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Does ESG Matter for Sovereign Debt Investing?

Our research shows that ESG (environmental, social, and governance) factors are important drivers of sovereign credit spreads and that an ESG-based trading strategy should not detract from investment return potential.

Executive Summary

- Our research shows that ESG (environmental, social, and governance) scores are significant drivers of sovereign credit spreads. Debt issued by countries with high social and governance scores, in particular, tends to have tighter credit spreads.
- The relationship between ESG scores and credit spreads is particularly strong for emerging market countries, where we find evidence of an additional ESG risk premium relative to developed markets.
- We find no evidence that investors are penalized for ESG-aware investment strategies in the form of lower returns.
- Our analysis supports the case for in-depth ESG analysis in the context of an active approach to portfolio management.

INTRODUCTION

ESG has become a hot topic in investment circles. In this paper, we train the ESG lens on sovereign debt, and assess whether environmental, social, and governance factors drive pricing and investment returns of sovereign external debt.

Our major finding is that ESG considerations matter for sovereign bond investing, even after relevant macroeconomic and credit variables are taken into consideration. This is particularly the case for emerging markets, where we find evidence of an additional ESG risk premium relative to developed markets.

By testing an ESG-focused investment strategy, we further examine the hypothesis that ESG could potentially detract from investment returns. We find no evidence over our historical time frame that an ESG-focused investment strategy results in any investment disadvantage. Different data sets and/or other time periods may produce different results.

This study is motivated by well-established findings in the corporate debt space (Barclays) that ESG factors affect a company's cost of borrowing. The general idea is that company practices such as labor rights (social), responsible waste management (environmental), or diversified board membership (governance) affect the underlying credit quality of the issuer, as well as its resilience to shocks.

In principle, similar considerations could be at play for sovereigns, albeit with a different expression. Countries with more stable and representative political systems, higher levels of social inclusion and civil rights, and greater focus on climate change risk mitigation are likely to be more resilient in the medium-term and potentially better credits relative to their less ESG-compliant peers. This would then be reflected in their cost of borrowing or spread levels.

To test the veracity of this hypothesis, we examine historical data on sovereign external bond spreads and assess the following questions:

- Is there a relationship between ESG scores and spreads over and above macroeconomic, financial, and credit factors?
- Are some ESG pillars more important for sovereign spreads than others?
- Do these relationships vary across developed and emerging markets?
- Does an ESG-aware approach to sovereign debt investing penalize returns relative to a more traditional approach?

Our study builds on and reinforces several existing academic findings. These include evidence of poorer ESG scores being associated with wider credit spreads (HSBC, Berg et al., Capell-Blancard) and the absence of any implicit additional cost for investment strategies focused on political risks (MSCI, Robeco). We add to this research by compiling a wide selection of sovereign data alongside our proprietary PIMCO ESG score, while incorporating several robustness checks to isolate the impact of ESG factors over time. Additionally, we create a formal out-of-sample, beta-neutral backtest of an ESG strategy covering a comprehensive set of indicators for E, S, and G.

DATA AND METHODOLOGY

We build a comprehensive dataset of 100 developed and emerging market sovereigns over 2006–2018. Our variables include external credit spreads and prices, country-specific macroeconomic and credit indicators, and global financial market indicator factors. Each sovereign is assigned an ESG score using PIMCO's proprietary ESG scoring model, which comprises three pillars measuring environmental (E), social (S), and governance (G) factors. Examples of underlying variables for each pillar include greenhouse gas emissions and share of fossil fuel and renewables in energy use for E; human capital and gender equality for S; and voice and accountability, control of corruption, and political stability for G.[1] The data runs at an annual rate.

PART 1: THE RELATIONSHIP BETWEEN ESG AND SOVEREIGN SPREADS

For our empirical work we estimate panel OLS (ordinary least squares) regressions of sovereign credit spreads against ESG scores, controlling for regional drivers, emerging market (EM)/developed market (DM) segmentation, changes in global risk aversion, and the effect of country-level financial variables. In addition to considering the overall ESG score as the main ESG variable, we separate the individual E, S, and G pillars to identify which variables are the main driving factors behind any significant relationship, and then determine whether they are equally important.

In order to formally estimate the impact of our variables on spread levels, we specify the following regression, estimating it in a panel across all years together.

$$\ln\left(s_t^i\right) = \boldsymbol{\alpha_t} + \sum_{j=E,S,G} \boldsymbol{\beta_j} z_{j,t-\delta}^i + \sum_{k=Fins} \boldsymbol{\beta_k} X_{k,t-\delta}^i + \sum_{m=Region} \delta_{i,m} \boldsymbol{\beta_{m,t}} + \delta_{i,DM} \boldsymbol{\beta_{DM,t}} + \varepsilon_t^i$$

1 Dataset: Where available, we use five-year CDS spreads from Markit supplemented with fitted external bond spreads at maturities as close as possible to five years. Macroeconomic and credit variables include GDP per capita, financial balance as a percentage of GDP, total government debt as a percentage of GDP, current account balance as a percentage of GDP, and an indicator for developed markets. Sources include PIMCO, Markit, Bloomberg, Haver Analytics, World Bank, World Development Indicators, Yale University, U.S. Energy Information Administration, UN Population Statistics, United Nations Development Program, and the World Economic Forum.

