Evaluating the Relationship Between ESG and Corporate Fixed Income

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MIT MANAGEMENT SLOAN SCHOOL

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Project Overview

Breckinridge Capital Advisors is an investment-grade fixed income investment manager with over $25B in assets under management. In order to strengthen the rigor of its research and deepen its understanding of the issuers in which it invests, Breckinridge integrated the analysis of environmental, social and governance (ESG) factors into its investment process in 2011. To that end, Breckinridge has actively begun researching the potential for both risk mitigation and outperformance in fixed income portfolios based on ESG criteria.

Problem Statement

While a number of academic and industry studies have looked at ESG issues and their impact on the performance of public equities, ESG impact on corporate fixed income has received little attention to date.

The overall scope of this project is to investigate phenomena that occur in fixed income markets, particularly with corporate interest rate spreads, rating downgrade potential, as well as predicting instances of default. With the dissemination of information regarding alpha-generating ESG strategies, cash flows will follow to reward companies who practice sustainable operations and penalize those who do not. This process, in aggregate effect, will reduce the use of non-renewable resources, increase capacity and utilization of regenerating renewable resources, and the reduction in the production of waste.

Objectives

The S-Lab team and Breckinridge leveraged both quantitative and qualitative research methods in order to find smart, sustainable investment recommendations for managers of fixed income portfolios. Our project was developed around two primary components that will be distributed internally at MIT Sloan. Those components are:

- A quantitative analysis to evaluate the relationship between Bloomberg ESG disclosure scores and corporate bond spreads for investment-grade bonds.
- Case studies that illustrate specific examples of the relationships uncovered through the data analysis.

Overview of the Research on ESG and Fixed Income

In January 2015 , Breckinridge Capital Advisors published a white paper that describes its approach to ESG investing in corporate fixed income securities. They conclude that integrating material ESG factors in corporate bond investing provides "a more complete understanding of...borrowers, including the quality and character of management."[1] Furthermore, they analyzed all companies in the S&P 500 vs. a subset of the 100 highest ESG-rated companies in the S&P 500, and found a dramatic difference in net income volatility, particularly during the financial crisis of 2008. In addition to quantitative analysis, Breckinridge conducted insightful qualitative interviews with corporate managers, and found that while most were pursuing sustainability related goals, very few had successfully linked manager's compensation to those goals.

Since this report, several others have released their own analyses which we think merit attention from the ESG investment community. Released in March of last year, Arabesque Partners has performed what we believe to be the most comprehensive report to date on the relationship between financial returns and sustainability. After compiling and analyzing over 200 academic and industry research papers, they conclude that "it is in the best economic interest for corporate managers and investors to incorporate sustainability considerations into decision-making processes."[2] 90% of the studies related to cost of capital demonstrate a positive relationship between high sustainability and low cost of capital. Furthermore, 88% of the studies indicate a healthy correlation between ESG ratings and operational performance of firms.

While the Arabesque report is focused primarily on equity markets, the United Nations' Principles for Responsible Investment (PRI) Initiative has also done a comprehensive report analyzing the reports directly related to sustainability and fixed income markets. They conclude that however limited in volume (fewer than 20 reports), the early research indicates that "ESG factors can be correlated with credit quality."[3] For example, cost of capital can increase as much as 64 bps, and is on average about 20% higher, for firms with poor environmental performance relative to their peers. In addition, relative differences in the quality of employer-employee relations can explain as much as 42% of an individual firm's spread over US Treasuries. They also find, however, that "the materiality between ESG factors tends to be dependent upon sector, region, timescale and leverage, and is often highly company-specific." Furthermore, "despite the research conducted, it remains difficult to demonstrate...a discrete causal relationship between ESG factors and credit quality." One explanation of this causation/correlation dichotomy is that analysts are using ESG criteria as a proxy for good management, which appears to

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[1] Breckinridge Capital Advisors, "ESGIntegration In Corporate Fixed Income," 2015 http://www.breckinridge.com/insights/whitepapers/esg-integration-in-corporate-esg/
[2] Arabesque Partners, "From the Stockholder to the Stakeholder," 2015
[3] PRI, "Corporate Bonds: Spotlight on ESG Risks," 2013

have compounded the potential for highly rated ESG companies to provide downside protection during volatile markets.

One particularly insightful demonstration of the impact that environmental and climate risk can have on credit ratings comes from a report released by Standard & Poor's last October[4]. Since November 2013, S&P identified 299 cases in which environmental risks were materially significant to their credit rating decision; 44 of which were credit downgrades that were the direct result of changes in the outlook for environmental risk. Furthermore, S&P mentions that the "lion's share" of downgrades occurred in energy and utilities sectors, and that they expect these downgrades to accelerate in coming years. In addition, these downgrades appear to be concentrated in North America (48%), with Europe (10%) and Asia-Pacific (8%) leading the rest.

Deutsche Bank scrutinized over 100 academic studies that include ESG factors and their correlations with financial performance of individual companies. According to their analysis, academic evidence shows firms with high ratings for ESG scores generally have a lower cost of capital and outperform in market-based financial measurements (e.g. stock/bond price, fund returns, Tobin's Q) as well as accounting-based financial measurements (e.g. ROA, ROE, firm value). As a remark, however, they pointed out that strong correlations don't necessarily determine causalities of financial performance at particular ESG scores. "Given the relatively long-term nature of E, S, and G factors…it is important to recognize the potential for a time lag in many of the data sets—for example, changes in market value are not always impounded immediately for firms with improved governance."[5]

In conclusion, virtually all the research conducted to this point indicates that fixed income managers should incorporate ESG criteria into their investment and credit rating analysis. Relative to equity portfolio managers, fixed income investors are justified in feeling left out of the early efforts to research the impact of ESG ratings on corporate and market performance. We do not expect this imbalance to continue, however, given the size of debt markets and the increased importance of incorporating long-term credit risks into the fixed income investment process. Our attempt to expand on the existing research is outlined below.

[4] S&P, "How Environmental and Climate Risks Factor Into Global Credit Ratings," 2015
[5] Deutsche Bank, "Sustainable Investing," 2012

Data

There are several firms that provide ESG scores for investors. In our analysis, we incorporated ESG score data provided by Bloomberg with fixed income pricing and financial metrics acquired from FactSet Research Systems. In addition, the team used ESG scores provided by Sustainalytics to further validate lessons learned from Bloomberg, as well as to further investigate case examples of ESG impact.

ESG Scores (Bloomberg)

Bloomberg collects ESG data based on company-sourced fillings such as CSR reports, sustainability reports, annual reports, company websites and Bloomberg's proprietary survey. According to Bloomberg, none of these data are estimated or derived: "every data field has transparency back to a company document."[6]

Company's environmental, social and governance performance are scored based on sector-wide relative percentile ranks. For the top 1%, the percentile is 99%; for the bottom 1%, the percentile is 1%. All scores are sector-neutralized.

