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FOUNDATIONS OF ESG INVESTING

Part 1: How ESG Affects Equity Valuation, Risk and Performance

Guido Giese, Linda-Eling Lee, Dimitris Melas, Zoltan Nagy, Laura Nishikawa

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EXECUTIVE SUMMARY

Many researchers have studied the relationship between companies with strong environmental, social and governance (ESG) characteristics and corporate financial performance. A major challenge has been to show that positive correlations — when produced — provide explanations for the behavior. As the classic phrase used by statisticians says, "correlation does not imply causation."

Instead of conducting a pure correlation-based analysis, we focus on understanding *how* ESG characteristics have led to financially significant effects. This way, we avoid the risk of data-mining and we can differentiate between correlation and causality.

We examined how ESG information embedded within companies is transmitted to the equity market. Borrowing the language of central banks describing how monetary policy can affect asset prices and economic conditions, we created three "transmission channels" within a standard discounted cash flow (DCF) model. We call these the cash-flow channel, the idiosyncratic risk channel and the valuation channel. The former two channels are transmitted through corporations' idiosyncratic risk profiles, whereas the latter channel is linked to companies' systematic risk profiles.

These three transmission channels are based on the following rationales:

- **Cash-flow channel:** High ESG-rated companies are more competitive and can generate abnormal returns, leading to higher profitability and dividend payments.
- **Idiosyncratic risk channel:** High ESG-rated companies are better at managing company-specific business and operational risks and therefore have a lower probability of suffering incidents that can impact their share price. Consequently, their stock prices display lower idiosyncratic tail risks.
- **Valuation channel:** High ESG-rated companies tend to have lower exposure to systematic risk factors. Therefore, their expected cost of capital is lower, leading to higher valuations in a DCF model framework.

We tested each of these transmission channels using MSCI ESG Ratings data and financial variables. For the two idiosyncratic transmission channels, high ESG-rated companies tended to show higher profitability, higher dividend yield and lower idiosyncratic tail risks.

We also found that high ESG-rated companies tended to show less systematic volatility, lower values for beta and higher valuations, which verifies the valuation channel.

Finally, we provide empirical evidence for a causal relationship between ESG and financial performance by looking at the extent to which changes in ESG ratings predicted changes in financial variables. We found that the ESG rating change may be a useful financial indicator in its own right, which we call ESG momentum.

INTRODUCTION

ESG investing is a very broad field with many different investment approaches addressing various investment objectives. At a top level, we can break down ESG investing into three main areas that each have their own investment objective:

1. ESG integration: where the key objective is to improve the risk-return characteristics of a portfolio.
2. Values-based investing: where the investor seeks to align his portfolio with his norms and beliefs.
3. Impact investing: where investors want to use their capital to trigger change for social or environmental purposes, e.g., to accelerate the decarbonization of the economy.

This paper focuses on the first investment objective — ESG as a means to achieve financial objectives in portfolio management.

In recent years, many researchers from both academia and the asset management industry have analyzed the relationship between the ESG profile of companies and their financial risk and performance characteristics. In fact, research has been so plentiful that several meta studies[1] have summarized the results of over 1,000 research reports and found that the correlation between ESG characteristics and financial performance was inconclusive: The existing literature found positive, negative and non-existent correlations between ESG and financial performance, although the majority of researchers found a positive correlation.

The reasons for these inconclusive results likely stem from the different underlying ESG data used and the varying methodologies applied, especially in how far they control for common factor exposures.

However, even researchers finding a positive correlation between ESG and financial performance often fail to explain the economic mechanism that led to better performance, as they typically focused on historical data analysis. Harvey et al. (2016) highlight that this type of purely data-focused research entails the risk of ”correlation mining,” i.e., overfitting a financial model to a specific dataset to observe correlations that will not prevail when tested out of sample.

Another criticism mentioned in Krueger (2015) is the fact that many empirical studies analyzing the link between ESG and financial performance do not strictly differentiate between correlation and causality. Often, a correlation between ESG and financial variables is implicitly interpreted to mean that ESG is the cause and financial value the effect,

[1] For example, see Carpenter et al. (2009) and Fulton et al. (2012)

although the transmission easily could also be reversed. For instance, one can argue that companies with high ESG scores are better at managing their risks, leading to higher valuations. Alternatively, companies with higher valuations might be in better financial shape and therefore able to invest more in measures that improve their ESG profile; such investments might lead to higher ESG scores.

To address these issues, this research paper takes a different approach. Instead of simply looking for correlations between ESG characteristics and financial performance in historical data, we:

- Analyze the *transmission channels* from ESG to financial performance and develop a fundamental understanding of how ESG characteristics affect corporations' valuations and risk profiles.
- Verify these transmission mechanisms using *empirical analysis*.

The advantages of this type of approach are threefold:

- It mitigates the risk of correlation mining between ESG data and financial performance data. We use MSCI's Barra Global Equity Model for all financial and risk data. Model data has not been fitted in any way to the underlying ESG dataset.
- It reduces the risk of finding correlations that are caused by unintentional exposures to common factors.
- It better differentiates between correlation and causality by studying transmission channels.

In essence, our analysis is designed to help explain how ESG affects the financial profile of companies in a fundamental way, thus producing more convincing evidence than simple correlation studies. In the Part 2 of this paper, to be published in 2018, we will address the more practical question of how to integrate ESG into different areas of portfolio management, including policy benchmarks, passive mandates, active mandates and factor-based investment strategies. In Exhibit A4 in the Appendix, we present key performance measures of the MSCI ESG Universal Index (which re-weights components in the MSCI ACWI Index according to their ESG profile) and the MSCI ESG Leaders index (which performs a best-in-class selection based on ESG ratings). Both ESG indexes, which are based on MSCI ESG Ratings, showed lower levels of risk, improved in risk-adjusted returns and higher levels of valuation in line with this paper's findings.

WHY ESG MATTERS

To develop a fundamental understanding of how ESG characteristics affect corporations' financial profiles, we rely on existing corporate finance models in establishing the transmission channels of ESG to the financial world.

El Ghoul et al. (2011) and Gregory et al. (2014) show that a DCF model framework (which describes a company's value as the sum of future cash flows, discounted at the cost of capital) can be used to break down the influence of a corporation's ESG profile on equity valuations, including cash flows, risk and cost of capital.

The authors argue that it is important to differentiate between the systematic and idiosyncratic risk of equities. Gregory et al. (2014) explain that systematic risk is macroeconomic in nature and describes the general market risk all companies are exposed to, e.g., the risk of shocks in commodity prices, interest rates or inflation rates. Systematic risk also includes industrywide issues such as regulatory changes, technological developments and stranded assets.

In contrast, firm-specific risk is particular to a company. The distinction between systematic and firm-specific risk is highly important for analyzing the impact of ESG characteristics on corporate valuation, because investors can typically diversify away firm-specific risk. Therefore, it is solely the systematic risk component that determines shareholders' required rate of return as compensation for the risk to which they are exposed.

Consequently, within a DCF model, systematic risk is typically captured through the cost of capital (i.e., the denominator in the DCF model), whereas firm-specific risk is linked to the numerator of the DCF model, i.e., future cash flows.

We follow this approach and use a standard DCF model as a starting point of our analysis. However, instead of simply analyzing the impact of ESG characteristics through the discounted cash flow model, we take the investor's perspective and break down the influence of ESG characteristics on corporations into three transmission channels: the cash-flow channel, the idiosyncratic risk channel and the valuation channel.

