Issuing bonds during the Covid-19 pandemic: is there an ESG premium? *

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Abstract

We rely on the ESG ratings assigned by four distinct agencies (MSCI, Refinitiv, Robeco, and Sustainalytics) to study the link between ESG scores and firms' cost of debt financing during the Covid-19 pandemic. We document the existence of a statistically and economically significant ESG premium, i.e. better rated companies access debt at a lower cost. Despite some differences across rating agencies, this result is robust to the inclusion of issuer's credit standing as well as several bond and firms' characteristics. We find that the effect is mainly driven by firms domiciled in advanced economies whereas creditworthiness considerations prevail for firms in emerging markets. Lastly, we show that the lower cost of capital for highly rated ESG firms is explained by both investors' preference towards more sustainable assets and by risk-based considerations unrelated to firms' creditworthiness.

JEL classification: G12, G23, G32, G4

Keywords: ESG scores; Covid-19; bond yield spreads; risk channel; non-pecuniary channel

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1 Introduction

In the early months of 2020, the spread of the Covid-19 pandemic triggered an abrupt reaction in global financial markets with pervasive and unprecedented impacts across geographical regions and asset classes. The most dramatic phase of the financial turbulence occurred between 21 February 2020, when the first lockdown measures were announced in Italy, and the last week of March, when unprecedented central banks' support measures prompted a gradual turnaround in global financial markets. During these weeks, the MSCI world market index dropped by 33%, the VIX index jumped by more than 44 points (reaching a record high value of 82), the global EMBI spread rose by around 370 basis points, the dollar appreciated by almost 3%, and portfolio outflows from funds investing in emerging markets exceeded 80$ billions.[1]

Despite this period of major turmoil and acute economic uncertainty, global bond issuance was extremely abundant, see Figure 1. Notably, the first three quarters of 2020 ranked as those with the largest global debt issuance on record until then, both in terms of proceeds and number of offerings, with a steep acceleration since late March as firms sped up their refinancing process to profit from the easing of global financial conditions and the adoption of massive programs of bond purchases by central banks worldwide (IMF, 2020a). Interestingly, and contrary to similar episodes of market downturn, this surge in bond issuance was not limited to bonds rated A or higher, but also extended to issues with higher credit risk (Halling et al., 2020a).

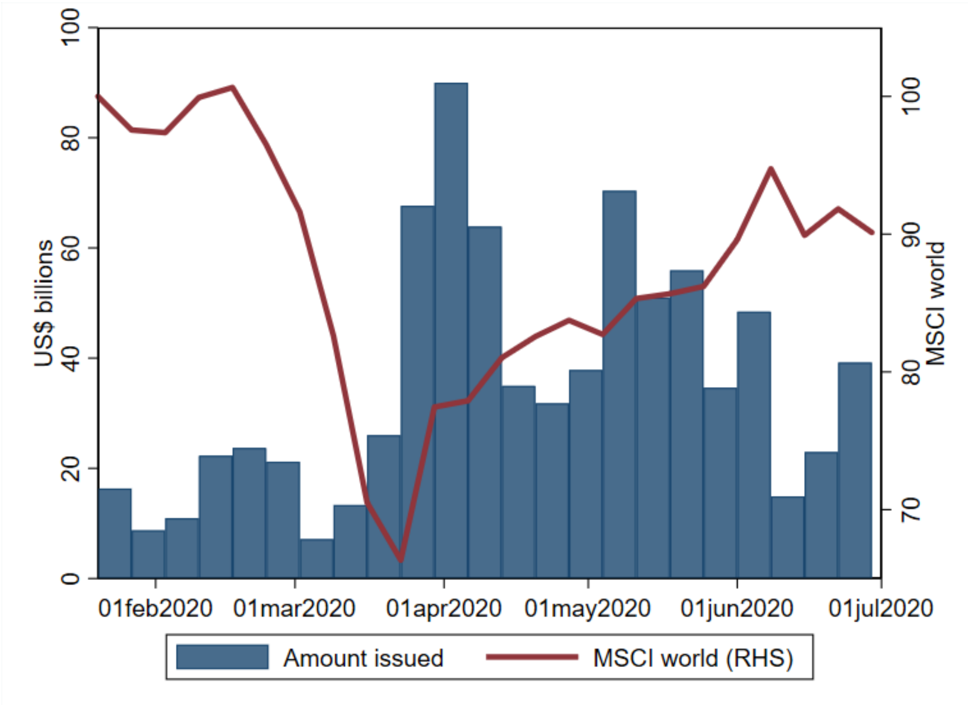
In this paper we focus on bond issuance during the early stages of the Covid-19 pandemic and study whether the environmental, social and governance (ESG) profiles of firms affect their funding costs beyond what could be explained by corporate fundamentals and bond characteristics.[2] This allows us to make inference on the asset-pricing implications of sustainability throughout a period of extreme turbulence as well as during the subsequent phase of market recovery. In general, ESG scores should matter as determinants of firms' funding costs to the extent that they are able to identify some components of intrinsic corporate risk (e.g. firms' exposure to climate risk) or are useful to capture investors' preferences towards more sustainable financial assets. The unexpected and exogenous nature of the shock triggered by the Covid-19 outbreak offers an ideal setting to investigate the interlink between ESG attributes and financial conditions, as the rapid and abrupt reaction observed in financial markets limited firms' ability to respond to the crisis (Albuquerque et al., 2020). In turn, this implies that any relation between ESG scores and cost of funding must necessarily reflect firms' preexisting conditions so that endogeneity concerns related to the joint determination of credit spreads and ESG attributes should be minimized.

We study the primary bond market because it allows a more direct analysis of the corporate

[1] See FSB (2020), Ramelli and Wagner (2020), IMF (2020b), Ding et al. (2021), Gormsen and Koijen (2020), and Ferriani (2021) among many others for some analyses of the pandemic-induced market turmoil.

[2] In the following we will use the terms ratings, score, ranking, profile, attributes as interchangeable.

Figure 1: **Bond issuance and MSCI world dynamics**



Bond issuance and MSCI world index dynamics. The graph displays the weekly amount of bond issuance between the 20th of January and the 30th of June 2020; see Section 3 for details about the bonds included in the sample. MSCI world index data come from Refinitiv and are normalized at 100 on the 20th of January 2020.

funding costs and is less likely to be affected by liquidity issues compared to the secondary bond market. We measure firms' funding costs in terms of asset swap spreads (ASS) and combine these data with the ESG ratings developed by four different data providers: MSCI, Refinitiv, Robeco, and Sustainalytics. With the only exclusion of MSCI, our dataset also allows to dissect the analysis not only at the aggregate level, i.e. in terms of the composite ESG score, but also with respect to the three distinct components of the ESG rating. As discussed in Section 2, previous research has found some disagreement across ESG ratings. Therefore, the availability of multiple scores is essential to exclude that the evidence of an interplay between ESG scores and corporate funding costs is driven by the sustainability assessment made by a particular rating agency.

Our empirical analysis highlights several results of interest. First, we find that the ESG scores are unconditionally correlated with the ASS or, in other words, firms with better ESG attributes achieved lower financing costs during the Covid-19 crisis. When an extensive set of controls related to bond and firms' characteristics is also included in the model, then the negative and statistically significant link between ESG scores and bond risk premia somehow weakens but it is still confirmed for MSCI, Robeco, and Sustainalytics. The impact of the ESG rating, where statistically significant, is nevertheless not negligible in economic terms; for example a one standard deviation increase in the MSCI ESG score is associated with approximately 14 basis point decrease in the ASS, around 7% of the average yield spread at issuance. A similar result is also obtained when multiple ESG scores are combined via principal component analysis (PCA) in order to maximize the informative content across different rating agencies.

Second, we replicate the baseline results but we split the sample to evaluate the relation between ASS and ESG scores with respect to firms' domicile and time phases of the Covid-19 crisis. We find strong evidence of geographical segmentation in the impact of ESG scores when distinguishing observations with respect to firms' nationality. Our estimates point to a more sizable effects for firms domiciled in advanced economies (AEs) rather than in emerging market economies (EMEs), a result possibly driven by differences in investors' tastes for sustainability and in the development of the ESG industry across geographical areas. As a collateral finding, we document that issuer's creditworthiness plays a crucial role in explaining ASS variation for firms domiciled in EMEs. The coefficient of the S&P rating for bonds issued in EMEs is more than twice the corresponding estimate for firms in AEs, with a sizable economic magnitude amounting to more than 100 basis points of lower ASS for a one standard-deviation increase in the issuer's credit rating. Moreover, we find evidence of a structural break in the pricing of ESG factors across the different stages of the Covid-19 crisis, with more sustainable firms achieving lower yield spreads especially during the most acute phase of market crash.

