ESG rating score revisions and stock returns*

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March 9, 2024

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Abstract

We analyze the impact of ESG rating score revisions on stock returns for U.S.-listed firms. Consistent with ESG's importance for long-term value, we find that stock prices adjust during a prolonged period of time due to long-term investors. Specifically, we find that it takes the market multiple months to reflect revisions. Using holding periods of six months, decreases in ratings are followed by annualized negative abnormal returns of approximately 3%. Our results appear to be mostly driven by decreases in the Environmental rating. Specifically for this E rating, we find three mechanisms that are congruent with our findings. First, part of the returns can be explained by sustainable index revisions following rating revisions. Second, long-term institutional investors decrease their holdings after a decrease in ratings. Third, rating downgrades are followed by increases in risk. Our results suggest that ESG rating revisions are relevant for firm valuations.

JEL-classification: M14, G14, D21, L21
Keywords: ESG, Environmental, Ratings, Institutional Investors, Sustainable Index

**Acknowledgements*. For helpful discussions and suggestions, we thank participants of the Alliance for Research on Corporate Sustainability (ARCS) conference 2023, the Global Research Alliance for Sustainable Finance and Investment (GRASFI) conference 2022, the Environmental Finance for the Common Good workshop 2022, and at seminars of Utrecht School of Economics, University of Victoria, and Kozminski University. In addition, we thank Kees Ouboter, Erik Hulsegge, and MSCI for their assistance with the data collection process. All remaining errors are the sole responsibility of the authors. *Compliance with Ethical Standards*. The authors have no relevant financial or non-financial interests to disclose. This is an observational study so ethical approval and informed consent do not apply here.

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1 Introduction

Investors increasingly take aspects of firms' Environmental, Social and Governance (ESG) performance into account when making investment decisions, often using ratings to integrate ESG in stock investment decisions (GSIA, 2020). ESG data considers the impact of firms' decisions on a wide range of stakeholders and thereby aids in measuring a firm's long-term financial value (Edmans, 2023). Nevertheless, a thorough assessment of long-term value is expensive and takes time, leading investors to excessively focus on hard information and short-term earnings. In response, firms may be inclined to also focus on short-term financial performance at the expense of investments in intangible assets that generate long-term value (Cremers et al., 2020; Edmans et al., 2016; Graham et al., 2005).

For firms to take the ethical decisions that increase their long-term value and benefit society as a whole, we require a better understanding of the process through which the intangible information reflected by ESG rating changes translates into stock prices. One aspect that is less well understood is exactly when changes in ratings impact stock returns, with the existing literature either using short-term event studies (e.g., Cauthorn et al., 2023) or longer-term portfolio approaches (e.g., Tsai and Wu, 2022) and findings being inconclusive. Another aspect that warrants more research, concerns the channels through which ESG rating changes impact stock returns, with some studies focusing on ESG news events (e.g., Krüger, 2015) and others concentrating on their economic impact (e.g., Berg et al., 2022b). Therefore, in this paper we study the effect of ESG rating changes on stock returns over different horizons and we identify several channels through which ESG rating changes could affect stock returns.

In theory, the short- and long-run impact of rating changes might differ with different groups of investors trading based on rating changes. On the one hand, if short-term investors speculate based on ESG information, we would expect their actions to affect stock returns immediately in the days after rating changes. Speculating based on ESG ratings changes could be complicated though, because it is difficult to interpret ratings with a lack of ESG standards (Kotsantonis and Serafeim, 2019) and disagreements between ESG rating agencies (Berg et al., 2022b) (see Liang and Renneboog (2020) for an overview of these issues). On the other hand, because sustainability is a typical long-term value driver, we would expect that especially longer-term oriented investors adjust their portfolios in response to ESG information (e.g., Cox et al., 2004; Oikonomou et al., 2020). As these investors tend to rebalance their portfolios more slowly over time (Van Duuren et al., 2016), their actions are more likely to have an effect on returns in the months instead of days after rating changes, especially when there are limits to arbitrage (Starks et al., 2023). Lagged responses to ESG information are, anecdotally, confirmed in UN Principles for Responsible Investment (PRI) Transparency Reports, with asset managers like Threadneedle employing "quarterly screening of (...) holdings according to various ESG criteria" (Threadneedle, 2016).

Heterogeneous impacts of ESG ratings could also arise due to investors having preferences for some aspects of ESG dimensions (Girerd-Potin et al., 2014) and because some dimensions may be more directly related to long-term value than others. E, S, and G are three very different constructs (Tett and Temple-West, 2022; Ehlers et al., 2022) and Blackrock (2020) shows that institutional investors prefer E over S and G, perhaps because S and G issues are harder to quantify than E issues (Eccles et al., 2011). Because ESG ratings are weighted averages, score increases on one dimension can be offset by decreases on others. Therefore, we explicitly distinguish the three rating dimensions E, S, and G in our analysis of stock returns for different holding periods.

We test two channels through which more long-term oriented investors, who rebalance their portfolios only gradually, might affect stocks returns in response to rating changes. First, we consider passive investors in a sustainable index and study sustainable index revisions after rating changes. We use the MSCI KLD 400 Social index, which is updated quarterly in response to, among others, MSCI ESG rating changes. This index is the oldest and one of the few sustainable indexes that is consistently available for our entire sample period. Possibly, buying and selling pressure or signaling effects (Kappou and Oikonomou, 2016) drive the excess returns after index revisions due to rating changes. Second, we specifically consider institutional investors as this group of investors is increasingly committed to investing sustainably. To illustrate, the UN PRI are signed by an increasing number of institutional investors every year that represent more than 120 trillion of assets under management in 2021. In addition to studying all institutional investors, we separate the impact of long-term institutional investors from that of short-term institutional investors.

Our main empirical tests are based on ESG ratings from MSCI ESG Research (henceforth: MSCI), which is perceived as the largest provider of ratings to the investments industry with the broadest coverage. We find no evidence for a significant short-run impact of rating changes in the days around a rating event. Instead, we find that it takes up to three months before abnormal returns materialize. In our preferred specification, we find that over a six-month period buy-and-hold abnormal returns (BHARs) of downgraded stocks are—on an annualized basis—approximately 3 percentage points lower than those of upgraded stocks. It is only relatively large ESG downgrades that are followed by significantly negative BHARs.

To analyze this ratings effect further, we first distinguish between long-term and short-term information by considering regular annual changes versus unexpected (i.e., mid-cycle) changes in ESG ratings. Mid-cycle rating changes result from firm-specific ESG news events and are therefore more reflective of short-term information. By contrast, regular annual rating changes are reflective of longer-term information. We find that unexpected updates are not driving the effect of ESG rating changes on returns, which is consistent with ESG rating changes mostly reflecting changes in a firm's long-term outlook. Second, when we distinguish the separate impact of E, S and G, the effect appears to be largely driven by changes in the E dimension.

With abnormal returns materializing over months instead of days and mostly in-the-cycle rating changes driving abnormal returns, we analyze to what extent this could be driven by investors who likely have ESG preferences. First, we find that the BHARs observed after E rating changes can be partially explained by sustainable index exclusions that occur during the six-month period following rating revisions. We thereby confirm that index revisions after rating revisions function as one mechanism through which rating revisions affect BHARs. Second, we show that revisions in ESG ratings are associated with portfolio adjustments of institutional investors. Especially after revisions of the E dimension, our results indicate that investors have a 2.4% lower likelihood to include downgraded stocks in their portfolios. We only find an effect for long-term institutional investors.[1] Because long-term institutional investors have lower portfolio turnover, this is consistent with the fact that we only find an effect on abnormal stock return in the months (instead of the days) after ESG rating changes. In addition to a lower portfolio turnover of long-term investors in general, these investors typically trade less during shocks (Cella et al., 2013). Their presence is associated with more resilience to adverse events (e.g., Lins et al., 2017; Ding et al., 2021) and with lower levels of idiosyncratic volatility (Chichernea et al., 2015). Congruent with less long-term investor presence after a rating downgrade, we find a concomitant increase in return volatility after downgrades.

We contribute to the emerging literature that considers the relevance of ESG ratings for stock returns. An older literature studies the effect of the *level* of ESG performance (e.g., Derwall et al., 2005; Galema et al., 2008). Recent contributions either investigate the short-run stock return impact of (i) ESG news events (e.g., Flammer, 2013; Capelle-Blancard and Petit, 2019; Serafeim and Yoon, 2023) and (ii) ESG rating revisions (Krüger, 2015; Cellier et al., 2016; Guest and Nerino, 2020) or apply a portfolio approach where stock returns are measured from the first day of the calendar year after the rating revision took place (Tsai and Wu, 2022). By using the rating revision day (which was unavailable to previous researchers using KLD data), we can more granularily estimate the return impact of revisions. Other contributions that also use MSCI ESG rating data include Cauthorn et al. (2023), Serafeim (2020) and Berg et al. (2022a). Cauthorn et al. (2023) find that rating changes do not

[1] We additionally control for index revisions to rule out that these revisions drive the effect. Here, we find that E downgrades are a distinct channel that affects long-term institutional ownership.

affect stock performance in the short-run. Serafeim (2020) conducts a portfolio study and finds excess returns for stocks with increasing ESG ratings *in conjunction with* negative sustainability sentiment. Finally, Berg et al. (2022a) focus on the economic impact of MSCI ESG rating changes including a firm's ESG practices and capital expenditures, whereas we focus on the financial impact of ESG rating changes.

Our paper is also related to a broader literature on the importance of ESG ratings. Rzeźnik et al. (2021) studies the relevance of Sustainalytics ratings by considering the effects of a new ratings methodology. They find a temporary stock price effect caused by a misinterpretation by retail investors. Starks et al. (2023) analyze institutional investors and find a relation between their investment horizon and the ESG composition of portfolios. A related literature that studies ESG fund ratings finds that the inclusion of sustainability ratings on the Morningstar platform is associated with high sustainability funds attracting fund inflows at the expense of low sustainability funds (e.g., Hartzmark and Sussman, 2019; Ammann et al., 2019), although the effect disappears from nine months onward after the inclusion of these ratings (Gantchev et al., 2021).

This paper proceeds as follows. Section 2 describes data, sample construction and return measures. Section 3 presents the results of the stock return analyses and Section 4 presents our different mechanisms: Sustainable index membership in Section 4.1 and institutional holdings and return volatility in Section 4.2. Finally, Section 5 concludes.

2 Data

In this section we first present the ESG ratings data. Next, we present the different dependent variables, control variables and resulting sample sizes of our different analyses.

2.1 MSCI ESG ratings

To test the effects of ESG rating revisions, we obtain and evaluate ratings published by MSCI. MSCI is generally perceived as the largest provider of ratings to the investments industry (Eccles and Stroehle, 2018; Christensen et al., 2021) with the broadest coverage (Serafeim and Yoon, 2023). Each rated firm typically receives a comprehensive, in-depth review by MSCI at least once per year. New ratings are published at specific rating event dates, so-called "rating action dates" (also known as "MSCI rating date" or "IVA rating date"). We consider all MSCI ESG ratings for U.S.-listed stocks published on rating action dates for the period 2012-2019. Early 2017 we obtained all ratings data for the period 2012-2016. As of then, on a weekly basis we download all ratings.[2] This process allows us to confirm that rating events are quickly available to users. This timely fashion is distinct from ratings that are frequently used in academia such as KLD STATS as these ratings become available to users with a considerable delay.

We use the numerical rating scores published by MSCI, which allows us to also study the effect of changes in the three ESG dimensions separately, and we adjust for industry by including industry fixed effects. For each rating action date, we obtain firms' total ESG ratings as well as their separate Environment, Social and Governance ratings. Because not every firm is reviewed at the same time, new ratings are published year-round. At each month-end, we compute the difference between the concurrent rating and the rating prevailing at previous month-end. We round the monthly revisions in ratings to one decimal and keep all rating announcements where the rating either increased or decreased. Given the annual revision cycle and the fact that MSCI considerably increased its coverage in 2012, our sample with revisions starts in January 2013 and lasts until July 2019.

We use CUSIP codes and company names (in that order) provided by MSCI to match firms to the CRSP database for stock prices. We carefully hand-check all matches. This

[2]Following Berg et al. (2020), an additional important requirement for using ESG ratings is that they are not changed retrospectively. We are not aware that such look-ahead-bias is an issue in the MSCI data (Welch and Yoon, 2023). The weekly downloads further mitigate these concerns.

provides our no-controls (i.e., initial) sample of 14,284 monthly ESG rating revisions for 3,511 distinct firms for which we observe both a revision in ESG rating and a stock price. Panel A of Table 1 provides an overview of the number of revisions per year for this sample. The number of rating increases and decreases are reasonably balanced with, respectively, 7,350 and 6,934 events.

[Insert Table 1 about here]

2.2 Monthly returns

We use price data from CRSP to compute monthly stock returns. We apply these returns in a BHAR setting and, additionally, in a calendar-time portfolio analysis for robustness. Our main analyses are based on a BHAR approach. Analogous to the literature analyzing BHARs after revisions in security analyst ratings (e.g., Altınkılıç et al., 2016) we compute the BHAR using two different asset pricing models: the Market Model (MM) and the characteristics model of Daniel et al. (1997) ($DGTW$). The BHAR for firm i with a duration of m months, denoted $BHAR_{i,t}$ equals the firm's raw return during the measurement period $r_{i,t}$ minus that period's return from the asset pricing model r_t^B:

$$BHAR_i = \prod_{t=1}^{m+1}(1 + r_{i,t}) - \prod_{t=1}^{m+1}(1 + r_t^B) \qquad (1)$$

where r_t^B is either the CRSP value-weighted market index (MM) or the characteristics-based benchmark return ($DGTW$). $DGTW$ is the return on the characteristics' portfolio of firms, which is matched on market-to-book, market equity and prior one-year return quintiles.

In our BHAR setting, we include control variables that have a demonstrated ability to predict stock returns (e.g., Jegadeesh et al., 2004; Altınkılıç et al., 2016). Therefore, for our all-controls (i.e., final) sample, we include 12 controls that represent five different categories, namely momentum and trading volume, earnings momentum, valuation multiples, firm size, and growth indicators. Appendix Table A.1 provides a complete set of variable definitions.

We follow the method applied by Jegadeesh et al. (2004) by assigning binary values to these variables. For variables that are positively (negatively) correlated with future returns, the variable takes a value of one if the explanatory variable is higher (lower) than the median for that quarter, and zero otherwise.