In the next two sections, we analyze the two idiosyncratic transmission channels and the systematic risk channel. Next, we assess the question of causality of ESG. Subsequently, we analyze the financial value of ESG rating changes, before examining the intensity-longevity profile of ESG ratings compared to common factors. Finally, we show the impact of the various ESG transmission channels on financial performance.

DATA AND METHODOLOGY

We now validate the three transmission channels using MSCI ESG Ratings[2] for the MSCI World Index universe for the January 2007 to May 2017 time period. The universe contains over 1,600 stocks and is therefore sufficiently diversified for the statistical analysis performed in this paper. All risk and factor calculations are performed using the Barra Long-Term Global Equity Model (GEMLT).

All the results shown in this paper are neutralized for industry exposure (through the use of industry-adjusted ESG scores) and size. We created size-adjusted ESG scores as the residuals from regressing standard MSCI ESG scores on the size exposure in the GEMLT model and an intercept variable.

In our analysis, we show the distribution of financial variables across five size-adjusted ESG score quintiles (Q1 to Q5), with Q1 indicating the companies with the lowest ESG rating and Q5 the highest-rated companies. Financial variables, such as beta or book-to-price ratio, are based on GEMLT and are therefore in the format of z-scores.[3] For each of these financial variables, we show the average value over the 10-year observation period as light blue dots, the current exposure as red dots and the 5% to 95% range of observed values as vertical bars.

The results of all simulations, including the corresponding t-statistics that show their statistical significance, are summarized in Exhibit A1 in the Appendix.

IDIOSYNCRATIC TRANSMISSION CHANNELS

In this section, we analyze the company-specific impact of ESG on risk and performance. The firm-specific risk profile of companies is transmitted through the numerator (future cash flows) in the DCF model framework and can be broken into two separate channels: The transmission of ESG into future opportunities and therefore into profitability on the one hand, and the transmission to firm-specific downside risk protection on the other.

[2] For more information see http://www.msci.com/products/esg/about_msci_esg_research.html. https://www.msci.com/esg-ratings

[3] Z-scores are normalized values, calculated by first subtracting the cross-sectional mean from all values and then dividing the difference by the cross-sectional standard deviation. Z-scores have zero mean and unit standard deviation. Following the GEMLT methodology, for risk-related variables, we subtract cross-sectional global means; for fundamental data-related variables, we subtract cross-sectional country means to control for potential country biases in fundamental data. Standard deviation is calculated globally.

CASH-FLOW CHANNEL

The cash-flow transmission channel can be summarized as follows:

Gregory et al. (2015) explain the economic rationale of the cash-flow channel:

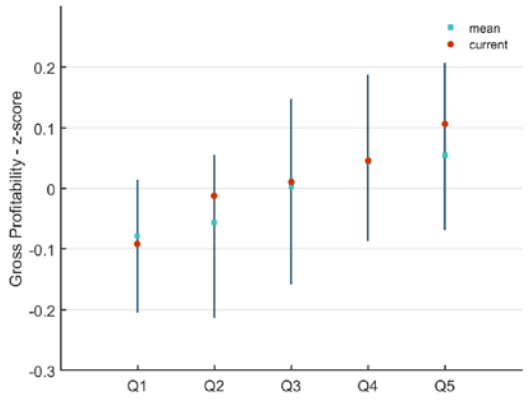
1. Companies with a strong ESG profile are more competitive than their peers. For instance, this competitive advantage can be due to the more efficient use of resources, better human capital development or better innovation management. In addition to this, high ESG-rated companies are typically better at developing long-term business plans and long-term incentive plans for senior management.
2. High ESG-rated companies use their competitive advantage to generate abnormal returns, which ultimately leads to higher profitability.
3. Higher profitability results in higher dividends.

The competitive advantage of high ESG-rated companies cannot be readily observed. Therefore, our empirical analysis focuses on the second and third steps of the cash-flow channel, i.e., higher profitability and higher dividends.

HIGHER PROFITABILITY AND DIVIDENDS

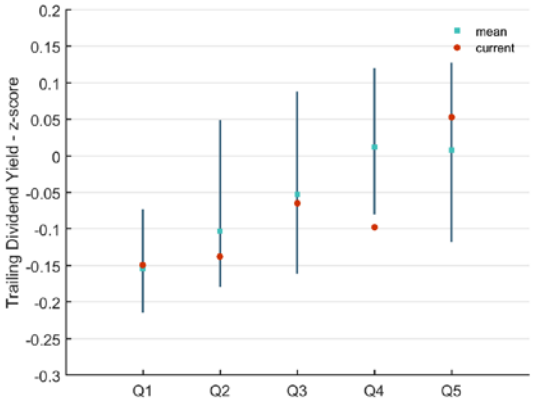
We found data supporting the assertion that high ESG-rated companies (Q5) were more profitable and paid higher dividends, especially when compared to bottom quintile (Q1) companies, as can be seen in Exhibits 1 and 2.

Exhibit 1: Gross Profitability of ESG Quintiles



Gross profitability (z-score) of size-adjusted ESG quintiles is computed as most recently reported sales less cost of goods sold, divided by most recently reported company total assets. Data from January 2007 to May 2017. Average value over the period is represented by blue dots; current exposure by red dots. The vertical bars represent the 5% to 95% range of observed values.

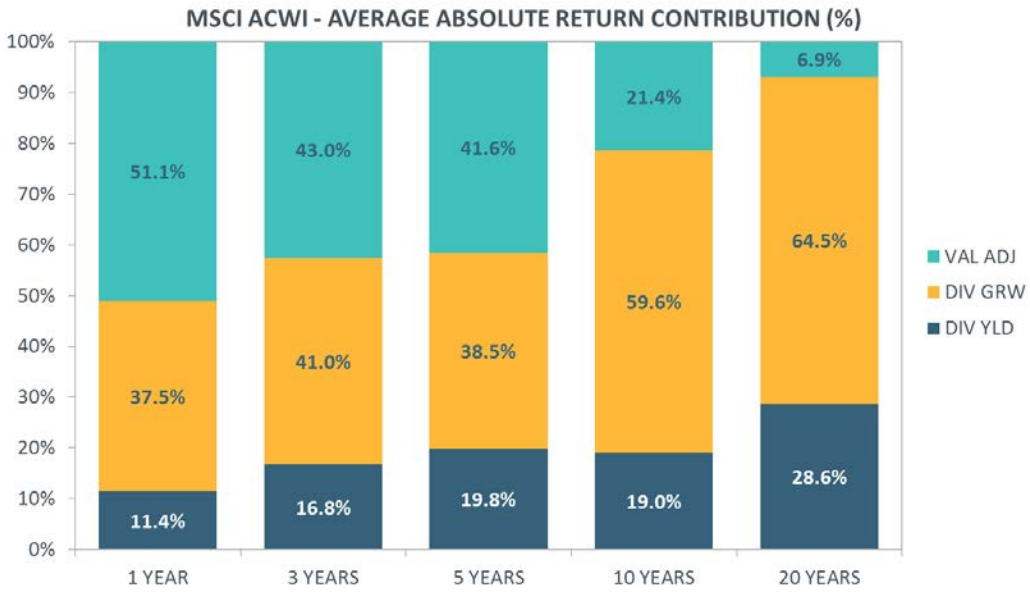
Exhibit 2: Trailing Dividend Yield of ESG Quintiles



Trailing dividend yield (z-score) of size-adjusted ESG quintiles is computed by dividing the trailing 12-month dividend per share by the price at the last month end. Data from January 2007 to May 2017. Average value over the period is represented by blue dots; current exposure by red dots. The vertical bars represent the 5% to 95% range of observed values.

