Aleksandra Rzeźnik | Kathleen Weiss Hanley | Loriana Pelizzon

The Salience of ESG Ratings for Stock Pricing: Evidence From (Potentially) Confused Investors

Leibniz Institute for Financial Research SAFE

Sustainable Architecture for Finance in Europe

The Salience of ESG Ratings for Stock Pricing: Evidence From (Potentially) Confused Investors[*]

Aleksandra Rzeźnik[†], Kathleen Weiss Hanley[‡], and Loriana Pelizzon[§]

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Abstract

We exploit the a modification to Sustainanlytics' environmental, social, and governance (ESG) rating methodology, which is subsequently adopted by Morningstar, to study whether ESG ratings are salient for stock pricing. We show that the inversion of the rating scale but not new information leads some investors to make incorrect assessments about the meaning of the change in ESG ratings. They buy (sell) stocks they misconceive as ESG upgraded (downgraded) even when the opposite is true. This trading behavior exerts transitory price pressure on affected stocks. Our paper highlights the importance of ESG ratings for investors and consequently for asset prices.

Keywords: Corporate Social Responsibility, ESG Rating Agencies, Sustainable Investments, Socially responsible investing, ESG, Portfolio choice

JEL Classification: G11, G12, G23, G59, M14, Q5

[†]York University, arz@yorku.ca.
[‡]Lehigh University, kwh315@lehigh.edu.
[§]Leibniz Institute for Financial Research SAFE, Goethe University Frankfurt, Ca' Foscari University of Venice and CEPR, pelizzon@safe-frankfurt.de.

1 Introduction

The Environmental, Social, and Governance (ESG) activities of firms is of increasing importance to regulators and investors.[1] Numerous initiatives are underway to improve the disclosure and monitoring of ESG activities. For example, the U.S. Securities and Exchange Commission is considering ways to create an effective ESG disclosure system.[2] The European Union recently adopted regulations that require financial market participants, such as mutual funds, insurance companies, venture capitalists, and others, to publish a statement on their website describing the policies in place "where they consider principal adverse impacts of investment decisions on sustainability factors, a statement on due diligence policies with respect to those impacts, or where they do not consider adverse impacts of investment decisions on sustainability factors, clear reasons for why they do not do so."[3] The demand for "green" assets, whether by regulation or by choice, has increased reliance on rating agencies to distill information on firms' ESG activities.

In this paper, we show that changes in ESG ratings are salient to investors' decision-making and can impact asset prices using a setting that abstracts away from any change in underlying firm fundamentals. We do so by exploiting a quasi-natural experiment that uses a modification in the methodology for determining ESG ratings by Sustainalytics and its subsequent adoption, one year later in September 2019, by Morningstar and Yahoo! Finance.

The change in the methodology has two main goals. The first is to reassess the unique components of a firm's ESG risk exposure in order to facilitate comparisons across compa-

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[1]In the U.S. Sustainable investments reached \$17.1 trillion at the beginning of 2020, which translates into a 42% increase since 2018 – https://www.ussif.org/blog_home.asp?Display=155. Around the world, the amount could be as high as \$100 trillion – https://www.unpri.org/news-and-press/principles-for-responsible-investment-releases-new-framework-for-signatories-to-take-action-on-the-sustainable-development-goals/5924.article.

[2]See https://www.sec.gov/news/public-statement/coates-esg-disclosure-keeping-pace-031121.

[3]Regulation (EU) 2019/2088 of the European Parliament and of the Council of 27 November 2019. The Principle for Responsible Regulation association counted up to 700 policy interventions since 2020. For further details, see https://www.unpri.org/policy/regulation-database.

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nies that may operate in different sectors. The second goal is to make the interpretation of the ESG Risk rating more logical by inverting the scale. Both the new and the old ratings share the same scale from 0 to 100, but under the old method, *higher* ratings indicate lower ESG risk while under the new method *lower* ratings indicate lower ESG risk. For example, a firm that is considered to be the best in terms of ESG risk would previously been rated closer to 100 but under the new methodology is rated closer to 0.

The inversion of the rating scale results in a decline in the level of the ESG rating for the majority of firms in our sample. This, in turn, leads to an unintended consequence during the transition period: a decline in the ESG rating is perceived to be a "downgrade" and is thus interpreted by some investors as bad news even when it is not. This causes them to rebalance their portfolio in such a way as to impact prices. We show that a one standard deviation decline in the ESG rating translates into a 1.12% decrease in the monthly four-factor abnormal return.

In order to make sure that it is the inversion of the scale and not the reevaluation of ESG risk that is driving our results, we employ two different methods to control for the potential information content of the new ratings methodology that may cause investors to rationally reassess the firm's ESG exposure. In the first, we incorporate two variables that capture the relative change in ESG risk of the firm due to the new methodology. The first variable measures how much a firm's ESG risk ranking changes relative to its peers before and after adoption. The second variable reflects whether the firm's change in rating is accompanied by a reclassification of its ESG risk within Morningstar's ESG Rating Assessment. For example, firms in high ESG risk sectors such as oil and gas may have been highly ranked in their industry under the old methodology but now have a worse ranking when compared to all other firms. The inclusion of either of these measures of new information does not change our findings.[4]

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[4]We have access to Sustainalytics' ESG Risk rating prior to the adoption by Morningstar and Yahoo! Finance. Including the change in the ESG Risk rating over the transition period does not affect our

In our second method, we restrict our sample to firms whose downgrade is not accompanied by a negative change in the firms' actual ESG exposure: firms whose ratings decline but their ESG ranking is the same or better than its peers after the adoption. These firms are unambiguously good (or at least no worse) in terms of the new ESG Risk rating and we would expect either an increase or no change in abnormal returns. Our results, however, for this sample of firms remain quantitatively and qualitatively unchanged. Investors perceive negative changes in ratings as a "downgrade" even when they are not. The combination of an exogenous shock to ESG ratings and investor confusion makes the interpretation of our findings clear; investor preferences for sustainable assets and their reliance on ESG ratings for making investment decisions can have pricing implications.

In our setting, investor preferences are made manifest through confusion, therefore, we expect that prices will eventually converge to rational values when misinformed investors correct their erroneous beliefs. Our empirical findings support this conjecture: the effect on abnormal returns is short-lived. We show that returns adjust to their pre-adoption level within five months by February 2020.

We next examine what type of investor is most likely to be confused by the new methodology and thus, drive the post-adoption abnormal returns. We investigate the trading behavior of four different types of investors: retail, institutional, ESG funds, and short sellers. We predict that investor confusion is more likely to be exhibited by uninformed or retail investors and less likely to be observed in the case of institutional investors.

Retail investors are generally perceived as less sophisticated, uninformed investors, or as noise traders (e.g., Calvet, Campbell, and Sodini, 2007; Barber, Odean, and Zhu, 2006). Using Robinhood data, we find that retail participation is reduced when firms

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results.

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have a large decline in their ESG ratings upon adoption even when these firms either have no change or experience an upgrade in their relative risk ranking. Conversely, they purchase stocks in firms that experience a positive change in their rating.[5]

We show that the new methodology is not accompanied by changes in the holdings of 13F institutions or ESG funds. These investors either do not react because they subscribe to Sustainalytics directly and thus, have been using the new ESG Risk ratings for a year prior to adoption or are savvy enough to understand implications of the change in methodology. The finding that there is no portfolio rebalancing for 13F institutions is not definitive because the reported transactions on Form 13F are only for long positions. Even if institutions believe that the Sustainalytics' rating change itself is uninformative, they may still take advantage of confused investors by shorting the stock.

