

# HOW MARKETS PRICE ESG

Have Changes in ESG Scores Affected Stock Prices?

Guido Giese, Zoltan Nagy

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**CONTENTS**

Executive Summary..... 3

Introduction..... 4

    ESG Profiles vs. ESG Scores ..... 6

Introduction to ESG Momentum..... 7

Financial Performance of ESG Momentum ..... 11

Conclusion ..... 21

Appendix..... 22

References ..... 23

## EXECUTIVE SUMMARY

Many researchers in both academia and the financial industry have studied the link between companies' Environmental, Social and Governance (ESG) characteristics and financial risk and performance. This paper examines some of the underlying economic questions: How have markets priced ESG characteristics? Have they been fully priced? Have there been sweetspots? How quickly did the market incorporate ESG information?

We investigate these questions by looking into how changes in companies' ESG profiles (proxied by changes in MSCI ESG scores, which we call ESG momentum) have historically predicted equity price movements while all other influences, including the market, remain controlled. Looking at changes in ESG scores and their impact on equity prices may provide evidence for causality.

The backbone of our analysis is a financial model where the valuation level of companies is a function of ESG scores and other factors (which we control for) and allows for a time-lag between ESG score changes and their impact on valuations.

We verify and assess the exact shape of this model function empirically by comparing the financial performance of companies with strong positive ESG momentum versus companies with negative ESG momentum. Overall, our findings suggest that equity markets reacted most sensitively to ESG information for companies that do not have extreme ESG scores (neither very low nor very high) and that equity markets showed a stronger reaction to improvements in ESG characteristics than to declines in ESG performance. We also found that the change in ESG characteristics showed the strongest move in equity prices over a one-year time horizon compared to both shorter and longer timeframes. These findings add further insight to our previous findings that ESG momentum has provided statistically significant predictive power during our study periods (Giese, 2017).

## INTRODUCTION

There is an ongoing debate in both academia and the asset management industry about the financial benefits of ESG investing, which has led to over 2,000 research papers published in this field.<sup>1</sup> These studies differ significantly in terms of the ESG methodologies and financial metrics used to assess the performance impact of ESG investing. Not surprisingly, there is no clear consensus on this matter.

However, underlying the question whether ESG has a real-world financial effect is a more fundamental economic question: Do ESG characteristics move equity prices? This question is crucial to understanding whether the correlations between ESG and financial performance that some researchers have observed are based on a causal relationship between ESG and performance. As many statisticians and we also have noted (*op. cit.*, Giese, 2017), “correlation does not imply causation.” This paper focuses on this question of causality.

Krueger (2015) emphasized that often a correlation between ESG and financial variables is implicitly interpreted to mean that ESG is the cause and the financial value the effect, although this is really a chicken-and-egg type of question. For instance, one can argue that companies with high ESG scores are better at managing their businesses, 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 assess the question of causality, in 2017, we identified three economic transmission channels from ESG characteristics to financial risk and performance, which we verified by empirical analysis using MSCI industry-adjusted ESG scores:<sup>2</sup> Historically, companies in the sample set with high MSCI ESG scores were associated with higher levels of profitability and dividend yield as well as lower levels of idiosyncratic tail risks and lower levels of systematic risk, while controlling for static factors. We also found high ESG-rated companies to be associated with higher levels of corporate valuations. In addition, the authors tested causality of ESG scores by analyzing whether changes in ESG characteristics were a leading indicator for a change of their financial characteristics, while controlling for other factors. They found changes in ESG scores were predictive of changes in risk characteristics and stock returns, based on the MSCI World Index from 2007 to 2017.

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<sup>1</sup> According to a meta study by DWS and the University of Hamburg: ESG & Corporate Financial Performance: Mapping the global landscape, December 2015.

<sup>2</sup> *Op cit.*, Giese et al. (2017). MSCI industry-adjusted ESG scores (“ESG scores”) measure companies’ financially most significant ESG-related risks and opportunities and are normalized per industry to a standard scale between 0 and 10, to avoid industry biases. MSCI ESG scores are calculated based on public and private information and a risk assessment by MSCI ESG analysts.

Not all of the previously mentioned studies found positive financial results for ESG scores. However, many studies found that companies' ESG profiles had a noticeable influence on their risk characteristics.

For instance, Eccles (2011), El Ghouli et al. (2011) and Gregory et al. (2014) also observed that companies with good ESG characteristics have shown less exposure to risks and higher levels of valuation. Fatemi, Fooladi, & Tehranian (2017) argued that the lower level of risk of companies with good ESG characteristics tended to have more loyal employees, more loyal customers, a lower chance of facing lawsuits and thus a higher chance to survive longer. The authors also developed a model that demonstrated that firms with higher chances of survival had higher valuation levels.