We include factors to capture not only environmental, social, and governance effects, but also a set of financial measures and regional effects, as well as annual intercepts to capture changes in risk aversion across time.

Specifically, in the regression equation above:

- $z^{i}_{j,t-\delta}$ denotes the (normalized) E, S, or G score of security j at time t- δ (for the single-aggregate ESG score analysis these are replaced with the one ESG score).
- ***Region*** takes the following values: Asia, Europe, and Middle East and Africa.
- ***Fins*** takes the following values: GDP per capital (PPP), debt to GDP, financial balance to GDP, and current account to GDP.
- δ_i denotes the lag and takes the values 0, 1, and 2 years.
- $\delta_{i,m}$ is an indicator variable taking the value 1 if the security ***i*** has country of risk in region ***m*** and zero otherwise.
- $\delta_{i,DM}$ indicates whether the security relates to a developed or an emerging market sovereign.

For the analysis of changes in spreads, we use the same specification but with changes in log spreads for the left-hand side and changes in ESG z-scores and changes in financial variables for the right-hand side independent variables.

We start with an analysis of whether absolute ESG scores are associated with credit spreads, and then look at the effect of changes in ESG scores on changes in spreads. Our log specification controls for any rating-based effects given the relative stability of proportional changes in spreads across rating categories, and allows us to reduce the number of right-hand variables.[2] This is of great value in the context of sovereign empirical analysis given the relatively few data points and the sample size issues this creates.

Our baseline specification uses contemporaneous data given the inherent lag (typically one year) in the release of ESG data compared with the other right-hand-side variables (see Exhibit 9 in Appendix 2 for a definition). In order to test this, we run several robustness checks, including varying lag structures, and report the results for zero-lag below. Intuitively, we would expect that for spread levels the lag factor would play a small part, as indicator levels tend to be slow-moving, while for spread changes lags could be more significant, as market pricing responds to the "new" information received with a time delay.

RESULT 1: ESG MATTERS

Our first finding is that ESG matters for the pricing of sovereign risk. Simply looking at the raw data, we find that there does seem to be a relationship between spread levels and ESG score. For example, from the December 2018 data we find that the average option-adjusted spread (OAS) of issuers in the top 20% of ESG scores is 41 basis points (bps) and the average OAS of the bottom 20% is 359 bps. These numbers, however, do not take account of other effects such as differences in financial indicators (e.g., GDP per capita, debt to GDP, region, etc.), which might also be expected to play a role in determining the spread level of sovereign debt. In order to include the effect of these other factors, we carry out the regression described above. Exhibit 1 shows that the resulting beta-to-ESG score is significant at the 95% level and that sovereign ESG scores are significant determinants of the level of sovereign spreads over and above the effect of macroeconomic, credit, regional, and global market variables.[3]

In other words, ESG factors have a direct, independent effect on sovereign spreads and don't necessarily only have an effect via their impact on financial variables. Specifically, on average, countries in the top quintile are expected to have spreads 87% tighter than those in the bottom quintile, all else equal.[4] See Exhibit 2 and note that this relationship is nonlinear and is over and above the effect of any macroeconomic and financial variables.

2 This is also based on the fact that Δ(log(s))~ Δs/s. See article under References: "A New Measure of Spread Exposure in Credit Portfolios."

3 The macroeconomic and financial variables have the intuitive signs with debt to GDP and GDP per capita significant at the 95% level and the government financial balance as a percentage of GDP significant at the 90% level. These are in line with the existing comparable literature, e.g., climate change risk studies from the University of London SOAS.

4 We project ln(S) using the betas from the regression, the ESG scores in each quintile and the non-ESG variable value of the middle 40%-60% quintile (so as to control for non-ESG effects). We then take the average implied ln(S)=z and take exp(z+0.5sigma^2) where sigma is the cross-sectional variance of spreads within the respective quintile, thereby correcting for convexity so as to convert to spread expectations from that of log spreads.

Moreover, we find that changes in ESG scores are also significant in determining changes in sovereign spreads (Exhibit 1). So, if a given country improves its ESG score from the bottom quintile to the top quintile in one year, it should expect to see its sovereign credit spreads tighten by almost 95%[5]. These results are an important addition to the existing literature, as they imply that not only does ESG matter in driving long-term sovereign spreads, but it is also a driver of short-term spread dynamics.

Previously, the prevalent belief was that, as ESG variables are slow-moving, their effects would have market implications only over time via changes in other "real" financial variables. The significant result regarding the short-term effect of ESG could be due to any, or all, of a number of potentially important considerations. These include the increasing spotlight on ESG variables as determinants of credit risk and opportunity; the greater incidence of changes in ESG factors like climate change, social risks, and politics affecting sovereign credit risk; and the behavior of groups of asset owners and regulators that are increasingly incorporating ESG screening and integration in their investment mandate.[6]

RESULT 2: GOVERNANCE AND SOCIAL FACTORS ARE IMPORTANT IN THEIR OWN RIGHT

To take a deeper look at the critical ESG drivers, we break down the PIMCO ESG composite score into its E, S, and G sub-pillars. This enables us to assess whether there is a key driver and the relative importance of each pillar in driving credit spreads. Among other variables, each sub-pillar comprises numerous underlying variables: The environmental sub-pillar includes greenhouse gas emissions, share of fossil fuels, and renewables in energy use; the social sub-pillar includes human capital and gender equality measures; and the governance sub-pillar includes voice and accountability, control of corruption, and political stability, among other variables.

