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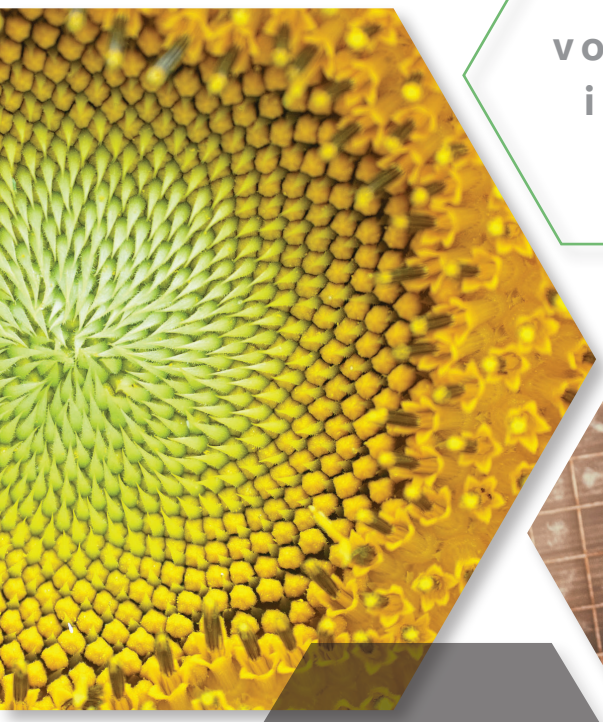

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Evidencing Financial Materiality of Sovereign ESG Risk

Astrid Sofia Flores Moya and Julien Moussavi

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KEY FINDINGS

- The countries with the lowest environmental, social, and governance (ESG) risk show tight sovereign five-year credit default swap (CDS) spreads, and vice versa.
- The correlation of sovereign ESG risk assessments with sovereign credit risk provides insightful information on the financial materiality of sovereign ESG risks.
- The financial materiality of sovereign ESG risk assessment is stronger for high-yield emerging markets.
- The financial materiality of sovereign ESG risk assessment in emerging markets is generally stronger for aggregated ESG, governance, and social risk assessments.

ABSTRACT

Empirical studies on ESG-related topics have focused mainly on equity markets. This article focuses on the financial materiality of ESG risk assessment for sovereign debt instruments. The authors first review the existing literature on sovereign ESG and transmission channels to sovereign risk. Using an econometric framework, they then examine the empirical correlation between ESG risk and credit risk for 70 sovereign issuers. They use sovereign ESG risk scores from FTSE Russell/Beyond Ratings as a proxy for ESG risk, and five-year credit default swap spreads as a proxy for sovereign credit risk. By controlling for economic factors, the authors find that sovereign ESG risk assessments are correlated with sovereign credit risk, providing information on the financial materiality of sovereign ESG risks, especially for high-yield emerging markets. They then calculate the implied sovereign five-year CDS spread curves, based on sovereign ESG risk scores, to illustrate those results. The authors also examine more-granular results for specific income groups and index universes.

The concept of sustainable development has gained momentum in recent years due to the growing awareness of the environmental and social impacts of economic activities. As a result, investors have started to integrate environmental, social, and governance (ESG) criteria into their analysis of companies' financial performance. However, despite the large size of the global bond market with US$126.9 trillion in outstanding debt (Securities Industry and Financial Markets Association 2022), less attention has been paid to the application of ESG criteria to the fixed-income market (Inderst and Stewart 2018) and for sovereign investments, in particular (Gratcheva, Emery, and Wang 2020 and Gratcheva et al. 2021).

In this article, we seek to fill this gap by examining the financial materiality of ESG risk[1] of sovereign investments. We focus on the sovereign fixed-income asset class, given that it represents a large share of the global financial market and has significant implications for global financial stability. We wish to determine whether ESG risk correlates with sovereign risk, and, if so, how investors can use this information to make more informed investment decisions.

We start with an analysis of the existing literature on sovereign ESG, examining the transmission channels between each environmental, social, and governance criterion and sovereign risk. Indeed, to evaluate the financial materiality of ESG risk, it is necessary to assess its theoretical links with the economic activity, public finances and, therefore, the creditworthiness of sovereign entities.

Using a simple econometric framework, we then examine the empirical correlation between the ESG risks of 70 sovereign entities and their credit risk. To do so, we use the FTSE Russell/Beyond Ratings Sustainable Sovereign Risk Methodology (2SRM) data set as a proxy of ESG risks for sovereigns, and the sovereign five-year credit default swap (sovereign 5Y CDS) spreads as a proxy for sovereign credit risk. We also use the real gross domestic product (GDP) growth rate and consumer price index (CPI) inflation rate as control variables to monitor cyclical economic conditions.

We demonstrate that

- **(i)** Sovereign ESG risk assessments are correlated with sovereign credit risk, therefore providing useful information on the financial materiality of sovereign ESG risks.
- **(ii)** The financial materiality of sovereign ESG risk assessment is empirically stronger for middle-income and weakly rated emerging markets and developing economies (EMDEs) than for high-income and highly rated advanced economies (AEs).
- **(iii)** The financial materiality of sovereign ESG risk assessment is empirically stronger for the aggregated ESG, governance, and social risk assessments than for the environmental assessment, especially for EMDEs.

These results must be nuanced, as some ESG risks (e.g., S and G risks) are already priced in by the financial market and therefore integrated into the intrinsic economic and financial characteristics of countries, especially for AEs.

Finally, we illustrate those results by constructing implied sovereign 5Y CDS curves based on different clusters of ESG risk scores and for the ESG risk breakdown scores. These results follow, validate, and complete similar work from Reznick et al. (2019, 2020) and Hübel (2020).

WHAT ARE THE TRANSMISSION CHANNELS BETWEEN ESG AND SOVEREIGN RISKS?

The following literature review clarifies the transmission channels between ESG and sovereign risks. A recent study from the Amundi Institute (Semet, Roncalli, and Stagnol 2021) provides an exhaustive survey of direct and indirect links between ESG and the creditworthiness of sovereigns. It asserts that extra-financial risks are strongly correlated with the credit risk of sovereign entities. However, ESG brings together

[1] ESG risk consists of factors that can have a negative impact on a sovereign issuer's ability to repay its debt and maintain its creditworthiness. These risks can stem from a variety of environmental, social, and governance-related issues. The following section gives us an exhaustive overview of the transmission channels between ESG and sovereign risks.

and assesses heterogeneous themes, particularly in the environmental pillar. In this context, Clarvis et al. (2014) observed that there remains a lack of understanding and integration of environmental risks into the investment decision, leading to a weak financial rationale. Capelle-Blancard et al. (2019), interestingly, showed that the environmental dimension of ESG did not have a significant relationship with sovereign bond yield spreads for 20 Organization for Economic Cooperation and Development (OECD) countries.

To better understand the transmission channels between ESG and sovereign risks, we propose a chronology in the consideration of ESG risk in the sovereign fixed-income universe. Indeed, while the risks related to governance are marked by the short-term electoral cycle, it appears that investments in education, health, or the labor market display medium-term dynamics. Finally, environmental risks are much more likely to materialize in the distant horizon and therefore in a more uncertain way.

Environmental Risk: A Forward-Looking and Long-Term Factor of Sovereign Risk

A few studies have focused on the link between climate risk and sovereign credit risk. Chaudhry et al. (2020) have suggested that CO_2 emissions can raise sovereign risk levels, while Battiston and Monasterolo (2020) have highlighted that countries reliant on fossil fuels face higher sovereign bond yields. Recent research has also pointed to the potential for rising temperatures to lead to sovereign credit rating downgrades and higher interest debt expenses by 2030. Klusak et al. (2021) have suggested that as global temperatures continue to rise, countries with high exposure to adverse weather events are at risk of suffering downgrades in their credit ratings, resulting in increased borrowing costs.

Several studies have shown that the impact of climate change on a country's borrowing costs is dependent on its exposure to adverse weather conditions, vulnerability, preparedness, and resilience. Studies by Beirne, Renzhi, and Volz (2020) have highlighted that countries with high vulnerability to climate change are likely to incur higher sovereign borrowing costs, while Buhr et al. (2018) have reported that climate vulnerability leads to an increase in average debt costs for developing economies.

The correlation between the types of pollution and economic development is another issue that has long been debated by researchers. Despite numerous studies attempting to decipher the nature of the relationship between these two factors, the findings have been varied and inconclusive. For instance, a study conducted by He (2006) on industrial sulfur dioxide emissions in China found a positive correlation with foreign direct investment. Meanwhile, Selden and Song (1994) suggested a curvilinear relationship between GDP per capita and emissions of air pollutants per capita, with an inverted-U shape. Interestingly, Orubu and Omotor (2011) posit an environmental Kuznets curve for air pollution in African countries, implying that as income per capita increases, pollution levels first rise but then decline at higher levels of income. In contrast, the study showed that the relationship between income per capita and water pollution tended to be strictly positive.

Natural capital is a valuable resource that provides vital ecological services, such as clean water, fertile land, and biodiversity, all of which contribute significantly to a country's economic growth and development. However, ensuring that natural capital is effectively managed is critical to avoid the "natural resource curse," (Badeeb, Lean, and Clark 2017) a phenomenon in which natural resource–rich countries suffer from economic instability, social unrest, and environmental degradation.

Therefore, prudent governance is important in promoting sustainable economic development while safeguarding natural resources.

Biodiversity is key for human health, providing essential resources such as food, medicine, clean air, and water. Ecosystems disruptions, such as deforestation, climate change, and pollution, can lead to the extinction of species, degraded water and soil quality, and reduced carbon absorption, which in turn can cause food shortages and hasten global warming. Biodiversity loss, decline of ecosystem services, and overall environmental degradation can hit economies through multiple channels. The combined macroeconomic consequences can impact sovereign creditworthiness (Agarwala et al. 2022).

Last, according to Wang's (2021) research, countries that rely heavily on nonrenewable resources may experience higher borrowing costs from the adverse effects of the natural resource curse. However, the development of renewable resources can help mitigate those effects and reduce borrowing costs.

Social Risk: A Structural and Medium-Term Factor of Sovereign Risk

The social dimension of ESG at the sovereign level has received less attention than the environmental and governance dimensions, not least due to data limitations. Despite these challenges, the importance of the social factors in sovereign risk is becoming increasingly recognized, particularly in the aftermath of the COVID-19 pandemic (Karapandza and Moussavi 2021), as the pandemic exposed vulnerabilities in health systems globally, and the importance of efficient health systems in promoting social resilience has come to the fore (Wang and Tang 2020). However, lagging countries tried to offset this unmet requirement by increasing tax revenue or reforming the healthcare system, leading to inequality surges and civil unrest.