While there has been an ongoing debate in both academia and the asset management industry about the financial benefits of ESG investing, the financial value of changes in companies' ESG profiles ("ESG momentum") has so far attracted relatively little attention from academic and industry researchers. There have been some notable exceptions, namely, Khan et al. (2015)<sup>3</sup> and Nagy et al. (2016).<sup>4</sup> Looking at ESG momentum may offer a more useful approach to understanding how equity markets price ESG characteristics than looking at static correlations because it may provide evidence for causality.

In this paper, we examine how ESG momentum has historically been priced by equity markets (see box). This paper builds on our 2017 research, where we discussed how new information — such as a change in a company's ESG profile — is transmitted to the market. As the ESG profile has influenced companies' idiosyncratic and systematic risk profile in many cases — and therefore the cost of capital — and ultimately the valuation level of companies, it is logical to conclude that a *change in the ESG profile* may be useful when analyzing the valuation of a company.<sup>5</sup>

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<sup>3</sup> Khan et al. (2015) found statistically significant predictive power of ESG momentum for stock returns. The authors used MSCI ESG data (KLD ESG data sets for the U.S. equity market from 1991 to 2013) to create customized ESG scores and performed a regression analysis of stock returns to ESG score changes, neutralized with respect to changes in size, market-to-book ratio, leverage, profitability, R&D intensity, advertising intensity, institutional ownership and sector membership.

<sup>4</sup> In MSCI's research, Nagy et al. (2016) found that an investment strategy which tilted a hypothetical standard market cap-weighted portfolio toward companies that showed a positive ESG momentum significantly outperformed both the benchmark and a comparable strategy that tilted portfolio weights toward companies with high static ESG scores from 2007 to 2015, based on the MSCI World Index.

<sup>5</sup> We tested this economic reasoning empirically in our 2017 paper: We found that changes in MSCI ESG scores were indicative of changes in beta (which were used as a proxy for the cost of capital) and changes in valuation levels (measured by book-to-price and earnings-to-price ratios) in the MSCI World Index from 2007 to 2017.

### ESG PROFILES VS. ESG SCORES

Throughout this paper, it is important to distinguish between the ESG profile of a company and its MSCI ESG score: The *ESG profile* of a company is an abstract term that involves all characteristics that investors may look at when doing a financial analysis of a company, such as its corporate governance, ownership structure, tax transparency, carbon footprint or gender diversity. The *MSCI ESG score* is a proxy for this ESG profile.

We seek to assess to what extent the ESG profile (and in particular a *change* in the ESG profile) may have an influence on how the market is pricing the company. However, we are *not* making the assumption that the market is reacting indirectly or directly to the MSCI ESG score or a change in the score. In brief, the MSCI ESG score is a proxy for the ESG-related information that the market is processing. Likewise, we will use the *year-on-year change* of the MSCI ESG score (“ESG momentum score”) as a proxy for the a change in the ESG profile of a company because all MSCI ESG scores are updated at least once a year.

Therefore, we start our analysis with the assumption that there is a relationship between the ESG profile and the valuation of companies. We test this assumption to see how changes in ESG scores translated into changes in valuation and ultimately stock performance.

As emphasized in Giese et al. (2017), there are various ways to measure valuation levels, e.g., using fundamental valuation ratios such as book-to-price or book-to earnings, or by looking directly at stock price movements while controlling for the market and other factors. We focus on the latter to provide the most visibility into ESG relation to equity markets.

We use empirical analysis to understand the shape of a corporate valuation model curve which expresses the valuation level of companies as:

$$Valuation(t+\Delta t) = Function(ESG(t), market, style factors)$$

We allow for a time lag  $\Delta t$  between a change of ESG scores and the price reaction of the market.

Using this equation, we analyze how changes in companies’ ESG scores led to changes in their valuation expressed as stock price movements not explained by the market and other factors. In the above model equation, the degree of stock price movement caused by changes in ESG scores depends on the slope of the valuation-ESG relationship and will be a key focus of our analysis.

## INTRODUCTION TO ESG MOMENTUM

The basis of our analysis are ESG momentum scores, which are defined as year-on-year changes of MSCI Industry-adjusted ESG scores. We briefly summarize their basic properties to better understand how they might be used in financial models.

First, we test the degree to which ESG momentum scores were correlated to traditional factors, which we must then control for in our analysis. Exhibit 1 compares the correlation of MSCI ESG scores as well as ESG momentum scores to standard equity style factors in MSCI's Barra GEMLT model. MSCI ESG scores have historically shown positive correlation to quality factors and the low volatility factor and negative correlation to the value factor.<sup>6</sup> In contrast, ESG momentum scores have historically been uncorrelated to any of the equity style factors. This has made ESG momentum fairly straightforward to apply in portfolio construction, since there has been little risk of suffering undesired factor biases when using ESG momentum.

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<sup>6</sup> Factors are measured using MSCI's Barra GEMLT model.

