Political Risk, Sustainability and Sovereign Credit:

Pricing High-Frequency Political, Environmental, Social and Governance News

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Abstract

Do environmental, social and governance (ESG) factors affect sovereign credit risk? As E, S, and G factors (e.g., natural and human capital) are critical inputs for long-term growth, they should affect both sovereign ability and willingness to pay. Drawing on a global corpus of more than four billion news articles in sixty-five languages to identify the frequency and tone with which ESG factors are discussed daily, this research note shows that ESG factors affect creditors' assessment of sovereign creditworthiness, even after accounting for political institutions and macroeconomic conditions. By revisiting previous work with a broader scope and more fine-grained data in an error correction model, we advance academic and practical conversations about how creditors formulate and update their expectations of sovereign creditworthiness. This project speaks to larger questions in the literature about the effects of globalization, the importance of extra-financial factors, and the pricing of information in international financial markets.

Introduction

Sustainable finance is on the rise and the COVID-19 pandemic has reinvigorated investors' concerns about extra-financial factors including public health, social inequalities, and climate risk. This drive for sustainable investing has largely manifested in the incorporation of environmental, social, and governance (ESG) factors into corporate bond pricing (Gehricke, Ruan, and Zhang 2023; Barth, Hübel, and Scholz 2022). Attention has more recently shifted to the role of ESG in sovereign finance. Recent evidence from JP Morgan, surveying emerging market investors, finds that two-thirds of participants believe it is their duty to integrate ESG factors into their financial decisions. There is also broad agreement among practitioners that improving performance on ESG factors will lead to lower sovereign credit risk (Gratcheva, Emery, and Wang 2021). Is this simply rhetoric or are E, S, and G factors actually material components of sovereign creditworthiness? The answer stands to shed new light on how and based on what information investors assess governments' likelihood of repayment.

Access to cheap credit is of paramount importance to sovereign governments because it allows them to raise resources without the political repercussions of taxes. In return, in deciding whether to lend and at what rate, creditors assess risk-adjusted returns on sovereigns' ability and willingness to pay. Willingness to pay is unobservable and thus difficult to quantify (Tomz 2007), particularly in the face of investors' information overload and short time horizons. Creditors, therefore, rely on shortcuts to make "good enough decisions" about the likelihood of repayment. A significant body of work in political science has focused on political institutions, like democracy, executive constraints, veto players, and rule of law, and how they serve as a heuristic (North and Weingast 1989; Beaulieu, Cox, and Saiegh 2012; Kohlscheen 2010; Staats and Biglaiser 2012). This work emphasizes long-term structural trends in sovereign credit access

and pricing. It also remains distinct from the most recent developments in how sovereign risk is analyzed by the international financial community.

This research note bridges the political economy and finance literatures to focus on how environmental, social, and governance factors affect creditors' assessment of sovereign credit risk in "real-time". We argue that ESG components, including natural and human capital, are critical inputs for long-term growth. The erosion of any component will generate long-term fiscal strain. Our contribution is primarily empirical, demonstrating that daily data on ESG factors as machine-coded from media events influences sovereign bond risk. Our results draw on a corpus of more than four billion news articles in sixty-five languages to identify the frequency and tone with which ESG factors are discussed daily. Pairing these novel ESG measurements with daily bond pricing data using an error correction model, we conclude that ESG factors are important to sovereign creditworthiness. Yet, while the improvement of ESG factors increases creditworthiness in the long term, creditors struggle to price ESG-related news in the short term. They also update primarily on news about social events. By revisiting previous work with a broader scope and more fine-grained data and analysis, we advance academic and practical conversations about how creditors formulate and update their expectations of sovereign risk.

Assessing sovereign creditworthiness

Globalization has heightened governments' abilities to fund current expenditures with debt issued in international capital markets. Governments borrow from a host of creditors, including commercial banks, bondholders, and foreign central banks. Sovereigns' access to and terms of credit are a function of both global capital market conditions (Ballard-Rosa, Mosley, and Wellhausen 2021; Mosley, Paniagua, and Wibbels 2020) and country-specific

characteristics. This is important to governments because cheap credit allows them to raise additional revenues without increasing taxes. Debt can be used to maintain supporters' loyalty or buy the support of the opposition. It can also be used to smooth domestic consumption more generally, which abets the governments' office-seeking motivations (DiGiuseppe and Shea 2015; Ballard-Rosa 2016). Because debt must be repaid, the more the government has to pay to access credit, the larger its debt burden and the more resources the government has to shift towards debt servicing.

In turn, creditors are sensitive to the risk-adjusted returns on the credit that they extend. Their primary objective is to generate an expected return that exceeds the opportunity cost of capital. Given their higher perceived risk of sovereign default or restructuring, governments must pay an interest rate premium to compensate creditors. Creditors calculate the required risk premium by estimating the probability that the debt contract will be honored over various term lengths and the value they will recover if it is not.

Sovereign credit risk, however, is a hard concept to quantify, in part because the likelihood of default is contingent on both observable and unobservable characteristics (Tomz 2007). Creditors must consider a government's "ability" to honor its debts, i.e., whether its macroeconomic fundamentals imply enough resources to make payments. They must also consider a government's "willingness" to pay, i.e., the likelihood that the government is willing to divert resources away from domestic purposes and towards debt servicing. Pleas of poverty do not perfectly correlate with pennilessness and the government's political preferences also matter. As willingness to pay is private information, creditors must rely on indirect indicators to gauge governments' likelihood of repayment. Their beliefs about the government's likelihood of repayment affect the price at which they extend credit.

Creditors hold a wide portfolio of debt instruments, spanning countries and term lengths. However, they are limited by both their short time horizons and their ability to process information. They, therefore, exhibit "bounded rationality" and rely on shortcuts to make "good enough decisions" about the likelihood of repayment (Brooks, Cunha, and Mosley 2015; 2022; Hafner-Burton et al. 2017). Several disparate literatures help to understand the cues on which creditors base their assessment of risk. The synthesis of these works is threefold. First, creditors update their beliefs about sovereign risk as new information is revealed, especially when this information plays against type (Tomz 2007). Second, creditors are sensitive to both long-term trends and short-term events. Third, creditors must economize the collection and evaluation of information (Mosley, Paniagua, and Wibbels 2020) and thus cannot respond uniformly to all cues.

In political science, much of this work has centered on political institutions as a heuristic. For example, whether because of executive constraints, veto players, or a strong rule of law, democratic institutions serve as a credible signal and are rewarded with a lower cost of borrowing (Beaulieu, Cox, and Saiegh 2012; 2012; Kohlscheen 2010; North and Weingast 1989; Staats and Biglaiser 2012). However, a subset of recent work finds that the "democratic advantage" is not foolproof; not all democratic leaders have incentives to repay (DiGiuseppe and Shea 2015; Mamone 2020). Financial institutions (Bodea and Hicks 2015) and their transparency (Copelovitch, Gandrud, and Hallerberg 2018) act as a similar heuristic. Elections (Block and Vaaler 2004) and government partisanship (Barta and Johnston 2018; Brooks, Cunha, and Mosley 2022) also cause creditors to update their perception of political risk, particularly in developing countries.