Indeed, since the adoption of the new methodology could be known in advance, we anticipate that short sellers will take advantage of unsophisticated investors' misinterpretation of the ratings change (Boehmer, Jones, and Zhang, 2008; Engelberg, Reed, and Ringgenberg, 2012; Cohen, Diether, and Malloy, 2007; Diether, Lee, and Werner, 2009; Boehmer, Huszar, and Jordan, 2010). We document that the size of the change in short interest is positively related to the change in ESG ratings. In other words, when confused investors are purchasing, short sellers increase their positions in the expectation that returns will have a subsequent reversal once investors' realize their error. On the other hand, when retail investors are selling, short sellers reduce their positions in order to take advantage of the price pressure on the stock.

We show that the effect of investor confusion about ESG ratings on stock prices is reduced when firms have high institutional holdings and hence, greater market capitalization. This means that the effect we document is in smaller firms (those with less institutional presence) where limits to arbitrage may be binding and the ability of unin-

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[5]Our findings are in contrast to Moss, Naughton, and Wang (2020) who find that the retail investors do not respond to ESG press releases.

formed or retail investors to affect returns is more pronounced.

This study is closely related to Hartzmark and Sussman (2019) who use the implementation of Morningstar's sustainability globes in March 2016 to rate mutual funds. Highly-rated sustainable funds, those with five "globes," experience significant inflows after the introduction of mutual fund sustainability rankings while low-ranked funds, those with one "globe," suffer investors' withdrawals. While investors trading appears to be related to the fund rating, the authors do not find any effect on fund performance. Unlike Hartzmark and Sussman (2019), we investigate the potential consequences of ESG ratings saliency for individual firms. In contrast to their results for mutual funds, we find that investors' ESG preferences have the capacity to exert significant price pressure on individual stocks and by extension, affect the cost of capital.

Our work is complementary to a broader literature investigating the impact of ESG-related risk on asset prices. Both theoretical and empirical papers have examined whether sustainability should be included in a modified CAPM (Merton (1987), Fama and French (2007), Pedersen, Fitzgibbons, and Pomorski (2020), and Pástor, Stambaugh, and Taylor (2020)), specific ESG-related risk factors (Hong and Kacperczyk (2009), Hong, Li, and Xu (2019), Bolton and Kacperczyk (2021) and Hsu, Li, and Tsou (2020)), and on drivers of investors preferences for sustainable investments (Bialkowski and Starks (2016), Barber, Morse, and Yasuda (2021), Riedl and Smeets (2017), Alok, Kumar, and Wermers (2020), Krueger, Sautner, and Starks (2020), and Ilhan, Sautner, and Vilkov (2021)).

Unlike those studies, however, our empirical setup allows us to disentangle the effect on asset prices of investor preferences for sustainability that is devoid of any change in either the firm's cash flows or ESG activities. We provide empirical support for Pedersen et al.'s (2020) proposed ESG-adjusted capital asset pricing model by showing that changes to a firm's perceived ESG performance may cause investor to trade and exert short-term price pressure on affected stocks. Our findings show the importance of "Type-M" investors,

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those investors that use ESG information and have preference for good ESG scores on asset prices.

Furthermore, our findings support the theoretical predictions of Goldstein, Kopytov, Shen, and Xiang (2021) who present a model in which firms have a monetary (cash flow) and non-monetary (e.g. carbon emissions) component and information is processed differently for each of these components depending on the investor's preference for sustainability. Traditional investors value only the monetary component while "green" investors value both the non-monetary component and the monetary component If ESG ratings are a proxy for the non-monetary component and retail investors are more likely to be green investors, our confirm that "differential use of information by traditional and green investors have several profound impacts on the stock price."

Our setting is unique in that we are using investor confusion to shed light on the salience of ESG ratings. We are not, however, the first to find that investor confusion can affect asset prices. Rashes (2001) notes that investors may confuse one ticker symbol for another and this mix up causes comovement among similar firms. Using an experimental setting, Kirchler, Huber, and Stöckl (2012) find that investor confusion about firms' fundamental values can create bubbles. Moreover, our results confirm Hirshleifer (2001) who states that "misperception that derives from a fundamental human psychological trait can remain important for asset prices. . . ."

Finally, we contribute to the literature on information intermediaries – in particular, rating agencies. When rating agencies incorporate fundamental information, they allow investors to make better investment decisions. Investors' blind reliance on ratings, however, can lead them astray, as evidenced by investors' use of credit ratings during the financial crisis. Many studies highlight potential problems in these ratings.[6] Unlike the components of credit ratings, different ESG rating providers incorporate and weight com-

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[6]Ashcraft (2010), Biglaiser (1993), Lizzeri (1999), Griffin and Tang (2011), and Bolton, Freixas, and Shapiro (2012) to name a few. For a review of the literature see Sangiorgi and Spatt (2017).

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ponents of sustainability differently making ESG ratings oftentimes incompatible (Chatterji, Durand, Levine, and Touboul, 2016; Chatterji, Levine, and Toffel, 2009; Semenova and Hassel, 2015; Dorfleitner, Halbritter, and Nguyen, 2015; Delmas and Blass, 2010; Berg, Koelbel, and Rigobon, 2019; Billio, Costola, Hristova, Latino, and Pelizzon, 2020; Berg, Fabisik, and Sautner, 2020), which increases the possibility of investor confusion.[7] Despite this fact, investors appear to value the ratings on sustainability for investment decisions (Hartzmark and Sussman, 2019; Cao, Titman, Zhan, and Zhang, 2020). Thus, our results suggest that blind reliance on these ratings without independent information production might lead investors to make sub-optimal choices (Malenko and Shen, 2016).

2   ESG Rating Methodology Change

Through a third-party vendor (Sustainalytics), Morningstar has provided sustainability (ESG) ratings for over 40,000 mutual funds and 75,000 companies worldwide since 2016 and 2018, respectively.[8] In September 2018, Sustainalytics launched its new enhanced ESG Risk rating.[9] Morningstar's adoption of the new Sustainalytics ESG Risk rating was delayed until October 2019 when it first disclosed the September 2019 ESG Risk ratings. Sustainalytics ESG ratings are also publicly available on Yahoo! Finance's website and an examination of the time-series of ESG ratings on Morningstar and Yahoo! Finance indicates that both platforms adopted the new methodology at the same time.[10] Figure

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[7]Regulators have also raised concerns about the challenges and importance of regulating ESG ratings. See https://www.esma.europa.eu/press-news/esma-news/esma-calls-legislative-action-esg-ratings-and-assessment-tools and https://www.sec.gov/oiea/investor-alerts-and-bulletins/environmental-social-and-governance-esg-funds-investor-bulletin.

[8]Morningstar acquired a 40% stake in Sustainalytics in 2017 and purchased the remaining 60% in April 2020.

[9]Sustainalytics still produces the old ESG rating for legacy clients and continued to provide it to clients during the transition period for adopters (https://www.sustainalytics.com/sustainable-finance/2019/04/26/webinar-understanding-esg-risk-ratings-2/).