ESG scoring includes resource efficiency, good community relations, training and developing the workforce, and board/committee structures. It reflects a company's overall disclosure relative to peers. In other words, inadequate or lack of reporting can have a severe negative impact on a company's ESG scores.

ENVIRONMENTAL	SOCIAL	GOVERNANCE
Carbon emissions	Supply chain	Cumulative voting
Climate change effects	Discrimination	Executive compensation
Pollution	Political contributions	Shareholders' rights
Waste disposal	Diversity	Takeover defense
Renewable energy	Human rights	Staggered boards
Resource depletion	Community relations	Independent directors

Figure 1 Components of ESG Scores[7]

Fixed Income Pricing and Financial Metrics (FactSet)

Fixed income pricing and financial metrics were pulled directly from FactSet Fundamentals in conjunction with FactSet Derived Analytics for spread data. FactSet Fundamentals is fetched on a monthly frequency (database updates daily

[6] Bloomberg, "ESG Brochure"
[7] Same as 6

and usually within 3 days post-call). The data uses a 45 Day lag as the database is not point-and-time and would introduce a look-ahead bias within the data.

Data Analysis

Methodology

In attempting an explanatory backtest, the first iteration was to explore what data was available. Given the limitations of historical credits ratings, ESG scores, pricing, fundamental data, and universe access, the following data was chosen:

- **Universe:** Russell 1000 fetched on an annual basis on the last date of the year (12/31/20xx). The Russell 1000 contains the largest 1000 domestic securities publically traded, of which most also issue investment grade debt.
- **Dates:** 12/31/2005 to 12/31/2015 with fundamental and pricing data fetched on a monthly basis as of end of month. The year 2005 was constrained from access to ESG data being limited to this time period.
- **Spreads (Dependent Variable):** The Option Adjusted Spread (OAS) was used as the main spread for this analysis. Other spreads were initially included (Z-Spread, To Worst Spread, and Treasury Spread). All spreads were highly correlated with each other (>.95), and it was decided that the OAS depicts the most accurate spread, including pricing adjustments from callable and puttable securities. The methodology to calculate an OAS for the issue level was based on fetching all fixed income instruments currently outstanding for each company, then calculating a weighted average OAS using the amount outstanding for each underlying issue. OAS's were winsorized at the 2nd and 98th percentile levels to remove noise.
- **ESG Scores (Independent Variables):** ESG scores (coupled with a composite ESG score) provided from Bloomberg. As mentioned previously, the database updates on an annual frequency and coverage ended 12/31/2005. Overall, coverage averaged 63% of the Russell 1000, however post 12/31/2008 coverage progressively increased to >80%.
- **Control Variables:** In order to assess ESG factor efficacy, fundamental control variables were added as they possess the ability to affect spread expansions/contractions. Five commonly-used debt factors were implanted to test what was driving spreads:
    - *Interest Coverage Ratio* – Calculated by Last Twelve Months (LTM) EBIT divided by the sum of Interest Expense and Interest Capitalized. Overall had 70% coverage.
    - *Debt to Equity Ratio* – Calculated by Total Debt divided by Shareholder's Equity. Overall had 91% coverage.
    - *Current Ratio* – Calculated by Total Current Assets divided by Total Current Liabilities. Overall had 74% coverage
    - *ROA* – Calculated by LTM Net Income divided by the two fiscal period average of Total Assets. Overall had 94% coverage.

- *Debt/EBITDA* – Calculated by Total Debt divided by LTM EBITDA. Overall had 95% coverage.

If the denominator was negative for any metric, it was discarded. Additionally, each fundamental factor, as mentioned before, is lagged by 45 Days to prevent look-ahead bias.

- **Sector:** Global Industry Classification Standard (GICS) was used for 10 sectors
- **Fractiling:** Quintiles were applied to the ESG metrics to mimic that of other providers as indicators. Non-applicable securities were removed from fracitilng for the period that the company lacked data (not for entire analysis).

Results

i. Absolute/Relational Analysis

After fractiling ESG scores into quintiles, factor averages were compared to realize a relationship. It was found that in each factor comparison, there was a strong linear relationship between ESG scores and the other variables.

Comparing ESG indicators against OAS spreads, the analysis shows a clear distinction between high spread stocks (higher capital cost of debt) and ESG. The better ranked the score, the lower the spread:

Table 1 OAS Averages (bps) per ESG Rank, equal weighted

OAS - Mean					
Rank	1	2	3	4	5
ESG	179.78	232.93	282.96	278.04	347.68
E	169.50	222.78	214.58	250.25	283.59
S	193.58	242.36	279.86	285.09	286.89
G	198.64	244.30	197.90	240.54	379.97

As Table 1 demonstrates, a company with an ESG score in the 1st fractile had an average spread of 179bps. Conversely, companies with a G score in the 5th fractile had an average spread of 378bps.

As ESG ratings increase, the expected OAS fractile not only decreases, but the variance between spreads within fractiles decreases as well:

Table 2 OAS Standard Deviations (bps) per ESG Rank, equal weighted

OAS - Std Dev					
Rank	1	2	3	4	5
ESG	137.88	131.05	237.88	226.68	278.53
E	133.86	137.11	127.58	173.66	245.53
S	125.48	172.03	188.35	231.11	233.58
G	159.01	166.79	241.60	151.32	282.71

The standard deviation of the 1st fractile S companies was at a lower level of 125.48 bps verses that of 5th fractile S companies with a standard deviation of 233.58bps.

Note that both averages and standard deviations were over an entire time series which had large fluctuations in market cycles, volatilities, and risk. The following table shows the average OAS of the various markets, clearly defining the 2008 credit crises with spreads in excess of 2,500 bps:

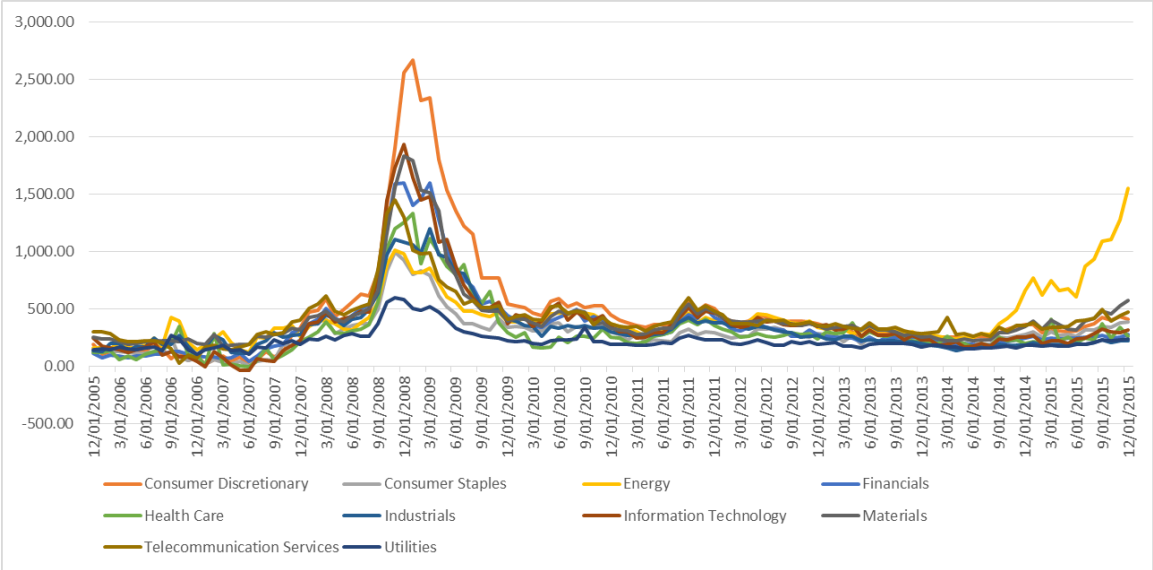

Figure 2 Average OAS (bps) of Sectors from 12/2005 to 12/2015, equal weighted

In looking at the spread of the top fractile versus the bottom fractile (F1-FN), ESG factors show that they consistently correlate with less volatility and reduced spreads, and that this relationship is even more positive when markets are in peril:

Figure 3 F1-FN Spread of ESG scores using OAS (bps), equal weighted

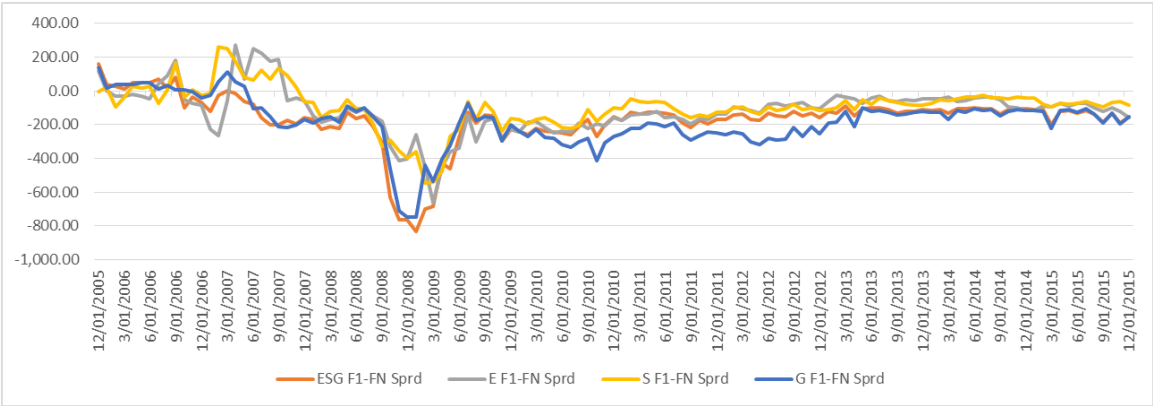

Figure 3 shows, companies that ranked better on ESG risk demonstrated lower spreads particularly during market turmoil, and this relationship held throughout the market's recovery. One possible explanation of this could be the treatment of governance risk as an indicator of quality. In other words, having a stronger board

and a more favorable structure for bond holders may be considered a signal of quality management, and in a flight to quality, these securities outperform others with lower governance scores.

The data also indicates strong, intuitive relationships between ESG scores and the financial control variables:

Table 3 Interest Coverage Ratio per ESG Rank, equal weighted

Interest Coverage Ratio - Mean					
Rank	1	2	3	4	5
ESG	22.16	16.65	13.48	6.73	19.84
E	28.56	13.17	15.52	12.04	14.65
S	20.40	14.37	11.79	11.24	19.63
G	22.75	15.78	15.92	15.14	8.75

Table 4 Debt to Equity Average per ESG Rank, equal weighted

Debt to Equity - Mean					
Rank	1	2	3	4	5
ESG	141.63	172.79	178.41	354.54	315.41
E	121.56	171.66	182.73	126.79	229.81
S	148.12	182.69	225.57	418.96	173.29
G	140.85	134.79	169.46	339.89	233.24

Table 5 ROA Average per ESG Rank, equal weighted

ROA - Mean					
Rank	1	2	3	4	5
ESG	6.72	5.74	4.93	4.59	4.44
E	6.94	5.60	6.17	4.91	4.93
S	6.80	5.59	5.39	4.23	4.27
G	6.36	5.53	5.08	5.51	4.26

Table 6 Debt/EBITDA Average per ESG Rank, equal weighted

Debt/EBITDA - Mean					
Rank	1	2	3	4	5
ESG	2.16	2.30	2.52	2.67	2.38
E	1.98	2.68	2.18	2.52	2.46
S	2.23	2.15	2.91	2.49	2.37
G	2.39	2.27	2.15	2.49	2.62

While most of the financial control variables demonstrated positive relationships with ESG criteria, Current Ratio actually had a slight negative relationship:

Table 7 Current Ratio Average per ESG Rank, equal weighted

Current Ratio - Mean					
Rank	1	2	3	4	5
ESG	1.61	1.54	1.80	2.03	2.01
E	1.65	1.58	1.51	1.72	1.97
S	1.52	1.69	1.97	1.72	1.73
G	1.62	1.61	1.68	1.94	1.85

These data tables in tandem with the time-series F1-FN spread analysis show that securities with high ESG scores generally have better balance sheets, are of higher profitability and lower leverage. In times of when the market flocks to quality, higher ESG companies will perform better and have lower downside risk.

ii. Time Series Regression

In addition to relational analysis, a time series regression was used in regressing OAS (dependent variable) with E, S, and G variables in addition to the fundamental set of independent variables. Results confirmed a statistically significant relationship (absolute value of t-stat > 1.96 at the 95% confidence interval) between individual ESG variables and OAS, however this phenomenon shows mostly clearly during highly volatile bear markets:

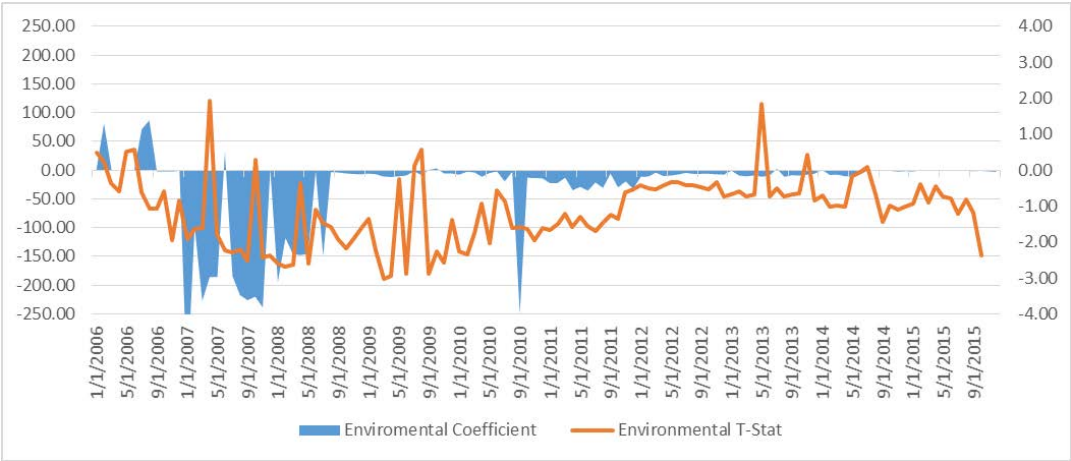

Figure 4 Environmental Score Coefficient (left Axis) and T-Stat (right Axis)

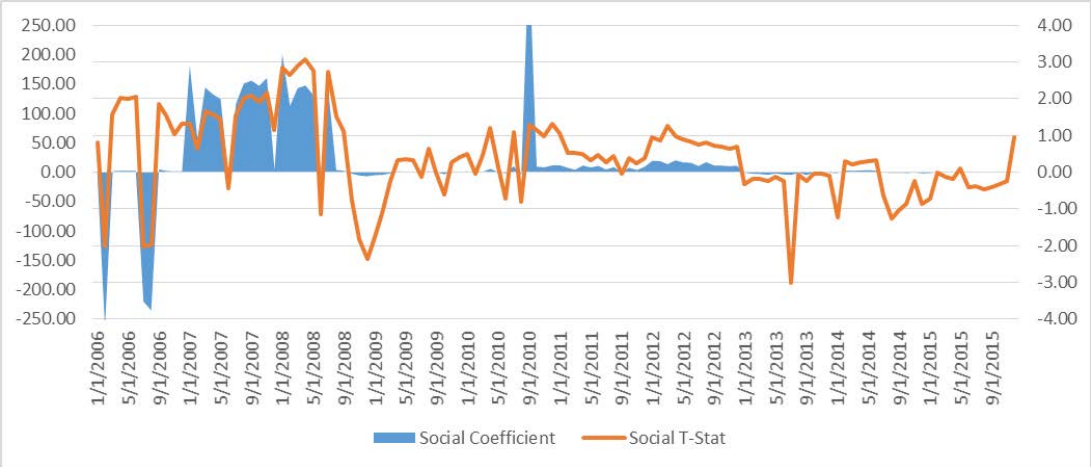

Figure 5 Social Score Coefficient (left Axis) and T-Stat (right Axis)

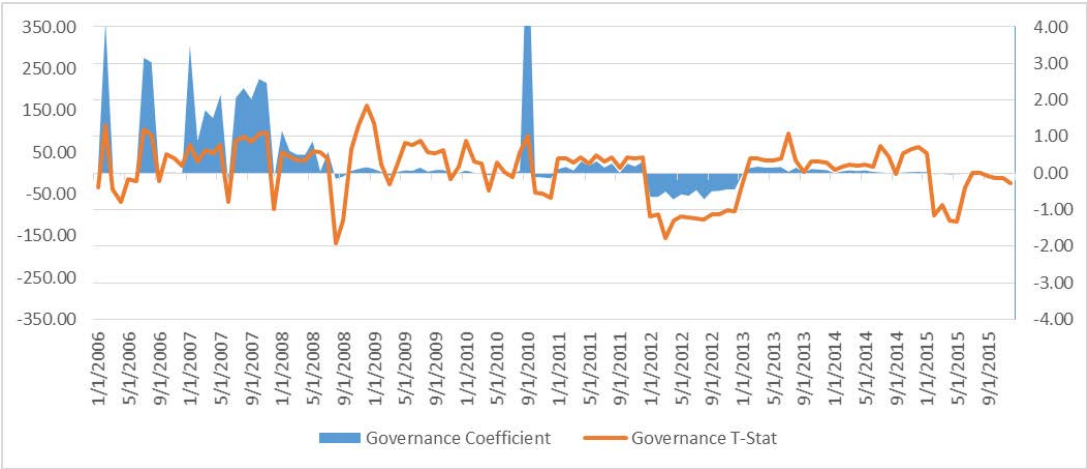

Figure 6 Governance Score Coefficient (left Axis) and T-Stat (right Axis)

As Figures 4, 5 and 6 show, each component of the independent variables leads to periods of time with predictive spread capabilities, however sparse. Looking closer at Figure 4, higher environmental scores reduced OAS, especially between the years of 2007 and 2011 (period of significance). Conversely, higher social scores increased OAS, yet this period of significance is only during the year of 2008. Governance scores show that better ranked securities increase OAS, although at no point was the data statistically significant from a predictive standpoint.

Combining a negative environmental coefficient with positive social and governance coefficients, the composite ESG score does not drive OAS significantly. In a separate ESG regression, the composite score barely touches significance, and when it does, the magnitude of the coefficient is not large:

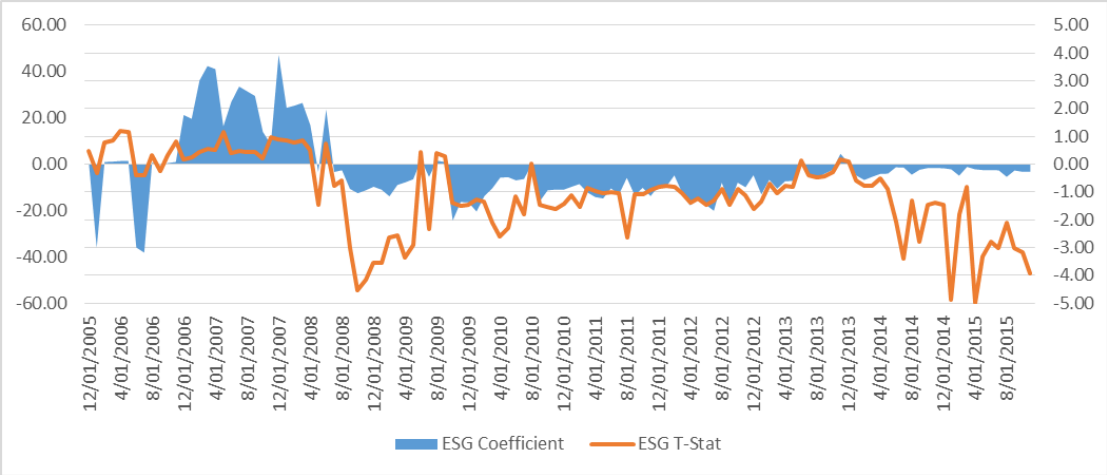

Figure 7 Composite ESG Score Coefficient (left Axis) and T-Stat (right Axis)

The positive and negative relationships between components and composite are most likely due to the controlling variables reducing significance.