Third, we explore the role of the individual components of the ESG rating, namely the environmental, social, and governance scores, as determinants of the bond yield spreads. As a matter of fact, the composite ESG score signals the attitude of firms towards an extensive list of "sustainable purposes" such as preserving the environment, pursuing energy efficiency, enhancing employee welfare, mitigating controversies with customers and suppliers, sustaining board independence, and strengthening governance mechanisms. To discern the specific contribution of each ESG subcomponents on firms' financing costs we regress the ASS on the three individual scores (E, S, G) assigned by each data provider. In general, our results show a very limited informativeness of the ESG subcomponents when included as distinct regressors in the empirical specifications. Their combination via principal component analysis (PCA) to develop a synthetic composite ESG score nevertheless confirms the negative link between sustainability and bond yield spreads.

Finally, in view of the general evidence pointing to a negative relation between ESG performance and corporate funding costs, we devote the last part of the paper to examine the possible channels shaping the relation between ESG scores and the ASS. Following previous theoretical contributions in this field, we examine the asset-pricing implications of two distinct channels.

The first one accounts for the impact of investors' preference towards sustainability (*non-pecuniary channel*), whereas the second one relates to the ability of more sustainable firms to provide a hedge against climate shocks or unexpected deteriorations in the environmental or the social dimension of corporate activity (*risk-channel*). To the best of our knowledge, this paper is the first to provide some empirical evidence of the interlink between these two channels and bond yield spreads. We proxy the contribution of the first factor using the share of sustainable funds holding the bond issuer's stock and the second factor using both emissions intensity and a measure of exposure to climate change extracted from the earning call transcripts and developed by Sautner et al. (2020). We do not find any of the two channels mutually excluding the other; on the contrary, they both played a role to determine the corporate cost of funding during the Covid-19 pandemic, with an impact of around 32 basis points for the non-pecuniary channel and up to 15 basis points for the risk channel.

Our study contributes to the literature investigating the relationship between firms' sustainability profiles and corporate cost of capital; in this regard we deliver multiple valuable insights and implications by focusing on the primary bond-market during a period of major crisis such as the one induced by the Covid-19 pandemic. First and from the perspective of bond issuers, we show that firms with better ESG profiles are generally able to finance their activity at a lower cost. This result is obtained by observing yield spreads throughout a period of abundant corporate bond issuance combined with elevated market uncertainty and it is robust to the inclusion of several controls, in particular a proxy of corporate credit standing. Second, from a demand perspective, the attention towards sustainable investments is part of a trend that has shaped the financial industry in recent times and has remarkably accelerated since the onset of the Covid-19 pandemic, see for instance ECB (2020), GSIA (2021), and Mohommad and Pugacheva (2022). As a result, an increasing amount of sustainable investments has been included in global portfolios (almost 36% at the end of 2020 according to GSIA, 2021) and financial service providers announced the launch of equity and bond indexes explicitly tracking companies with high ESG profiles.[3] Even more interestingly, ESG considerations and benchmarking have been integrated in the portfolio decisions of central banks (Bernardini et al., 2021) and in their collateral framework for monetary policy operations.[4] We document that this shift in investors' preference is not just a tendency of the industry but it has also important implications in terms of asset pricing, with more sustainable firms benefiting from lower cost of capital. Lastly, from a regulatory and policy perspective, our study also highlights some degree of heterogeneity across rating agencies in the assessment of firms' ESG profiles and this must be necessarily taken into account when analyzing

[3]See for example the launch of the S&P 500 ESG index in 2019, the announcement in 2021 of two Euronext ESG indexes targeting the French and the Italian stock exchanges respectively, and the launch in 2021 of a Citi equity benchmark tracking best-in-class ESG performers across global markets.

[4]See the ECB decisions at https://bit.ly/2WrhBrW and shorturl.at/fhP06.

the relation between ESG scores and the price of financial assets. The availability of multiple ESG scores is an infrequent feature of most of the empirical research in this field, and this makes us confident that the evidence and the conclusions presented in this paper are not flawed by some data limitations. However, the lack of a full agreement across rating providers reinforces the urgency of initiatives to overcome the current inconsistencies in the ESG classifications and deliver a common taxonomy that enhances data comparability and transparency for investors (e.g. Visco, 2019, Kleimeier and Viehs, 2021). Efforts in this regard are likely to accelerate in the near future as policy actions to embrace the ESG paradigm are spreading rapidly, see Regulation 2020/852 establishing the EU taxonomy for sustainable initiatives, the decision of the European Commission to issue around 30% of its Covid-19 recovery program (NextGenerationEU) as green bonds[5] or the recommendation by the European Banking Authority to incorporate ESG considerations in the risk management and capital allocation process of credit institutions.[6]

The remainder of this paper is organized as follows. Section 2 briefly reviews the relevant literature for this study, Section 3 introduces the dataset and presents some descriptive statistics, Section 4 discusses the empirical results, while Section 5 focuses on the two channels affecting the corporate cost of debt. Finally, Section 6 concludes.

2 Literature

Over the last decade we have witnessed a growing body of research investigating the connection between firms' ESG attributes and multiple dimensions of corporate financial performance including but not limited to equity returns, bond yields, access to the credit market, see Friede et al. (2015), Brooks and Oikonomou (2018), Matos (2020), and Gillan et al. (2021) for some comprehensive reviews. As a matter of fact, a large part of the previous empirical studies has focused on the equity market, in particular the US one, it has limited the analysis to a single data provider of ESG ratings, and it has not explicitly investigated the link between sustainability and asset prices throughout periods of financial turbulence (on this last point see Lins et al., 2017 or Albuquerque et al., 2020 for a few exceptions regarding the stock market). On the contrary, we concentrate on the global primary bond market during the Covid-19 crisis and we use multiple data providers to analyze the interlink between corporate sustainability and debt cost of capital. The interest for this topic is at least twofold. First of all, the Covid-19 period was characterized by a drastic, although limited in time, deterioration of firms' liquidity and funding conditions, resulting in a dash-for-cash episode with direct effects on corporate risk premia and access to credit (Acharya and Steffen, 2020 and FSB, 2020). In this regard, the existence of any ESG premium for newly-issued bonds

[5] See a brief summary of the program at https://bit.ly/38i6P9D.
[6] See the details of the EBA announcement at https://bit.ly/2WspFZt.

could deliver important insights for both firms and investors on the extent of corporate resilience throughout a crisis period. Second, the Covid-19 pandemic has been an incredible wake-up call for the importance of sustainability factors (e.g. Mohommad and Pugacheva, 2022) so that it is worth analyzing whether the ESG premium, where existing, has been channeled via investors' preference towards more sustainable financial assets.

In principle, two main motivations have been advanced by the literature to explain why firms chose to embrace ESG objectives and how this choice influences the price of financial assets, see Heinkel et al. (2001), Goss and Roberts (2011), Albuquerque et al. (2019), Pástor et al. (2021) Albuquerque et al. (2020), and Pedersen et al. (2021) for some contributions on the theoretical rationale of ESG investing. On one side, the interest towards firms with high ESG scores could be driven by individuals' intrinsic preference for more sustainable assets; this makes investors willing to acknowledge a premium to highly-rated ESG firms on the basis of non-pecuniary considerations. On the other side, the relation between ESG score and asset returns can be shaped by investors' conviction that ESG factors capture some source of risk that is not fully account for by traditional credit metrics, so that more sustainable assets ultimately deliver better risk-adjusted returns. On this basis, firms could be incentivized to improve their ESG profile as far as it diminishes corporate inherent risk and ensures an increase in the value of corporate assets or a reduction in income volatility. As an example, this may occur because firms with higher ESG scores are less exposed to capital and operational losses associated with a more strict environmental regulation, adverse climate events, strikes, corruption cases. As a result, ESG considerations could deliberately shape the asset allocation decisions of individuals and institutions and have important asset-pricing implications.

As concerns the interaction between ESG scores and firms' cost of debt, previous research has generally documented a lower cost of financing for more sustainable firms in terms of bond yields and credit spreads on loan data, with most of the studies explicitly targeting the US market. Bauer and Hann (2010) provide evidence that firms' credit standing and the yield spreads of newly issued bonds are influenced by the exposure of US firms to environmental concerns. Oikonomou et al. (2014) investigate the impact of several distinct dimensions of sustainability in the primary and secondary US bond market and find lower risk premia and higher credit ratings for firms with less social transgressions. Ge and Liu (2015) present similar evidence also focusing on the US primary market but using aggregate measures of corporate sustainability and adopting an IV approach to mitigate endogeneity concerns between ESG performance and bond yield spreads determination. Goss and Roberts (2011) and Chava (2014) respectively report that corporate social responsibility (CSR)[7] and lack of environmental concerns also matter for corporate

[7]The boundaries and the differences between CSR and ESG are not immediate to outline and are nevertheless beyond the scope of this research; consistently with other contributions in the literature (e.g. Gillan et al., 2021), and

access to bank credit, with better positioned firms achieving lower spreads on their loans. Díaz and Escribano (2021) show that "green" energy firms, identified as those included in the Dow Jones Sustainability Index, benefit of a sustainability premium when issuing bonds as opposed to their "brown" counterparts. Results are partially mixed as concerns the European bond market: Menz (2010) document marginal statistical significance of the connection between CSR and the price of bonds, Stellner et al. (2015) show that sustainable firms are rewarded in terms of rating and yield spreads only to the extent that they operate in a sustainability friendly environment as expressed by the ESG profiles of their corresponding countries, while La Rosa et al. (2018) concentrate only on the social performance score and find that it reduces firms' cost of debt in normal times.