Our all-controls sample includes 8,347 rating revisions for 2,486 firms. Panel B of Table 1 provides an overview of the revisions for our all-controls sample. This panel shows that the number of rating increases and decreases is, as in our no-controls sample, reasonably balanced. Because most of the sample decrease from our no-controls to our all-controls sample is caused by the limited availability of the long-term growth forecast, we will also report regression results excluding this particular variable. Summary statistics for the all-controls sample of our BHAR analysis are presented in Panel A of Table 2.

[Insert Table 2 about here]

2.3 Quarterly holdings

Our data source for institutional holdings is the Thomson Reuters s34 dataset. This dataset consolidates all 13(f) filings by institutional investment managers (e.g., banks, insurance companies, pension funds) that manage over $ 100 million in so-called Section 13(f) securities. The 13f institutional ownership data is available on a quarterly basis, so at each quarter-end we compute the difference between the concurrent holdings and the holdings prevailing at previous quarter-end. We consider whether institutional ownership changes around event dates. Specifically, for each event and event quarter t we compute ΔIO *Indicator*. This is a dummy variable equal to one when institutional ownership increases and equal to zero when institutional ownership decreases in quarter $t+1$ compared to quarter $t-1$.[3] We use a dummy variable because the continuous distribution of ΔIO is characterized by many positive and negative extremes.[4]

[3]Note that the underlying continuous variable ΔIO never equals zero in our sample.

[4]Note that Appendix Table B.3 presents a robustness check in which we take truncated ΔIO as dependent variable and results are qualitatively the same.

Our initial quarterly sample for which we observe changes in institutional ownership data consists of 12,339 quarterly ESG rating revisions for 3,005 distinct firms. In our regression setting where we explain the changes in institutional ownership, we add (in addition to the level of the ESG rating ($Rating_i$)) one-quarter lagged stock-level control variables that are similar to those used in other studies that investigate the effect of ESG on institutional holdings (e.g., Hong and Kacperczyk, 2009). Panel C of Appendix Table A.1 provides variable definitions. As a result of the inclusion of control variables, our sample decreases to 7,667 quarterly ESG rating revisions for 2,196 distinct firms. Panel C of Table 2 provides the summary statistics for our IO sample.

2.4 Quarterly return volatility

We use daily stock price data from Compustat to compute each quarter three different measures of return volatility, namely total risk (i.e., the standard deviation of excess returns), systematic risk, and idiosyncratic risk. We use the market model to estimate β as measure for systematic risk, and we compute the standard deviation of the residuals as estimate for idiosyncratic risk. For each event and event quarter t, we compute $\Delta\,Volatility$ as the difference between risk in quarter $t+1$ and risk in quarter $t-1$. Our initial sample with observed changes in risk measures consists of 12,286 quarterly ESG rating revisions for 2,999 distinct firms. We explain the changes in the various risk measures in a regression setting. Here we add control variables in the spirit of Albuquerque et al. (2019), in addition to the level of the ESG rating ($Rating_i$). When we add all controls, our sample decreases to 11,748 quarterly ESG rating revisions for 2,894 distinct firms, which is our final sample for our risk analysis. All variables are winsorized at the 1 percent level. Panel D of Appendix Table A.1 provides variable definitions and Panel D of Table 2 provides the summary statistics.

3 Return analyses

In this section we analyze the differential effect of downgrades versus upgrades on stock returns. First, in Section 3.1 we present our main method and results, where we also consider the relevance of the length of the holding period and the size of the revision. Second, in Section 3.2 we consider the extent to which abnormal returns are driven by long-term or short-term ESG information by differentiating regular annual revisions from unexpected (i.e. mid-cycle) revisions. Third, in Section 3.3 we study to what extent our findings are driven by E, S, or G. Fourth, congruent with the literature on the estimation of long-run abnormal returns (see, e.g., Lyon et al. (1999)), we check the robustness of our results using a calendar-time portfolio analysis in Section 3.4.

3.1 Buy-and-hold abnormal returns

In our main analysis, we analyze the differential effect of a decrease in ESG rating versus an increase in ESG rating on BHARs. That is, we regress event BHARs on an indicator equal to one when an event is associated with a rating decrease and equal to zero when the event is associated with a rating increase:

$$BHAR_i = \alpha + \beta_1 \Delta Rating < 0\ dummy_i + \beta_2 Rating_i + \beta_3 Controls_i + \eta + \tau + \varepsilon_i \qquad (2)$$

where $BHAR_i$ indicates the buy-and-hold abnormal returns after event i. We define ESG rating revisions in terms of a dummy variable to conservatively account for outliers in $\Delta Rating$. That is, $\Delta Rating < 0\ dummy_i$ is a dummy equal to one when the rating decreases and equal to zero when the rating increases. After our main analysis, we present alternative categorizations where we account for outliers by including $\Delta Rating$ and $Rating$ as variables transformed into five quintiles, and where we make a distinction between large and small revisions. We control for level effects by including the lagged ESG rating, i.e., $Rating_i$, which equals the outstanding rating prior to its revision. Similar to our other controls, we include $Rating_i$ as a dummy variable which takes on the value of one if it is above the median and zero otherwise. $Rating_i$ can be either the ESG rating or that of one of its three dimensions. $Controls_i$ indicates a vector of firm control variables detailed in Section 2.2. We include MSCI IVA-industry fixed effects (η) based on the sector to which MSCI assigns each firm. We include event-date fixed effects (τ) to control for variation due to clustering of ESG rating revisions on certain event dates. To further adjust for clustering, we double cluster standard errors: Once by firm and once by event date.

We start by visually inspecting the time it takes for rating changes to be incorporated into stock prices. Initially, we separately study increases and decreases in ESG ratings using holding periods from one month (the event month only) to eleven months (month t + 10). Panel A of Figure 1 reports the results, where the line indicates the average BHAR with bands indicating a 90% confidence interval. To allow for clustering standard errors by firm and rating month, we compute confidence intervals by regressing BHARs on a constant for a sample of increases in ratings (i.e., *ESG upgrade*) and a sample of decreases in ratings (i.e., *ESG downgrade*). Panel A shows that increases in the ESG rating are not associated with any significant returns during either the event month or any of the ten post-event months. By contrast, decreases in ESG ratings are associated with significant negative BHARs for most of the investigated holding periods.

[Insert Figure 1 about here]

Next, we estimate Equation 2 for BHARs computed using holding periods up to month t + 10. Panel B of Figure 1 shows the estimates of $\Delta ESG < 0$ *dummy* from Equation 2 using BHARs for different holding periods, also including a full set of control variables, event-date fixed effects, and industry fixed effects in the regression. The left-hand graph illustrates that the cumulative negative returns from decreases versus increases in ESG ratings are non-distinguishable from zero in both the event month and the first post-event months. The absence of an event-month effect is confirmed by an event study, reported in Appendix Table

B.1 (and explained in the notes of this table), for days [-1, 1], [-5, 5] and [-10,10] around each event date, which shows no significant short-term effect of $\Delta ESG < 0$ *dummy* on cumulative abnormal returns (CARs).[5] BHARs become more negative and increasingly statistically significant as the post-event holding period increases. Thus, we only find evidence for a more long-run effect of ESG rating revisions and this effect is driven by rating downgrades. The right-hand graph of Panel B depicts monthly pre-event BHARs. This graph shows that there are no significant BHAR patterns discernible prior to rating revisions. Since (i) the event month may include stock returns achieved prior to the rating revisions, (ii) portfolio formation based on ESG ratings can only happen after the rating is published, and (iii) the effect of an ESG rating revision largely materializes during the first six post-event months, we continue in our subsequent analyses with six-month holding periods starting from the post-event month.

Table 3 presents the results of the regression analysis in which we test for significant differences in six-month BHARs between ESG rating decreases and increases starting from the post-event month. Columns (1) to (3) present the results when using the market model (MM) as benchmark and Columns (4) to (6) present the results for the $DGTW$ benchmark. Columns (1) and (4) pertain to our no-controls sample and only include $\Delta ESG < 0$ *dummy* and the ESG rating (ESG). Columns (2) and (5) include all firm controls except LTG, since that variable leads to a relatively large reduction of our sample size. Columns (3) and (6) add LTG and industry fixed effects and thereby represent our all-controls sample.

[Insert Table 3 about here]

In line with findings from Figure 1, the effect of $\Delta ESG < 0$ *dummy* is negative. That is, decreases in ESG ratings are associated with lower abnormal returns than increases in ratings. Results are generally similar in size and significance for both the MM and $DGTW$ benchmarks. In Columns (1) and (4), where we show our results for the no-controls sample,

[5] In unreported results we also find no short-term impact of the three dimensions E, S, or G. We also find no evidence that either increases or decreases in ESG rating separately are associated with CARs that are significantly different from zero. Results are available on request.

the findings are at best marginally statistically significant. In Columns (2) and (5), we add all control variables except LTG. $\Delta ESG < 0$ *dummy* is negative and significant in both specifications. The coefficient suggests that stocks with a decrease in ESG rating experience a 1 percentage point lower return than stocks with an increase in rating. Columns (3) and (6) show the results for our all-controls sample. The estimated difference in BHARs between decreases and increases in ratings is, again, significant and sizable: 1.5 percentage points during a six-month period. Considering the control variables, most of them exhibit the expected positive sign, although few are consistently significant across different specifications.

For robustness, we consider an alternative method to deal with outliers: We transform both the continuous ΔESG and (level) ESG ratings into quintile variables ranging from one to five. Appendix Table B.2 presents the results. Both the significance and the size of the effect are comparable to those of our main findings: Based on the parameter of ΔESG, a decrease in ESG rating of one quintile is associated with around a 0.5 to 0.6 percentage point decrease in BHAR over a six-month period.

In our next analysis, we separate relatively large ESG rating decreases from smaller ones. Instead of including the $\Delta ESG < 0$ *dummy*, we now include two separate dummy variables: *Small* $\Delta ESG < 0$ *dummy* is equal to one if the decrease in ESG rating is in the lower 50^{th} percentile of the ESG rating decrease distribution and zero otherwise. *Large* $\Delta ESG < 0$ *dummy* is equal to one if the decrease in ESG rating is in the upper 50^{th} percentile of the ESG decrease distribution and zero otherwise. The omitted category still comprises increases in ESG ratings. Table 4 presents our findings. The buildup of the models across columns is the same as in Table 3: Columns (1) and (4) include event-date fixed effects, Columns (2) and (5) also include all controls except LTG and Columns (3) and (6) include all controls including LTG and both event-date and industry fixed effects. *Large* $\Delta ESG < 0$ *dummy* is negative and significant at at least the 5% level across all specifications. Compared with increases in ratings, large decreases are followed by negative six-month BHARs of 2%. By contrast, small decreases are followed by small BHARs that are insignificant in most specifications.

[Insert Table 4 about here]

3.2 Mid-cycle revisions

The preceding analysis shows that downgrades are followed by negative BHARs. The fact that we fail to find an effect of ESG rating changes in the days after a rating change event, could be because rating changes mostly communicate information concerning changes in firms' long-term prospects on which investors that update their portfolios more frequently do not trade. If so, we would expect that there are is (i) no *ex ante* effect on returns in the months before rating change events due to e.g. ESG-specific news and (ii) no *ex post* effect of ESG rating changes that are likely due to ESG-specific news events.

Concerning the first, if BHARs after a decrease in rating would be driven by news or other short-term information concerning a firm's ESG performance manifesting prior to the rating revision, we would expect to see accumulating negative BHARs already prior to the rating event. In Panel B of Figure 1 we touched upon this issue and presented BHARs for ten pre-event months. Here, we already observed that there was no clear trend in pre-event BHARs, suggesting that the rating event triggers the post-event BHARs that we documented.

Second, we exploit the fact that although ESG ratings are generally updated on an annual basis (MSCI, 2018), some firms receive a rating update well within the year, which likely reflects the arrival of short-term ESG information (e.g., ESG news). To illustrate, Figure 2 provides the distribution of the number of months between rating change events for the no-controls sample. On the aggregate, most revisions happen on an interval of 12 months (36%), while in total 63% of the revisions happen after 11, 12 or 13 months. This is congruent with MSCI's policy that companies receive a new rating in the same calendar quarter of the next year (MSCI, 2018). We refer to these events as "annual revisions". Figure 2 further shows that 16% of the revisions happen before 11 months due to significant developments in a firm's ESG profile. Typically, these events receive widespread media coverage.[6] Similar

[6]For example, Boeing Company typically receives their annual ratings in either November of December.

to MSCI, we label these rating events as "mid-cycle". 21% of the revisions occur after 13 months due to, e.g., the accommodation of more complex reviews or the (re-)alignment of rating events to a company's reporting cycle. We include this category in a robustness check for our mid-cycle findings.

[Insert Figure 2 about here]

We separate the impact of rating revisions that are likely triggered by significant ESG news from annual rating revisions. This allows us to further consider whether the observed BHARs are a consequence of the rating revision itself, which likely reflects changes in a firm's long-term ESG outlook, or of significant short-term ESG developments that in turn trigger rating changes. More specifically, we create a dummy variable equal to one when the previous ESG rating revision was an annual revision (as to ensure that we do not capture rating events that bring back a firm in its cycle after a mid-cycle rating event), estimated as a rating update after a period between 11 and 13 months, and the current ESG rating revision is outside the cycle, estimated as an update after less than 11 months. Note that our reported results are qualitatively the same when we also include revisions occurring after 13 months as mid-cycle revisions.

In our estimations, we control for *Mid-cycle update* and interact it with the $\Delta Rating < 0$ *dummy*.[7] Table 5 presents the results in which all specifications include all firm controls and both event-date fixed effects and industry fixed effects.

[Insert Table 5 about here]

Columns (1) and (3) are specifications similar to Columns (3) and (6) of Table 3, respectively, now with the main effect of *Mid-cycle update* included. The number of observations is

In 2019 however, just over 100 days after its latest rating Boeing saw its ESG rating decrease, driven by a lowered social rating. The decrease was driven by a lowered rating for 'Product safety & Quality' following the crash of Ethiopian Airlines Flight 302 on March 10, 2019, and reports that the Lion Air crash in 2018 resulted from a faulty sensor and that certain safety measures would only be installed for extra costs.