Yet, structural trends like political institutions are not the only factor that may alter a country's ability or willingness to pay back creditors. While they focus on many of the same

variables, the political science literature has remained distant from the international finance literature, which emphasizes shorter-term changes in how macroeconomic and financial data affect a government's likelihood of repayment. One of the more nascent literatures in international finance focuses on environmental, social and governance factors (ESG), compiled into indices or sub-indices, and their impact on sovereign credit risk. Still another body of work explores real-time analysis of political factors using media events. We integrate these streams of research and use them to productively nuance conversations about sovereign debt in political science.

The role of ESG

Sustainable investment has shifted from a niche industry to a part of mainstream finance. In the past decade, the financial community has paid greater attention to analyzing extra-financial factors, arguing that a wide range of historically omitted ESG factors should be incorporated within financial analysis. They have paid particular attention to how environmental (e.g., water access, biodiversity, climate risk), social (e.g. inequality, public health), and governance (e.g. corruption, legal structure) factors are linked to long-term financial outcomes.

Underpinning the analysis of ESG factors on sovereign credit risk is the mechanism of long-term fiscal strain caused by erosion of natural or human capital or weak governance of the economic and political system which are critical inputs into long-term growth. In other words, ESG factors harbor additional information not contained in macro variables. The finance literature has largely focused on the ability to pay and the political science literature has largely focused on the willingness to pay as defined by political preferences for distribution. In reality, ability and willingness encompass wider considerations about long-run economic growth and sustainability as well as their determinants. For this reason, evidence suggests that the majority of emerging

market investors are already using E, S and G factors as inputs to their investment decisions (Gratcheva, Emery, and Wang 2021). Individual investment groups, like JP Morgan and BlackRock, have also developed their own white papers on the subject and designed their own ESG scores (He and Wu 2022) . According to one industry publication, focusing soley on political, economic and financial considerations "…is not enough…investors must consider ESG factors to obtain a more complete picture of a country's risk profile" (Reznick and Viehs 2019). While there is certainly heterogeneity in investors' incorporation of ESG, it remains a hot topic in investment circles and herd mentality implies that because bondholders care about relative performance, they have incentives to follow others incorporating ESG (Zeckhauser, Patel, and Hendricks 1991).

Following practitioners' attention, academic research has tried to quantify how much and to what extent investors have followed through on their pro-sustainability rhetoric. The first analysis of ESG and sovereign risk was undertaken by Crifo et al. (2017), who demonstrated that the country ESG rating, compiled by the company Vigeo was negatively associated with credit risk in a model that already controlled for traditional economic, fiscal and governance factors. Capelle-Blancard et al. (2019) built on this initial finding by constructing their own transparent ESG index and extending the temporal sample. Their measure relies on World Bank-reported data at the country-level. Rahman et al. (2021) find a similar overall and disaggregated set of results using a proprietary index constructed by the investment management firm PIMCO covering more than 100 countries from 2006-18. Ten Bosch et al. (2022) use the Sachs et al. (2020) measure of national performance on the Sustainable Development Goals (SDG) and also find support for a negative correlation between sustainability performance and credit default swap spreads.

In an extension to the base correlations reported above, a number of analyses explore various contingencies and alternative dependent variables. For example, in an analysis of 33

emerging markets, Margaretic & Pouget (2018) find a negative association between ESG performance and credit yields as well as the likelihood of financial crisis. Pineau et al. (2022) show a stronger effect in advanced versus emerging economies. Hübel (2022) finds both that higher ESG performance lowers credit risk and that this effect is larger for longer-term bonds. Martellini & Vallée (2021) and Semet, Roncalli, and Stagnol (2021) both use proprietary data to explore how the relative impact of E, S, and G factors varies by countries' income level.

A final approach has been to focus more deeply on one of the three dimensions, with the environmental pillar being the most commonly explored. Chaudhry et al. (2020) link national carbon emissions both overall and, more strongly, from the electricity, industrial, and transport sectors, to a measure of systemic financial risk in the G7 economies. Work has also demonstrated a correlation between climate vulnerability and bond yields, with the largest implications for the most vulnerable nations and emerging markets (Beirne, Renzhi, and Volz 2021; Cevik and Jalles 2022). Klusak et al. (2021) assess the credit risk rating implications of climate change and predict 63 countries suffering climate-induced downgrades by 2030. The only study to similarly focus on the social (S) dimension finds evidence that inequality and its impact on long-term growth are factored into sovereign bond ratings (Semet, Roncalli, and Stagnol 2021).

One of the biggest challenges to incorporating ESG considerations into assessments of sovereign creditworthiness is data. Creditors expend significant effort in predicting sovereigns' repayment preferences but their ability to assess the riskiness of sovereign investments is complicated by the over-provision of information in a time-constrained environment. The World Bank acknowledges the practical dimensions of this issue saying that "the current data landscape makes it difficult to accurately assess recent performance, consistently compare country performances or construct reliable investment indices" (Gratcheva, Emery, and Wang 2021, 11).

This not only hampers the ability of sovereign investors to incorporate ESG factors, but it also leads to disagreements about what "good" ESG performance looks like. These concerns are echoed by investors themselves. According to JP Morgan, ESG data can be difficult to source. Where it is available, timelines are an issue as most data is only available annually with multi-year publication lags (He and Wu 2022). Because of these challenges, third parties have stepped in to provide ESG indices for the investment community. While these products play an important role, there is no industry standardization. Scores are proprietary, lack transparency, and may not be aligned with specific investors' objectives.

We argue that previous analyses of sovereign credit risk have not captured the full process by which creditors assess risk. Economic, political, social, and environmental indicators are important but slow to change. Sovereign bond markets on the other hand are volatile. Even when political and institutional variables change, financial markets may adapt unevenly (Duyvesteyn, Martens, and Verwijmeren 2016). This implies that creditors are assimilating not just information on *de jure* factors like executive constraints or environmental agreements, but also their *de facto* application. They are also updating their perceptions of risk more quickly than country-year or even country-month observations that have heretofore dominated empirical studies of ESG factors in sovereign credit. Therefore, similar to Benton and Philips (2020), we argue that it isn't just about governments' economic, political, or environmental policies, but also about their revealed commitment to them. For example, while country constitutions may guarantee democratic elections, democratic practices are reaffirmed over time and continued democratic consolidation is rewarded by the bond market (Glaurdić, Lesschaeve, and Vizek 2020). In other words, creditors' assessments of risk update continuously as they assimilate information that either confirms or contradicts their prior judgments (Tomz 2007). This is evident in the movement of international

capital markets around political events and announcements (Luechinger and Moser 2014; Moser and Dreher 2010).