According to Arawatari and Ono (2017), a low-inequality country realizes tight fiscal policy with low public debt accumulation, whereas a high-inequality country experiences loose fiscal policy with high public debt. That finding implies that inter- and intra-generational inequalities can both have a direct impact on the creditworthiness of a country. Moreover, if the links between inequalities and unemployment are established (that includes, inter alia, Dasgupta and Ray 1986 and Saunders 2002), it is worth highlighting the fact that the lack of high-value-added employment within an economy can reinforce inequalities by limiting innovations linked to research and development. That will have the effect of increasing the sovereign risk of economies with high unemployment rates, as well as low-value-added human capital.

Furthermore, addressing human rights abuses is critical to promote political stability, economic development, and international trade relations (Forsythe 2006). The protection of human rights is at the forefront of international trade standards and economic policies. Failing to address human rights issues can result in a loss of trust and credibility, leading to a decline in economic growth and international relations, thus increasing country and sovereign risk (Bantekas and Lumina 2019).

Governance Risk: A Well-Known and Short-Term Factor of Sovereign Risk

Governance plays a crucial role in shaping a country's development and creditworthiness, and extensive academic literature has explored that issue. The stability and effectiveness of a government's democratic institutions are critical factors that determine sovereign creditworthiness. For example, political instability and protests can weaken a government's ability to manage the country effectively and lead to significant impacts on sovereign yields. Block and Vaaler (2004) noted that extreme political parties, coalition formation, and protests can pose risks to government stability and negatively affect sovereign credit ratings. However, Smaoui, Boubakri,

and Cosset (2017) found that high electoral competitiveness and political stability can reduce sovereign spreads. In addition, a government's ability to deliver good public and civil services, maintain law and order, manage fiscal revenues, and honor its commitments can have significant implications for a country's creditworthiness (Jeanneret 2018).

Several studies, including those from Ciocchini, Durbin, and Ng (2003) and Connolly (2007), have highlighted the detrimental effects of corruption on economic growth and stability. However, there are factors that can help mitigate these risks and increase a country's credibility in the eyes of investors. One such factor is transparency. Investors tend to reward countries that are open and transparent with their financial information, such as public finance external audits and detailed budget drafts made available to the public. These efforts can help reduce the sovereign risk premium, as highlighted by Bernoth and Wolff (2008). Moreover, the credibility of a country's governance is linked closely to the credibility of its fiscal, monetary, and social policies, as emphasised by several studies, including Blackburn and Christensen (1989), Alesina and Tabellini (1990), Obstfeld and Taylor (2003), and De Mendonça and Machado (2013).

Citizens' rights, such as freedom of assembly and opinions, are also essential indicators of a country's level of democracy and subsequent risk premium required by investors. Strong legal frameworks and independent institutions that safeguard these rights can prevent money laundering and tax avoidance, thereby reinforcing government effectiveness, as noted by Hallerberg and Wolff (2008). In addition, creditor rights offered by the sovereign are crucial to securing international investors' appetite, as according to Qi, Roth, and Wald (2010), conflicts of interest and shareholder rights must be avoided.

Terrorism and violent acts can cause devastating effects on a country's economic stability, political structure, and financial markets. The impact of these violent incidents can have a ripple effect, leading to severe consequences on the country's overall creditworthiness (Procasky and Ujah 2016). The negative implications of terrorism are far-reaching, and they can create a lasting effect on a nation's economy, politics, and social structures.

Therefore, governments must take proactive measures to prevent such occurrences and reduce the potential risk of future incidents. For that purpose, investing in law enforcement agencies and counterterrorism capabilities can be an effective strategy to mitigate the risk of violent acts. Strengthening the police and intelligence agencies' capabilities can help prevent such incidents from occurring, thereby attracting foreign investment and boosting the country's economic growth.

ECONOMETRIC FRAMEWORK, DATA, AND HYPOTHESES

The theoretical links having been widely assessed and discussed, we now seek to empirically evaluate the financial materiality of ESG risk, and its E, S, and G risk breakdown, on sovereign creditworthiness.

Econometric Framework

To evidence the financial materiality of ESG risk data relating to sovereign creditworthiness, we investigate the relationship between sovereign credit risk and ESG risk assessment. To do so, we regress the sovereign 5Y CDS on ESG risk scores for

a maximum of 70 economies[2] between Q1 2010 and Q4 2022 using a panel model with country and time fixed effects,[3] as shown below:

$$cds_{i,t} = \alpha + \beta_{ESG} ESG\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + \ _i + \lambda_t + \varepsilon_{i,t}$$

where

- Dependent variable $cds_{i,t}$ denotes the natural logarithm of the sovereign 5Y CDS of country *i* at time *t*;
- Independent variable $ESG\ Score_{i,t}$ denotes the FTSE Russell/Beyond Ratings 2SRM aggregated ESG risk score for country *i* at time *t*;
- $GDP\ Growth\ Rate_{i,t}$ denotes the growth rate of the real GDP for country *i* at time *t*;
- $CPI\ Inflation\ Rate_{i,t}$ denotes the inflation rate, as measured by the year-on-year percentage change of the CPI for country *i* at time *t*;
- μ_i denotes unobservable fixed effects that vary across countries but are constant over time; and
- λ_t denotes unobservable fixed effects that vary over time but are constant across countries.

As does Hübel (2020), we employ a country and time fixed-effects regression model. In contrast to a pooled analysis, this econometric framework allows us to account for cross-sectional and time-variance to draw conclusions that persist over time. With that, the fixed-effects estimators allow us to best tackle possible omitted variable bias driven by mixed country characteristics that are constant over time and time effects that are constant across countries (Stock and Watson 2018). To ensure that the conditions of a panel fixed-effects regression were met, we first conducted the White test and the Breusch–Pagan test to check for the dispersion of errors. These tests allowed us to confirm their heteroskedasticity. Then, we conducted a Durbin–Watson test to check for the autocorrelation in the residuals of the regressions. This test provides evidence that we must use a panel rather than a pooled framework. Last, we performed the Hausman test to examine the adequacy of the fixed-effects regression model, which was confirmed. It is key to note that this method is performed using an unbalanced panel due to different availabilities of data for each country and period. While the lack of data is not correlated with idiosyncratic errors, the unbalanced panel poses no issues to our estimation (Wooldridge 2013).

In conjunction, to account for countries' heterogenous characteristics, we analyze countries at various levels of development (i.e., AEs and EMDEs) and income levels (lower-middle-, upper-middle-, and high-income countries).[4] Moreover, we analyze samples with a financial dimension, such as investment-grade (IG) and high-yield (HY)

[2] Angola, Argentina, Australia, Austria, Belgium, Bulgaria, Brazil, Canada, Switzerland, Chile, China, Colombia, Costa Rica, Cyprus, Czechia, Germany, Denmark, Dominican Republic, Egypt, Estonia, Finland, France, United Kingdom, Ghana, Greece, Hong Kong, Croatia, Hungary, Indonesia, India, Ireland, Iceland, Israel, Italy, Jordan, Japan, Korea, Kuwait, Sri Lanka, Lithuania, Latvia, Morocco, Mexico, Malta, Malaysia, Netherlands, Norway, New Zealand, Panama, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russia, Saudi Arabia, Singapore, Serbia, Slovak Republic, Slovenia, Sweden, Thailand, Turkey, Ukraine, Uruguay, United States, Venezuela, Vietnam, and South Africa.

[3] The model has been fitted using clustered standard errors.

[4] Low-income countries could not be included in the analysis due to limited data availability.

economies,[5] as well as index universes (e.g., FTSE World Government Bond Index [WGBI],[6] and FTSE European Monetary Union [EMU] Government Bond Index [EGBI]).[7]

Data

Sovereign five-year CDS spreads. Analogous to insurance contracts, sovereign 5Y CDS spreads represent an annualized premium paid by investors to protect their investments from potential losses incurred by so-called credit events, such as defaults or debt restructuring (International Monetary Fund 2013). 5Y CDS are commonly used by market participants as a sentiment measure of the credit risk of a given country. In this model, the natural logarithm of a sovereign 5Y CDS spread is used to proxy sovereign credit risk. The data are sourced from Refinitiv.

5Y CDS are recorded as an average on a quarterly basis and are measured in US dollars. To limit the bias incurred by outliers, we cap the CDS spreads at 1,000 points. This is equivalent to removing the upper 5% of the distribution.

ESG risk scores. As a proxy for ESG risk, we use 2SRM sovereign ESG risk scores from the Beyond Ratings/FTSE Russell (Flores Moya and Moussavi 2023). 2SRM is a quantitative, relative, and systematic approach based on 36 indicators for 151 countries, divided into three pillars of sustainable sovereign risk assessment.

FTSE Russell/Beyond Ratings calculates a score on a quarterly basis for each indicator, starting from Q4 1999 to Q4 2022. Each of the indicators is the outcome of numerous adjustments—systematic to a considerable extent—based on public, private, and proprietary data. All indicators are combined at a risk theme level and a pillar level to obtain an aggregated score, which is derived from advanced statistical and econometric techniques. We refer to Exhibit 1 for an illustration of the 2SRM framework. These scores range from 0 to 100, with higher scores reflecting less risk and vice versa. The methodology is illustrated in Exhibit 1.

The methodology is designed to be flexible and adaptable, allowing users to customize the pillar weightings based on their specific preferences and investment objectives. For the purposes of this study, each of the E, S, and G risk scores were equally weighted to obtain an aggregated ESG risk score. For this study, we use the aggregated ESG risk score and E, S, and G risk scores separately.

Control variables. Sovereign risk can be determined using a wide selection of macroeconomic and financial variables. Among these are a variety of indicators on economic and external performance, fiscal flexibility, and financial system stability. For example, Heinz and Sun (2014) suggest using forecast real GDP growth and governments' current account balance. Kocsis and Monostori (2016) and Hilscher and Nosbusch (2010) employ measures on countries' external position, such as trade balances and the volatility in trade, respectively. Dumičić and Rizdak (2011) use the real GDP growth rate, the inflation rate, and the real exchange rate. However, social and governance scores have an inherent income bias (Gratcheva et al. 2021). In other words, any economic indicators highly correlated with the level of economic development can bias the econometric framework and, thus, its results.