[10]Yahoo! Finance has been providing sustainability ratings from Sustainalytics for more than 2,000 companies since February 1, 2018 (https://www.sustainalytics.com/esg-investing-news/yahoo-finance-adds-sustainability-scores/).

1 shows the time series of Sustainalytics ESG ratings methodologies and the subsequent adoption by Morningstar and Yahoo! Finance.[11]

Under the old ESG rating, a company was evaluated with respect to "its general preparedness to address its ESG risks and opportunities on an industry-relative basis."[12] The old ESG rating was on a scale from 0 to 100 and a firm with a high ESG rating was considered to be a leader in managing ESG risks within an industry. According to Morningstar, "To a large degree, it (the old ESG rating) was focused only on what is called "managed risk" without regard to how much ESG risk exposure a company faced in the first place."[13] One drawback to the old ESG rating was the inability of investors to compare companies' ESG scores across industries.

To address the problem of comparability and to update the score to better reflect ESG risk exposure, Sustainalytics introduced a new rating, "ESG Risk," that first identifies the material ESG risks in each industry. For example, "in the integrated oil and gas industry, greenhouse-gas emissions, other emissions, effluents and waste from operations, management of human capital, community relations, and bribery and corruption issues have been identified by Sustainalytics as the key material ESG risks. By contrast, in the enterprise and infrastructure software industry, the most important material ESG risks include data privacy and security issues, management of human capital, and corporate governance."[14] Thus, companies in different industries may have a distinct set of material ESG risks and each of these risks have a unique weighting depending on their importance. In addition, the ESG Risk rating then incorporates any risk mitigation activities by the firm and determines the ESG Risk rating based on the unmanaged ESG risk exposure.[15]

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[11]Note the name changed on Morningstar and Yahoo! Finance from "ESG" ratings to "ESG Risk" ratings in October 2019.

[12]https://www.morningstar.com/articles/954595/enhancement-to-sustainability-rating-emphasizes-material-esg-risk.

[13]Ibid

[14]Ibid

[15]Note that the new ESG Risk rating eliminates the complicated calculation that included a deduction for a company's involvement in ESG-related controversies under the old rat-

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Finally, all ESG risks are standardized so they are on the same scale across all economic sectors.[16]

Sustainalytics implemented one additional change to the ratings, in order to make their interpretation easier, and this change is independent of any information regarding the firm's ESG risk exposure. Although the new ESG Risk rating is still between 0 and 100, the scale is inverted. After the methodology change, a firm with a low exposure to ESG risk is given a *low* ESG Risk rating, rather than a high ESG rating as under the prior rating regime. Morningstar provides an example of how the methodology changes the interpretation of the ESG risk exposure:[17]

> For example, in the older company ratings, Royal Dutch Shell and Microsoft both scored 75 out of 100 within their industry groups, ranking in the best quartile among their peers. (Higher scores were better in this version.) These were good scores, indicating the two companies were among the best-in-class ESG performers in their respective peer groups. At the portfolio level, assuming their position size was the same, they would have had the same impact on the Portfolio Sustainability Score.
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> In the new company ESG Risk rating, by contrast, Royal Dutch Shell's score is 34, an indicator of High ESG Risk, while Microsoft's score is 13.8, an indicator of Low ESG Risk. While both companies do reasonably well managing the material ESG risks they face relative to their peers–one reason why their old scores were similar–Royal Dutch Shell operates in an industry that carries far more ESG risk exposure. As a result, its ESG Risk rating has a much more negative impact on the Portfolio Sustainability Score compared with Microsoft's rating.
>
> That said, the new rating remains sensitive to best-in-class comparisons. For example, a portfolio that holds an oil company would be better off with exposure to Royal Dutch Shell, with its ESG Risk rating of 34, than with exposure to ExxonMobil, which has an ESG Risk rating of 40.5.

ing – https://www.morningstar.com/articles/954595/enhancement-to-sustainability-rating-emphasizes-material-esg-risk.

[16]This discussion only briefly describes a more complicated methodology as we do not focus on the specific information content of the new ratings. For more information on how the ESG Risk ratings are calculated, see https://globalaccess-tutorials.s3.amazonaws.com/ESG%20Risk%20Rating_Methodology%20document.pdf.

[17]https://www.morningstar.com/articles/954595/enhancement-to-sustainability-rating-emphasizes-material-esg-risk.

The new methodology and the subsequent change in the ESG rating may create some confusion for unsophisticated investors, at least in the short-term. If some investors incorporate the ESG rating in their portfolio but do not understand that the scoring scale has been inverted, then they may make incorrect investment decisions. Thus, we predict that less sophisticated investors, those that are most likely to rely on information from readily available sources such as Morningstar and Yahoo! Finance, are expected to simply respond to the change in the rating without understanding the specific details of the new rating methodology. In other words, retail investors may be unaware of the components of the rating change and interpret a reduction in the ESG rating as a "downgrade" or worse score, and an increase as an "upgrade" or better score, even when this may not be the case. If investors value ESG ratings, then this confusion should result in purchases of firms with an increase in their ESG rating and sales of firms with a decrease in their ESG rating. These actions are expected to affect asset prices and their effect is not due to any new fundamental information regarding the company but simply the salience of ESG ratings.

Institutional investors, however, are expected to respond to the new methodology as intended (e.g., purchasing firms with better ratings) or not at all because they either have access to the new Sustainability Risk ratings prior to October 2019 so the adoption by Morningstar and Yahoo! Finance has already been incorporated into their portfolio decisions and/or are able to better understand the construction and information content of the new ESG Risk rating.

Finally, since the announcement of the ratings change was made by Morningstar in July 2019, we predict that short sellers may take advantage of the possibility of unsophisticated investor misinterpretation. If so, then we expect an increase (a decrease) in short selling for firms that experience a decline (increase) in their ESG ratings.

As we note above, the change in the ESG rating under the new methodology could

contain new information on the ESG risk exposure of the firm that may be relevant to investors. It is important, therefore, to isolate this new information in order to test whether some investors misinterpret the nature of the rating change rather than rationally respond to a change in ESG risk. We do this in several ways that will be discussed in more detail later in the next section. First, we control for any change in the relative ranking of the firm in terms of ESG scores. As noted in the example above, Microsoft's ranking among all firms is unlikely to change after the adoption of the new methodology. In contrast, Royal Dutch Shell's ranking is likely to worsen because it was highly ranked in its industry before but is considered to have more ESG risk exposure relative to other firms after.

Second, we control for whether the firm had a change in its Morningstar ESG Rating Assessment, which is similar to the globe rating used in the Morningstar Sustainability Rating for funds (Hartzmark and Sussman (2019) and hereafter referred to as "Morningstar Classification"). Finally, during the quarter preceding the rating change, a firm may have an ESG event that could affect its rating. For example, an oil and gas company might experience an oil spill in September 2019 that could change its ESG Risk rating but the effect of this event on ESG exposure on ratings would be difficult to determine as it coincides with the adoption of the new ESG Risk rating by Morningstar and Yahoo! Finance. Since we have the firm's Sustainalytics ESG Risk rating during the pre-adoption period, we can control for any actual changes in the ESG Risk rating around this time that might reflect a change in a firm's ESG exposure or activities.