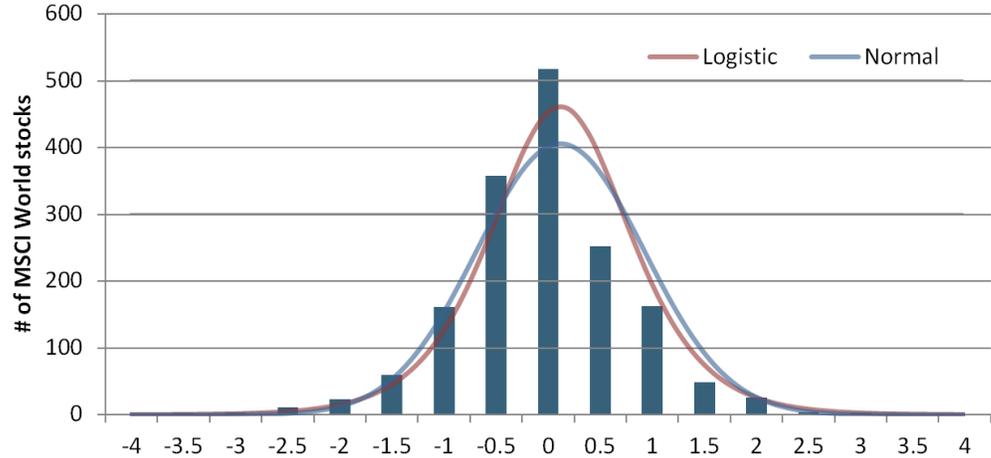
**Exhibit 1: Correlation of MSCI’s Barra GEMLT Factors with ESG and ESG Momentum**

Factor	Correlation with ESG	Correlation with ESG Momentum
Mid Capitalization	-0.14	0.02
Earnings Variability	-0.13	-0.03
Residual Volatility	-0.09	-0.04
Book-to-Price Ratio	-0.08	-0.03
Liquidity	-0.04	-0.01
Leverage	-0.03	-0.01
Growth	-0.02	0.00
Beta	-0.02	-0.01
Earnings Yield	0.00	0.01
Momentum	0.00	0.02
Earnings Quality	0.02	-0.04
Long-Term Reversal	0.05	-0.02
Profitability	0.05	0.02
Dividend Yield	0.08	0.01
Investment Quality	0.09	0.00
Size	0.14	-0.02

*MSCI World Index. Sample period from June 2009 to February 2018*

When constructing portfolios based on ESG momentum scores, it is also important to understand that they have been tilted toward upgrades. Exhibits 2 and 3 show the distribution and statistics of ESG momentum scores within the MSCI World Index. The distribution was roughly in a bell shape with a slightly positive mean and a positive skew (Exhibit 2). The distribution was closer to a logistic distribution (which has excess kurtosis of 1.2) than to a normal distribution (excess kurtosis of zero).

**Exhibit 2: Distribution of ESG Momentum Scores**



MSCI World Index as of Feb. 28, 2018

**Exhibit 3: Statistics of the ESG Momentum Distribution**

Mean	St. deviation	Skew	Excess Kurtosis
0.1317	0.8021	0.0029	1.2557

MSCI World Index as of Feb. 28, 2018

To what extent do ESG momentum scores display positive or negative auto-correlation?<sup>7</sup> Auto-correlation can impact the turnover created by ESG momentum in rules-based portfolio construction methodologies.

ESG momentum scores showed a slight negative degree of auto-correlation (Exhibit 4) — an average of -0.164 over the study period. This means that companies whose ESG scores have improved over one-year tended to see their score reverse the next year, i.e., there was no inertia but some degree of reversal in ESG score changes over time.

<sup>7</sup> Auto-correlation is measured as the cross-sectional correlation between ESG momentum scores at time t and ESG momentum scores at time t – 1 year.

**Exhibit 4: One-year Auto-correlation of ESG Momentum Scores**



*MSCI World Index. Sample period from June 2009 to February 2018*

No such pattern exists in credit rating models, where it is often assumed that credit rating changes fulfill the property of a Markov chain, i.e., credit rating changes are a “memoryless” time series (Andersson and Vanini, 2010). Credit ratings are typically linked to the probability of default of the respective debtor, without reference to the credit quality of other debtors.

In contrast, with MSCI ESG scores, companies in each industry compete with their industry peers for achieving a high ESG score, i.e., MSCI industry-adjusted scores show the *relative position* of a company within its industry peer group on a scale between 0 and 10.

For example, if Company A improves its ESG score in Year One, other companies in its industry peer group might improve the following year while Company A’s score may slip if it does not change its ESG practices. In this example, Company A’s score would increase in Year One and drop in Year Two. Conversely, if Company A’s ESG score falls in Year One, it may take actions the following year to achieve a better ESG score. If the competitors’ do not improve their ESG practices, Company A’s score would drop in Year One and rise in Year Two. This could help explain the observed degree of reversal in ESG momentum scores.

