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ESG Investing in Credit: A Broader and Deeper Look

- We expand our prior study of the relationship between ESG (Environmental, Social and Governance) ratings and bond portfolio performance to include the euro investment grade and US high yield markets in addition to US investment grade.
- Our approach is data driven: We source issuer-level ESG scores from two prominent providers – MSCI ESG Rating and Sustainalytics – and map them to bond-level data from Bloomberg Barclays bond indices. We address the following questions:
  - What are the characteristics of ESG scores?
  - What is the effect of ESG on bond valuation?
  - What is the effect of an ESG tilt on portfolio performance?
  - Does the effect of ESG investing vary depending on the industry sector?
- We find that tilting a credit portfolio in favour of high ESG bonds, while keeping all other risk characteristics unchanged, is not detrimental to return but tends to lead to higher performance in all three markets considered.
- While our previous study found that Governance rating was most closely associated with performance, Environment has had the strongest effect in the past two years in the US and, over the whole nine year history in Europe.
- The link between ESG pillar scores and performance varies across sectors. Governance is important in the banking sector while Environment is significant in most others.
- The Euro credit market is pricing ESG attributes differently than the US market: High ESG bonds trade at persistently tighter spreads than low ESG peers in Europe, but not in the US. European issuers also tend to have higher ESG ratings than US issuers.

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Introduction

Nearly two years ago, we published a flagship report on Sustainable Investing and Bond Returns.[1] It included a broad overview of sustainable investing and the use of Environment, Social and Governance (ESG) ratings in managing investment portfolios. ESG investing started as a small niche market in equity investment and has expanded to bond markets to become more and more mainstream. Investors weighing the merits of incorporating ESG criteria into their portfolios often ask the same critical question: how does this affect performance?

Many studies have examined the effect of sustainable investing on portfolio performance; however, most have focused on equity markets. Our study addressed this question from the perspective of bond investors, using bond data from the Bloomberg Barclays US Investment-Grade (IG) Corporate Bond Index, and ESG ratings from two providers, Sustainalytics and MSCI ESG Research. We found no evidence that tilting a corporate bond portfolio towards issuers with better ESG ratings all else equal negatively affected performance; if anything, it increased returns.

Many bond investors appear to be interested in objective quantitative analysis of the effect of ESG investing on portfolio performance. Following our report, we received requests to extend our study in various directions. Do these results apply in the euro corporate bond market, or to high yield bond portfolios? Do results vary by industry? Is there a relationship between credit ratings and ESG ratings?

This report addresses these questions. We update and expand our prior analysis to study the effect of ESG investing in EUR-denominated IG and in US High Yield bond markets in addition to US IG. In each asset class, we study the effect of ESG in individual industry sectors.

The report is organized along the following outline. First, we explain how we assemble a dataset of ESG ratings mapped to corporate bond data. We provide an overview of the data used in our study and we detail the level of index coverage in each target market.

Next, we discuss some key characteristics of the ESG scores obtained from the two providers considered in our analysis. What do they represent? How are they calculated? How stable have they been? How closely correlated are they? Do they exhibit distinct geographical patterns? We then illustrate how a naive ESG bias can induce unwanted risk exposures in a portfolio.

The following section investigates the relationship between ESG rating and bond valuation. Do investors need to pay a premium for bonds with higher ESG scores? Has this effect changed over time? Does it vary across markets?

Then, we address the key question of bond market performance. We construct pairs of bond portfolios – one with high ESG scores and one with low ESG scores – designed to be matched as closely as possible with respect to all major risk characteristics. Using this technique, we systematically measure the relative performance achieved when we impose this ESG tilt using ESG composite scores or individual pillar scores from either of the two providers. We analyse US and European IG markets, and in each one we test results in individual credit sectors, as well as in the overall corporate bond market.

In the last section, we investigate these issues in the US high yield market, including an analysis of spread premium, as well as of the performance associated with ESG ratings.

Finally, following a short conclusion, we include two appendices with additional details on ESG rating dynamics and on the effect of ESG on bond portfolio performance.

[1] We produced two versions: a public one, *Sustainable Investing and Bond Returns*, 31 October 2016, and a more detailed report available on Barclays Live: *ESG Investing in Credit Markets*, 17 November 2016.

Assembling a Dataset of ESG Ratings and Bond Returns

We have assembled a dataset of corporate bonds and their ESG ratings that constitutes the core of this study. We merged data from three distinct sources. Bloomberg Barclays Index data provided bond characteristics and returns; to this, we added ESG ratings from two providers: MSCI ESG Research and Sustainalytics.

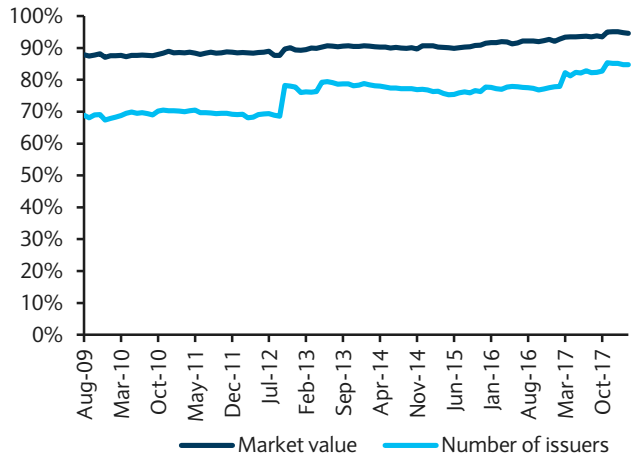
This merge process required careful attention because the ESG ratings providers assign ratings to companies, not to specific bonds. Furthermore, as they primarily targeted equity market investors (and due to data availability), they mostly cover publicly-traded companies, and their ratings correspond to equity security identifiers. Thus, to obtain an ESG rating for each bond in our database, one must first map it to an equity security for which an ESG rating is available (for each provider and for each month). We were greatly aided in this process by previous bond-equity mapping exercises, performed when we designed cross-market systematic strategies in equity[2] and in fixed income markets[3].

The resulting dataset, which we use for most of the analysis in this article, is the set of bonds for which we have ratings from both MSCI ESG and Sustainalytics. In the most recent months, this dataset covers close to 90% by market value, of the USD and EUR IG Corporate index universes. However, as ESG ratings are relatively new, we find less extensive coverage as we go back in time. Figure 1 shows how the coverage of the US IG corporate index has evolved for the intersection of the Sustainalytics and MSCI ESG ratings universes, in terms of market value and number of issuers. Figure 2 details the same metrics for the EUR IG market. Over the period of our analysis (August 2009 to April 2018), coverage always exceeded 80% of index market value and 63% of the issuers in each market.[4] The discrepancy between the two metrics implies that the issuers that are not covered tend to be relatively small. We also observe a step improvement in the number of US issuers covered in 2012.

Figure 3 gives a more detailed view of our ESG data coverage and includes US HY in addition to the US and EUR IG markets. High yield stands in contrast to the investment grade market, with a much lower joint coverage by ESG providers. This is, in part, explained by the prevalence of private issuers of HY debt, as well as by the usually smaller size of HY issuers relative to IG ones, meaning that covering them could often be a less immediate

FIGURE 1

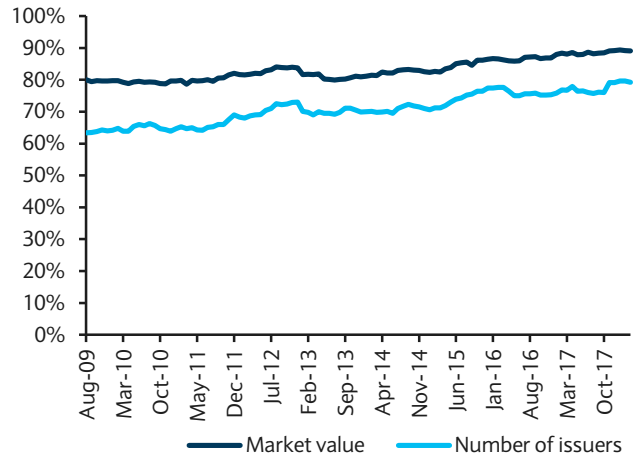
ESG coverage in the US IG index universe



Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics

FIGURE 2

ESG coverage in the euro IG index universe



Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics

[2] See, for example, Ben Dor, A. and Z. Xu. Should Equity Investors Care about Corporate Bond Prices? Using Bond Prices to Construct Equity Momentum Strategies, Journal of Portfolio Management, Summer 2015

[3] See, for example, *Quantitative Credit Scorecards for Relative Value (ESP) and Cross-Asset Momentum (EMC)*, Barclays Research, 2017

[4] Our coverage ratios measure what percentage of the issuers of each bond index is covered by our dataset. This study includes only a small fraction on the many thousands of companies covered by MSCI and Sustainalytics. Our sample is, therefore, not representative of their work, (it is biased in favour of the larger companies that are represented in bond indices), and our study should not be viewed as a test of the quality of their ratings.

priority for investors and ESG providers alike than covering larger IG issuers. In addition, the total number of companies covered by either of the two ESG providers can be larger than the number of companies in our intersection dataset.

Coverage considerations lead us to start our data sample at different points in time for our studies of the investment grade (from August 2009) and high yield (from October 2012) markets.

FIGURE 3

Coverage of US IG, Euro IG, and US HY bond index universe by providers of ESG scores (intersection of ratings from MSCI ESG and Sustainalytics), as of the end of each calendar year

	2009	2010	2011	2012	2013	2014	2015	2016	2017
US IG index universe									
Index MV ($bn)	2,555	2,843	3,175	3,651	3,727	4,097	4,401	4,907	5,192
Index bonds	3,387	3,685	4,005	4,467	4,868	5,201	5,680	5,919	5,588
Index issuers	562	606	637	688	725	761	784	783	729
MV coverage	87%	89%	89%	89%	90%	91%	91%	93%	95%
Bond coverage	82%	84%	84%	87%	87%	88%	88%	89%	93%
Issuer coverage	67%	70%	69%	78%	78%	77%	78%	78%	85%
Euro IG index universe									
Index MV (€bn)	1,303	1,307	1,209	1,310	1,303	1,442	1,507	1,682	1,865
Index bonds	1,363	1,369	1,297	1,312	1,401	1,532	1,729	1,958	2,229
Index issuers	350	352	348	333	352	396	451	491	538
MV coverage	80%	80%	82%	84%	81%	83%	86%	87%	89%
Bond coverage	75%	76%	80%	83%	79%	81%	85%	85%	87%
Issuer coverage	64%	64%	69%	73%	70%	71%	77%	75%	79%
US HY index universe									
Index MV ($bn)	747	930	928	1,145	1,270	1,326	1,199	1,334	1,339
Index bonds	1,642	1,822	1,847	2,009	2,131	2,229	2,174	2,086	2,043
Index issuers	771	879	944	1,013	1,047	1,068	1,011	947	934
MV coverage	30%	24%	32%	43%	43%	47%	54%	56%	59%
Bond coverage	24%	20%	24%	36%	37%	39%	43%	47%	51%
Issuer coverage	12%	9%	12%	24%	25%	26%	27%	30%	34%

Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics

Characteristics of ESG Scores[5]

Before addressing the effect of ESG scores on bond market performance, we examine some of the characteristics of the scores themselves. First of all, what do these scores measure and how are they calculated? How stable have these scores been? How different are the scores from one provider to another? How do ESG scores tend to relate to other bond characteristics such as credit ratings and spreads?

ESG scoring methodologies are complex and vary across providers

ESG scoring, by its very nature, is a complex and somewhat subjective enterprise. ESG issues span a wide range of business practices; each of the three main pillar scores are calculated based on a large number of component inputs. Within the environmental score, for example, different ESG providers give different focus to criteria such as a company's energy usage, its contribution to air and water pollution, or the extent of its recycling efforts. This covers non-financial information assumed to be material to the long-term sustainability of the company. However, despite standardization efforts by industry bodies,

[5] We use the terms "ESG scores" and "ESG ratings" interchangeably. Scores are numerical representations of ratings.

such as the SASB[6] and GRI[7], there is no industry-wide consensus on which detailed Environment- and Social-related criteria should be used to evaluate a corporation, and how they should be weighted. For companies in different industries, different factors are more relevant – in terms of how the E, S and G pillar scores are constructed from component factor scores, and how the three are combined to form the overall ESG score.

There are a number of providers of ESG ratings in the market and each has built a comprehensive system for gathering a large, multidimensional dataset on the ESG records of companies. They collect dozens of indicators within each of the three pillars; the weights given to each of these indicators when forming the E, S and G scores vary by industry. Once aggregated, top level scores are then normalised by sector, such that the most relevant comparison is between the scores of two companies in the same industry.

We have chosen to use ESG scores from two providers, MSCI ESG and Sustainalytics. This does not imply that we have deemed these providers to be superior to others; these are the only firms whose scores we have studied. In our previous article on this topic[8], we discussed the ratings methodology of each of these two firms in more detail.

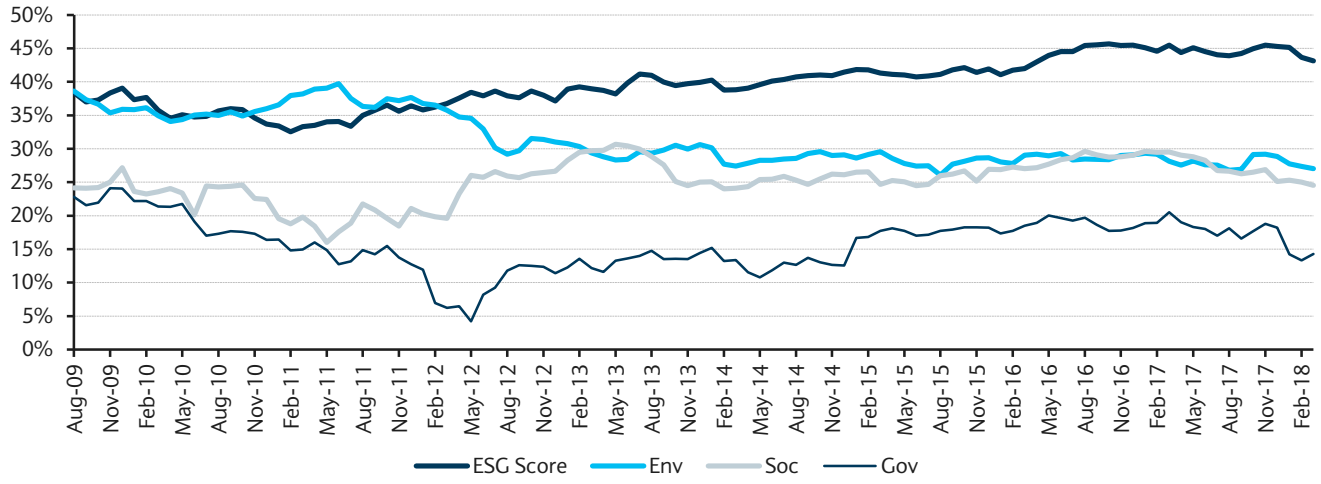
ESG scores from different providers do not measure exactly the same thing

Given the lack of standardisation in methodologies for compiling ESG scores and their qualitative nature, it is not surprising that scores from different providers do not always agree. To test this, we ranked the full universe of companies by scores from the two providers, and measured the correlation between the two sets of rankings at each point in time. Figure 4 shows the time series of these correlations, for the overall ESG score and for each pillar score. The ESG scores from the two providers exhibit positive but low correlations as a consequence of the differences in their methodologies.

