to-stall-or-fall-in-2024.html

[2] https://www.afme.eu/Publications/Data-Research/Details/Government-Bond-Data-Report-Q4-2024--2024FY

[3] https://www.afme.eu/Publications/Data-Research/Details/Government-Bond-Data-Report-Q4-2024--2024FY

Source: Own elaboration.

The NGEU green bonds, issued by the EC, benefit from the EU's AAA credit rating, which further lowers yields and makes them attractive to businesses co-financing projects. However, smaller firms or those with lower environmental scores face higher compliance costs to meet EU Taxonomy requirements. On April 2, 2025, the European Investment Bank (EIB, hereafter) priced its first 15-year Climate Awareness Bond, aligned with the European Green Bond Standard ('EuGBS-aligned CAB'). The bond pays an annual coupon of 3.125% and provides a spread of +53 basis points (bps) to mid- swaps, thus obtaining financing at a *higher* cost than conventional bonds. For comparison, the NGEU program's 15-year bond carries a coupon of 0.40% and offers a negative spread of minus eight basis points in the primary market compared to mid-swaps. The EIB's higher spread (+53 bps) versus NGEU's negative spread (-8 bps) may reflect differences in issuer risk, liquidity, or market conditions, not merely the green label.

These examples suggest that while EU-backed green bonds can offer lower financing costs in certain cases, the advantage is not universal–and often modest in economic terms.

2.4. Role in Attracting Sustainable Investment

The EuGBS and the NGEU programs have boosted sustainable investment. In 2024, more than half of the aligned green bond volume originated from Europe

(58%), amounting to USD 388.4bn, representing 17% year-on-year growth compared to the USD 322.3bn recorded in 2023.[6] The EuGBS' standardized framework has attracted institutional investors by improving clarity on taxonomy alignment and reducing due diligence costs. Anecdotal evidence and early surveys suggest a growing interest from retail investors, with studies showing a "green label effect" influencing investment decisions; however, susceptibility to greenwashing remains a concern.

NGEu's green bonds have drawn a diverse investor base, including pension funds and asset managers, due to their liquidity and high credit rating. The program's €12 billion issuance in 2023 funded projects like renewable energy infrastructure, which attracted private co-investment at a ratio of 1:3.

Together, these programs demonstrate that credible frameworks, liquidity, and transparency can significantly influence investor demand–but their long-term impact depends on maintaining trust and delivering verifiable environmental outcomes.

2.5. Mitigating Financial Uncertainty

The EuGBS and the NGEU programs aim to reduce financial uncertainty by providing clear sustainability metrics and enhancing market confidence. The EuGBS' external review requirements and alignment with the EU Taxonomy reduce the risk of greenwashing, increasing investor trust. Studies (Flammer, 2021; Tang and Zhang, 2020) show that certified green bonds are associated with higher stock market returns and improved ESG ratings, signaling reduced risk perceptions.

NGEU green bonds, backed by the EU's credit rating, offer a low-risk investment vehicle, encouraging capital flows to sustainable projects. However, geopolitical risks and economic fluctuations, such as the rise in interest rates from 2021 to 2023, have temporarily reduced green bond issuance, highlighting persistent uncertainties. The EU Taxonomy's delayed implementation has also created uncertainty for issuers, particularly SMEs, limiting broader adoption.

Overall, while both programs help reduce information asymmetry and boost credibility, their effectiveness in stabilizing market conditions is moderated by external shocks and regulatory delays.

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[6] https://www.climatebonds.net/data-insights/publications/https-www.climatebonds.net-data-insights-publications-global-state-market

2.6. Evidence on Expected Results

2.6.1. Environmental Impact

Empirical studies present mixed results on environmental outcomes. On the one hand, Flammer (2021) finds that green bond issuance, particularly certified green bonds, is associated with a significant reduction in CO_2 emissions. Pang *et al.* (2024) present similar results, noting that the reduction effect is more pronounced in less economically developed regions than in more economically developed regions. On the other hand, Fantica and Panzica (2021) find mixed evidence on whether green issuers display a decrease in carbon emissions after borrowing on the green segment. Hoang *et al*. (2022) report an insignificant relationship between green bond issuance and GHG emissions. Zhou and Kythreotis (2024) found no significant causality (using a DID setting) between green bond issuance and CO_2 emission reductions following the introduction of net-zero policies in 2016, suggesting that issuers face limited pressure to meet emissions targets. In summary, the environmental impact of green bonds appears highly context-dependent, shaped by firm characteristics and the credibility of certification mechanisms.

Empirical studies on the environmental impact of green bond issuance in the EU and globally report mixed results, because some find significant reductions in CO_2 emissions, while others find little or no effect. Table 2 summarizes key sources of heterogeneity that influence the environmental effectiveness of green bond issuance.

Differences in certification rigor, issuer and project characteristics, measurement approaches, regulatory context, and market incentives drive the heterogeneity in environmental impact outcomes of green bond issuance. Besides, the issue of the extent of *additionality* is relevant, as many green bonds refinance already planned or completed projects, thereby limiting the marginal environmental benefit. For instance, Lam and Burgler's (2024) analysis of U.S. corporate and municipal green bonds indicates that the vast majority of green bond proceeds are used for refinancing ordinary debt, continuing ongoing projects, or initiating projects that lack green aspects and are novel for the issuer.

Addressing these sources of variation through stricter standards, improved data, and more effective oversight could enhance the consistency and credibility of environmental benefits from green finance.

Table 2

SUMMARY OF SOURCES OF HETEROGENEITY

Source of Heterogeneity	Example/Explanation
Certification and tandards	Certified bonds have a greater impact, but self-labeled bonds may not deliver tangible outcomes.
Issuer Characteristics	Large firms and some sectors (energy) present more potent effects than SMEs and other sectors. Developed regions present a lower impact than less developed regions.
Project Selection	High-impact (renewables) vs. low-impact projects: Additionality matters when green bond proceeds are used to finance projects that would have occurred otherwise ("business as usual"). Thus, the marginal environmental benefit is limited.
Time Horizon & Measurement	Short-term vs. long-term effects. Some benefits of green investments may take years to materialize, while most studies focus on short to medium-term outcomes; different metrics (*e.g.*, absolute versus relative emissions) and data quality.
Regulatory Environment	Taxonomy complexity/delays, greenwashing, and enforcement gaps.
Market Incentives	The size of the "greenium" affects the issuer's willingness, as well as investor pressure for real impact.