As already mentioned, being the nature of the Covid-19 shock essentially exogenous (Albuquerque et al., 2020), the crisis induced by the pandemic should represent an ideal framework to test the presence of a sustainability premium. The analysis of the connection between ESG factors and the performance of financial assets during the Covid-19 turmoil is rapidly accelerating and extending to several fields. Ferriani and Natoli (2020) and Pástor and Vorsatz (2020) show that investment funds with more sustainable assets attracted a larger amount of net inflows and delivered better returns during the Covid-19 crisis as compared to funds with high ESG risk. Ding et al. (2021) find that the drop in stock returns across 61 countries during the first five months of 2020 was milder for firms with stronger CSR activities prior to the pandemic, emphasizing the role of sustainability as a resilience factor throughout periods of heightened market stress. A similar evidence is also reported by Albuquerque et al. (2020) who expand the analysis to cover return volatility and several measures of operating performance and confirm the superior dynamics of firms with better environmental and social scores in the US equity market. Gianfrate et al. (2021) provide a cross-country and multi-asset study on the resilience of ESG investing during the Covid-19 market crash; they document a complementarity between corporate sustainability and national sustainability as they find that green assets outperformance is limited to countries with relatively lower national environmental capital. Halling et al. (2020b) do not explicitly target the Covid-19 period in their analysis of the bond yields in the primary market. Contrary to us, they do not rely on ESG ratings but on a unique measure of sustainability built by aggregating firms' strengths and concerns over environmental and social attributes using company data available at the end of 2018. Most importantly, and at odds with evidence reported in this study, they do not find that firms with higher sustainability scores benefited from lower bond spreads during the pandemic crisis.

Finally, our paper also relates to the research focusing on ESG score misalignment across different data providers, see Dorfleitner et al. (2015), Berg et al. (2022), Billio et al. (2020), and Gib-

without loss of generality, in this study we consider the two terms as synonyms.

son et al. (2021) for some contributions on this topic. Although we do not deliberately tackle the motivations behind the divergence across various ESG ratings, one major advantage of this study is the availability of several ESG metrics. The simultaneous adoption of multiple ESG scores is designed to avoid that our findings and conclusions are driven by the use of a specific rating agency. This is not a minor issue being the evidence of the interplay between firm performance and ESG attributes somewhat mixed in the literature (Gillan et al., 2021). We generally uncover a very robust evidence of a negative relation between sustainability and corporate cost of debt, but our empirical analysis nevertheless confirms the existence of some disagreement across rating agencies, which is probably more apparent when the sample is broken down with respect to firms' nationality or ESG subcomponents. Hence, our study offers some new evidence in support of academic and policy contributions calling for greater methodological transparency and comparability in the measurement of firms' ESG performance (e.g. Visco, 2019, Boffo and Patalano, 2020, Iosco, 2021, and Kleimeier and Viehs, 2021).

3 Data

We rely on multiple sources to create our dataset. Data on the global issuance of bonds by non-financial firms are obtained from Refinitiv, starting from the 20$^{\text{th}}$ of January 2020 (the date of confirmed human-to-human transmission of Covid-19) to the 30$^{\text{th}}$ of June 2020, covering the most acute phase of the crisis as well as the financial markets recovery of the pandemic-induced losses. For each issuer, we also use Refinitiv to retrieve a wide range of firm characteristics (e.g. total revenues, leverage, dividend yields...); all these data refer to the last available fiscal year. Then, we add information on the composite ESG score at the issuer level, which is obtained from four different data providers: MSCI, Refinitiv, Robeco, and Sustainalytics. MSCI ESG scores are collected from the MSCI website via its ESG ratings corporate search tool, Refinitiv (Asset4) scores are retrieved from Eikon, Robeco ESG scores are obtained from Bloomberg, whereas the Sustainalytics scores are collected from Morningstar. MSCI ESG scores are measured via a 7-step rating scale ranging from CCC (lowest score) to AAA (highest score); the other data providers develop a rating scheme ranging from 0 to 100, with higher values associated with superior ESG standing. For our analysis we consider the last available score at the end of 2019, i.e. the score available to investors immediately before the outburst of the Covid-19 pandemic.[8] In the case of Refinitiv, Robeco, and Sustainalytics we also have access to the three individual scores related to the subcomponents of the ESG valuation, namely the environmental, social, and governance individual

[8]Starting from October 2019 Sustainalytics replaced its ESG sustainability ratings with company-level ESG risk scores measuring the degree to which a company's economic value may be at risk driven by materially relevant ESG factors. To ensure comparability across rating agencies, the Sustainalytics scores refer to September 2019, i.e. the last available score before the adoption of the new ESG methodology.

Table 1: **Descriptive statistics**

	N	Mean	St.Dev.	25p	50p	75p
MSCI ESG	899	4.1	1.6	3.0	4.0	6.0
Refinitiv ESG	1052	64.9	18.1	55.6	69.7	78.0
Robeco ESG	969	52.4	29.1	29.0	54.0	76.0
Sustainalytics ESG	994	62.7	10.7	55.0	63.0	70.0
S&P issuer rating	839	10.3	2.6	9.0	10.0	12.0
Refinitiv E	1052	63.5	23.9	51.3	70.7	81.4
Refinitiv S	1052	67.8	21.6	56.1	74.2	83.3
Refinitiv G	1052	61.1	20.9	46.0	63.6	77.7
Robeco E	969	53.4	28.8	31.0	54.0	78.0
Robeco S	969	51.9	29.2	26.0	52.0	76.0
Robeco G	969	51.4	28.9	27.0	53.0	77.0
Sustainalytics E	915	65.2	13.3	55.0	66.0	76.0
Sustainalytics S	915	61.7	12.6	52.0	61.0	72.0
Sustainalytics G	915	65.4	9.5	59.0	66.0	72.0
Asset swap spread (bps)	1078	214.1	161.4	98.3	179.9	273.0
Tenor (years)	1073	9.7	8.4	5.0	7.0	10.0
Amount issued (US$ millions)	1078	751.0	677.9	200.0	600.0	1000.0
Advanced economy (%)	1078	0.7	0.5	0.0	1.0	1.0
Dividend yield(%)	1003	2.7	1.9	1.3	2.3	3.7
Revenues (US$ billions)	1078	39.0	53.9	6.9	18.6	51.3
Leverage (%)	1078	0.3	0.1	0.2	0.3	0.4
Interest coverage ratio	1063	11.8	18.1	3.7	7.0	12.3
Price to book	1062	3.6	8.7	1.2	2.4	5.1

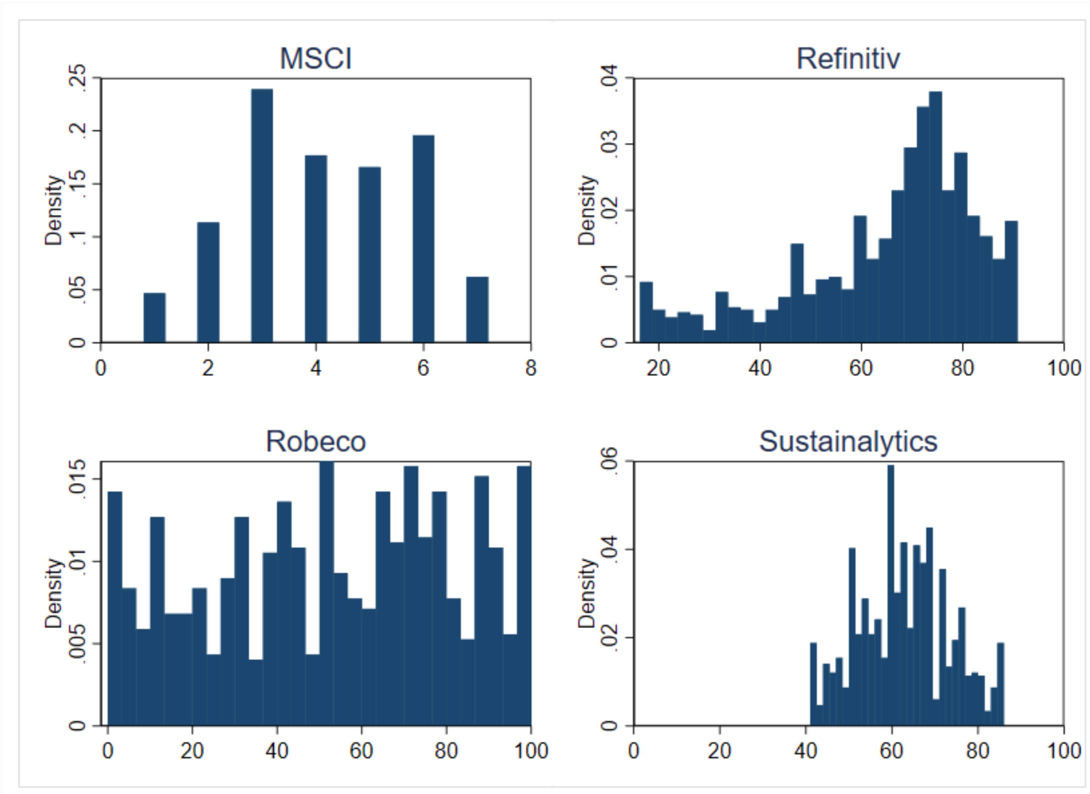
Descriptive statistics for bond issued globally by non-financial corporations between 20th January 2020 and 30th June 2020.