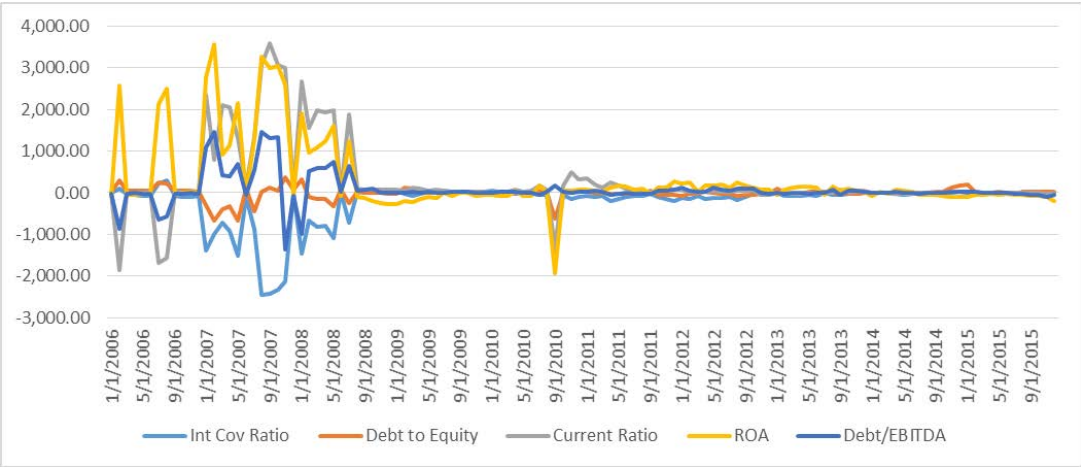

Figure 8 Independent Variable Coefficients (normalized factors through Z-score)

Again, the coefficients of independent variables vary with time as well as the level of volatility and uncertainty changes in the market. In terms of linear fitting, the relationship between OAS and many variables is unlikely to be perfectly linear, but there are instances of periods with high R-Square:

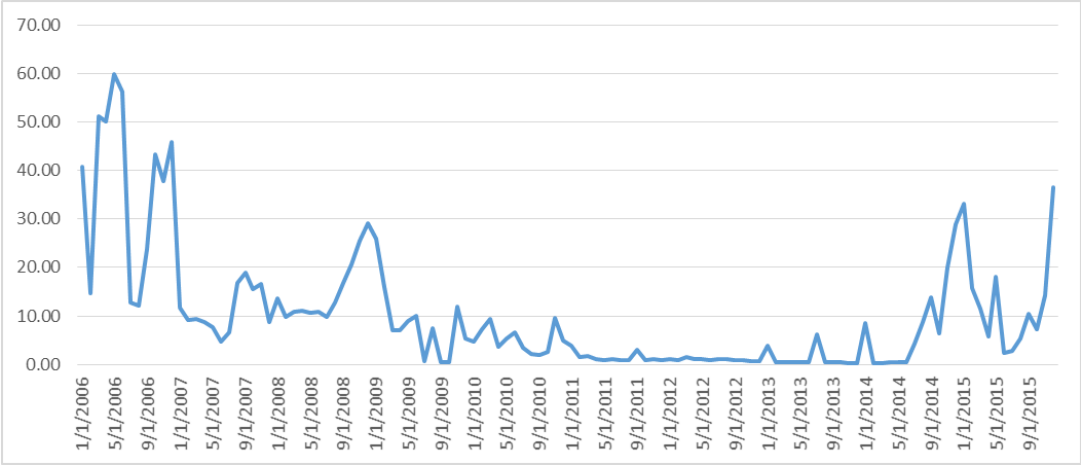

Figure 9 R-Squared of E, S and G Variable Regression

Table 8 Coefficients, T-Stats, and Regression Values of E, S, G Model

Normalized Slope Coefficient							
Enviro	Social	Gov	Interest Cov Ratio	Debt to Equity	Current Ratio	ROA	Debt/EBITDA
-456.37	**319.44**	**177.59**	**-214.87**	**-13.01**	**274.35**	**310.82**	**70.86**
Slope T-Stat							
Enviro	Social	Gov	Interest Cov Ratio	Debt to Equity	Current Ratio	ROA	Debt/EBITDA
-1.09	**0.39**	**0.10**	**-0.49**	**0.55**	**0.82**	**-1.06**	**0.02**

	F-Stat	P-Value	R-Squared
Average	**2.96**	**0.39**	**10.23**
Max	28.95	1.00	59.95
Min	0.08	0.00	0.17

The main conclusion to draw from a time series regression is that there are predictive capabilities of the model in times of duress, however a more reliable method would be to look at relative relationships, as previously discussed, instead.

iii. Correlation Matrices

This positive relationship between high ESG scores and low, stable spreads is also evident in a correlation matrix of the data. In order to account for macro-volatility throughout the various market cycles of our time period, we looked at the fractile relationships between the data. Furthermore, we wanted to test for any differences between Bloomberg and Sustainalytics ESG scores, so we have broken them out individually. The following tables show the correlations between ESG factors, key financial metrics and, most importantly, OAS.