Figure 4 shows that the correlations between the Governance scores from MSCI and Sustainalytics have been persistently lower than for other pillars. This highlights a significant methodological difference between the two sets of scores. The G score from MSCI ESG research is a measure of the quality of corporate governance, focusing on issues such as the composition of the board and executive compensation. The Governance score from Sustainalytics, while it includes some of these issues, also gives a large weight to the company's

FIGURE 4

ESG scores from MSCI and Sustainalytics exhibit small but positive correlations with each other



Note: Monthly rank correlations between the E, S, G and ESG scores of the two providers. Source: MSCI ESG Research, Sustainalytics, Barclays Research

[6] The Sustainability Accounting Standards Board (SASB) is an independent organisation that develops and maintains sustainability accounting standards. See www.sasb.org

[7] The Global Reporting Initiative (GRI) is an independent organisation that promotes sustainability reporting standards. See www.globalreporting.org

[8] See *ESG Investing in Credit Markets*, Barclays Research, 2016

governance of environmental and social issues. Sustainalytics also produces a separate set of pure Corporate Governance scores, but these are not included in our study, as they are not the ones that are rolled up into their overall ESG scores.

ESG scores have been stable

Understanding the dynamics of ESG ratings is important to bond portfolio managers, as systematically favouring high ESG bonds might require incremental portfolio turnover and, therefore, entail high transaction costs if these ratings change often. At the same time, one would expect some ESG score to change as a function of the evolving nature of corresponding risks and of company characteristics, including the effects of management decisions to mitigate ESG risk or to address disclosure of non-financial information deemed material to the prospects of the company.

We now return to our combined dataset of all bonds with scores from Sustainalytics and MSCI, and examine the stability of these ratings. We first combine the data from all three bond markets considered (US IG, US HY and EUR IG); since the ratings are assigned at the company level, this division by bond market is not fundamental to the scoring process. We then order all available companies by their ESG score as of a given date, and rank them into terciles that we label Low, Medium and High. We then measure the 12-month transition frequencies among these ESG tiers. Figure 5 shows the transition matrices obtained for the ESG scores of our two providers. Both sets have been relatively stable. For example, the bottom row of Figure 5 shows that an issuer with a top-tier ESG score at the beginning of a year has a 79% (88%) probability of remaining top tier a year later, according to MSCI ESG rating (Sustainalytics) in our data sample. Figure 5 has been calculated using overall ESG scores; we have repeated the analysis for each of the three pillars independently, and found similar transition patterns, with Governance slightly less stable than Social and Environment, and MSCI ESG scores slightly less stable historically than Sustainalytics ones. An appendix provides more details on the dynamics of ESG ratings in the period of our study.

FIGURE 5

Transition frequencies across ESG tiers on a one-year horizon (2009-18)

		MSCI				Sustainalytics		
		End of period						
		Low	Medium	High		Low	Medium	High
Start of period	Low	77%	20%	2%	Low	86%	14%	0%
	Medium	19%	61%	20%	Medium	11%	75%	14%
	High	2%	19%	79%	High	0%	12%	88%

Source: MSCI ESG Research, Sustainalytics, Barclays Research

An ESG tilt can bias a portfolio

Although both sets of ESG scores are normalised by sector, a strategy that systematically favours high ESG bonds over low ones may bring unintended exposures. For example, Figure 6 shows the characteristics of three equal-sized ESG tiers in the US and euro IG markets, according to our two providers. The top tier is associated with substantially lower spreads than the bottom tier in all four cases considered, with the difference in spread between High and Low ESG buckets being 15-36bp. The spread difference is associated with a small difference in credit rating. Repeating this analysis for individual ESG pillars shows that Environment has the strongest association with credit rating and spreads, and Governance the weakest in the US market. In other words, a systematic portfolio tilt in favour of issuers that score well on Environment is more likely to result in an unintended conservative, low yield bias.

In the credit markets, spread is taken as a measure of expected return over government bonds and is closely associated with credit risk. A strategy that systematically favours high ESG bonds without controlling for portfolio risk characteristics can easily underperform just because of its systematic bias towards higher-quality, lower-spread issuers.

FIGURE 6

Average differences in characteristics between high and low ESG portfolios (2009-18)

	MSCI				Sustainalytics			
	Low	Medium	High	H – L	Low	Medium	High	H - L
US IG index universe								
Average ESG Score	2.5	4.9	7.6	**5**	51	61	70	**18**
Spread over Treasury Bonds (bp)	162	146	126	**-36**	162	147	131	**-31**
Rating Quality	A3	A3	A2		Baa1	A3	A2	
Rating Quality Number	8.3	8.1	7.3	**-1**	8.6	8	7.3	**-1.2**
Euro IG index universe								
Average ESG Score	3.8	6.3	8.6	**5**	59	69	77	**18**
Spread over Treasury Bonds (bp)	166	144	143	**-22**	162	146	147	**-15**
Rating Quality	A3	A3	A3		A3	A3	A3	
Rating Quality Number	7.7	7.6	8	**0.2**	7.8	7.7	7.9	**0.1**

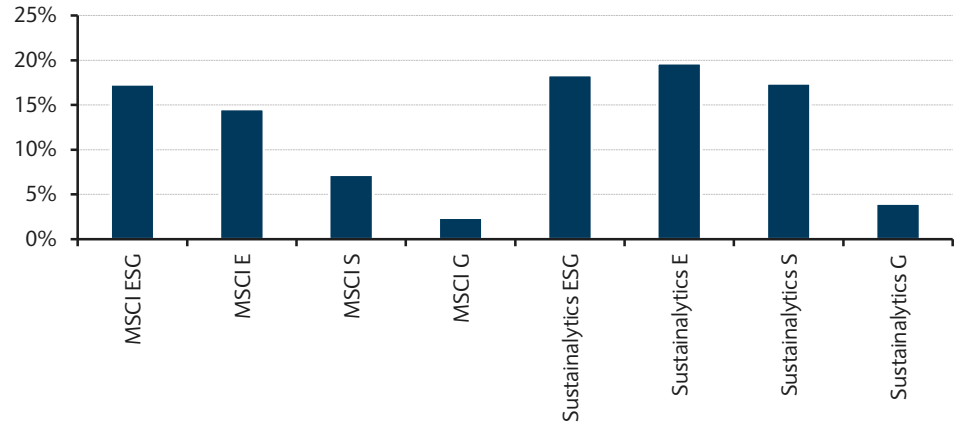
Note: In the numeric quality scale used here, higher numbers correspond to lower ratings. For example, A2 = 7.0, A3 = 8.0, Baa1 = 9.0.
Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics, Barclays Research

Figure 6 provides a mild indication that corporations with strong credit quality tend to score higher in terms of ESG. To confirm this and to test the linkage with individual pillars, we calculate the correlations between ESG scores and credit ratings. We use the index convention – taking the median rating from three agencies (Moody's, S&P and Fitch) and transforming letter ratings into numbers – and calculate the rank correlations between these index credit ratings and each ESG score each month. The time averages of these correlations over our study period are reported in Figure 7. Small positive correlations using ESG ratings from both providers confirm that they are related to credit ratings, but correlations are more pronounced for Environment than for Governance. We find that this pattern is similar for the two providers and stable across major industry sectors.

Of course, correlation does not explain causation. Have high-E companies earned higher credit ratings in recognition of their better handling of environmental risks? Or is it just that

FIGURE 7

Average correlation between credit rating and ESG score (2009-18)



Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics, Barclays Research

companies with higher credit ratings are in better financial condition, and were thus better able to invest in their ESG reporting and oversight capabilities? While it is true that credit rating agencies have started to incorporate ESG factors into their process, we think that the latter explanation has been the dominant one over the course of our study period.

In addition to quality and spread, ESG ratings can vary according to the country of domicile of the issuer. Figure 8 presents ESG scores for different groups of issuers split by geography. MSCI (on a scale of 10) and Sustainalytics (scale of 100) ESG scores are included, together with their individual pillar scores. US-domiciled issuers, and then other non-European issuers, score, on average, lower on all reported ESG metrics, especially Social. Governance scores, and in particular the pure corporate governance provided by MSCI, are relatively more stable across regions.

FIGURE 8

Average ESG score by country of domicile of the issuer (2009-18)

	USA	Euro area	Other	All Countries
MSCI ESG	4.9	6.6	5.8	5.4
MSCI Environment	6.1	6.5	6.2	6.2
MSCI Social	4.7	5.8	5.1	4.9
MSCI Governance	5.2	5.4	5.3	5.3
Sustainalytics ESG	61.0	70.8	66.6	63.7
Sustainalytics Environment	61.2	70.3	66.0	63.6
Sustainalytics Social	59.4	71.8	65.9	62.7
Sustainalytics Governance	64.8	71.3	69.3	66.7
Average Credit Rating	A3	A3	A2	A3

Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics, Barclays Research

The pattern found in Figure 8 might be explained by the joint effect of differences in reporting requirement by region and of the treatment of disclosure by ESG rating agencies. As lack of disclosure can be penalised with a lower ESG rating, companies that are based in European countries and must follow stricter disclosure rules on a broad set of non-purely financial metrics can find it easier to obtain a high ESG rating. In addition, local interest in responsible investing and associated demand for high ESG-rated securities can encourage corporate issuers to conform to high standards of sustainability. Regional differences in investor interest in responsible investing could, therefore, explain differences in average ESG scores. We find some evidence in investor surveys that the proportion of Socially Responsible Investing (SRI) relative to total managed assets is higher in Europe than in other parts of the world[9].

As it is clear that a naive ESG tilt can come with various unintended biases, it is important to carefully control portfolio risk exposures to ensure that any analysis of the effect of ESG on valuation or on performance is done "everything else equal". Regional variations in ESG scores also point to the need to analyse the effect of ESG investing in the US and in Europe separately from each other.

[9] See, for example, Global Sustainable Investment Review, GSIA 2016; *http://www.gsi-alliance.org/wp-content/uploads/2017/03/GSIR_Review2016.F.pdf*

The Effect of ESG on Bond Valuation

We have seen that ESG characteristics can be associated with differences in spread and other risk attributes. For example, higher-rated issuers tend to have better ESG scores. Therefore, to determine whether the market is pricing in an "ESG premium", we need to control for all other relevant bond risk characteristics.

To isolate the effect of ESG ratings on bond valuation, we run a regression analysis in which we explain the spread of all bonds in our study universe at a particular point in time using the ESG score of their respective issuer while controlling for systematic sources of risk such as credit rating, sector and duration. In the euro market, we also control for geography, as issuers from peripheral Europe are likely to have been affected by the high volatility of sovereign spreads observed from 2010 to 2012[10]. This analysis provides an attribution of issuer spread, including the component due to the ESG factor.

Figure 9 provides a sample result of such a regression in the US IG market using MSCI ESG scores, as of the end of March 2018. The regression has a high R-squared (72%), meaning that the full set of bond attributes used (industry, credit rating, OASD, and ESG score) explains much of the spread of any given bond at this time. Most of the control variables are highly significant, economically (large coefficient) and statistically (t-Stats well in excess of 2 in most cases). In this case, however, the factor that we are interested in, the ESG spread premium, is negative, meaning that high ESG bonds tend to trade at slightly tighter spreads than low ESG bonds. The coefficient of -0.6 means that for a one-standard deviation increase in the ESG score of an issuer, the spread of its bonds decreases by 0.6bp, making them marginally more expensive than comparable bonds of other issuers. The statistical significance of this coefficient is low (t-Stat of -0.5), as there is substantial uncertainty around that estimate.

FIGURE 9

Example spread attribution to ESG attributes in the US IG market at the end of March 2018 (using MSCI ESG data)

	ESG	Duration	Credit Rating						Industry Sector							
	Score	OASD	A1	A2	A3	BAA1	BAA2	BAA3	BAS	CYC	NCY	COT	TRE	UTI	BAB	FIO
Coefficient	-0.6	8.4	2.3	8.8	18.9	35.7	51.2	77.6	62.8	64.9	57.3	72.2	77.0	77.1	87.0	76.0
t-Stat	-0.5	22.7	0.4	1.7	3.8	7.3	10.6	14.6	12.2	11.1	12.1	14.3	14.3	12.9	18.5	14.4
R-Squared	**71.8%**															

Source: Bloomberg Barclays Indices, MSCI ESG Research, Barclays Research

Repeating this analysis every month, we can chart the evolution of the ESG spread premium over time. Any significant changes in the ESG spread premium can point to a change in valuation of bonds resulting from their ESG characteristics. For example, if the spread difference between high and low ESG bonds decreases (or becomes more negative), meaning that high ESG bonds become more expensive relative to low ESG ones, one could assume that high ESG bonds benefit from increasing investor appetite. However, such re-pricing is typically limited in time, as high ESG bonds cannot continue to become increasingly expensive forever. Therefore, any performance based on such transient phenomenon should not be expected to be sustained but could be exposed to the risk of a reversal.