5 This is calculated assuming a normal distribution of ESG z-scores together with the sensitivity of changes in log spreads to changes in ESG scores of 1.08, as shown in Exhibit 1

6 For example, in 2019 an asset manager publicly disclosed it suspended purchases of Brazilian government bonds due to concerns over deforestation and environmental policy.

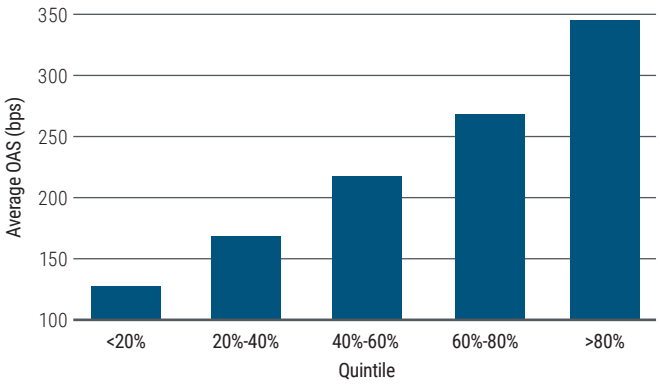
Exhibit 1: Estimated sensitivities of sovereign spread levels and changes to composite ESG score and financial variables: panel regression, 2006–2018 (zero lag)

	Spread level		Spread changes	
	Beta	p-value	beta	p-value
Composite ESG score*	0.73**	0.00%**	1.08**	0.24%**
Gov't financial balance/GDP (%)	-0.01**	3.88%**	-0.007	25.93%
Gov't debt/GDP (%)	0.005**	0.0%**	0.002**	0.2%**
Gov't current account/GDP (%)	-0.001	84.43%	0.006	13.75%
GDP per capita, PPP (per $10,000)	-0.2	0.0%**	-0.1	40.40%
DM (average if p-value <=5%)	-0.74**	10/13 (sig at 5% level)	0.14**	9/13 (sig at 5% level)
R^2	80%		72%	

* Higher is worse. ** Denotes significance at the 95% level and *** at the 90% level.

Hypothetical example for illustrative purposes only. Source: PIMCO, Markit, Bloomberg, World Bank, United Nations Development Program, Haver Analytics, and Moodys as of September 2020. A higher ESG score is worse in PIMCO's methodology. Beta is a measure of price sensitivity to market movements. Market beta is 1. P-value is a measure of the probability that an observed difference could have occurred just by random chance. The lower the p-value, the greater the statistical significance of the observed difference. DM denotes developed markets. R^2 represents the proportion of the variance of a dependent variable that is explained by an independent variable or variables. Different data sets and/or other time periods may produce different results.

Exhibit 2: Model-projected OAS of five-year sovereign credit by quintiles of ESG scores, 2018, controlled for non-ESG effects†



† We project ln(S) using the betas from the regression, the ESG scores in each quintile and the non-ESG variable value of the middle 40%-60% quintile (so as to control for non-ESG effects). We then take the average implied ln(S)=z and take exp(z+0.5sigma^2) where sigma is the cross-sectional variance of spreads within the respective quintile, thereby correcting for convexity so as to convert to spread expectations from that of log spreads.

Hypothetical example for illustrative purposes only. Source: PIMCO, Bloomberg, World Bank, and United Nations Development Program as of 31 Dec 2018. The option adjusted spread (OAS) measures the spread over a variety of possible interest rate paths that reflects the additional yield demanded by the market to compensate for various factors including credit risk and liquidity.

As with the aggregate ESG score, we find statistically significant relationships between the S and G sub-pillars and sovereign spreads in both absolute and relative terms. (Exhibit 3). We interpret this to mean that higher governance and social scores are associated with tighter sovereign spreads, and changes in governance and social scores result in changes in sovereign spreads.

These results are intuitive in that countries with more stable governments and higher human capital generally have better growth trajectories and lower risks of profligate or inefficient spending, leading to better credit ratios over time. Moreover, our robustness checks – including varying lag structures (where lagged S and G variables are still significant) – imply that the causality runs from the sub-pillars to credit spreads and not the other way around. In other words, higher social and governance scores lead to tighter spreads, and not vice versa. Importantly, these effects are observed not only over long time horizons, but also over the near-term.

In terms of magnitudes, we observe that governance scores have a notably larger effect on spreads than social scores. In fact, a governance beta of 0.60 compared with a social beta of 0.37 implies a more-than-60% greater impact.[7,8]

Looking at the environmental sub-pillar, the regression results indicate that a better (lower) environmental score is associated, all things equal, with wider credit spreads.

This result would at first appear counterintuitive; why would investors require more compensation for the risk of investing in economies that are more environmentally friendly than those that are polluting more or have higher exposure to carbon emissions?