While we seek to broaden the scope of variables that inform creditors' perceptions of sovereign risk, we are not the first to turn to policy events as a way of identifying "real-time" swings in risk premiums. A growing body of research in finance shows that the daily shifts in the sentiment of news coverage related to a country predict shifts in credit default swap spreads (Bedendo, Cathcart, and El-Jahel 2011) or credit yield spreads (Hirsch et al. 2020; Wolfinger et al. 2018) for sovereign bonds. Another line of inquiry explores the impact of announcements from the European Commission (Afonso, Jalles, and Kazemi 2019) or a broader set of political actors. Blanqué et al. (2022) also identify correlations among media-reported themes (e.g., recession or unemployment) identified using natural language parsing routines, which add predictive power to macroeconomic measures in predicting shifts in aggregate US stock price indexes.

Our primary contribution is the empirical fusing of these research streams, which show the importance of ESG factors and real-time data. We integrate broad, long-run, indicators with faster-moving information channels, measuring inputs at an empirical level that mirrors the fluctuation of bond prices. How do creditors know what sovereigns are doing? As the policy events literature above suggests, the media is an important source. In what follows, we rely on the Global Database of Events and Language (GDELT) from the Global Knowledge Graph (GKG). We draw on a corpus of more than four billion news articles in sixty-five languages to identify the frequency and tone with which ESG factors are discussed on a daily level. Pairing daily data on the practice and application of ESG factors to sovereign borrowers with daily trade data on sovereign risk premiums is an important advancement. By revisiting previous work with a broader scope and more fine-grained data, we productively advance academic and practical conversations about how

creditors formulate and update their expectations of sovereign creditworthiness. We note that this mirrors the approach of new private-market tools, which incorporate media event data with long-term structural trends in proprietary algorithms. Using media events data from GDELT allows us to transparently replicate the most sophisticated approaches available in the market.

Data and empirical strategy

We build our dataset at the country-day level. Our sample includes every country that issues sovereign bonds with ten-year maturity for the time period 2015-2020.

Dependent variable

We build on robust literatures in political science and finance and measure sovereign creditworthiness with ten-year sovereign bond spreads, expressed in percentage points. Bond spreads are calculated by subtracting the yield of a ten-year US treasury bond (considered a risk-free investment) from the yield of a ten-year bond issued by a given country. This data comes from Bloomberg and using data from one source ensures that we are not pooling non-comparable bond types. Following the literature, we winsorize the data at the first and 99^{th} percentiles to deal with outliers. We also log transform the data due to heteroskedastic residuals. Finally, we multiply the data by 100 to avoid statistical computing errors for minuscule coefficients. As expected, the data are non-stationary, which our error-correction model, described below, is designed for.

Independent variables

Our independent variable is a daily measure of ESG factors. We build our measure based on dictionary coding of open-source global media. Following existing scholarship (Gertz 2018; Henisz and Mansfield 2019; Parizek and Stephen 2021), we source our media data from the Global Knowledge Graph (GKG) data series of the Global Database of Events Language and Tone

(GDELT) (Leetaru & Schrodt, 2013). GDELT-GKG includes media in 65 languages. Every article is labeled based on sentiment, themes, actors, and locations. This information is sourced from both international and national news, which are translated and then coded using the automated TABARI system (Textual Analysis by Augmented Replacement Instructions) as outlined by Leetaru (2015). Drawing from both domestic and international news decreases the potential for bias. This is particularly true in cases where domestic press may face suppression; the presence of foreign journalists within the nation enhances the probability of accurate reporting (Leetaru 2015).

Drawing on GKG's more than four billion media articles, we aggregated GDELT-GKG data on the frequency of our themes of interest, ESG factors, as well as the average sentiment toward them in individual articles, to the country-day level. We did this using GDELT's pre-programmed 3,700 themes, which include everything from 'scholarships' to 'gender equality.' For example, if there were 400 articles in Ghana on April 3rd, 2018 that talked about the theme of the environment, we recorded that number and calculated the average sentiment, or tone, across them (Leetaru 2015). The GDELT-GKG method establishes tone by evaluating the proportion of words in an article linked with positive sentiment and those linked with negative sentiment, and then computing the disparity between them. Consequently, this allows for the assessment of both the frequency and depth of conversations on overarching subjects like corruption, as well as on more precise topics like air pollution.

An illustration of a GDELT-GKG record can illuminate how the data compilation works. Consider this fictitious record: 1) Date, detailed to the 15-minute slot: August 14, 2021; 3:30pm, 2) News source: BBC, 3) Article title: 'Tech startup develops new sustainable energy solution,' 4) Article URL: www.bbc.com/tech/08-14-21/startup-energy.html, 5) The tone of the piece: 2.1, 6) a compilation of the themes (from the 3,700 themes in the database) that this article addresses:

renewable energy, technology, startup, environmental sustainability, green tech revolution, and 7) The specific entities mentioned in the article, which could encompass individuals, companies, NGOs, and so forth: GreenTech Innovations, Silicon Valley, Dr. Jane Thompson.

We aggregate GKG themes[1] into ESG themes based on the existing typology provided in Baier et al. (2020), who published a dictionary of E, S and G-related words.[2] Our first independent variable is a combined measure of ESG. For each country-day, we multiply the average tone of ESG-related articles by the number of ESG-related articles. This generates a weighted measure of ESG that is standardized by the number of articles reported in each country-day. We then repeat this process for E, S, and G individually to create separate measures. Figure 1 displays the frequency of articles across the entire sample in each category by month. This left graph confirms that the social category has the largest share of articles and the environmental bucket has the smallest share. Figure 1 (right) also reveals that across the entire sample governance-related articles tend to have the most negative tone and environmental articles tend to have the most positive tone, but the mean tone is still negative.

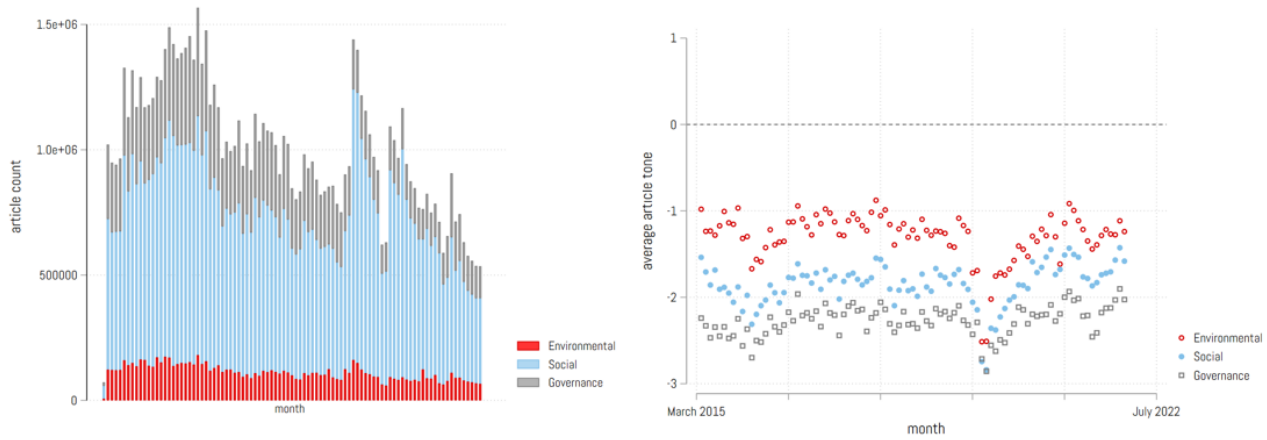

Figure 1. Count of articles under E, S and G themes (left) and average sentiment (right) over time

[1] Baier et al. (2020) provide a ESG world list of 482 items that we hand-match to GDELT-GKG themes. We assign more than one theme to each term, as appropriate. See Appendix B.