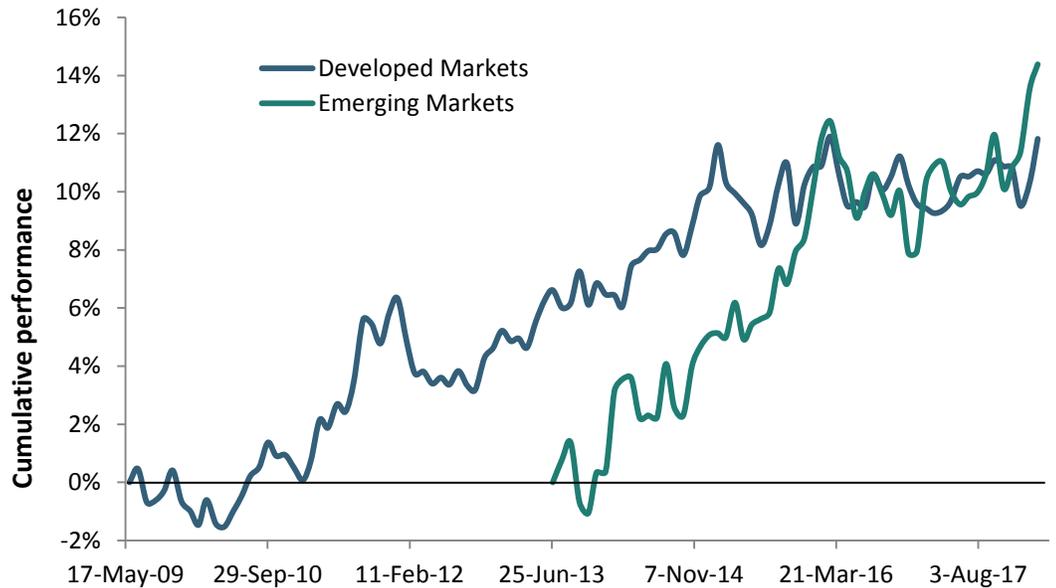
## FINANCIAL PERFORMANCE OF ESG MOMENTUM

Here we compare the historical performance of the top ESG momentum quintile to the bottom ESG momentum quintile. In Exhibit 5, we test the financial performance of ESG momentum within developed markets for the study period 2009 to 2018 and for emerging markets from 2013 to 2018 using simulated long-short indexed portfolios.<sup>8</sup>

The simulation period is longer for developed markets because MSCI ESG scores fully cover developed markets since end of 2007, whereas emerging markets are fully covered since end of 2012.

The simulation is based on a hypothetical investment strategy with monthly re-balancing, where each month the constituents of the parent index are sorted according to their ESG momentum score. The upper quintile is invested long (equal-weighted), the lowest quintile is invested short (equal-weighted) and the performance of this long-short portfolio is simulated for the following month until the next re-balancing takes place. The use of a long-short performance analysis enables us to control for market movements.

**Exhibit 5: Performance of Top versus Bottom ESG Momentum Quintile Portfolios**



*Data covers two hypothetical long-short indexed portfolios. Developed market performance represents going long for the equal-weighted upper quintile of MSCI World Index, while the bottom equal-weighted quintile goes short. DM data is from June 2009 to February 2018. The emerging-market hypothetical portfolio applies the same methodology to the MSCI Emerging Markets Index, from June 2013 to February 2018.*

In both regions, we see that, on average, companies with positive ESG momentum outperformed companies with negative ESG momentum. Despite the shorter time period, ESG momentum outperformed by about 14% cumulatively in emerging markets over the nearly 5-year period, higher than the 12% outperformance experienced by developed markets over a nearly 9-year-period in our simulation. Comparing results in the same period, we find that, the cumulative outperformance was 5.2% in developed markets versus 14.4% in emerging markets for the five-year period ended February 2018.

This result is consistent with the findings in Giese et al. (2018), where the MSCI ESG Leaders Index outperformed in emerging markets versus its developed market counterpart. The authors found that the best-in-class component selection based on MSCI ESG scores had a stronger positive performance effect in emerging markets than in developed markets while controlling for equity style factors. Exhibit 5 confirms this observation in the sense that not only have MSCI ESG scores been more differentiating in emerging markets, but also ESG momentum scores have provided a stronger signal in the live period from 2013 to 2018.

Although we saw in Exhibit 1 that ESG momentum scores are practically uncorrelated to our 16 factors, we now check the degree to which the outperformance shown in Exhibit 5 was explained by key drivers of risk and return. We use the common equity style factors in MSCI's Barra GEMLT model to explore this question. Exhibit 6 shows the decomposition of the outperformance of the ESG momentum history shown in Exhibit 5 into the contribution of these key drivers as well as stock-specific contribution. The results confirm that the main share of outperformance was not caused by common factors, but were linked to the stock-specific performance created by the difference between stocks with stronger ESG momentum ("leaders") and those with weaker ESG momentum ("laggards").