Once we note that our environmental score includes fossil fuel emissions, with the U.S. and China as the world's largest emitters, the results become more understandable. After all, fossil fuel consumption is closely linked with the financial development of an economy in that it indicates industrial scale and activity, with developed countries generally consuming more. Couple that with the fact that spreads ultimately reflect default and liquidity risk, and the results are even more logical. Namely, developed economies are generally more likely to be able to meet their financial obligations, resulting in tighter spreads.

Exhibit 3: Estimated sensitivities of sovereign spread levels and changes to E, S, and G scores and financial variables; panel regression, 2006–2018 (zero lag)

	Spread level		Spread changes	
	Beta	p-value	beta	p-value
Social*	0.37**	0.00%	0.42**	3.47%
Environmental*	-0.14**	0.04%	-0.05	81.20%
Governance*	0.60**	0.00%	0.66**	0.28%
Gov't financial balance (%)	-0.03**	0.01%	-0.007	30.06%
Gov't debt/GDP (%)	0.006**	0.00%	0.002**	0.11%
Gov't current account/GDP (%)	-0.007**	3.24%	0.0051	21.96%
GDP per capita, PPP (per $10,000)	-0.03	10.65%	-0.12	42.17%
DM (average if p-value <=5%)	-0.63**	8/13 (sig at 5% level)	0.12**	8/13 (sig at 5% level)
R^2	84%		72%	

* Higher is worse. ** Denotes significance at the 95% level and *** at the 90% level.

Hypothetical example for illustrative purposes only. Source: PIMCO, Markit, Bloomberg, World Bank, United Nations Development Program, Haver Analytics, and Moodys as of September 2020. A higher ESG score is worse in PIMCO's methodology. Beta is a measure of price sensitivity to market movements. Market beta is 1. P-value is a measure of the probability that an observed difference could have occurred just by random chance. The lower the p-value, the greater the statistical significance of the observed difference. DM denotes developed markets. R^2 represents the proportion of the variance of a dependent variable that is explained by an independent variable or variables.

RESULT 3: ESG MATTERS MORE FOR EMERGING MARKETS THAN FOR DEVELOPED MARKETS

All of our analysis so far has been carried out on the full set of sovereigns, both developed and emerging. The question naturally arises as to whether there are differences between the sensitivity of sovereign credit spreads in developed markets and those of emerging sovereigns. To shed light on this question, we repeat our analyses on each data set separately and compare the results.

7 Here we refer to the normalized governance and social z-scores that form the G and S variables in our regressions. The detailed sub-scores are normalized for each year cross-sectionally with respect to the mean and standard deviation of other scores in each indicator, the aggregated into the E, S, and G level, and then again at the overall ESG level.

8 The precise ratio of spread impact depends on the change to the respective G and S scores and also reflects the logarithmic specification we use. It will always be in excess of 1.6=0.60/0.37 but may reach higher ratios for larger changes in z-scores

We find that, all things being equal, developed market spreads are tighter, on average, than those of emerging markets (Exhibit 4). This implies that if we consider two sovereigns – one developed and one emerging – with identical ESG ratings, identical financials, and similar geographic attributes, we would expect the developed market spread to be tighter than that of the emerging market. This finding is consistent with the view that emerging market spreads reflect other factors beyond quantitative macroeconomic, credit, and ESG factors, such as greater uncertainty of outcomes and lower market liquidity.

Exhibit 4: Estimated sensitivities (betas) of sovereign spread levels and changes to E, S, and G scores and financial variables; panel regression, 2006–2018 (zero lag)

	Spread level		Spread changes	
	Emerging markets (EM)	Developed markets (DM)	Emerging markets (EM)	Developed markets (DM)
Social*	0.35**	1.03**	0.36	0.82
Environmental*	-0.22**	-0.18***	0.14	-0.47
Governance*	0.66**	0.69**	0.68**	0.66
Gov't financial balance/GDP	-0.022**	0.008	0.003	-0.029**
Gov't debt/GDP	0.01**	0.002**	0.005**	0.001
Gov't current account/GDP	0.001	-0.008	0.004	0.01
GDP per capita, PPP (per $10,000)	-0.01	-0.19**	-0.06	-0.08
R^2	74%	85%	69%	80%

* Higher is worse. ** Denotes significance at the 95% level and *** at the 90% level.

Hypothetical example for illustrative purposes only. Source: PIMCO, Markit, Bloomberg, World Bank, United Nations Development Program, Haver Analytics, and Moodys as of September 2020. A higher ESG score is worse in PIMCO's methodology. R^2 represents the proportion of the variance of a dependent variable that is explained by an independent variable or variables.

Second, for both developed and emerging markets, ESG-related variables show evidence of long-term relationships with sovereign credit spreads. Interestingly, while the magnitude of the governance and environmental variables is similar across both EM and DM, the social coefficient is much higher for DM than for EM (even though both are significant). We interpret this to mean that changes in social indicators affect developed markets spreads more than EM spreads.