scores; the three dimensions are again assessed on a 0-100 scale with larger values indicating a better standing. Finally, we resort to Bloomberg to obtain data on the S&P long-term rating of the issuer and on the ASS of each bond on its placement day. The ASS represents our measure of firms' cost of debt and is defined as the difference between the bond yield and the yield of an asset swap contract with similar characteristics; the use of the ASS rather than the yield spread computed by resorting to interpolated yield curves of sovereign securities is more appropriate for corporate market instruments and during periods of high volatility, see Zaghini (2016) and Zaghini (2021) on this point.[9]

To minimize the impact of outliers, we winsorize all variables at 1% on both tails; descrip-

[9]Bonds where the ASS is missing are excluded from the sample. The main results of this study are qualitatively similar when considering yield spreads with respect to a benchmark sovereign rate. The S&P long term rating of the issuer is remapped on a 17-step scale based on ratings observed in the sample, from 1 (CCC+) to 17 (AAA).

Figure 2: **ESG score distribution**



Frequency distribution of the ESG composite scores. MSCI rating spans over a 7-step scale, the other scores are defined on a 0-100 scale.

tive statistics on the sample are reported in Table 1. The sample consists of 1078 bonds for which at least one of the four ESG ratings is available; on average, the aggregate ESG score is approximately 4 in the case of MSCI which corresponds to a BBB rating of its 7-step scale, it is almost 65 for Refinitiv and around 63 for Sustainalytics, while it is slightly more than 52 for Robeco. As to the three subcomponents of the ESG scores we observe a very similar pattern, with Refinitiv and Sustainalytics providing comparable average ratings, generally above 60, while the three equivalent scores assigned by Robeco are generally lower and in the range 50-53. The average ASS is approximately equal to 214 basis points and the sample mainly includes long-term bonds, with the average maturity being almost equal to 10 years. The average S&P rating is larger than 10 corresponding to a BBB+ once converted to the proprietary S&P codification, with approximately 90% of rated firms comprised in the investment grade category. Almost 70% of the bonds are issued in advanced economies and the average amount issued is around 750 USD millions.

The distribution of the composite ESG score is displayed in Figure 2. We observe some heterogeneity across rating providers: the distribution exhibits a quite evident negative skewness

Table 2: **Correlation matrix of S&P and ESG ratings**

	S&P	MSCI ESG	Ref. ESG	Rob. ESG	Sust. ESG	Ref. E	Ref. S	Ref. G	Rob. E	Rob. S	Rob. G	Sust. E	Sust. S	Sust. G
S&P	1.00													
MSCI	0.27	1.00												
Refinitiv	0.37	0.40	1.00											
Robeco	0.20	0.38	0.65	1.00										
Sustainalytics	0.23	0.58	0.60	0.63	1.00									
Ref. E	0.36	0.32	0.85	0.65	0.56	1.00								
Ref. S	0.33	0.40	0.91	0.66	0.61	0.75	1.00							
Ref. G	0.17	0.26	0.65	0.23	0.29	0.31	0.39	1.00						
Rob. E	0.20	0.38	0.64	0.95	0.62	0.66	0.66	0.20	1.00					
Rob. S	0.18	0.32	0.62	0.95	0.61	0.62	0.61	0.22	0.89	1.00				
Rob. G	0.16	0.35	0.61	0.94	0.55	0.55	0.62	0.27	0.86	0.86	1.00			
Sust. E	0.15	0.51	0.50	0.54	0.85	0.48	0.55	0.18	0.57	0.51	0.46	1.00		
Sust. S	0.18	0.46	0.50	0.49	0.88	0.49	0.50	0.20	0.48	0.52	0.40	0.56	1.00	
Sust. G	-0.02	0.50	0.45	0.47	0.79	0.34	0.44	0.31	0.46	0.47	0.43	0.56	0.62	1.00

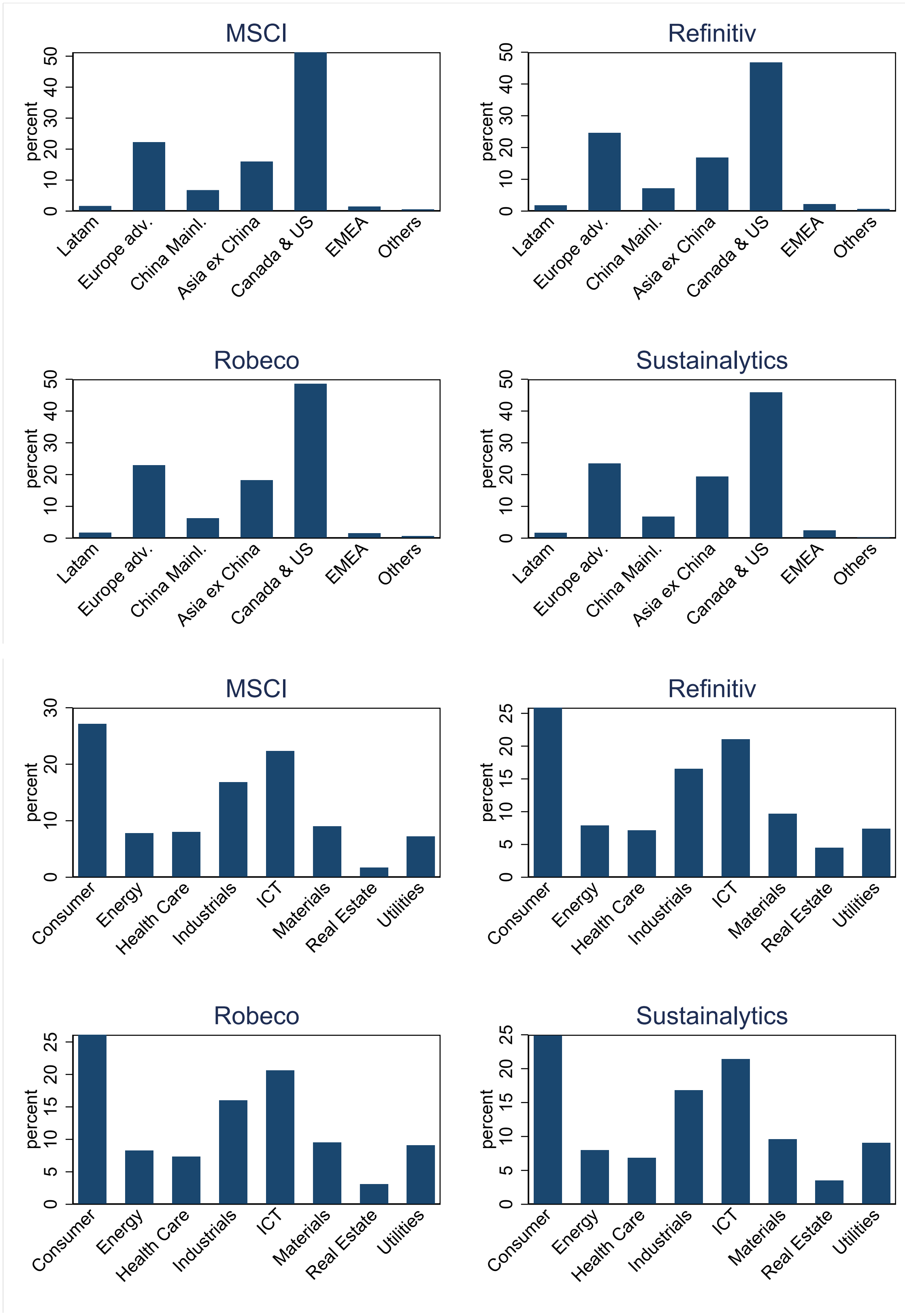
The table displays the correlation matrix of the S&P issuer rating and the ESG scores defined both at the aggregate and the subcomponent level. MSCI ESG rating is only available at the aggregate level.

in the case of Refinitiv where the mode is equal to 74, whereas it is very concentrated for Sustainalytics with a slightly negative skewness and a mode equal to 67. On the contrary, the distribution tends to be somewhat more uniform for Robeco (mode equal to 66) and MSCI where the mode is equal to 3 (BB in the original scale).[10] Table 2 displays the correlation matrix of the S&P issuer rating and the ESG scores at the aggregate as well as at the subcomponent level. As expected the correlation is positive although not extremely high for several pairwise combination, a fact already emphasized in other empirical studies (e.g. Dorfleitner et al., 2015 and Berg et al., 2022). Correlations tend to be higher within each data provider (e.g. Refinitiv ESG composite rating vs. Refinitiv score at the subcomponent level) and across similar dimensions (e.g. Refinitiv E vs. Robeco E vs. Sustainalytics E). The correlation is also quite low between the S&P and the ESG ratings, both with respect to the composite and the subcomponent scores.