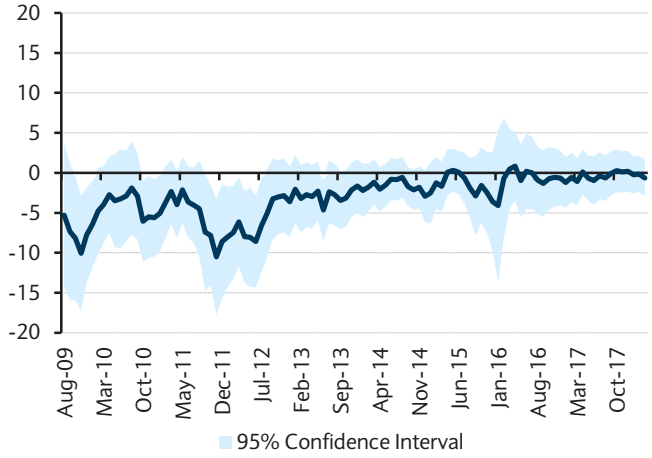
Figure 10 presents the time series of results for the ESG factor for the regression in Figure 9.[11] The solid line in the plot shows the coefficient obtained for the ESG factor each month; a negative result means that high ESG bonds trade at tighter spreads than low ESG

[10] We investigated the relationship between sovereign and corporate spreads in *Sovereign Risk Spill-over into Euro Corporate Spreads*, Barclays Research, 2013

[11] For conciseness, neither the charts in Figures 10 to 13 nor the tables in Figures 14 and 15 include results for the (highly significant) control variables related to duration, credit rating and sectors. They are all key drivers of spread but our interest is on the incremental effect of ESG rating on spread after controlling for these.

FIGURE 10

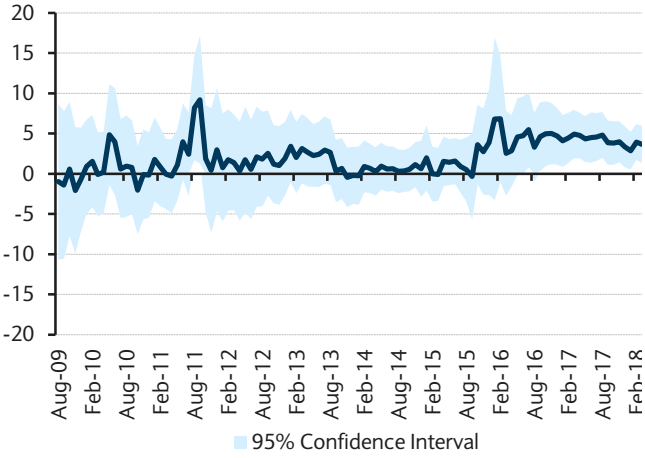
Historical ESG spread premium in the US IG market (MSCI) (bp per one standard deviation in ESG score)



Source: Bloomberg Barclays Indices, MSCI ESG Research, Barclays Research

FIGURE 11

Historical ESG spread premium in the US IG market (Sustainalytics) (bp per one standard deviation in ESG score)



Source: Bloomberg Barclays Indices, Sustainalytics, Barclays Research

peers. The shaded region around each plot represents the 95% confidence interval; if a value of 0 is included in this region, then the result for that month is not statistically significant. We find that the results of the regression over the past few years have been consistent with that shown in Figure 9: there is a slight indication of an ESG spread premium, but it is not often statistically significant.

Figure 11 presents the evolution of the ESG spread premium estimates and confidence intervals in the US based on Sustainalytics ESG scores; Figures 12 and 13 give results for the Euro IG market using scores from the two providers. Taken together, Figures 10 through 13 provide several insights:

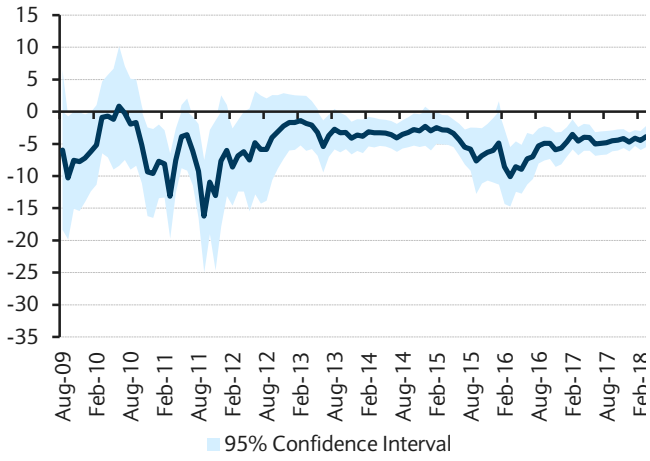
- One might have expected that increased interest in sustainable investing would have driven up the prices (thus reducing spreads) of high ESG bonds. This hypothesis, which could explain why high-ESG portfolios have outperformed over this period (as we will show in the following section), is not supported by the data in Figures 10 through 13. We do not observe a downward trend in ESG-related spreads in IG markets; if anything, they seem to have increased.

- We find some differences in the level of the ESG premium depending on the provider in the US market but less so in the euro market. In the US market, we were unable to detect a statistically significant premium in most months. When estimating spread premia in the US, we find that bonds considered high ESG by MSCI have traded at slightly tighter spreads, on average, than their low ESG peers (but significantly so only for a few months in the early part of the data sample). This is not the case when using Sustainalytics data.

- In contrast to the US market, we find that in Europe, high ESG bonds trade at lower spreads than their low ESG peers irrespective of the provider. The magnitude of the spread factor in recent years is small (approximately -5bp per standard deviation of ESG score) but significant. This could indicate different attitudes to ESG investing in the two markets: European investors might be more prepared to give up some income in favour of desirable ESG characteristics. This might also be a reflection of investor guidelines mandating a focus on high ESG issuers.

FIGURE 12

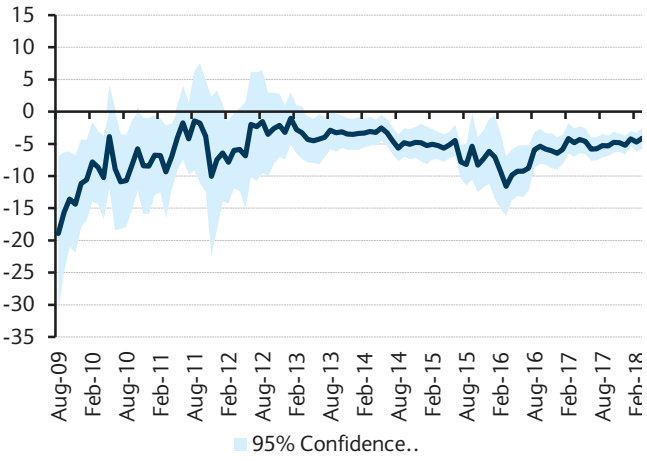
Historical ESG spread premium in the euro IG market (MSCI) (bp per one standard deviation in ESG score)



Source: Bloomberg Barclays Indices, MSCI ESG Research, Barclays Research

FIGURE 13

Historical ESG spread premium in the euro IG market (Sustainalytics) (bp per one standard deviation in ESG score)



Source: Bloomberg Barclays Indices, Sustainalytics, Barclays Research

Can this analysis tell us which pillar score has been most valued by investors? To address this, we repeat our analysis with two changes: we substitute either the E, S, or G score alone for the overall ESG score in the above analysis; and we pool together the results for all months of the study. Figures 14 and 15 summarise the results of this pooled analysis for the two providers for the US IG and euro IG markets.

FIGURE 14

Average spread premium, by ESG pillar, in US IG and Euro IG markets (2009-18), using MSCI ESG scores

	US IG	Euro IG
ESG Score (bp per std)	-3.0	-5.1
Env. Score (bp per std)	-2.2	-2.3
Soc. Score (bp per std)	0.0	-2.9
Gov. Score (bp per std)	-4.2	-5.0

Source: Bloomberg Barclays Indices, MSCI ESG Research, Barclays Research

For both providers, all three pillars of ESG are found to have a significant effect[12] on bond valuations in euro IG credit: a higher ESG rating corresponds to tighter spreads, and a cheaper cost of debt. When using MSCI data, we find that Governance has the largest and most significant effect. When using Sustainalytics data, we find a slightly different pattern of relationship between ESG attributes and bond spreads: Environment has the most influence on spreads, followed by Social and Governance (but remember that for Sustainalytics, Governance relates mainly to the sustainability commitment of the corporation while for MSCI it is corporate governance). The same analysis performed in the US IG market is less conclusive: the coefficients are generally smaller in magnitude, and their signs vary depending on the provider and on the pillar considered.

[12] We base this conclusion on the prevalence of significant monthly results. T-statistics are not shown for the time-averaged coefficients in Figures 14 and 15. In this setting, the standard interpretation of T-statistics is not applicable, as the results of the spread regression exhibit trends and are highly correlated over time.

FIGURE 15

Average spread premium, by ESG pillar, in US IG and Euro IG markets (2009-2018), using Sustainalytics ESG scores

	US IG	Euro IG
ESG Score (bp per std)	2.1	-6.0
Env. Score (bp per std)	1.1	-5.9
Soc. Score (bp per std)	2.6	-4.6
Gov. Score (bp per std)	1.8	-3.8

Source: Bloomberg Barclays Indices, Sustainalytics, Barclays Research

Spread premium analysis reveals differences in appetite for ESG attributes between the US and euro markets. These differences are not very large and did not follow a very clear trend or pattern during the time of our analysis, but they have been significant in recent years. From the perspective of euro issuers, high ESG attributes have been rewarded with lower credit spreads and, hence, a lower cost of funding. On the other hand, investors favouring high ESG bonds have received slightly lower income returns. This was not the case in the US market. Could this mean that that an investment style that systematically favours high ESG bonds would perform differently in Europe than in the US?

The Effect of ESG Investing on Portfolio Performance in US and Euro IG Markets

Does favouring issuers with high ESG scores help or hinder portfolio performance? To answer this question[13], we perform a historical simulation of diversified portfolios that match all major index exposures except for a positive or negative ESG tilt. The difference in return between high and low ESG portfolios illustrates the performance effect of the ESG factor in the period considered.

This analysis was presented in our previous research but was limited to the US investment grade market. In the next section, we update our results, adding two years of data, and expand to the euro IG and US HY markets. We also study the effect of ESG investing in individual industry sectors with a view to identify which one of E, S or G has been most influential in each sector. Finally, we explore the effect of diversification on our ESG performance study.

Constructing index-matched high-ESG and low-ESG portfolios

To measure the effect of ESG investing on credit portfolio performance in an objective manner, we construct pairs of portfolios that differ substantially in their ESG scores, but whose characteristics are otherwise identical across all important dimensions of risk for corporate bonds. By isolating the ESG effect from other sources of risk, we capture the difference in performance between these portfolios that is attributed to the ESG tilt. We then monitor the performance of these portfolios over time.

The core of our portfolio construction technique is a mechanism for building well-diversified portfolios of bonds designed to track a benchmark – in this case, the Bloomberg Barclays US Corporate Investment Grade Index[14]. We constrain portfolios to remain neutral to the benchmark along multiple risk dimensions that are known to affect bond portfolio returns. Specifically, the portfolios are constrained to match the average spread, duration, DTS of the index. A quality constraint ensures that the portfolio allocation matches that of the

[13] An alternative approach to answering this question would be to use a statistical analysis similar to the one used in the previous section. Results using this approach are presented in Appendix 2, and broadly agree with those presented here.

[14] To ensure consistency, the universe of bonds considered for portfolio construction is not the entire index, but limited to those for which ESG ratings were available from both MSCI and Sustainalytics. A detailed profile of this dataset, including its index coverage and other properties, was provided above.

index across three rating buckets. Sector and maturity allocations are matched along a 16-cell partition of eight industry sectors by two maturity buckets for the US IG market. For each industry-maturity cell, the portfolio must match the index market weight, spread duration and DTS[15] contribution. To control idiosyncratic risk, concentration limits ensure that no bond or issuer is significantly overweight in terms of market weight and DTS contribution. These rules make our tracking portfolios highly diversified, with close to 180 bonds, on average.

Several adjustments apply to the euro market. The benchmark is not the published Bloomberg Barclays Euro IG Corporate bond index but its subset that includes bonds covered by MSCI and Sustainalytics. This ensures that portfolio construction is not biased as a consequence of some index bonds being unavailable in the investment universe. We use a 10-cell partition of five industry sectors by two maturity buckets and we control for issuer geography.

The specific set of constraints used in each market can be satisfied by many different portfolios. The key to our technique is that the objective function selected determines which specific bonds should be used to fill each industry maturity cell.[16] We run the model twice with two different objectives: once to maximise the weighted-average portfolio ESG score subject to these constraints and once to minimise it. The two tracking portfolios are reconstructed every month-end, at the time of monthly index rebalancing, to ensure that they keep pace with any changes in the structure of the corporate bond market. Both are expected to track the index quite well, so that monthly tracking error volatility should be low. The key question is whether substantial differences would arise over time between the average returns of the two portfolios.

The difference between the high and low ESG tracking portfolios can be interpreted as an ESG return factor: the return contribution associated with systematically favouring high ESG corporate bonds over low ESG ones while keeping everything else equal. This approach does not automatically exclude any issuer or any industry sector, no matter how controversial they might be.

In addition to pairs of portfolios with the minimum and maximum overall ESG rating, we also create portfolio pairs that accentuate the differences in individual E, S, and G scores, to observe which one of these three pillars has the largest effect on performance. All portfolio simulations are carried out using ESG ratings from either MSCI or Sustainalytics.

Outperformance of high-ESG portfolios persists in US and Euro IG markets

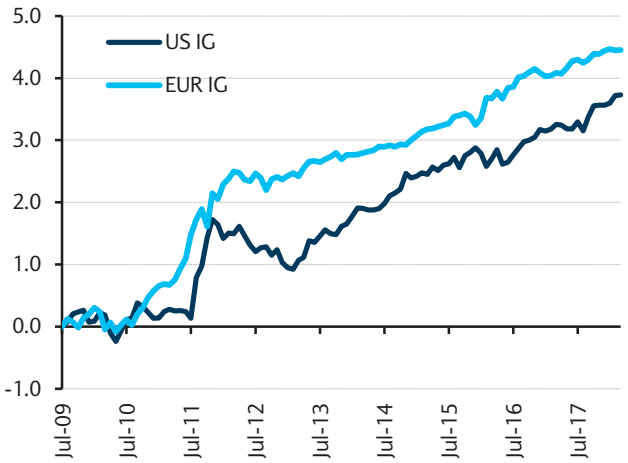
Figures 16 and 17 report the cumulative outperformance of high ESG portfolios over low ESG ones in the US IG and euro IG markets. Figure 16 shows results based on ESG data provided by MSCI while those shown in Figure 17 are based on Sustainalytics ESG scores. The performance paths follow a similar pattern: in all four cases, the cumulative performance has been positive and trending upwards over the past nine years, with some more volatile patches along the way. The period up to 2012 was generally more volatile than more recent years.