[2] We confirm robustness to an alternate ESG typology provided in Vracheva et al. (2016) in Appendix D. The two environmental measures are significantly correlated at 61.1%, the social measures are significantly correlated at 97.3%, and the government measures are significantly correlated at 97.1%.

Control variables

To ensure that additional factors aren't driving the relationship between ESG factors and sovereign credit spreads, we control for a range of economic and political variables. Our empirical approach balances the need to eliminate alternative causal pathways with the need to preserve sample size. Given the importance of domestic macroeconomic and fiscal indicators, we control for the current account balance and GDP per capita. Next, we use Varieties of Democracy (Coppedge et al. 2015) to control for levels of democracy, which have been extensively linked to market risk assessments. Finally, given the demonstrated covariance with bond spreads (Pan and Singleton 2008), we control for the volatility of the S&P 500 using the Chicago Board Options Exchange Volatility Index (VIX). With the exception of VIX, which is daily, the rest of our control variables are at the quarterly or yearly level. In those cases, we carry forward the values to create daily observations. We confirm robustness to additional control variables in the Appendix. We also emphasize that this approach allows us to isolate the effect of "real-time" reporting of de jure ESG conditions, while holding structural elements constant.

Research design

Following the existing literature (Copelovitch, Gandrud, and Hallerberg 2018; Brooks, Cunha, and Mosley 2015), our primary modeling strategy is to employ error-correction models (ECMs). The idea behind an ECM model is that while two variables might be in equilibrium over a long time period, they might deviate from each other in the short term (Clarke, Stewart, and Whiteley 1998). There are several reasons to employ ECMs to study sovereign bond spreads. First, ECMs are excellent at modeling dynamic behavior: they estimate the rate at which a variable returns to equilibrium after a change, which is useful for modeling short-term versus long-term fluctuations (Box-Steffensmeier et al. 2014). Second, ECMs are useful for dealing with both

stationary and co-integrated data (De Boef and Keele 2008), which are features we observe in our data. We specifically use the mean-group estimator of Pesaran and Smith (1995) with the dynamic fixed effects option, which allows for panel-specific intercepts. Finally, due to listwise deletion that dramatically decreases sample size when we include all control variables at once (Wang and Aronow 2023), our main models feature a core group of controls but in the appendix, we add additional controls one at a time.

Results

Our error-correction models provide three coefficients of interest (see **Table 1**). First, our main result shows that the long-term combined measure of ESG (*ESG (combined)*) has a statistically significant and negative impact on ten-year bond spreads. We expected that the long-term coefficient would be negative because as media coverage of ESG issues becomes more prevalent and more positive, we expect risk premiums to fall. In other words, the more positively and frequently the media reports on ESG factors, the less expensive it becomes to borrow capital in the long run. In terms of economic significance, the long-term coefficient of about -.0002 indicates that over the long term ESG will reduce the spread by .99 of a percentage point, which is nearly a fifth of the standard deviation of the non-log-transformed data (5.5). Second, the error-correction coefficient tells us that only 6% of the deviation from the long-term equilibrium is corrected for within the day. Finally, the positive and short-term coefficient for our combined ESG measure (*Δ ESG(combined)*) suggests that ESG news is mispriced by markets in the short run, where the short run is defined as the day.

Table 1: ESG and bond spreads, 2015-2020

VARIABLES	(1)
Error-correction coefficient	-0.0605***
	(0.00174)
ESG combined	-0.000116***
	(2.52e-05)
Δ ESG (combined)	5.99e-06***
	(2.20e-06)
Volatility	1.067***
	(0.184)
Δ Volatility	0.652***
	(0.0460)
Electoral Democracy Index	38.73
	(29.93)
GDP per capita	4.41e-05***
	(5.95e-06)
Current account (% GDP)	2.103***
	(0.646)
Constant	-1.646
	(1.254)
Observations	39,481

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

We confirm robustness in the appendix to an alternative ESG coding typology (**Appendix D**). We also confirm robustness to the inclusion of additional standard control (**Appendix E**). Next, we confirm robustness to the inclusion of a non-standard control variable: a proprietary daily measure of political risk[3] (**Appendix F**). We include this to help rule out the possibility that this is simply a story about political news. Finally, to ensure that this result is not simply a relic of

[3]Our measure of political risk comes from GeoQuant, a company recently acquired by Fitch that develops specialized proprietary high-frequency political risk data. This data yields a particular advantage in that it is available daily and defined according to a taxonomy based on social science scholarship.

high-frequency data, we conduct placebo test using other themes and find no results (**Appendix G**).

We next investigate whether E, S, or G is driving these results. To do so, we include each of our separate E, S and G indicators into a common model. The results are presented graphically in **Figure 2** (tabular results in **Appendix H**). The left-most panel presents the long-run coefficients (*Environmental, Social and Governance*) and the right-most panel presents the short-run coefficients (*Δ Environmental, Δ Social, Δ Governance),* where the short-run is again considered the daily effect. We find that the negative effect of our combined ESG measure on risk premiums is predominantly driven by the "S" factor, though again, it is notably mispriced in the short term. To interpret the magnitude of our findings, the long-term coefficient of -.0001 on the social measure indicates that over the long term ESG will reduce the spread by .99 of a percentage point, which is nearly a fifth of the standard deviation of non-log-transformed data (5.5). The error correction coefficient again suggests that only about six percent of the deviation is corrected for within the day. As above, we confirm robustness to an alternative ESG typology, to inclusion of additional standard controls, and the inclusion of high-frequency political risk data.[4] Notably, neither governance nor environmental factors affect long-run or short-run bond yields.

[4] Results available from authors upon request.

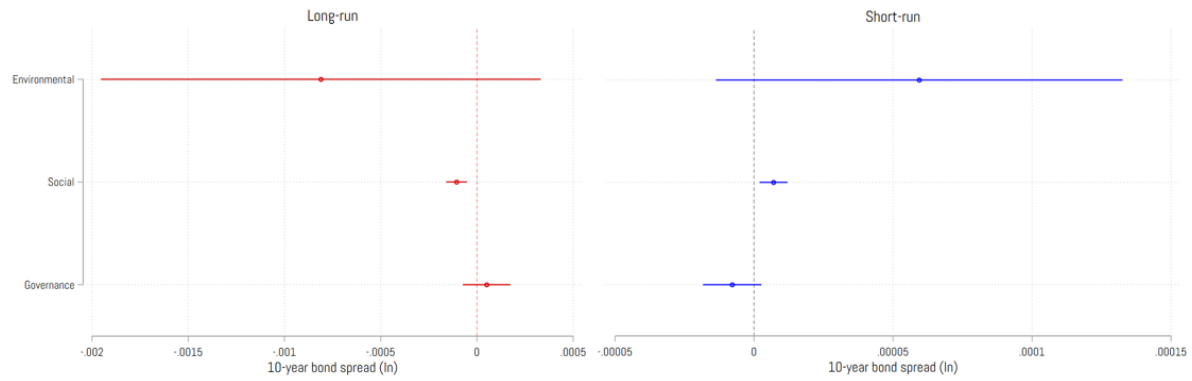

Figure 2. Long-run (left) and short-run (right) coefficient estimates of ESG factors on bond yields, 2015-2020