Source: Own elaboration.

2.6.2. Economic Impact

Green bonds may generate economic benefits in some cases, including lower financing costs and enhanced firm valuations. Several studies (*e.g.,* Flammer, 2021) report a positive stock market response to green bond announcements, with certified bonds showing more potent effects. However, the evidence on operational performance is mixed. Short-term financial performance metrics, such as ROA and ROE, show limited improvement and even deterioration in some cases. Hoang *et al.* (2022) report that the amount of green bonds issued negatively correlates with ROA and ROE for European firms and firms in light industries, respectively. However, caution should be exercised when interpreting these results at face value, as potential endogeneity may be present (*e.g.*, firms issuing green bonds may already have weaker financials). Further research is needed to determine whether financing costs, ESG integration burdens, or self-selection drives these effects.

A recent meta-analysis by Khan and Vismara (2025) concludes that the impact of green bonds on financial performance is not consistently significant, due to high heterogeneity in financial outcomes influenced by factors such as geographic region, bond maturity, chosen financial metrics, and methodological variations across studies.

Taken together, firm-level economic benefits from green bonds remain inconclusive and context-dependent, highlighting the need for more granular and methodologically robust evaluation.

2.6.3. Actual Investment financed by Sovereign Green Bonds

Sovereign green bonds, *i.e.*, government-issued debt securities labeled as "green," "social," or "sustainability" bonds, have shown marked growth since 2016, raising over $500 billion raised globally. These instruments are primarily intended to finance renewable energy and energy efficiency projects. However, analysis of post-issuance allocation data for 23 reporting countries reveals a predominant investment in rail transportation infrastructure.[7] Nations such as Belgium, Spain, Denmark, Chile, and Israel have dedicated over 90% of their green bond proceeds explicitly to railways, while the UK demonstrated more diversified allocations but still directed 37% of its green bonds towards rail renewal and upgrades.

Despite eligibility frameworks that broadly encompass various sustainability goals, the overwhelming channeling of funds into railways is attributed to their measurable impact: reduced air and noise pollution, decreased road accidents, and lower congestion. This category provides tangible key performance indicators (KPIs), such as "kilometers of railway installed" and "emissions avoided", which feature prominently in impact reports. Nevertheless, only half of these bonds enforce the termination of their green label if the underlying projects fail to meet eligibility criteria after allocation, reflecting weak regulatory oversight and loose adherence to local green taxonomies.

Furthermore, the efficacy of these bonds as tools for additional investment is questionable. Many issuers refrain from committing to new capital expenditures, often using proceeds for refinancing existing projects. In response to potential "greenwashing," some European countries now impose short lookback periods (as little as 12 months) on refinancing eligibility.

Regulatory guidance is still fragmented. While the International Capital Market Association (ICMA) provides voluntary principles, they are non-binding. The EU Green Bond Standard was introduced with more rigorous requirements in late 2024. In the absence of robust standards, the primary incentive for issuance appears to be rooted more in a positive perception than in substantive impact, raising critical questions about the overall effectiveness of current green sovereign bond practices.

In the absence of strong oversight and project-level conditionality, sovereign green bonds risk becoming instruments of perception rather than genuine vehicles for climate-aligned investment.

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[7] https://www.ft.com/content/9d56fb00-8164-4760-b90d-2eb162036721

2.6.4. Challenges and Limitations

Despite steady growth, green bonds account for only 6.8% of EU bond issuances in 2023, indicating substantial room for further expansion. Greenwashing remains a concern, as some issuers may obtain certifications without achieving meaningful environmental outcomes, potentially undermining market confidence and the credibility of sustainable finance initiatives. The Corporate Climate Responsibility Monitor (CCRM, hereafter) has documented widespread deficiencies in corporate climate strategies in major companies in Europe. Its 2024 CCRM report[8] found that none of the 51 major companies assessed had a high degree of integrity in their climate strategies, and only 5% were rated as having "reasonable" integrity. Furthermore, Avi (2023) reports an empirical survey conducted in 14,000 companies across all EU countries, and the results suggest that greenwashing appears to be increasingly widespread. Evidence on the consequences of greenwashing suggests that news affecting European companies does not lead to adverse stock market reactions (Teti *et al.*, 2024), although causality has not been established. The EU has been actively working to combat greenwashing through legislation and regulations, aiming at improving the accuracy and transparency of environmental claims. While a proposed Green Claims Directive was withdrawn, the EU continues to address greenwashing through other means, including the Unfair Commercial Practices Directive and national- level enforcement. Nonetheless, several challenges persist in aligning EU consumer protection law more closely with the broader legal framework for environmental policy (Hedemann-Robinson, 2025).

Additionally, the EU Taxonomy's complexity and delayed criteria have hindered SME participation, thereby limiting the reach of these policies.

2.7. Policy Analysis and Recommendations

2.7.1. Effectiveness Analysis

The EuGBS and the NGEU programs have successfully increased green bond issuance and investor interest. However, inconsistent CO_2 reductions and risks of greenwashing constrain their environmental impact. The "greenium" provides economic incentives, but these benefits are disproportionately captured by larger certified issuers. Additionally, the size of the "greenium", although statistically significant in some cases, is generally of limited economic significance. While these policies have contributed to increased capital mobilization and, in some cases, improved ESG metrics, empirical evidence for widespread adoption and substantial *emissions reductions remains mixed, highlighting the need for further policy* refinement and rigorous impact assessment.

[8] https://newclimate.org/resources/publications/corporate-climate-responsibility-monitor-2024

2.7.2. Recommendations

Based on the above analysis, this section puts forward the following recommendation. First, simplify EU Taxonomy Compliance by streamlining reporting requirements and reducing compliance costs for SMEs to enhance accessibility, supported by educational resources. Second, it is crucial to strengthen anti-greenwashing measures by expanding ESMA's oversight and mandating stricter penalties for non-compliant issuers. Third, leverage the NGEU program more effectively by increasing co-financing ratios for private investments in high-impact sectors, such as clean energy, can have a positive impact on attaining the ambitious EU sustainability goals. Fourth, promote retail investor engagement by developing simplified green bond products to capitalize on the "green label effect" while ensuring robust oversight. Finally, integrate Transition Finance into the mainstream by defining clear standards for sustainability-linked bonds to support industries transitioning to net-zero.