High-dividend yields play an essential role in our analysis, because sustainability investors typically have a long-time investment horizon.[4] Gupta et al. (2016) analyzed the importance of dividends for long-term performance. Exhibit 3 illustrates their breakdown of the total return for the MSCI ACWI Index into stock price increases, dividends and dividend growth, over different time periods. The performance contribution of dividends to portfolio returns was increasingly important as time horizons lengthened.

Exhibit 3: In the Long Run, Cash Flows to Shareholders Drive Most of the Portfolio Return



The graph presents a decomposition of the total return of the MSCI ACWI Index for the time period from December 1994 to September 2015. Total return is decomposed into dividend yield and price return components, and price return is further decomposed into dividend per share (company fundamental) growth and price-to-dividend (valuation ratio) growth.

Therefore, the apparent tilt of high ESG-rated strategies such as the ESG Universal Index toward high dividend-paying companies may have helped enhance medium- to long-term improvement of risk-adjusted returns. Performance data can be found in Exhibit A4 in the Appendix.

[4] See Eccles and Kastrapeli (2017).

IDIOSYNCRATIC RISK CHANNEL

The second company-specific transmission channel relates how well high ESG-rated companies manage their business and operational risks. Their stock prices typically have shown lower idiosyncratic tail risk, as outlined below:

The economic rationale for this transmission channel is explained in Godfrey et al. (2009), Jo and Na (2012) and Oikonomou et al. (2012). It is summarized as follows:

1. Companies with strong ESG characteristics typically have above-average risk control and compliance standards across the company and within their supply chain management.
2. Due to better risk control standards, high ESG-rated companies suffer less frequently from severe incidents such as fraud, embezzlement, corruption or litigation cases (cf. Hong and Kacperczyk [2009]) that can seriously impact the value of the company and therefore the company's stock price. Hoepner et al. (2013) call this an ''insurance-like protection of firm value against negative events.''
3. Less frequent risk incidents ultimately lead to less stock-specific downside or tail risk in the company's stock price.

The authors also support this transmission channel by empirical analysis. For instance, Hoepner et al. (2013) observe that high ESG-rated companies showed statistically significant lower downside risk measures such as volatility, lower partial moments and worst-case loss.

We will now verify each step of the idiosyncratic risk channel.

BETTER RISK MANAGEMENT PRACTICES

The analysis of companies' exposure and management techniques in relation to environmental, social and governance risks is the backbone of MSCI ESG Research's framework: The MSCI ESG Rating model measures both risk exposure to and risk management of a company's key ESG issues. Table A3 in the Appendix shows an overview of the key risk issues that are assessed as part of the MSCI ESG Rating research process.

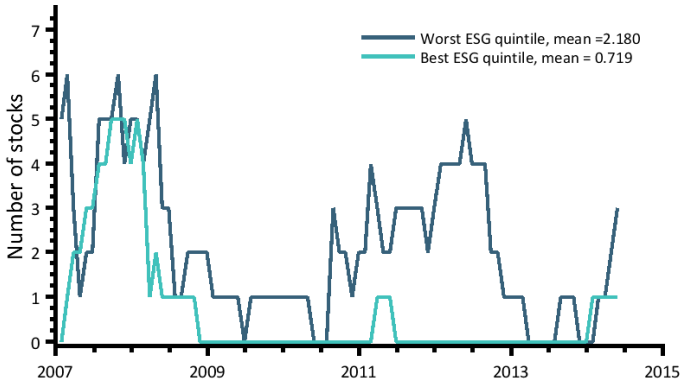
To score well on a key issue, management needs to be commensurate with the level of exposure: A company with high ESG risk exposure must also have very strong management, whereas a company with limited exposure can have a more modest approach. Conversely, a highly exposed company with poor management will score worse than a company with the same management practices but lower exposure to the risk.

In each of 157 GICS® sub-industries, the MSCI ESG Rating model incorporates only a handful of key issues that it determines are the most financially significant for the specific industry. That is, not all ESG issues are considered important; those that are not deemed significant do not carry a weight in a company's rating. In essence, the MSCI ESG Rating is a reflection of companies' residual risk exposure to their industry's most significant key issues after taking into account companies' risk-mitigation techniques. Therefore, these ESG ratings are a suitable starting point for our analysis.

LOWER RISK OF SEVERE INCIDENTS

To assess the ability of companies' risk management functions to successfully mitigate severe incidents that can lead to financial losses, we looked at the frequency of large adverse idiosyncratic stock price moves. To be precise, for the 10-year observation period, we identified companies in the MSCI World Index that have had a drawdown of more than 95% or went bankrupt in the 3-year period after the company was categorized in either the top or bottom ESG rating quintile, which we consider to be an idiosyncratic risk incident. For each of these incidents, we look at each company's ESG rating before the respective 3-year drawdown period started. Exhibit 4 shows how frequently such incidents occurred (the "incident frequency") for the top and bottom ESG quintile over the full 10-year time period.

Exhibit 4: Idiosyncratic Incident Frequency of Top and Bottom ESG Quintile



For each month, we report the number of stocks that realized a more than 95% cumulative loss over the next 3 years, taking the price at month end as the reference point for return calculation.

Over the past 10 years, higher ESG-rated companies showed a lower frequency of idiosyncratic risk incidents, suggesting that high ESG-rated companies were better at mitigating serious business risks. We have also tested the robustness of this result by using different drawdown thresholds (25%, 50% and 95%) and drawdown periods (three years and five years). In each parameter setup, companies with high ESG ratings had a significantly lower incident frequency than companies with poor ESG ratings.

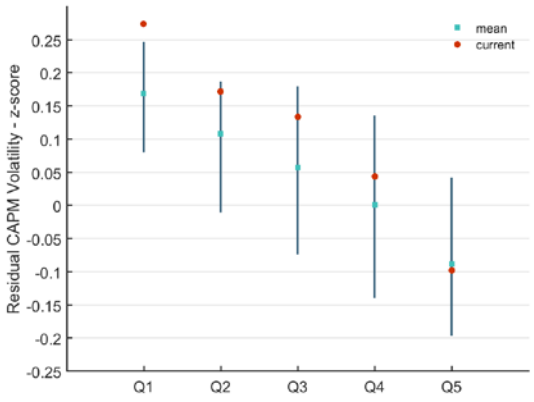
LOWER IDIOSYNCRATIC TAIL RISKS

Better risk management practices should ultimately be visible in the form of reduced stock-specific risk of the corresponding stock price – especially stock-specific tail risk as discussed in Hoepner et al. (2013).

To understand how ESG characteristics are linked to tail risks, Exhibit 5 compares the residual volatility of companies across ESG quintiles, i.e., the volatility that is *not* explained by the common factors in the MSCI Barra Global Equity Model. Exhibit 6 shows the kurtosis of stock returns across ESG quintiles; kurtosis is a commonly used measure for tail risks.

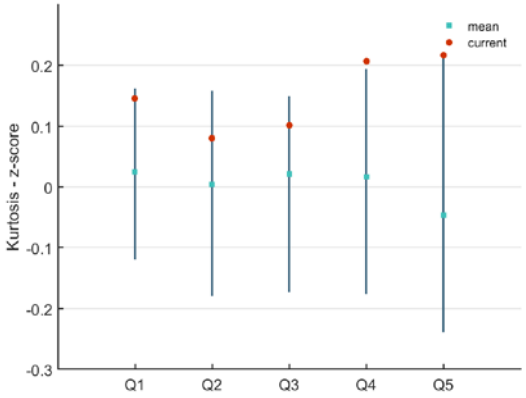
Both stock-specific risk measures show lower idiosyncratic risk for high ESG-rated companies, in particular with respect to tail risks.