[15] See *DTS (Duration Times Spread)*, Ben Dor A., L. Dynkin, J. Hyman, P. Houweling, E. van Leeuwen and O. Penninga, Journal of Fixed Income, Spring 2007

[16] We have used a similar technique in other settings, such as forming index tracking portfolios that invest in highly liquid bonds.

FIGURE 16

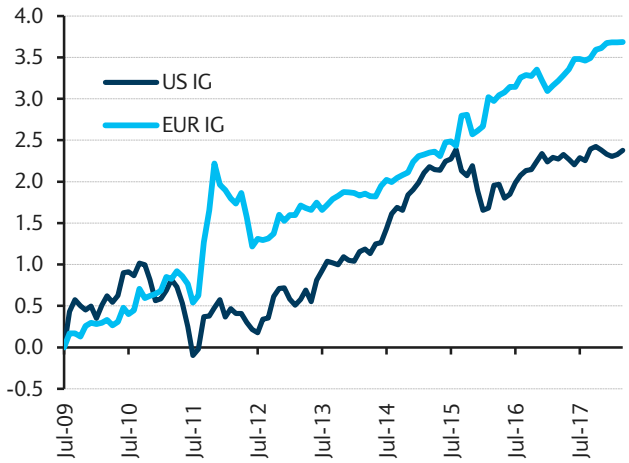
Cumulative performance (exc. ret., %) of a high ESG portfolio over a low ESG portfolio in the US IG and euro IG markets, using MSCI ESG data, 2009-18



Source: Bloomberg Barclays Indices, MSCI ESG Research, Barclays Research

FIGURE 17

Cumulative performance (exc. ret., %) of a high ESG portfolio over a low ESG one in the US IG and euro IG markets, using Sustainalytics ESG data, 2009-18



Source: Bloomberg Barclays Indices, Sustainalytics, Barclays Research

Our previous research has indicated that an ESG tilt helped improve performance in the US market from August 2009 to April 2016, with Governance having the strongest link to performance. With the benefit of two additional years of data, we expand our study and summarise results in Figure 18, which includes results based on the two providers and a split between the three components of ESG. The leftmost block of data in Figure 18 reports ESG factor performance for the entire nine years of our analysis in the US IG market. The first seven years, repeated from our previous publication, are covered in the second section while the third section relates to the past two years. The rightmost section of the table relates to the euro IG market. To put portfolio average tracking errors and tracking error volatilities in perspective, the top row includes average returns and volatilities of the respective indices. These are expressed in excess of duration-matched local Treasury bond portfolios to keep the focus on credit performance independently of any fluctuations in the general level of interest rates. Our two-year update of ESG factor performance in the US IG market does not produce any major surprises: the outperformance of high ESG portfolios over low ESG ones through April 2018 looks about the same as it does through 2016. Maximising overall ESG scores from either provider produces small but steady outperformance, with the best single-pillar results coming from Governance. If we drill down into the performance during the past two years in isolation, we find that all score components from both providers led to outperformance, but that the pillar most closely related to outperformance in this period was Environment.

Our study of the euro IG market confirms our US results. High ESG portfolios have outperformed low ESG ones over the past nine years, both overall and using any of the three pillar scores, using data from either provider. The performance numbers for the two markets are strikingly similar, with slightly lower volatility in Europe. As a result, the information ratios are higher in Europe. In terms of the role played by different pillar scores, the euro IG results show less variation amongst them: all three pillars turn in positive performance, with the largest effect coming from the Environment score. The Social score seems to be the least important factor in both markets, for both providers.

The existence of a small negative spread premium in the euro market does not seem to have affected the performance of our simulated long-short ESG strategy. The annualised outperformance of high ESG over low ESG portfolios was 42bp or 51bp/yr, depending on which ESG data source is used. This is much larger than, and of opposite sign to the spread

premium (about -5bp) discussed in the previous section. This spread premium remained in place and did not mean revert over the period of the study.

FIGURE 18

Portfolios of high ESG issuers have outperformed low ESG portfolios in the Euro, as well as in the US IG market

	US IG Market									Euro IG Market		
	Full Period: August 2009 to April 2018			Original Study Period: August 2009 to April 2016			Update Period: May 2016 to April 2018			Full Period: August 2009 to April 2018		
	Avg (bp/m)	StDev (bp/m)	I.R.	Avg (bp/m)	StDev (bp/m)	I.R.	Avg (bp/m)	StDev (bp/m)	I.R.	Avg (bp/m)	StDev (bp/m)	I.R.
IG Index Excess Return over Treasuries	17.0	97.5	0.6	14.7	107.1	0.5	25.2	52.0	1.7	16.3	87.0	0.7
Using MSCI ESG scores												
High - Low ESG	3.6	13.6	0.9	3.5	14.6	0.8	3.8	10.0	1.3	4.3	11.4	1.3
High - Low Env.	2.9	13.3	0.7	3.0	14.0	0.7	2.4	10.8	0.8	2.7	13.5	0.7
High - Low Soc.	-0.8	13.6	-0.2	-1.4	14.3	-0.3	1.5	10.7	0.5	1.8	10.2	0.6
High - Low Gov.	5.4	14.4	1.3	6.8	15.3	1.5	0.6	9.5	0.2	2.7	11.0	0.8
Using Sustainalytics ESG scores												
High - Low ESG	2.3	13.5	0.6	2.4	14.7	0.6	1.8	7.7	0.8	3.5	13.9	0.9
High - Low Env.	1.6	15.8	0.3	1.4	17.1	0.3	2.0	10.1	0.7	3.6	11.1	1.1
High - Low Soc.	0.4	14.5	0.1	0.3	16.1	0.1	0.8	6.6	0.4	2.4	12.1	0.7
High - Low Gov.	2.1	13.8	0.5	2.4	15.0	0.6	1.1	8.8	0.4	3.4	13.2	0.9

Note: Sustainalytics' Governance pillar measures governance of sustainability issues. Sustainalytics has a separate corporate governance rating that is not represented in this study. Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics, Barclays Research

Breaking down ESG performance by industry

How does the "ESG factor" perform in major industry sectors? Has an ESG tilt had a positive return contribution across all sectors? And are E, S and G contributions similar at sector level to what is shown in Figure 18 for the entire market?

To address these questions, we repeat our long-short portfolio simulations for eight major sectors of the index in the US market and five sectors in the euro market. The choice of sectors is motivated by the need to have sufficient issuer diversification within each sector for the entire period of the analysis, so that issuer-specific risk remains limited. As in the market-wide portfolios discussed above, industry-specific high ESG and low ESG portfolios are rebalanced every month to ensure that they have the same risk characteristics while being broadly diversified. Construction rules can vary from one sector to another according to issuer diversity within each sector. In practice, the average number of bonds in each such portfolio vary by industry, ranging from 65 (cyclical) to over 110 (banks and brokerages) in the US market and from 50 (utility) to over 110 (for an enlarged cyclical sector, broader than its US cousin) in the euro market.

Figure 19 reports the average returns of ESG-tilted sector portfolios in the US IG market. Return contributions of ESG tilts are positive in most cases. As intuition suggests, Governance is the most significant factor in banking and brokerages, for both providers of ESG scores. The effect of Environment is always positive and especially significant in non-cyclicals or transportation and energy. The effect of Social is highly variable, and sometimes negative. The sector with the most significant relationship to ESG (that is with the highest information ratio of the high ESG over low ESG portfolio) is non-cyclical consumer goods, for both ESG providers. While in most sectors, similar results are obtained for the two providers, there are some sectors (such as basic and capital goods), where performance varies a lot from one ESG provider to the other.

FIGURE 19

Return difference (in bp/month) between portfolios with high ESG scores over similar risk portfolios with low ESG scores (200918) in various sectors of the US IG market

	Basic and Capital Goods	Cyclical	Non-Cyclical	Comm. and Technology	Transport and Energy	Utility	Banking and Brokerage	Other Financials
Using MSCI ESG scores								
ESG	6.6**	2.0	5.8**	3.4*	6.9**	0.3	6.3**	5.4**
Environment	7.1**	4.0**	8.2**	1.8	6.5*	1.4	0.4	4.3**
Social	-0.8	-3.2	-0.1	3.3*	-2.7	0.1	3.5*	1.7
Governance	2.6	1.5	4.6**	-0.8	3.9*	0.4	6.5**	2.0
Using Sustainalytics ESG scores								
ESG	-1.1	2.4*	10.3**	3.5*	8.3**	2.4*	2.0	3.3**
Environment	1.8	5.6**	9.3**	3.1*	4.6*	2.1*	0.8	6.0**
Social	-0.5	-3.4	8.8**	0.8	3.8	0.6	0.4	-1.4
Governance	-3.7	0.2	4.3**	-3.5	3.8*	1.7	5.1**	3.0*

Note: * Indicates a 5% significance while ** correspond to a 1% significance for positive results in the sample considered. Sustainalytics' Governance pillar measures the governance of sustainability issues. Sustainalytics has a separate corporate governance rating that is not represented in this study.
Source: Bloomberg Barclays Bond Indices; MSCI ESG Research; Sustainalytics, Barclays Research

Figure 20 summarises the results of a similar analysis in the euro market. Given the need for diversification, we consider only five sectors. Banking and brokerage and non-cyclical consumer goods are the ones in which the link between ESG and performance is most visible; for the less-diversified utility portfolios, high ESG portfolios have underperformed low ESG ones. As in the US market, high-low portfolio pairs exhibit similar behaviour for the two ESG providers in most sectors but not in the cyclical sector which in Europe is enlarged to include capital goods.

FIGURE 20

Return difference (in bp/month) between portfolios with high ESG scores over similar risk portfolios with low ESG scores (2009-18) in various sectors of the euro IG market

	Cyclical	Non Cyclical	Utility	Banking and Brokerage	Other Financials
Using MSCI ESG scores					
ESG	2.1*	1.3*	-2.5	5.5**	1.5
Environment	-0.3	1.2	-2.4	1.2	3.1*
Social	1.2	0.5	-3.6	1.2	-0.1
Governance	2.3*	0.3	-0.8	1.4	1.4
Using Sustainalytics ESG scores					
ESG	-0.4	1.9**	-0.9	3.2*	5.3**
Environment	-0.7	2.3**	0.9	3.2*	5.7**
Social	0.8	1.4*	-3.1	1.7	2.0
Governance	-0.2	1.0	-0.4	2.5	3.7*

Note: * Indicates a 5% significance while ** correspond to a 1% significance for positive results in the sample considered. Sustainalytics' Governance pillar measures governance of sustainability issues. Sustainalytics has a separate corporate governance rating that is not represented in this study.
Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics, Barclays Research

Our broad findings confirm our previous reports: ESG tilts have been broadly associated with positive portfolio performance, with E and G being the strongest contributors. This can help reassure investors that favouring high ESG bonds has not been detrimental to returns.

In individual sectors, as for the market-wide results, one should be cautious not to over-interpret these results. The economic effects illustrated in portfolio simulation could be specific

to the data sample and the set of parameters used in designed ESG-tilted portfolios. Some relationships are not intuitive and, therefore, could well be accidental despite being statistically significant in the data sample considered. This includes, for example, the effect of Environment in the "other financial" sector. We should also caution against forming views on ESG providers on the basis of such data.

Higher diversification can sharpen results

Having constructed individual tracking portfolios for each sector, we now have the opportunity to carry out a simple test of the effect of diversification. We recombine the sector-specific portfolios each month by index market weight to form a single high ESG and low ESG tracking portfolio for each market that should be much more diversified than our original trackers. While the average number of bonds in our original tracking portfolios was about 180, these aggregated tracking portfolios contain an average of about 420 bonds in EUR IG and over 700 bonds each month in the US IG market. This should help reduce idiosyncratic risk; if the outperformance from an ESG tilt remains or decreases by less than the volatility, this should enhance the achieved information ratios.

FIGURE 21

Effect of diversification on the outperformance of high over low ESG portfolios (2009-18)

	US IG Tracking Portfolios						EUR IG Tracking Portfolios					
	Original			Highly Diversified			Original			Highly Diversified		
	Average (bp/m)	Volat. (bp/m)	Inf. Ratio	Average (bp/m)	Volat. (bp/m)	Inf. Ratio	Average (bp/m)	Volat. (bp/m)	Inf. Ratio	Average (bp/m)	Volat. (bp/m)	Inf. Ratio
Using MSCI ESG Scores												
High - Low ESG	3.6	13.6	0.9	5.0	8.8	2.0	4.3	11.4	1.3	2.9	7.4	1.4
High - Low Env.	2.9	13.3	0.7	3.8	7.5	1.8	2.7	13.5	0.7	0.7	8.7	0.3
High - Low Soc.	-0.8	13.6	-0.2	1.0	7.0	0.5	1.8	10.2	0.6	0.6	7.7	0.3
High - Low Gov.	5.4	14.4	1.3	3.1	6.9	1.6	2.7	11.0	0.8	1.4	8.8	0.6
Using Sustainalytics ESG Scores												
High - Low ESG	2.3	13.5	0.6	4.0	6.8	2.1	3.5	13.9	0.9	1.9	9.5	0.7
High - Low Env.	1.6	15.8	0.3	4.0	6.0	2.3	3.6	11.1	1.1	2.2	8.2	0.9
High - Low Soc.	0.4	14.5	0.1	1.5	6.0	0.8	2.4	12.1	0.7	0.9	6.8	0.5
High - Low Gov.	2.1	13.8	0.5	1.8	7.1	0.9	3.4	13.2	0.9	1.5	8.9	0.6

Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics, Barclays Research

Figure 21 shows the resulting performance. As expected, diversification reduces the volatility of the performance difference between all pairs of high ESG and low ESG portfolios in both markets. The effect on performance, however, is less uniform: the more diversified portfolios seem to outperform in the US IG market, but underperform in EUR IG. The average outperformance in the US is, in many cases, above that of the original portfolios, an unexpected result since the ESG tilt is reduced by diversification; the opposite is true in Europe.[17]

To gain more insight into the key drivers of outperformance, we can also check which leg of our tracking pairs generates the most performance: is it that the high ESG names outperform the index, or that the low ESG names underperform? We obtain different results to this question in the two markets. As shown in Figure 22, if we look only at the performance of our high ESG portfolios relative to the index, we find a different story than in the high ESG versus low ESG numbers shown above. For this long-only variation,

[17] Too much significance should not be read into the small differences in average returns between the two sets of back-tested tracking portfolios. Even the smaller tracking error volatilities measured in the diversified case are far greater than the observed differences in average performance between the original and diversified portfolio pairs.

performance is better in Europe than in the US, and the expected sharpening of risk-adjusted performance is illustrated in the EUR results: risk is reduced by diversification, return is flat or even up slightly, and information ratios are up across the board. In the US, the original high ESG portfolios do not show very significant outperformance, but diversification helps, at least for the overall ESG scores.