#### Exhibit 6: Performance Attribution by Key Drivers of Risk and Return

Source of return	MSCI World long-short ESG momentum Average return (% p.a.)	MSCI Emerging Markets long-short ESG momentum Average return (% p.a.)
<b>Total Active</b>	<b>1.09</b>	<b>3.61</b>
Risk Indexes	0.09	-0.06
Industry	0.26	-0.76
Country	0.05	1.22
Currency	-0.28	0.33
<b>Specific</b>	<b>0.97</b>	<b>2.88</b>

*MSCI World Index, from June 2009 to February 2018, MSCI Emerging Markets Index, June 2013 to February 2018*

These results show that the performance of the long-short strategies were not driven by equity style factors. Rather, changes in company ESG profiles influenced how equity markets priced stocks during our study period.

## ESG VALUATION CURVE

Next, we explore the exact shape our equation takes when it is graphed. We would like to answer the following questions:

- Does the financial impact of ESG score upgrades or downgrades depend on the initial ESG score of a company? That is, is the ESG-valuation curve non-linear?
- Do ESG score upgrades have a stronger financial impact than ESG downgrades?
- How robust are the valuations results, i.e., do they depend on the choice of the percentile used?
- What is the time horizon for ESG score changes to be priced by the market?

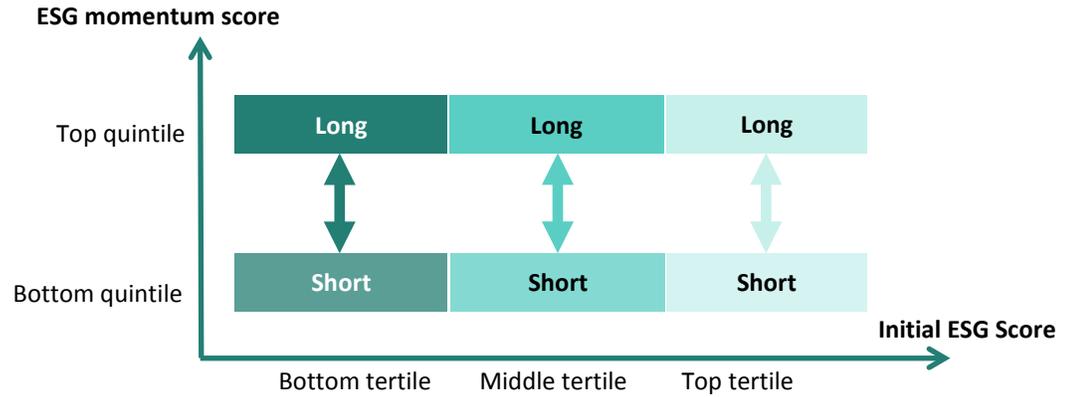
To better understand how much a change in ESG score hinges on a company’s initial score, we split the universe of companies in our analysis into groups of different ESG score levels, e.g., tertiles, quartiles or quintiles, and then rerun the performance analysis above for each group individually. We divide the universe of companies into three equal groups — those with high ESG scores, medium ESG scores and low ESG scores, based on their ESG scores from a year ago, i.e., the starting point for the calculation of ESG momentum scores.

Technically speaking, this means we calculate the historical performance of the top versus bottom ESG momentum score in each of the matching ESG score tertiles as shown in Exhibit 7.<sup>9</sup> We focus on developed markets, where we have a longer history of MSCI ESG scores.

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<sup>9</sup> An alternative way of decomposing the ESG momentum performance into initial ESG tertiles would be to first create initial ESG score tertiles and then calculate the ESG momentum performance within each of these tertiles. The disadvantage of this method would be that in the bottom ESG score tertile there are fewer downgrades of ESG scores and likewise there are fewer upgrades in the highest ESG score tertile. Therefore, the results may suffer from a bias in terms of covering upgrades and downgrades in a symmetrical way in all three ESG tertiles.

**Exhibit 7: Calculation of ESG Momentum Performance per Initial ESG Score Tertile**



The decomposition of the top versus bottom ESG momentum quintile performance into tertiles of initial ESG scores is shown in Exhibit 8. The strongest performance (2.59%) was generated in the middle tertile of initial ESG scores. The three tertiles had very similar realized volatilities (around 4%), indicating that the the middle tertile’s strong performance was not explained by higher levels of risk.