Discussion and extensions

The contributions of this research note are largely empirical. One of the advantages of an ECM in particular, and a contribution of this paper, is that we can separate short-term deviations from the long-term equilibrium. We consistently find that while more and more positive ESG coverage decreases bond yields in equilibrium, the daily change in information is initially mispriced. While it is beyond the scope of this note to draw definitive conclusions about why ESG coverage is initially mispriced, several possible explanations emerge. First, and least likely, investors may be engaging in arbitrage. Early movers, who are following ESG coverage closely may be making simultaneous transactions to benefit from small movements in price. Second, and more likely, the sustainability movement is still relatively new. The granularity of data that we use in this analysis is also just now beginning to be integrated into professional investment tools. As industry publications suggest, investors have not arrived at a "best" way to incorporate ESG news and most are supplementing quantitative data with qualitative assessments (He and Wu 2022). These types of assessments to "fill the holes" take time, as does making judgments about the general tone or sentiment that a news event conveys. This is also captured in our error correction

term which suggests that the speed with which the market returns to long-run equilibrium is relatively slow.

This second explanation also fits with our disaggregated findings and the emphasis on "S". This is the field in which investors receive the newest information from the media. Governance factors are the component of ESG that has received the most attention to date. The idea that poor governance impacts the willingness of a government to repay its obligations is well established, and of ESG factors, credit rating agencies are most likely to take governance into account ex-ante.[5] On the other hand, environmental and social factors are less well understood. According to the World Bank, data quality on environmental quality is weakest among ESG factors. (Gratcheva, Emery, and Wang 2021). While our approach to data collection attempts to rectify this issue, environmental reporting still makes up a minority of our sample, which suggests that media information may not be the best way to address the data gap in "E". On the other hand, social criteria have also not received significant consideration at the sovereign level (Semet 2020). In part, this is because social factors have historically been the hardest to measure because "the matter of social progress is generally unclear…it encompasses human behavior, social standards and cultural heritage…making its quantifiable measurement limited" (Semet, Roncalli and Stagnol, 2021). However, unlike environmental factors, our media data offers significant coverage in this area. Reporting on issues like public health, human rights, and other social issues is highly prevalent. Therefore, the fact that our findings are driven by the "S" factor is indicative of creditors' updating in areas where there is the "newest" information.

While we encourage scholars to investigate the weighting of E, S and G in future work, we probe our findings further by disaggregating the social category. Our ESG typology further divides

[5] According to Gracheva et al. (2022), 24 of the 100 most mentioned terms in their survey of CRA methodologies relate to governance factors.

the "S" topic into four categories: public health, human rights, labor standards, and society. As such, we coded GDELT themes to match these four categories.[6] We repeat the analysis in four separate models (each including one of the "S" categories). All models also controlled for "E" and "G" news. In **Figure 3,** we plot the coefficient estimates for the long-run (*Society, Public Health, Labor Standards, Human Rights*) on the left and the coefficient estimates for the short-run (*Δ Society, Δ Public Health, Δ Labor Standards, Δ Human Rights*) on the right. We find that the results were driven by the "society" category. Full results are reported in **Appendix G**. Consistent with our previous findings, more and more positive society-related news decreases bond yields in the long run but is mispriced in the short term (the day). Public health also has a significant effect on the long-run equilibrium in the expected direction but the coefficient is considerably smaller.

We go one step further. Our ESG typology includes three sub-categories of "society": charity, education, and employment. We repeat our analyses one more time, estimating separate models for each of these three sub-components. We report the results in **Appendix H**, but emphasize that employment and charity have significant effects in line with previous findings: negative long-term implications for bond yields with short-term mispricing. Employment has nearly double the effect size on charity, which is in line with the existing literature that shows that bond markets react to job data (Jones, Lamont, and Lumsdaine 1998). Our data and data aggregation methods allow scholars to delve into even more specific categories or specific words in the future.

[6] We did not require these four categories to be mutually exclusive. It did not seem meaningful to distinguish between 'labor standards' and 'employment' (a sub-category of society).

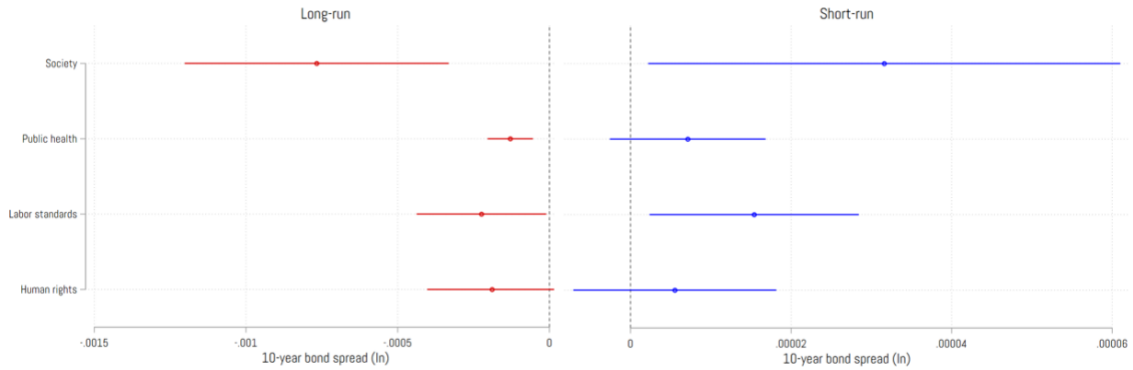

Figure 3. Long-run (left) and short-run (right) coefficient estimates of "S" sub-categories on bond yields, 2015-2020

A final benefit of our approach is that we include all countries that have active 10-year bonds. This expands the cross-sectional sample significantly from previous work; yet prior findings suggest that investors might respond to ESG factors differently in advanced and emerging markets (Pineau, Le, and Estran 2022; Semet, Roncalli, and Stagnol 2021). Therefore, we ask whether certain types of countries are driving the results. We first consider the effect of wealth. We divide the sample into OECD and non-OECD countries and repeat our main analysis with the combined ESG measure. Again, we plot the coefficient estimates for long-run (left) and short-run (right) effects in Figure **4** (full results available in **Appendix I**). We find that this result is being driven by OECD countries. At -0.003, the long-run coefficient for OECD countries is considerably larger than the coefficient in our main specification (-.0002). We also consider the role of regime type. Following the methodologies of the existing literature,[7] we divide the sample into three categories: democracies, anocracies, and autocracies. As the coefficient plots in **Figure 5** show (full results available in **Appendix J**), our result is being driven by democracies.