FIGURE 22

Effect of diversification on the performance of high ESG portfolios relative to the index (2009-18)

	US IG Tracking Portfolios						EUR IG Tracking Portfolios					
	Original			Diversified			Original			Diversified		
	Average (bp/m)	Volat. (bp/m)	Inf. Ratio	Average (bp/m)	Volat. (bp/m)	Inf. Ratio	Average (bp/m)	Volat. (bp/m)	Inf. Ratio	Average (bp/m)	Volat. (bp/m)	Inf. Ratio
Using MSCI ESG Scores												
High ESG - Index	1.7	14.3	0.4	1.8	9.8	0.6	2.4	9.4	0.9	2.4	6.9	1.2
High Env. - Index	1.9	13.2	0.5	1.8	8.6	0.7	0.9	11.8	0.3	1.3	7.9	0.6
High Soc. - Index	0.2	14.0	0.0	-0.4	9.4	-0.1	0.6	9.9	0.2	1.4	6.1	0.8
High Gov. - Index	2.3	14.8	0.5	0.5	8.3	0.2	1.3	10.7	0.4	1.5	8.3	0.6
Using Sustainalytics ESG Scores												
High ESG - Index	-0.3	12.6	-0.1	1.7	9.0	0.7	1.8	8.2	0.8	1.8	5.8	1.1
High Env. - Index	-0.1	11.3	0.0	1.6	7.9	0.7	2.1	7.5	1.0	1.7	5.1	1.2
High Soc. - Index	-1.7	13.9	-0.4	0.1	8.3	0.1	0.8	9.6	0.3	1.4	5.8	0.8
High Gov. - Index	1.1	14.1	0.3	0.0	9.0	0.0	1.7	8.0	0.7	1.6	6.4	0.9

Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics, Barclays Research

Figure 23 shows the other side of the coin: low ESG portfolios underperform relative to the index. After diversification, in particular, this effect seems to be much stronger in the US market than in Europe. It appears that the US strategy of choice in the past nine years was "avoid poor ESG ratings", while in Europe it was "seek the best ESG ratings".

FIGURE 23

Effect of diversification on the performance of low ESG portfolios relative to the index (2009-18)

	US IG Tracking Portfolios						EUR IG Tracking Portfolios					
	Original			Diversified			Original			Diversified		
	Average (bp/m)	Volat. (bp/m)	Inf. Ratio	Average (bp/m)	Volat. (bp/m)	Inf. Ratio	Average (bp/m)	Volat. (bp/m)	Inf. Ratio	Average (bp/m)	Volat. (bp/m)	Inf. Ratio
Using MSCI ESG Scores												
Low ESG - Index	-1.9	12.1	-0.5	-3.1	6.3	-1.7	-1.9	9.7	-0.7	-0.5	5.7	-0.3
Low Env. - Index	-0.9	12.8	-0.3	-2.0	7.9	-0.9	-1.8	9.4	-0.7	0.5	6.0	0.3
Low Soc. - Index	0.9	10.8	0.3	-1.3	6.0	-0.8	-1.2	9.6	-0.4	0.8	8.1	0.3
Low Gov. - Index	-3.2	10.3	-1.1	-2.6	5.8	-1.6	-1.4	9.1	-0.5	0.0	5.3	0.0
Using Sustainalytics ESG Scores												
Low ESG - Index	-2.6	14.6	-0.6	-2.3	7.3	-1.1	-1.8	11.9	-0.5	-0.1	7.3	-0.1
Low Env. - Index	-1.7	17.8	-0.3	-2.4	7.6	-1.1	-1.5	11.9	-0.4	-0.5	6.4	-0.3
Low Soc. - Index	-2.1	14.2	-0.5	-1.3	7.3	-0.6	-1.6	10.8	-0.5	0.5	7.5	0.2
Low Gov. - Index	-1.0	13.8	-0.2	-1.7	6.9	-0.9	-1.7	12.2	-0.5	0.2	7.6	0.1

Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics, Barclays Research

Why do we observe such different results from the diversified portfolios in the US and Europe? We do not have a definitive answer, but can think of several contributing factors. The first is, simply, to acknowledge that there is still plenty of noise in this study. The simulated portfolio optimisations have many moving parts and could include some spurious effects. (Having said that, the information ratios above two achieved by the diversified portfolios using overall ESG scores from either provider in the US IG market, as shown in Figure 21, are hard to dismiss as chance.) Second, the increase in diversification was more dramatic in the US than in Europe. Not only were there a greater number of bonds in the diversified portfolios; but in Europe, the structure of the market made it difficult to add meaningful diversification.

An ESG tilt is seldom the only active bias in a portfolio but more often part of a set of active strategies that can be fundamental or quantitative. For example, credit portfolios can integrate ESG scores in the management process by combining them with security-level quantitative scorecards that provide momentum or relative value signals and correspond to thematic style factors[18]. Such ESG integration into the portfolio management process can be implemented in different ways. For example, an ESG filter can help screen out securities with weak ESG attributes, at the risk of reducing the investment universe and, hence, the potential for generating alpha. On the other hand, portfolios can be constructed with the aim of achieving a high average ESG score without *a priori* excluding any securities (as in the simulations presented above) and at the same time choosing from securities that have desirable characteristics, such as relative value or momentum. In that case, it is acceptable to find a low ESG issuer in a portfolio considering the trade-off between ESG and purely financial characteristics.

The Effect of ESG on Downgrade Rates

Are high ESG scores associated with less frequent or milder downgrades in credit rating? For this, we partition our bond universe into above and below median Governance scores and observe the number and magnitude of downgrades for each one of these two sets. This allows us to report an annual "downgrade notch rate" that captures the frequency and intensity of downgrades (a two-notch downgrade in one year is equivalent to two one-

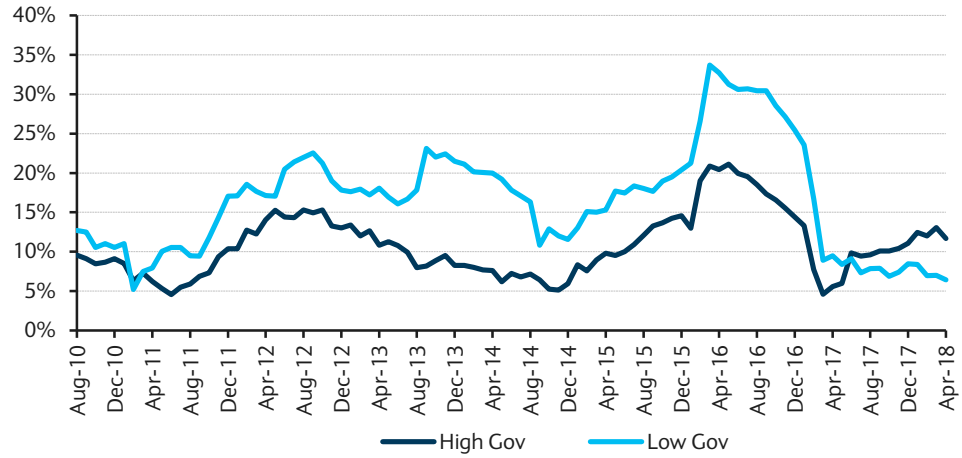
[18] For an overview of systematic investing in credit markets, see *Smart Beta in Credit*, Barclays Research 2017 and for an introduction to quantitative scorecards for relative value and momentum in credit markets, see *Quantitative Credit Scorecards for Relative Value (ESP) and Cross-Asset Momentum (EMC)*, Barclays Research, 2018

notch downgrades in the same year). In our previous study related to the US IG market, we found that companies with above median corporate governance scores had a lower rate of downgrades than those with below median governance.

An update of this analysis is presented in Figure 24, which plots the annual downgrade rate for US IG issuers partitioned according to MSCI data. It is clear that for most of the period of the study, high Governance scores have come with a lower rate of downgrades than low Governance, but not for the most recent year when the downgrade risk was generally milder than in earlier years.

FIGURE 24

Rolling average number of downgrade notches per issuer and per year (US IG market)



Source: Bloomberg Barclays Indices, MSCI ESG Research, Barclays Research

We extended this analysis to other ESG scores and to other markets and found that other ESG metrics exhibited a similar pattern but none were statistically significant, neither in the US, nor in Europe.

Similarly, we wondered whether credit downgrade rates could be predicted not just by the level of ESG scores, but by changes in ESG scores. We investigated whether companies whose ESG ratings decreased over the past 12 months were more likely to experience credit downgrades – either during the same period or during the following 12 months. Due to the relatively small sample size, we were not able to find any statistically significant results indicating a relationship of this sort.

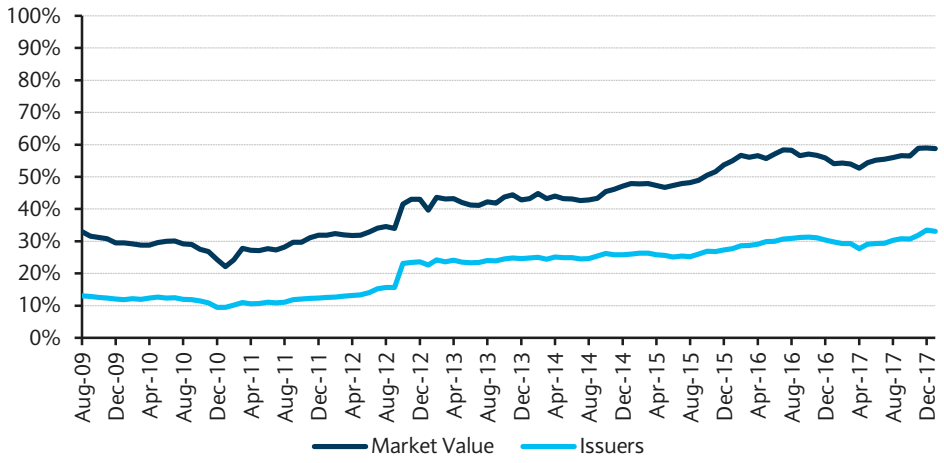
Focus on the US High Yield Market

ESG investing poses different challenges in high yield than in the investment-grade market. Many high yield issuers are private issuers and ESG rating coverage is sparser in HY than in IG. Building diversified portfolios of bonds may, therefore, be more challenging in HY than in IG markets where a larger proportion of the market is ESG rated. However, even though difficult to achieve, portfolio diversification is even more important in HY than in IG markets, given the high issuer-specific risk of HY bonds. Extending our analysis of the IG market to HY may, therefore, yield less precise insights.

Figure 25 shows the share of the US HY index that is covered by both ESG providers over time and echoes information reported in Figure 3. The current coverage is just over a third of HY index issuers, but close to 60% of the index market value has ESG ratings. Coverage jumped in the last quarter of 2012, when the share of HY issuers that were assigned ESG ratings by both providers increased from 16% to 23%. For this reason, we start our study of the HY market in October 2012, as opposed to the end of August 2009 for IG indices.

FIGURE 25

ESG coverage of the US HY market has been limited, with an improvement in 2012



Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics, Barclays Research

As in IG markets, a naive allocation to high ESG issuers may entail unintentional exposures. Figure 26 shows the differences in characteristics between the top and bottom tiers of ESG bonds. Figure 26 reports average ESG scores (on a scale of 10 for MSCI and of 100 for Sustainalytics) in each bucket, as well as the differences between high and low ESG buckets. The second row of Figure 26 reports average spreads. Unlike what we found in IG markets, spreads do not necessarily decrease as ESG ratings improve. When using Sustainalytics data, the opposite is true: high ESG-rated bonds have, on average, provided higher spreads than lower-rated ones. This is related to the one-year longer duration that these higher-rated bonds also happen to exhibit over that of lower-rated ones. As before, any analysis of the effect of ESG must carefully control for differences in systematic risk.

FIGURE 26

Average differences in characteristics between high and low ESG portfolios in the US HY market (2012-18)

	MSCI				Sustainalytics			
	Low	Medium	High	H - L	Low	Medium	High	H - L
Average ESG Score	2.0	3.8	6.1	4.1	47	55	68	21
Spread over Treasury Bonds (bp)	407	385	377	-30	359	363	379	20
OASD	4.4	4.3	4.5	0.0	4.1	4.6	5.1	1.0
Liquidity Cost Score	1.1	1.0	1.1	0.0	1.0	1.0	1.1	0.1
Rating Quality	B1	B1	Ba3		Ba3	Ba3	Ba3	
Rating Quality Number	14.7	14.6	14.5	-0.2	14.5	14.3	13.9	-0.5

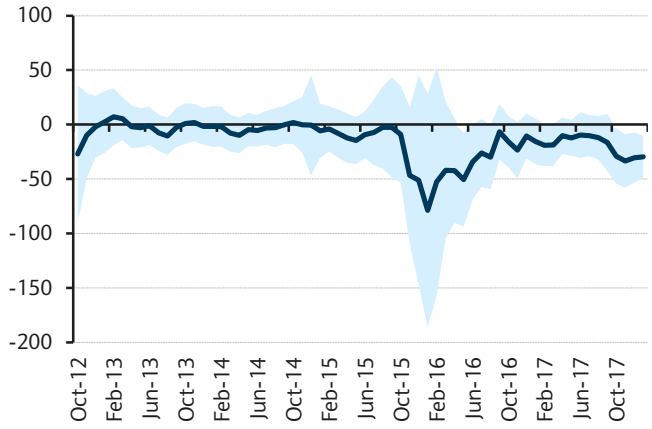
Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics, Barclays Research

To assess the sign and magnitude of the ESG spread premium, we perform a regression analysis every month, controlling for duration, quality and sector allocation. Estimated spread premia and corresponding 95% confidence intervals (shaded areas) are shown in Figures 27 and 28 and display some interesting similarities, as well as differences from one provider to the other. In both cases, we find that spread premium has tended to decrease in the time window considered, although this reduction is small: starting and ending premia are not significantly different from each other. However, spread premia follow different paths over time, in particular during the energy crisis of 2015-16, depending on which provider is used. Confidence intervals are very wide throughout, especially during the energy crisis, which is characterised by elevated spread volatility, as well as spread dispersion across issuers and sectors. What does this imply for the performance of ESG tilted HY portfolios?