**Exhibit 8: Annualized ESG Momentum Performance per Initial ESG Score Tertile**

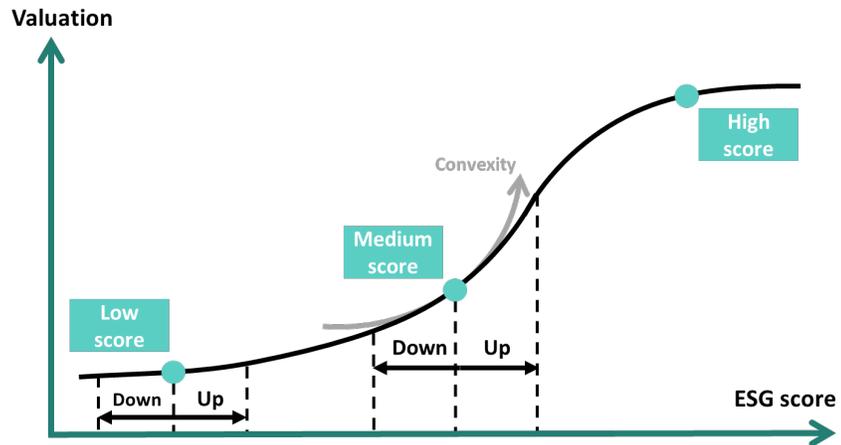
Variable	Bottom ESG tertile	Middle ESG tertile	Top ESG tertile
<b>Average ESG score</b>	2.68	5.08	7.58
<b>ESG momentum  Long – short </b>	3.77	3.58	3.54
<b>Return pa (%)</b>	0.82	2.59	0.66
<b>Volatility pa (%)</b>	4.36	4.05	3.92
<b>Information Ratio</b>	0.19	0.64	0.17

*MSCI World Index, from June 2009 to February 2018*

The differences in long and short average ESG momentum among all three ESG score tertiles were minor, which means that performance variation was not due to differences in ESG score upgrades or downgrades across the ESG tertiles. Instead, the results suggest that there was a non-linear link between MSCI ESG scores and corporate valuations, as illustrated in Exhibit 9. A non-linear ESG valuation relationship means that ESG score upgrades and downgrades had the strongest financial performance effect where this function was

steepest — the middle range of MSCI ESG scores. In contrast, at the top and bottom end of ESG scores, an ESG score change had less of a financial performance effect in our study period — where the ESG valuation curve was relatively flat.

**Exhibit 9: Stylized ESG-valuation Curve**



As a second step, we assessed whether ESG score upgrades had the same effect on valuation than ESG score downgrades, thus illustrating to what extent the ESG-valuation curve was symmetrical or asymmetrical. To determine this, we split the ESG momentum performance chart shown in Exhibit 5 for developed markets into two parts: 1) the performance of the upper ESG momentum quintile versus the middle ESG momentum portfolio, and 2) the middle portfolio versus the lowest ESG momentum quintile.

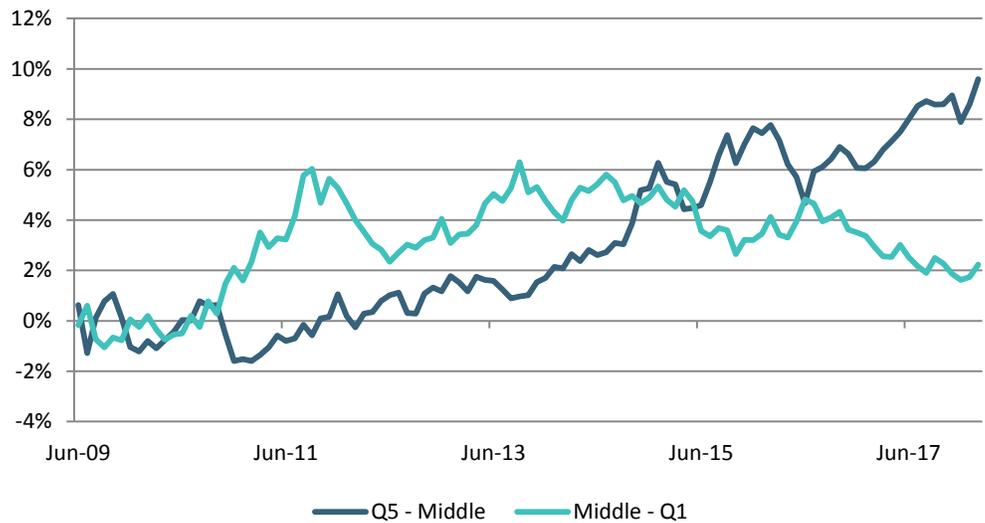
We define the middle ESG momentum portfolio as the equal-weighted portfolio  $(Q2 + Q3 + Q4)/3$ .

Exhibit 10 shows the decomposition of the performance into the performance of upgrades (Q5 minus Middle) and downgrades (Middle minus Q1). By construction, the two return lines in Exhibit 10 sum up to the developed markets performance chart in Exhibit 5.

ESG score upgrades have historically had a stronger performance effect than ESG score downgrades. Both simulated portfolios had similar volatility (around 2% annually), so this difference is not due to different levels of risk. This asymmetry can best be explained by a corresponding asymmetry in the ESG valuation curve: Since the steepness of the ESG-valuation curve drives the strength of the performance impact of ESG score changes, the curve has clearly been steeper in the region of high ESG scores than for low ESG scores. A simple and intuitive way to fulfill this condition is to assume an ESG valuation curve that is

convex (at least in the middle range of ESG scores where the curve is steepest and most of the outperformance has been generated) as illustrated in Exhibit 9: When the ESG valuation curve is convex, then an ESG score upgrade has a stronger impact on valuation than a downgrade, as the curve is steeper above the middle ESG score level than below the middle.