[7] We divide the sample using the Polity (Marshall and Jaggers 2002) cut-offs of -6 and +6. We confirm robustness to different cut-points as well as alternative measures of regime type. These robustness tests are available from the authors upon request.

While the access and cost of credit are less explored in developed economies, recent experience suggests that they are not immune from financial crises. Our sample begins after the 2008 financial crisis which affected many industrialized nations. As wealthy democracies typically enjoy access to financial markets, it is not surprising that domestic factors, particularly social factors, play an important role in explaining the variation in creditworthiness (Barta and Johnson 2017). These are also the countries that are most likely to be covered by the media and are currently spearheading ESG initiatives.[8] For example, EU policymakers have developed new roles around the EU Taxonomy for sustainable activities and the Sustainable Finance Disclosure Regulation.

Conclusion

Our analyses highlight that recent efforts to incorporate real-time indicators of shifts in a country's ability or willingness to pay creditors can offer important signals as to the long-term credit risk of a country. Notably, through the use of an error correction model, we see that much of this news has a long-term effect on credit yield spreads but less of a short-term effect. The lag in the incorporation of this information may offer substantial arbitrage trading opportunities to creditors and investors in sovereign bonds. Specifically, real-time information on shifts in social issues and in the policy environment in particular, can influence the trajectory of bond yields in the long-term but not be priced on release. While investors are increasingly attuned to the importance of ESG in their financial decisions, there is still significant work that needs to be done to integrate ESG measures in a timely and consistent way.

Turning from the market or financial implications to those for the international political economy, our results add to the growing evidence of the informational content of media events

[8] Although we standardize our ESG measures by country media coverage, it's possible that there is just ESG news on which investors can update for industrialized countries.

and the rapidly accelerating capability to process media event information at scale. Using automated unsupervised coding schemes applied to the open-sourced GDELT-GKG corpus, we find a signal for long-term sovereign bond risk. This signal adds predictive power above and beyond that offered within error correction models and the existing set of fiscal and political variables found to influence creditors' and investors' perceptions of a country's ability and willingness to pay. Investors are paying attention to the media and it does provide new information that is not already "priced in" from other sources.

Many questions in the field beyond the pricing of sovereign credit risk hinge both on an understanding of structural political factors as well as the (strategic) actions of actors within them. Media event data can offer powerful insight into the latter not only in the analysis of sovereign credit risk but inter-state relations including trade policy agreements, international investment and financial policy and security as well as relations between host country actors, intergovernmental organizations, multinational firms, and civil society. Our empirical contribution to this field highlights just one application of how increased data granularity productively nuances existing theoretical and empirical debates.

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APPENDIX

Appendix A: Country List (ISO 3 codes)

AFG	BHR	COL	GAB	IRQ	MDA	NIC	SEN	TUR
AGO	BIH	CPV	GBR	ISL	MDG	NLD	SGP	TWN
ALB	BLR	CRI	GEO	ITA	MEX	NOR	SLE	TZA
ARE	BOL	CYP	GHA	JOR	MLI	NZL	SLV	UGA
ARG	BRA	CZE	GMB	JPN	MLT	PAK	SVK	UKR
ARM	BWA	DEU	GNQ	KEN	MNE	PER	SVN	URY
AUS	CAF	DNK	GRC	KOR	MOZ	POL	SWE	USA
AUT	CAN	DOM	GTM	KWT	MRT	PRT	SYC	UZB
AZE	CHE	ECU	HND	LBN	MUS	PRY	TCD	VEN
BDI	CHL	EGY	HRV	LBR	MWI	QAT	TGO	VNM
BEL	CHN	ESP	HUN	LKA	MYS	ROU	THA	YEM
BEN	CIV	EST	IDN	LSO	NAM	RUS	TJK	ZAF
BGD	CMR	FIN	IND	LVA	NER	RWA	TKM	ZMB
BGR	COD	FRA	IRL	MAR	NGA	SAU	TUN	ZWE

Appendix B: Baier et al. (2020) ESG schema

Topic	Category	Subcategory
Environmental	-	-
Environmental	Climate Change	-
Environmental	Climate Change	Biofuels
Environmental	Climate Change	Climate change strategy
Environmental	Climate Change	Emissions management and reporting
Environmental	Ecosystem Service	-
Environmental	Ecosystem Service	Access to land
Environmental	Ecosystem Service	Biodiversity management
Environmental	Ecosystem Service	Water
Environmental	Environmental Management	-
Environmental	Environmental Management	Pollution control
Environmental	Environmental Management	Waste and recycling
Governance	-	-
Governance	Business Ethics	-
Governance	Business Ethics	Bribery and Corruption
Governance	Business Ethics	Political influence
Governance	Business Ethics	Whistle-blowing system
Governance	Corporate Governance	-
Governance	Corporate Governance	Audit and control
Governance	Corporate Governance	Board Structure
Governance	Corporate Governance	Remuneration
Governance	Corporate Governance	Shareholder rights

Governance	Corporate Governance	Talent
Governance	Corporate Governance	Transparency
Governance	Sustainability Management and Reporting	-
Governance	Sustainability Management and Reporting	Disclosure and reporting
Governance	Sustainability Management and Reporting	Stakeholder engagement
Governance	Sustainability Management and Reporting	UNGC compliance
Social	-	-
Social	Human Rights	-
Social	Human Rights	Community relations
Social	Human Rights	Privacy and free expression
Social	Human Rights	Security
Social	Labor Standards	-
Social	Labor Standards	Diversity
Social	Labor Standards	Health and safety
Social	Labor Standards	ILO core conventions
Social	Labor Standards	Supply chain labor standards
Social	Public Health	-
Social	Public Health	Access to medicine
Social	Public Health	HIV and AIDS
Social	Public Health	Nutrition
Social	Public Health	Product safety
Social	Society	-
Social	Society	Charity
Social	Society	Education
Social	Society	Employment

Appendix C: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Ten-Year Bond Spread (ln)	126097	123.751	130.561	-1611.81	314.461
ESG (combined)	338285	-38782.4	132716.5	-6349524.5	145693.09
Environmental	338306	-1168.537	5949.238	-1090589.8	36069.492
Governance	343798	-21030.756	71941.981	-3021091	64466.328
Social	343843	-44220.609	153813.37	-7614419	177251.77
Current Account (% GDP)	379831	-2.16	7.41	-37.414	39.901
GDP per capita	406126	1982396.9	6836834.9	594.773	52673488
Electoral Democracy Index	417449	.56	.254	.015	.926
Volatility	316230	17.84	7.383	9.14	82.69

Appendix D: ESG combined (Vracheva ESG dictionary vs. Baier et al. ESG dictionary)

VARIABLES	(1)
Error-correction coefficient	-0.0605***
	(0.00174)
ESG (combined)	-0.000178***
	(4.20e-05)
Δ ESG (combined)	1.12e-05***
	(2.84e-06)
Volatility	1.169***
	(0.180)
Δ Volatility	0.647***
	(0.0458)
Electoral Democracy Index	37.41
	(29.82)
GDP per capita	4.48e-05***
	(5.93e-06)
Current account (% GDP)	2.152***
	(0.644)
Constant	-1.728
	(1.249)
Observations	39,660