Finally, Figure 3 presents the frequency distributions of bonds with respect to issuers' nationality and Global Industry Classification Standard (GICS) sectors. The upper plot shows that a substantial share of issuers is domiciled in advanced economies, especially in United States and Canada with a relative weight generally equal or larger than 50% across all rating providers. Around 20% of the bond issuers are located in European advanced economies, while the remaining observations are generally split between China and other Asian countries. The frequency

[10]The distribution of the scores at the subcomponent level mimics quite closely the one displayed for the aggregate ESG ratings; graphical evidence is available upon request.

Figure 3: **Residence and industrial sector of the issuer**



The upper panel displays the distribution of the issuers' residence across geographical areas, the lower panel presents the distribution of issuers with respect to GICS sectors. Full list of countries included in each geographical area is available upon request; GICS sector "Consumer" include both Consumer Discretionary and Consumer Staples, whereas GICS sector "ICT" include both Information Technology and Communication Services.

distribution of the issuer's industrial sector is very similar across rating providers, with about a fourth or more of the observations belonging to the Consumer sector. Other sectors accounting for a sizable share of the observations are ICT and Industrial; a fraction approximately equal to a third of the sample is distributed across the remaining sectors, namely Energy, Health care, Materials, Real estate, and Utilities.

4 Results

To assess the impact of the ESG scores on firms' cost of debt we estimate pooled regression models of the following forms:

$$\begin{aligned} Spread_{j,i,t} &= ESG\,score_i + Z_{j,i,t} + X_i + \gamma_t + \delta_i + \epsilon_{j,i,t} \\ Spread_{j,i,t} &= E\,score_i + S\,score_i + G\,score_i + Z_{j,i,t} + X_i + \gamma_t + \delta_i + \epsilon_{j,i,t} \end{aligned}$$

where $Spread$ is the (log) asset swap spread of the bond j issued by firm i on its placement day t, $ESG\,score$ is the ESG metrics assigned by one of the four data providers, $E\,score$, $S\,score$, and $G\,score$ are the score of the three subcomponents of the composite ESG rating, $Z_{j,i,t}$ and X_i respectively include a set of bond and firm characteristics, γ_t are time fixed effects controlling for the month of issuance, δ_i are geographical and industrial sector fixed effects, and ϵ is the error term. The first equation is meant to analyze the impact of the composite ESG rating on the ASS, whereas the second equation focuses on the impact of each individual component of the ESG score.

In our first empirical specifications, we limit the set of explanatory variables to the ESG composite rating in addition to industry, geographic, and time fixed effects to account for possible composition effects related to the Covid-19 period. Results are reported in Table 3 where we display standardized coefficients to compare the impact across different ESG metrics. For all rating providers we find evidence of a statistically significant relation between ESG scores and bond yield premia at issuance, with a higher score associated to a lower cost of funding. The effect is also sizable in economic terms: in the case of MSCI, a one standard deviation increase in the aggregate ESG score (approximately equal to a 1.5 rating upgrade on a 7 step scale) generates a 11% decline in the cost of debt at the issuance or alternatively 23 bps with respect to the average asset swap spread. The effect is similar across the remaining rating providers, but smaller in terms of magnitude: in this case a one standard deviation increase in the aggregate ESG score (or equivalently an upgrade by 11-29 points on a 100 scale depending on the provider) reduces the ASS in the range between 13 and 16 basis points.

The relative importance of the aggregate ESG ratings somewhat changes when we augment our baseline specifications with a wide set of controls referred to bond and corporate characteris-

Table 3: Bond spreads and aggregate ESG scores: baseline results

	(1)	(2)	(3)	(4)
MSCI ESG	-0.116***			
	(-4.251)			
Refinitiv ESG		-0.063***		
		(-2.611)		
Robeco ESG			-0.068***	
			(-2.790)	
Sustain. ESG				-0.078***
				(-2.597)
Fixed-effects	Y	Y	Y	Y
N	899	1052	969	994
R^2	0.33	0.26	0.25	0.24

The first line reports standardized coefficients defined as the marginal effect of a one standard deviation increase in each regressor on the log-ASS; t-statistics based on bootstrapped standard errors are displayed between parentheses in the second line. All models include industrial, geographic (geographical macroareas), and time (month of issuance) fixed-effects.

tics, and in particular with a synthetic measure of the issuer's creditworthiness, namely the S&P issuer rating. Estimates are reported in Table 4 where several results are worth emphasizing. First of all, we notice that firm's creditworthiness turns out to be the most important driver of the ASS, with a marginal effect outpacing the one of the ESG score: a one standard deviation increase in the S&P issuer rating (corresponding to about a 2.5 notch upgrade) diminishes the ASS between 65 and 77 basis points on average, depending on the specification. This is not a totally unexpected result as investors are likely to assign a larger weight to indicators of credit risk when pricing new bonds. As a second remark, we notice that the ESG score generally maintains its negative connection with firms' funding costs, however only three out of the four ESG scores preserve their statistical significance, namely MSCI, Robeco, and Sustainalytics. The marginal effect is lower but not negligible in economic terms: it ranges between 4-7% of the average ASS or equivalently between 9 and 14 basis points. These estimates confirm that a better ESG standing was rewarded in terms of lower cost of debt at issuance. This result is particularly interesting as it survives the inclusion of a set of controls, the most notably being issuer's creditworthiness; in turn this suggests that ESG scores have asset-pricing implications and are able to capture some previously unexplained component of corporate cost of funding. Most of the remaining controls do not display a statistically significant results as both the S&P rating and the regression fixed effects are likely to account for most of the heterogeneity in the data; we nevertheless find that firms paying larger dividends and bonds with longer maturities or larger amounts outstanding are generally associated with a higher ASS. Lastly, but not unexpectedly, we notice that the model goodness of

Table 4: Bond spreads and ESG scores: augmented specifications

	(1)	(2)	(3)	(4)
MSCI ESG	-0.070***			
	(-2.858)			
Refinitiv ESG		0.024		
		(0.907)		
Robeco ESG			-0.044**	
			(-2.149)	
Sustain. ESG				-0.060**
				(-2.169)
S&P	-0.362***	-0.436***	-0.449***	-0.434***
	(-15.935)	(-20.545)	(-21.145)	(-19.430)
Firm size	0.002	-0.031	-0.006	-0.030
	(0.063)	(-1.076)	(-0.248)	(-1.188)
Leverage	-0.013	-0.022	-0.041*	-0.049**
	(-0.485)	(-0.971)	(-1.827)	(-2.165)
Dividend	0.052**	0.057***	0.070***	0.063***
	(1.965)	(2.601)	(3.546)	(2.806)
ICR	0.014	0.002	0.000	-0.006
	(0.555)	(0.092)	(0.004)	(-0.239)
PtB	0.004	-0.007	0.001	-0.009
	(0.230)	(-0.497)	(0.075)	(-0.687)
Tenor	0.194***	0.175***	0.171***	0.185***
	(11.944)	(11.062)	(10.688)	(11.847)
Amount issued	0.164***	0.169***	0.150***	0.165***
	(4.763)	(5.612)	(4.648)	(5.161)
Fixed-effects	Y	Y	Y	Y
N	685	743	725	724
R^2	0.60	0.61	0.63	0.61

The first line reports standardized coefficients defined as the marginal effect of a one standard deviation increase in each regressor on the log-ASS; t-statistics based on bootstrapped standard errors are displayed between parentheses in the second line. All models include industrial, geographic, and time fixed-effects. S&P is the long-term rating of the issuer, firm size is the total revenues of the issuer in log terms, leverage is the ratio between issuer's total debt and total assets, ICR is the interest coverage ratio defined as Ebit/Interest expenses, PtB is the price to book value, dividend yield is the ratio between dividend and stock price, tenor is the maturity in years, amount issued is the (log) amount of the bond issuance expressed in USD.

fit achieves a remarkable improvement and increases by around three decimal points across all specifications.