In response, we conducted a correlation analysis that studies a total of 28 indicators of macroeconomic fundamentals proposed by the academic literature against CDS spreads, such as real GDP growth rate, GNI per capita, CPI inflation rate, debt to GDP, external debt measures, and trade balance measures, among others. Indicators with the strongest relationship were selected and then evaluated against

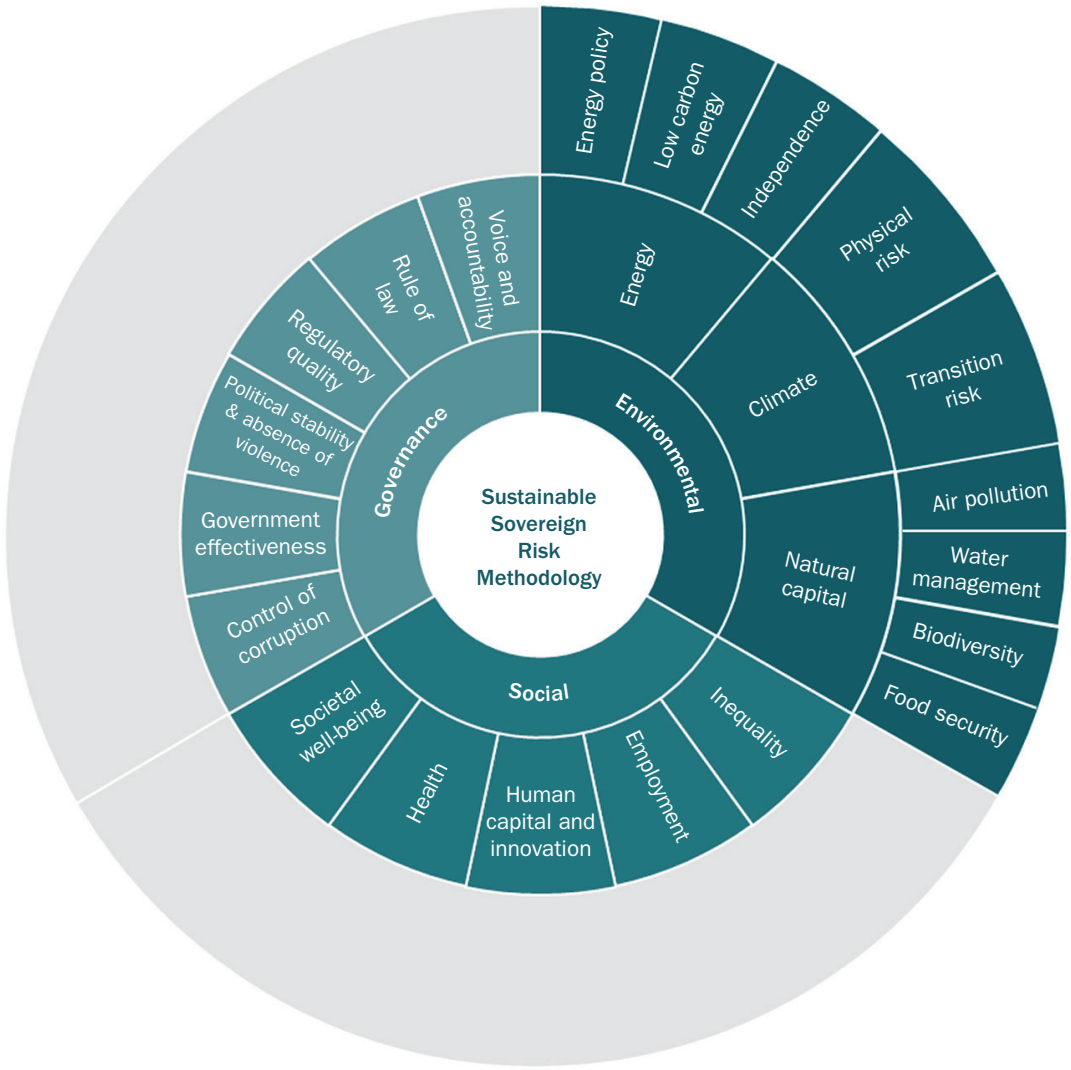
[5] We use Standard & Poor's Global credit ratings. Countries rated AAA to BBB– are considered investment grade, while those rated BB+ to D are considered high yield.

[6] FTSE World Government Bond Index (WGBI) Series | FTSE Russell.

[7] EMEA Fixed Income Indexes | FTSE Russell.

EXHIBIT 1

2SRM Framework



SOURCE: Beyond Ratings.

E, S, and G scores for correlation to check for potential collinearity. Ultimately, real GDP growth rate and CPI inflation rate were selected as the best-adapted contenders,[8] in line with the controls used by Dumičić and Rizdak (2011).

Descriptive statistics. Exhibit 2 shows the summary statistics. In the sample, the sovereign 5Y CDS appear to be skewed mostly toward countries that have less than 200 basis points (bps). On average, ESG risk scores are similar to S risk scores, while E risk scores are lower, and G risk scores are higher. There seems to be more variance in G risk scores and less for E risk scores.[9]

[8] Even if the real GDP growth rate appears less correlated with sovereign 5Y CDS than the CPI inflation rate, we retained this control variable because it showed no significant sign of collinearity with the other variables of interest.

[9] Given the considerable number of countries covered in this study, it did not seem appropriate to illustrate all the time series by country on the ESG, E, S, and G risk scores. Nevertheless, by analyzing by country, the inertia of the risk scores is well and truly confirmed. Indeed, the averages of the standard deviations over all the time series studied evolve between c. 1 and 2 points. The ESG risk score

EXHIBIT 2

Main Descriptive Statistics

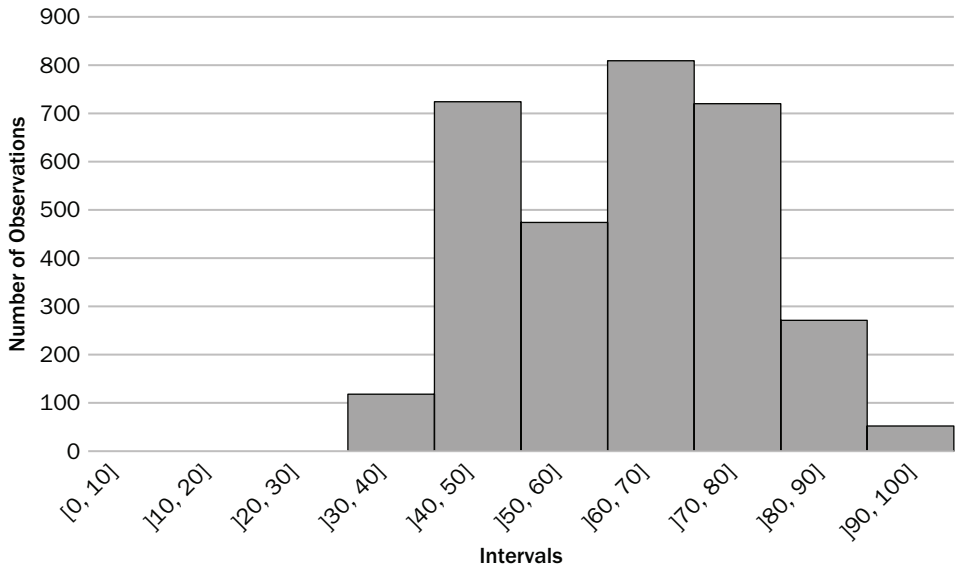
	Sovereign 5Y CDS	Real GDP Growth Rate	CPI Inflation Rate	ESG Risk Score	E Risk Score	S Risk Score	G Risk Score
Minimum	5.00	–38.61	–3.75	30.77	34.14	15.68	9.66
25th Percentile	45.00	1.20	0.97	49.30	55.44	50.21	44.03
Average	136.92	2.98	3.43	62.44	60.14	61.20	65.97
75th Percentile	168.00	5.00	4.23	72.41	67.12	75.06	87.76
Maximum	993.00	68.15	81.10	92.04	91.88	88.35	99.97
Standard Deviation	151.00	4.87	4.86	14.31	10.51	16.77	23.12
Number of Observations	3,168	3,168	3,168	3,168	3,168	3,168	3,168

NOTES: The main descriptive statistics exhibit provides the minimum, 25th percentile, average, 75th percentile, maximum, and standard deviation of the statistical distribution of all variables of interest. It also reports the number of observations for each statistical distribution.

SOURCES: National sources, Refinitiv, Beyond Ratings.

EXHIBIT 3

Distribution of Aggregated ESG Risk Score, Q1 2010–Q4 2022



NOTES: This exhibit provides the distribution of the aggregated ESG risk score by 10-point intervals from Q1 2010 to Q4 2022. For example, 118 observations are included in the interval]30, 40]. The distribution of the aggregate ESG risk score approximates a normal distribution, is a bit negatively skewed, and is platykurtic.

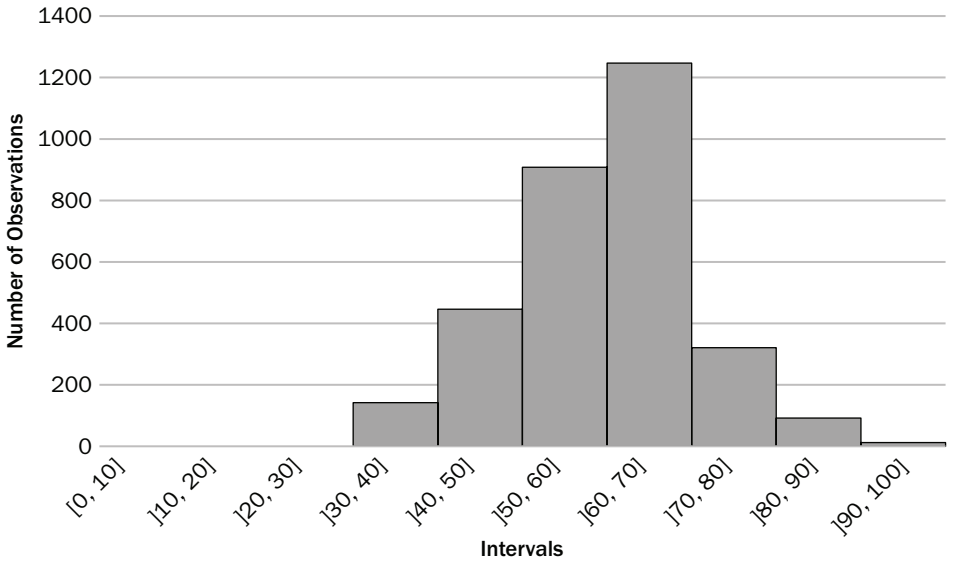
SOURCE: Beyond Ratings.