To measure the effect of ESG investing in HY bond markets, we assemble diversified portfolios that either minimise or maximise ESG scores while having otherwise matching exposures, such as duration, spread, rating, and sector allocations. High and low portfolios included close to 160 bonds, on average. The observed difference between the returns of high and low ESG portfolios represents an "ESG return factor". Portfolios are rebalanced monthly and the cumulative excess return of high over low ESG portfolios is shown in Figures 29 and 30 for the two ESG providers. Although cumulative performances end up being positive and similar to each other in both

FIGURE 27

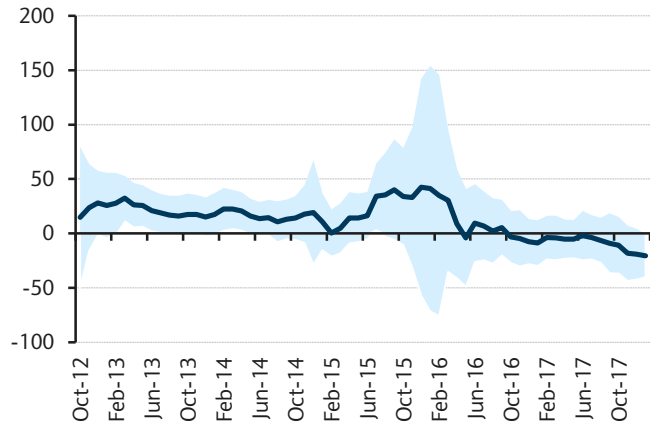
Historical ESG spread premium in the US HY market (MSCI) (bp)



Source: Bloomberg Barclays Indices, MSCI ESG Research, Barclays Research

FIGURE 28

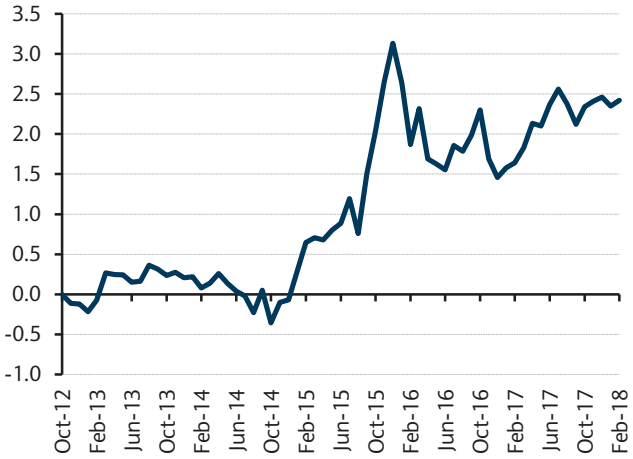
Historical ESG spread premium in the US HY market (Sustainalytics) (bp)



Source: Bloomberg Barclays Indices, Sustainalytics, Barclays Research

FIGURE 29

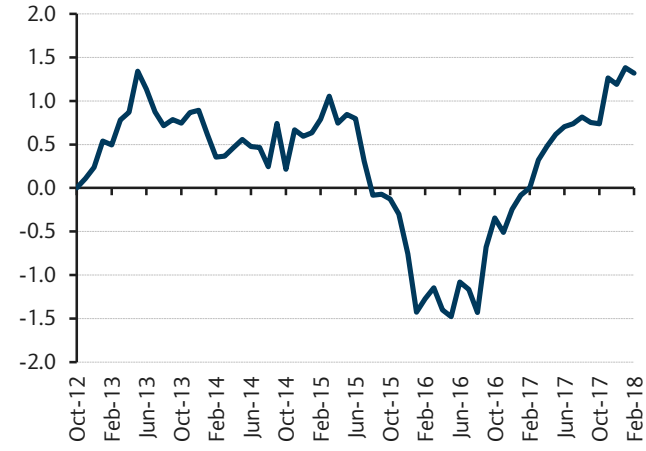
Cumulative performance (%) of a high ESG portfolio over a low ESG portfolio in the US HY market (using MSCI ESG data)



Source: Bloomberg Barclays Indices, MSCI ESG Research, Barclays Research

FIGURE 30

Cumulative performance (%) of a high ESG portfolio over a low ESG portfolio in the US HY market (using Sustainalytics ESG data)



Source: Bloomberg Barclays Indices, Sustainalytics, Barclays Research

cases, the patterns are different and mirror the patterns of spread premia shown above. In one case, the drop in spread premium seen at the end of 2015 corresponds to high returns of the ESG factor. This is followed by a spread reversal which corresponds to sluggish returns. In the other case, the spread widening of high ESG bonds in 2015 corresponds to underperformance, as shown in Figure 30, also followed by reversal in the subsequent years.

These contrasting spread and performance patterns illustrate the effect of different methodologies in ESG rating. The scores of the two providers are positively correlated in the period of the analysis but correlations are low.

A summary of the ESG factor performance is shown in Figure 31 and includes a split between E, S and G. The top row reports the excess return of the high yield index over duration-matched Treasuries. The sections below relate to the two providers. Most, but not all performances, are positive, on average. Long-short portfolio strategies tilted according to the MSCI Environment factor or the Sustainalytics Social factor had negative returns in the past five years and a half. The highest return, and the only one that exhibits statistical significance, relates to portfolios tilted according to corporate governance (supplied by MSCI).

FIGURE 31

Portfolios of high ESG issuers have outperformed low ESG portfolios in the US HY market (2012-18)

	Average (bp/m)	Volatility (bp/m)	Information Ratio
HY Index Excess Return over Treasuries	41.5	152	0.9
Using MSCI ESG scores			
High - Low ESG	3.8	28	0.5
High - Low Env.	-2.4	39	-0.2
High - Low Soc.	2.3	31	0.3
High - Low Gov.	10.3	32	1.1
Using Sustainalytics ESG scores			
High - Low ESG	2.1	27	0.3
High - Low Env.	2.9	30	0.3
High - Low Soc.	-0.3	30	-0.0
High - Low Gov.	3.5	31	0.4

Note: Sustainalytics' Governance pillar measures governance of sustainability issues. Sustainalytics has a separate corporate governance rating that is not represented in this study.
Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics, Barclays Research

When attempting to expand this analysis to individual industry sectors of the high yield market, we faced a practical issue in portfolio construction in that it was difficult to have sufficient diversification within individual sectors, especially in the early part of the period analysed. Sector portfolios included, on average, 20-40 bonds. As a consequence, tracking error volatility was high and very few returns exhibited statistical significance. While there was no ESG return effect (average returns were marginally negative for both providers) in the highly volatile transportation and energy sector, the ESG factor was mildly positive in the non-cyclical sectors for both providers. In other cases, performance was too low in regards to volatility to be significant, and sometimes of opposite sign depending on the provider. Due to the instability of these results, we do not report the details of this analysis.

Conclusion

Our follow-up investigation of the effect of ESG on credit portfolio performance has strengthened our main conclusion. Over the past nine years, tilting a portfolio systematically to companies with better ESG ratings has been beneficial to performance.

The distribution of ESG ratings is linked to other bond characteristics. We have shown that ESG scores have been higher, on average, in EUR IG credits than in USD IG; and that bonds with higher ESG ratings tend to have higher credit ratings and lower spreads as well. This makes it difficult to adjust the ESG characteristics of a portfolio without introducing a bias in some other direction, or to cleanly measure the performance effect of an ESG tilt in isolation.

Our study of valuation addresses this challenge using statistical analysis. We carried out regressions to test for an ESG premium by which high ESG bonds are systematically priced at tighter spreads than their low ESG peers of similar industry and quality. Over most of the data sample, we were unable to identify a statistically significant ESG premium in the US IG markets, but did find a fairly stable premium of about 5bp (per one standard deviation in ESG scores) in EUR IG markets in the past four years. This implies that European bond markets have placed greater emphasis on ESG criteria than their US counterparts.

We took a different approach in our analysis of performance. For this, we compared the performance of index tracking portfolios with high ESG and low ESG tilts. We built these portfolios subject to an array of constraints designed to avoid any other systematic bias in our historical back-test. Adding two more years of data to our previously published US IG study and repeating the study in the euro IG market corroborated our earlier results: high ESG portfolios consistently outperformed low ESG ones, in many cases significantly. For example, using overall ESG scores from either provider, outperformance in the euro market was about 3bp/month, with an information ratio close to one, over the nine years of our study. However, while we previously found that Governance was the attribute most closely associated with performance, we now find that Environment-tilted portfolios delivered the highest returns, in the US for the past two years and in Europe for the entire nine-year period of our study.

We then carried out an additional set of tests using industry-specific tracking portfolios. Results here were more uneven. Most, but not all, results were positive; quite a few significantly so. For example, a tilt to high ESG scores, and particularly Governance, was significantly positive in the banking and brokerage sector; E scores were more significant in the non-cyclical sector.

A side benefit of our sector-specific tests was that we were then able to recombine them to form more highly diversified tracking portfolios for the entire index. These highly diversified tracking portfolios showed consistently lower volatility of outperformance in the US and euro IG markets. Particularly in the US, this helped improve information ratios. However, results in Europe were less pronounced: with reduced risk came reduced outperformance. The outperformance in the US was driven mainly by low ESG portfolios underperforming the index, while in the euro market, high ESG portfolios outperformed the index significantly.

In the US HY market, our efforts were hampered by relatively poor coverage; many HY issuers are private firms, therefore, we were unable to map them to ESG scores. We repeated much of the analysis described above, but found few significant results. In valuation, we did not detect a significant ESG premium versus peers. In performance tests of tracking portfolios with ESG tilts, there was a tendency for high ESG to outperform, but with low information ratios. An alternative approach to our backtest of tracking portfolios would be to use a regression-based analysis of returns, just as we did for our analysis of the ESG spread premium. We have carried out this analysis as well and results, presented in Appendix 2, show a weak positive ESG performance effect, largely corroborating the findings of our simulation study. For the US HY market, the regression analysis indicates a stronger relationship between ESG attributes and returns than shown in our portfolio simulations.

Our study has strengthened the evidence that ESG has a positive effect on performance in two primary directions: that the results extend to the euro market, and that further diversifying the tracking portfolios enhances the statistical power of the results. However, it still leaves us with a bit of a puzzle: if there has been no systematic change in the ESG valuation premium, then what has driven the outperformance of high ESG portfolios? Our hypothesis is that companies that are better prepared to face the broad range of non-financial risks covered by ESG scores might be less likely to have negative surprises. One finding that supports this is that in the US, bonds with lower corporate governance scores experienced higher frequencies of downgrades in credit ratings. More generally, the ESG return benefit may take the form of idiosyncratic (issuer-specific) returns. Low ESG companies may be more likely to suddenly experience a problem during a month of otherwise calm markets (eg, an environmental disaster or a labour conflict), while high ESG ones might be better positioned than their peers to weather some market turmoil. The benefits of a systematic tilt towards higher ESG scores might, thus, be hard to identify as a market-wide ESG factor, but still accrue slowly and steadily towards better long-term performance.

Appendix 1 – ESG Rating Dynamics

The data we have analysed are highly multi-dimensional. We have studied three markets, which can each be subdivided into several industry sectors; and we relate various bond characteristics (spreads, excess returns, credit ratings) to ESG scores from two providers, which can each be broken down into three pillar scores. To keep our report readable, it was critical that we carefully select which charts and tables best represent our main results, and not try to present an encyclopaedic record of the results of all possible permutations.

Inevitably, though, some investors will want more detail about one particular aspect of our study that was not presented in the main body of our report. For this reason, this Appendix and the next fill in additional details that supplement the above results.

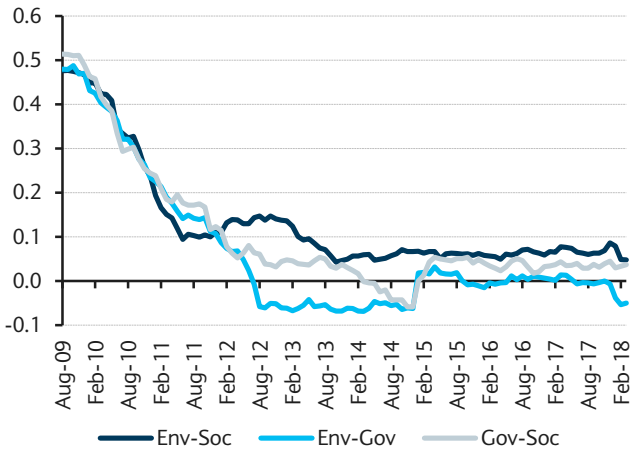
Correlations amongst ESG scores

Measuring correlations among ESG scores provides insights on whether individual pillars complement each other by holding non-overlapping information. If correlations across scores are low, pursuing investment styles specific to individual pillars will potentially yield different portfolio and performance characteristics.

Cross-sectional correlations[19] amongst E, S and G scores of individual providers are calculated every month and their evolution over time is reported in Figures 32 and 33. In this analysis, we pool together ESG data from all three markets covered in this study (US IG, EUR IG and US HY). The correlations amongst the different pillars of MSCI ESG scores were high – close to 50% – at the beginning of our sample, in 2009, but have declined to almost zero in recent years. On the other hand, correlations among the different pillars of Sustainalytics' ESG scores have remained relatively stable – close to 35% – throughout the period. The way that Sustainalytics defines Governance, as quality of governance of sustainability issues as opposed to corporate governance as defined by MSCI, makes this variable intrinsically closely related to the other two E and S pillars. Therefore, we observe a slightly higher correlation between Governance and the other two pillars for Sustainalytics than for MSCI.