Third, changes in S and G variables matter strikingly more for emerging market spreads than for developed market spreads. We see this in the difference between the sensitivities of DM and EM spreads to changes in ESG variables. DM spreads show no significant relationship to changes in any E, S, or G factor, and this holds for all lag structures (not shown). For emerging markets, however, the governance variable alone is significant at the 95% level, with social just missing out on significance at the 90% level (p-value=10.33%). Specifically for emerging markets, a country that improves its social indicator from the bottom to the top quintile should expect to see spreads tighten by 64% (350 bps using 2018 data), all else equal. If it improves its governance score by a similar magnitude, its spreads should tighten by 85% (440 bps using 2018 data).

PART 2: DOES THE MARKET PENALIZE ESG-AWARE INVESTORS?

A key question in the evaluation of ESG-aware investing is whether sensitivity to ESG risks in a portfolio exposes investors to some ESG-related cost. In other words, do markets punish (or indeed reward) high quality ESG behavior of sovereigns? To answer this question, we simulate the historical returns of an investment strategy that takes long credit-risk positions by selling protection via credit default swaps. This is done by offsetting high-scoring sovereigns with short positions in sovereigns whose ESG scores are poor. We focus on emerging market sovereigns based on our finding that ESG is relatively more important in driving emerging market sovereign spreads compared with those of developed markets.

In order to isolate ESG factors and not some combination of market beta and ESG risk, we ensure that we are not net long or short spread-carry or any market beta (as measured by DTS, or duration-times-spread, exposure) or regional exposures.[9] We then take long credit-risk positions in sovereigns with scores in the top half of the ESG score under consideration in each strategy and, correspondingly, short positions in issuers in the bottom half.[10]

As we did for the regression analysis in Part 1, in addition to running the strategy at the aggregated ESG score level, we split the analysis into E, S, and G variable-based strategies. To guard

9 DTS, or duration-times-spread, is a widely used measure of spread exposure that incorporates the level of credit risk (as captured by the spread level), as well as the spread duration of the security. It can be thought of as a beta-adjusted spread duration. For further details, see "DTS℠ (Duration Times Spread) for CDS: A New Measure of Spread Sensitivity."

10 The dataset is the same as in Part 1, with all returns calculated gross of transaction fees.

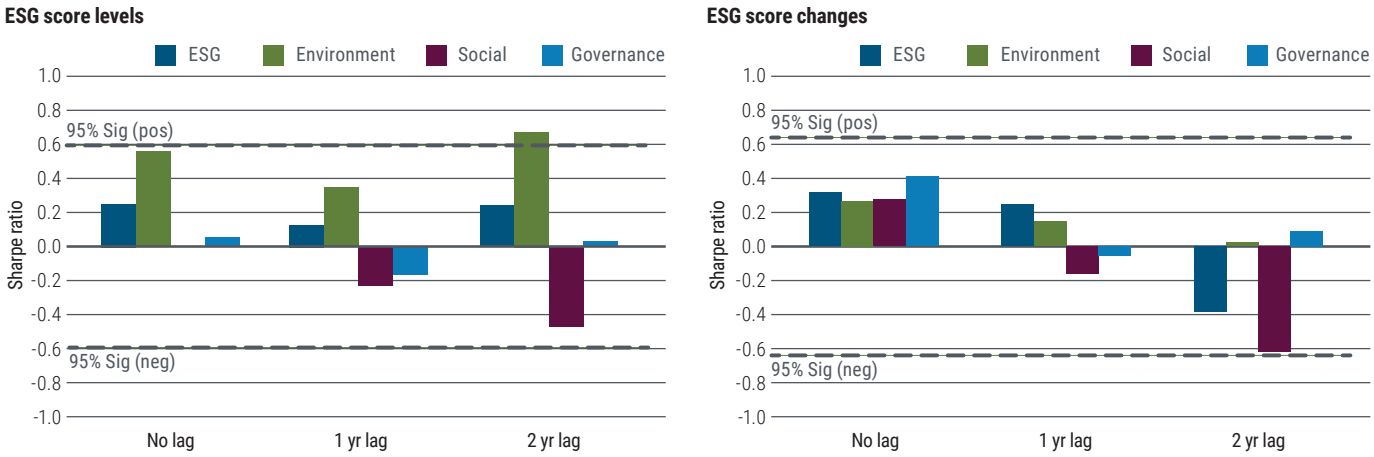
as much as possible against idiosyncratic effects, we ensure maximal diversification across each of the two legs of the trade. Finally, to minimize net directionality, we rebalance at the end of each month.[11] In a second analysis, we repeat the above exercise, but this time by looking at changes in ESG scores: The biggest improvers form the constituents of the long leg, and those that have exhibited the greatest deterioration form the short leg.

Exhibits 5 and 6 show the results of the respective strategies: First, we show the Sharpe ratios of the overlay for zero, one-year, and two-year lags for the ESG score (see Appendix 2, Exhibit 9 for the lag definitions and interpretation). The second pair of charts shows the cumulative return of the zero lag version of the strategy across time.[12]

11 We promote diversification in two ways: First, we impose a maximum level of weight to any given sovereign of 15%; second, we define our objective function that we seek to minimize the sum of squares of issuer weight times DTS. Together, these should guard against concentrated positions in a few sovereigns.