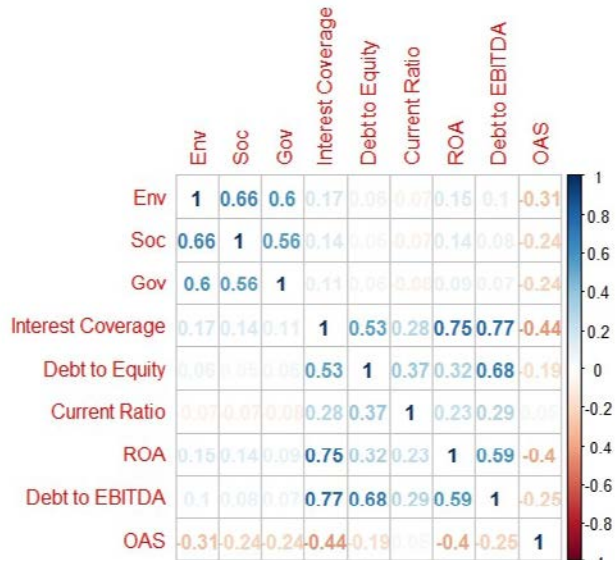

Figure 10 Correlation Matrix: ESG (Bloomberg), Financial Metrics and OAS

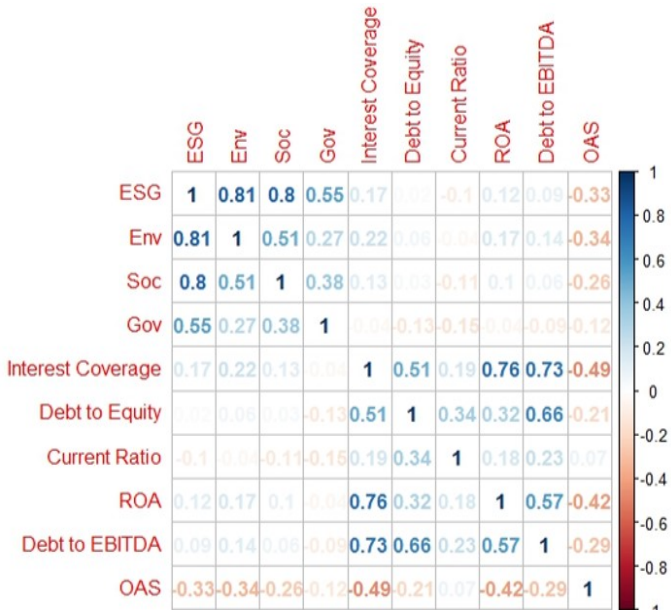

Figure 11 Correlation Matrix: ESG (Sustainalytics), Financial Metrics and OAS

There is little to no difference between the datasets from these two providers. While all the variables are negatively correlated with OAS (ie. the higher the ESG score, the lower the spread), some indicate a stronger relationship than others. Interest Coverage and ROA, for example, are more negatively correlated with OAS than ESG, however ESG scores are, on average, more negatively correlated with OAS than the remaining leverage metrics.

Qualitative Analysis

According to our quantitative analysis, ESG scores demonstrate net positive relationships with smaller, less volatile option-adjusted spreads, as well as positive relationships with key financial metrics. Taking a closer look at an individual firm's ESG score and its components may not always indicate, however, a company's financial well-being, nor its sustainability.

As discussed earlier, ESG scores can be significantly influenced by a company's level of disclosure. In other words, companies that are willing to report ESG performance, and do so more thoroughly than others, tend to score higher. For example, Table 9 illustrates that companies from highly carbon intensive industries such as energy, utilities and mining scored high on ESG score as well as Environmental score in 2015. Although we cannot determine those companies are environmentally-unfriendly just by looking at their industrial backgrounds, it is fair to say the results are counter-intuitive when approached from a sustainability perspective.

We also observed that most companies on the Top 20 list are multi-billion-dollar corporations with well-known brand images. We could argue these companies are more willing to disclose information in order to preserve or enhance their brand image and hence the scoring institute could more easily assess their ESG performance.

We will argue more on this point in the next section.

Table 9 Top 20 Firms with Highest ESG Score in 2015

	Company Name	Ticker	Sector	ESG			E		
				2011	2015	% Growth 2011-2015	2011	2015	% Growth 2011-2015
20151231	Baker Hughes Incorporated	BHI	"Energy"	66.12	76.03	15.0%	56.59	78.29	38.4%
20151231	Hess Corporation	HES	"Energy"	57.68	73.44	27.3%	52.89	72.73	37.5%
20151231	Bank of New York Mellon Corporat	BK	"Financials"	42.54	66.23	55.7%	38.39	67.86	76.7%
20151231	International Business Machines C	IBM	"Information Technology"	40.5	65.7	62.2%	34.88	71.32	104.4%
20151231	Newmont Mining Corporation	NEM	"Materials"	56.61	64.88	14.6%	55.81	61.24	9.7%
20151231	E. I. du Pont de Nemours and Con	DD	"Materials"	31.41	64.46	105.2%	31.01	67.44	117.5%
20151231	Johnson Controls, Inc.	JCI	"Consumer Discretionary	58.68	63.64	8.5%	57.36	64.34	12.2%
20151231	AT&T Inc.	T	"Telecommunication Serv	41.15	63.37	54.0%	29.27	65.85	125.0%
20151231	Kimberly-Clark Corporation	KMB	"Consumer Staples"	52.89	62.81	18.8%	56.59	60.47	6.8%
20151231	Mosaic Company	MOS	"Materials"	37.6	62.4	66.0%	32.56	58.14	78.6%
20151231	Intel Corporation	INTC	"Information Technology"	73.55	61.98	-15.7%	76.74	60.47	-21.2%
20151231	State Street Corporation	STT	"Financials"	51.75	61.84	19.5%	42.86	66.96	56.3%
20151231	Owens Corning	OC	"Materials"	50.83	61.16	20.3%	47.29	66.67	41.0%
20151231	Exelon Corporation	EXC	"Utilities"	43.4	60.75	40.0%	40.00	60.69	51.7%
20151231	Schlumberger NV	SLB	"Energy"	32.23	60.33	87.2%	27.91	52.71	88.9%
20151231	Exxon Mobil Corporation	XOM	"Energy"	57.26	60.17	5.1%	52.89	57.02	7.8%
20151231	Bank of America Corporation	BAC	"Financials"	35.96	60.09	67.1%	35.71	57.14	60.0%
20151231	United Parcel Service, Inc. Class E	UPS	"Industrials"	55.79	59.92	7.4%	46.51	58.14	25.0%
20151231	Monsanto Company	MON	"Materials"	35.54	59.09	66.3%	27.91	61.24	119.4%
20151231	Eli Lilly and Company	LLY	"Health Care"	47.52	59.09	24.3%	51.94	58.91	13.4%

While we believe the quantitative analysis offers great lessons for fixed income managers considering ESG risk, we think it is extremely important to consider the individual situations and circumstances where these lessons are either reinforced or challenged.

Case Studies

We conducted case studies on two companies: Harley Davidson, an example of when spreads seem to be responding positively to improvements in ESG score; and Peabody Energy, an example of when fixed income managers would want to avoid using a rule of thumb approach towards incorporating ESG into the investment decision.

Upon selecting these companies, we particularly focused on the Environmental performance of firms since E-Score showed the strongest negative correlation with OAS spreads. We compared Top 20/Worst 20 companies in terms of the percentage change in E-Score with the yearly average OAS from 2011 to 2015.