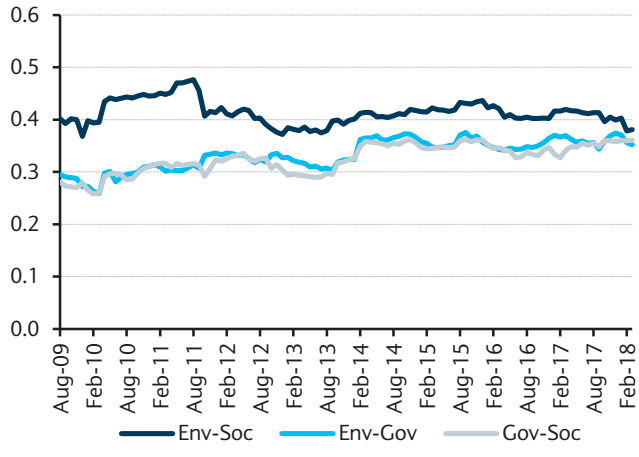
In addition to correlations amongst the different pillar scores within a single provider, it is interesting to test the correlations of a given pillar score across the two providers. We reported these for the entire universe in Figure 4; we now detail how these correlations vary by industry in Figure 34. Because of the different definitions of Governance, it is not surprising to find relatively low correlations between the Governance scores from the two providers.

FIGURE 32
Correlations amongst MSCI E, S and G scores



Source: MSCI ESG Research, Barclays Research

FIGURE 33
Correlations amongst Sustainalytics E, S and G scores



Source: Sustainalytics, Barclays Research

[19] We calculate Kendall rank correlations between the numerical ESG scores for all issuers in our combined US IG, Euro IG and US HY universe.

FIGURE 34

Average over time of the correlations between MSCI and Sustainalytics ESG scores in industry sectors of the US IG market (2009-18)

	Basic and Capital Goods	Cyclical	Non-Cyclical	Comm. and Technology	Transport and Energy	Utility	Banking and Brokerage	Finance Other	All
ESG	0.40	0.38	0.41	0.44	0.46	0.47	0.33	0.43	**0.40**
Environment	0.36	0.33	0.26	0.23	0.41	0.44	0.30	0.38	**0.31**
Social	0.21	0.25	0.26	0.30	0.32	0.24	0.21	0.20	**0.25**
Governance	0.17	0.16	0.17	0.18	0.28	0.16	0.03	0.15	**0.16**

Note: Sustainalytics' Governance pillar measures governance of sustainability issues. Sustainalytics has a separate corporate governance rating that is not represented in this study. Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics, Barclays Research

Stability of ESG scores

Figure 35 reports the annual transition frequencies at which issuers change between low, medium and high ESG score groups. ESG scores are more stable over time for the top and bottom tiers than for the medium tier. We focus on the diagonal elements of each transition matrix (shown in bold), which indicate the percentage of bonds that remain in a given category one year later. In a given year, an issuer in the top tier has had a 77% probability of remaining there when ranked by MSCI scores and 86% using Sustainalytics. Stability numbers for the bottom tier were at similar levels (79% and 88%, respectively), and those in the middle tier were somewhat lower (61% and 75%). For both providers, Environment tended to be the most stable pillar while Governance was the most dynamic one.

FIGURE 35

Annual transition frequencies between tiers of ESG scores (2009-18)

(%)	MSCI ESG Scores							
		End of period				End of period		
At start of period	ESG	Q1	Q2	Q3	Social	Q1	Q2	Q3
	Q1	**77**	20	2	Q1	**69**	23	7
	Q2	19	**61**	20	Q2	22	**54**	23
	Q3	2	19	**79**	Q3	8	23	**69**
	Environment	Q1	Q2	Q3	Governance	Q1	Q2	Q3
	Q1	77	19	5	Q1	63	24	13
	Q2	18	60	21	Q2	24	48	28
	Q3	4	20	77	Q3	13	31	56

	Sustainalytics ESG Scores							
		End of period				End of period		
At start of period	ESG	Q1	Q2	Q3	Social	Q1	Q2	Q3
	Q1	**86**	14	0	Q1	**83**	15	2
	Q2	11	**75**	14	Q2	15	**68**	17
	Q3	0	12	**88**	Q3	1	15	**84**
	Environment	Q1	Q2	Q3	Governance	Q1	Q2	Q3
	Q1	**85**	14	1	Q1	**82**	15	2
	Q2	12	**74**	15	Q2	14	**68**	18
	Q3	0	13	**86**	Q3	1	19	**80**

Source: MSCI ESG Research, Sustainalytics, Barclays Research

Figure 36 shows that when averaged over the past nine years, MSCI scores have been somewhat less stable than those from Sustainalytics. However, as shown in Figure 32, MSCI seems to have made significant changes in their scoring process around 2012. Might the stability properties have changed over time as well? To address this, Figure 36 reports the frequency of an issuer remaining in the same ESG tier on a one-year horizon for three sub-periods. These data correspond to the diagonal of the transition matrices reported in Figure 35. Sustainalytics scores were nearly equally stable in the three sub-periods, while MSCI scores were less stable in the early part of our dataset than recently. This increase in stability might be due to changes in methodology. In the most recent three years, ESG scores from the two providers are nearly equally stable.

FIGURE 36

Annual probability of remaining in the same tier of ESG scores, by sub-period

	MSCI				Sustainalytics		
	Low-Low	Med.-Med.	High-High		Low-Low	Med.-Med.	High-High
2009-12	68	52	72	2009-12	83	72	88
2013-15	78	62	83	2013-15	87	77	89
2016-18	86	68	82	2016-18	88	76	87

Source: MSCI ESG Research, Sustainalytics, Barclays Research

Finally, we also find that these results are stable across the three different markets. Having partitioned our dataset into separate universes for the US IG, EUR IG and US HY markets, and repeated the above analysis within each one in isolation, we found very similar results (not shown) across all three markets. The stability of ESG ratings does not depend on the asset class considered.

Appendix 2 – Details on the Effect of ESG on Bond Portfolio Returns for US and EUR credit markets

This appendix includes additional analysis on the tracking portfolio simulations presented above. We also present another investigation into the relationship between ESG and returns based on an approach similar to the regression analysis used to attribute the spread of a bond to ESG while controlling for systematic risk factors.

Details of portfolio simulations

First, we provide details on sector-specific portfolio simulations in the US and EUR IG markets. Figures 37 and 38 expand on Figures 19 and 20 and report standard performance metrics for sector portfolios. ESG-tilted portfolios are constructed to match the risk exposures of the index and results are presented for all high over low ESG sector portfolios. We also report performances of corresponding sector indices in the leftmost column of Figures 37 and 38.[20]

In the US IG market, the social factor often brings a negative contribution to performance while Environment-tilted portfolios perform best in most sectors, but not in banking and brokerages where a Governance tilt is most significant. We find that performance patterns are very consistent across the two ESG providers.

In the euro IG market, sector portfolios cover a coarser partitioning of the index than in the US to ensure that maturity cells are well populated within each sector. The effect of an ESG tilt is negative in the utility sector and it is positive in most other sectors, except for the Sustainalytics Governance pillar for the cyclical sector and the MSCI social pillar for the 'other financials' sector where they are slightly negative.

For both markets, we find that ESG-tilted portfolios can have a significant economic outperformance in the majority of sectors considered. Nonetheless, within a sector, the magnitude of the E, S or G effect can sometimes be hard to explain and does not necessarily fit intuition. This situation reflects, to a large extent, the different level of aggregation and weighting methods used to obtain pillar scores and the use of market-weighted portfolios to measure the strength of the relationship between ESG scores and performance. So, in addition to the portfolio simulation presented above, we perform a statistical analysis of bond returns with a view to attribute returns to ESG factors.

[20] These index returns do not match published industry-specific Bloomberg Barclays indices. The numbers reported here include only those bonds for which we had full sets of ESG scores.

FIGURE 37

Tilted portfolio performance by sector of the US IG market – Expands on Figure 19 (2009-18)

			Using MSCI ESG data				Using Sustainalytics ESG data			
		Index	High - Low ESG	High - Low Env.	High - Low Soc.	High - Low Gov.	High - Low ESG	High - Low Env.	High - Low Soc.	High - Low Gov.
Basic and Capital Goods	Avg. (bp/m)	14.8	6.6	7.1	-0.8	2.6	-1.1	1.8	-0.5	-3.7
	Vol. (bp/m)	96.2	18.3	22.1	13.6	17.4	14.4	16.0	15.2	15.1
	I.R.	0.53	1.26	1.12	-0.20	0.51	-0.26	0.38	-0.12	-0.85
Cyclical	Avg. (bp/m)	14.7	2.0	4.0	-3.2	1.5	2.4	5.6	-3.4	0.2
	Vol. (bp/m)	88.8	13.7	12.7	14.5	12.8	12.9	14.1	15.1	17.6
	I.R.	0.57	0.51	1.08	-0.77	0.40	0.65	1.38	-0.77	0.04
Non-cyclical	Avg. (bp/m)	11.6	5.8	8.2	-0.1	4.6	10.3	9.3	8.8	4.3
	Vol. (bp/m)	70.6	15.1	15.5	15.3	16.8	18.1	14.8	18.4	15.4
	I.R.	0.57	1.33	1.83	-0.02	0.94	1.97	2.18	1.66	0.98
Comm. and Technology	Avg. (bp/m)	15.7	3.4	1.8	3.3	-0.8	3.5	3.1	0.8	-3.5
	Vol. (bp/m)	107.0	18.6	21.6	19.5	16.0	16.8	14.4	15.8	13.9
	I.R.	0.51	0.64	0.29	0.59	-0.17	0.72	0.74	0.17	-0.87
Transport and Energy	Avg. (bp/m)	14.0	6.9	6.5	-2.7	3.9	8.3	4.6	3.8	3.8
	Vol. (bp/m)	150.8	26.3	29.4	21.4	20.5	23.8	21.1	27.1	22.1
	I.R.	0.32	0.91	0.77	-0.43	0.65	1.21	0.75	0.49	0.59
Utility	Avg. (bp/m)	14.8	0.3	1.4	0.1	0.4	2.4	2.1	0.6	1.7
	Vol. (bp/m)	82.2	12.1	11.7	12.1	11.1	10.7	12.2	10.4	10.8
	I.R.	0.62	0.09	0.41	0.04	0.12	0.77	0.61	0.20	0.55
Banking and Brokerage	Avg. (bp/m)	21.6	6.3	0.4	3.5	6.5	2.0	0.8	0.4	5.1
	Vol. (bp/m)	112.6	17.1	14.6	17.4	22.1	13.7	15.0	12.1	16.0
	I.R.	0.66	1.27	0.09	0.69	1.03	0.49	0.19	0.10	1.11
Other Financials	Avg. (bp/m)	27.5	5.4	4.3	1.7	2.0	3.3	6.0	-1.4	3.0
	Vol. (bp/m)	110.7	17.1	14.2	17.7	18.7	14.0	12.8	11.3	17.1
	I.R.	0.86	1.10	1.05	0.33	0.37	0.81	1.61	-0.43	0.60

Note: Sustainalytics' Governance pillar measures governance of sustainability issues. Sustainalytics has a separate corporate governance rating that is not represented in this study. Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics, Barclays Research

FIGURE 38

Tilted portfolio performance by sector of the euro IG market – Expands on Figure 20 (2009-18)

			Using MSCI ESG data				Using Sustainalytics ESG data			
		Universe Index	High - Low ESG	High - Low Env.	High - Low Soc.	High - Low Gov.	High - Low ESG	High - Low Env.	High - Low Soc.	High - Low Gov.
Cyclical	Avg. (bp/m)	13.9	2.1	-0.3	1.2	2.3	-0.4	-0.7	0.8	-0.2
	Vol. (bp/m)	65.5	10.1	10.0	10.1	11.5	11.6	11.3	10.4	11.1
	I.R.	0.73	0.72	-0.10	0.41	0.70	-0.11	-0.20	0.26	-0.05
Non-Cyclical	Avg. (bp/m)	11.5	1.3	1.2	0.5	0.3	1.9	2.3	1.4	1.0
	Vol. (bp/m)	58.2	7.7	8.5	7.6	8.0	7.8	7.3	7.8	6.8
	I.R.	0.69	0.60	0.48	0.25	0.15	0.84	1.08	0.63	0.53
Utility	Avg. (bp/m)	14.0	-2.5	-2.4	-3.6	-0.8	-0.9	0.9	-3.1	-0.4
	Vol. (bp/m)	82.7	13.2	13.1	12.7	12.1	14.4	15.9	15.7	10.3
	I.R.	0.59	-0.66	-0.63	-0.99	-0.23	-0.21	0.20	-0.68	-0.13
Banking and Brokerage	Avg. (bp/m)	18.8	5.5	1.2	1.2	1.4	3.2	3.2	1.7	2.5
	Vol. (bp/m)	120.0	18.1	20.8	18.1	19.8	18.9	17.7	12.6	18.7
	I.R.	0.54	1.04	0.20	0.23	0.25	0.58	0.62	0.47	0.47
Other Financials	Avg. (bp/m)	28.9	1.5	3.1	-0.1	1.4	5.3	5.7	2.0	3.7
	Vol. (bp/m)	135.1	15.6	18.0	17.6	13.7	18.1	18.3	15.0	17.8
	I.R.	0.74	0.32	0.61	-0.02	0.34	1.02	1.09	0.46	0.71

Note: Sustainalytics' Governance pillar measures governance of sustainability issues. Sustainalytics has a separate corporate governance rating that is not represented in this study. Sector definitions in the above table are different from the ones used in the US IG market. For example, cyclical is enlarged to also include basic and capital goods. Index performances shown in the leftmost column relate to the subset of index bonds that is covered by Sustainalytics and MSCI ESG ratings.
Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics, Barclays Research

Estimating the "ESG Return Factor" through regression analysis

As an alternative to our construction of tracking portfolios, we also tested the effect of ESG scores on performance using a statistical analysis very similar to the one we used to assess the ESG spread premium. We carried out monthly cross-sectional regressions of bond excess returns using various control variables such as OAS, OASD and DTS loadings to individual industry sectors. One additional variable is added to see whether there is a systematic outperformance or underperformance of high ESG bonds: the normalised ESG score[21]. The resulting coefficient on the ESG factor can be interpreted as the excess return advantage realised by high ESG over low ESG bonds (in basis points per one std deviation) each month. Figure 39 presents an example result of this analysis, using MSCI overall ESG scores, for the US IG market in February 2018.