3 Data and Variable Construction

We collect ESG ratings from two sources for all companies trading on the NYSE, NAS-DAQ, and Amex exchanges between June 2019 and January 2020. First, we obtain both the old ESG rating and the new ESG Risk ratings from Morningstar Direct and confirm

that the same ratings are reported on Yahoo! Finance. Second, we collect the new ESG Risk ratings during the transition period (June 2019 to September 2019) from Sustainalytics.

Morningstar reports Sustainalytics monthly ESG ratings at the beginning of the following month, therefore, the first time the new September ESG Risk rating is available is at the beginning of October 2019. Thus, we define an indicator variable, POST_t, equal to one if the month is equal to or later than October 2019 to capture the post-adoption period of the new ESG Risk rating.

We define four measures that capture the change in firm's ESG rating as reported by Morningstar and Yahoo! Finance. First, ΔESG_i is defined as the difference in stock i's ESG rating between October 2019 (the first month when the new ESG Risk rating is available at Morningstar and Yahoo! Finance) and September 2019 (the last month before the adoption of the new methodology). Second, $\Delta\overline{\text{ESG}}_i$ is the difference between the average new ESG Risk rating in the three months (October-December 2019) after the adoption and the average old ESG rating in the three months (July-September 2019) before the adoption of the new methodology by Morningstar and Yahoo! Finance.

Figure 2 shows the distribution of the average old ESG rating in the three months (July-September 2019) before the adoption in Panel A and the average new ESG Risk rating in the three months (October-December 2019) after the adoption of the new methodology by Morningstar and Yahoo! Finance in Panel B. The inversion in the ratings is evident from the two graphs. In Panel A, most firms have an old average ESG rating between 40 and 80 while in Panel B, most firms have a new average ESG Risk rating between 10 and 60. In Table 1, Panel A, the average ESG rating was 50.51 and after the average ESG Risk rating is 30.38, translating into an overall average change of -20.17 (Panel B). Further evidence on the impact of the new methodology on the change in numerical ratings is in Figure 3. This figure plots the difference between the two ratings,

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$\Delta\overline{\text{ESG}}_i$ and as can be seen in the figure, most firms experience a decline in their rating.

The last measure of the change in a firm's ESG ratings are two indicator variables that isolate the direction of the change in rating. The first indicator variable is ESG PSEUDO- DOWNGRADE$_i$ that is equal to one if stock i's change in its average ESG rating is in the lowest quartile of the $\Delta\overline{\text{ESG}}_i$ distribution. Firms that have a value of one for ESG PSEUDO-DOWNGRADE$_i$ have the largest negative change in their ESG rating. For example, Microsoft has a value of one for this variable because it experienced a large change in its ESG rating from 75 to 13.8. In other words, firms that have a ESG PSEUDO-DOWNGRADE$_i$ equal to one generally have very low ESG risk both before and after the adoption. Moreover, the decline in ESG rating for firms that we classify as ESG PSEUDO-DOWNGRADED is not an indication of worsened ESG exposure. Indeed, we find that most firms in this category, 86%, are in the same or better Morningstar Classification after the change.

The second indicator variable is similar to the first but captures whether or not the firm has been "upgraded." We define ESG PSEUDO-UPGRADE$_i$ as an indicator variable equal to one if stock i's pre-adoption ESG rating is lower than its post-adoption ESG Risk rating. Unlike the previous downgrade indicator variable, we do not restrict an observation to be in any particular quartile because only 6% of the firms in our sample experienced an increase in their ESG ratings.

The change in ESG rating reflects not only the inversion of the scale, but also potential new information on the relative ESG risk of the firm. This new information may cause some investors to rationally reassess the ESG risk of the firm and trade accordingly. To control for change in a firm's ESG risk exposure due to a change in the firm's underlying fundamentals, we include three additional variables to confirm the robustness of our results. The first variable is the change in the relative ranking of the firm before and after adoption. To construct this variable, we rank each firm from 1 to 2,310 (the number

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of firms in our sample) where one is the firm with the *best* ESG rating. In the pre-adoption period, the number one firm would have the highest ESG rating and in the post-adoption period, the number one firm would have the lowest ESG Risk rating. Ties are given the same ranking and the next ranking reflects the number of ties in the previous ranking. We define ΔESG $\textsc{Rank}_i$ as the difference in the stock's relative ranking, scaled by the number of firms, in the first month (October) after the adoption and in the last month (September) before the adoption.

Panel A of Figure 5 shows the distribution of the change in ranking of the firms around the adoption of the new methodology. Most of the firms have little change in their ranking as the distribution is centered on zero (also confirmed in Panel B of Table 1) but there are firms who move rankings by more than 25% in either direction.

The second variable that incorporates a potential change in the firm's actual ESG risk exposure is the change in the Morningstar Classification. At the time of the adoption of the new methodology, Morningstar also changed the definition of each "globe" in the classification but kept the same five-point scale. Table 2 Panel A defines both the old and the new categories. Under the old ESG rating methodology, firms are assigned to a classification based upon their ranking in their industry. Under the new ESG Risk rating methodology, firms are assigned to a classification based upon the level of their ESG Risk rating. Because there are the same number of categories under both rating regimes, we define the classifications numerically from 1 to 5 with 1 being the best ESG category and 5 the worst (to mimic our ranking variable).

Table 2 presents the definition of each category and the transition matrix of each firm's classification. Fewer firms are classified as having the best ESG risk after adoption (9 are classified as Negligible or Low) than before adoption (16 are classified as Industry Leaders). A number of firms move up in their classification after the new methodology adoption. For example, 265 firms that were in the Average Performer category pre-

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adoption are now in the Low category post-adoption. The majority of firms pre-adoption are considered average performers (57%) but post-adoption this number drops to only 33%. In the worst ESG categories pre-adoption, Underperformer and Industry Laggard, a number of firms go down a notch or two in classifications, i.e., their classification improves. Overall, firms below the diagonal improve their ranking (31%) and firms above the diagonal worsen their ranking (28%), and those on diagonal do not change their classification (41%).

Panel B of Figure 5 shows the percentage of firms that move up or down a category. As can be seen in the figure, the majority of firms remain in their original classification, but many move up or down one or two notches. Panel B of Table 1 shows that the median change in the Morningstar Classification is zero. In order to capture changes in a firm's Morningstar Classification, we construct CLASSIFICATION UPGRADE$_i$ (CLASSIFICATION DOWNGRADE$_i$), an indicator variable equal to one if the stock has an increase (decrease) in its Morningstar Classification after the adoption of the new methodology.

The third variable is designed to capture the change in actual ESG risk over the two transition months. For example, a firm could experience an ESG event or implement new policies in September 2019 that could have affected its ESG rating for October irrespective of the methodology change. Although Morningstar and Yahoo! Finance adopted the new ESG Risk rating in October 2019, it has been available from Sustainalytics since September 2018. $\Delta\overline{\text{SUSTAINALYTICS RATING}}_i$ measures the change in a firm's ESG Risk rating between October 2019 and September 2019.

Panel A of Figure 4 shows the change in the Sustainalytics ESG Risk rating before and after adoption. As shown in the figure and Panel B of Table 1, most firms do not experience any meaningful change in their ESG Risk rating during the transition period as most of the distribution is centered at zero. This figure also shows that

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$\Delta\overline{\text{Sustainalytics Rating}}_i$ is almost zero (between -5 and +5) for 98.6% of stocks.