2.7.3. Discussion

The EuGBS and the NGEU green bond programs have significantly advanced sustainable finance, increasing green bond issuance from 0.3% to 6.8% of the EU bond market between 2014 and 2023. They may have reduced financing costs to some extent, attracted a diverse range of investors, and improved corporate-level ESG performance. However, their environmental impact is limited by inconsistent CO_2 reductions and risks of greenwashing, particularly for non-certified bonds. Going forward, priority should be given to simplifying compliance, enhancing oversight, and expanding access to ensure these policies align with the EU's ambitious climate goals.

3. THE 2025 EUROPEAN UNION REGULATORY FRAMEWORK ON THE COMPARABILITY OF ENVIRONMENTAL, SOCIAL, AND GOVERNANCE (ESG) RATINGS

The 2025 European Union (EU) regulatory framework, particularly Regulation (EU) 2024/3005 on the transparency and integrity of ESG rating activities, marks a significant step toward standardizing ESG ratings across the EU. This section evaluates the impact of this framework on the comparability of ESG ratings, its effectiveness in reducing variability among providers, its role in enhancing investor and company confidence, and its influence on transparency and financing costs for sustainable projects. The framework is expected to enhance comparability by mandating stricter transparency requirements. However, empirical evidence confirming this outcome is still limited. The regulation aims to enhance investor confidence by ensuring greater reliability and reducing greenwashing risks. Nevertheless, its impact on financing

costs remains uncertain, considering implementation costs and market adjustments, as explained in Section 2.1. Recommendations are provided to refine the framework further and maximize its benefits.

3.1. Issues

ESG ratings have become critical tools for investors and companies navigating the transition to sustainable finance. These ratings assess a company's or a financial instrument's sustainability profile, evaluating exposure to ESG risks and impacts on society and the environment. However, the ESG ratings market has historically suffered from inconsistencies, a lack of transparency, and variability among providers (Peña *et al.,* 2025a), which undermines their reliability and comparability. The EU's 2025 regulatory framework, particularly Regulation (EU) 2024/3005, seeks to address these issues by introducing a common regulatory approach to enhance transparency, integrity, and comparability of ESG ratings. This section analyzes the framework's impact on:

1. *Comparability of ESG Ratings*: The extent to which the framework standardizes ratings across providers.

2. *Reduction of Variability:* The regulation's potential to reduce divergence in methodologies and scoring outcomes across rating agencies.

3. *Investor and Company Confidence:* Whether the framework fosters trust in ESG ratings.

4. *Transparency and Financing Costs:* The framework's role in improving transparency and reducing uncertainty in financing sustainable projects.

3.2. Background: The EU Regulatory Framework for ESG Ratings

3.2.1. Overview of Regulation (EU) 2024/3005

Adopted on November 19, 2024, and effective as of 2025, Regulation (EU) 2024/3005 establishes a comprehensive framework for ESG rating activities within the EU. Key provisions include:

- *Authorization Requirements and Supervision:* ESG rating providers operating in the EU must be authorized and supervised by the ESMA. Providers outside the EU must obtain endorsement, recognition, or equivalence to operate within the EU.

- *Transparency Requirements*: Providers must publicly disclose their methodologies, models, and key assumptions, specifying whether ratings address single (E, S, or G) or aggregated factors, along with explicit weightings for aggregated ratings.
- *Conflict of Interest Management:* The regulation mandates the separation of business activities to prevent conflicts of interest, ensuring ratings are independent and impartial.
- *Small Provider Provisions:* A temporary, lighter registration regime is available for small ESG rating providers until July 2, 2026, to ease compliance burdens.

The regulation complements existing frameworks, such as the Sustainable Finance Disclosure Regulation (SFDR, hereafter), the Corporate Sustainability Reporting Directive (CSRD, hereafter), and the EU Taxonomy Regulation (EUTR, hereafter), aligning with the EU's Green Deal objectives to achieve climate neutrality by 2050.

The SFDR, implemented in March 2021 with Level II requirements effective from January 2023, aims to enhance transparency in sustainability-related disclosures by financial market participants (FMPs) and financial advisers in the EU. By standardizing ESG disclosures, the SFDR aims to combat greenwashing, enhance the comparability of financial products, and channel capital toward sustainable investments. The extent to which this regulation has achieved some of its intended goals is discussed in Martínez- Meyers *et al.* (2024), which shows limited results so far.

The CSRD entered into force on January 5, 2023, with a phased application until 2029. It expands mandatory sustainability reporting for large EU companies and listed SMEs, moving beyond non-financial reporting. It requires detailed disclosures of ESG impacts, risks, and opportunities, as outlined in the European Sustainability Reporting Standards (ESRS). Aiming for greater transparency and comparability, it helps investors and stakeholders assess corporate sustainability performance accurately.

The EUTR entered into force on July 12, 2020, with phased application until 2023. It establishes a classification system to identify environmentally sustainable economic activities. It defines technical screening criteria for six environmental objectives (*e.g.*, climate change mitigation, pollution prevention). Companies must disclose the proportion of their turnover, capital expenditure, and operating expenditure aligned with the Taxonomy. It is designed to guide investment toward activities genuinely contributing to sustainability objectives.

Regulation (EU) 2024/3005 complements existing EU frameworks, the SFDR, the CSRD, and the EUTR, by targeting ESG rating providers, an area previously lacking direct oversight. While the SFDR and the CSRD primarily impose transparency

and disclosure obligations on financial market participants, advisors, and corporates regarding sustainability risks and impacts, Regulation (EU) 2024/3005 mandates standardized disclosures from ESG rating agencies themselves. The EUTR, conversely, classifies environmentally sustainable activities but does not directly regulate ratings. Thus, Regulation (EU) 2024/3005 fills a critical regulatory gap by focusing on the integrity and comparability of ESG scoring systems, directly affecting rating providers, market supervisors (ESMA), and users of ESG scores–whereas the other frameworks focus primarily on disclosing sustainability impacts and performance.