[7] We performed two unreported robustness checks. First, we exclude all possibly confounding ESG events, i.e., rating events for the same firm that fall in the post-event holding period of six months we use in the BHAR analyses. Second, we categorize also revisions happening after 14 months or more as a Mid-cyle update. Results are robust to both checks and are available on request.

lower because the definition of *Mid-cycle update* also requires that the lagged revision in rating is available for each event. Columns (1) and (3) show that the main effect of *Mid-cycle* is insignificant for ESG rating downgrades. When we include the interaction of *Mid-cycle* with $\Delta ESG < 0$ *dummy*, the main effect of $\Delta ESG < 0$ *dummy* remains statistically significant and the interaction is insignificant in Columns (2) and (4).

In sum, we neither find evidence for significant pre-event BHARs nor do we find evidence for post-event BHARs being driven by significant changes in short-term ESG information as captured by mid-cycle updates. Conversely, it is mainly annual rating changes, which likely reflect changes in firms' long-term outlook, that impact returns.

3.3 ESG dimensions: E, S, and G

Having established a negative association between a decrease in ESG ratings and stock returns, we now test to what extent this effect is driven by the ESG dimensions. That is, in Table 6 we separately analyze stock returns following rating increases and decreases for Environmental, Social, and Governance performance. For each dimension, Columns (1), (4) and (7) include event-date fixed effects, Columns (2), (5) and (8) include all controls except *LTG* and Columns (3), (6) and (9) include all controls including *LTG* and both event-date and industry fixed effects. Panel A of Table 6 shows MM BHARs and Panel B shows *DGTW* BHARs. Columns (1) to (3) in Panel A show that a decrease in the E rating is associated with six-month ahead stock returns that are in between 1 percentage point and 1.4 percentage points lower than after an increase in the E rating. These returns are somewhat smaller in a DGTW-setting where they amount to, around, 1 percentage point. The magnitude of these findings is relatively similar to that of our findings for decreases in the ESG rating.[8] Columns (4) to (6) show our findings for decreases in the Social rating, and Columns (7) to (9) for decreases in the Governance rating. For both these dimensions, we fail to find consistent significant effects. So the relationship between stock returns and

[8] Appendix Figure B.1 graphically confirms the relevance of E revisions. Similar to Figure 1, the BHARs following revisions are driven by E downgrades.

ESG rating revisions appears to be mostly driven by E.

[Insert Table 6 about here]

3.4 Calendar-time portfolio returns

Although the BHAR methodology is often used for computing long-run abnormal returns, the approach does not address the potential issue of cross-correlation of abnormal returns (Fama, 1998). For robustness, we therefore also conduct a calendar-time portfolio analysis, although this method is not perfect either as it fails to precisely measure investor experience (Lyon et al., 1999). We compose a value-weighted portfolio that includes stocks that witnessed a rating increase ('upgrade'), a value-weighted portfolio that includes stocks that saw their rating decrease ('downgrade'), and a difference portfolio where we take long positions in the upgrade-portfolio and short positions in the downgrade-portfolio ('up–down'). We perform this analysis separately for ESG and its three dimensions. We include a stock in month $t+1$ when it experiences a revision in rating in month t. Subsequently, and similar to our BHAR analysis, it is held in the portfolio for six months. We use both excess returns and different factor models to measure portfolio performance. The risk-free interest rate and the factors are collected from Ken French's website.[9]

We present results for the no-controls sample.[10] Panel B of Table 2 reports descriptive statistics of the calendar-time portfolio analysis. Table 7 presents the results of our calendar-time portfolio regression. Panel A shows the results for the portfolios based on ESG rating revisions. Excess returns for both the upgrade portfolio and downgrade portfolio are significantly positive, reflecting the positive market returns during our sample period. The up–down portfolio yields 0.23% per month but this return is not statistically significant. The different factor models all document a negative and significant intercept of around 0.3% for the downgrade portfolio. Similar to the excess returns, the difference portfolios are never

[9]Data are obtained from https://mba.tuck.dartmouth.edu/pages/faculty/ken.french
[10]The results are qualitatively similar for the all-controls sample and available on request.

significant. Panel B provides results for the E rating. Here, the up–down portfolio results in monthly returns of, on average, 0.35%, a finding that is significant at the 5% level in all estimations. This return is largely driven by the downgrade portfolio. Panels C and D show the results for the Social and Governance rating, respectively. Similar to our BHAR regressions, we do not find returns that are statistically significantly different from zero.

The effect sizes from our calendar-time portfolio analysis are in line with those of our BHAR analysis. However, only our findings for the difference portfolio based on E revisions are statistically significant in our calendar-time portfolio analysis. Hence, we conclude that the impact of E downgrades on stock returns is more robust than that of ESG rating downgrades. Since we did not find any significant effects for S and G thus far, we limit the remainder of our analysis to ESG and E ratings.

[Insert Table 7 about here]

4 Mechanisms

In this section we consider potential mechanisms how ESG ratings may affect returns in the months instead of days after a rating change. First, investors may be investing passively in a sustainable index that is composed on the basis of ESG ratings. Therefore, in Section 4.1 we consider index revisions as a potential mechanism through which rating revisions affect stock returns. Second, we specifically consider buying and selling pressure by institutional investors, who are the main users of ESG ratings. In Section 4.2 we investigate whether their portfolio adjustments constitute a more long-run mechanism that is consistent with our BHAR evidence. Because institutional holdings are known to partially absorb the stock price impact of adverse shocks, we also consider the effects of a rating revision on subsequent stock return volatility.

4.1 Sustainable index revisions

We first consider the potential relevance of index revisions following ESG rating revisions. We know from the literature on index revisions in general (Lynch and Mendenhall, 1997) and on sustainable indexes specifically (e.g., Kappou and Oikonomou, 2016) that index revisions are associated with abnormal returns. Sustainable indexes are based on ESG ratings of index candidates and can thereby represent a channel through which ESG rating revisions affect stock returns in the months after a rating change.

The MSCI KLD 400 Social index (henceforth: KLD 400 index) is a sustainable index that is based on MSCI ESG ratings. It is described as an index "that provides exposure to companies with outstanding Environmental, Social and Governance (ESG) ratings and excludes companies whose products have negative social or environmental impacts" (MSCI, 2021). Specifically, the index composition is based on MSCI ESG ratings, in addition to controversy scores and business involvement screening. From the latter, it follows that companies active in alcohol, gambling, tobacco, etc. are excluded from this index. The KLD 400 index comprises 400 companies out of a universe (i.e., the MSCI USA Investable Market Index) of more than 2300 companies. Each calendar quarter, companies are dropped from the index if they fail the eligibility criteria, among which a certain minimum level of the ESG rating. Companies omitted from the index are then replaced by new companies that meet all criteria. MSCI kindly provided snapshots of the index constituents prior to and after each index revision. We use these snapshots to identify inclusions and exclusions.

We create two dummy variables: *In KLD 400* equals one when a stock is added to the KLD 400 index within six months after the rating event, and zero otherwise, and *Out KLD 400* equals one when a stock is dropped from the KLD 400 index within six months after the rating event, and zero otherwise. Next, we estimate Equation 2 and also include interactions of these dummies with $\Delta Rating < 0$ *dummy* for the ESG and the E rating. Because we find that mostly decreases in ratings are associated with negative BHARs, we expect that especially the interaction with *Out KLD 400* is negative. If a resulting exclusion from the KLD 400 index would fully drive our results, then the interaction of $\Delta Rating < 0$ *dummy* with *Out KLD 400* should render the main effect of the $\Delta Rating < 0$ *dummy* insignificant. Table 8 presents the results in which all specifications include firm controls, event-date fixed effects, and industry fixed effects.

[Insert Table 8 about here]

The first two rows in Columns (1) to (8) show that the main effects of *In KLD 400* and *Out KLD 400* are, as expected, positive and negative, respectively, but mostly insignificant. When we include the interactions of $\Delta Rating < 0$ *dummy* with *In KLD 400* and *Out KLD 400* (i.e., Columns (2) and (6) for ESG and Columns (4) and (8) for E), the main effect of $\Delta Rating < 0$ *dummy* always stays significant and negative although its size becomes slightly smaller. Most interestingly, Columns (4) and (8) show that the interactions between $\Delta Environmental < 0$ *dummy* and *Out KLD 400* are negative and significant. Moreover, these effects are economically large, in the order of 10 to 15 percentage points over a six-month period. These effect are similarly-sized to that of general KLD 400 index exclusions as reported by Kappou and Oikonomou (2016). By contrast, the interactions of *In KLD 400* with $\Delta Rating < 0$ *dummies* are never statistically significant. Our findings show that the negative BHARs following decreases in E ratings are to some extent driven by sustainable index exclusions during the six-month holding period. This suggests that part of the documented returns after these rating revisions is driven by (gradual) changes in sustainable index composition. This appears consistent with longer-term oriented investors driving our findings, also because it is mostly passive investors that follow a sustainable index.

4.2 Institutional holdings

We now consider institutional investors specifically. We analyze changes in overall institutional holdings after ESG rating revisions, make a distinction between short-term and long-term investors, and consider the potential impact of index revisions on our findings.

For each event and event quarter ($t = 0$), we analyze the difference in institutional ownership in stock i in quarter $t + 1$ versus quarter $t - 1$.

$$\Delta \text{IO Indicator}_i = \alpha + \beta_1 \Delta Rating < 0\ dummy_i + \beta_2 \text{Rating}_i + \beta_3 Controls_i + \eta + \tau + \varepsilon_i \quad (3)$$

where $\Delta IO\ Indicator$ is a dummy variable equal to one when institutional ownership increased and equal to zero when institutional ownership decreased.[11] $\Delta Rating < 0\ dummy_i$ is an indicator variable equal to one for a decrease in ESG rating and equal to zero for an increase in ESG rating. Here, at each quarter-end, we compute the difference between the concurrent ESG rating and the rating prevailing at previous quarter-end. We round the quarterly revisions in ratings to one decimal and keep all rating announcements where the rating either increased or decreased. We estimate Equation 3 as a logit model. All estimations include firm controls (as detailed in Section 2.3), MSCI IVA-industry fixed (η) effects and event-date fixed effects (τ). Standard errors are clustered at the firm level.

[Insert Table 9 about here]

Table 9 presents the marginal effects of our logit estimations. Columns (1) and (2) present the results based on all institutional ownership. The effect of a decrease in ESG rating is shown in Column (1). The effect is negative but not statistically significant. Column (2) shows that a decrease (versus an increase) in E rating is associated with a 2.4% lower likelihood that institutional ownership by long-term investors will increase instead of decrease. This effect is significant at 5%.

Starks et al. (2023) show that compared to short-term oriented investors, long-term institutional shareholders have a stronger preference for high-ESG firms. Inspired by their research, we test if our findings are driven by changes in holdings by different types of institutional investors, where we expect that it is mostly long-term investors that adjust their

[11] Note that Appendix Table B.3 presents a robustness check in which we take a truncated ΔIO as dependent variable and results are qualitatively the same.

holdings in response to ESG rating revisions. To distinguish short-term from long-term institutional investors, we follow the categorization by Bushee (1998) to identify different types of holders.[12] Bushee (1998) makes a distinction between transient investors, dedicated investors, and quasi-indexers. Transient investors are generally short-term investors and are characterized by high portfolio turnover and highly diversified portfolios. Such a short investment horizon is congruent with little incentives to gather relevant long-term information and therefore with myopic investment decisions (Bushee, 2001). Dedicated investors make large investments per firm and have low turnover, whereas quasi-indexers generally follow a relatively passive investment strategy that is characterized by low turnover and highly diversified portfolios. Both dedicated investors and quasi-indexers are associated with long-term ownership. These long-term investors are less focused on short-term earnings.

Columns (3) and (4) of Table 9 present the results for the group of short-term (transient) investors. Here we find no significant effects of revisions in either the ESG rating or the E rating on changes in institutional ownership. Columns (5) and (6) report the results for long-term investors (i.e., dedicated investors and quasi indexers). Here, we find a significant negative effect of the $\Delta Environmental < 0$ *dummy*. Its size and significance is comparable to that found for specifications concerning all institutional investors, so the effect we find in the total sample appears to be mostly driven by long-term investors. In terms of control variables it is interesting to note that the lagged return (RET) and standard deviation (STD) have significant effects on changes in institutional holdings for short-term investors but not for long-term investors. This appears to validate the classification by Bushee (1998) in this setting.

We test the robustness of our IO findings in two ways. First, we include as dependent variable ΔIO instead of ΔIO *Indicator* where we exclude the top and bottom 10% of ΔIO to limit the impact of outliers. Appendix Table B.3 presents the results, which are qualitatively consistent with our main results in Table 9. A decrease in E rating is associated with about

[12]We thank Prof. Bushee for making the categorization available at `https://accounting-faculty.wharton.upenn.edu/bushee/`

0.2 percentage point lower ownership by long-term institutional investors. This effect is modest but economically meaningful, given an average ΔIO in this reduced sample of -0.3% with a standard deviation of about 3.9% (both unreported). Second, we use breadth as an alternative measure of institutional ownership, measured by computing the number of institutions that hold the stock, scaled by the total number of institutions in the sample each quarter (Chen et al., 2002). Here, the dependent variable is a dummy variable equal to one when investor breadth increases and zero when it decreases. Appendix Table B.4 shows a negative effect of $\Delta Environmental < 0$ *dummy* for long-term investors, which is significant at the 10% level. Hence, a decrease in E rating is associated with a decrease in breadth of long-term institutional investors.

The role of index inclusions. Thus far, in Sections 4.1 and 4.2, we found (i) that a part of the negative BHARs after a decrease in the E rating can be explained by exclusions from a prominent sustainable index, and (ii) that institutional investors are less likely to invest in shares that saw their E rating decrease. Our finding that investors divest in response to rating revisions could be driven by resulting sustainable index exclusions (see Starks et al., 2023) instead of by E rating revisions per se. In our next analysis, we disentangle both effects. We specifically turn to our analysis of long-term institutional investors and additionally include explanatory variables in Equation 3 that capture whether a stock is included or excluded from the KLD 400 index one quarter after the quarter in which the rating is revised. In addition, we add interactions between the index revision variables (*In KLD 400* and *Out KLD 400*) and $\Delta Rating < 0$ *dummy. In KLD 400* and *Out KLD 400* are now equal to one when in quarter $t + 1$ a stock is included in or excluded from the KLD 400, respectively. If our findings would be mainly driven by an index exclusion following a decrease in the ESG rating instead of by the decrease itself, the interaction effect would become significant and the main effect of the $\Delta Rating < 0$ *dummy* would become insignificant.