Panel C of Table 1 presents the correlation matrix among our variables of interest. Both ΔESG Rank$_i$ and ΔMorningstar Classification are highly correlated. Thus, we do not include both of them in the same specification. Otherwise, the correlation between ΔESG$_i$ and all other variables is generally low.

We are interested in whether investors' perception regarding the new ESG Risk ratings affects their trading behavior. Therefore, we collect daily returns, prices, and shares outstanding from the Center for Research in Security Prices (CRSP). In order to merge the ESG ratings data with the CRSP stock database, we convert the ISINs of U.S. companies (starting with 'US') from Morningstar to 8-digit CUSIPs. We eliminate small 'penny' stocks by requiring that the stock price, at the end of the beginning of the sample period, be greater than \$1.

In order to compute abnormal returns, we download information on daily and monthly risk factors for Fama and French (1993) three- and Carhart (1997) four-factor model from Kenneth French's website. We compute abnormal returns as follows. Using daily stock excess returns for each firm, we estimate the loadings on the risk factors using 12-month rolling-window regressions beginning in September 2018 and calculate expected returns. We compute abnormal returns in the following month by subtracting the firm's expected return from its actual return.[18]

Some types of investors are more likely to be confused by the change in ESG rating methodology than others. Therefore, we collect information on the participation or holdings of four different types of investors: retail, institutional, ESG funds, and short sellers. We download data on the number of retail investors holding a given stock from the Robinhood (Robintrack.net) website. Robintrack provides hourly intra-day informa-

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[18]Our results are robust to using two sub-periods to estimate loadings on risk factors: from July 2018 to June 2019 (for the pre-adoption period) and from October 2018 to September 2019 (for the post-adoption period).

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tion on the number of investors holding each stock.[19] We then average the reported number of retail investors holding the stock over the day and aggregate the daily means into monthly averages.[20] Following Coval and Stafford (2007), we adjust retail investors' participation for the size of the company by dividing the mean number of Robinhood investors holding a stock i in month t, $\# \text{RETAIL}_{i,t}$, by the average dollar trading volume from April to June 2019 (one quarter before the transition period).[21] Finally, we merge Robinhood data to the CRSP dataset using a stock's ticker symbol.

We collect quarterly 13F institutional ownership from Thomson Reuters and aggregate holdings across all 13F institutional investors at a stock level. For the purpose of our analysis, our data consists of 13F long positions for the two quarters surrounding the adoption of the new ESG Risk rating methodology: at the end of September 2019 (the last quarter-end before the old ESG rating ends being reported) and December 2019 (the first quarter-end after the new ESG Risk rating begins being reported). We compute 13F $\text{OWNERSHIP}_{i,t}$ by dividing the aggregated position of a stock held by all 13F institutions at the end of a quarter by the number of shares outstanding.

Using textual analysis on key words, we classify any U.S. mutual funds actively investing in U.S. equities in the Morningstar database as an ESG fund if it has the following strings in its name: esg, sust, impact, rspnb, env, scl, eco (but not "econ"), social, and/or green. The sample of 58 ESG funds are listed in Appendix A. For each ESG fund, we obtain data from Morningstar on the number of shares each ESG mutual fund holds at the end of each quarter surrounding the adoption of the new methodology (September 2019 and December 2019). We do not collect intra-quarter information for two reasons. First, the data is more widely available at the end of the quarter than in months within

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[19]In August 2020, Robinhood closed down the API for Robintrack making data available only to this date.

[20]Our results remain unchanged if we use the median number of investors instead.

[21]Dividing the number of retail investors by the market capitalization in a previous quarter yields very similar results.

the quarter. Second, it makes the determination of the holdings of ESG funds analogous to the approach used for 13F institutions. We compute ESG FUND OWNERSHIP$_{i,t}$ by dividing the aggregated position of ESG funds in a firm at the end of a quarter by the number of shares outstanding.

Last, we collect information from Compustat – Capital IQ on the end of the month short interest for NYSE, Amex, and NASDAQ firms for the six month period around the introduction of the new methodology. We then average short interest during the three months prior to the adoption from July 2019 to September 2019 and during the three months after the adoption from October 2019 to December 2019.[22] We construct SHORT INTEREST$_{i,t}$ by dividing the average number of shares sold short during the pre- or post-adoption period by the number of shares outstanding during the same period.

Table 1 reports summary statistics for the firms before (July 2019 to September 2019) and after the Morningstar ESG rating methodology change (October 2019 to December 2019). Consistent with Figures 2 and 3, the average ESG rating declines from 50.51 to 30.38. Mean returns change depending on whether we use a one-, three-, or four-factor model. Abnormal returns increase over the sample period when estimated with a one-factor model, and decrease when estimated with a three- or four-factor model. Median returns exhibit declines from the pre-adoption to the post-adoption period.

The mean number of investors on the Robinhood platform holding a stock increases slightly in the periods surrounding the introduction of the new ESG Risk ratings. In the pre-adoption period, there are approximately 2,750 retail investors in a given stock and in the post-adoption there are 2,920. However, the median number of investors is much smaller, approximately a tenth the size of the mean. 13F institutional holdings are roughly similar pre- and post-adoption (approximately 52% of shares outstanding). ESG Funds hold 0.07% of shares outstanding. On average, around 5.5% of shares outstanding

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[22]We ignore the short interest reported in the middle of the month, however our results are robust to its inclusion in the average short interest.

are shorted and this number is similar across the two time periods.

4   Empirical Results

Our empirical strategy is to test the differences in abnormal returns and ownership surrounding the adoption of the new ESG Risk rating by Morningstar and Yahoo! Finance. If ESG ratings are salient to investors but some investors are unsophisticated, the change in methodology may result in misinterpretation about its meaning. In other words, investors who rely on the ratings available through Morningstar and Yahoo! Finance to provide them with information about a firm's ESG exposure but who are unlikely to do their own due diligence, may mistakenly interpret the inversion of the rating scale in the wrong way. In this case, we expect that retail investors, who are assumed to be otherwise uninformed, will interpret a decline in the ESG rating after adoption as bad news and an increase as good news even when this is not the case.

More sophisticated and informed investors, such as 13F institutions and ESG funds will either be aware of the implications of the change or will have already previously incorporated the change through their subscription to Sustainalytics. Finally, short sellers, who are also informed, may take advantage of the uninformed investors confusion and trade accordingly. Therefore, if enough investors are confused and rebalance their portfolio based on their confusion, then we expect that abnormal returns will be negative when the rating declines and positive when the rating increases even after controlling for any new information that the change in rating may contain. Moreover, we predict that this effect will be primarily driven by the changes in participation by uninformed or retail investors and holdings of short sellers, but not by the change in holdings of institutional investors such as those that report on Form 13F or funds whose primary objective is sustainable investing.