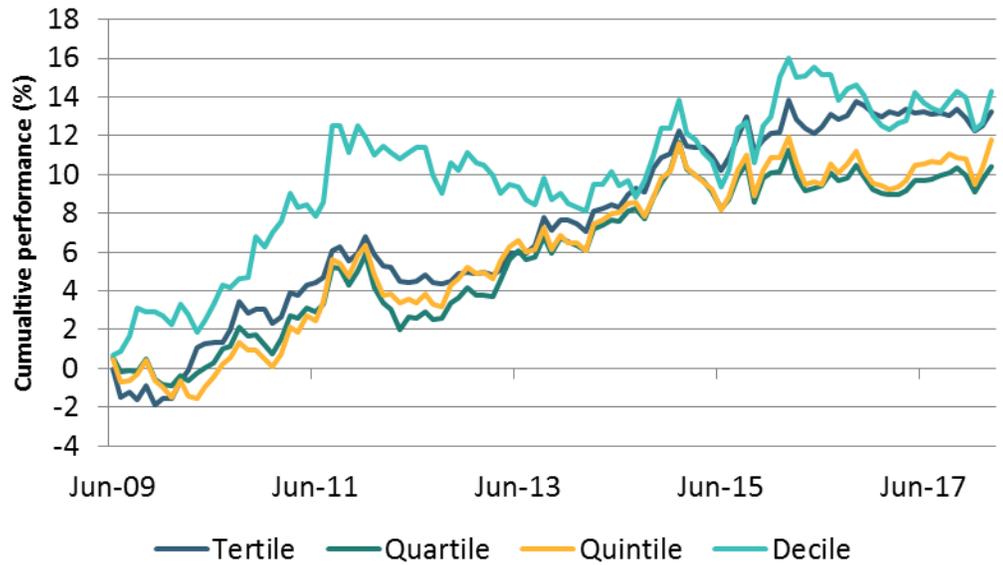
**Exhibit 10: Comparison of ESG Momentum for Upgrades and Downgrades**



MSCI World Index, from June 2009 to February 2018

Finally, we assess the robustness of our research methodology using long-short performance analysis, regardless of which percentile grouping was used. Exhibit 11 compares the performance of equal-weighted top versus bottom ESG momentum tertile, quartile, quintile and decile hypothetical portfolios, respectively. The performance of all four strategies is similar, i.e., in the range between 10% and 14% during the study period, providing additional evidence that the shape of the ESG valuation curve was steepest in the middle and relatively flat at the lower end and upper end of the ESG scale. The detailed performance analysis of all percentile portfolios is shown in Appendix A1.

**Exhibit 11: Comparison of ESG Momentum Long-short Performance by Breakpoint**



*MSCI World index, from June 2009 to February 2018*

Finally, we look at the time gap ( $\Delta t$  in our equation), to understand in which timeframe markets digested new ESG information.

ESG momentum is measured as an ESG score change over one year, because all MSCI ESG scores are updated on an annual basis. Here we ask, what was the timeframe for equity markets to price new information? Or, from a more practical point of view, what investment period might investors use when investing in ESG momentum? We compare four different investment horizons in the following simulations:

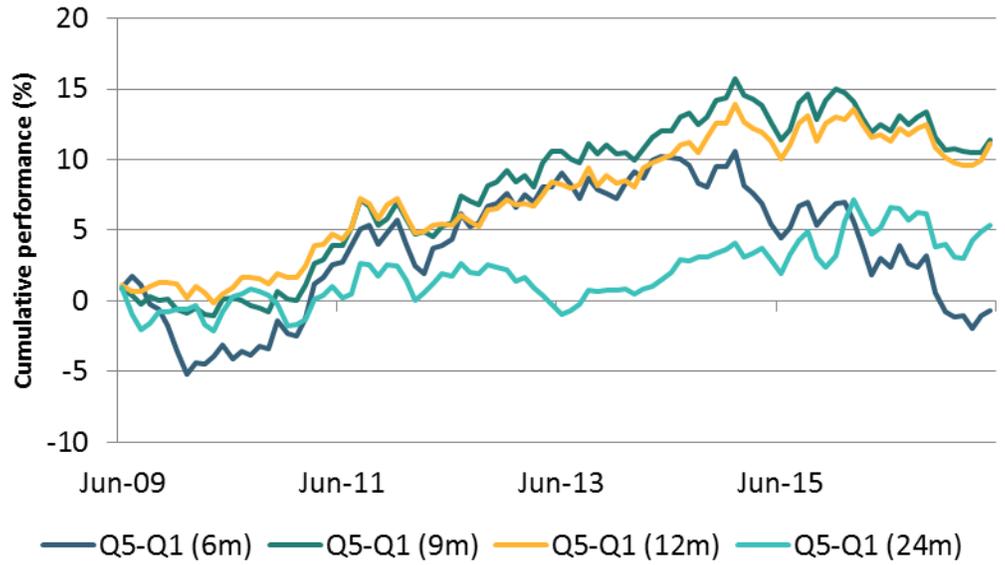
- 6-month period: In the construction of monthly long-short portfolios, we consider only those stocks within the MSCI World Index whose ESG score has changed within the previous six-month period. This effectively reduces the number of ESG stocks in the long-short portfolios by roughly half.
- 9-month period: In the construction of monthly long-short portfolios, we consider only those stocks within the MSCI World universe whose ESG score has changed within the previous nine-month period. This effectively reduces the number of ESG stocks in the portfolios by roughly one quarter.
- 12-month period: Simulation as in Exhibit 5 above.