Table 10 Top 20 Firms with E-Score Growth between 2011 and 2015

	Company Name	Ticker	Sector	Environmental			OAS (bps)		
				2011	2015	% Growth 2011-2015	2011	2015	% Growth 2011-2015
20151231	Compass Minerals International, Inc.	CMP	"Materials"	2.33	49.61	2033.3%	397.49	321.58	-19.1%
20151231	Lincoln National Corporation	LNC	"Financials"	1.79	36.61	1950.0%	250.21	197.64	-21.0%
20151231	MetLife, Inc.	MET	"Financials"	2.68	47.32	1666.6%	101.16	59.49	-41.2%
20151231	Harley-Davidson, Inc.	HOG	"Consumer	2.33	38.76	1566.7%	248.41	83.05	-66.6%
20151231	Prudential Financial, Inc.	PRU	"Financials"	1.79	28.57	1500.0%	203.63	156.94	-22.9%
20151231	Starwood Hotels & Resorts Worldwide, Inc.	HOT	"Consumer	1.55	23.26	1400.0%	280.99	180.87	-35.6%
20151231	FMC Corporation	FMC	"Materials"	1.55	17.83	1050.0%	181.22	170.40	-6.0%
20151231	AES Corporation	AES	"Utilities"	3.10	35.66	1050.0%	387.75	320.64	-17.3%
20151231	CONSOL Energy Inc.	CNX	"Energy"	3.10	32.56	950.0%	401.48	890.91	121.9%
20151231	EQT Corporation	EQT	"Energy"	4.13	34.71	740.0%	#N/A	#N/A	#N/A
20151231	Honeywell International Inc.	HON	"Industrials"	1.55	12.40	700.0%	82.87	82.15	-0.9%
20151231	Fifth Third Bancorp	FITB	"Financials"	1.79	13.39	650.0%	-266.71	125.66	-147.1%
20151231	Wyndham Worldwide Corporation	WYN	"Consumer	4.65	33.33	616.7%	292.70	196.06	-33.0%
20151231	Principal Financial Group, Inc.	PFG	"Financials"	1.79	12.50	600.0%	157.17	107.22	-31.8%
20151231	Equity Residential	EQR	"Financials"	1.55	10.85	600.0%	122.77	109.25	-11.0%
20151231	Toro Company	TTC	"Industrials"	1.55	9.30	500.0%	309.45	272.66	-11.9%
20151231	Lennox International Inc.	LII	"Industrials"	6.20	34.88	462.5%	209.09	199.81	-4.4%
20151231	Cincinnati Financial Corporation	CINF	"Financials"	1.79	9.82	450.0%	275.32	219.40	-20.3%
20151231	Boston Properties, Inc.	BXP	"Financials"	1.55	8.53	450.0%	-355.66	121.61	-134.2%
20151231	Westar Energy, Inc.	WR	"Utilities"	2.76	13.79	400.0%	171.92	122.74	-28.6%

Table 11 Worst 20 Firms with E-Score Growth between 2011 and 2015

	Company Name	Ticker	Sector	Environmental			OAS (bps)		
				2011	2015	% Growth 2011-2015	2011	2015	% Growth 2011-2015
20151231	Campbell Soup Company	CPB	"Consumer	40.31	1.55	-96.2%	70.49	125.88	79%
20151231	Tyson Foods, Inc. Class A	TSN	"Consumer	24.81	1.55	-93.7%	267.57	152.72	-43%
20151231	Williams Companies, Inc.	WMB	"Energy"	23.97	1.65	-93.1%	541.79	316.35	-42%
20151231	Ball Corporation	BLL	"Materials"	53.49	3.88	-92.8%	310.36	270.12	-13%
20151231	Harris Corporation	HRS	"Information	13.95	1.55	-88.9%	176.62	185.50	5%
20151231	Church & Dwight Co., Inc.	CHD	"Consumer	35.66	4.65	-87.0%	143.06	111.54	-22%
20151231	Wells Fargo & Company	WFC	"Financials"	37.50	5.36	-85.7%	160.66	137.65	-14%
20151231	U.S. Bancorp	USB	"Financials"	17.86	2.68	-85.0%	105.62	83.89	-21%
20151231	Bemis Company, Inc.	BMS	"Materials"	46.51	12.40	-73.3%	172.14	135.28	-21%
20151231	Unum Group	UNM	"Financials"	49.11	13.39	-72.7%	318.18	202.39	-36%
20151231	NIKE, Inc. Class B	NKE	"Consumer	53.13	14.58	-72.5%	#N/A	#N/A	#N/A
20151231	Masco Corporation	MAS	"Industrials"	58.14	16.28	-72.0%	398.00	223.94	-44%
20151231	AGL Resources, Inc.	GAS	"Utilities"	4.83	1.38	-71.4%	172.39	161.66	-6%
20151231	Progressive Corporation	PGR	"Financials"	25.00	7.14	-71.4%	179.55	142.10	-21%
20151231	Crown Holdings, Inc.	CCK	"Materials"	12.40	3.88	-68.7%	381.77	291.18	-24%
20151231	Danaher Corporation	DHR	"Industrials"	6.98	2.33	-66.7%	268.78	105.36	-61%
20151231	Nucor Corporation	NUE	"Materials"	34.11	11.63	-65.9%	104.87	171.60	64%
20151231	Clorox Company	CLX	"Consumer	51.16	17.83	-65.2%	144.11	112.52	-22%
20151231	Brown-Forman Corporation Class B	BF.B	"Consumer	50.39	18.60	-63.1%	#N/A	#N/A	#N/A
20151231	Corning Incorporated	GLW	"Information	31.01	11.63	-62.5%	173.34	152.43	-12%

Harley Davidson (HOG)

With over $6B revenues and approximately one third of the global market share in heavyweight motorcycles, Harley Davidson is one of the most widely known and respected brands on the road today. Throughout the 20th century, Harley Davidson appreciated stellar growth in sales and loyal customers as their brand became synonymous with American culture.[8] In recent years, however, Harley has come under significant pressure thanks to changes in consumer preferences in the global motorcycle market. New generations of motorcycle enthusiasts have steadily turned away from the "hog," and have welcomed the lightweight products offered by competitors such as Honda and Suzuki.[9] Furthermore, thanks to a rapidly globalized market for motorcycles, consumer purchasing decisions appear to be less influenced by image or lifestyle, and more influenced by practical and efficient transportation concerns[10]. These developments have eroded much of Harley's market share and should be of some concern to both equity and debt investors.

2005 – 2015: Financial Performance

Over the time period we analyzed, Harley Davidson experienced a decline in all three of our key metrics we identified as indicating financial performance (Debt/EBITDA, Debt/Equity and Return on Assets). Likely in part thanks to the global economic recession, Harley's ROA fell from approximately 20% in the early 2000s to about 7.5% today. Leverage has also increased substantially over this time period, with both Debt/Equity and Debt/EBITDA ratios increasing by over 500%. Both sales and earnings declined in 2015 by 4% and 11% respectively.

2005 – 2015: ESG Performance

Despite the weak financial performance, Harley Davidson's ESG score has improved significantly as they have made considerable efforts towards addressing their environmental and social risk. Beginning in 2009, Harley Davidson has made sustainability goals and reporting on sustainability a key part of their business. The environmental score has seen a dramatic improvement from 2.3 to 38.8 as manufactured CO2 emissions have declined 40%, recycled materials have climbed above 86% and water consumption has fallen by 20% in just the last five years[11]. Furthermore, Harley has launched a global tour of Project LiveWire, their first electric motorcycle which many expect to be launched in the near future. In addition to environmental improvements, Harley's social score has improved from 3.5 to 19.3 as the Harley Davidson Foundation and Harley employees have donated money and volunteered time with a focus on improving education, health and the environment in their local communities.