The distributions of ESG, E, S, and G risk scores appear in Exhibits 3, 4, 5, and 6, respectively. ESG, E, and S risk scores are relatively normally distributed with a bell-curve shape. E risk scores are slightly positively skewed, while S scores are more negatively skewed. However, as observed in the statistics, the standard deviation is lower for E scores such that most countries cluster around the mean, and there is less variation in scores across the sample. In the case of G scores, the data do not exhibit a normal distribution. Rather, there is larger variation of scores in the

is the most inertial, with a standard deviation of 1.05 point on average, while the S and G risk scores are less inertial with an average standard deviation of about 2 points.

EXHIBIT 4

Distribution of Environmental Risk Score, Q1 2010–Q4 2022

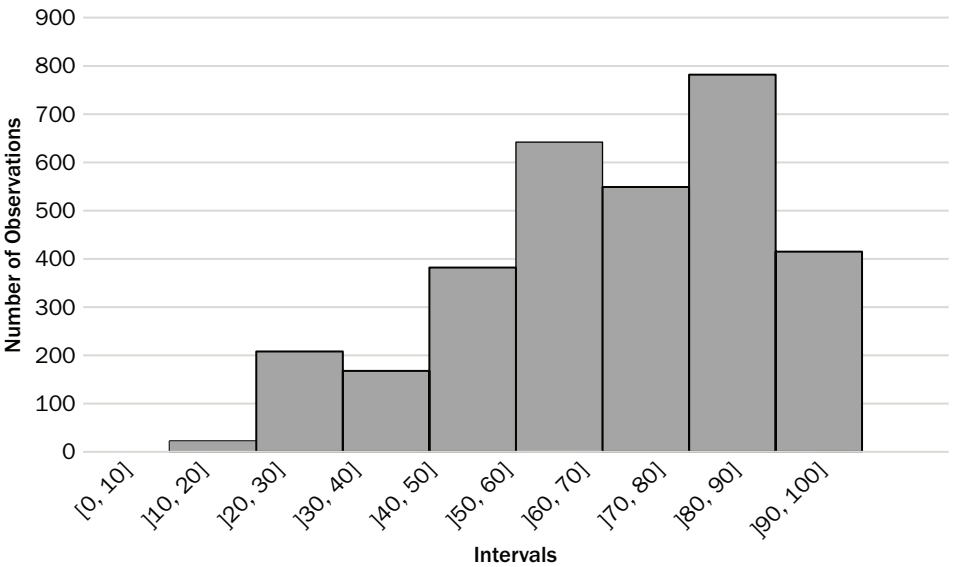


NOTES: This exhibit provides the distribution of the environmental risk score by 10-point intervals from Q1 2010 to Q4 2022. For example, 1,247 observations are included in the interval]70, 80]. The distribution of the environmental risk score closely approximates a normal distribution, is a bit positively skewed, and is leptokurtic.

SOURCE: Beyond Ratings.

EXHIBIT 5

Distribution of Social Risk Score, Q1 2010–Q4 2022

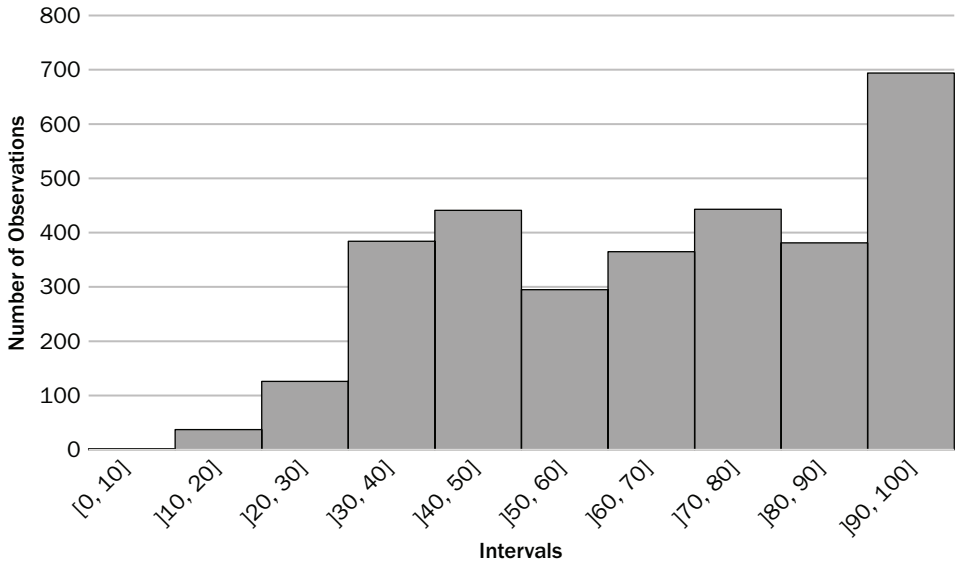


NOTES: This exhibit provides the distribution of the social risk score by 10-point intervals from Q1 2010 to Q4 2022. For example, 782 observations are included in the interval]60, 70]. The distribution of the social risk score approximates a normal distribution and is negatively skewed.

SOURCE: Beyond Ratings.

EXHIBIT 6

Distribution of Governance Risk Score, Q1 2010–Q4 2022



NOTES: This exhibit provides the distribution of the governance risk score by 10-point intervals from Q1 2010 to Q4 2022. For example, 694 observations are included in the interval]90, 100]. High scores are overrepresented here because more than half of our sample is made up of AEs with very high governance standards.

SOURCE: Beyond Ratings.

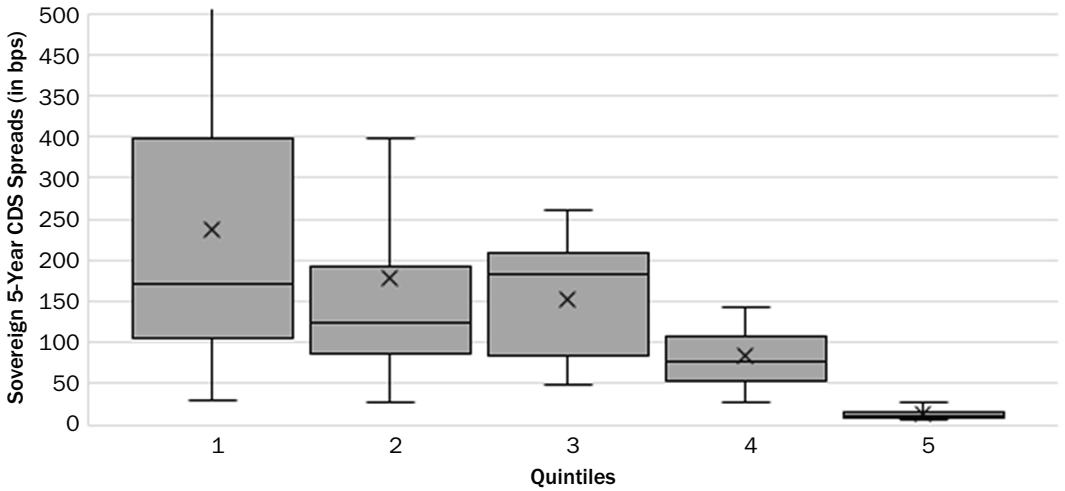
sample with a skewedness to the right of the distribution. This overrepresentation of high scores is due to more than half of our sample having been made up of AEs with high governance standards.

The boxplots in Exhibit 7 show the distribution of sovereign 5Y CDS for aggregated ESG risk scores, grouped by quintile. Overall, the average and variance in sovereign 5Y CDS appear to increase when the ESG risk score decreases. The least ESG-risky, represented by quintile 5, have a short range of sovereign 5Y CDS capped at about 30 bps. Yet, as ESG risk scores start to decrease, the range rapidly expands. The moderately ESG-risky have spreads varying from c. 50 to c. 270 bps, while the ESG-riskiest have sovereign 5Y CDS that vary from c. 30 to c. 700 bps. It is indeed possible to hypothesize that ESG risk can provide additional and financially material information to better understand sovereign risk, which would otherwise not be captured by purely economic and financial indicators.

Hypotheses. As per the literature, we expect the ESG risk coefficient (and those of the individual components) to have a negative sign. An overall good performance across environmental, social, and governance pillars implies that a country is equipped to withstand exogenous macroeconomic, social, or environmental shocks via higher resilience to transition and physical risks, high human capital, and good governance, among others. The interdependency of ESG factors in turn brings about virtuous economic conditions that increase a government's probability to repay its debt (Georgieva and Sloggett 2019), which can thus translate to lower spreads. However, given that we are estimating a panel model with country and time fixed effects and that the aggregated ESG, E, S, and G risk scores are strongly inertial (see Footnote 9), it is possible that the fixed effects remove part of the significance of the coefficients related to the ESG risk as some ESG risks are already priced in by the financial market and therefore integrated into the intrinsic economic and financial characteristics of countries, especially for AEs.

EXHIBIT 7

Sovereign Five-Year CDS Spreads by Aggregated ESG Risk Score Quintile, Q1 2010–Q4 2022



NOTES: This exhibit provides useful boxplots and shows the distribution of sovereign 5Y CDS by aggregated ESG risk score quintile. The boxplot shows the descriptive statistics: the minimum, lower quartile (Q1), median (represented by a horizontal line in the interquartile range Q1–Q3), average (represented by a cross in the interquartile range Q1–Q3), upper quartile (Q3), and maximum for each quintile of the aggregated ESG risk score. For the exhibit to be easier to read, we have not reported the maximum for the first quintile of the distribution. This maximum is c. 700 bps. This exhibit shows the decreasing statistical relationship between the aggregated ESG risk score and the level of sovereign 5Y CDS. On average, the lower the aggregated ESG risk score (i.e., the higher the ESG risk), the higher the sovereign 5Y CDS.

SOURCE: Beyond Ratings.

Hand in hand with that, a higher real GDP growth rate should carry a negative coefficient, as increased economic activity would result in higher accumulated capital and higher fiscal capacity and thus reduced sovereign risk. In the case of the inflation rate, our hypothesis is that inflation carries a positive relationship with sovereign 5Y CDS, as persistently high inflation rates can be indicative of political turmoil, economic mismanagement, and overly accommodating monetary policy, resulting in poor economic and financial sentiment and thus increased sovereign risk (Corsetti et al. 2013). This can especially be the case of EMDEs (Balima, Combes, and Minea 2017).