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix E: ESG combined with additional controls

VARIABLES	(1) External debt	(2) Deficit	(3) Exchange Rate Regime	(4) Financial openness
Error-correction coefficient	-0.0603***	-0.0604***	-0.0530***	-0.0549***
	(0.00188)	(0.00186)	(0.00181)	(0.00188)
Δ ESG (combined)	6.57e-06***	7.22e-06***	6.25e-06***	6.98e-06***
	(2.33e-06)	(2.26e-06)	(2.13e-06)	(2.25e-06)
Δ Volatility	0.761***	0.729***	0.733***	0.738***
	(0.0509)	(0.0499)	(0.0479)	(0.0489)
ESG	-9.85e-05***	-0.000116***	-0.000111***	-0.000124***
	(2.82e-05)	(2.59e-05)	(2.84e-05)	(2.80e-05)
Volatility	1.140***	1.129***	1.082***	1.090***
	(0.195)	(0.196)	(0.209)	(0.204)
Electoral Democracy Index	62.42*	53.44	79.89**	28.13
	(34.70)	(32.99)	(36.47)	(36.53)
GDP per capita	4.21e-05***	3.33e-05***	-1.47e-05	5.55e-05***
	(8.68e-06)	(6.72e-06)	(1.40e-05)	(9.35e-06)
Current Account (% GDP)	3.224***	3.024***	3.116***	2.950***
	(0.796)	(0.787)	(0.835)	(0.840)
External Debt	1.10e-10			
	(7.36e-11)			
Deficit		-0***		
		(0)		
Δ Deficit		0**		
		(0)		
Exchange Rate Regime			-1.822	
			(1.276)	
Δ Exchange Rate Regime			0	
			(0)	
Capital Openness				-125.9***
				(32.37)
Δ Capital Openness				0
				(0)
Constant	-2.438	-1.411	4.633***	1.979
	(1.519)	(1.467)	(1.657)	(1.705)
Observations	33,463	34,112	32,388	32,733

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix F: ESG combined + GeoQuant political risk controls

VARIABLES	(1) ESG & GQ
Error-correction coefficient	-0.0607***
	(0.00175)
ESG (combined)	-1.18e-06***
	(2.29e-06)
GQ Political Risk	5.880
	(2.128)
Δ GQ Political Risk	2.934
	(21.10)
Δ Volatility	0.654***
	(0.0462)
Δ ESG (combined)	6.13e-06***
	(2.21e-06)
Volatility	1.145***
	(0.182)
Electoral Democracy Index	53.46*
	(30.57)
GDP per capita	4.55e-05***
	(5.95e-06)
Current Account (% GDP)	1.813***
	(0.657)
Constant	-19.64***
	(6.787)
Observations	39,305

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix G: Placebo test

We apply our empirical strategy to a context where the effects being studied should not be present, to check if the methodology falsely detects effects even when none should exist. In other words, this placebo test is a way to check for potential spurious relationships or for biases in the empirical strategy. As there is not a perfect placebo, as theoretically, any category of media could affect bond prices, we employ multiple categories of news as placebos:

VARIABLES	(1) Holiday	(2) Sports	(3) Religion	(4) Birds	(5) Languages	(6) Food Staples
Error correction coefficient	-0.0638***	-0.0638***	-0.0638***	-0.0638***	-0.0638***	-0.0638***
	(0.00238)	(0.00237)	(0.00238)	(0.00237)	(0.00237)	(0.00237)
Δ Volatility	1.008***	1.008***	1.008***	1.008***	1.008***	1.008***
	(0.0720)	(0.0720)	(0.0720)	(0.0720)	(0.0720)	(0.0720)
Volatility	1.474***	1.490***	1.490***	1.489***	1.489***	1.489***
	(0.247)	(0.245)	(0.245)	(0.245)	(0.245)	(0.245)
Electoral Democracy Index	235.8***	235.7***	235.7***	235.7***	235.9***	235.4***
	(57.65)	(57.67)	(57.66)	(57.66)	(57.65)	(57.65)
GDP per capita	4.87e-05***	4.90e-05***	4.89e-05***	4.89e-05***	4.90e-05***	4.89e-05***
	(1.03e-05)	(1.03e-05)	(1.03e-05)	(1.03e-05)	(1.03e-05)	(1.03e-05)
Current Account (% GDP)	3.671***	3.677***	3.675***	3.677***	3.669***	3.680***
	(1.115)	(1.116)	(1.115)	(1.115)	(1.115)	(1.115)
Holiday news	-0.00306					
	(0.00631)					
Δ Holiday news	0.000193					
	(0.000357)					
Sports news		-0.0586				
		(0.248)				
Δ Sports news		-0.00707				
		(0.0113)				
Religion news			-0.0656			
			(0.387)			
Δ Religion news			0.0108			
			(0.0191)			
Birds news				-7.038		
				(32.45)		
Δ Birds news				0.286		
				(1.458)		
Languages news					-0.0948	
					(0.176)	
Δ Languages news					0.0105	
					(0.0136)	
Food staples news						-1.589
						(4.666)
Δ Food staples news						-0.0836
						(0.267)
Constant	-12.12***	-12.14***	-12.14***	-12.14***	-12.15***	-12.13***
	(2.465)	(2.465)	(2.465)	(2.465)	(2.465)	(2.465)
Observations	22,009	22,009	22,009	22,009	22,009	22,009

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix H: E, S and G subcomponents,

VARIABLES	(1)
Error-correction coefficient	-0.0606***
	(0.00174)
Δ Environment	5.94e-05
	(3.73e-05)
Δ Social	7.01e-06***
	(2.57e-06)
Δ Government	-7.84e-06
	(5.36e-06)
Δ Volatility	0.651***
	(0.0460)
Environment	-0.000811
	(0.000583)
Social	-0.000106***
	(2.74e-05)
Governance	5.05e-05
	(6.33e-05)
Volatility	1.049***
	(0.189)
Electoral Democracy Index	39.37
	(29.91)
GDP per capita	4.40e-05***
	(5.95e-06)
Current Account (% GDP)	2.097***
	(0.646)
Constant	-1.640
	(1.258)
Observations	39,481

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix G: S categories (Society, Public Health, Labor Rights, Human Rights)