Exhibit 5: Residual CAPM Volatility of ESG Quintiles



Residual CAPM volatility (z-score) here is defined as the volatility of the residual returns from the CAPM regression used in the calculation of historical beta (see Exhibit 3). Data from January 2007 to May 2017. Average value over the period is represented by blue dots; current exposure by red dots. The vertical bars represent the 5% to 95% range of observed values.

Exhibit 6: Kurtosis of ESG Quintiles



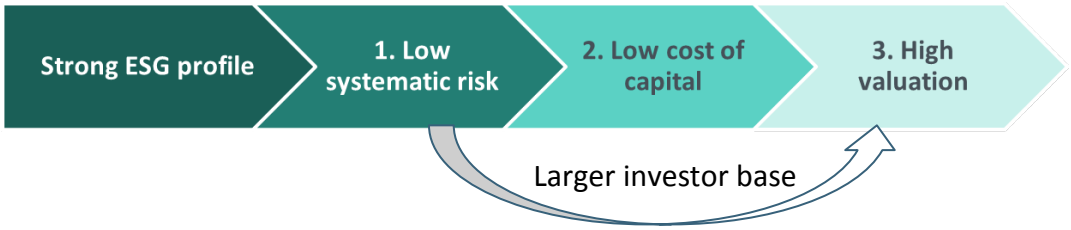
Kurtosis (z-score) is computed as the ratio of the fourth central moment of daily returns divided by the square of daily return variance. Data from January 2007 to May 2017. Average value over the period is represented by blue dots; current exposure by red dots. The vertical bars represent the 5% to 95% range of observed values.

SYSTEMATIC RISK TRANSMISSION CHANNEL

We now analyze how companies' ESG profile impacts their exposure to systematic risk and how this impact may ultimately lead to financially significant effects. In a DCF model framework, the systematic risk exposure affects the denominator of the DCF model.

VALUATION CHANNEL

Eccles (2011), El Ghoul et al. (2011) and Gregory et al. (2014) argue that a strong ESG profile leads to higher valuations through the following transmission process:



Their economic rationale is as follows:

1. Companies with a strong ESG profile are less vulnerable to systematic market shocks and therefore show lower systematic risk. For instance, energy- or commodity-efficient companies are less vulnerable to changes in energy or commodity prices than less efficient companies and therefore their share price tends to show less systematic market risk with respect to these risk factors.
2. In a CAPM model framework (cf. Ruefli 1999), the beta of a company has two important functions: First, beta measures the systematic risk exposure of companies (i.e., lower beta means less systematic risk) and second, it translates the equity risk premium into the required rate of return for the individual company. Therefore, lower systematic risk means a company's equity has a lower value for beta and therefore investors require a lower rate of return. Ultimately, this translates into a lower cost of capital for a company. This argument can be extended to multi-factor models, where the systematic risk exposure of a company is measured by several factor loadings instead of one beta.
3. Finally, a lower cost of capital leads directly to the last step of the transmission mechanism: In a DCF model framework, a company with lower cost of capital would have a higher valuation.

In addition to this, Hong and Kacperczyk (2009) together with El Ghoul et al. (2011) show that the transmission channel from lower systematic risk to higher valuations can also be explained through the relative size of the investor base. That is, the authors argue that companies with low ESG ratings have a relatively small investor base due to two effects:

- Investor preferences: Many risk-averse investors and socially conscious investors avoid exposure to low ESG-ranked companies.
- Information asymmetry: The problem of asymmetric information between companies and their investors is less severe for high ESG-rated companies, since high ESG-rated companies are typically more transparent, in particular with respect to their risk exposures and their risk management and governance standards.

While the impact of ESG ratings on a company's investor base is fairly difficult to measure in practice, it can be a key motivation for large asset owners to integrate ESG in their portfolios. For instance, SwissRe (2017) mention that ''a shift to ESG benchmarks would lead to a smaller investment universe and hence lower demand for the excluded securities. Over the long term, we expect that such movements will motivate these companies to further include ESG aspects into their business approach and extend their ESG-related disclosure. Due to the improved resilience to long-term risks, this is beneficial for investors as well as for the company itself. Consequently, ESG factors will have an impact on company valuation and cost of capital, and as such become an integral part of financial analysis.''

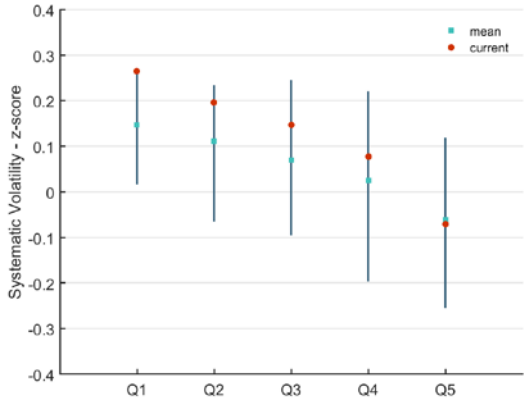
Next, we examine how ESG ratings have affected systematic risk, the cost of capital and equity valuations.

LOWER SYSTEMATIC RISK

Exhibit 7 compares the average systematic volatility of ESG rating quintiles within the MSCI World Index over a 10-year period, while Exhibit 8 compares the earnings variability of the ESG-rated quintiles.

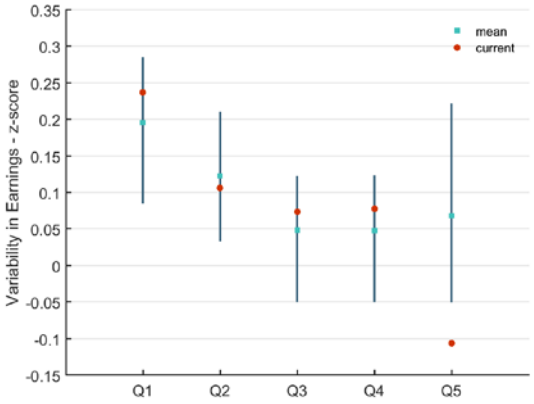
Exhibits 7 and 8 illustrate that companies with high ESG ratings have shown less volatile earnings and less systematic volatility, in line with the conjecture that companies with high ESG ratings show lower systematic risk exposure.

Exhibit 7: Systematic Volatility of ESG Quintiles



Systematic volatility (or common factor risk) is calculated as the volatility predicted by all the factors of the GEMLT model. Data from January 2007 to May 2017. Average value over the period is represented by blue dots; current exposure by red dots. The vertical bars represent the 5% to 95% range of observed values.

Exhibit 8: Variability in Earnings of ESG Quintiles

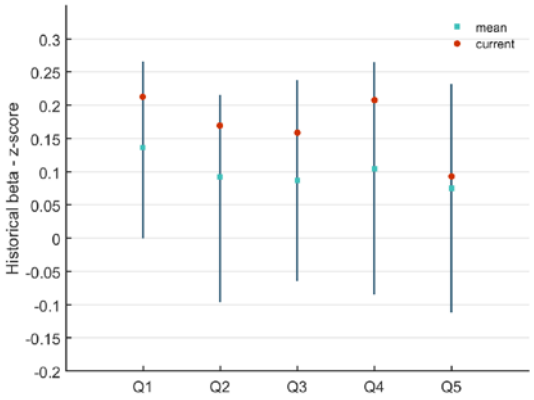


Variability in earnings (z-score) is computed as the standard deviation of company reported annual earnings over the last five fiscal years, divided by the average annual earnings. Data from January 2007 to May 2017. Average value over the period is represented by blue dots; current exposure by red dots. The vertical bars represent the 5% to 95% range of observed values.