Table 10 shows our results. Columns (1) and (3) show that *Out KLD 400* is significant and has the expected negative sign, which extends the results by Starks et al. (2023) on the

FTSE4Good index to the KLD 400 index. To test to what extent in- and exclusions could drive our main findings, we add interaction effects between $\Delta Rating < 0$ *dummy* and *In KLD 400* and *Out KLD 400* in Columns (2) and (4). The interaction effects in these columns are insignificant. Furthermore, the $\Delta Environmental < 0$ *dummy* has a similar economic and statistical significance as in the main specifications in Table 9. We therefore conclude that the decrease in long-term institutional holdings following a decrease in the E rating is not driven by contemporaneous exclusions from the sustainable KLD 400 index. Rather, rating revisions and index revisions are likely two separate determinants of institutional investor portfolio decisions.

[Insert Table 10 about here]

Return volatility. A smaller proportion of long-term investors after rating downgrades might have consequences for return volatility. To this end, we now explore whether a firm's stock risk is affected in the quarter after an ESG rating revision. We first estimate three different risk measures y, which is defined as either total risk or idiosyncratic risk or systematic risk, for each stock and each quarter using daily data. Then, for each event and event quarter ($t = 0$), we regress the change in y from quarter $t-1$ to quarter $t+1$ on the rating revision, in addition to control variables:

$$\Delta \mathrm{y}_i = \alpha + \beta_1 \Delta Rating < 0 \; dummy_i + \beta_2 Rating_i + \beta_3 Controls_i + \eta + \tau + \varepsilon_i \qquad (4)$$

where $\Delta Rating < 0 \; dummy_i$ is an indicator variable equal to one for a decrease in ESG rating and equal to zero for an increase in ESG rating in quarter t. All specifications include controls (see Section 2.4), event-date fixed effects (τ) and industry fixed effects (η), and standard errors are clustered at the firm level.

Table 11 presents our findings. Columns (1) and (2) show that both ESG downgrades and E downgrades are associated with increases in total risk of 0.049 and 0.029 percentage points, respectively. When we decompose total risk into idiosyncratic risk and systematic risk, we find in Columns (3) and (4) that ESG downgrades are associated with a significant increase in idiosyncratic risk of 0.043 percentage points, and in Columns (5) and (6) that E downgrades lead on average to a statistically significant increase in β of 0.023. Although the effect sizes are modest, these results are in line with literature that shows firms are more resilient to adverse shocks when they have more long-term investors and perform well on ESG.

[Insert Table 11 about here]

5 Conclusion

ESG rating agencies have emerged as important institutions for evaluating the performance of firms on Environmental, Social, and Governance dimensions. Because the main users of ESG ratings typically adopt a low rebalancing frequency, we study the effect of ESG rating revisions on stock returns in a period of up to six months. We consider all ESG rating revisions issued by one of the largest ESG rating providers and we present evidence that both ESG and E rating downgrades are followed by six-month negative buy-and-hold abnormal returns in the magnitude of 2.5% to 3% (annualized). For larger downgrades, this effect becomes even more pronounced: Around 4.5% per year. We find that the effect of the E rating is most robust because we can confirm its significance in a calendar-time portfolio analysis.

We conclude from additional analyses (i.e., mid-cycle versus annual revisions; pre-event trends) that these BHARs would not have materialized in the absence of rating revisions, despite the fact that rating revisions rely to a large extent on public information. We only find evidence for an effect after several months, because in the days surrounding an ESG rating change we find that cumulative abnormal returns are statistically insignificant. These two findings differentiate our results from literature on the short-term return effects of ESG rating changes and from literature on the effect of ESG-specific news on stock returns.

We find evidence for a more long-run effect running via three possible mechanisms that point towards the E dimension as the main driver of the effect of rating revisions. First, changes in a quarterly updated sustainable investment index based on ESG ratings explain part of the effect of E rating changes on abnormal returns. Second, institutional investors adjust their portfolios in response to decreases in E ratings. We only observe this for institutional investors with a long-term perspective, which is in accordance with the long-term value creation associated with ESG activities and with institutional investor portfolios that are updated relatively infrequently. While we also find that long-term institutional investors decrease their holdings based on sustainable index exclusions, this findings does not drive the effect of E rating revisions on institutional holdings. Third, we show that return volatility slightly increases following both ESG downgrades and E downgrades, a finding which is congruent with a reduced commitment from long-term institutional investors.

Our results have several implications for firms and investors. While firms receiving a lower ESG rating will not always see this immediately reflected in their stock price, we show that there is a negative effect and that this effect takes multiple months to transpire. This implies that a long-term focus that includes the environment is beneficial for a firm's long-term financial value. For investors this lagged impact presents an arbitrage opportunity that might be exploited, to the extent that limitations to arbitrage allow for this. If so, investors are advised to consider specifically ESG downgrades, focus on the E dimension of ESG and trade based on rating changes likely to impact the composition of sustainable investment indexes.

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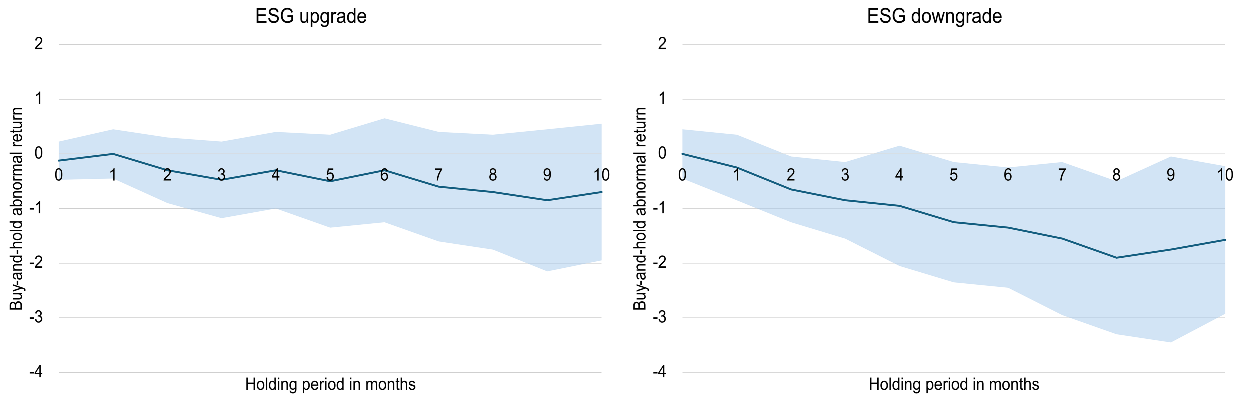
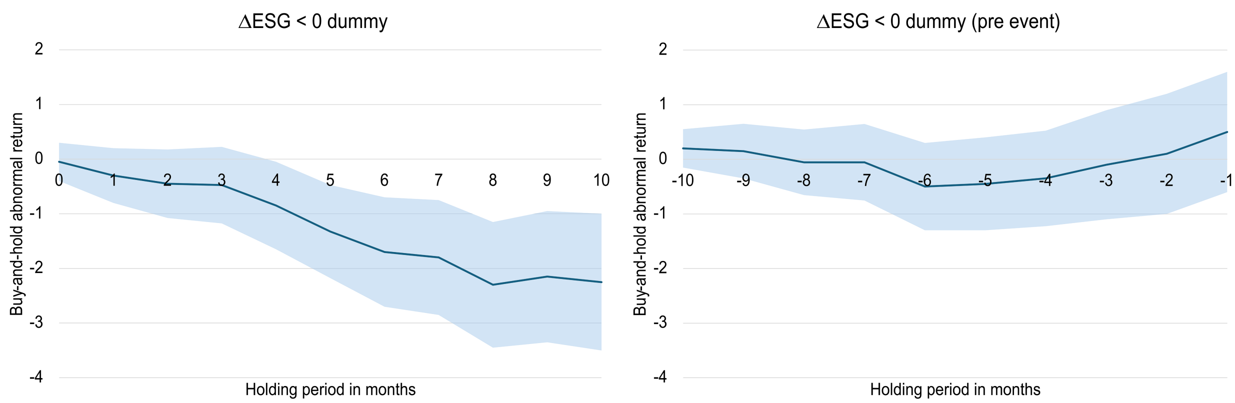
Figure 1: BHAR analysis: ESG rating increases and decreases

Panel A: T-tests positive and negative ESG rating revisions

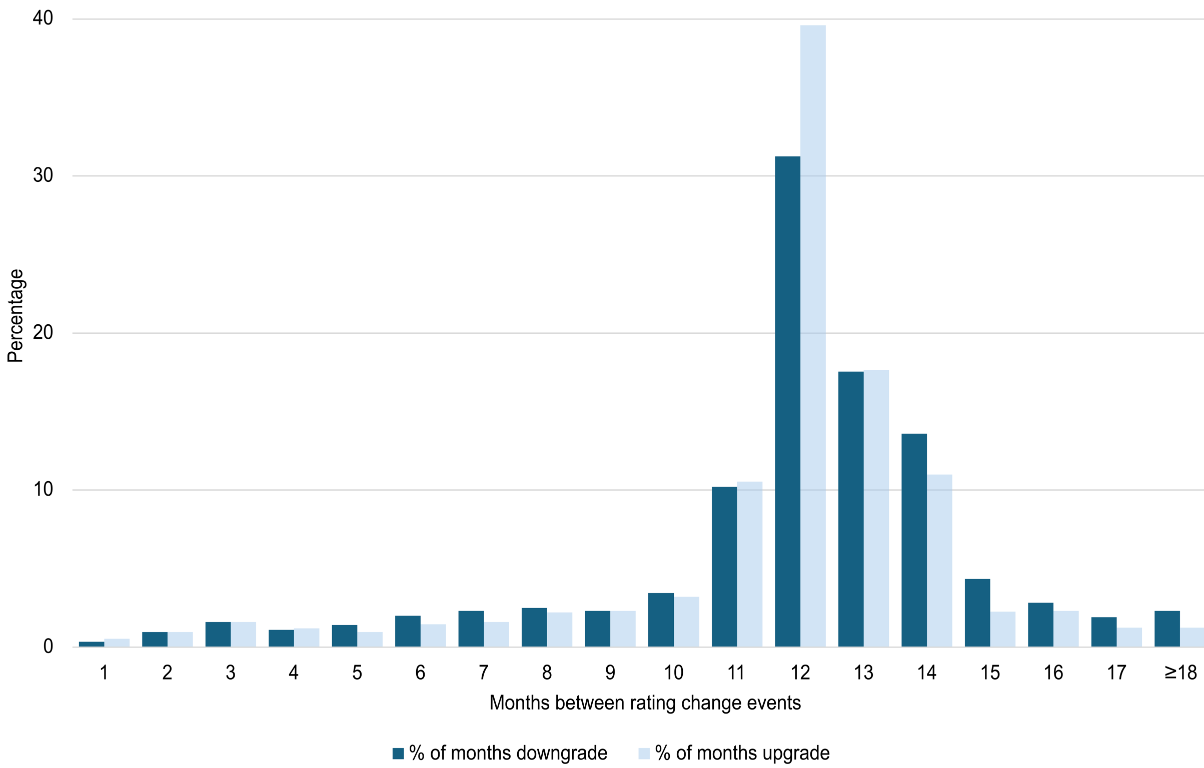


Panel B: Regressions ESG rating decreases versus increases



This figure presents buy-and-hold abnormal returns for ESG rating increases and decreases. The x-axis displays different holding periods (in months) and the y-axis presents buy-and-hold abnormal returns in percentages. The line indicates average BHARs with the bands indicating a 90% confidence interval. In Panel A, the left graph indicates average BHARs for positive ESG rating revisions and the right graph indicates average BHARs for negative ESG rating revisions. These graphs present 90% confidence intervals for a t-test whether BHAR is significantly different from zero, where we double cluster standard errors: once by firm and once by rating date. In Panel B, for the left graph we regress BHAR on the $\Delta ESG < 0$ *dummy* with the line indicating the parameter estimates from these regressions. This regression includes a full set of control variables, event-date fixed effects and industry fixed effects as in Column (3) of Table 3. Because we only include increases and decreases in the ESG rating in this regression, the parameter of the $\Delta ESG < 0$ *dummy* is the difference between average BHAR for positive ESG rating revisions and the average BHAR for negative ESG rating revisions. The same methodology is employed in the right graph, where we now run the regressions for a pre-event window of ten months.

Figure 2: Distribution of number of months between rating event dates



This figure presents two distributions of months between rating event dates: one with downgrade events (i.e., decrease in rating) and one with upgrade events (i.e., increase in rating). The x-axis indicates the number of months between consecutive ESG rating revisions with ≥ 18 indicating number of months equal to or more than 18. The y-axis indicates the percentage of events for each rating month differential. The graph is constructed for the entire sample of events ($N = 14{,}284$).

Table 1: ESG rating score revisions

Year	# revisions	# increases	# decreases	# firms
Panel A: No controls sample				
2013	2,222	772	1,450	2,164
2014	2,376	1,310	1,066	2,333
2015	2,358	887	1,471	2,318
2016	2,284	1,102	1,182	2,229
2017	2,174	1,292	882	2,106
2018	2,143	1,540	603	2,114
2019	727	447	280	725
Total	14,284	7,350	6,934	3,511
Panel B: All controls sample				
2013	1,311	482	829	1,290
2014	1,474	827	647	1,453
2015	1,425	519	906	1,398
2016	1,373	674	699	1,330
2017	1,232	750	482	1,200
2018	1,155	853	302	1,140
2019	377	231	146	376
Total	8,347	4,336	4,011	2,486

This table reports descriptive statistics for ESG rating revisions for each year in the sample with 2019 applying to half a year. Total indicates the entire sample. Panel A provides descriptives for the sample without control variables (N = 14,284) and Panel B provides descriptives for the sample with control variables (N = 8,347). The number of revisions, # revisions, indicates the number of events per year for which the ESG rating either increases or decreases, which is subdivided into the number of events for which the ESG rating increases, # increases, and the number of events for which the ESG rating decreases, # decreases. Revisions in ESG rating that are smaller than 0.1 (on an ESG rating score scale of 0 to 10) are excluded. The number of firms, # firms, indicates the distinct number of firms (in each year) that have a revised ESG rating.