3.2.2. Context and Rationale of Regulation (EU) 2024/3005

Prior to 2025, the ESG ratings market was largely unregulated, resulting in inconsistent methodologies, opaque processes, and potential conflicts of interest. These issues resulted in low comparability (*e.g.,* Chatterji *et a*l., 2016; Gibson *et al.,* 2021), which undermines investor trust and hinders capital flows to sustainable activities (Wong *et al.,* 2023). The EU's framework aims to address these deficiencies by setting minimum standards for transparency, governance, and reliability among rating providers, without mandating uniform methodologies, thereby preserving diversity in analytical approaches.

3.2.3. Impact on Comparability of ESG Ratings

3.2.3.1. Evidence of Enhanced Comparability

The 2025 framework aims to significantly improve the comparability of ESG ratings by enforcing standardized disclosure requirements. Providers must publish detailed methodologies, including data sources, key assumptions, and whether ratings follow a single or double materiality perspective (assessing both financial risks and societal and environmental impacts). This transparency enables users to understand and compare ratings across providers. For instance, the requirement to disclose weightings for aggregated E, S, and G factors addresses previous inconsistencies where providers applied varying emphases to each factor. However, these improvements in comparability remain largely theoretical until they are empirically validated.

A study by the German supervisory authority BaFin[9] in 2024 highlighted dissatisfaction among capital management companies with the comparability of ESG ratings, citing inconsistent methodologies as a primary issue. The new regulation mitigates this by mandating clear documentation of rating processes, which facilitates cross-provider

[9] https://www.bafin.de/SharedDocs/Downloads/EN/Anlage/dl_anlage_180324_Marktstudie_ESG_englisch.pdf?__blob=publicationFile&v=2

comparisons and transparency. Additionally, oversight by ESMA is expected to promote consistent application of disclosure standards, reducing arbitrary variations.

Currently, there is no empirical evidence assessing whether the intended goals of Regulation (EU) 2024/3005, specifically enhancing the comparability and reliability of ESG ratings, have been achieved. The regulation entered into force on January 2, 2025, but its provisions will apply from July 2, 2026, pending the approval of ESMA's draft RTS. As a result, no data or academic studies have yet captured its actual impact on rating comparability in the real world. Regarding ESMA's RTS, ESMA issued its Draft RTS on May 2, 2025, specifying provisions related to transparency, governance, and the separation of business. These standards determine how rigorously the regulation will be enforced. Until final RTSs are adopted and implemented in July 2026, it is premature to evaluate outcomes. The EC's evaluation clause indicates that a formal assessment will only occur after January 2, 2029, meaning measurable effects will be evident later. However, while transparency mandates may improve comparability, persistent divergence in methodologies, particularly in weighting schemes and factor definitions, may continue to limit full alignment across providers, as noted by the CFA Institute (2024).

3.2.3.2 Limitations in Achieving Full Comparability

Despite these intended advancements, the framework does not harmonize methodologies, allowing providers to retain flexibility in their approaches. This flexibility, while preserving innovation, can perpetuate methodological fragmentation. For example, providers may differ in their interpretation of ESG factors or weighting schemes, leading to divergent ratings for the same entity. A CFA Institute survey in 2024 (CFA, 2024) noted that ESG ratings are not considered helpful for investors due to the significant variance in outcomes and a lack of trust in their methodologies. Therefore, the lack of standardized ESG metrics remains a significant challenge, despite regulatory efforts. Table 3 summarizes the key factors that affect comparability.

Table 3

FACTORS INFLUENCING ESG RATINGS COMPARABILITY

Factor	Pre-2025 Issue	2025 Framework Impact
Methodology transparency	Opaque, provider-specific methodologies.	Mandatory disclosure of methods and assumptions.
Weighting of E, S, G factor	Inconsistent and undisclosed weightings.	Explicit weighting disclosure for aggregated ratings.
Data sources	Unclear or inconsistent data usage.	Required disclosure of data sources.
Materiality perspective	Varying use of single and double materiality.	Providers must specify the materiality approach.
Methodological standardization	No common standards.	No harmonization, flexibility retained.

Source: Own elaboration.

3.2.3.3. Assessment

The framework aims to enhance comparability by mandating transparency and standardizing disclosure practices significantly. However, the absence of methodological harmonization limits complete alignment, as providers may still produce divergent ratings based on differing analytical frameworks. This balance between standardization and flexibility is a deliberate design choice to encourage innovation while improving comparability. Since the regulation has not yet taken effect, there is no empirical proof of its intended effects. Analysts and researchers should await the post-2026 environment and ESMA's finalized guidelines, followed by comparative studies post-implementation. Although Regulation (EU) 2024/3005 aims to enhance ESG ratings comparability through increased transparency, its effectiveness remains provisional, given the lack of harmonized methodologies, ongoing methodological flexibility, and the absence of empirical validation until post-implementation evaluations occur after 2026.

4. THE THEORY AND EVIDENCE OF THE IMPACT OF ESG POLICIES ON FINANCING COSTS

ESG policies have emerged as a crucial strategy for companies aiming to enhance sustainability and manage financing costs. This section examines how ESG policies, particularly those addressing climate-related risks, can impact the cost of capital for sustainable companies.

4.1. Theoretical Trade-Offs

Literature has put forward theoretical arguments for expecting higher or lower financing costs from ESG policies. The theoretical basis for expecting higher financing costs from implementing ESG policies stems from several economic and financial perspectives that highlight the potential costs and risks associated with ESG adoption. While ESG policies are often linked to expected long-term benefits, such as risk mitigation and investor appeal, their short-term implementation may lead to financial burdens, operational inefficiencies, and increased market scrutiny. The key theoretical arguments are as follows:

- *Increased Upfront Costs and Capital Expenditures*. Implementing ESG policies often requires significant upfront investments in infrastructure, technology, and process changes (*e.g.,* transitioning to renewable energy, upgrading to sustainable supply chains, or enhancing governance systems). These capital expenditures can strain a firm's cash flow, increasing leverage ratios and perceived credit risk, which may lead lenders and investors to demand higher returns to compensate for the short-term financial burden. This is particularly

relevant for smaller firms or those operating on tight margins, where the financial burden of ESG investments is more pronounced.

- *Agency Costs and Managerial Overinvestment*. Agency theory suggests that managers may pursue ESG initiatives to enhance their reputation or align with stakeholder pressures, even when these initiatives do not maximize shareholder value. Such overinvestment in ESG projects can be perceived as inefficient, leading to higher financing costs as investors and creditors demand compensation for the risk of misallocated resources. This effect is more likely in firms with weak governance structures, where managerial incentives are misaligned with those of shareholders.