The outputs of this regression can be used to draw implied sovereign 5Y CDS curves as a function of the ESG risk score. This method can facilitate the derivation of the probability of the default of sovereigns in any period for a given ESG risk score and therefore help investors to price sovereign ESG risk with greater precision.

FINANCIAL MATERIALITY OF SOVEREIGN ESG RISK: THE RESULTS

In Exhibit 8, the estimates of the complete sample regression show that the coefficients related to the aggregated ESG and S risk scores are significant and carry the expected sign, although the R-squared figures are relatively low. However, the E and G risk score coefficients are not significant. The control variables show a significant relationship with the expected signs, behaving similarly across the aggregated ESG, E, S, and G risk score regressions. But the strength of the relationship between the S risk score and sovereign 5Y CDS is not as large as observed in the aggregated ESG risk score. Moreover, these results imply that only the aggregated ESG and S risk scores have a significant impact on sovereign risk. These results can be explained by

EXHIBIT 8

Main Panel Regression Estimates, Q1 2010–Q4 2022

	Complete Sample			
α	7.220***	3.148**	5.785***	5.639***
	(1.602)	(1.363)	(0.749)	(0.912)
β_{ESG}	−0.045*			
	(0.0257)			
β_{E}		0.021		
		(0.022)		
β_{S}			−0.022*	
			(0.012)	
β_{G}				−0.018
				(0.014)
β_{GDP}	−0.027**	−0.027**	−0.027**	−0.027**
	(0.011)	(0.003)	(0.011)	(0.011)
β_{CPI}	0.016***	0.018***	0.017***	0.017***
	(0.005)	(0.005)	(0.005)	(0.005)
Country Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	3,168	3,168	3,168	3,168
R-Squared	0.10	0.08	0.10	0.09

NOTES: This panel regression estimates exhibit provides the estimates for four regressions for the main and complete sample: (i) $cds_{i,t} = \alpha + \beta_{ESG} ESG\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + {}_{i} + \lambda_{t} + \varepsilon_{i,t}$; (ii) $cds_{i,t} = \alpha + \beta_{E} E\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + {}_{i} + \lambda_{t} + \varepsilon_{i,t}$; (iii) $cds_{i,t} = \alpha + \beta_{S} S\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + {}_{i} + \lambda_{t} + \varepsilon_{i,t}$; and (iv) $cds_{i,t} = \alpha + \beta_{G} G\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + {}_{i} + \lambda_{t} + \varepsilon_{i,t}$. Standard errors are in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level of confidence, respectively.

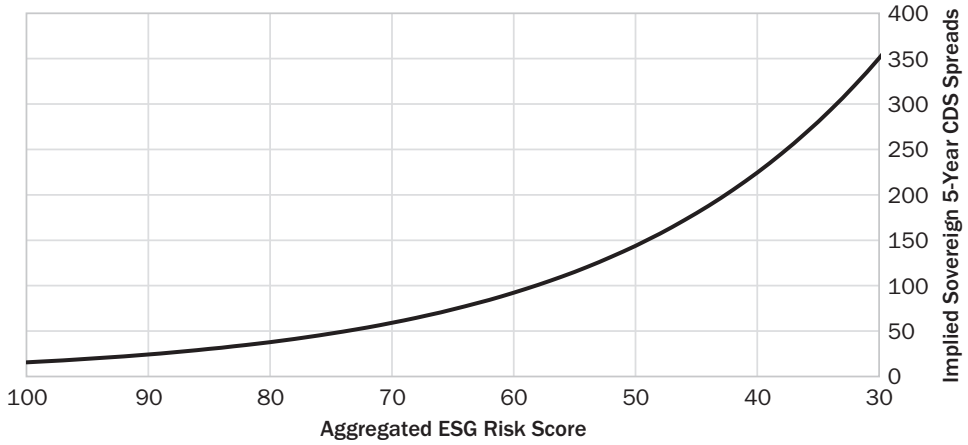
SOURCE: Beyond Ratings.

the heterogeneity of countries in the full sample, as sovereign 5Y CDS in countries with high ESG risk scores vs. low ESG risk scores behave very differently. That can be further explained by constructing ESG's implied CDS curve (see Exhibit 9).

Illustrating these results, the implied sovereign 5Y CDS curve in Exhibit 9 shows the exponential relationship between the aggregated ESG risk score and implied sovereign 5Y CDS. For economies with aggregated ESG risk scores between 100 and 60, sovereign 5Y CDS are relatively low and stable. In this case, the sovereign 5Y CDS top c. 100 bps. However, when aggregated ESG risk scores are below 60, sovereign 5Y CDS increase at a higher speed going from c. 100 to a maximum of c. 350 bps for a minimum score of 30. We tested these bounds and split our sample into two groups with ESG risk scores above and below 60. The results outline that countries with an ESG risk score higher than 60 show no significant relationship with sovereign 5Y CDS. Alternatively, for sovereign issuers with an ESG risk score lower than 60, sovereign 5Y CDS decrease by 7.6% for a 1-unit increase in the ESG risk score. This highlights that the impact of a change in ESG risk score is higher for the ESG-riskiest and insignificant for the least ESG-risky. We attribute this result to the fact that S and G risks shift more over time for countries with low ESG risk scores (i.e., high ESG risks), while for countries with high ESG risk scores, inertia is visible. In other words, we can partly explain this by the catch-up effect (Barro 1991), whereby the starting point is lower for the ESG-riskiest and thus evolution in creditworthiness is more notable over time. In contrast, the starting point for the least ESG-risky is high and thus evolves much less significantly over a given period.

EXHIBIT 9

Main Implied Sovereign Five-Year CDS Spreads Curve as a Function of Aggregated ESG Risk Score, Q1 2020–Q4 2022



NOTES: The main implied sovereign 5Y CDS curve illustrates the main estimate of the regressions in Exhibit 8. We show that when the aggregated ESG risk score is above 60, sovereign 5Y CDS levels are low and top c. 100 bps, while they increase at a higher speed going from c. 100 bps to a highest c. 350 bps in the interval from 60 to 30 (minimum score).

SOURCE: Beyond Ratings.

The implied sovereign 5Y CDS curves in Exhibit 10 illustrate the relationships for the ESG risk scores broken down. The S- and G-related curves behave similarly to the one in Exhibit 9 (i.e., the aggregated ESG-related curve), with low levels of sovereign 5Y CDS when S and G risk scores are above 50, and an exponential increase in sovereign 5Y CDS when S and G risk scores drop below 50. The E-related curve is not in the expected direction as the coefficient related to the E risk score is not significant and does not carry the expected sign (see Exhibit 8).

These results show that most of the sovereign 5Y CDS variation is explained by aggregated ESG and S risk scores. Moreover, when combined with E and G risk scores, sovereign 5Y CDS are better explained, given a higher ESG-related coefficient.

From a Level of Development Viewpoint

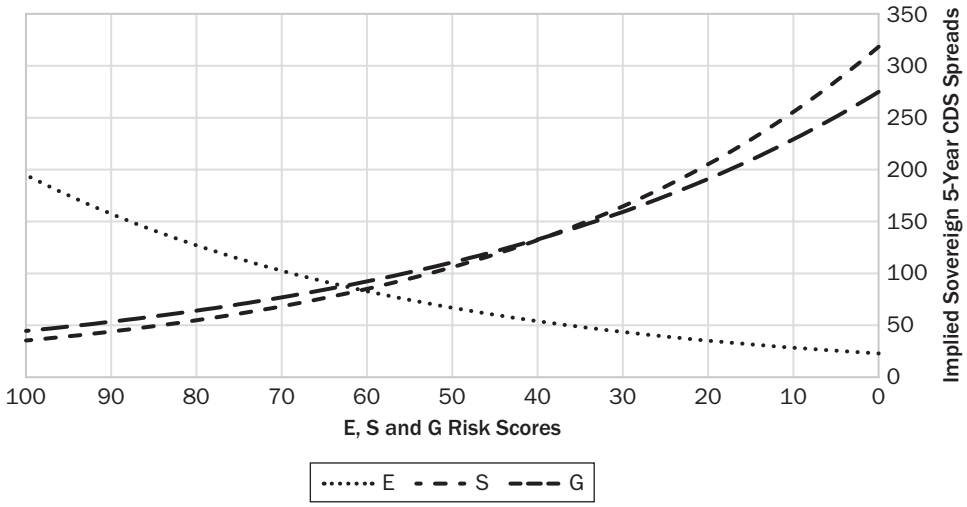
To further understand these results, we divide the whole sample according to the International Monetary Fund classification of AEs and EMDEs. Referring to Appendix Exhibit A1, we observe that the results for AEs differ from the complete sample. The aggregated ESG, S, and G risk scores do not explain any of the variation of the sovereign 5Y CDS, as the coefficients are not significant. Only the coefficient related to the E risk score is significant, although it does not carry the expected sign. The real GDP growth rate control variable carries the same sign and level of significance, although the CPI inflation rate is significant only for the E risk regression.[10] Likewise, in the Appendix Exhibit A2, the previous results hold for the high-income OECD countries. These results can be partly explained by the lack of understanding and integration of environmental risks into investment decisions (Clarvis et al. 2014).

The EMDEs behave more similarly and strongly to the complete sample regressions (see Exhibit 8). The ESG-, S-, and G-related coefficients are significant, and

[10] We explain this by the fact that during the period considered and within the AEs, the CPI inflation rate was on average exceptionally low and not slightly volatile except in 2022.

EXHIBIT 10

Implied Sovereign Five-Year CDS Spread Curves as Functions of E, S, and G Risk Scores, Q1 2020–Q4 2022



NOTES: The implied sovereign 5Y CDS curves illustrate the main estimates of the regressions in Exhibit 8. We show that when S and G risk scores are above 50, sovereign 5Y CDS levels are low and top 100 bps, while they increase at a higher and quite similar speed going from 100 bps to a highest around 300 bps for S and G risk scores below 50.

SOURCE: Beyond Ratings.

relative to the complete sample, the magnitude of the coefficients is significantly larger. The ESG-related coefficient for EMDEs, for example, is almost two times larger than that for the complete sample regression. However, the coefficients of the S and G risk scores are close in magnitude across their respective regressions, although the impact of G is larger relative to S. Moreover, as observed for the complete sample regressions, the aggregated ESG risk score better explains the variation in CDS relative to the S and G risk scores in isolation. All controls are significant and carry the expected sign. Further splitting countries, we observe in Appendix Exhibit A3 that the estimates from the regressions for the upper-middle-income sample are close to those of the EMDE sample; all ESG-, S-, and G-related coefficients increase significantly in magnitude. The estimates of the regressions for the lower-middle-income sample show that only the G-related coefficient is significant and carries the expected sign.