4.1 Change in abnormal returns

We begin our analysis by examining the effect of the ESG rating methodology change on the firm's abnormal returns. We estimate the following difference-in-differences specification:

$$\text{ARET}_{i,t} \;=\; \gamma_0 + \gamma_1 \Delta \text{ESG}_i \times \text{POST}_t + \text{D}_i + \text{D}_t + \varepsilon_{i,t}, \qquad (1)$$

where $\text{ARET}_{i,t}$ is stock i's abnormal return in month t computed with either a single-, three-, or four-factor model. ΔESG_i captures stock i's exposure to the change in the firm's rating due to the adoption by Morningstar and Yahoo! Finance of the new Sustainalytics ESG Risk rating. We measure the change in the ESG rating in four ways: as the change between September 2019 and October 2019 (calculated as the difference between a firm's ESG Risk rating in October 2019 and its ESG rating in September 2019), ΔESG_i, and as the average change over three month periods after and three months before the adoption, $\Delta \overline{\text{ESG}}_i$. We also use two indicator variables to capture the direction of the ESG rating change: ESG PSEUDO-DOWNGRADE$_i$ and ESG PSEUDO-UPGRADE$_i$. D_i and D_t represent firm and month fixed effects. Standard errors are clustered at a firm level.[23]

If our conjectures about the effect of investor confusion are correct, then we expect the coefficient on the interaction terms that include our measures of ESG rating changes to be positive and significant, i.e., a decline (increase) in ΔESG_i would induce investors to sell (buy) the stock causing negative (positive) abnormal returns from October 2019 onward. We report the regression estimates of equation (1) in Table 3. Panel A presents the baseline regression. Single-factor abnormal returns are presented in columns (1) to (4), three-factor abnormal returns are presented in columns (5) to (8), and in the last

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[23]Our time-series consists of only six months around the methodology adoption. According to Angrist and Pischke (2008), six clusters is not enough for the standard cluster adjustment. See, Chapter 8.2.3 'Fewer than 42 Clusters' of *Mostly Harmless Econometrics* for more details.

four columns, we show Carhart (1997) four-factor abnormal returns.

The coefficient estimates on the interaction terms, $\Delta \text{ESG}_i \times \text{POST}_t$ and $\Delta \overline{\text{ESG}}_i \times \text{POST}_t$, are indeed positive and highly statistically significant in all specifications, regardless of how abnormal returns are constructed. This implies that firms that have greater declines (increases) in their new ESG Risk rating relative to their old ESG rating, experience more negative (positive) abnormal returns after adoption. In terms of economic significance, a one standard deviation decrease in firm's ESG rating translates into more than 1 percentage point drop in monthly abnormal return regardless of the return model employed.

To further understand the relationship between the change in the ESG rating and abnormal returns, we investigate whether abnormal returns are differentially impacted by firms that experience large ESG rating declines, PSEUDO-ESG DOWNGRADE$_i$ and firms that experience an increase in their rating, ESG PSEUDO-UPGRADE$_i$. In columns (3), (7), and (11), we compare the average abnormal returns of firms with very large negative changes in their ESG ratings to the abnormal returns of all other firms. The coefficient on the interaction term, ESG PSEUDO-DOWNGRADE$_i \times \text{POST}_t$, is negative and statistically significant indicating that returns are lower for firms that have very large declines in the ESG ratings compared to all other firms. In economic terms, this translates to a decrease of between 1% and 2% monthly returns depending on the specification. As noted previously, the majority of the firms that have a value of one for DOWNGRADE$_i$ also do not experience any change in their Morningstar Classification. This is preliminary evidence that the decline in abnormal returns we document is most likely due to a misinterpretation in the meaning of the ratings change and is unlikely to be driven by investors rationally trading on new information, i.e., it is evidence of the salience of ESG ratings on stock prices.

In columns (4), (8), and (12), we include the ESG PSEUDO-UPGRADE$_i \times \text{POST}_t$ to

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the specification. We find that this interaction term is positive (it ranges between 3.215% and 4.340%) and statistically significant indicating that firms that experience an increase in their ESG ratings have higher abnormal returns after adoption than firms that do not. The coefficient on PSEUDO-DOWNGRADE$_i \times$ POST$_t$ remains negative and highly statistically significant. To better understand the relationship between the change in ESG rating and abnormal returns, we use a semi-parametric regression as in Goldstein, Jiang, and Ng (2017) where the relationship between ESG ratings and abnormal returns is allowed to assume a flexible function form. The regression specification has as the dependent variable, the firm's change in its single-factor abnormal return and as the independent variable, the demeaned change in a firm's average ESG rating after adoption. Figure 6 presents the outcome of this analysis. The orange horizontal dashed line represents the zero change in a firm's abnormal return while the vertical dashed line represents the mean change in ESG rating. The shaded area represents the 95% confidence interval.

It is evident from the graph that the change in a firm's abnormal returns is associated with a corresponding change in ESG rating relative to the mean. The change in abnormal returns is declining as the change in ESG rating becomes more negative and is increasing as the change in ESG rating becomes more positive. These results suggest that investors who value ESG ratings in their investment decision have an impact on stock returns even when they may incorrectly assess the meaning of the change in the firm's ESG risk exposure. Next, we strengthen our argument that confusion is driving the results by examining both the impact of potential new information on returns as well as restricting the sample to only those firms for which the interpretation of the change is unambiguous.

4.1.1 Effect of new information on abnormal returns

In order to disentangle the inversion of the scale from new information about a firm's ESG risk exposure conveyed by the change in methodology, we control for two possible types

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of new information. The first is the possibility that an ESG event may occur during the transition from the old ESG rating to the new ESG Risk rating. Using the same specifications as in Panel A of Table 3, we add $\Delta\overline{\text{SUSTAINALYTICS RATING}}_i$, the change in the Sustainalytics Risk rating over the transition period, as an independent variable in Panels B and C of the table.

We also incorporate additional information that is generated by virtue of the new Sustainalytics ratings methodology on the change in the relative ESG risk of the firm by controlling for $\Delta\text{ESG RANK}_i$ in Panel B, which is the difference in the stock's relative ESG Risk ranking among all other firms and CLASSIFICATION UPGRADE$_i$ (CLASSIFICATION DOWNGRADE$_i$) in Panel C, which is an indicator variable equal to one if the firm becomes less (more) ESG risky according to the Morningstar Classification after the adoption of the new methodology.

In Panel B of Table 3, the coefficient of $\Delta\overline{\text{SUSTAINALYTICS RATING}}_i$ is never significant indicating that a change in the Sustainalytics ESG Risk rating from October 2019 to September 2019 does not impact returns. In other words, most firms do not experience an ESG event that could affect investors' trading behavior and their impact on stock returns.

The coefficient of the change in the relative ranking of the firm, $\Delta\text{ESG RANK}_i$, is marginally significant in columns (1)-(4) where the dependent variable is the single-factor abnormal return and the sign is in the correct direction. Abnormal returns are higher if the firm's rank gets better (lower). The coefficient on this variable is insignificant in all other remaining columns when additional factors are included in the abnormal return model. More importantly, the inclusion of these variables does not change the overall significance or the size of the coefficients on any of our main independent variables from Panel A or the level of the R^2.

A similar conclusion can be drawn from Panel C of Table 3. This panel includes

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whether the firm experiences a downgrade or an upgrade in its Morningstar Classification. The coefficients on the Morningstar Classification upgrade variable are always insignificant and remain generally insignificant for the Morningstar Classification downgrade variable. As with the prior panel, the statistical significance of the change in ESG ratings variables and the R^2 of the specifications remain unaffected compared to Panel A. Thus, we conclude that both Panels B and C support our assumption that the relationship between the change in ESG rating after the adoption of the new methodology and subsequent abnormal returns is due to investor misinterpretation and not to new information about the firm's ESG risk exposure.