LOWER COST OF CAPITAL

In a CAPM model framework, the cost of capital is determined by the expected return, which is calculated as the risk-free rate plus the stock's beta times the market's excess return. Therefore, the stock's beta is a one-to-one measure for the cost of capital, i.e., higher cost of capital coincides with higher values of beta. Exhibit 9, which compares the average beta of ESG quintiles, demonstrates that high ESG-rated companies experienced lower levels of beta and therefore – in the context of the CAPM – lower costs of capital.

Exhibit 9: Historical Beta of ESG Quintiles



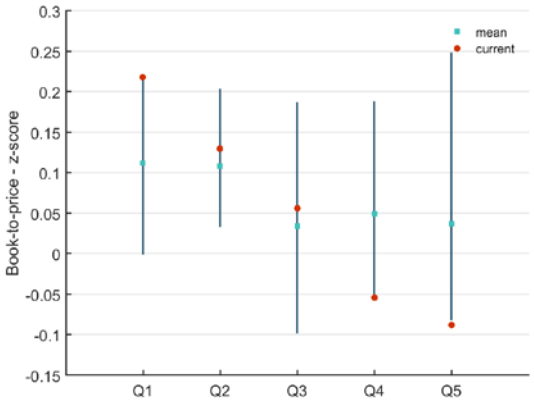
Historical beta (z-score) is computed as the slope coefficient from a time-series regression of stock excess returns, against the cap-weighted excess returns of the estimation universe over a trailing window of 504 trading days, with a 252-day half-life. Data from January 2007 to May 2017. Average value over the period is represented by blue dots; current exposure by red dots. The vertical bars represent the 5% to 95% range of observed values.

HIGHER VALUATION

Ultimately, we expect lower costs of capital to result in higher company valuations. Exhibits 10 and 11 compare the average book-to-price and predicted earnings-to-price ratios of ESG quintiles, respectively. The two exhibits show that high ESG ratings coincided with higher valuations in terms of both book-to-price and earnings-to-price ratios.[5]

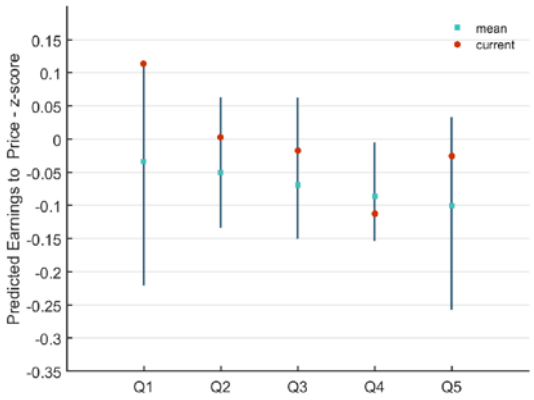
[5] A higher valuation means lower book-to-price and lower earnings-to-price ratios.

Exhibit 10: Book-to-Price Ratio of ESG Quintiles



Book-to-price ratio is computed as the last reported book value of common equity divided by current market capitalization. Data from January 2007 to May 2017. Average value over the period is represented by blue dots; current exposure by red dots. The vertical bars represent the 5% to 95% range of observed values.

Exhibit 11: Predicted ETOP Ratios of ESG Quintiles



Predicted earnings-to-price ratio is computed by dividing the average analyst estimate of 12-month forward-looking earnings by the current market capitalization. Data from January 2007 to May 2017. Average value over the period is represented by blue dots; current exposure by red dots. The vertical bars represent the 5% to 95% range of observed values.

It is worth noting that the valuation channel has been supported by both academic and industry researchers. El Ghoul et al. (2011) show that higher ESG-rated companies had lower costs of capital according to four different measures while controlling for common

factor exposures. Dunn et al. (2016) observe that high ESG ratings coincided with lower systematic risk and higher valuations. Furthermore, Melas et al. (2016) show that ESG ratings exhibited a negative correlation to the value factor, which is in line with the observation that high ESG-rated stocks have carried higher valuations (and consequently less exposure to the value factor).

In addition, Desclee et al. (2015) found a similar transmission channel in the corporate bond market: In their analysis, they show that higher ESG-rated corporate bonds had lower systematic risk, lower spreads and therefore higher valuations while controlling for common corporate bond factors.

FROM CORRELATION TO CAUSALITY

When it comes to understanding whether higher ESG ratings can lead to higher valuations or whether higher valuations lead to higher ESG ratings, we have a chicken-and-egg problem. Krueger (2015) emphasized that the direction of causality between positive correlations for ESG rating and corporate valuation is not clear: Higher ESG ratings can – through lower systematic risk and lower cost of capital – lead to higher valuations. Alternatively, higher valuations can indicate successful companies that have more money to invest in sustainability related areas, leading to a higher ESG rating.[6]

Understanding the causal relationship between ESG characteristics and financial values is crucial in showing the benefits of ESG investing. To start with, the fundamental basis of our transmission channels is the observation that ESG characteristics influence both the systematic and idiosyncratic risk profile of corporates. Consequently, we examine the extent to which a change in a company's ESG characteristics has been a leading indicator for changes in systematic and idiosyncratic risk, and how far these changes in the risk profile have led to a change in the financial target variable of the transmission channels. This analysis helps us understand how ESG rating changes have affected ESG strategies.

Testing and verifying causality empirically is more difficult than looking at correlations alone. While correlations can be assessed by simply analyzing datasets at a given point in time, understanding causality requires an analysis of changes over time, which limits the dataset to events where actual changes have occurred. Another limiting factor is the length of time series that is available for observing rating changes, which in our case is the 10-year time period used for the empirical analysis of the transmission channels.

As a consequence, we expect the statistical significance of our causality analysis to be lower than for the static analysis of the transmission channels, in particular due to the relatively short time series. For that reason, we focus the causality analysis on those channels where we were able to find empirical support for causality, namely, the valuation channel (where the empirical evidence was strongest) and the idiosyncratic risk channel.

[6] The question of causality between ESG ratings and systematic and idiosyncratic risk is also analyzed in Dunn et al. (2016). The authors show by using a regression model that ESG ratings are predictive of future systematic and idiosyncratic risk figures, while controlling for the current level of risk and common factor exposures. The authors' empirical results show ESG ratings to be predictive for both future systematic and future stock-specific risk for up to five years.

CAUSALITY IN THE SYSTEMATIC RISK CHANNEL

To assess causality in the valuation channel, we analyze the extent to which changes in the ESG profile of companies have led to changes in the systematic risk profile, changes in the cost of capital and, finally, changes in the valuation of companies.

The economic rationale can be derived directly from the previous arguments for the valuation channel:

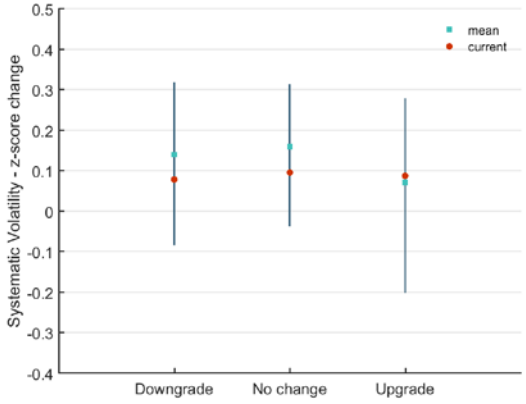
- An improving ESG profile means a company is becoming less susceptible to systematic risks.
- Lower systematic risk leads to a reduction in a company's cost of capital.
- The reduction in cost of capital leads to an increase in valuation.