The implied sovereign 5Y CDS curves derived for AEs and EMDEs (see Appendix Exhibit A9) show that the exponential relationship between the aggregated ESG risk score and sovereign 5Y CDS is indeed driven mostly by EMDEs while the relationship for AEs is less evident.

These results help portray that, on average, the ESG risk provides an additional and financially material information on sovereign risk, as do its components. However, these results vary according to the level of the countries' development. Social risk, followed by governance risk, are more material than environmental risk in explaining sovereign 5Y CDS variation for the EMDEs. Moreover, the combination of the three factors is even more beneficial for doing so. Across the AEs, the results are unclear and difficult to interpret. The financial materiality of ESG risk is thus better perceived within the EMDEs than within the AEs.

We explain these results by (i) the inertia of S and G risk scores, especially for AEs during the studied period, and (ii) the fact that S and G features represent structural

and therefore intrinsic characteristics of mature economies.[11] Those characteristics may already be partly priced in by the financial market. The country fixed effects were therefore able to remove part of the significance of the coefficients related to the ESG, E, S, and G risk. To support our argument, we performed regressions without fixed effects (i.e., pooled ordinary least squares [OLS] regressions) for the complete sample and AEs vs. EMDEs (see Appendix Exhibits A4 and A5, respectively). The complete sample regression shows similar and significant ESG-related and S-related coefficients. However, the E-related and G-related coefficients become significant as well. Nevertheless, the main outcome of relevance is that the complete sample results seem to be driven by the AEs, whereby the coefficients behave similarly with higher magnitudes. In contrast, the results for EMDEs show significantly lower coefficients. The outputs can imply that there is a statistically significant relationship between ESG risks and sovereign 5Y CDS for AEs. However, even if these outcomes are not necessarily captured by the panel fixed-effects regression, these results should be interpreted with caution given the inconsistency of the pooled OLS estimation for our analytical framework.

From an Investor Viewpoint

For more direct use in financial applications, we divide the sample according to the commonly used IG vs HY classification (see Appendix Exhibit A6). Within the IG sample, the results behave similarly to the AE sample regressions. Indeed, only the E-related coefficient is significant but does not carry the expected sign. These results are expected given the inertia of the risk scores, especially among AEs, which in turn is partly absorbed by the country fixed effects. All control variables are significant with the expected sign, except for the G regression in which the CPI inflation rate is not significant. As expected, the implied sovereign 5Y CDS curve derived for the IG sample shows a linear trend (see Appendix Exhibit A10), as the aggregated ESG-related coefficient is not significant.

Focusing on some FTSE index universes, it appears that the WGBI sample (see Appendix Exhibit A7) behaves almost identically to the IG sample, whereby none of our coefficients of interest are significant. This can notably be explained by the greater heterogeneity in the WGBI universe, which includes a small selection of EMDEs and, thus, results in inconclusive results. In addition, only the GDP growth rate control variable is significant and carries the expected sign. Turning to the EGBI sample estimates, we show that the ESG-related and S-related coefficients are significant, with the expected sign (see Appendix Exhibit A7). Interestingly, both coefficients are the largest relative to any other performed regressions, although the aggregated ESG risk score continues to explain most of the variation in sovereign 5Y CDS. These results can be driven by two reasons: (i) the smaller sample of AEs tend to see less inertia into the S risk score in comparison with the AE sample and (ii) the limited sample size. The real GDP growth rate control carries the expected sign and is significant across the sample, although the CPI inflation rate loses its significance in the G-related regression.

Within the HY sample (see Appendix Exhibit A6), the ESG-, S-, and G-related coefficients behave comparably to the EMDE regression. They are significant, with the ESG-related regression explaining most of the variation in sovereign 5Y CDS, followed by G and then S. The implied sovereign 5Y CDS curve translates well the significant exponential relationship between the aggregated ESG risk score and sovereign 5Y

[11] A mature economy is defined as an economy that has reached an advanced stage of development, categorized inter alia by slowing GDP growth, decreased spending on infrastructure, and a relative increase in consumer spending.

CDS (see Appendix Exhibit A10). Across the EMGBI universe and the EMGBI frontier markets subsample (see Appendix Exhibit A8), the results are in line with those of the HY regressions. In both cases, the ESG-related coefficient is of the largest magnitude. While the S- and G-related coefficients follow the E-related coefficient in the EMGBI sample, the opposite is the case in the frontier markets subsample. Moreover, the estimated coefficients for the frontier markets subsample are larger in magnitude, which can be explained by the country selection and limited sample size. The controls, however, behave differently. In the EMGBI regressions, the significance of the control variables is mixed.

CONCLUSION

There is extensive literature around the financial materiality of ESG criteria, but empirical studies have focused on corporates and equities. After reviewing the existing literature on sovereign ESG and the potential transmission channels to sovereign risk, we seek to demonstrate and quantify the potential financial materiality of ESG risk assessment.

Primarily, the countries with the highest ESG risk scores (i.e., the lowest ESG risk) show tight sovereign 5Y CDS, and vice versa. Using a fixed-effects panel framework, we show that sovereign ESG risk assessments are correlated with sovereign credit risk, thus bringing valuable information on the financial materiality of sovereign ESG risks. Breaking down our full sample of 70 sovereign entities by specific income groups and index universes, we show that the financial materiality of sovereign ESG risk assessment is empirically stronger for middle-income and high-yield EMDEs than for high-income and investment-grade AEs. Moreover, and as expected, the financial materiality of sovereign ESG risk assessment is empirically stronger for the aggregated ESG, the governance, and the social risk assessments than for the environmental risk assessment, especially for EMDEs.

By illustrating those results with implied sovereign 5Y CDS curves based on sovereign ESG risk scores, we offer evidence of the financial materiality of sovereign ESG risk assessment for fixed-income investors seeking to integrate ESG risk into their sovereign debt investment decisions.

APPENDIX

EXHIBIT A1

Panel Regression Estimates for Advanced Economies vs. Emerging Markets and Developing Economies, Q1 2010–Q4 2022

	Advanced Economies Sample				Emerging Markets and Developing Economies Sample			
α	3.319	–0.342	5.133***	3.879**	8.929***	7.090***	6.226***	6.472***
	(3.082)	(1.199)	(1.468)	(1.840)	(1.060)	(1.793)	(0.485)	(0.557)
β_{ESG}	0.009				–0.078***			
	(0.042)				(0.021)			
β_{E}		0.068***				–0.037		
		(0.019)				(0.031)		
β_{S}			–0.016				–0.026***	
			(0.020)				(0.010)	
β_{G}				0.001				–0.033***
				(0.002)				(0.012)
β_{GDP}	–0.040***	–0.039***	–0.040***	–0.040**	–0.012**	–0.011**	–0.012**	–0.012**
	(0.012)	(0.011)	(0.012)	(0.011)	(0.005)	(0.006)	(0.006)	(0.006)
β_{CPI}	0.006	0.017**	–0.009	0.007	0.013***	0.019***	0.016***	0.014***
	(0.009)	(0.007)	(0.008)	(0.010)	(0.004)	(0.005)	(0.004)	(0.003)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	1,674	1,674	1,674	1,674	1,494	1,494	1,494	1,494
R-Squared	0.09	0.13	0.10	0.09	0.17	0.09	0.11	0.14

NOTES: This panel regression estimates exhibit provides the estimates for four different regressions for AEs and EMDEs samples: (i) $cds_{i,t} = \alpha + \beta_{ESG} ESG\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + \ _i + \lambda_t + \varepsilon_{i,t}$; (ii) $cds_{i,t} = \alpha + \beta_{E} E\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + \ _i + \lambda_t + \varepsilon_{i,t}$; (iii) $cds_{i,t} = \alpha + \beta_{S} S\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + \ _i + \lambda_t + \varepsilon_{i,t}$; and (iv) $cds_{i,t} = \alpha + \beta_{G} G\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + \ _i + \lambda_t + \varepsilon_{i,t}$ Standard errors are in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% level of confidence, respectively.
The AE sample is composed of Australia, Austria, Belgium, Canada, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Malta, Netherlands, New Zealand, Norway, Portugal, Singapore, Slovak Republic, Slovenia, Sweden, Switzerland, United Kingdom, and United States. The EMDE sample is composed of Angola, Argentina, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Croatia, Dominican Republic, Egypt, Ghana, Hungary, India, Indonesia, Jordan, Kuwait, Malaysia, Mexico, Morocco, Panama, Peru, Philippines, Poland, Qatar, Romania, Russia, Saudi Arabia, Serbia, South Africa, Sri Lanka, Thailand, Turkey, Ukraine, Uruguay, Venezuela, and Vietnam.

SOURCE: Beyond Ratings.

EXHIBIT A2

Panel Regression Estimates for High-Income OECD vs. High-Income Non-OECD Economies, Q1 2010–Q4 2022

	High-Income OECD Sample				High-Income Non-OECD Sample			
α	2.193	0.739	3.004**	4.564**	6.100***	5.650***	6.371***	3.956**
	(3.043)	(0.616)	(1.388)	(1.842)	(2.275)	(1.201)	(1.451)	(1.610)
β_{ESG}	0.023				–0.020			
	(0.041)				(0.037)			
β_{E}		0.048***				–0.016		
		(0.009)				(0.024)		
β_{S}			0.012				–0.024	
			(0.019)				(0.022)	
β_{G}				–0.009				0.013
				(0.022)				(0.024)
β_{GDP}	–0.032***	–0.033***	–0.032***	–0.033***	–0.030**	–0.030**	–0.029**	–0.030**
	(0.010)	(0.010)	(0.010)	(0.010)	(0.014)	(0.013)	(0.013)	(0.012)
β_{CPI}	0.037***	0.041***	0.037***	0.039*	–0.044**	–0.047***	–0.038**	–0.046**
	(0.011)	(0.012)	(0.011)	(0.011)	(0.018)	(0.018)	(0.015)	(0.018)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	1627	1627	1627	1627	390	390	390	390
R-Squared	0.10	0.11	0.10	0.10	0.19	0.19	0.21	0.19

NOTES: This panel regression estimates exhibit provides the estimates for four regressions for high-income OECD and high-income non-OECD samples: (i) $cds_{i,t} = \alpha + \beta_{ESG} ESG\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{l,t} + \beta_{CPI} CPI\ Inflation\ Rate_{l,t} + {}_{i} + \lambda_{t} + \varepsilon_{i,t}$; (ii) $cds_{i,t} = \alpha + \beta_{E} E\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{l,t} + \beta_{CPI} CPI\ Inflation\ Rate_{l,t} + {}_{i} + \lambda_{t} + \varepsilon_{i,t}$; (iii) $cds_{i,t} = \alpha + \beta_{S} S\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{l,t} + \beta_{CPI} CPI\ Inflation\ Rate_{l,t} + {}_{i} + \lambda_{t} + \varepsilon_{i,t}$; and (iv) $cds_{i,t} = \alpha + \beta_{G} G\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{l,t} + \beta_{CPI} CPI\ Inflation\ Rate_{l,t} + {}_{i} + \lambda_{t} + \varepsilon_{i,t}$ Standard errors are in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% level of confidence, respectively.