Table 2: Summary statistics

	Mean	SD	Min	Max	N
Panel A: BHAR					
R_i − MM	-0.58	21.55	-94.03	197.26	8,347
R_i − DGTW	-0.02	20.15	-90.03	153.19	8,038
ΔESG < 0 dummy	0.48	0.50	0.00	1.00	8,347
ESG	0.50	0.50	0.00	1.00	8,347
Small ΔESG < 0 dummy	0.22	0.42	0.00	1.00	8,347
Large ΔESG < 0 dummy	0.26	0.44	0.00	1.00	8,347
CAPEX	0.48	0.50	0.00	1.00	8,347
TA	0.50	0.50	0.00	1.00	8,347
SG	0.48	0.50	0.00	1.00	8,347
LTG	0.51	0.50	0.00	1.00	8,347
SIZE	0.35	0.48	0.00	1.00	8,347
TURN	0.48	0.50	0.00	1.00	8,347
EP	0.57	0.49	0.00	1.00	8,347
BP	0.45	0.50	0.00	1.00	8,347
SUE	0.52	0.50	0.00	1.00	8,347
FREV	0.34	0.47	0.00	1.00	8,347
RETP	0.51	0.50	0.00	1.00	8,347
RET2P	0.50	0.50	0.00	1.00	8,347
ΔEnvironmental < 0 dummy	0.45	0.50	0.00	1.00	7,025
Environmental	0.49	0.50	0.00	1.00	7,025
ΔSocial < 0 dummy	0.48	0.50	0.00	1.00	8,294
Social	0.51	0.50	0.00	1.00	8,294
ΔGovernance < 0 dummy	0.48	0.50	0.00	1.00	8,415
Governance	0.48	0.50	0.00	1.00	8,415
Mid-cycle update	0.14	0.34	0.00	1.00	7,362
In KLD 400	0.01	0.10	0.00	1.00	8,347
Out KLD 400	0.01	0.08	0.00	1.00	8,347
Panel B: Portfolio regressions					
ESG Upgrade	0.94	3.38	-9.96	8.80	78
Environmental Upgrade	1.00	3.23	-9.44	8.65	78
Social Upgrade	0.93	3.19	-9.64	8.09	78
Governance Upgrade	0.86	3.25	-9.97	8.39	78
ESG Downgrade	0.71	3.42	-11.11	8.83	78
Environmental Downgrade	0.69	3.51	-9.91	9.23	78
Social Downgrade	0.88	3.49	-10.56	11.49	78
Governance Downgrade	0.87	3.36	-10.21	8.54	78
ESG Up–down	0.23	1.26	-3.91	5.19	78
Environmental Up–down	0.31	1.35	-2.16	6.06	78
Social Up–down	0.05	1.40	-4.67	3.98	78
Governance Up–down	-0.01	1.26	-4.28	3.68	78
Panel C: Δ IO regressions					
ΔIO Indicator	0.45	0.50	0.00	1.00	7,667
ΔESG < 0 dummy	0.48	0.50	0.00	1.00	7,667
ESG	0.50	0.50	0.00	1.00	7,667
ΔEnvironmental < 0 dummy	0.45	0.50	0.00	1.00	6,469
Environmental	0.49	0.50	0.00	1.00	6,469

Table 2: Summary statistics (continued)

	Mean	SD	Min	Max	N
In KLD 400	0.01	0.08	0.00	1.00	7,667
Out KLD 400	0.00	0.07	0.00	1.00	7,667
RET	0.00	0.00	-0.01	0.01	7,667
STD	0.02	0.01	0.00	0.10	7,667
LOGMB	1.04	0.82	-1.33	4.30	7,667
VOLUME	1.70	2.38	0.01	10.11	7,667
LOGSIZE	15.27	1.51	10.07	20.69	7,667
NASDAQ	0.37	0.48	0.00	1.00	7,667
SP500	0.29	0.45	0.00	1.00	7,667
BETA	1.09	0.52	-0.85	3.63	7,667
PRINV	0.04	0.05	0.00	2.22	7,667
LTGROWTH	12.87	10.07	-9.29	50.50	7,667
SGROWTH	2.14	1.99	0.61	10.31	7,667
Panel D: Firm risk					
ESG $<$ 0 dummy	0.48	0.50	0.00	1.00	11,748
$\Delta\sigma_{total}$	0.11	0.91	-7.77	8.71	11,748
$\Delta\sigma_{idiosyncratic}$	0.08	0.88	-7.71	8.50	11,748
$\Delta\beta$	0.01	0.59	-3.70	4.48	11,748
ESG	0.47	0.50	0.00	1.00	11,748
OPERLEV	0.71	0.48	-1.40	2.36	11,748
R&D	0.80	1.94	0.00	14.48	11,748
LEV	0.24	0.20	0.00	0.99	11,748
CAPEX	0.50	0.50	0.00	1.00	11,748
CASH	0.38	1.40	0.00	18.23	11,748
SIZE	8.20	1.74	3.35	12.99	11,748
EARNINGSVAR	0.44	0.47	0.02	2.81	11,748
Environment $<$ 0 dummy	0.46	0.50	0.00	1.00	9,793
Environment	0.46	0.50	0.00	1.00	9,793

This table reports descriptive statistics for the variables included in each of the analyses. Panel A provides summary statistics for the buy-and-hold abnormal return analyses in Tables 3, 4, 5, 6 and 8. Panel B provides summary statistics for the calendar-time portfolio analyses in Table 7. Panel C provides summary statistics for the institutional investment analyses in Table 9 and 10. Panel D provides summary statistics for the return on assets and firm risk analyses in Table 11. All variable definitions can be found in Appendix table A.1.

Table 3: BHAR analysis ESG: Decreases versus increases

	MM			DGTW		
	(1)	(2)	(3)	(4)	(5)	(6)
ΔESG < 0 dummy	-1.047^{*}	-1.191^{**}	-1.694^{***}	-0.774	-0.973^{*}	-1.583^{***}
	[0.577]	[0.583]	[0.569]	[0.517]	[0.530]	[0.561]
ESG	0.921	0.779	0.533	0.469	0.590	0.576
	[0.616]	[0.584]	[0.530]	[0.507]	[0.504]	[0.502]
CAPEX		0.459	0.263		0.419	0.072
		[0.486]	[0.576]		[0.414]	[0.492]
TA		-0.012	0.217		0.043	0.457
		[0.427]	[0.459]		[0.389]	[0.393]
SG		0.517	1.817^{***}		0.564	1.535^{**}
		[0.692]	[0.661]		[0.623]	[0.646]
SIZE		-0.620	-0.131		0.807	0.915
		[0.780]	[0.850]		[0.530]	[0.631]
TURN		1.070	0.159		0.950	0.151
		[0.723]	[0.644]		[0.607]	[0.590]
EP		0.816	0.204		0.964^{*}	0.456
		[0.638]	[0.580]		[0.522]	[0.564]
BP		-1.474^{**}	-1.041		-1.043^{**}	-0.684
		[0.604]	[0.667]		[0.410]	[0.540]
SUE		0.813^{*}	0.850^{*}		0.519	0.687
		[0.474]	[0.479]		[0.424]	[0.446]
FREV		-0.113	0.038		-0.182	0.016
		[0.449]	[0.513]		[0.410]	[0.459]
RETP		-0.206	-0.441		-0.291	-0.470
		[0.782]	[0.783]		[0.596]	[0.596]
RET2P		-0.294	-0.407		-0.698	-0.845^{*}
		[0.601]	[0.553]		[0.443]	[0.470]
LTG			0.924			0.884^{*}
			[0.604]			[0.510]
Constant	-1.265^{***}	-1.500	-1.310	-0.175	-1.032	-1.022
	[0.368]	[1.424]	[1.192]	[0.327]	[1.050]	[0.998]
Observations	14,284	12,408	8,347	13,574	11,946	8,038
Adjusted R^2	0.022	0.020	0.039	0.006	0.005	0.016
Event date FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	No	Yes	No	No	Yes
N firms	3511	3119	2486	3384	3025	2414
N event dates	78	76	75	78	76	75

This table reports results of estimating Equation 2 in which the dependent variable is six-month buy-and-hold abnormal return (BHAR). Columns (1) to (3) and Columns (4) to (6) indicate specifications using the market model (MM) and characteristics-based benchmarks (DGTW) (Daniel et al., 1997) to calculate BHAR, respectively. All variables are defined in Panel A of Appendix Table A.1. *Event date FE* indicates the inclusion of indicator variables for event dates. *Industry FE* indicates the inclusion of industry indicator variables based on MSCI-defined industries. *N firms* and *N event dates* indicate the number of distinct firms and event dates respectively. Standard errors are double clustered at the firm and event-date level and are reported in parentheses, with ***, **, * corresponding to the 1%, 5%, and 10% level of significance, respectively.

Table 4: BHAR analysis ESG: Small and large decreases versus increases

	MM			DGTW		
	(1)	(2)	(3)	(4)	(5)	(6)
Small ΔESG $<$ 0 dummy	-0.334	-0.569	-1.243^{*}	0.039	-0.230	-0.996
	[0.659]	[0.665]	[0.631]	[0.597]	[0.618]	[0.623]
Large ΔESG $<$ 0 dummy	-2.002^{**}	-2.044^{**}	-2.271^{***}	-1.865^{**}	-1.985^{**}	-2.328^{***}
	[0.803]	[0.833]	[0.761]	[0.722]	[0.763]	[0.705]
ESG	1.129^{*}	0.962^{*}	0.655	0.705	0.807	0.731
	[0.573]	[0.560]	[0.528]	[0.479]	[0.491]	[0.504]
Observations	14,284	12,408	8,347	13,574	11,946	8,038
Adjusted R^2	0.022	0.021	0.039	0.007	0.005	0.016
Event date FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm controls	No	Yes	Yes	No	Yes	Yes
Industry FE	No	No	Yes	No	No	Yes
N firms	3511	3119	2486	3384	3025	2414
N event dates	78	76	75	78	76	75

This table reports results of estimating Equation 2 in which the dependent variable is six-month buy-and-hold abnormal return (BHAR). Small ΔESG $<$ 0 dummy is a dummy equal to 1 when the decrease in ESG rating score is in the lower 50^{th} percentile of the ESG rating score decrease distribution, and zero otherwise. Large ΔESG $<$ 0 dummy is a dummy equal to 1 when the decrease in ESG rating score is in the upper 50^{th} percentile of the ESG rating score decrease distribution, and zero otherwise. Columns (1) to (3) and Columns (4) to (6) indicate specifications using the market model (MM) and characteristics-based benchmarks (DGTW) (Daniel et al., 1997) to calculate BHAR, respectively. Columns (2) and (5) include all control variables except *LTG* and Columns (3) and (6) include all control variables and industry fixed effects. All variables are defined in Panel A of Appendix Table A.1. *Event date FE* indicates the inclusion of indicator variables for event dates. *Industry FE* indicates the inclusion of industry indicator variables based on MSCI-defined industries. *N firms* and *N event dates* indicate the number of distinct firms and event dates respectively. Standard errors are double clustered at the firm and event-date level and are reported in parentheses, with ***, **, * corresponding to the 1%, 5%, and 10% level of significance, respectively.

Table 5: The effect of mid-cycle updates on BHAR

	MM		DGTW	
	(1)	(2)	(3)	(4)
Mid-cycle update	−1.251	−1.002	−1.254	−1.338
	[1.022]	[1.120]	[0.969]	[1.023]
Δ ESG $<$ 0 dummy	−1.403**	−1.357**	−1.341**	−1.357**
	[0.576]	[0.598]	[0.561]	[0.570]
Δ ESG $<$ 0 dummy × Mid-cycle update		−0.479		−0.162
		[1.414]		[1.276]
Observations	7,362	7,362	7,087	7,087
Adjusted R^2	0.046	0.046	0.022	0.022
Event date FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes
N firms	2276	2276	2214	2214
N event dates	75	75	75	75

This table reports results of estimating Equation 2 in which the dependent variable is six-month buy-and-hold abnormal return (BHAR). Columns (1) and (2) present specifications using the market model (MM) and Columns (3) and (4) present specifications using the characteristics-based benchmarks (DGTW) (Daniel et al., 1997) to calculate the BHAR. All variables are defined in Panel A of Appendix Table A.1. The variable *mid-cycle update* is an indicator variable equal to one when the previous update was after a period between 11 and 13 months (i.e., annual) and the current update is after less than 11 months, and zero otherwise. *Event date FE* indicates the inclusion of indicator variables for event dates. *Industry FE* indicates the inclusion of industry indicator variables based on MSCI-defined industries. *N firms* and *N event dates* indicate the number of distinct firms and event dates respectively. Standard errors are double clustered at the firm and event-date level and are reported in parentheses, with ***, **, * corresponding to the 1%, 5%, and 10% level of significance, respectively.