Finally, we provide further confirmation that investor misinterpretation is the likely driver of our results in Table 4. This table replicates our baseline analysis but restricts the sample to firms whose interpretation of the ratings change is clear. We use a subsample of firms that experience a decline in their ESG ratings but have either no corresponding change or an improvement in their relative sustainability ranking.[24] In other words, this subsample consists of firms similarly or better ranked under the new ratings regime as under the old ratings regime. Thus, we exclude the possibility that an informed investor would view these firms as having been correctly downgraded in terms of ESG ratings after the adoption and therefore, be motivated to sell the security. Approximately 50% of the firms in our sample meet these criteria.

Uninformed investors, however, will simply look to the ratings change without understanding the implications or doing due diligence. If our results are driven by the misperception of unsophisticated investors that a firm's ESG risk exposure has increased when its rating declines, then our results should remain the same when we restrict the sample to these firms. Table 4 presents the results for this set of firms and they remain similar to the results for the full sample. The coefficients of ΔESG_i and the correspond-

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[24]Our results are robust to restricting the sample of firms with negative changes in their ESG ranking and also have no change or an upgrade in their Morningstar Classification.

ing R^2 are relatively similar to Panel A of Table 3. As further evidence that investors are confused by the new rating methodology, the best firms in terms of ESG risk exposure, those in the lowest quartile of changes in ESG rating, continue to experience negative abnormal returns. We find that the coefficient on ESG PSEUDO-DOWNGRADE$_i$ × POST$_t$ is negative and significant. (Note there is no ESG PSEUDO-UPGRADE$_i$ by construction.) Overall, these results highlight the importance of ESG ratings for investors and the potential for investors' misinterpretation of these ratings to have a significant impact on firms' abnormal returns.

4.1.2 The dynamics of abnormal returns

The findings of the previous section indicate that investor reliance on ESG ratings and their confusion about the new methodology impacts stock prices. This impact, however, should be short-lived and ultimately reversed as investors recognize their error and reverse their positions and/or market forces correct it. To test whether this is the case, we estimate a dynamic version of the regression equation (1) as follows (Célerier and Matray, 2019):

$$\text{ARET}_{i,t} \;=\; \gamma_0 + \sum_{e=-4,\, e\neq-1}^{5} \gamma_e \Delta\text{ESG PSEUDO-DOWNGRADE}_i \times \text{D}(e)_t + \text{D}_i + \text{D}_t + \varepsilon_{i,t}, \;(2)$$

where $\text{ARET}_{i,t}$ is the abnormal four-factor monthly return and $\text{D}(e)_t$ is equal to one exactly e periods after (or before if e is negative) the implementation of the new ESG rating methodology. We use September 2019 as the reference month. D_i and D_t denote stock and year-month fixed effects and standard errors are clustered by firm. The main coefficient of interest is γ_e, that captures the differential effect over time for firms that experience the most severe decline in the value of their ESG rating (treated firms where ESG PSEUDO-DOWNGRADE=1), against those that have less severe declines (control firms where ESG PSEUDO-DOWNGRADE=0). We expect that the difference in abnormal

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returns will become more negative after the adoption as investor confusion is greatest for firms with the largest declines in their ESG rating. The difference in returns will most likely reverse once confused investors become informed about the implications of the new methodology or arbitrageurs eliminate the effect.

Figure 7 plots the γ_e coefficients together with the 95% confidence intervals. In the months prior to the adoption of the new methodology, the two types of firms do not have statistically significant differences in their abnormal returns relative to September 2019. Once Morningstar and Yahoo! Finance begin disclosing the new ESG Risk ratings in October, firms with the largest declines in their ESG ratings begin to experience significantly lower abnormal returns than control firms and this becomes most pronounced in November 2019. The magnitude of the effect is quite large as the abnormal returns of the ESG Pseudo-Downgraded firms drop by 2.5 percentage points more than the control firms one month after the methodology change. However, this difference in returns is short-lived and persists only until January 2020 when the gap between the abnormal returns of the treated and control firms again begins to converge. By the end of February 2020, five months after the adoption, the abnormal returns between the two types of firms are no longer statistically different. Thus, any investor confusion about the meaning of the change in ESG rating methodology has been either clarified or its effect eliminated a few months after adoption.

The results of this section suggest that investors find ESG ratings salient even when they may be confused about their interpretation. When investors believe a firm's ESG risk has increased, their trading behavior results in negative abnormal returns, at least in the short-run. Next, we examine whose trading behavior may be driving the change in stock prices.

4.2 Change in investor participation and ownership

The misinterpretation of some investors about the new methodology results in price pressure as they sell firms that experience a decline in their ESG rating and buy firms that experience an increase. Since confusion is more likely among uninformed investors, we anticipate that changes in ESG ratings will be associated with a change in the participation of retail investors. Sophisticated investors, such as institutional investors and ESG funds, are less likely to misunderstand the implications of the ESG rating change or have already incorporated the change when Sustainalytics revised the methodology in September 2018. Therefore, we expect that these investors will not rebalance their portfolio in response to the adoption of the new ratings regime by Morningstar and Yahoo! Finance. Finally, since Morningstar announced that it would adopt the new ESG Risk rating in July 2019, informed investors such as short sellers, may take advantage of the confusion of less informed investors. (It is also possible, of course, that institutional investors may similarly take the other side of uninformed investors' trades.) In our analysis, we consider whether retail participation, institutional and ESG fund ownership, and short interest change in relation to the change in the firm's ESG rating.

We follow Mian and Sufi (2011) and estimate the generalized difference-in-differences specification of the form:[25]

$$\Delta\text{OWNERSHIP}_i \quad = \quad \delta_0 + \delta_1 \Delta\text{ESG}_i + \eta_{i,t}, \tag{3}$$

where $\Delta\text{OWNERSHIP}_i$ is defined as the change from the quarter after to the quarter before the adoption in 1) the average number of investors in a firm on the Robinhood platform, 2) the average percentage of shares outstanding held by 13F investors, 3) the average

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[25]This specification is equivalent to Mian and Sufi's (2011) first-stage regression from equation (2). We replace $HousePriceGrowth0206_{zm}$ with $\Delta\text{OWNERSHIP}_i$ on the left hand side of the equation and $Elasticity_{m,1997}$ with ΔESG_i on the right hand side of the equation.

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percentage of shares outstanding held by ESG Funds, and 4) the average monthly short interest. We measure the change in the ESG rating in four ways as in the prior tables on abnormal returns: the change between October 2019 and September 2019, ΔESG_i, and the average change three months before and three months after the adoption, $\Delta\overline{\text{ESG}}_i$. We also substitute two indicator variables for ΔESG_i in the specification above that capture the direction and magnitude of the ESG rating change. ESG PSEUDO-DOWNGRADE$_i$ and ESG PSEUDO-UPGRADE$_i$ are indicator variables equal to one if the firm has a large negative or has a positive change in the rating, respectively.

We report the regression coefficients in Table 5. In columns (1)-(4), we focus on how retail investor participation responds to the methodology change. Since the data measures the number of retail investors in a particular stock, retail participation changes only when an investor sells her entire holdings or when an investor, who currently does not own the stock, purchases shares. The change in the ESG rating is a positive and significant predictor of retail participation. Economically, the participation of retail investors drops by 8% relative to the mean for firms experiencing a one standard deviation decrease in their ESG rating.