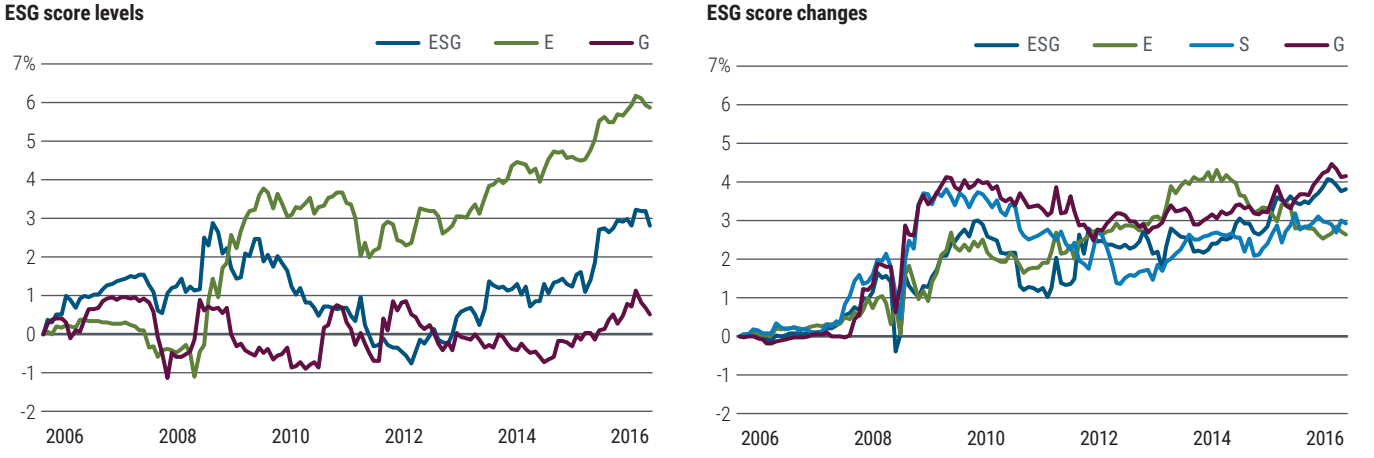
12 Results for social scores (levels) with zero lags were not feasible due to lack of regional diversity relating to ESG score quantiles.

Exhibit 5: ESG strategy simulations, Sharpe ratio, regional controls



Hypothetical example for illustrative purposes only. Source: PIMCO, Markit, Bloomberg, World Bank, United Nations Development Program, Haver Analytics, and Moodys as of September 2020

Exhibit 6: ESG strategy simulations, regional controls, cumulative performance, (zero lag)



Hypothetical example for illustrative purposes only. Source: PIMCO, Markit, Bloomberg, World Bank, United Nations Development Program, Haver Analytics, and Moodys as of September 2020

RESULT: ESG INVESTMENT STRATEGIES DO NOT UNDERPERFORM

Overall, we find no evidence of any significant additional cost (or reward) associated with ESG-aware investing. In fact, our analysis finds positive performance for the ESG long/short trading strategy, and this holds whether the strategy is based on levels of ESG scores or on changes in ESG scores. Furthermore, this result holds true for individual environmental, social, and governance scores, as well as for aggregate ESG scores. We are cautious in interpreting this as meaning that ESG investing strategies outperform non-ESG-aware strategies, as the estimated Sharpe ratios are not significant at the 95% level. Nonetheless, we do find that this positive result is consistent across various specifications and lag structures. We also recognize that, as Cornell and Damodaran point out, ESG-aware investing is a fairly new phenomenon and it is possible that as prices reach their equilibrium with respect to differences in ESG score, early effects that might result in positive returns for better scores may fizzle out in the future.

RESULTS SUPPORT THE CASE FOR ACTIVE MANAGEMENT IN ESG INVESTING

One important implication of our results is that the performance of the return strategies deteriorates as the lag in information increases, as demonstrated by the falling Sharpe ratios in Exhibit 5. This is particularly the case with strategies based on improving/deteriorating ESG scores and argues for the use of forward-looking, real-time analysis that anticipates published ESG metrics.

It also implies a need for deep ESG analysis incorporating both quantitative and qualitative factors when assessing sovereign credit risk. Together, these support the greater need for active management in ESG-focused portfolios and sovereign credit analysis that incorporates ESG factors on an ongoing basis.

CONCLUSIONS

The investment community is increasingly turning its attention to issues of sustainable investing and whether this affects credit risk and investment performance. We have turned the ESG spotlight on sovereign credit risk and returns and asked how these relate to ESG ratings and their dynamics.

We find that ESG considerations matter for sovereign bond investors: ESG scores exhibit correlation with spread levels and dynamics, and show high levels of explanatory power and significance with respect to spreads, even when other relevant variables are taken out of the picture. In the context of a backtested trading strategy, we find no evidence that a higher weighting in ESG-compliant sovereigns results in any investment disadvantage. In fact, our results suggest that a timely anticipation of ESG scores improves potential investment performance and supports the case for active management in the ESG space.