Table 6: BHAR analysis E,S and G: Decreases versus increases

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Market-adjusted returns (MM)									
ΔEnv. < 0 dummy	−1.318**	−1.057**	−1.378**						
	[0.519]	[0.484]	[0.566]						
Environmental	0.256	0.134	−0.665						
	[0.676]	[0.624]	[0.595]						
ΔSocial < 0 dummy				−0.534	−0.169	−0.313			
				[0.477]	[0.466]	[0.498]			
Social				0.564	0.271	−0.043			
				[0.444]	[0.448]	[0.513]			
ΔGov. < 0 dummy							−0.330	−0.414	−0.175
							[0.475]	[0.504]	[0.537]
Governance							1.442**	1.336**	0.741
							[0.589]	[0.552]	[0.547]
Observations	11,939	10,342	7,025	14,068	12,232	8,294	14,529	12,631	8,415
Adjusted R^2	0.020	0.019	0.041	0.022	0.021	0.036	0.021	0.020	0.037
Event date FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Industry FE	No	No	Yes	No	No	Yes	No	No	Yes
N firms	3379	2988	2337	3504	3124	2483	3508	3129	2495
N event dates	78	76	75	78	76	75	78	76	76
Panel B: DGTW-adjusted returns (DGTW)									
ΔEnv. < 0 dummy	−0.971**	−0.668	−1.158**						
	[0.459]	[0.446]	[0.544]						
Environmental	−0.052	−0.010	−0.625						
	[0.535]	[0.525]	[0.579]						
ΔSocial < 0 dummy				−0.454	−0.307	−0.464			
				[0.430]	[0.462]	[0.489]			
Social				0.171	−0.114	−0.562			
				[0.411]	[0.424]	[0.497]			
ΔGov. < 0 dummy							−0.746	−0.785*	−0.705
							[0.462]	[0.471]	[0.532]
Governance							1.486***	1.445***	1.185**
							[0.510]	[0.468]	[0.500]
Observations	11,349	9,971	6,791	13,358	11,765	7,984	13,790	12,143	8,096
Adjusted R^2	0.006	0.004	0.016	0.006	0.005	0.016	0.006	0.005	0.017
Event date FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Industry FE	No	No	Yes	No	No	Yes	No	No	Yes
N firms	3255	2904	2275	3371	3029	2408	3388	3034	2421
N event dates	78	76	75	78	76	75	78	76	76

This table reports results of estimating Equation 2, in which the dependent variable is six-month buy-and-hold abnormal return (BHAR). Panel A displays specifications using the market model (MM) and Panel B displays specifications using the characteristics-based benchmarks (DGTW) (Daniel et al., 1997) to calculate BHAR, respectively. This table considers revisions in ratings for ESG dimensions: Environmental, Social and Governance. All variables are defined in Panel A of Appendix Table A.1. Columns (2), (5) and (8) include all control variables except *LTG* and Columns (3), (6) and (9) include all control variables and industry fixed effects. *Event date FE* indicates the inclusion of indicator variables for event dates. *Industry FE* indicates the inclusion of industry indicator variables based on MSCI-defined industries. *N firms* and *N event dates* indicate the number of distinct firms and event dates respectively. Standard errors are double clustered at the firm and event-date level and are reported in parentheses, with ***, **, * corresponding to the 1%, 5%, and 10% level of significance, respectively.

Table 7: Calendar-time portfolio return analyses

	Upgrade	Downgrade	Up–down
Panel A: ESG			
Excess returns	0.941**	0.711*	0.229
CAPM alpha	−0.070	−0.315***	0.245
FF3 alpha	−0.075	−0.312***	0.236
FFC4 alpha	−0.049	−0.291**	0.242
FF5 alpha	−0.076	−0.311**	0.236
Panel B: Environmental			
Excess returns	0.996***	0.685*	0.311**
CAPM alpha	0.017	−0.340**	0.357**
FF3 alpha	0.008	−0.352**	0.361**
FFC4 alpha	0.018	−0.324**	0.342**
FF5 alpha	0.017	−0.361**	0.378**
Panel C: Social			
Excess returns	0.935**	0.881**	0.054
CAPM alpha	−0.009	−0.167	0.158
FF3 alpha	−0.029	−0.166	0.137
FFC4 alpha	−0.026	−0.142	0.116
FF5 alpha	−0.029	−0.159	0.130
Panel D: Governance			
Excess returns	0.859**	0.869**	−0.009
CAPM alpha	−0.109	−0.135	0.025
FF3 alpha	−0.129	−0.140	0.010
FFC4 alpha	−0.106	−0.122	0.016
FF5 alpha	−0.125	−0.139	0.014

This table reports excess returns and Jensen's alphas of estimating several factor models. *Excess returns* indicates the average of returns in excess of the risk free rate, $R_{jt} - R_{ft}$. *CAPM alpha* is estimated based on: $R_{jt} - R_{ft} = \alpha_j + \beta_j(R_{mt} - R_{ft}) + \epsilon_{jt}$. *FF3 alpha* is estimated based on: $R_{jt} - R_{ft} = \alpha_j + \beta_j(R_{mt} - R_{ft}) + s_j SMB_t + h_j HML_t + \epsilon_{jt}$. *FFC4 alpha* is estimated based on: $R_{jt} - R_{ft} = \alpha_j + \beta_j(R_{mt} - R_{ft}) + s_j SMB_t + h_j HML_t + m_t MOM_t + \epsilon_{jt}$. Finally, *FF5 alpha* is estimated based on $R_{jt} - R_{ft} = \alpha_j + \beta_j(R_{mt} - R_{ft}) + s_j SMB_t + h_j HML_t + r_t RMW_t + c_t CMA_t + \epsilon_{jt}$. Upgrade, Downgrade, and Up–down indicate respectively the increase and decrease portfolios and their differences. All portfolios are value-weighted. Holding period after a buy or a sell is six months and each portfolio is rebalanced monthly. Panel A indicates portfolios based on the ESG rating and Panels B, C and D indicate portfolios based on ESG dimensions Environmental, Social and Governance, respectively. All variables are defined in Panel B of Appendix Table A.1. We used robust standard errors, with ***, **, * corresponding to the 1%, 5%, and 10% level of significance, respectively.

Table 8: BHAR and index revisions

	MM				DGTW			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
In KLD400	1.390	2.138	1.986	1.722	0.705	2.488	1.229	1.455
	[2.331]	[2.230]	[2.383]	[2.885]	[2.389]	[2.211]	[2.434]	[3.125]
Out KLD400	−2.018	−2.851	−4.706	−0.032	−4.755	−2.866	−6.722**	0.549
	[3.022]	[6.010]	[3.341]	[3.418]	[3.284]	[5.209]	[3.061]	[3.837]
ESG <0 dummy	−1.655***	−1.637***			−1.526***	−1.478**		
	[0.580]	[0.580]			[0.574]	[0.572]		
ESG < 0 dummy × In KLD400		−2.397				−5.533		
		[4.787]				[4.740]		
ESG < 0 dummy × Out KLD400		0.883				−2.109		
		[6.257]				[5.798]		
Env.< 0 dummy			−1.365**	−1.320**			−1.146**	−1.058*
			[0.568]	[0.576]			[0.546]	[0.552]
Env.< 0 dummy × In KLD400				0.688				−0.583
				[3.543]				[3.868]
Env.< 0 dummy × Out KLD400				−10.127**				−15.814***
				[4.263]				[4.645]
ESG	0.512	0.513			0.547	0.548		
	[0.530]	[0.531]			[0.501]	[0.502]		
Environmental			−0.677	−0.673			−0.642	−0.637
			[0.594]	[0.594]			[0.578]	[0.578]
Observations	8,347	8,347	7,025	7,025	8,038	8,038	6,791	6,791
Adjusted R^2	0.0386	0.0384	0.0409	0.0409	0.0158	0.0157	0.0166	0.0171
Event date FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N firms	2486	2486	2337	2337	2414	2414	2275	2275
N dates	75	75	75	75	75	75	75	75

This table reports results of estimating Equation 2 in which the dependent variable is six-month buy-and-hold abnormal return (BHAR). Columns (1) to (4) and Columns (5) to (8) indicate specifications using the market model (MM) and characteristics-based benchmarks (DGTW) (Daniel et al., 1997) to calculate BHAR, respectively. All variables are defined in Panel A of Appendix Table A.1. *In KLD 400* is a dummy variable equal to one when a stock is added to the KLD 400, within the period of six months after the rating event. *Out KLD 400* is a dummy variable equal to one when a stock is deleted from the KLD 400, within the period of six months after the rating event. *Event date FE* indicates the inclusion of indicator variables for event dates. *Industry FE* indicates the inclusion of industry indicator variables based on MSCI-defined industries. *N firms* and *N event dates* indicate the number of distinct firms and event dates respectively. Standard errors are double clustered at the firm and event-date level and are reported in parentheses, with ***, **, * corresponding to the 1%, 5%, and 10% level of significance, respectively.

Table 9: Changes in institutional investment around event quarters

	All investors		Short-term investors		Long-term investors	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ ESG < 0 dummy	−0.002		0.005		−0.017	
	[0.010]		[0.011]		[0.012]	
ESG	−0.004		0.011		−0.007	
	[0.010]		[0.011]		[0.012]	
Δ Env. < 0 dummy		−0.024**		−0.004		−0.024**
		[0.011]		[0.011]		[0.012]
Environment		−0.006		0.023**		−0.021
		[0.011]		[0.012]		[0.013]
RET	6.146***	4.914*	16.387***	14.451***	2.167	3.746
	[2.383]	[2.669]	[2.359]	[2.642]	[2.679]	[2.905]
STD	−0.860	−1.095	−2.062**	−2.085**	1.032	0.076
	[0.884]	[0.936]	[0.869]	[0.946]	[0.992]	[1.053]
LOGMB	−0.007	−0.008	−0.002	−0.007	0.011	0.009
	[0.007]	[0.007]	[0.007]	[0.008]	[0.008]	[0.009]
VOLUME	0.003	0.005*	−0.003	−0.003	0.009***	0.009***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
LOGSIZE	−0.006	−0.006	−0.007	−0.007	−0.007	−0.009
	[0.006]	[0.006]	[0.007]	[0.007]	[0.006]	[0.007]
NASDAQ	0.016	0.012	0.008	0.011	0.010	−0.008
	[0.011]	[0.012]	[0.011]	[0.013]	[0.013]	[0.015]
SP500	−0.008	−0.003	−0.017	−0.006	−0.040**	−0.021
	[0.014]	[0.015]	[0.014]	[0.015]	[0.016]	[0.018]
BETA	0.005	0.003	−0.002	−0.003	−0.002	−0.006
	[0.012]	[0.013]	[0.012]	[0.014]	[0.013]	[0.014]
PRINV	−0.123	−0.132	0.252	0.172	−0.453***	−0.377***
	[0.120]	[0.124]	[0.222]	[0.195]	[0.145]	[0.142]
LTGROWTH	0.001	0.000	−0.001	−0.000	0.001*	0.001**
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
SGROWTH	−0.000	−0.004	−0.003	−0.004	0.004	0.002
	[0.004]	[0.005]	[0.004]	[0.005]	[0.004]	[0.005]
Observations	7,667	6,469	7,667	6,469	7,667	6,469
Pseudo R^2	0.2600	0.2640	0.2160	0.2200	0.0907	0.0869
Event date FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
N firms	2196	2075	2196	2075	2196	2075
N event quarters	26	26	26	26	26	26

This table reports results of estimating Equation 3 in which the dependent variable is ΔIO Indicator is an indicator equal to one when institutional investment increased in quarter $t+1$ compared to quarter $t-1$, and zero when it decreased, where quarter t is the rating event quarter. $\Delta Rating < 0$ *dummy* is an indicator variable equal to one for a decrease in ESG rating and equal to zero for an increase in ESG rating in quarter t compared to quarter $t-1$. All control variables are measured in quarter $t-1$ and are defined in Panel C of Appendix Table A.1. Using the fixed classification of Bushee (1998), Short-term investors are defined as transient investors (Columns (3) and (4)), Long-term investors are defined as dedicated investors and quasi-indexers (Columns (5) and (6)), and All institutional investors are Long-term, Short-term and other institutional investors for whom the type is not classified (Columns (1) and (2)). *Event date FE* indicates the inclusion of indicator variables for quarterly event dates. *Industry FE* indicates the inclusion of industry indicator variables based on MSCI-defined industries. *N firms* and *N event quarters* indicate the number of distinct firms and quarterly event dates respectively. Standard errors are clustered at the firm level and are reported in parentheses, with ***, **, * corresponding to the 1%, 5%, and 10% level of significance, respectively.

Table 10: Changes in institutional investment around event quarters and index revisions

	Long-term investors			
	(1)	(2)	(3)	(4)
In KLD 400	−0.032	−0.070	−0.056	−0.064
	[0.076]	[0.088]	[0.078]	[0.104]
Out KLD 400	−0.164*	−0.226	−0.200**	−0.138
	[0.087]	[0.248]	[0.099]	[0.122]
ΔESG < 0 dummy	−0.016	−0.017		
	[0.012]	[0.012]		
ΔESG < 0 dummy × In KLD 400		0.114		
		[0.166]		
ΔESG < 0 dummy × Out KLD 400		0.070		
		[0.264]		
Environmental < 0 dummy			−0.024**	−0.023*
			[0.012]	[0.012]
ΔEnv. < 0 dummy × In KLD 400				0.016
				[0.156]
ΔEnv. < 0 dummy × Out KLD 400				−0.126
				[0.200]
ESG	−0.007	−0.007		
	[0.012]	[0.012]		
Environmental			−0.021	−0.021
			[0.013]	[0.013]
Observations	7,667	7,667	6,469	6,469
Adjusted R^2	0.0910	0.0911	0.0874	0.0875
Event date FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
N firms	2196	2196	2075	2075
N event quarters	26	26	26	26

This table reports results of estimating Equation 3 in which the dependent variable is ΔIO Indicator which is an indicator equal to one when institutional investment increased in quarter $t+1$ compared to quarter $t-1$, and zero when it decreased, where quarter $t = 0$ is the rating event quarter. $\Delta Rating < 0$ *dummy* is an indicator variable equal to one for a decrease in ESG rating and equal to zero for an increase in ESG rating in quarter t compared to quarter $t-1$. *In KLD 400* is a dummy variable equal to one when a stock is added to the KLD 400, within the period of two quarters after the rating event. *Out KLD 400* is a dummy variable equal to one when a stock is deleted from the KLD 400, within the period of two quarters after the rating event. All control variables are measured in quarter $t-1$ and are defined in Panel C of Appendix Table A.1. Using the fixed classification of Bushee (1998), long-term investors are defined as dedicated investors and quasi-indexers. *Event date FE* indicates the inclusion of indicator variables for quarterly event dates. *Industry FE* indicates the inclusion of industry indicator variables based on MSCI-defined industries. *N firms* and *N event quarters* indicate the number of distinct firms and quarterly event dates respectively. Standard errors are clustered at the firm level and are reported in parentheses, with ***, **, * corresponding to the 1%, 5%, and 10% level of significance, respectively.