- *Market Skepticism and Greenwashing Risks.* Market skepticism about the authenticity or effectiveness of ESG policies can lead to increased financing costs. The growing literature on ESG rating disagreements (*e.g.*, Gibson *et al.,* 2021; Peña *et al.,* 2025a) may be illuminating in this regard. Rating disagreements amplify concerns about greenwashing, thereby increasing risk premiums. Investors and creditors may perceive ESG initiatives as greenwashing, which refers to superficial efforts to appear sustainable without a substantive impact, leading to higher risk premiums due to uncertainty about the firm's accurate risk profile. This situation is particularly relevant in markets with low ESG standardization or where investors are wary of exaggerated sustainability claims.

- *Regulatory and Compliance Costs.* ESG policies often require compliance with complex and evolving regulatory frameworks (*e.g.*, the EU's SFDR, the SEC's climate disclosure rules). These regulations impose significant compliance costs, including reporting, auditing, and legal expenses, which can increase operational costs. Compliance costs reduce profitability and increase leverage, prompting creditors to charge higher interest rates and equity investors to demand higher returns on firms' shares. This effect is more pronounced in industries subject to stringent environmental regulations, such as the energy and manufacturing sectors.

- *Transition Risks in High-Risk Industries*. In industries heavily reliant on carbon-intensive operations (*e.g.*, oil and gas, mining), transitioning to ESG-compliant practices involves significant costs and risks. Investors may perceive these transition risks, such as stranded assets or revenue losses resulting from the phasing out of fossil fuels, as increasing financial instability, which could lead to higher financing costs. This situation primarily applies to carbon-intensive sectors that face pressure to decarbonize rapidly.

However, while fossil fuel firms face transition risks, those with credible decarbonization plans may access green bonds at lower rates.

In summary, the expectation of higher financing costs resulting from ESG policies is grounded in the short-term financial burdens of capital expenditures,

agency problems associated with overinvestment, market skepticism about greenwashing, regulatory compliance costs, and transition risks in carbon-intensive industries. These factors can increase perceived risk, leading investors and creditors to demand higher returns. However, the magnitude of these costs depends on firm size, industry, and the effectiveness of ESG implementation.

Next, we discuss the theoretical basis for expecting lower financing costs from implementing ESG policies rooted in economic and financial theories that emphasize risk reduction, stakeholder value creation, and market signaling. The key theoretical arguments are:

- *Risk Reduction and Lower Risk Premiums*. Modern portfolio theory suggests that firms with lower risk exposures face lower costs of capital. When ESG policies reduce exposure to environmental risks (*e.g.*, climate change impacts), regulatory risks (*e.g.*, carbon pricing), and social risks (*e.g.*, labor disputes), both cash flow volatility and the risk premium demanded by investors and creditors decrease. This argument is particularly relevant for firms in industries exposed to climate or regulatory risks, such as the energy and the manufacturing sectors.

- *Stakeholder Theory and Long-Term Value Creation*. Stakeholder theory posits that firms prioritizing the interests of all stakeholders (*e.g.*, employees, customers, communities) create sustainable value, enhancing long-term financial stability. ESG policies align with stakeholder expectations can minimize reputational risk, social conflict, and litigation, contributing to a lower cost of capital. This situation applies broadly across industries, especially those with high stakeholder scrutiny, such as the consumer goods and technology sectors.

- *Signaling Theory and Investor Confidence*. Signaling theory suggests that firms use ESG disclosures to signal their quality and commitment to sustainability to investors. Transparent ESG practices, such as TCFD-aligned climate risk reporting, reduce information asymmetry, increasing investor confidence and lowering the cost of capital. This theory is particularly relevant in markets with a strong demand for sustainable investments, such as those in Europe or those with a global focus on ESG.

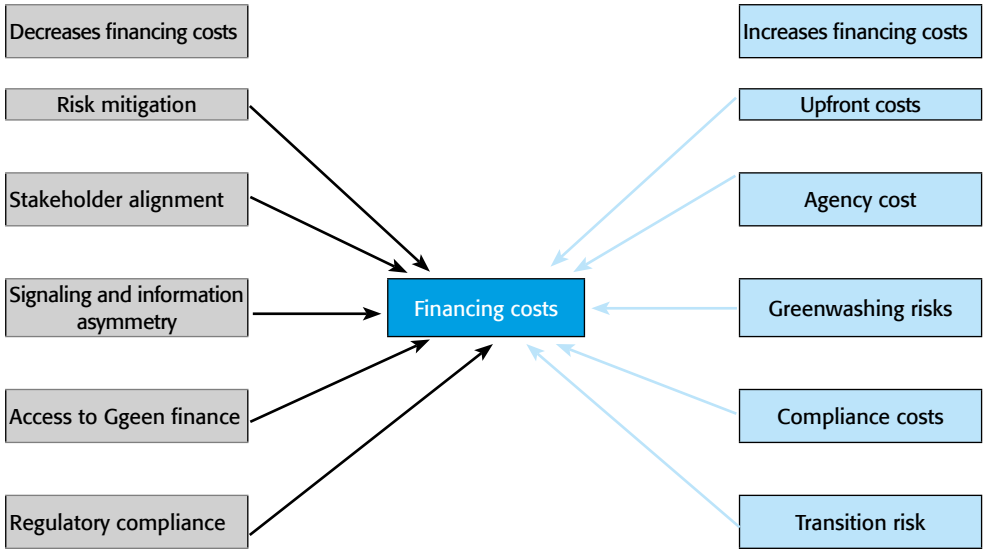
- *Access to Green and Sustainable Finance.* The rise of green finance and ESG-focused investment vehicles (*e.g.*, green bonds, sustainability-linked loans) provides firms with access to capital at preferential rates. ESG policies enable firms to tap into these markets, where investors and lenders offer lower interest rates to support sustainable projects. This argument is most applicable in jurisdictions with developed green finance markets, such as the EU or China.