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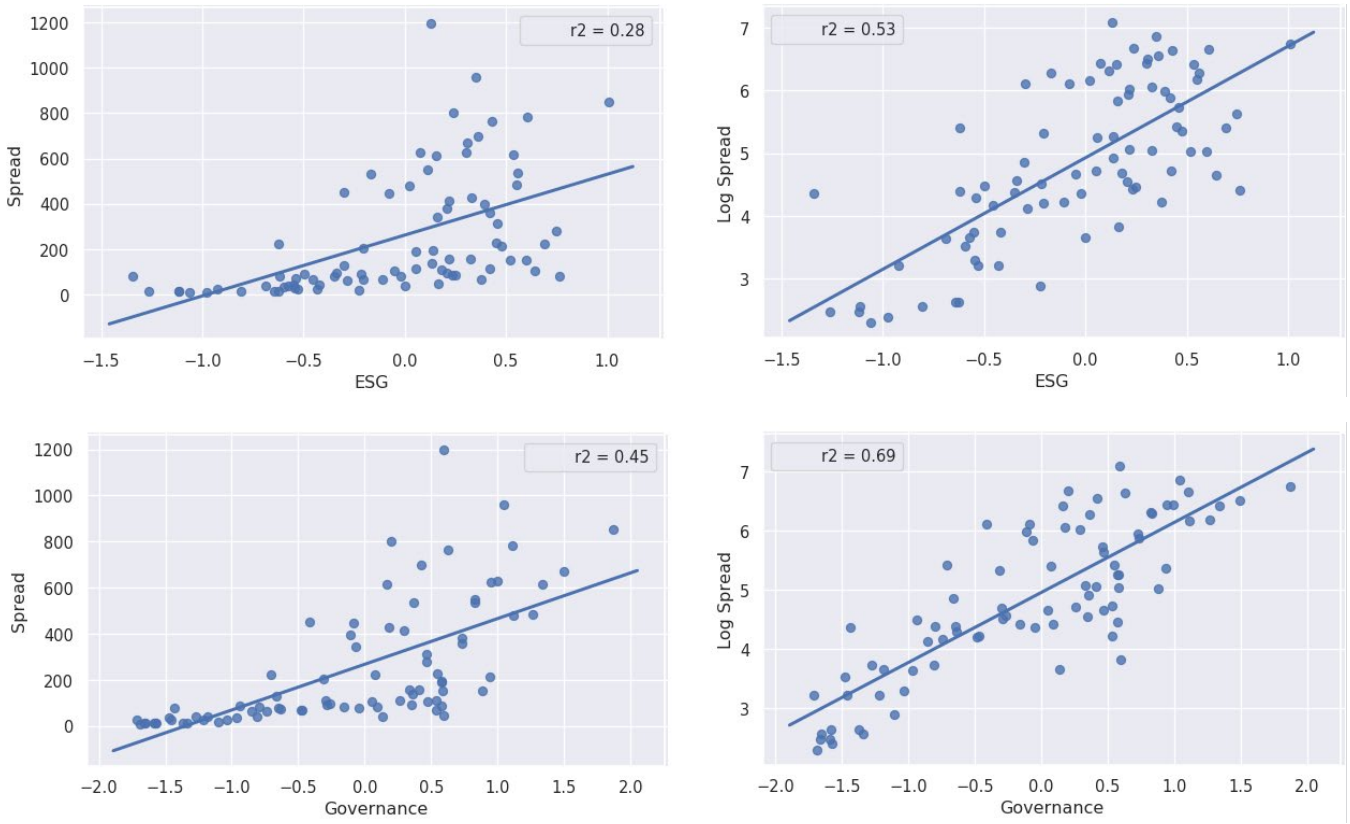
Appendices

APPENDIX 1: SPREADS VERSUS LOG SPREADS

The decision to use the logarithm of spreads is motivated by the empirical observation that the relationship between spread levels and ESG scores seems closer to linear when spreads are expressed in these terms. In Exhibit 7 below, by way of illustration, we chart spread levels and their logs against the aggregate ESG and the governance (G) score for the available country CDS spreads as of 31 December 2018.

Exhibit 7: ESG score versus spreads and versus log spreads: 31 December, 2018, EM and DM Sovereigns



Hypothetical example for illustrative purposes only. Source: PIMCO, Markit, World Bank, United Nations Development Program, and Haver Analytics as of September 2020 Sovereign spreads are five-year USD CDS (Source: Markit); ESG and governance scores are normalized (ESG is the average of E, S, and G normalized scores).

This closer-to-straight-line relationship between logarithms of spreads and ESG variables was borne out through our experimentation with different formulations of our regressions: We try using spread levels and log-spreads and find superior explanatory power of our selected variables with respect to the latter across our analysis time period.[13]

13 We note that the non-linear relationship between spread levels and ESG scores is clearer with the governance score than with the aggregate ESG score, a finding that will be reflected in the later findings of our regressions as we examine the individual E, S, and G scores.

APPENDIX 2: LAG RESULTS AND DEFINITIONS

The results shown in the main body of the article (e.g., Exhibit 3) correspond to zero lag values of the ESG variables, e.g., the spread changes during the year January 2010 – December 2010 are aligned with ESG changes derived from ESG values pertaining to the years 2009 and 2010, respectively. However, we note that there is in general a significant lag in the publication of the variables underlying the ESG scores, which means that in practice these are not available to the investor until late in that year if not in the following year. To try and capture the impact of this issue, we additionally carry out regressions using lagged values of the ESG variables; we use one-year and two-year lags. Exhibit 8 shows the corresponding results.