We now analyze the same financial variables as in the valuation channel, with one key difference: We assess to what extent changes in companies' ESG profiles predicted changes in these financial variables. Therefore, we plot the change of key variables over three buckets of changes in ESG ratings – downgrades, neutral (no change) and upgrades. As we can see from Exhibit A2 in the Appendix, rating changes of more than one notch were relatively rare and are therefore aggregated into one combined upgrade and downgrade bucket . Since ESG characteristics can be expected to influence corporations' financial profile mainly in the medium- to long-term (i.e., over a multi-year period), we look at changes in financial variables over a 3-year time period after the change in ESG rating occurred.

DECREASING SYSTEMATIC RISK

Exhibit 12 shows the change in companies' systematic volatility (as above) over the rating change buckets. Companies with a rating upgrade demonstrated a relative improvement in their systematic risk profile compared to neutral or downgraded companies. As expected, the statistical significance of the result (shown in Exhibit A1 in the Appendix) is lower than in the corresponding analysis of the valuation channel.

Exhibit 12: Change in Companies' Systematic Volatility



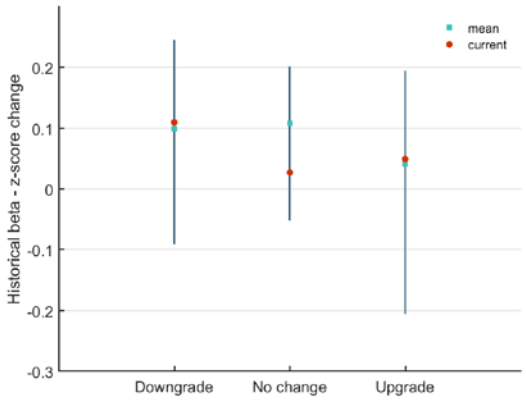
Change in systematic volatility (also known as common factor risk) is computed using the volatility predicted by all the factors of the responsive variant of the GEMLT model. The difference is calculated between the volatility 36 months after the analysis date and the volatility as of the analysis date. (See also Exhibit 1.) Data from January 2007 to May 2017. Average value over the period is represented by blue dots; current exposure by red dots. The vertical bars represent the 5% to 95% range of observed values.

DECREASE IN COST OF CAPITAL

Analogous to the valuation channel, we use companies' betas as proxies for their cost of capital. In Exhibit 13, we assess how far a rating upgrade or downgrade predicted a fall or rise in a company' beta respectively. These changes can be used as a proxy for a change in their cost of capital.

We observed a relative decrease in beta for companies whose ESG rating improved compared to downgraded companies. As for systematic volatility, the statistical significance was lower than in the analysis of the valuation channel.

Exhibit 13: Change in Companies' Beta

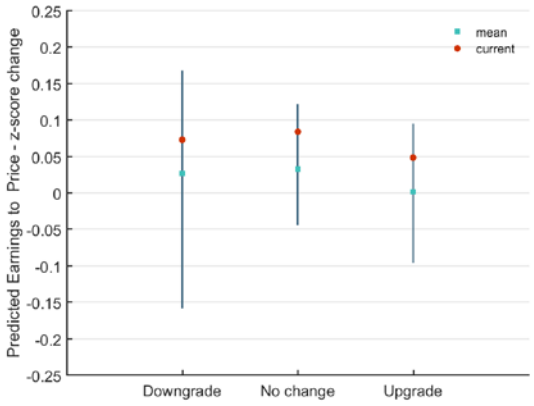


Change in historical beta (z-score) is computed as the difference between historical beta 36 months after the analysis date and beta as of the analysis date. (See also Exhibit 3.) Data from January 2007 to May 2017. Average value over the period is represented by blue dots; current exposure by red dots. The vertical bars represent the 5% to 95% range of observed values.

INCREASE IN VALUATION

The final step of the causality analysis is to study the impact a change in the cost of capital had on a company's valuation. We analyze this relationship in Exhibit 14, looking at the predicted earning-to-price ratio. We observe that rating upgrades led to a relative decrease in the predicted earning-to-price ratio compared to rating downgrades, indicating an increase in valuation.

Exhibit 14: Change in Predicted Earnings-to-price Ratio



Change in predicted earnings-to-price ratio is computed as the difference between predicted earnings-to-price ratio 36 months after the analysis date and earnings-to-price ratio as of the analysis date (see also Figure 5). Data from January 2007 to May 2017. Average value over the period is represented by blue dots; current exposure by red dots. The vertical bars represent the 5% to 95% range of observed values.

To conclude, we have analyzed the causality of the valuation channel analogously to the valuation channel itself, using changes in financial variables relative to changes in ESG ratings. However, the statistical significance of the obtained results is clearly lower than for the valuation channel, which can be explained by the relatively short time period of our analysis. To improve the statistical significance of our analysis, a longer time series is needed; this will be an important focus of future research.

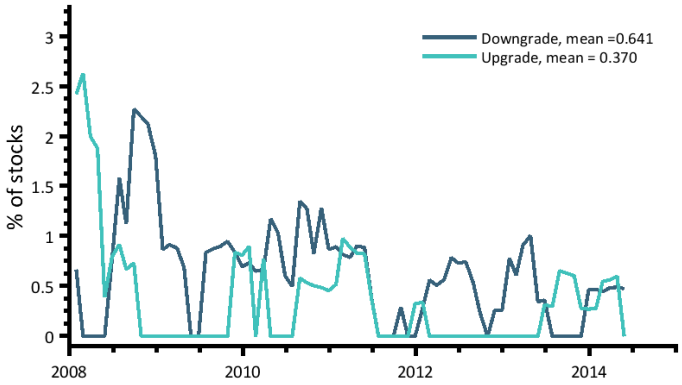
CAUSALITY IN THE IDIOSYNCRATIC RISK CHANNEL

Obtaining statistically significant evidence of causality for all the different steps in the cash-flow channel and the idiosyncratic risk channel is more challenging than for the valuation channel.

We therefore focus on the empirically strongest result that we found, i.e., the relationship between a change in ESG ratings and the impact on the incident frequency.

Exhibit 15 shows the idiosyncratic risk profile (measured as incident frequency) of rating upgrades and rating downgrades. Over the 10-year observation period, rating upgrades had a lower incident frequency than rating downgrades, supporting the assertion that rating changes are a leading indicator for idiosyncratic risks.

Exhibit 15: Proportion of Large Losses by Rating Notch Changes



For each month, stocks are sorted into three groups – rating upgrades, neutral and downgrades over the previous 12 months. For each group, we then compute the proportion of stocks that realized a more than 95% cumulative loss over the next three years, assuming the price at month end as the reference point for return calculation. The graph shows only the time series of upgrades and downgrades (see also Exhibit 12).

To conclude, in our causality analysis of the systemic and idiosyncratic risk channels, we found that downgraded companies experienced a relative increase in both systematic and stock-specific risk compared to companies whose ESG rating was upgraded.

ESG MOMENTUM

Assessing the transmission of a change in a company's ESG profile to a change in financial indicators such as valuation or profitability is not only important for testing causality: It is also important because the change in financial variables such as valuation can be a source of alpha. For instance, Gregory et al. (2014) argue from a conceptual point of view that since ESG characteristics have impacted corporations' valuation through systematic risk, a change in a company's ESG profile should be a predictor for a change in valuation and therefore for stock returns.

In a more practical analysis, Nagy et al. (2016) show that an investment strategy which tilts a hypothetical standard market cap-weighted portfolio toward companies that show a positive ESG rating trend significantly outperformed both the benchmark and a comparable strategy that tilted the portfolio weights toward companies with high ESG ratings.