- *Regulatory Compliance and Avoidance of Penalties.* Firms adhering to ESG-related regulations are less likely to face penalties, litigation, and reputational

damage, thereby reducing financial risk and lowering financing costs. By proactively complying, they enhance their creditworthiness and financial stability, reducing financing costs. This factor is particularly relevant in regions with stringent ESG regulations, such as the EU. The flowchart in Figure 2 summarizes how the key ESG channels contribute to overall financing costs. Arrows depict how regulatory costs increase financing costs, while risk reduction decreases them. Blue (red) boxes indicate factors that decrease (increase) financing costs.

Figure 2

FACTORS AND FINANCING COSTS



Source: Own elaboration.

Regarding the greenwashing risk factor, in jurisdictions with strict ESG disclosure rules, the risks of greenwashing are higher; however, credible signals yield greater rewards. Moreover, while agency costs may arise in poorly governed firms, robust governance structures can align ESG investments with shareholder value, mitigating these risks.

In summary, the expectation of lower financing costs from ESG policies is grounded in risk reduction (lower risk premiums), stakeholder value creation (enhanced stability), signaling (increased investor confidence), access to green finance (preferential rates), and regulatory compliance (avoided penalties). These

factors collectively may reduce the perceived risk and cost of capital for ESG-focused firms.

Theoretical mechanisms linking ESG performance to financing costs are not mutually exclusive. Instead, they may operate simultaneously, often in opposing directions. On one hand, strong ESG practices can lower financing costs by mitigating firm-specific risks, enhancing transparency, and signaling long-term orientation to investors. On the other hand, ESG initiatives may increase costs through regulatory compliance burdens, capital-intensive transitions, and agency problems if such policies are poorly aligned with shareholder value. These opposing effects can vary across firms, industries, and institutional contexts, leading to heterogeneity in empirical findings. For instance, while green firms in regulated markets may enjoy preferential borrowing rates, carbon-intensive firms facing transition mandates may experience risk premia. Moreover, investors' perceptions of credibility and the risk of greenwashing can modulate these dynamics. As such, understanding the net impact of ESG on financing costs requires empirical scrutiny that accounts for firm characteristics, disclosure quality, and evolving regulatory landscapes.

4.2. Empirical Evidence

The empirical evidence on the relationship between ESG performance and financial outcomes remains deeply contested, with support for multiple and sometimes contradictory narratives. One strand of research documents the capital attraction power of high ESG ratings, with sustainable investment funds capturing significant capital flows despite failing to deliver superior risk-adjusted returns (Hartzmark and Sussman, 2019). This pattern suggests that ESG preferences may reflect non-pecuniary investor motivations that come at a financial cost, consistent with arguments that ESG-focused portfolios may reduce diversification and lead to underperformance (Hong and Kacperczyk, 2009; Adler and Kritzman, 2008).

Regarding the cost of equity capital, some evidence supports the business case for sustainability, as it is linked to lower equity capital costs, enhanced valuations, superior returns, and reduced tail risk exposure (Giese *et al.*, 2019). However, recent research reveals important temporal and sector-specific nuances, with environmental sustainability ratings showing a negative correlation with stock performance, despite positive impacts on operational metrics (Kranias *et al*., 2024).

Adding to this complexity, Alves *et al.* (2025) find no compelling evidence linking ESG ratings to global stock returns over a two-decade period, underscoring the conditional and context-dependent nature of sustainability-performance relationships. For the relationship between ESG and the cost of equity, prior literature has reported a negative (Albuquerque *et al.*, 2019; Husted *et al.*, 2016; Peña *et al.*, 2025b), positive (Desender *et al.*, 2020), and a non-significant (Humphrey *et al.,* 2012) covariation.

Regarding the cost of debt, Hoepner *et al.* (2016) do not find conclusive evidence that firm-level sustainability influences the interest rates charged to borrowing firms by banks. Magnanelli and Izzo (2017) document that increases in corporate social performance correlate with increases in the cost of debt, whereas Devalle *et al.* (2017) report that social and governance metrics are positively correlated with higher credit ratings; however, the results are not significant when referring to environmental scores.

In contrast, Apergis *et al.* (2022) document that all pillars of ESG exhibit a negative and significant impact on bond yields. However, in a recent paper, Gigante and Manglaviti (2022) do not find meaningful covariation between ESG ratings and the cost of debt. These divergences may stem from methodological variation. For instance, Apergis et al. focus on bond yields globally, while Gigante and Manglaviti use regression discontinuity designs, which may not capture long-term effects.

These contradictory findings underscore need for rigorous theoretical frameworks and robust empirical strategies that account for the boundary conditions governing the ESG-cost-of-capital relationship. Several robustness concerns warrant caution. Endogeneity remains a central issue, as firms with superior governance or performance may both adopt ESG practices and benefit from lower financing costs, confounding causal inference.

Rating dispersion across ESG data providers introduces measurement error, potentially biasing estimates and obscuring actual effects. Moreover, temporal dynamics complicate interpretation: ESG benefits may unfold gradually, while market reactions to disclosures or policy shifts can be immediate or anticipatory. Studies relying solely on cross-sectional snapshots risk missing these dynamic effects. Addressing these challenges requires longitudinal designs, the use of instrumental variables, and robustness tests utilizing multiple ESG rating sources.

4.3. Discussion

ESG policies influence financing costs through multiple and often competing channels. Up-front capital expenditures, agency frictions, greenwashing perceptions, regulatory burdens, and transition risks can increase the cost of external capital, particularly for smaller firms and carbon-intensive sectors. Conversely, risk abatement, stakeholder alignment, credible signaling, preferential access to green finance, and penalty avoidance can compress required returns, particularly in markets where disclosure standards and sustainable finance are well-established. Empirical studies mirror this theoretical duality. Literature documents both the cost of capital discounts and premia, moderated by time horizon, industry, ESG dimension, regulation, and rating disagreement. Evidence of persistent flows into high-rated funds, despite neutral risk-adjusted performance, highlights nonpecuniary investor preferences.

In contrast, more recent work questions the unconditional "green premium". Taken together, the literature suggests that ESG's net effect on financing costs is conditional, nonlinear, and context-specific. Future research should integrate granular transition-risk metrics, harmonized rating methodologies, and dynamic modeling to disentangle causality from self-selection and reverse effects. Policymakers should enhance disclosure comparability and strengthen verification mechanisms to reduce information asymmetry, while corporate managers must align ESG investments with material risk exposure to avoid wasteful spending. Overall, the financial impact of ESG policies is context-dependent, varying by industry, governance quality, and regulatory environment.