In Table 5 we estimate our augmented specifications but distinguish between firms domiciled in advanced and emerging market economies. To save space we only present the estimates referred to the composite ESG score and S&P issuer rating; the full set of results is available upon

Table 5: Bond spreads and ESG scores: AEs vs EMEs

	AE	EME	AE	EME	AE	EME	AE	EME
MSCI ESG	-0.130***	0.082						
	(-6.151)	(1.135)						
Refinitiv ESG			-0.053**	0.144*				
			(-2.165)	(1.815)				
Robeco ESG					-0.077***	0.036		
					(-3.702)	(0.585)		
Sustain. ESG							-0.127***	-0.015
							(-5.410)	(-0.265)
S&P	-0.267***	-0.721***	-0.383***	-0.650***	-0.360***	-0.730***	-0.352***	-0.693***
	(-12.025)	(-6.300)	(-16.898)	(-6.659)	(-16.569)	(-7.298)	(-14.863)	(-7.373)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Fixed-effects	Y	Y	Y	Y	Y	Y	Y	Y
N	558	127	599	144	575	150	566	158
R^2	0.57	0.77	0.54	0.75	0.56	0.76	0.57	0.75

The first line reports standardized coefficients defined as the marginal effect of a one standard deviation increase in each regressor on the log-ASS; t-statistics based on bootstrapped standard errors are displayed between parentheses in the second line. All models include industrial and time fixed-effects. S&P is the long-term rating of the issuer. Controls include variables to account for firms' size, leverage, ICR, price to book, dividend yield, tenor and amount of the bond issue; see Table 4 for the exact definition of each regressor.

request. Table 5 offers some important insights on the previous findings. For the subsample of firms domiciled in AEs, the impact of the ESG composite score is always negative and statistically significant; moreover, the marginal effect substantially increases, suggesting that the subsample of EMEs firms actually generates some sort of dilution effect of the results obtained on the whole set of observations. The picture for the subsample of bonds issued in EMEs turns out to be quite different: a higher ESG score is generally not supportive of a lower cost of debt. As mentioned in the Introduction, this result could not only reflect differences in terms of firm coverage and rating methodologies but it could suggest that ESG valuations in EMEs are not as common and developed as the ones referred to firms domiciled in AEs, also possibly because of the different level of firms' voluntary disclosure that is crucial for ESG assessment (Ilhan et al., 2021, van der Lugt et al., 2020). Alternatively, and under the assumption of home-investor bias, firms issuing in AEs are more likely to face investors with broader and more complex preferences embracing social responsibility beside standard risk-return considerations; this could also explain the premium in terms of lower ASS for firms domiciled in AEs. As a second remark, it is worth emphasizing the different impact of issuer's creditworthiness across the two subsamples. The S&P coefficient for bonds issued in EMEs is larger than the corresponding estimate for AEs by a factor ranging

Table 6: Bond spreads and ESG scores: crisis vs recovery

	Crisis	Recov.	Crisis	Recov.	Crisis	Recov.	Crisis	Recov.
MSCI ESG	-0.119**	-0.076**						
	(-2.278)	(-2.478)						
Refinitiv ESG			-0.125***	0.049				
			(-2.710)	(1.459)				
Robeco ESG					-0.057	-0.018		
					(-1.299)	(-0.787)		
Sustain. ESG							-0.136***	-0.030
							(-2.821)	(-0.988)
S&P	-0.178***	-0.413***	-0.246***	-0.479***	-0.275***	-0.485***	-0.289***	-0.477***
	(-4.054)	(-16.323)	(-5.161)	(-18.883)	(-6.089)	(-19.417)	(-6.180)	(-18.858)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Fixed-effects	Y	Y	Y	Y	Y	Y	Y	Y
N	185	429	196	464	196	444	195	445
R^2	0.65	0.59	0.65	0.60	0.65	0.62	0.65	0.61

The first line reports standardized coefficients defined as the marginal effect of a one standard deviation increase in each regressor on the log-ASS; t-statistics based on bootstrapped standard errors are displayed between parentheses in the second line. All models include industrial, geographic, and time fixed-effects. S&P is the long-term rating of the issuer. Controls include variables to account for firms' size, leverage, ICR, price to book, dividend yield, tenor and amount of the bond issue; see Table 4 for the exact definition of each regressor. Column "crisis" presents the estimates for bonds issued from the 21st of February to 31st of March 2020, while column "recovery" refers to bonds issued from 1st April until 30th June 2020.

between 1.7-2.7; this amounts to up to around 111 basis points of lower ASS for a one standard deviation increase in S&P in the MSCI and Robeco EME subsample. In other words, geographical differentiation also matters in terms of the relative weight assigned by investors to the corporate credit standing, with a larger penalization for firms domiciled in countries where financial conditions are possibly more fragile, financial markets are less developed, and corporate disclosure less established.

In Table 6 we study the impact of ESG scores on bonds' ASS across different stages of the Covid-19 pandemic and to this purpose we split the sample into two distinct sub-periods. Consistently with other empirical research on the financial impacts of Covid-19 (Ramelli and Wagner, 2020), the first period includes bonds issued since 21 February 2020, when the first lockdown measures were announced in Italy, to the end of March 2020, when the Federal Reserve announced major interventions in the corporate bond market. This period, labeled as crisis in the table, covers the most intense phase of the stock market crash induced by the Covid-19 pandemic.[11] The second

[11]Results, available upon request, are qualitatively similar if the crisis sub-period includes also bonds bond issued between the 20th of January (start of the sample) and the 21st of February.

period, referred to as recovery, encompasses bonds issued from April to June 2020 and it embraces the stage of gradual rebound in global financial markets. Table 6 shows that the ESG attributes are more priced in bond yields during the most acute phase of the crisis, whereas no statistically significant effect is generally found during the recovery phase with the exception of MSCI. Interestingly, and contrary to what is observed for the ESG score, the coefficient of the S&P rating is statistical significant across rating providers and market stages, with its magnitude being always larger during the phase of market recovery. This finding can be possibly attributed to the steep acceleration in bond issuance started at the end of March, as displayed in Figure 1. Following a phase of pervasive market crash hitting indistinctly all categories of financial assets, investors increasingly relied on (more established) external credit assessment to discriminate among firms during a period of abundant bond issuance. Evidence of a structural break in the importance of the ESG factor is not clear-cut in the literature, and the empirical analysis is still preliminary in this regard. As concerns the equity market, Albuquerque et al. (2020) show that environmental and sustainable ratings have grown in importance to explain the differences in cumulative stock returns following the Covid-19 shock, with a sizable increase of their relative loading since late February 2020 before flattening at the end of March. Focusing on the first semester of 2020, Ferriani and Natoli (2020) find that the ESG exposure of mutual funds has been increasingly considered by fund investors during the recovery of financial markets, while Pástor and Vorsatz (2020) show that the Covid-19 pandemic did not result in a structural break of investor sustainability preferences before and after the Covid-19 crisis.[12]

Table 7 simultaneously considers the informative content of the four ESG ratings, which is substantially equivalent to estimate the model on the common set of observations across the four rating providers. To this purpose we first include all ESG ratings in the same specification. Then, and in the same spirit, we also create a synthetic ESG index by extracting the first principal component from composite ESG scores. We consider two possible alternatives for this second approach: one combining all the available scores and one where we exclude one rating agency at a time. The first column of Table 7 displays a negative and statistically significant only for MSCI, with an economic magnitude not dissimilar from the one reported in Table 4. This result must not necessarily be interpreted as a ranking across different ESG metrics and we are not claiming the superiority of a specific rating provider compared to the others, although some previous research pointed out substantial differences across rating agencies in terms of firm coverage and rating use by professional investors (e.g. Eccles and Stroehle, 2018, Hirai and Brady, 2021). As a matter

[12] As a further analysis we investigate the relation between corporate cost of funding and ESG scores across different industrial sectors, but we do not find any clear-cut evidence of sectoral-specific impacts. These results could be related to the limited number of observations available for some industries and to the fact that the across-industry analysis is likely to exacerbate the divergence across ESG ratings because of factors including, but not limited to, firm coverage and methodological assumptions such as industry-specific adjustments. Results are available upon request.

Table 7: Bond spreads and ESG scores: joint inclusion of ESG ratings

	Full s.	Full s.	Full s.	Full s.	Full s.	Full s.
MSCI ESG	-0.078***					
	(-2.623)					
Refinitiv ESG	0.013					
	(0.435)					
Robeco ESG	-0.035					
	(-1.424)					
Sustain. ESG	0.008					
	(0.226)					
PCA all		-0.063**				
		(-2.377)				
PCA ex MSCI			-0.036			
			(-1.471)			
PCA ex Refinitiv				-0.073***		
				(-2.732)		
PCA ex Robeco					-0.056*	
					(-1.959)	
PCA ex Sust.						-0.060**
						(-2.443)
S&P	-0.387***	-0.395***	-0.444***	-0.393***	-0.373***	-0.392***
	(-15.587)	(-16.571)	(-19.846)	(-16.393)	(-15.364)	(-17.586)
Controls	Y	Y	Y	Y	Y	Y
Fixed-effects	Y	Y	Y	Y	Y	Y
N	641	641	683	641	658	664
R^2	0.63	0.62	0.64	0.62	0.60	0.63

The first line reports standardized coefficients defined as the marginal effect of a one standard deviation increase in each regressor on the log-ASS; t-statistics based on bootstrapped standard errors are displayed between parentheses in the second line. All models include industrial, geographic, and time fixed-effects. S&P is the long-term rating of the issuer. Controls include variables to account for firms' size, leverage, ICR, price to book, dividend yield, tenor and amount of the bond issue; see Table 4 for the exact definition of each regressor."PCA all" measures the first principal component from the four composite ESG scores; analogously, "PCA ex MSCI", "PCA ex Refinitiv", "PCA ex Robeco", and "PCA ex Sustainalytics" measure the first principal component from composite ESG scores but excluding one agency at a time.