- 24-month period: We simulate monthly long-short portfolios as in Exhibit 5 above, but measure ESG scores changes over the previous 24-month period instead of 12-month period.

Exhibit 12 compares the four simulations. The simulations with 9-month and 12-month periods show the strongest and most persistent outperformance. The outperformance signal clearly became weaker when using a 24-month horizon. The performance of the six-month investment period is very noisy and roughly flat over the study period. This is due to the smaller number of stocks available for constructing the long-short portfolios and due to sectorial effects: MSCI ESG scores are updated industry-by-industry throughout the year, and therefore only roughly half of the industries will be present in the simulations when using ESG scores that have changed over the past six-month period.

This means that stable and robust performance results of ESG momentum can be observed only when using a time horizon that uses score changes of at least one year to cover all industries. At the same time, the results show that the ESG momentum price signal tended to become weaker over two years. This suggests that the market has priced ESG characteristics into valuations on an ongoing basis and that the signal became less effective beyond a one-year horizon.

Exhibit 12: ESG Momentum Performance with Different Lookback Periods



MSCI World Index, from June 2009 to February 2018

## CONCLUSION

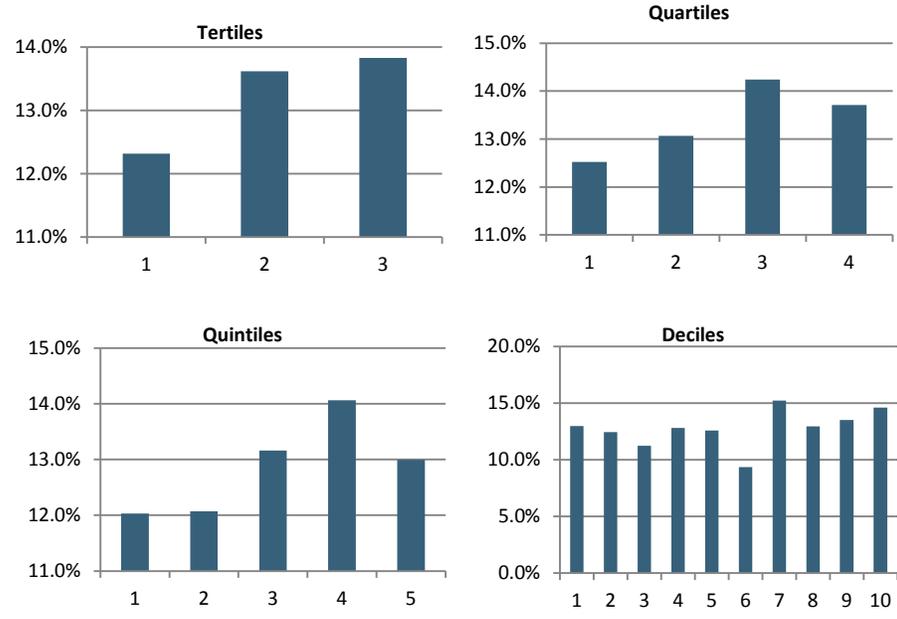
We have previously shown that companies' ESG profiles influence their valuations. We now extend that research, using the economic model of an ESG-valuation curve to test whether changes in ESG scores have historically moved equity prices. We focused the analysis on developed markets where we have a longer history of MSCI ESG scores available. In this economic model, MSCI ESG score upgrades led to higher valuations, and downgrades to lower valuations, all other parameters being equal. The steepness of this ESG valuation curve defines the degree of stock price impact that ESG momentum can potentially create.

Based on our empirical analysis using long-short quintile analysis, we found that this ESG valuation curve was steepest in the middle range of MSCI ESG scores for developed markets only. The fact that ESG score upgrades have led to a stronger performance impact than ESG score downgrades can be explained by a convex ESG valuation curve. The curve was shown to be relatively flat for very low and very high MSCI ESG scores. Finally, these results suggest that financial markets have historically not been agnostic with respect to companies' ESG profile when pricing securities: A change in a company's ESG profile has had an impact on valuation levels and stock prices that is not explained by the general market or other factors.

Thus, ESG momentum may offer important new insights into how global markets price stocks.

**APPENDIX**

**Exhibit A1: Performance of ESG Momentum Tertiles, Quartiles, Quintiles and Deciles**



MSCI World Index, from June 2009 to February 2018

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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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