The high-income OECD sample is composed of Australia, Austria, Belgium, Canada, Chile, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Sweden, Switzerland, United Kingdom, and United States. The high-income non-OECD sample is composed of Croatia, Cyprus, Hong Kong, Kuwait, Malta, Qatar, Saudi Arabia, Singapore, and Uruguay.

SOURCE: Beyond Ratings.

EXHIBIT A3

Panel Regression Estimates for Lower-Middle-Income vs. Upper-Middle-Income Countries, Q1 2010–Q4 2022

	Lower-Middle-Income Sample				Upper-Middle-Income Sample			
α	9.358***	4.103***	6.148***	7.756***	9.592***	8.998***	6.640***	7.282***
	(2.742)	(1.077)	(0.765)	(1.214)	(1.054)	(2.498)	(0.604)	(0.473)
β_{ESG}	–0.094				–0.092***			
	(0.065)				(0.021)			
β_E		0.022				–0.070		
		(0.019)				(0.043)		
β_S			–0.022				–0.035***	
			(0.021)				(0.012)	
β_G				–0.067**				–0.053***
				(0.034)				(0.011)
β_{GDP}	–0.006*	–0.005	–0.006*	–0.004*	–0.012*	–0.010	–0.012*	–0.011
	(0.004)	(0.003)	(0.003)	(0.002)	(0.006)	(0.008)	(0.007)	(0.007)
β_{CPI}	–0.001	0.007	0.003	0.004	0.019***	0.026***	0.023***	0.016***
	(0.006)	(0.005)	(0.004)	(0.005)	(0.004)	(0.004)	(0.005)	(0.003)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	390	390	390	390	761	761	761	761
R-Squared	0.09	0.02	0.03	0.15	0.14	0.18	0.24	0.31

NOTES: This panel regression estimates exhibit provides the estimates for four different regressions for lower-middle- and upper-middle-income samples: (i) $cds_{i,t} = \alpha + \beta_{ESG} ESG\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + {}_i + \lambda_t + \varepsilon_{i,t}$; (ii) $cds_{i,t} = \alpha + \beta_E E\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + {}_i + \lambda_t + \varepsilon_{i,t}$; (iii) $cds_{i,t} = \alpha + \beta_S S\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + {}_i + \lambda_t + \varepsilon_{i,t}$; and (iv) $cds_{i,t} = \alpha + \beta_G G\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + {}_i + \lambda_t + \varepsilon_{i,t}$ Standard errors are in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% level of confidence, respectively. The lower-middle-income sample is composed of Angola, Egypt, Ghana, India, Indonesia, Morocco, Philippines, Sri Lanka, Ukraine, Venezuela, and Vietnam. The upper-middle-income sample is composed of Argentina, Brazil, Bulgaria, China, Colombia, Costa Rica, Dominican Republic, Jordan, Malaysia, Mexico, Panama, Peru, Romania, Russia, Serbia, South Africa, Thailand, and Turkey.

SOURCE: Beyond Ratings.

EXHIBIT A4

Pooled Ordinary Least Squares Regression Estimates for the Complete Sample, Q1 2010–Q4 2022

	Complete Sample			
α	7.185***	5.763***	6.568***	6.167***
	(0.071)	(0.096)	(0.065)	(0.049)
β_{ESG}	–0.045***			
	(0.001)			
β_{E}		–0.026***		
		(0.002)		
β_{S}			–0.036***	
			(0.001)	
β_{G}				–0.027***
				(0.001)
β_{GDP}	–0.017***	–0.009***	–0.015***	–0.014***
	(0.003)	(0.003)	(0.003)	(0.003)
β_{CPI}	0.031***	0.073***	0.030***	0.029***
	(0.003)	(0.007)	(0.003)	(0.003)
Number of Observations	3,168	3,168	3,168	3,168
Adjusted R-Squared	0.45	0.18	0.40	0.43

NOTES: This pooled OLS regression estimates exhibit provides the estimates for four different regressions for the main and complete sample: (i) $cds_{i,t} = \alpha + \beta_{ESG} ESG\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + \varepsilon_{i,t}$; (ii) $cds_{i,t} = \alpha + \beta_{E} E\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + \varepsilon_{i,t}$; (iii) $cds_{i,t} = \alpha + \beta_{S} S\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + \varepsilon_{i,t}$; and (iv) $cds_{i,t} = \alpha + \beta_{G} G\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + \varepsilon_{i,t}$. Standard errors are in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% level of confidence, respectively.

SOURCE: Beyond Ratings.

EXHIBIT A5

Pooled Ordinary Least Squares Regression Estimates for Advanced Economies vs. Emerging Markets and Developing Economies, Q1 2010–Q4 2022

	Advanced Economies Sample				Emerging Markets and Developing Economies Sample			
α	9.369***	6.131***	7.958***	7.817***	5.372***	4.117***	5.344***	5.290***
	(0.162)	(0.117)	(0.167)	(0.133)	(0.114)	(0.089)	(0.083)	(0.076)
β_{ESG}	–0.074***				–0.011***			
	(0.002)				(0.002)			
β_{E}		–0.0349***				0.012***		
		(0.002)				(0.002)		
β_{S}			–0.055***				–0.011***	
			(0.002)				(0.001)	
β_{G}				–0.046***				–0.010***
				(0.002)				(0.001)
β_{GDP}	–0.022***	–0.0213***	–0.016***	–0.014**	–0.013***	–0.010***	–0.013***	–0.012***
	(0.006)	(0.007)	(0.006)	(0.006)	(0.003)	(0.003)	(0.003)	(0.003)
β_{CPI}	–0.001	0.001	–0.008	–0.005	0.050***	0.053***	0.048***	0.048***
	(0.006)	(0.008)	(0.007)	(0.007)	(0.006)	(0.006)	(0.005)	(0.005)
Number of Observations	1,674	1,674	1,674	1,674	1,494	1,494	1,494	1,494
Adjusted R-Squared	0.36	0.13	0.27	0.29	0.25	0.25	0.26	0.26

NOTES: This pooled OLS regression estimates exhibit provides the estimates for four different regressions for AEs and EMDEs samples: (i) $cds_{i,t} = \alpha + \beta_{ESG} ESG\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + \varepsilon_{i,t}$; (ii) $cds_{i,t} = \alpha + \beta_{E} E\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + \varepsilon_{i,t}$; (iii) $cds_{i,t} = \alpha + \beta_{S} S\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + \varepsilon_{i,t}$; and (iv) $cds_{i,t} = \alpha + \beta_{G} G\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + \varepsilon_{i,t}$ Standard errors are in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% level of confidence, respectively.
The AE sample is composed of Australia, Austria, Belgium, Canada, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Malta, Netherlands, New Zealand, Norway, Portugal, Singapore, Slovak Republic, Slovenia, Sweden, Switzerland, United Kingdom, and United States. The EMDE sample is composed of Angola, Argentina, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Croatia, Dominican Republic, Egypt, Ghana, Hungary, India, Indonesia, Jordan, Kuwait, Malaysia, Mexico, Morocco, Panama, Peru, Philippines, Poland, Qatar, Romania, Russia, Saudi Arabia, Serbia, South Africa, Sri Lanka, Thailand, Turkey, Ukraine, Uruguay, Venezuela, and Vietnam.

SOURCE: Beyond Ratings.

EXHIBIT A6

Panel Regression Estimates for Investment Grade vs. High Yield, Q1 2010–Q4 2022

	Investment-Grade Sample				High-Yield Sample			
α	4.252**	1.835*	5.371***	3.389***	11.367***	6.830***	4.229***	8.131***
	(1.788)	(1.080)	(0.886)	(1.052)	(2.020)	(2.510)	(0.792)	(0.631)
β_{ESG}	–0.001				–0.122***			
	(0.027)				(0.003)			
β_{E}		0.038**				–0.021		
		(0.017)				(0.044)		
β_{S}			–0.018				–0.034*	
			(0.014)				(0.019)	
β_{G}				–0.012				–0.060***
				(0.015)				(0.015)
β_{GDP}	–0.031**	–0.031**	–0.031**	–0.031**	–0.016***	–0.015**	–0.014**	–0.021**
	(0.013)	(0.013)	(0.013)	(0.013)	(0.006)	(0.006)	(0.006)	(0.002)
β_{CPI}	0.013*	0.015**	0.014*	0.013	0.006	0.011	0.013**	0.011***
	(0.007)	(0.007)	(0.008)	(0.007)	(0.005)	(0.007)	(0.006)	(0.002)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	2,510	2,510	2,510	2,510	470	470	470	470
R-Squared	0.08	0.09	0.09	0.08	0.16	0.08	0.09	0.23

NOTES: This panel regression estimates exhibit provides the estimates for four different regressions for IG and HY samples: (i) $cds_{i,t} = \alpha + \beta_{ESG} ESG\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + {}_{i} + \lambda_t + \varepsilon_{i,t}$; (ii) $cds_{i,t} = \alpha + \beta_{E} E\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + {}_{i} + \lambda_t + \varepsilon_{i,t}$; (iii) $cds_{i,t} = \alpha + \beta_{S} S\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + {}_{i} + \lambda_t + \varepsilon_{i,t}$; and (iv) $cds_{i,t} = \alpha + \beta_{G} G\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + {}_{i} + \lambda_t + \varepsilon_{i,t}$ Standard errors are in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% level of confidence, respectively.
The IG sample is composed of Australia, Austria, Belgium, Bulgaria, Canada, Chile, China, Colombia, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Korea, Kuwait, Latvia, Lithuania, Mexico, Morocco, Netherlands, New Zealand, Norway, Panama, Peru, Philippines, Portugal, Qatar, Romania, Russia, Serbia, Singapore, Slovak Republic, Slovenia, Sweden, Switzerland, Thailand, United Kingdom, United States, and Uruguay.
The HY sample is composed of Angola, Argentina, Brazil, Costa Rica, Dominican Republic, Egypt, Ghana, Greece, Jordan, South Africa, Sri Lanka, Turkey, Ukraine, and Vietnam.