of fact, the estimates in Table 7 are not necessarily explained by the better informative content of one particular score but could be related to other motivations including, but not limited to, the firm coverage, the specific sample analyzed in this study, the public availability of ratings, the estimating technique. In this regard, the use of PCA is particularly useful as it allows to exploit data variation in our sample without imposing any ex-ante ranking across rating agencies. Rather, in the assessment of the relation between ESG performance and bond yield premia, the PCA allows to maximize the informative content conveyed by different ESG scores. Depending on the specific version of the PCA index, the first principal component explains between 64% and 74% of the variance and is therefore able to capture a substantial amount of heterogeneity in the data. Columns 2-6 generally confirm the negative relation between ESG score and corporate cost

Table 8: Bond spreads and ESG subcomponents scores

	(1)	(2)	(3)	(4)	(5)	(6)
Refinitiv E	-0.007					
	(-0.264)					
Refinitiv S	0.045					
	(1.422)					
Refinitiv G	-0.016					
	(-0.813)					
PCA Ref. subc.		0.013				
		(0.509)				
Robeco E			-0.024			
			(-0.657)			
Robeco S			0.156***			
			(3.376)			
Robeco G			-0.192***			
			(-4.469)			
PCA Rob. subc.				-0.047**		
				(-2.123)		
Sustain. E					-0.139***	
					(-5.057)	
Sustain. S					0.060**	
					(2.053)	
Sustain. G					0.042	
					(1.571)	
PCA Sust. subc						-0.061**
						(-2.495)
S&P	-0.438***	-0.452***	-0.468***	-0.446***	-0.390***	-0.424***
	(-20.201)	(-19.138)	(-22.004)	(-18.471)	(-16.244)	(-18.145)
Controls	Y	Y	Y	Y	Y	Y
Fixed-effects	Y	Y	Y	Y	Y	Y
N	743	743	725	725	694	694
R^2	0.61	0.54	0.65	0.55	0.62	0.55

The first line reports standardized coefficients defined as the marginal effect of a one standard deviation increase in each regressor on the log-ASS; t-statistics based on bootstrapped standard errors are displayed between parentheses in the second line. All models include industrial, geographic, and time fixed-effects. S&P is the long-term rating of the issuer. Controls include variables to account for firms' size, leverage, ICR, price to book, dividend yield, tenor and amount of the bond issue; see Table 4 for the exact definition of each regressor. "PCA Refinitiv subcomponents", "PCA Robeco subcomponents", "PCA Sustainalytics subcomponents" measure the first principal component of the E-, S-, and G- subcomponent scores for each rating agency.

of funding, albeit the synthetic proxy based on the exclusion of the MSCI score is non statistically significant.

Finally, in our last empirical exercise we investigate the relation between the ASS and the ESG rating at the subcomponent level, namely the environmental, social, and governance scores.[13] We re-estimate the model substituting the composite ESG rating with the three individual scores (E, S, G) obtained from each data provider; moreover, we also include a synthetic composite ESG score defined as the first principal component of the E-, S-, and G- individual scores. In general, the estimates reported in Table 8 highlight a limited or almost non-existent informativeness of the ESG subcomponents on the cost of debt at issuance, being regression coefficients not statistically significant in most of the cases. These findings are consistent with other studies showing that better achievements at the subcomponent level do not always result in a superior financial performance, see for example Pástor and Vorsatz (2020) and Ferriani and Natoli (2020) for mutual funds, Broadstock et al. (2021), Ding et al. (2021) for the equity market, and Oikonomou et al. (2014), Ge and Liu (2015), Halling et al. (2020a) for the bond market. Even when statistically significant results emerge, the estimates should be interpreted with extreme caution in view of the very high level of correlation across ESG subcomponents within each rating agency; indeed, this is particularly true for Robeco ratings (correlation >0.85) as displayed by the correlation matrix in Table 2 and confirmed by a post-estimation VIF test. On one side this lack of statistical significance could reveal investors' inclination towards a more comprehensive assessment of firms' ESG profiles; in absence of further analysis we cannot nevertheless rule out the hypothesis that individual ESG dimensions *per se* are not successful in capturing unexplained components of corporate risk or investors' preference for a specific dimension of firms sustainability. However, and possibly more interestingly, we notice that the PCA index obtained from the three individual scores is able to convey an information content very close to the original composite counterpart, i.e. more sustainable firms benefit from lower cost of capital, with an impact that is also statistically significant and economically sizable for Robeco and Sustainalytics.

5 Determinants of the ESG yield premium

In the previous Section, we provide a robust evidence of the negative link between ESG scores and corporate cost of funding. Despite some differences in terms of economical and statistical significance across rating agencies and analysis subsamples, we generally find that better ESG scores are associated with lower ASS, even after controlling for an extensive list of bond and corporate characteristics, including firms' credit rating.

In this Section we extend our investigation to the channels that are likely to inform the relation between ESG scores and bond yields. Our analysis is inspired by previous contributions that outline the rationale behind the asset pricing of the ESG factor, see for example Heinkel et al.

[13] We recall that this classification is not available for MSCI in our dataset.

(2001), Albuquerque et al. (2019), Pástor et al. (2021), Pedersen et al. (2021). Although each study has its own peculiarities in terms of the overall theoretical framework, the literature is generally consistent in identifying the two main drivers of ESG investing. On one side, investors with strong ESG preferences derive utility from holdings assets of more sustainable firms and are willing to pay a premium to include these assets in their portfolio, ultimately lowering firms' cost of capital; we refer to this as the *non-pecuniary channel*. On the other side, firms with better ESG scores are also more likely to offer a hedge against climate shocks or unexpected deteriorations in the regulation concerning the environmental and the social dimension of corporate activity, so that investors require a higher compensation to hold the assets of less sustainable firms; we refer to this driver as the *risk channel*. The fact that sustainability preferences and ESG risk-related considerations are not directly observed partially explains why most of the previous empirical research has analyzed asset-pricing implications by using a comprehensive measure such as the ESG score. In this paper we fill this gap by separately estimating the impact of the non-pecuniary and the risk channel on the ASS; our estimation strategy is based on the use of proxies that should reasonably reflect the two drivers at play.

As concerns the non-pecuniary channel, we rely on Morningstar to retrieve the share of sustainable funds holding the stock of the bond issuer in the quarter immediately before the bond issuance. We consider as sustainable those funds that are assigned a Morningstar's Sustainability rating (the so-called "globes") equal to 4 or 5 on a 1-5 scale, with previous research showing that the globe rating is successful in capturing investors' non-pecuniary motivations (e.g. Hartzmark and Sussman, 2019).[14] We consider firms' equity rather than the corresponding bond issued during the Covid-19 period as the first is a much more liquid category of corporate asset; moreover, newly-issued bonds are likely to be included into mutual funds' portfolios with some delay and this could have some limitations in terms of exogeneity and sample representativeness. Previous literature has provided robust evidence that more sustainable funds are less exposed to flow volatility compared to conventional funds and that non-financial considerations, rather than past financial performance, act as the main driver of investors' flows towards this type of investment vehicles (e.g. Bollen, 2007, Renneboog et al., 2011, Riedl and Smeets, 2017, Bauer et al., 2021, Bialkowski and Starks, 2016). Hence, our proxy should reveal those assets where investors tend to embody their non-pecuniary preferences.

We rely on two different approaches to proxy the risk-channel of ESG investing; both are based on corporate exposure to climate change risks. The first one is based on carbon dioxide emissions: more polluting firms (CO_2) may be exposed to interventions curbing corporate emissions via regulatory acts or via carbon pricing mechanisms such as emissions trading systems

[14]The share is computed with respect to all mutual funds holding the issuer's stock; mutual funds holding the stock but not assigned with a Sustainability score are excluded from the computation.