Exhibit 8: Estimated sensitivities of sovereign spread changes to E, S, and G variable changes across various lags: panel regression, 2006–2018

	Lag=0	Lag=1	Lag=2
Delta social[1]	0.42**	-0.15	-0.01
Delta environmental[1]	-0.05	-0.22	0.34
Delta governance[1]	0.66**	-0.09	0.09
Delta gov't financial balance/GDP	-0.007	-0.0031	0.0006
Delta gov't debt/GDP	0.0023**	0.0018**	0.0007
Delta gov't current account/GDP	0.0051	-0.0066*	-0.0052
Delta GDP per capita PPP (per $10,000PPP)	-0.12	0.24**	0.02
DM (average if p-value <=5%)	0.12** (8/13)	0.15** (7/12)	0.14** (9/11)
R^2	72%	72%	72%

1 Higher is worse. ** Denotes significance at the 95% level and * at the 90% level.

Hypothetical example for illustrative purposes only. Source: PIMCO, Markit, Bloomberg, World Bank, United Nations Development Program, Haver Analytics and Moodys as of September 2020. R^2 represents the proportion of the variance of a dependent variable that is explained by an independent variable or variables.

Exhibit 9: Lag terminology – trading strategy backtest

Lag (years)	Return period	Date to which explanatory variables signals pertain	Typical date at which relevant explanatory variables are available
0	31 Dec. 2009 – 31 Dec. 2010	Year ending Dec 2010	4Q 2011
1	31 Dec. 2009 – 31 Dec. 2010	Year ending Dec 2009	4Q 2010
2	31 Dec. 2009 – 31 Dec. 2010	Year ending Dec 2008	4Q 2009

Hypothetical example for illustrative purposes only. Source: PIMCO

The analysis contained in this paper is based on hypothetical modeling. Hypothetical performance results have many inherent limitations, some of which are described below. No representation is being made that any account will or is likely to achieve profits or losses similar to those shown. In fact, there are frequently sharp differences between hypothetical performance results and the actual results subsequently achieved by any particular trading program or strategy.

One of the limitations of hypothetical performance results is that they are generally prepared with the benefit of hindsight. In addition, hypothetical trading or modeling does not involve financial risk, and no hypothetical example can completely account for the impact of financial risk in actual trading. For example, the ability to withstand losses or to adhere to a particular trading program in spite of trading losses, are material points which can also adversely affect actual trading results. There are numerous other factors related to the markets in general or to the implementation of any specific trading program which cannot be fully accounted for in the preparation of hypothetical performance results, all of which can adversely affect actual results. No guarantee is being made that the stated results will be achieved.

Figures are provided for illustrative purposes and are not indicative of the past or future performance of any PIMCO product.

All investments contain risk and may lose value. Investing in the **bond market** is subject to risks, including market, interest rate, issuer, credit, inflation risk, and liquidity risk. The value of most bonds and bond strategies are impacted by changes in interest rates. Bonds and bond strategies with longer durations tend to be more sensitive and volatile than those with shorter durations; bond prices generally fall as interest rates rise, and low interest rate environments increase this risk. Reductions in bond counterparty capacity may contribute to decreased market liquidity and increased price volatility. Bond investments may be worth more or less than the original cost when redeemed. **Management risk** is the risk that the investment techniques and risk analyses applied by an investment manager will not produce the desired results, and that certain policies or developments may affect the investment techniques available to the manager in connection with managing the strategy.

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PIMCO's credit research analysts assess the Environmental, Social, and Governance ("ESG") profile of issuers relative to peer issuers with a goal of separating leaders from laggards. Using industry-specific ESG frameworks, analysts review issuers' ESG performance based on information available in public filings, recent ESG news and controversies, as well as through engagement with company management teams. Analysts assign three separate numerical scores from 1 to 5 (with 5 being the highest) to their environmental, social and governance-based business practices. The score in each category is related to an issuer's rank relative to industry peers, and the relative weights of the E, S, and G scores in the composite score vary based on industries, as each industry is assigned a different factor weight. For example, the environmental category has the greatest weight for issuers in extractive industries (e.g., oil, gas, and mining), the social category has the greatest weight for pharmaceutical issuers, and the governance category has the greatest weight for financial issuers. Analysts also include a forward-looking ESG trend assessment, which recognizes companies whose ESG performance is significantly improving or deteriorating. These factors are combined to create a proprietary composite ESG score. We use the MSCI and other ratings for reference but make our own assessment based on our own, independent analysis of the industry and relevant ESG factors. PIMCO's resulting assessments are proprietary and distinct from those provided by ESG rating providers.

Statements concerning financial market trends or portfolio strategies are based on current market conditions, which will fluctuate. There is no guarantee that these investment strategies will work under all market conditions or are appropriate for all investors and each investor should evaluate their ability to invest for the long term, especially during periods of downturn in the market. Investors should consult their investment professional prior to making an investment decision. Outlook and strategies are subject to change without notice.

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