Table 11: Firm risk after ESG decreases versus increases

	$\Delta\sigma_{total}$		$\Delta\sigma_{idiosyncratic}$		$\Delta\beta$	
	(1)	(2)	(3)	(4)	(5)	(6)
ESG < 0 dummy	0.049***		0.043**		0.005	
	[0.017]		[0.018]		[0.012]	
ESG	−0.032*		−0.031*		0.018	
	[0.017]		[0.017]		[0.012]	
Environment < 0 dummy		0.029*		0.018		0.023**
		[0.017]		[0.018]		[0.011]
Environment		−0.043**		−0.034*		0.003
		[0.017]		[0.018]		[0.012]
OPERLEV	−0.007	0.001	−0.004	0.004	−0.005	−0.010
	[0.017]	[0.019]	[0.017]	[0.019]	[0.012]	[0.014]
R&D	0.002	−0.011	−0.001	−0.014	0.004	0.005
	[0.010]	[0.009]	[0.011]	[0.009]	[0.006]	[0.006]
LEV	0.030	0.081	0.021	0.078	0.064**	0.059*
	[0.045]	[0.052]	[0.046]	[0.054]	[0.029]	[0.034]
CAPEX	−0.046***	−0.029*	−0.048***	−0.033*	0.009	0.011
	[0.016]	[0.018]	[0.016]	[0.018]	[0.011]	[0.012]
CASH	−0.008	0.005	−0.011	0.001	0.006	0.009
	[0.017]	[0.019]	[0.017]	[0.020]	[0.009]	[0.010]
SIZE	−0.013**	−0.010*	−0.011**	−0.008	−0.009**	−0.007*
	[0.005]	[0.006]	[0.005]	[0.006]	[0.004]	[0.004]
EARNINGSVAR	−0.008	−0.009	−0.005	0.000	−0.001	−0.014
	[0.018]	[0.019]	[0.017]	[0.019]	[0.011]	[0.012]
Constant	0.229***	0.184***	0.195***	0.148***	0.051	0.038
	[0.049]	[0.053]	[0.049]	[0.053]	[0.033]	[0.037]
Observations	11,748	9,793	11,748	9,793	11,748	9,793
Adjusted R^2	0.196	0.204	0.111	0.118	0.067	0.058
Event date FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
N firms	2894	2769	2894	2769	2894	2769
N event quarters	26	26	26	26	26	26

This table reports results of estimating Equation 4 in which the dependent variable is Δy, where y can be total risk ($\Delta\sigma_{total}$, Columns 1 and 2), idiosyncratic risk ($\Delta\sigma_{idiosyncratic}$, Columns 3 and 4), or market risk ($\Delta\beta$, Columns 5 and 6). Δy indicates continuous difference in performance in quarter $t+1$ compared to quarter $t-1$, where quarter $t=0$ is the rating event quarter. $\Delta Rating < 0$ *dummy* is an indicator variable equal to one when for a decrease in ESG rating and equal to zero for an increase in ESG rating in quarter t compared to quarter $t-1$. All control variables are measured in quarter $t-1$ and are defined in Panel D of Appendix Table A.1. *Event date FE* indicates the inclusion of indicator variables for quarterly event dates. *Industry FE* indicates the inclusion of industry indicator variables based on MSCI-defined industries. *N firms* and *N event quarters* indicate the number of distinct firms and quarterly event dates respectively. Standard errors are clustered at the firm level and are reported in parentheses, with ***, **, * corresponding to the 1%, 5%, and 10% level of significance, respectively.

Appendices

A Appendix: Definitions

Table A.1: Variable definitions

Variable	Definition
<u>Panel A: BHAR variables</u>	
R_i - MM	Buy-and-hold abnormal returns, calculated over a period of six months after the event according to Equation 1 and based on stock returns (R_i) and the CRSP value-weighted market index (MM)
R_i - DGTW	Buy-and-hold abnormal returns, calculated over a period of six months after the event according to Equation 1 and based on stock returns R_i and the characteristic-based returns (DGTW).
ESG	The overall ESG score that identifies key Environmental, Social, and Governance issues that hold the greatest potential risk or opportunity for each industry sector. MSCI analyzes each company's risk exposure, measuring the extent to which a company's core business is at risk of incurring unanticipated losses. When comparing companies, the data are normalized by the most relevant, available factor, such as sales or production levels. The ESG rating is a weighted average of E, S and G, as measured at one month before the rating change, converted to a dummy equal to 1 above the median and zero otherwise.
Environmental	MSCI ESG score of the dimension Environmental. The environmental score is the environmental pillar of the ESG score and applies the same rating metrics based on potential risk or opportunity in each industry. The unadjusted scores are defined on a range between zero (worst performance) and 10 (best performance). Environmental is measured one month before the rating revision, converted to a dummy equal to 1 above the median and zero otherwise.
Social	MSCI ESG score of the dimension Social. The Social score is the social pillar of the ESG score and applies the same rating metrics based on potential risk or opportunity in each industry. The unadjusted scores are defined on a range between zero (worst performance) and 10 (best performance). Social is measured one month before the rating revision, converted to a dummy equal to 1 above the median and zero otherwise.
Governance	MSCI ESG score of the dimension Governance. The governance score is the governance pillar of the ESG score and applies the same rating metrics based on potential risk or opportunity in each industry. The unadjusted scores are defined on a range between zero (worst performance) and 10 (best performance). Governance is measured one month before the rating revision, converted to a dummy equal to 1 above the median and zero otherwise.
ΔESG $<$ 0 dummy	Indicator variable equal to one when an event is associated with a decrease in ESG score and equal to zero when the event is associated with an increase in ESG score.
ΔEnvironmental $<$ 0 dummy	Indicator variable equal to one when an event is associated with a decrease in Environmental score and equal to zero when the event is associated with an increase in Environmental score.
ΔSocial $<$ 0 dummy	Indicator variable equal to one when an event is associated with a decrease in Social score and equal to zero when the event is associated with an increase in Social score.
ΔGovernance $<$ 0 dummy	Indicator variable equal to one when an event is associated with a decrease in Governance score and equal to zero when the event is associated with an increase in Governance score.
ΔESG score	ESG score differential calculated as the first difference of ESG scores between consecutive rating dates.
ΔESG_{5q}	Quantile indicator calculated on the basis of Δ ESG score.
CAPEX	Capital expenditure. Moving sum of last four quarters capital expenditure scaled by total assets. $\frac{\sum_{i=0}^{3} Capex_{q-i}}{(Totalassets_q + Totalassets_{q-4})/2}$ where q is the most recent quarter. Equals one if below median, zero otherwise.
TA	Total accrual, where q is the most recent quarter, Δ is the difference between quarter q and q-4. Equals one if below median, zero otherwise. $\frac{\Delta CurA_q - \Delta Cash_q - (\Delta CurLiab_q - \Delta CurLTD_q) - \Delta deftax_q - depandAmor_q}{Totalassets_q + Totalassets_{q-4})/2}$
SG	Sales growth in past year. $\frac{\sum_{i=q-3}^{q} Sales_i}{\sum_{i=q-7}^{i=q-4} Sales_{i-1}}$ where q denotes the most recent quarter. Equals one if below median, zero otherwise.

Table A.1: Variable definitions (Continued)

Variable	Definition
LTG	IBES long-term growth forecast in month t - 1. Equals one if below median, zero otherwise.
SIZE	Logarithm of market equity at the fourth quarter-end of the last fiscal year. Equals one if below median, zero otherwise.
TURN	Mean daily number of shares traded relative to shares outstanding, for months (-6,-1). Equals one if below median, zero otherwise.
EP	Moving sum of earnings per share EPS for prior four quarters deflated by quarter-end price. Equals one if above median, zero otherwise.
BP	Book-to-market at the most recent quarter. Equals one if above median, zero otherwise.
SUE	Standardized unexpected earnings $\frac{eps_q - eps_{q-4}}{\sigma_{q-(q-7)}}$ where q denotes fiscal quarter and sigma denotes standard deviation over the last eight quarters. Equals one if above median, zero otherwise.
FREV	Rolling sum of analyst earnings forecast revisions to price ratios months (-6, -1): $\sum_{i=1}^{6} \frac{f_{m-i} - f_{m-1-i}}{p_{m-1-i}}$ where f_m is the month m FY1 forecast and P_{m-1} is month $m - 1$ stock price. Equals one if above median, zero otherwise.
RETP	Cumulative MM-adjusted return for months (-6,-1). Equals one if above median, zero otherwise
RET2P	Cumulative MM-adjusted return for the months (-12, -7). Equals one if above median, zero otherwise.
Mid-cycle update	An indicator variable equal to one when the previous rating event was after a period between 11 and 12 months (i.e., annual) and the current update is either after less than 11 months or after more than 13 months, and zero otherwise.
In KLD 400	A dummy variable equal to one when a stock is included in the KLD 400 during an index revision, within a period of six months after the rating event.
Out KLD 400	A dummy variable equal to one when a stock is deleted from the KLD 400 during an index revision, within a period of six months after the rating event.
Panel B: Portfolio variables	
ESG Upgrade	Excess return on a value-weighted portfolio formed in month $t-1$ based on increases in ESG score and subsequently held for six months.
Environmental Upgrade	Excess return on a value-weighted portfolio formed in month $t-1$ based on increases in Environmental score and subsequently held for six months.
Social Upgrade	Excess return on a value-weighted portfolio formed in month $t-1$ based on increases in Social score and subsequently held for six months.
Governance Upgrade	Excess return on a value-weighted portfolio formed in month $t-1$ based on increases in Governance score and subsequently held for six months.
ESG Downgrade	Excess return on a value-weighted portfolio formed in month $t-1$ based on decreases in ESG score and subsequently held for six months.
Environmental Downgrade	Excess return on a value-weighted portfolio formed in month $t-1$ based on decreases in Environmental score and subsequently held for six months.
Social Downgrade	Excess return on a value-weighted portfolio formed in month $t-1$ based on decreases in Social score and subsequently held for six months.
Governance Downgrade	Excess return on a value-weighted portfolio formed in month $t-1$ based on decreases in Governance score and subsequently held for six months.
ESG Up–down	Difference portfolio constructed as the differential return between ESG Upgrade and ESG Downgrade
Environmental Up–down	Difference portfolio constructed as the differential return between Environmental Upgrade and Environmental Downgrade
Social Up–down	Difference portfolio constructed as the differential return between Social Upgrade and Social Downgrade
Governance Up–down	Difference portfolio constructed as the differential return between Governance Upgrade and Governance Downgrade
R_m - R_f	Market factor: The excess rate of return on the market
SMB	Small minus big: The average return on three small portfolios minus the average return on three big portfolios
HML	High minus low: The average return on two value portfolios minus the average return on two growth portfolios
MOM	Momentum: The average return on the two high prior return portfolios minus the average return on the two low prior return portfolios
RMW	Robust minus weak: the average return on the two robust operating profitability portfolios minus the average return on the two weak operating profitability portfolios
CMA	Conservative minus aggressive: the average return on the two conservative investment portfolios minus the average return on the two aggressive investment portfolios.

Table A.1: Variable definitions (Continued)

Variable	Definition
Panel C: IO variables	
Δ IO Indicator$_i$	An indicator variable equal to one when institutional ownership increased and equal to zero when decreased in rating quarter q+1 compared to rating quarter q-1, where rating quarters are defined as consecutive quarters in which rating revisions take place.
Δ IO	The first difference between institutional ownership defined as the difference between IO in rating quarter q+1 and IO in rating quarter q-1, where rating quarters are defined as consecutive quarters in which rating revisions take place.
ΔESG < 0 dummy	Indicator variable equal to one when an event is associated with a decrease in ESG score and equal to zero when the event is associated with an increase in ESG score, measured in the quarter a rating revision takes place.
ΔEnvironmental < 0 dummy	Indicator variable equal to one when an event is associated with an Environmental rating downgrade and equal to zero when the event is associated with an ESG rating upgrade, measured in the quarter a rating revision takes place.
ΔSocial < 0 dummy	Indicator variable equal to one when an event is associated with a Social rating downgrade and equal to zero when the event is associated with an ESG rating upgrade, measured in the quarter a rating revision takes place.
ΔGovernance < 0 dummy	Indicator variable equal to one when an event is associated with a Governance rating downgrade and equal to zero when the event is associated with an ESG rating upgrade, measured in the quarter a rating revision takes place.
ESG	The ESG score is a weighted average of E, S and G, as measured at one quarter before the rating event quarter, converted to a dummy equal to 1 above the median and zero otherwise. A more extensive definition is provided in Panel A above.
Environmental	Environmental is measured one quarter before the rating event quarter, converted to a dummy equal to 1 above the median and zero otherwise. A more extensive definition is provided in Panel A above.
Social	Social is measured one quarter before the rating event quarter, converted to a dummy equal to 1 above the median and zero otherwise. A more extensive definition is provided in Panel A above.
Governance	Governance is measured one quarter before the rating event quarter, converted to a dummy equal to 1 above the median and zero otherwise. A more extensive definition is provided in Panel A above.
LOGMB	Natural logarithm of market-to-book value, as measured at quarter end one quarter before the event quarter, winsorized at the 0.5% level.
VOLUME	Average daily volume in USD millions, calculated quarterly and as measured one quarter before the event quarter, winsorized at the 2.5% level.
RET	Average daily return in %, calculated quarterly and as measured one quarter before the event quarter, winsorized at the 0.5% level.
STD	Standard deviation of daily returns, calculated quarterly and as measured one quarter before the event quarter, winsorized at the 0.5% level.
LOGSIZE	Natural logarithm of stock market capitalization ,as measured at quarter end one quarter before the event quarter.
NASDAQ	Dummy equal to 1 when a stock is listed on the NASDAQ stock exchange, zero otherwise.
SP500	Dummy equal to 1 when a stock is part of the S&P500, zero otherwise.
BETA	Quarterly stock beta calculated using daily data with MM as benchmark, calculated quarterly and as measured one quarter before the event quarter.
PRINV	The inverse of the stock price, as measured at quarter end one quarter before the event quarter, winsorized at the 0.5% level.
LTGROWTH	IBES long-term growth forecast, as measured at quarter end one quarter before the event quarter, winsorized at the 2.5% level.
SGROWTH	Sales growth in the last four quarters, as measured at quarter end one quarter before the event quarter, winsorized at the 2.5% level.
Panel D: Firm fundamentals	
$\Delta\sigma_{total}$	The difference in standard deviation of excess returns measured from quarter $t-1$ to quarter $t+1$. Quarterly standard deviation is calculated using daily stock excess returns in percentages.
$\Delta\sigma_{idiosyncratic}$	The difference in idiosyncratic risk measured from quarter $t-1$ to quarter $t+1$. Idiosyncratic risk is defined as the standard deviation of the residuals of the market model and measured in percentages.
$\Delta\beta$	The difference in quarterly stock beta measured from quarter $t-1$ to quarter $t+1$. Quarterly stock beta is calculated using daily data with MM as benchmark.
OPERLEV	Operating leverage, the sensitivity of growth in total operating costs to growth in sales. To construct it, for every firm and year, we calculate ex ante expectations of operating costs and sales based on the geometric growth rate over the previous two years.