Additionally, some empirical studies have limitations, such as failing to account for temporal dynamics. ESG policies may initially raise costs but reduce them over time as risks materialize; longitudinal studies, such as Kranias *et al.* (2024), support this intuition. Also, research should address cultural and regional biases. Most studies focus on the EU and U.S. markets, but results in emerging markets may differ due to weaker institutions. Emerging market findings (*e.g.*, Husted *et al.,* 2016) suggest ESG effects are weaker where enforcement is lax. To advance both scholarship and policy design, future studies should prioritize context-sensitive, multi-market analyses that incorporate firm-level ESG strategy execution, not just ratings, as a core explanatory variable.

5. THE ROLE OF ESG POLICIES, TAX INCENTIVES, AND GREEN FINANCING IN ENHANCING CORPORATE FINANCING CONDITIONS DURING ECONOMIC CRISES

This section examines how ESG policies, including tax incentives for sustainable investments and green financing mechanisms, can improve corporate financing conditions during economic crises when liquidity constraints and risk premiums rise. By analyzing the trade-offs between factors that increase and decrease financing costs in the previous section, we highlight the dual impact of ESG adoption on financing costs. Economic policies, including tax incentives and regulatory frameworks, play a crucial role in creating a supportive environment for sustainable businesses, promoting economic stability, and mitigating capital costs during crises.

5.1. ESG Policies and Their Relevance in Crises

ESG policies encompass environmental initiatives (*e.g.*, reducing carbon emissions), social commitments (*e.g.*, labor welfare), and governance practices (*e.g.*, transparency and accountability). During economic crises, such as recessions or market disruptions, firms face heightened financial pressures, including tighter credit

markets and increased risk premiums. ESG policies can serve as a strategic tool to mitigate these pressures by signaling resilience, attracting sustainable investment, and accessing preferential financing.

Crises underscore the importance of effective risk management and maintaining stakeholder trust. Firms with robust ESG practices are better positioned to navigate regulatory changes, maintain investor confidence, and access green financing vehicles, such as green bonds and sustainability-linked loans. However, the adoption of ESG policies involves trade-offs, as short-term costs may offset long-term benefits, particularly for firms with limited resources and financial capabilities. Higher financing costs associated with ESG policies stem from short-term financial burdens of capital expenditures, agency problems associated with overinvestment, market skepticism about greenwashing, regulatory compliance costs, and transition risks in carbon-intensive industries. On the other hand, lower financing costs resulting from ESG policies stem from risk reduction, stakeholder value creation, signaling, access to green finance (including preferential rates), and regulatory compliance (avoidance of penalties), as detailed in Section 4.

However, the benefits of ESG signaling may be diluted by the divergence in ESG scoring across rating agencies. Firms often receive markedly different ESG assessments from different providers due to methodological inconsistencies, varying weightings of environmental, social, and governance factors, and firm-specific characteristics (Peña *et al.*, 2025a). This inconsistency complicates investors' ability to distinguish genuinely sustainable firms, thereby weakening the informational value of ESG scores and reducing the associated financing benefits. Even firms with strong ESG performance may struggle to access preferential financing if conflicting ratings create uncertainty or perceptions of greenwashing. As such, scoring divergence poses a barrier to fully realizing the risk-reducing and trust-enhancing benefits of ESG practices.

5.2. Tax Incentives and Green Financing Mechanisms

Tax incentives for sustainable investments, such as tax credits for adopting renewable energy sources or deductions for ESG-compliant projects, help mitigate the financial burden of implementing ESG practices. For example, the U.S. Inflation Reduction Act (2022) provides tax credits for clean energy investments, lowering upfront costs and improving cash flow. These incentives are particularly effective during crises, when liquidity is constrained, as they reduce leverage and enhance creditworthiness.

Green financing mechanisms, such as green bonds and sustainability-linked loans, may provide access to capital at lower rates. Green bonds, which fund environmentally beneficial projects, often carry lower gross (before adjusting for compliance costs) yields due to high investor demand (Apergis *et al*., 2022).

Sustainability-linked loans tie interest rates to a company's ESG performance, incentivizing firms to meet specific sustainability targets. In crisis periods, these tools can provide essential liquidity while reinforcing sustainability commitments.

5.3. Economic Policy and Financing Conditions

Economic policies can enhance financing conditions by fostering a regulatory environment that supports sustainability and stability. Key strategies include:

- *Standardized ESG Disclosures*: Harmonized disclosure standards, such as the EU SFDR, reduce greenwashing risks and enhance investor confidence (Peña *et al.,* 2025a).
- *Tax Incentives:* Expanding tax credits for sustainable investments tends to lower upfront costs, particularly for SMEs (Kranias *et al*., 2024).
- *Green Finance Frameworks:* Governments can promote green bond markets and sustainability-linked loans through subsidies or guarantees (Apergis *et al.,* 2022).
- *Regulatory Stability:* Clear and predictable ESG regulations reduce compliance costs and transition risks (Devalle *et al.*, 2017).

During crises, policies that stabilize financial markets, such as central bank interventions or liquidity support, can complement ESG incentives by ensuring access to capital. For example, the European Central Bank's green monetary policy framework supports sustainable investments, reducing financing costs for ESG-compliant firms.

5.4. Policy Recommendations

To leverage ESG policies for better financing conditions during crises, policymakers and corporate leaders should consider the following:

- *Enhance Disclosure Standards:* Develop harmonized ESG rating methodologies to reduce greenwashing risks and improve transparency.
- *Expand Tax Incentives:* Offer targeted tax credits for SMEs and carbon-intensive industries to offset upfront ESG costs.
- *Promote Green Finance*: Subsidize green bond issuance and sustainability-linked loans to lower financing costs.

- *Foster Regulatory Clarity:* Provide clear ESG regulations to minimize compliance costs and transition risks.

- *Support Longitudinal Research: Fund studies to capture temporal dynamics and regional variations in ESG i*mpacts.