To verify the conjecture that ESG rating changes — which we call ESG momentum — can be a financially significant indictor and a potential link to returns, we compare the historical performance of the top ESG momentum quintile to the bottom ESG quintile. The ESG momentum indicator is calculated as the year-on-year change in the industry-adjusted ESG score.

The results in Exhibit 16 show significant outperformance of the top ESG momentum quintile over the bottom quintile, corresponding with the findings from our transmission-channel analysis: An improvement in ESG characteristics has led to increasing valuations over time.

Exhibit 16: Financial Performance of Top versus Bottom ESG Momentum Quintile

Cumulative performance differential of the top ESG momentum quintile versus the bottom ESG momentum quintile. ESG momentum is defined as the 12-month change in ESG score.

We conclude that ESG momentum can be a useful financial indicator in its own right and may be used in addition to the actual ESG rating in index or portfolio construction methodologies.

It is important to emphasize that the financial value of ESG momentum is also supported in existing literature, for instance by Khan et al. (2015). The authors used MSCI ESG Ratings data to create customized ESG scores and performed a regression analysis of stock returns to ESG score changes (i.e., ESG momentum), neutralized with respect to changes in size, market-to-book ratio, leverage, profitability, R&D intensity, advertising intensity and institutional ownership and sector membership. The authors found statistically significant predictive power of ESG momentum for stock returns.

FACTOR INTENSITY AND LONGEVITY

The verification of the different transmission channels and the causality analysis also points to other important conclusions about the differences between ESG ratings and more traditional factors. Those differences relate to the intensity of the signal (i.e., financial impact per unit of time) and the longevity of the signal (i.e., how long the signal persists):

- **Intensity:** Looking at the impact ESG ratings have shown in the transmission channels, especially on systematic and idiosyncratic risk figures, we consider that

the intensity of ESG ratings is lower than common factors such as momentum or low volatility.

- **Longevity:** The existence of a risk-reduction effect, even three years after an ESG rating upgrade, indicates a relatively long timespan for ESG as an investment signal.

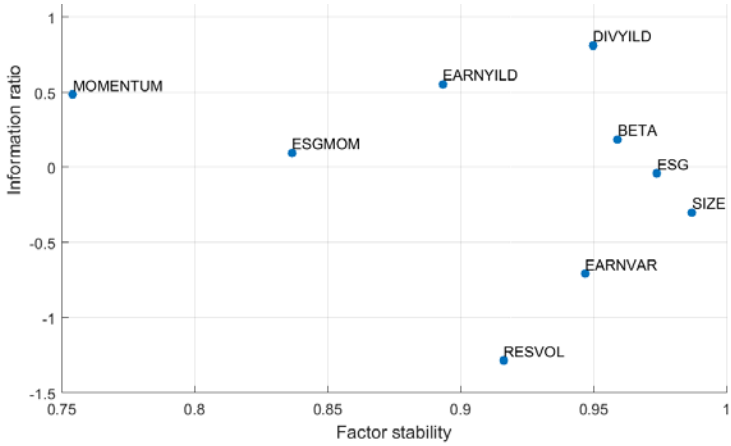
Now, we assess the differences between ESG and common factors in terms of intensity and longevity in a more quantitative way. We use the information ratio (IR) of a factor as a measure of its intensity and factor stability as a measure of the longevity of the factor (Exhibit 17).

We observe that dynamic factors, such as momentum, are quite intense (i.e., high IR), but their lifespan is relatively short.

Defensive factors such as dividend yield are in the middle of the intensity-longevity spectrum. The two factors with the longest lifespan are in fact ESG and size, but their intensity as measured by their IRs is relatively low.

ESG momentum shows higher intensity levels than ESG itself, but also a shorter lifespan.

Exhibit 17: Intensity and Longevity of Common Factors, ESG Ratings and ESG Momentum



Factor stability is computed as the average cross-sectional correlation between factor exposures (or ESG scores and ESG momentum scores) at month end and three months later. For GEMLT factors, factor performance is computed as the annualized information ratio of monthly factor returns; for ESG, it is computed as the annualized Sharpe ratio of the equal-weighted top minus bottom quintile portfolio created from ESG scores.

In essence, ESG ratings have displayed a different intensity-longevity profile to most other factors, with important implications for how and where more traditional factors and ESG

ratings can be used, based on our historical analysis. While these factors have become increasingly popular in quantitative strategies and strategies replicating factor indexes that have experienced high turnover, the longevity of ESG ratings makes them especially suited for integration into indexes that serve as benchmarks.

In addition, combining traditional factors with ESG could have resulted in both the short-term performance benefits of quantitative factors and the medium to long-term risk reduction potential of ESG ratings.

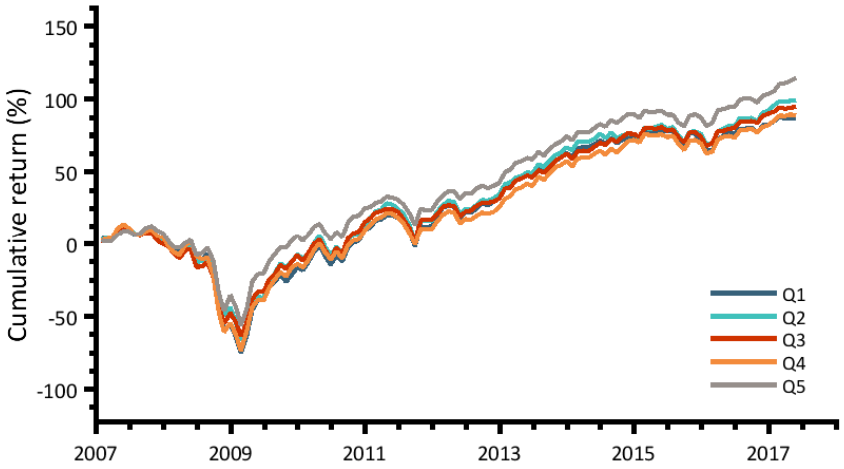
ESG AND STOCK PERFORMANCE

As previously discussed, the jury is still out as to whether good ESG characteristics have led to higher stock returns. In the following, we run a 10-year backtest with monthly re-balancing of the five ESG quintiles portfolios. These five sub-portfolios are equal-weighted and – for the sake of simplicity – are not neutralized with respect to other factor exposures.

Since regional differences have affected the contribution of ESG characteristics to financial performance, we have split the simulation into two regions: U.S. equities and MSCI World ex-U.S. equities.

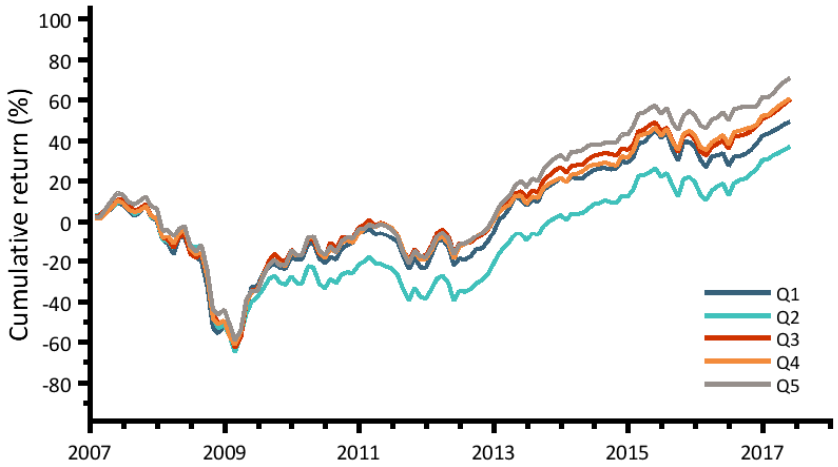
Exhibits 18 and 19 show the performance of the five ESG quintile sub-portfolios for these two regions over time.