FIGURE 39

Example regression analysis of monthly returns (February 2018, using normalised MSCI ESG scores, US IG market), controlling for spread, duration and sector exposures

	ESG Score	OAS	OASD	BAS	CYC	NCY	COT	TRE	UTI	BAB	FIO
Coeff	3.8	0.69	-0.04	-0.11	-0.10	-0.08	-0.09	-0.08	-0.09	-0.11	-0.09
t-Stat	1.6	8.3	-3.6	-15.6	-7.7	-10.9	-14.3	-11.3	-10.2	-8.8	-12.8
Rsq	43.7%										

Source: Bloomberg Barclays Indices, MSCI ESG Research, Barclays Research

[21] For each month, we calculate the cross-sectional mean and standard deviation of the selected ESG score at the start of each month. The normalised score for each bond is then computed as (score – mean score)/stdev. A normalised score of one thus corresponds to an ESG score that is one standard deviation above the mean.

We carried out similar analysis for each market covered, using overall ESG scores from each provider, as well as using each pillar score independently. We also included all three pillar scores together. The R-squared values obtained from these monthly regressions varied between 5% and 76%.

Monthly results are aggregated over the entire time window of our analysis and presented in Figures 40 and 41.

Overall, the regression analysis shows weak positive results. Almost all ESG factors, for both providers, have positive coefficients indicating that high ESG names outperform low ESG names by about 0.5bp/month to 1bp/month for a one standard-deviation tilt in ESG score.

Regression analysis on returns should not be expected to deliver the same results as the tracking portfolio simulations. The regression analysis implicitly gives the same weight to all observations, while portfolio simulations are anchored to the structure of the market capitalisation-weighted index, which can be very unevenly distributed across issuers. Also, the results of this kind of statistical analysis can be heavily influenced by model specifications such as, for example, the nature of the relationship (linear or not), the weighting of individual observations, or the choice of control variables. We find the portfolio simulations presented in the main body of this report to be more intuitive to market practitioners. We see the regression analysis as a validation of the results obtained in portfolio simulations. In this sense, it is comforting that the results shown here corroborate the overall positive effect of ESG on performance. Furthermore, we measured the correlations between the monthly regression coefficients for the ESG score and the monthly excess returns of high ESG over low ESG simulated portfolios, and found them to be positive – approximately 0.5 – for the overall ESG scores from MSCI and Sustainalytics, in the US IG and EUR IG markets.

FIGURE 40

US IG Market: ESG attributes link to performance according to regression analysis (2009-18)

MSCI	ESG	Environment	Social	Governance	Combined
ESG Score (bp/m per std)	1.1				
Env. Score (bp/m per std)		0.8			0.6
Soc. Score (bp/m per std)			0.5		0.1
Gov. Score (bp/m per std)				0.6	0.9
Avg. R-squared	29.9%	29.8%	29.7%	29.8%	30.3%
Sustainalytics	**ESG**	**Environment**	**Social**	**Governance**	**Combined**
ESG Score (bp/m per std)	0.9				
Env. Score (bp/m per std)		0.8			0.6
Soc. Score (bp/m per std)			0.8		0.8
Gov. Score (bp/m per std)				0.1	-0.5
Avg. R-squared	29.9%	30.0%	29.9%	29.8%	30.5%

Note: Sustainalytics' Governance pillar measures governance of sustainability issues. Sustainalytics has a separate corporate governance rating that is not represented in this study. Control variables are not shown.
Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics, Barclays Research

FIGURE 41

Euro IG Market: ESG attributes link to performance according to regression analysis (2009-18)

MSCI	ESG	Environment	Social	Governance	Combined
ESG Score (bp/m per std)	0.6				
Env. Score (bp/m per std)		0.2			0.4
Soc. Score (bp/m per std)			-0.5		-0.6
Gov. Score (bp/m per std)				0.5	0.9
Avg. R-squared	38.7%	38.9%	38.7%	38.8%	39.5%
Sustainalytics	**ESG**	**Environment**	**Social**	**Governance**	**Combined**
ESG Score (bp/m per std)	0.5				
Env. Score (bp/m per std)		0.4			0.2
Soc. Score (bp/m per std)			0.3		0.2
Gov. Score (bp/m per std)				0.3	0.1
Avg. R-squared	39.0%	39.0%	38.9%	38.8%	39.6%

Note: Sustainalytics' Governance pillar measures governance of sustainability issues. Sustainalytics has a separate corporate governance rating that is not represented in this study. Control variables are not shown.
Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics, Barclays Research

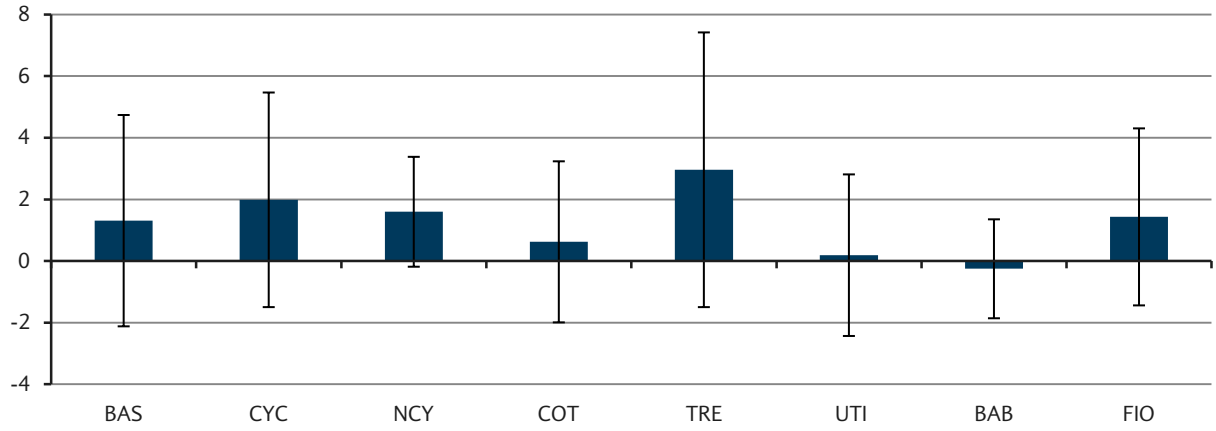
We also carried out regression analysis one industry at a time. The resulting industry-specific ESG return premia are summarised in Figures 42 and 43 for the US IG and EUR IG markets. While the ESG relationship with returns is positive in most sectors, it is not significantly different from zero in any of them. For both ESG providers, the utility sector is where the confidence interval is the widest.

The results of portfolio simulations and regression analysis are consistent with each other. When assessing the effect of ESG scores on performance, we find weak, but persistent, positive relationships in the two investment grade markets.

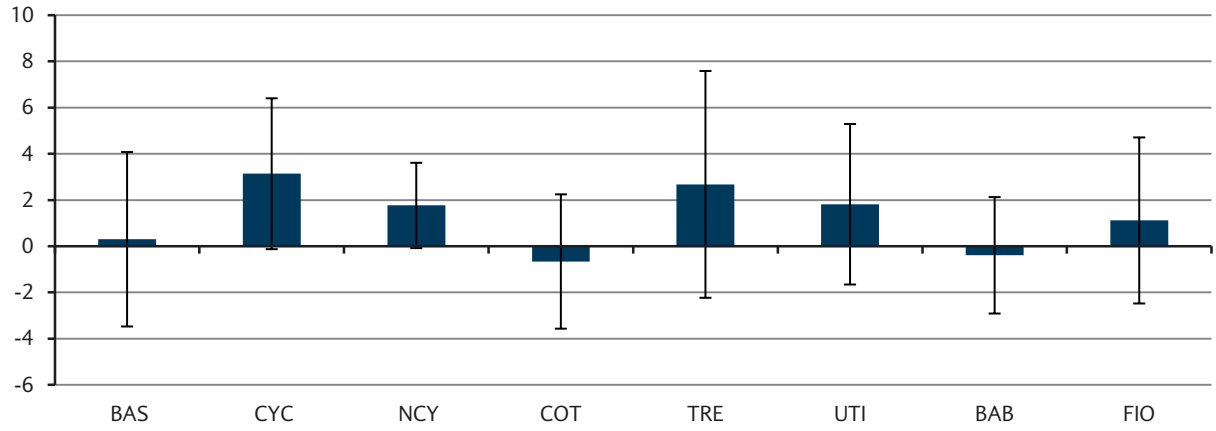
FIGURE 42

Average ESG return premium by sector in the US IG market; vertical bars indicate confidence intervals (2009-18)

Panel A: using data from MSCI



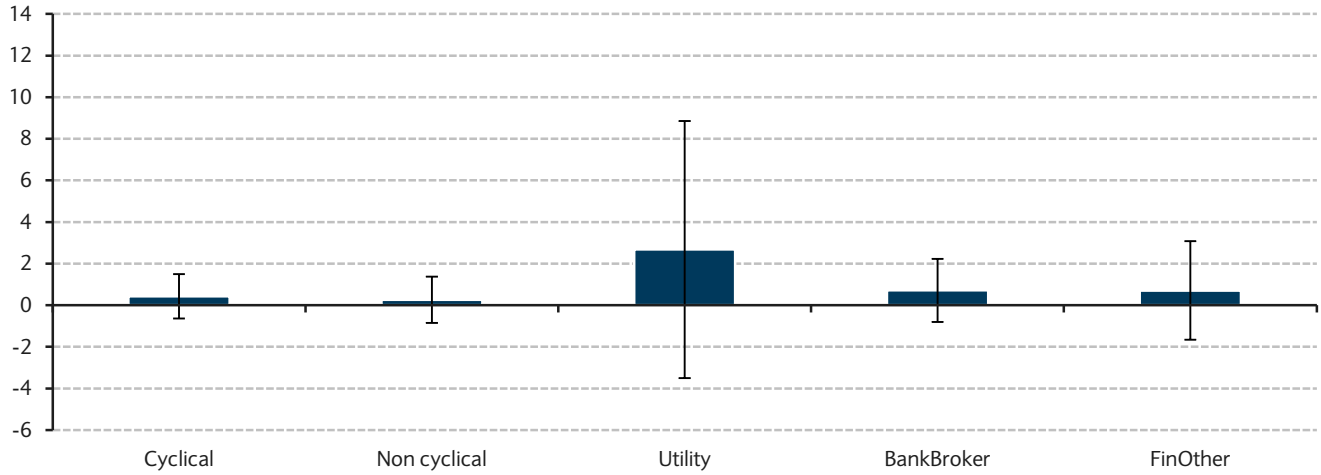
Panel B: using data from Sustainalytics



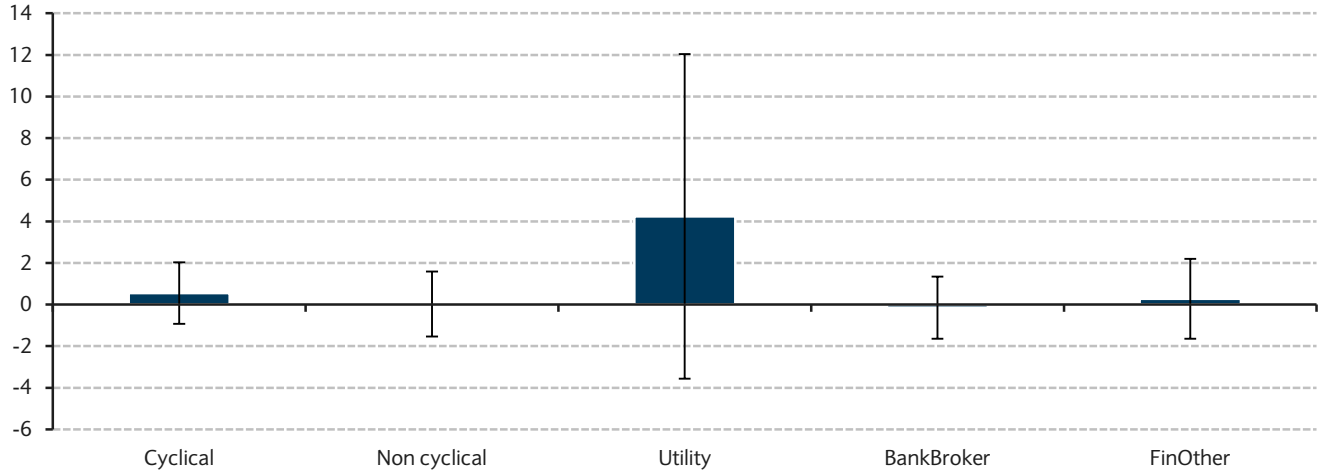
Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics, Barclays Research

FIGURE 43
Average ESG return premium by sector in the EUR IG market; vertical bars indicate confidence intervals (2009-18)

Panel A: using data from MSCI



Panel B: using data from Sustainalytics



Source: Bloomberg Barclays Indices, MSCI ESG Research, Sustainalytics, Barclays Research

We have carried out this regression analysis of issuer monthly returns on ESG scores while controlling for risk characteristics (spread, spread duration, and DTS partitioned to eight industry sectors) in the US HY market as well. Results are shown in Figure 44.

We find that that for all pillars taken individually, coefficients are positive and relatively large. The overall ESG return factor is significant for both providers, as is the Governance pillar. The effect of Environment appears to be weak in the HY market. In the combined regression, the Governance pillar is also the most significant factor. We must, however, stress two caveats to this analysis: issuer coverage is low and the time window is relatively short.

FIGURE 44

US HYMarket: ESG attributes link to performance according to regression analysis (2012-18)

MSCI	ESG	Environment	Social	Governance	Combined
ESG Score (bp/m per std)	6.4				
Env. Score (bp/m per std)		1.5			0.7
Soc. Score (bp/m per std)			4.6		5.4
Gov. Score (bp/m per std)				5.7	5.9
Avg. R-squared	33.7%	33.6%	33.9%	33.7%	35.0%
Sustainalytics	**ESG**	**Environment**	**Social**	**Governance**	**Combined**
ESG Score (bp/m per std)	5.3				
Env. Score (bp/m per std)		3.0			-1.9
Soc. Score (bp/m per std)			4.6		2.4
Gov. Score (bp/m per std)				7.4	7.5
Avg. R-squared	33.9%	33.7%	33.9%	33.7%	35.0%

Note: Control variables are not shown. Source: Bloomberg Barclays Indices, MSCI ESG Research, Barclays Research

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