Table 9: Bond spreads and ESG scores: underlying channels

	(1)	(2)	(3)	(4)
Share sust. funds (%)	-0.146***	-0.146***	-0.160***	-0.157***
	(-3.457)	(-3.482)	(-3.877)	(-3.695)
C02/Total Assets	0.068**			
	(1.967)			
C02/Total Revenues		0.058*		
		(1.759)		
CC expos.			0.067***	
			(2.918)	
CC regul. expos.				0.049**
				(1.966)
CC phys. expos.				-0.018
				(-0.254)
S&P	-0.361***	-0.367***	-0.355***	-0.364***
	(-13.177)	(-12.942)	(-14.140)	(-14.281)
Controls	Y	Y	Y	Y
Fixed-effects	Y	Y	Y	Y
N	642	642	670	670
R^2	0.64	0.64	0.63	0.63

The first line reports standardized coefficients defined as the marginal effect of a one standard deviation increase in each regressors on the log-ASS; t-statistics based on bootstrapped standard errors are displayed between parentheses in the second line. All models include industrial, geographic, and time fixed-effects. S&P is the long-term rating of the issuer. Controls include variables to account for firms' size, leverage, ICR, price to book, dividend yield, tenor and amount of the bond issue; see Table 4 for the exact definition of each regressor. *Share of sustainable funds* is the share of sustainable funds (Morningstar's Sustainability equal to 4 or 5) holding the bond issuer's stock in the quarter immediately before the bond issuance. C02/Total Assets and C02/Total Revenues measure scope 1 emissions over firms' assets and revenues. CC exposure, CC regulatory exposure, CC physical exposure, and CC risk measure firm-level exposure to climate change and its corresponding degree of uncertainty, see Sautner et al. (2020) for the exact definition of each variable.

and carbon taxes. Moreover, highly polluting firms could also be indicative of more conventional business model whose profitability could be impacted by the ongoing ecological transition. Bolton and Kacperczyk (2021) document that investors require a compensation for their exposure to more polluting activities, while Ilhan et al. (2020) show that the cost of protection against adverse shift in climate regulation is larger for firms with more carbon-intense business models. We base our analysis on corporate emissions intensity measured n terms of tons of scope 1 - CO_2 equivalents over firms total assets or firm revenues.[15] The second proxy for the risk-channel

[15] CO_2 emissions can be broken down into three categories: scope 1 emissions are defined as those caused directly by the organization's activities, scope 2 emissions count indirect emissions resulting from the organization's energy consumption, while scope 3 emissions are defined as all other indirect emissions that are a result of the organization's operations but are generated from sources that are not owned or controlled by the organization itself. We focus

takes advantage of the measure of climate change exposure recently developed by Sautner et al. (2020). By applying machine learning techniques to earning calls transcripts, the authors are able to quantify *firm-level* exposure to climate change shocks. In a few words, the exposure to climate change is measured by counting the frequency with which certain climate change bigrams (i.e. pre-specified combination of words) occur in the transcript, scaled by the total number of bigrams in the transcript; we nevertheless refer to the original paper for a more precise description of the methodology. A recent study on the asset-pricing implications of this measure shows that firm-level exposure to climate change is positively correlated with equity risk premium Sautner et al. (2021). In the following we use the measure of climate change exposure referring to the quarter immediately preceding the issuance of each bond; we also complement the analysis with further measures disentangling the overall exposure to climate change into its subcomponents related to regulatory and physical shocks.

As we want to jointly assess the impact of the two channels of ESG investing on corporate cost of funding, we substitute the ESG ratings with the corresponding proxies described in this section; estimates are reported in Table 9. As a first remark, we note that both drivers of investors' preference towards more sustainable assets play a role in the determination of the ASS. The direction of the effect is clearly opposite: on one side firms potentially more exposed to climate change pay a premium on their bond yields, on the other side the premium is lower for those issuers that are able to attract the demand of investors with strong ESG appetite. Also the magnitude of the effect is not totally comparable and is larger for the non-pecuniary dimension: a one standard deviation increase in the share of sustainable funds holding the equity stock of the bond issuer generates a reduction in the ASS up to 32 basis points, whereas the analogous estimate for the risk channel ranges between 12 and 15 basis points. Interestingly, the alternative approaches used to proxy the risk channel delivers very similar point estimates, despite the two measures being only mildly correlated (0.40 for CC exposure and CO_2/Total Assets and 0.54 for CC exposure and CO_2/Total Revenues). Although tempting, it would be pretentious to draw some general conclusions on the dominance of one channel over the other without a lengthy time span. Indeed, as shown in Bolton and Kacperczyk (2021) and Ilhan et al. (2020), the pricing of the carbon factor is not stable and evolves over time; however, our analysis focuses on a period characterized by a substantial surge in media and investors' attention towards sustainability triggered by the Covid-19 pandemic Mohommad and Pugacheva (2022) and this could ultimately put more weight on the non-pecuniary channel of ESG investing. Lastly, we notice that most of the impact of risk channel seems to be driven by the exposure to adverse regulatory shocks such as an unexpected

on scope 1 emissions as they are more directly linked to firm's business and are less exposed to imputation and estimations issues. Data are obtained from Carbon4Finance and refer to the latest available calendar year before 2020.

Table 10: Bond spreads and ESG scores: underlying channels - no polluting sectors

	(1)	(2)	(3)	(4)
Share sust. funds (%)	-0.107**	-0.111**	-0.179***	-0.176***
	(-2.141)	(-2.231)	(-3.665)	(-3.469)
C02/Total Assets	0.075**			
	(2.005)			
C02/Total Revenues		0.066*		
		(1.792)		
CC expos.			0.048***	
			(2.680)	
CC regul. expos.				0.005
				(0.175)
CC phys. expos.				-0.015
				(-0.160)
S&P	-0.375***	-0.378***	-0.342***	-0.339***
	(-10.782)	(-10.931)	(-11.262)	(-10.892)
Controls	Y	Y	Y	Y
Fixed-effects	Y	Y	Y	Y
N	524	524	543	543
R^2	0.61	0.61	0.63	0.63

The first line reports standardized coefficients defined as the marginal effect of a one standard deviation increase in each regressor on the log-ASS; t-statistics based on robust standard errors are displayed between parentheses in the second line. All models include industrial, geographic, and time fixed-effects. S&P is the long-term rating of the issuer. Controls include variables to account for firms' size, leverage, ICR, price to book, dividend yield, tenor and amount of the bond issue, and corporate carbon intensity; see Table 4 for the exact definition of each regressor. *Share of sustainable funds* is the share of sustainable funds (Morningstar's Sustainability equal to 4 or 5) holding the bond issuer's stock in the quarter immediately before the bond issuance. C02/Total Assets and C02/Total Revenues measure scope 1 emissions over firms' assets and revenues. CC exposure, CC regulatory exposure, CC physical exposure, and CC risk measure firm-level exposure to climate change and its corresponding degree of uncertainty, see Sautner et al. (2020) for the exact definition of each variable.

tightening of the environmental regulation rather than a physical threat in line with the evidence in Krueger et al., 2020, Seltzer et al., 2021.

Notwithstanding the inclusion of industry fixed effects in the empirical specification, a possible critique to the results displayed in Table 9 is that our sample also consists of bonds issued by firms in highly polluting sectors. These financial assets could be assimilated to the so called "sin stocks" (Hong and Kacperczyk, 2009) and investors could be tempted to operate a preemptive exclusionary strategy on the basis of ethical considerations. If this is the case, then a proper identification of the two channels of ESG-investing could be altered. In line with the approach of Bolton and Kacperczyk (2021), Table 10 presents the estimates where we exclude the bonds issued by firms in the oil and gas, utilities, and transportation sectors (GIC Industry 2, 65-69, 19, 20 and 23). The coefficients are very similar to the ones based on the whole set of observations suggesting that the impact of the risk channel on the ESG premium is not driven by a divestment effect from more polluting sectors. The unique difference concerns the coefficient of the variable capturing the impact of a regulatory shock linked to climate change which is now insignificant. In turn, this could suggest that investors consider the overall assessment of ESG related risks as a relevant factor to be priced in, while a more narrow proxy explicitly focusing on the adverse shifts in climate regulation is material only for more polluting industries.[16]

6 Conclusions

We study the relation between corporate ESG scores and the yield spreads of bonds issued by global non-financial corporations during the first phase of the Covid-19 crisis. Despite the episode of major turbulence in international financial markets, corporate activity in the primary bond market was substantial as firms strove to alleviate the funding and liquidity strains induced by the pandemic. Our analysis investigates the presence of a sustainability premium to be intended as a lower cost of debt for firms meeting ESG objectives. To this purpose we rely on ESG scores assigned by four distinct rating agencies (MSCI, Definitive, Robeco, and Sustainalytics) and highlight several new results of interest. First, we generally document a negative relation between aggregate ESG scores and debt cost of funding; even when a measure of firm's creditworthiness is explicitly included in the empirical specifications we find that the connection between ESG profiles and bond risk premia is economic meaningful and amounts to up to 14 basis points or approximately 7% of the sample average asset swap spread. Second, we find that the ESG premium is remarkably more sizable for firms domiciled in advanced economies whereas the issuer's creditworthiness is largely regarded as the most critical determinant of corporate cost of capital in emerging market economies. We show that the ESG factor was priced in bond yields especially during the phase of the market crash rather than the recovery stage; moreover, we find that the ESG individual subcomponents *per se* have generally little power to explain the heterogeneity in bond yield spreads. Finally, but not less importantly, we empirically test the theoretical rationale behind the ESG premium and show that both non-pecuniary motivations as well as risk-based considerations explain investors' preference towards more sustainable assets. The findings reported in this paper set the stage for future research avenues including, but not limited to, the impact of the two channels of ESG investing on financial instruments beyond corporate bonds or the analysis of the role played by new categories of investors (e.g. central banks) in the ESG

[16]CC exposure and CC regulatory exposure are positively correlated at 0.58; the lack of significance of the latter in Table 10 could be also driven by methodological aspects that are beyond the scope of this research.

arena. In terms of policy implications, our study underscores how the divergence across ESG ratings should be carefully taken into consideration when studying the impact of ESG scores on the price of financial assets, ultimately supporting the initiatives to rapidly achieve a common and transparent taxonomy of the ESG attributes.

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