5.5. Interactions with Macro-Financial Conditions

The financial benefits of ESG adoption are not immune to broader macroeconomic and financial dynamics, as well as economic policy uncertainty, as illustrated in Peña *et al.* (2025b), which presents a framework for measuring the impact of policy uncertainty on ESG financing using the Economic Policy Uncertainty (EPU) index. During periods of inflationary pressure or monetary policy tightening, overall financing conditions deteriorate as interest rates rise and credit availability shrinks. In such environments, the cost advantages presumably associated with ESG financing, such as lower yields on green bonds or reduced interest rates on sustainability-linked loans, may become narrower. For instance, central bank rate hikes compress the spread between ESG and conventional debt instruments, weakening firms' incentives to pursue ESG-linked financing. Moreover, inflation can erode the real value of long-term sustainability investments, making short- term liquidity concerns more salient for firms and investors.

Macroeconomic volatility and economic policy uncertainty may also heighten investor risk aversion, prompting a flight to liquidity and high-grade assets. This uncertainty can divert capital away from ESG projects, especially those in early stages or located in emerging markets. In addition, monetary tightening can crowd out public spending on green subsidies or guarantees, further limiting firms' access to affordable ESG financing. Therefore, the financial efficacy of ESG strategies must be assessed within the broader context of macroeconomic cycles. Future policy design should account for these interactions to ensure that ESG incentives remain robust even under restrictive financial conditions.

5.6. Discussion

ESG policies, supported by tax incentives and green financing mechanisms, present significant opportunities for companies to secure more favorable financing conditions during times of crisis. While upfront costs, regulatory burdens, and greenwashing risks may increase financing costs, risk reduction, stakeholder trust, and access to green finance can lower them. Economic policies that promote standardized disclosures, tax incentives, and green finance frameworks enhance these benefits, fostering sustainability and economic stability. However, inconsistent ESG assessments remain a bottleneck to maximizing ESG's financial benefits, especially under crisis conditions where investor confidence is already fragile.

Economic policies play a pivotal role in amplifying the expected benefits of ESG. By promoting standardized ESG disclosures, expanding fiscal incentives, and fostering stable regulatory environments, governments can create conditions conducive to sustainable finance and macroeconomic stability. Nonetheless, challenges remain, including data inconsistencies, regional disparities in policy effectiveness, and the long-term nature of ESG payoffs. Addressing these limitations requires coordinated policy efforts and more robust, longitudinal research. Ultimately, ESG-aligned financial strategies, when embedded within a supportive policy and regulatory framework, hold promise for improving firms' crisis resilience while advancing broader sustainability goals.

Future research should develop methodologies that account for crisis-specific conditions, ESG execution quality, and macro-financial interactions to refine our understanding of ESG's financial impact across diverse contexts.

6. CONCLUSIONS

This paper evaluates the effectiveness of key EU sustainable finance policies, specifically the EU Green Bond Standard (EuGBS), the NextGenerationEU (NGEU) green bond program, and Regulation (EU) 2024/3005, in terms of ESG rating comparability and their impact on financing conditions for firms. Our findings indicate that while these instruments have increased the volume and visibility of green finance in the EU, their economic impact remains uneven and, in many cases, modest. Green bonds have shown some potential to reduce borrowing costs, particularly for highly rated sovereign and corporate issuers. However, these benefits are often neutralized by certification and compliance costs, especially for smaller firms. Similarly, while ESG regulations have improved transparency and investor trust, persistent rating dispersion and regulatory complexity continue to limit the intended effects on market efficiency and capital allocation.

To enhance the effectiveness of EU green finance initiatives, we offer four key policy recommendations:

1. *Streamline compliance for SMEs*: Simplifying taxonomy-alignment disclosures and offering subsidized certification mechanisms would lower entry barriers for smaller firms, thereby broadening participation in sustainable finance markets.

2. *Enhance post-issuance accountability:* Requiring impact verification audits and more precise tracking of use-of-proceeds, particularly for sovereign green bonds, can increase the credibility and environmental additionality of green finance.

3. *Addressing rating divergence*: Regulators should promote the harmonization of ESG methodologies by mandating the disclosure

of materiality frameworks, factor weightings, and data sources, while supporting the development of a centralized, ESMA-supervised ESG rating comparison database. To mitigate rating divergence, ESMA should mandate disclosure of factor weightings and maintain a public database of provider methodologies, as proposed by Wong *et al.* (2023). SMEs could benefit from proportional disclosure thresholds, which would reduce compliance costs without compromising transparency.

4. *Link incentives to verified outcomes:* Green bond programs could incorporate performance-based rebates or tax credits that are conditional on demonstrated reductions in emissions or other measurable sustainability impacts.

Several limitations of this study warrant consideration. First, the analysis is based on early-stage data from recently implemented regulations, particularly the ESG rating framework, whose full provisions will only take effect after July 2026. As such, definitive empirical evaluation of their long-term effects is premature. Second, while we assess the pricing dynamics of green bonds and ESG disclosure incentives, we do not model the full general equilibrium effects on capital markets, which may result in an underestimate of systemic feedback loops. Third, our focus on EU instruments means that extrapolation to other jurisdictions with different regulatory and institutional environments (*e.g.*, the U.S. or emerging markets) must be approached cautiously.

Future studies should pursue more granular, firm-level panel data analysis to disentangle causality in the ESG versus cost-of-capital relationship and to capture long-run effects of green bond issuance on firm performance. Comparative assessments across jurisdictions can shed light on the institutional features that either drive or hinder the adoption of sustainable finance. Moreover, research should examine investor behavior in response to allegations of greenwashing, exploring how credibility shocks affect bond spreads, equity valuations, and ESG fund flows. Finally, integrating measures of policy uncertainty and geopolitical risk could provide a more comprehensive understanding of how macroeconomic volatility interacts with ESG financial dynamics.

Overall, while the EU's sustainable finance agenda has made meaningful strides in institutionalizing sustainability within capital markets, it now stands at a strategic inflection point. Aligning financial incentives with real environmental outcomes will require not only targeted regulatory refinements and stronger enforcement mechanisms but also a systemic shift toward performance-based accountability. As green finance matures, policymakers must prioritize verifiable impact over formal compliance, investors must look beyond labels toward substance, and firms must embed ESG considerations into core strategy rather than treat them as peripheral commitments. In this context, success will hinge on the EU's ability to integrate transparency, innovation, and inclusivity into its sustainable finance architecture, ensuring that climate alignment is not only a policy ambition but a financial reality.

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