SOURCE: Beyond Ratings.

EXHIBIT A7

Panel Regression Estimates for FTSE WGBI and FTSE EGBI, Q1 2010–Q4 2022

	FTSE WGBI Sample				FTSE EGBI Sample			
α	0.513	–1.132	3.085*	1.975	14.317***	3.331	9.797***	0.775
	(3.470)	(3.396)	(1.638)	(2.617)	(4.256)	(5.612)	(1.588)	(2.875)
β_{ESG}	0.044				–0.145**			
	(0.048)				(0.056)			
β_{E}		–0.016				0.106		
		(0.024)				(0.088)		
β_{S}			0.009				–0.086***	
			(0.022)				(0.021)	
β_{G}				0.021				0.049
				(0.032)				(0.033)
β_{GDP}	–0.041***	–0.029**	–0.042***	–0.041***	–0.035***	–0.038***	–0.037***	–0.039***
	(0.014)	(0.013)	(0.014)	(0.014)	(0.010)	(0.011)	(0.010)	(0.011)
β_{CPI}	0.028	–0.047***	0.021	0.029	0.055***	0.041*	0.060***	0.034
	(0.020)	(0.018)	(0.021)	(0.018)	(0.020)	(0.023)	(0.020)	(0.023)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	1,159	1,159	1,159	1,159	416	416	416	416
R-Squared	0.11	0.18	0.10	0.10	0.16	0.13	0.25	0.13

NOTES: This panel regression estimates exhibit provides the estimates for four different regressions for FTSE WGBI and FTSE EGBI samples: (i) $cds_{i,t} = \alpha + \beta_{ESG}ESG\ Score_{i,t} + \beta_{GDP}GDP\ Growth\ Rate_{i,t} + \beta_{CPI}CPI\ Inflation\ Rate_{i,t} + {}_{i} + \lambda_{t} + \varepsilon_{i,t}$; (ii) $cds_{i,t} = \alpha + \beta_{E}E\ Score_{i,t} + \beta_{GDP}GDP\ Growth\ Rate_{i,t} + \beta_{CPI}CPI\ Inflation\ Rate_{i,t} + {}_{i} + \lambda_{t} + \varepsilon_{i,t}$; (iii) $cds_{i,t} = \alpha + \beta_{S}S\ Score_{i,t} + \beta_{GDP}GDP\ Growth\ Rate_{i,t} + \beta_{CPI}CPI\ Inflation\ Rate_{i,t} + {}_{i} + \lambda_{t} + \varepsilon_{i,t}$; and (iv) $cds_{i,t} = \alpha + \beta_{G}G\ Score_{i,t} + \beta_{GDP}GDP\ Growth\ Rate_{i,t} + \beta_{CPI}CPI\ Inflation\ Rate_{i,t} + {}_{i} + \lambda_{t} + \varepsilon_{i,t}$ Standard errors are in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% level of confidence, respectively.
The FTSE WGBI sample is composed of Australia, Austria, Belgium, Canada, China, Denmark, Finland, France, Germany, Ireland, Israel, Italy, Japan, Malaysia, Mexico, Netherlands, New Zealand, Norway, Poland, Singapore, Sweden, United Kingdom, and United States. The FTSE EGBI sample is composed of Austria, Belgium, Finland, France, Germany, Ireland, Italy, and Netherlands.

SOURCE: Beyond Ratings.

EXHIBIT A8

Panel Regression Estimates for FTSE EMGBI and FTSE EMGBI Frontier Markets Subsample, Q1 2010–Q4 2022

	FTSE EMGBI Sample				FTSE EMGBI Frontier Markets Subsample			
α	8.495***	8.207***	6.322***	6.118***	13.869***	2.679	8.402***	9.307***
	(1.225)	(2.946)	(0.684)	(0.722)	(4.378)	(1.959)	(1.238)	(2.090)
β_{ESG}	–0.073***				–0.174*			
	(0.024)				(0.092)			
β_{E}		–0.061				0.049		
		(0.051)				(0.033)		
β_{S}			–0.032**				–0.066**	
			(0.014)				(0.029)	
β_{G}				–0.029*				–0.091*
				(0.015)				(0.051)
β_{GDP}	–0.017	–0.013	–0.017	–0.017	–0.013***	–0.011**	–0.013***	–0.009***
	(0.010)	(0.011)	(0.011)	(0.011)	(0.003)	(0.005)	(0.003)	(0.003)
β_{CPI}	0.020***	0.027***	0.023***	0.019***	–0.001	0.016	0.004	0.006
	(0.004)	(0.004)	(0.004)	(0.005)	(0.009)	(0.010)	(0.008)	(0.008)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	797	797	797	797	300	300	300	300
R-Squared	0.2	0.16	0.20	0.20	0.18	0.07	0.15	0.16

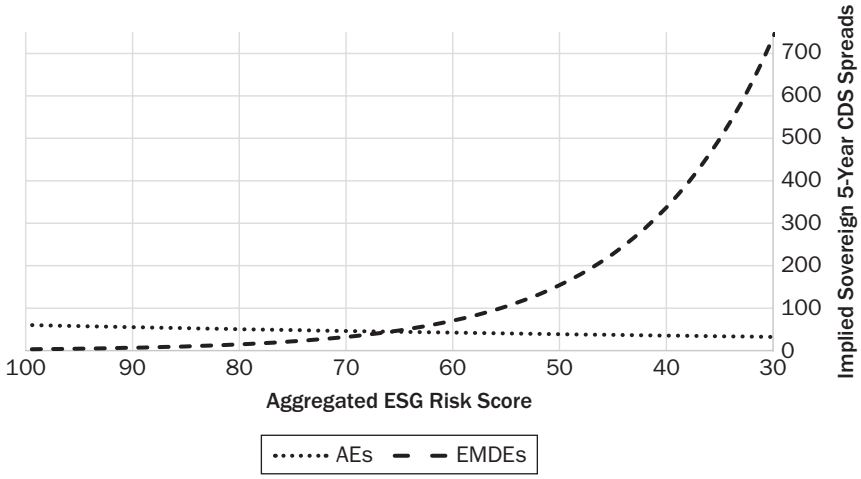
NOTES: This panel regression estimates exhibit provides the estimates for four different regressions for FTSE EMGBI and FTSE EMGBI frontier markets samples: (i) $cds_{i,t} = \alpha + \beta_{ESG} ESG\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + \ _{i} + \lambda_{t} + \varepsilon_{i,t}$; (ii) $cds_{i,t} = \alpha + \beta_{E} E\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + \ _{i} + \lambda_{t} + \varepsilon_{i,t}$; (iii) $cds_{i,t} = \alpha + \beta_{S} S\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + \ _{i} + \lambda_{t} + \varepsilon_{i,t}$; and (iv) $cds_{i,t} = \alpha + \beta_{G} G\ Score_{i,t} + \beta_{GDP} GDP\ Growth\ Rate_{i,t} + \beta_{CPI} CPI\ Inflation\ Rate_{i,t} + \ _{i} + \lambda_{t} + \varepsilon_{i,t}$ Standard errors are in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% level of confidence, respectively.

The FTSE EMGBI sample is composed of Brazil, Chile, China, Colombia, Hungary, Indonesia, Malaysia, Mexico, Peru, Philippines, Poland, Romania, Saudi Arabia, South Africa, Thailand, and Turkey. The FTSE EMGBI frontier markets subsample is composed of Costa Rica, Dominican Republic, Egypt, Ghana, Morocco, Serbia, Sri Lanka, Ukraine, and Vietnam.

SOURCE: Beyond Ratings.

EXHIBIT A9

Implied Sovereign Five-Year CDS Spread Curves as Functions of Aggregated ESG Risk Score, AEs vs. EMDEs, Q1 2020–Q4 2022

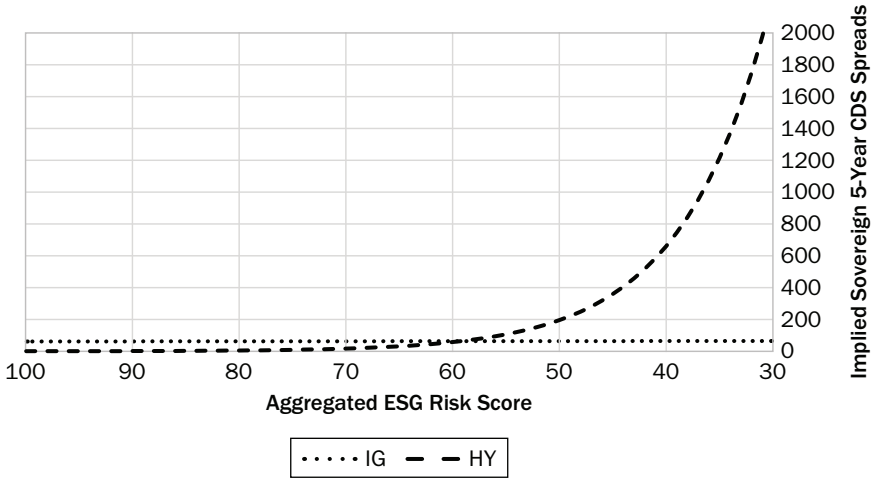


NOTES: The implied sovereign 5Y CDS curves (AEs vs EMDEs) illustrate the main estimates of the regressions in Appendix Exhibit A1. By dichotomising our main sample into AEs vs EMDEs, we show that the relationship between aggregated ESG risk score and sovereign 5Y CDS is only significant for the EMDEs. It clearly demonstrates that the financial materiality of ESG risk is better perceived within the EMDEs than within the AEs.

SOURCE: Beyond Ratings.

EXHIBIT A10

Implied Sovereign Five-Year CDS Spread Curves as Functions of Aggregated ESG Risk Score, IG vs. HY, Q1 2020–Q4 2022



NOTES: The implied sovereign 5Y CDS curves (IG vs HY) illustrate the main estimates of the regressions in Appendix Exhibit A4. By dichotomising our main sample into IG vs HY, we show that the relationship between aggregated ESG risk score and sovereign 5Y CDS is only significant for HY-rated economies. It clearly demonstrates that the financial materiality of ESG risk is better perceived within the HY-rated economies than within the IG-rated economies.

SOURCE: Beyond Ratings.

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