Exhibit 18: Historical Performance of ESG Rating Quintiles for the US



Equal-weighted quintiles are formed every month from the US constituents of the MSCI World Index. The ranking is based on the MSCI ESG score. Returns are measured in local currency and include dividend reinvestment.

Exhibit 19: Historical Performance of ESG Rating Quintiles for World ex US



Equal-weighted quintiles are formed every month from the non-US constituents of the MSCI World Index. The ranking is based on the MSCI ESG score. Returns are measured in local currency and include dividend reinvestment.

In both regions, the highest ESG-rated companies' quintile (Q5) performed slightly better over the 10-year backtesting period than the other quintiles. In Europe, the two lowest ESG quintiles (Q1 and Q2) provided the weakest performance; therefore, the performance advantage of higher ESG-rated companies is visible across the entire universe. In contrast to Europe, there was little difference in performance in the U.S. for the different ESG quintiles; there was no statistically significant performance difference between quintiles Q1 to Q4.

Overall, higher ESG-rated companies mildly outperformed those with lower ratings.

CONCLUSION

By creating transmission channels, we have shown how ESG has affected the valuation and performance of companies, both through their systematic risk profile (lower costs of capital and higher valuations) and their idiosyncratic risk profile (higher profitability and lower exposures to tail risk). Thus, the transmission from ESG characteristics to financial value is a multi-channel process, as opposed to factor investing where the transmission mechanism is typically simpler and one dimensional.

In addition, ESG ratings were lower in intensity than traditional factors such as momentum or low volatility (i.e., the financial impact per unit of time for ESG ratings is relatively low), but typically lasted for several years. Classical factors such as momentum typically have lasted for a few months only, making them suitable for factor investing but not necessarily as long-term policy benchmarks.

Key findings include:

- To extract the optimal value from ESG data, ESG integration required a multi-channel approach that uses both systematic and idiosyncratic risk information provided in the ESG rating within a long-term investment horizon.
- ESG ratings may need to be integrated into the financial analysis of companies to ensure model valuations are in line with stock market valuations.
- Both ESG ratings and ESG momentum were important indicators. While ESG ratings measured both systematic and idiosyncratic risks and consequently influenced corporate valuation and profitability measures, ESG momentum indicated potential future changes, e.g., valuation changes.
- ESG ratings may have acted as long-term predictors for future tail risks; in this study, they reflected how exposed a company was to key risks and how well it mitigated those risks. Thus, it may be useful to incorporate ESG ratings into the asset allocation process and policy benchmarks.
- ESG ratings may be suitable for integration into policy benchmarks due to their robustness, long-term nature and potential long-term protection from tail risks.
- The financial industry may be able to use financial risk measures as proposed in this paper to assess, validate and compare the financial performance of different ESG ratings.

APPENDIX

Exhibit A1: Summary of Simulations

Variable	Exhibit	Average |t-stat|	Percent |t|>2	Bottom bucket average	Top bucket average
Gross Profitability	1	1.49	28.80	-0.08	0.06
Trailing Dividend Yield	2	1.89	53.60	-0.15	0.01
Residual CAPM Volatility	5	3.00	88.00	0.17	-0.09
Kurtosis	6	1.21	15.20	0.03	-0.05
Systematic Volatility	7	2.35	59.20	0.15	-0.06
Variability in Earnings	8	1.73	44.00	0.20	0.07
Historical Beta	9	1.27	15.20	0.14	0.08
Book-to-price	10	1.46	25.60	0.11	0.04
Predicted Earnings to Price	11	0.97	5.60	-0.03	-0.10
Systematic Volatility (change)	12	1.35	0.17	0.14	0.07
Historical Beta (change)	13	1.04	0.14	0.10	0.04
Pred. earnings to price (change)	14	0.63	0.01	0.03	0.00

Data from January 2007 to May 2017

The table shows the respective time series averages of the exposure of the companies in the top-rated and bottom-rated bucket over the 10-year observation period. The standard deviation of the z-score distribution is calculated each month as the inverse of the square root of the effective number of stocks in the portfolio that is long the top bucket and short the bottom bucket, as per the methodology described in Appendix 3 of Roisenberg et al. (2017). This standard deviation is then used to compute the t-statistic of the z-score difference between the top and bottom bucket each month. The table shows the time series average of the absolute value of the t-statistics, and the percentage of months where this absolute value is above 2.

Exhibit A2: ESG Rating Migration Matrix

row: from column: to	AAA	AA	A	BBB	BB	B	CCC
AAA	68	21	8	3	1	0	0
AA	14	55	20	8	2	1	0
A	3	17	54	19	5	2	0
BBB	1	4	19	55	16	5	1
BB	0	1	5	23	53	16	2
B	0	1	2	8	22	57	10
CCC	0	0	1	4	8	19	68

The table shows the probability of a migration of a company's ESG rating in percent over a one year time period.

Exhibit A3: ESG Research Methodology Overview

3 Pillars	10 Themes	37 ESG Key Issues	
Environment	**Climate Change**	Carbon Emissions	Financing Environmental Impact
		Product Carbon Footprint	Climate Change Vulnerability
	Natural Resources	Water Stress	Raw Material Sourcing
		Biodiversity & Land Use	
	Pollution & Waste	Toxic Emissions & Waste	Electronic Waste
		Packaging Material & Waste	
	Environmental Opportunities	Opportunities in Clean Tech	Opp's in Renewable Energy
		Opportunities in Green Building	
Social	**Human Capital**	Labor Management	Human Capital Development
		Health & Safety	Supply Chain Labor Standards
	Product Liability	Product Safety & Quality	Privacy & Data Security
		Chemical Safety	Responsible Investment
		Financial Product Safety	Health & Demographic Risk
	Stakeholder Opposition	Controversial Sourcing	
	Social Opportunities	Access to Communications	Access to Health Care
		Access to Finance	Opp's in Nutrition & Health
Governance	**Corporate Governance**	Board	Ownership
		Pay	Accounting
	Corporate Behavior	Business Ethics	Corruption & Instability
		Anti-Competitive Practices	Financial System Instability
		Tax Transparency	

Exhibit A4: Performance Metrics of MSCI ESG Universal and MSCI ESG Leaders Indexes

MSCI Index	ACWI	ESG Universal	ESG Leaders
Total Return %	8.3	8.7	8.6
Total Risk %	12.3	12.0	11.9
Return/Risk	**0.67**	**0.72**	**0.73**
Sharpe Ratio	0.64	0.69	0.70
Active Return %		0.4	0.4
Tracking Error %		1.0	1.0
Information Ratio		0.45	0.37
Hist. Beta	1.0	0.97	0.96
# Stocks	2,457	2,017	1,149
Turnover %	2.8	14.1	9.2
Price to Book	1.9	2.0	2.1
Price to Earnings	16.7	16.8	17.4
Dividend Yield %	2.6	2.7	2.6
ESG Score	5.5	6.3	6.6

Data from May 2011 to September 2017

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CONTACT US

esgclientservice@msci.com

AMERICAS

+ 1 212 804 5299

EUROPE, MIDDLE EAST & AFRICA

+ 44 20 7618 2510

ASIA PACIFIC

+ 612 9033 9339

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