Table A.1: Variable definitions (Continued)

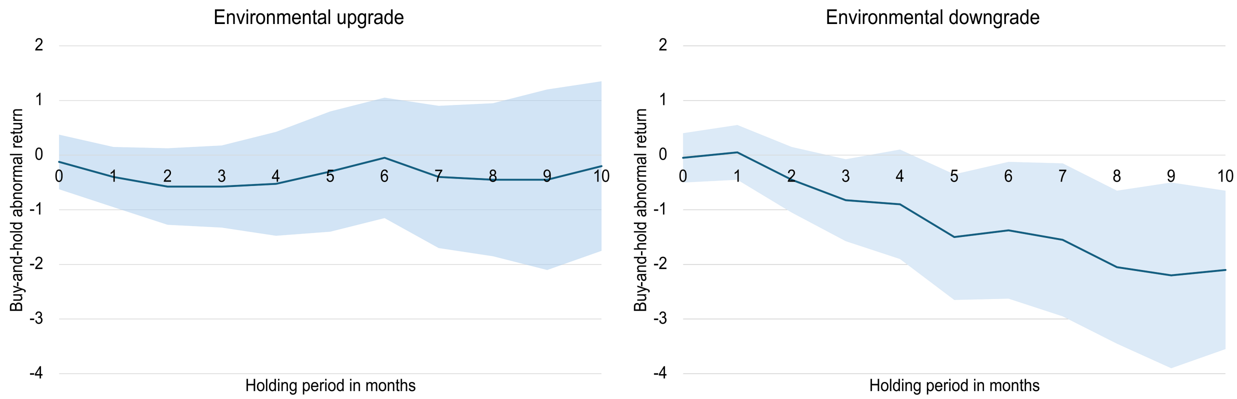
Variable	Definition
R&D	R&D is defined as R&D expenditure over total assets times 100%. Following prior literature, we set missing values to zero.
LEV	Leverage is defined as long-term debt over total assets.
CAPEX	The moving sum of last four quarters capital expenditure scaled by total assets. $\frac{\sum_{i=0}^{3} Capex_{q-i}}{(Totalassets_q + Totalassets_{q-4})/2}$ where q is the most recent quarter. Equals one if below median, zero otherwise.
CASH	Cash is defined as the ratio of cash and marketable securities to total assets net of cash and marketable securities.
SIZE	Size is defined as the log of total assets.
EARNINGSVAR	Earnings variability is defined as the standard deviation of income before extraordinary items per share using a five-year rolling window.

This table provides variable definitions. Panel A provides variable definitions for the buy-and-hold abnormal return analyses in Tables 3, 4, 6, 5 and 8. Panel B provides variable definitions for the portfolio analyses in Table 7. Panel C provides variable definitions for the institutional investment analyses in Table 9 and 10. Panel D provides variable definitions for the channel analyses in Table 11.

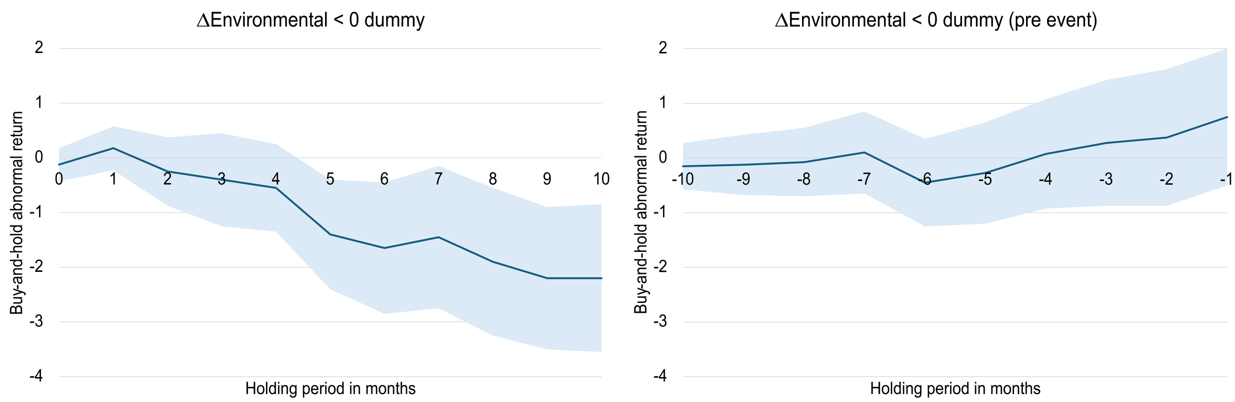
B Appendix: Additional analyses and robustness checks

Figure B.1: BHAR analysis: Environmental rating increases and decreases

Panel A: T-tests positive and negative Environmental rating revisions



Panel B: Regressions Environmental rating increases versus decreases



This figure presents buy-and-hold abnormal returns for Environmental rating increases and decreases. The x-axis displays different holding periods (in months) and the y-axis presents buy-and-hold abnormal returns in percentages. The line indicates average BHARs with the bands indicating a 90% confidence interval. In panel A, the left graph indicates average BHARs for positive Environmental rating revisions and the right graph indicates average BHARs for negative Environmental rating revisions. These graphs present 90% confidence intervals for a t-test whether BHAR is significantly different from zero, where we double cluster standard errors: once by firm and once by rating date. In panel B, for the left graph we regress BHAR on the $\Delta Env. < 0$ *dummy* with the dots indicating the parameter estimate from this regression. This regression includes a full set of control variables, event-date fixed effects and industry fixed effects as in Column (3) of Table 3. Because we only include increases and decreases in the Environmental rating in this regression, the parameter of the $\Delta Env. < 0$ *dummy* is the difference between average BHAR for positive Environmental rating revisions and the average BHAR for negative Environmental rating revisions. The right graph is the same as the left graph, but we run the regression for a pre-event window of 10

Table B.1: Event study analysis

	CAR[-1,1]		CAR[-5,5]		CAR[-10,10]	
	(1)	(2)	(3)	(4)	(5)	(6)
ESG < 0 dummy	−0.061	−0.075	0.021	0.011	−0.062	−0.113
	[0.085]	[0.082]	[0.164]	[0.158]	[0.209]	[0.207]
ESG	0.056*	0.026	0.093*	0.061	0.043	0.024
	[0.030]	[0.027]	[0.054]	[0.052]	[0.084]	[0.080]
Observations	8,111	8,111	8,111	8,111	8,111	8,111
Adjusted R^2	0.040	0.046	0.031	0.033	0.039	0.041
Event date FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	Yes	No	Yes	No	Yes
N firms	2478	2478	2478	2478	2478	2478
N event dates	246	246	246	246	246	246

This table provides the results of an event study analysis in which for each firm-event pair we estimate a market model using estimation periods of 250 trading days ending 50 days before the event date. Abnormal returns for event i and event day t are defined as $AR_{it} = r_{it} - a_i - b_i \times r_{vw,t}$, where a_i and b_i are the estimated model parameters, r_{it} is the firm's return and $r_{vw,t}$ is the CRSP value-weighted market index return on event day t. CAR[-1,1], CAR[-5,5] and CAR[-10,10] indicate the cumulative abnormal returns calculated as the sum of abnormal returns over the event windows [-1,1], [-5,5] and [-10,10], respectively. The sample is based on the main sample used in the BHAR regression analyses ($N = 8,347$), where in case of multiple event days per firm-month, we keep the last available day. We exclude event days on non-trading days, and event days with missing observations in either the estimation window or the event window (or both) and arrive at a sample of $N = 8,111$ firm-event day pairs after including event date fixed effects. Analogous to the BHAR-analyses in Table 3 we regress cumulative abnormal returns on *ESG* $<$ 0 *dummy*, which is an indicator variable equal to one when an event is associated with a decrease in ESG score and equal to zero when the event is associated with an increase in ESG score. We control for the lagged *ESG* score in all models. *Event date FE* indicates the inclusion of indicator variables for event dates. *Industry FE* indicates the inclusion of industry indicator variables based on MSCI-defined industries. *N firms* and *N event dates* indicate the number of distinct firms and event dates respectively. Standard errors are double clustered at the firm and event-date level and are reported in parentheses and ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively.

Table B.2: BHAR Analysis: ΔESG with five quintiles

	MM			DGTW		
	(1)	(2)	(3)	(4)	(5)	(6)
ΔESG_{5q}	0.637***	0.619***	0.605***	0.509**	0.507**	0.571***
	[0.217]	[0.220]	[0.199]	[0.194]	[0.196]	[0.196]
ESG_{5q}	0.654***	0.582**	0.263	0.411**	0.409**	0.255
	[0.244]	[0.232]	[0.205]	[0.187]	[0.189]	[0.190]
Observations	14,284	12,408	8,347	13,574	11,946	8,038
Adjusted R^2	0.023	0.021	0.039	0.007	0.005	0.016
Event date FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	No	Yes	No	No	Yes
Controls	No	Yes	Yes	No	Yes	Yes
N firms	3511	3119	2486	3397	3030	2419
N event dates	78	76	75	78	76	75

This table reports results of estimating Equation 2 in which the dependent variable is six-month buy-and-hold abnormal return (BHAR). Columns (1) to (3) and Columns (4) to (6) indicate specifications using the market model (MM) and characteristics-based benchmarks (DGTW) (Daniel et al., 1997) to calculate BHAR, respectively. Instead of ESG dummy variables, we use the continuous variables ΔESG and the continuous ESG score and transform them into quantile variables ranging from one to five: ΔESG_{5q} and ESG_{5q}, respectively. All variables are defined in Panel A of Appendix Table A.1. Controls are not reported for brevity sake. *Event date FE* indicates the inclusion of indicator variables for event dates. *Industry FE* indicates the inclusion of industry indicator variables based on MSCI-defined industries. *N firms* and *N event dates* indicate the number of distinct firms and event dates respectively. Standard errors are double clustered at the firm and event-date level and are reported in parentheses, with ***, **, * corresponding to the 1%, 5%, and 10% level of significance, respectively.

Table B.3: ΔInstitutional investment with top and bottom 10% excluded

	All institutional investors		Short-term investors		Long-term investors	
	(1)	(2)	(3)	(4)	(5)	(6)
ESG < 0 dummy	−0.037		0.070		−0.074	
	[0.100]		[0.069]		[0.089]	
ESG	−0.000		0.003		−0.027	
	[0.092]		[0.065]		[0.085]	
Environment < 0 dummy		−0.182*		−0.016		−0.185**
		[0.097]		[0.070]		[0.089]
Environment		−0.036		0.124*		−0.118
		[0.102]		[0.071]		[0.098]
Observations	7,667	6,469	7,664	6,467	7,667	6,469
Adjusted R^2	0.570	0.579	0.519	0.527	0.170	0.169
Event date FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	2196	2075	2195	2074	2196	2075
N event quarters	26	26	26	26	26	26

This table reports results of estimating Equation 3 in which the dependent variable is ΔIO instead of ΔIO Indicator, winsorized to exclude the top and bottom 10% of ΔIO to control for outliers. ΔIO is defined as institutional ownership in quarter $t+1$ compared to quarter $t-1$, where quarter t is the rating event quarter. $\Delta Rating < 0$ *dummy* is an indicator variable equal to one for a decrease in ESG score and equal to zero for an increase in ESG score in quarter t compared to quarter $t-1$. The levels of each Rating (*ESG*, *E*, *S* and *G*) are measured in quarter $t-1$ and are included as dummy variables equal to one if above the median and zero otherwise. All control variables are measured in quarter $t-1$ and are defined in Panel C of Appendix Table A.1. Using the fixed classification of Bushee (1998), Short-term investors are defined as transient investors (Columns (3) and (4)), Long-term investors are defined as dedicated investors and quasi-indexers (Columns (5) and (6)) and All institutional investors are Long-term, Short-term and other institutional investors of which the type is not classified (Columns (1) and (2)). *Event date FE* indicates the inclusion of indicator variables for quarterly event dates. *Industry FE* indicates the inclusion of industry indicator variables based on MSCI-defined industries. *N firms* and *N event quarters* indicate the number of distinct firms and quarterly event dates respectively. Standard errors are clustered at the firm level and are reported in parentheses, with ***, **, * corresponding to the 1%, 5%, and 10% level of significance, respectively.

Table B.4: Changes in institutional breadth around event quarters

	All institutional investors		Short-term investors		Long-term investors	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ ESG < 0 dummy	−0.002		0.010		−0.015	
	[0.011]		[0.013]		[0.012]	
ESG	0.001		0.007		−0.009	
	[0.011]		[0.012]		[0.012]	
Δ Environment < 0 dummy		−0.012		0.000		−0.022*
		[0.012]		[0.013]		[0.012]
Environment		−0.000		0.005		−0.015
		[0.012]		[0.013]		[0.013]
Observations	7,507	6,320	7,402	6,247	7,382	6,223
Adjusted R^2	0.145	0.144	0.078	0.078	0.131	0.134
Event date FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N firms	2182	2061	2170	2045	2169	2040
N event quarters	26	26	26	26	25	25

This table reports results of estimating Equation 3 in which the dependent variable is ΔIO Indicator is an indicator equal to one when the breadth of institutional investors increased in quarter $t+1$ compared to quarter $t-1$, and zero when it decreased. Breadth is measured as the number of institutions that hold a stock each quarter, scaled by the total number of institutions in the sample each quarter. $\Delta Rating < 0$ *dummy* is an indicator variable equal to one when for a decrease in ESG score and equal to zero for an increase in ESG score. All variables are defined in Panel C of Appendix Table A.1. Using the fixed classification of Bushee (1998), Short-term investors are defined as transient investors (Columns (3) to (4)), Long-term investors are defined as dedicated investors and quasi-indexers (Columns (5) and (6)) and All institutional investors are Long-term, Short-term and other institutional investors of which the type is not classified (Columns (1) and (2)). *Event date FE* indicates the inclusion of indicator variables for quarterly event dates. *Industry FE* indicates the inclusion of industry indicator variables based on MSCI-defined industries. *N firms* and *N event quarters* indicate the number of distinct firms and quarterly event dates respectively. Standard errors are clustered at the firm level and are reported in parentheses, with ***, **, * corresponding to the 1%, 5%, and 10% level of significance, respectively.