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[8] HBS, "Harley-Davidson: Preparing for the Next Century," 2006
[9] Ibid.
[10] PR Newswire, "Global Motorcycles Market Worth $120 Bil by 2018," 2014
[11] Harley-Davidson, "Sustainability Strategy Report," 2013

Impact on Spread
While Harley's spread over the risk-free rate of return was predictably volatile through the economic recession and collapse in earnings, their OAS has seen a remarkably consistent rate of improvement right in line with their improvements in ESG. With an average OAS in 2011 of 248, bondholders now enjoy an average OAS of 83.

Takeaway
Harley Davidson offers a compelling example of the benefit to incorporating ESG criteria into fixed-income portfolios. The positive correlation between higher ESG scores and lower OAS spread demonstrated by Harley Davidson over this time period is a common attribute of many of the companies we analyzed in our database. To be sure, correlation does not equal causation; there are plenty of other factors to consider when attempting to rationalize debt market valuations and a firm's operational performance. That being said, we believe that bondholders of Harley Davidson will be rewarded by management's efforts to embrace the challenge of sustainability and continue to make improvements in the ESG score of the company.

Peabody Energy (BTU)

The recent collapse of Peabody Energy Corporation is perhaps the most compelling example of why fixed income investors should not only incorporate quantitative ESG analysis into their investment decisions, but also understand the qualitative aspects of environmental, social and governance risk as well. As one of Fortune Magazine's most admired companies in 2008[12] and over $8B annual revenue in 2012, very few could have predicted the Chapter 11 bankruptcy of "the King of coal"[13] in April 2016. Indeed, as our data shows, there was no indication of trouble based on a *quantitative* analysis of ESG risk at Peabody Energy. While the broad universe of corporate debt indicates positive relationships between ESG improvements and market outcomes, Peabody Energy highlights a very important exception to this rule.

2005 – 2015: Financial Performance

Peabody Energy's financial performance through the global recession was actually quite remarkable given the situation. From 2005 to 2012, all of our key metrics of leverage indicate a brief rise followed quickly by a smooth recovery. For example, Debt to Equity ratio in this time period began at 69 in 2005, peaked at 139 in 2007, and had settled below 50 by the end of 2011. In addition, profitability over this time period was relatively stable at around 5%, and had actually improved to about 6.5% by the end of 2012. Beginning in February 2013, however, Peabody Energy's financial performance rapidly deteriorated across all relevant metrics. ROA hovered between -3 and -6%, Debt to Equity gradually increased above 300, and Interest Coverage dropped as low as .21 in February 2015.

2005 – 2015: ESG Performance

Throughout this time period, Peabody Energy's ESG scores from both Bloomberg and Sustainalytics saw gradual improvement. Starting from 52 in 2009, BTU's composite ESG score from Sustainalytics bumped up to 55 in October 2011, and steadily increased to 62 by April 2016. Similarly, Bloomberg's Environmental score for Peabody Energy made several short jumps over these years, from about 2 in 2008, finishing at 27 before Bloomberg pulled the plug on ESG coverage of BTU in May 2015. To be sure, Peabody Energy was never considered a leader in sustainability or ESG, however the quantitative data from both Bloomberg and Sustainalytics does suggest there were at least some improvements being made by the company to address environmental, social and governance risk of their operations.

Impact on Spread

Measured by the OAS of Peabody's outstanding debt, investors do not seem to have worried much over the sustainable profits of BTU until about July 2014. Pre-recession, BTU's option-adjusted spread averaged about 171. During the crisis and

[12] Fortune, "America's Most Admired Companies," 2008
[13] Hoovers, "Peabody Energy Corporation Company Information"

through the end of 2012, BTU's OAS averaged about 350; it was even trading at one point in the 4th quartile for OAS among all the companies we analyzed in our dataset during this period. By July 2014, Peabody's OAS started climbing, pushing the average spread from 2013 – 2015 above 1000, and finishing at 6800 in December 2015.

Takeaway

Peabody Energy offers two very important lessons for fixed income investors looking to incorporate ESG analysis into their investment decisions. First, a purely quantitative analysis of ESG can fall short of providing investors with an accurate estimate of credit risk. Despite the positive relationship between ESG scores and option-adjusted spreads for the broad universe of corporate debt, there are exceptions to the rule, and those exceptions can be massive. Second, and most likely related to the first, Peabody Energy highlights a common attribute of many of the exceptions to the rule: Energy. There does not appear to be as strong a relationship between ESG score and spread in the energy sector as there are in others. In addition to the quantitative evidence we found in our data, there are numerous qualitative examples of credit ratings companies and analysts who urge caution when considering an investment in energy sector debt (see Standard & Poor's "How Environmental and Climate Risks Factor Into Global Corporate Ratings").

Key Findings and Recommendations

It is becoming more and more important for companies to integrate sustainability activities into their business operations. In this regard, proper ESG reporting has become a measurement of business well-being, with important implications for not only environmental, social and governance sustainability, but also financial sustainability.

We found significant quantitative evidence that ESG scores are positively correlated with small, stable spreads in corporate debt markets. This relationship also applies to other financial metrics such as ROA and leverage ratios. Furthermore, these relationships appear to strengthen during periods of market turmoil, and persist throughout market recoveries.

There is some evidence, however, that this relationship is more correlation than causation. Since ESG score is based on information disclosure, companies that are willing to disclose their information may be more likely to score higher regardless of the quality of sustainability actions. Furthermore, investors in companies with high ESG scores appear to benefit from downside risk protection in bear markets, which may indicate that ESG is being treated as a proxy for quality.

Therefore, it is important to pay attention to individual companies and the valuation of their fixed income securities. Unsurprisingly, mismatches between ESG scores and sustainability actions are observed in Peabody Energy case.

In conclusion, we observed the following two trends in terms of the relationship between ESG scores and corporate fixed income

1. ESG integration may not satisfy every sustainability oriented investor, however considering these extra-financial factors in the credit research process may offer downside protection that should be valuable to anyone regardless of interest in sustainability.

2. We expect ESG criteria to become increasingly more relevant in the market's determination of credit quality as ESG methods develop and the pressure for sustainability increases.

Based on our analysis, we recommend that fixed income managers

1. Use ESG scores as high level indicators of sustainability, as well as high level indicators of reduced risk among corporate debt securities.

2. Take caution applying correlations between ESG scores and credit spreads—there may be other idiosyncratic variables that outweigh the impact of ESG on credit risk.

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