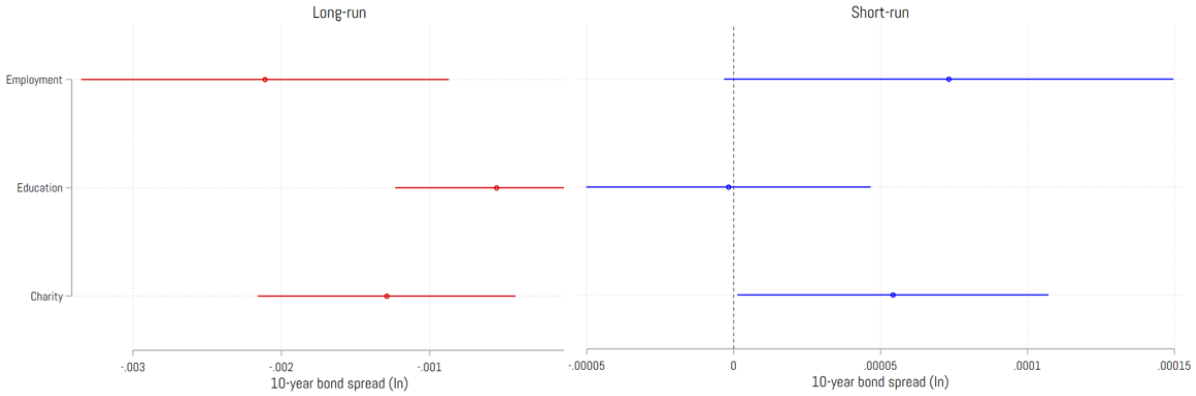
VARIABLES	(1)	(2)	(3)	(4)
Error-correction coefficient	-0.0606***	-0.0604***	-0.0603***	-0.0605***
	(0.00174)	(0.00174)	(0.00174)	(0.00174)
Δ S: Society	3.16e-05**			
	(1.50e-05)			
Δ Environmental	6.35e-05*	7.13e-05*	6.96e-05*	8.02e-05**
	(3.72e-05)	(3.69e-05)	(3.71e-05)	(3.67e-05)
Δ Governance	-3.54e-06	-1.15e-06	-7.11e-06	-1.36e-06
	(4.65e-06)	(4.44e-06)	(5.53e-06)	(5.15e-06)
Δ Volatility	0.650***	0.651***	0.645***	0.646***
	(0.0460)	(0.0461)	(0.0460)	(0.0460)
S: Society	-0.000767***			
	(0.000222)			
Environmental	-0.000845	-0.000975*	-0.00105*	-0.00116**
	(0.000583)	(0.000579)	(0.000584)	(0.000575)
Governance	2.69e-05	-3.98e-05	3.33e-05	1.10e-05
	(6.14e-05)	(5.47e-05)	(7.76e-05)	(7.41e-05)
Volatility	1.100***	1.052***	1.271***	1.242***
	(0.186)	(0.192)	(0.181)	(0.181)
Electoral Democracy Index	36.69	40.01	35.42	38.11
	(29.85)	(30.01)	(30.03)	(29.91)
GDP per capita	4.45e-05***	4.40e-05***	4.51e-05***	4.48e-05***
	(5.93e-06)	(5.97e-06)	(5.97e-06)	(5.95e-06)
Current Account (% GDP)	2.133***	2.085***	2.201***	2.171***
	(0.645)	(0.649)	(0.649)	(0.646)
S: Public health		-0.000129***		
		(3.82e-05)		
Δ S: Public health		7.13e-06		
		(4.95e-06)		
S: Labor standards			-0.000224**	
			(0.000109)	
Δ S: Labor standards			1.54e-05**	
			(6.65e-06)	
S: Human rights				-0.000189*
				(0.000109)
Δ S: Human rights				5.52e-06
				(6.45e-06)
Constant	-1.603	-1.633	-1.810	-1.833
	(1.257)	(1.259)	(1.258)	(1.257)
Observations	39,481	39,481	39,481	39,481

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix H: S sub-categories (Employment, Charity, Education)

VARIABLES	(1)	(2)	(3)
Error-correction coefficient	-0.0607***	-0.0603***	-0.0604***
	(0.00174)	(0.00174)	(0.00174)
Δ Employment	7.32e-05*		
	(3.90e-05)		
Δ Environmental	7.73e-05**	8.10e-05**	7.71e-05**
	(3.67e-05)	(3.68e-05)	(3.67e-05)
Δ Governance	-7.35e-07	1.15e-06	-1.24e-06
	(4.16e-06)	(4.32e-06)	(4.33e-06)
Δ Volatility	0.650***	0.648***	0.645***
	(0.0460)	(0.0460)	(0.0460)
Employment	-0.00211***		
	(0.000632)		
Environmental	-0.00111*	-0.00116**	-0.00113**
	(0.000572)	(0.000577)	(0.000574)
Governance	-3.18e-05	-4.80e-05	-2.90e-05
	(5.51e-05)	(5.69e-05)	(5.60e-05)
Volatility	1.104***	1.186***	1.252***
	(0.186)	(0.186)	(0.181)
Electoral Democracy Index	36.84	36.43	37.45
	(29.88)	(29.99)	(29.99)
GDP per capita	4.46e-05***	4.49e-05***	4.52e-05***
	(5.95e-06)	(5.96e-06)	(5.97e-06)
Current account (% GDP)	2.147***	2.139***	2.148***
	(0.645)	(0.648)	(0.648)
Education		-0.000550	
		(0.000348)	
Δ Education		-1.76e-06	
		(2.47e-05)	
Charity			-0.00129***
			(0.000443)
Δ Charity			5.42e-05**
			(2.70e-05)
Constant	-1.652	-1.690	-1.870
	(1.260)	(1.257)	(1.259)
Observations	39,481	39,481	39,481

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1



Appendix I: OECD vs non-OECD

VARIABLES	(1) OECD	(2) Non-OECD
Error correction coefficient	-0.0682***	-0.0455***
	(0.00353)	(0.00173)
Δ ESG	1.38e-05***	2.09e-06
	(5.08e-06)	(1.66e-06)
Δ Volatility	1.267***	0.252***
	(0.123)	(0.0330)
ESG	-0.000280***	-1.85e-05
	(6.10e-05)	(2.27e-05)
Volatility	1.145**	1.278***
	(0.453)	(0.175)
Electoral Democracy Index	309.3***	72.51**
	(109.7)	(29.84)
GDP per capita	4.08e-05***	-0.000178***
	(8.43e-06)	(4.44e-05)
Current account (%GDP)	2.538	1.192**
	(2.129)	(0.564)
Constant	-33.05***	8.143***
	(6.067)	(0.721)
Observations	11,697	24,957

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix J: Variation by regime type

VARIABLES	(1) Democracy	(2) Anocracy	(3) Autocracy
Error-correction coefficient	-0.0645***	-0.0387***	-0.00906*
	(0.00196)	(0.00411)	(0.00547)
Δ ESG	7.60e-06***	-2.15e-06	-1.25e-06
	(2.69e-06)	(3.31e-06)	(2.37e-06)
Δ Volatility	0.669***	0.442***	0.794***
	(0.0515)	(0.102)	(0.105)
ESG	-0.000129***	2.99e-05	0.000390
	(2.84e-05)	(6.89e-05)	(0.000351)
Volatility	1.018***	2.565***	2.145
	(0.196)	(0.858)	(4.533)
GDP per capita	4.69e-05***	-0.000267**	-0.00684
	(5.89e-06)	(0.000134)	(0.00571)
Current account (% GDP)	1.786**	2.208	-1.674
	(0.745)	(1.950)	(9.595)
Constant	-1.763*	12.61***	3.889
	(1.016)	(4.608)	(3.815)
Observations	33,120	4,725	1,046

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1