In columns (3) and (4), we investigate how retail investors respond to ESG pseudo-downgrades or upgrades. The coefficient estimate on ESG PSEUDO-DOWNGRADE$_i$ is negative and significant, while the coefficient on ESG PSEUDO-UPGRADE$_i$ is positive and also significant. In other words, retail investors appear to misunderstand the nature of the change in ESG ratings and attribute a decline in the rating to bad news and therefore sell all of their holdings in the firm. Conversely, an increase in the ratings is interpreted as good news and therefore, more retail investors are attracted to the stock. In economic terms, the participation of retail investors increases (decreases) by roughly 10% relative to the mean as a result of an ESG rating upgrade (extreme downgrade) of a stock compared to firms which do not experience such changes.

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Next, we shift our focus toward investors that are traditionally perceived as more informed, such as institutional investors and ESG funds. These investors are more likely to understand the implications of the adoption of the new ratings methodology by Morningstar and Yahoo! Finance. Moreover, they may have access to ratings directly from Sustainalytics and therefore, could have been aware of and using the new ESG Risk ratings since September 2018. We predict that the portfolios of 13F institutions and ESG funds will either not be affected by the ESG ratings change or rebalanced in the correct direction based on new information.[26]

In columns (5)-(8) of Panel A of Table 5, the dependent variable is the change in the aggregate percentage of institutional ownership between December 2019 (the first quarter-end after new methodology implementation) and September 2019 (the last quarter-end before the methodology change). In columns (9)-(12), the dependent variable is similarly constructed for ESG funds. As expected, we find that institutional investors and ESG funds do not rebalance their portfolios in response to the adoption of the new methodology. The coefficients are insignificant for almost every measure of the change in the ESG ratings (ΔESG_i, $\Delta\overline{\text{ESG}}_i$, ESG PSEUDO-DOWNGRADE$_i$, ESG PSEUDO-UPGRADE$_i$). An exception is a significant, positive coefficient on ESG PSEUDO-UPGRADE$_i$ for ESG funds. We conclude that informed investors are much less likely to make an investment decision based upon an incorrect interpretation of the ESG rating methodology after its adoption by Morningstar and Yahoo! Finance.

Last, we investigate how short sellers respond to the adoption of the new Sustainalytics ratings by Morningstar and Yahoo! Finance. In columns (13)-(16), we regress the change in the average percentage of shares sold short pre- and post-adoption. We find that short sellers behave in opposite ways to retail investors. Short interest changes in the same direction as the ESG change. Short sellers appear to take advantage of the

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[26]Both the mutual funds holdings and 13F data are for long positions only.

buying behavior of confused investors by increasing their short positions for stocks that experienced an ESG Pseudo-Upgrade.

A decline in ESG ratings is accompanied by lower abnormal returns after adoption. A decline in returns creates a profit opportunity for short sellers by allowing them to cover their position at a lower price. We find that short sellers reduce their positions in firms who experience the largest ESG ratings decline. The relationship between the change in short interest and ESG ratings is economically relevant. A one standard deviation decrease in the ESG rating translates to 3% decrease in short interest relative to the mean.

In column (16), short interest increases by 10% relative to the mean for firms that experience an increase in their ESG rating after the adoption. Short interest declines by a smaller amount, 4%, for firms that have an extreme decline in their ESG ratings as shown in column (15).

As the final test, we again restrict the sample to firms whose reduction in ESG rating does not translate into a decline in their relative ranking. Under the new methodology, these firms are either unaffected or experience good news regarding their ESG risk. In Table 6, we find the same relationships between ESG ratings and changes in investor participation or ownership as in the analysis using the entire sample. Retail investors are clearly confused by the change because they sell firms with declines in their ESG rating and short sellers take advantage of this. We do find that some 13F institutions may also be misinterpreting the new ratings as the coefficient on the change in ESG rating is positive but only marginally significant.

Overall, this section sheds additional light on the type of investor that may be driving the decline in abnormal returns. Uninformed investors, such as retail investors, rebalance their portfolio under the mistaken assumption that a decline in the ESG rating signals worsened ESG risk. Short sellers appear to take advantage of their confusion and increase

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their positions when retail investors are buying and decrease their positions when retail investors sell. Informed investors portfolios generally remain unchanged during this time.

4.3 Firms with high institutional ownership

The results of the prior sections suggests that confused investors, who value firms' sustainability, may impact prices and these investors are more likely to be uninformed retail investors. In this section, we further examine whether the effect of confused investors on abnormal returns is attenuated in firms that have large institutional holdings compared to all other firms. Retail traders in firms with high institutional ownership are unlikely to be the marginal investors and to move prices to the same degree as firms with greater retail participation. In addition, information is more widely available to investors in these firms. We, therefore, expect that firms with higher institutional holdings will not be as affected by the adoption of the new methodology by Morningstar and Yahoo! Finance as firms with lower institutional holdings.

In Table 7, we examine abnormal returns using a triple difference-in-differences regression where our main independent variable of interest is $\Delta\overline{\text{ESG}}_i \times \text{POST}_t \times \text{HIGH INST}_i$. HIGH INST$_i$ is an indicator variable equal to one if the stock's ownership is in both the highest quartile of institutional ownership and the lowest quartile of retail participation, and zero otherwise. We also control for any change in the Sustainalytics ESG Risk rating over time as well as any new information conveyed by the change in methodology through the change in the firm's relative ranking.

The coefficient on the triple interaction term is negative and significant indicating that the effect of investor confusion on abnormal returns is lower for firms that have high institutional ownership but low retail participation compared to firms that have lower institutional ownership and higher retail participation. As a robustness test in untabulated results, we perform the same analysis but substitute an indicator variable

equal to one if the stock is included in the S&P 500 Index, zero otherwise. S&P 500 firms are not only more likely to have high institutional ownership but also to be the largest publicly traded companies in the U.S. Indeed, we find a similar attenuation of the effect of the change in ESG ratings on abnormal returns. These findings are consistent with misinterpretation by uninformed investors in less well-known firms as the channel by which incorrect assessments of ESG risk become impounded in stock prices.

5 Conclusion

We provide evidence that investors pay attention to ESG ratings and use them in their investment decisions. Using a quasi-natural experiment, of the adoption of Sustainalytics new ESG Risk rating in October 2019 by Morningstar and Yahoo! Finance that changed the ratings methodology and inverted the scale, we show that potentially incorrect assessments about the meaning of the change in ESG ratings shape investors portfolio allocation decisions and result in temporary price pressure on the affected stocks.

We find that subsequent abnormal returns are positively related to the change in a firm's ESG rating. We show that firms with large negative changes in their ESG ratings experience significantly negative abnormal returns while firms with positive changes have positive abnormal returns. We interpret this as evidence that investors view the decline or downgrade in ESG rating as bad news and the increase or upgrade as good news. We show, however, that this interpretation is often not true. Many firms with declines in their ESG rating have no change or are better ranked in terms of their ESG exposure than their peers. Thus, some investors rely on ESG ratings when making an investment decisions without adequate due diligence.

In order to understand the mechanism through which the implementation of the new ESG rating methodology affects prices of stocks, we investigate the responses of four types of investors: individual investors, 13F institutions, ESG funds, and short-sellers. Using

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novel data on investor participation from Robinhood, we find that a shift in individual investors trading behavior is consistent with the direction in the change in stock prices. They increase their investment in stocks that they perceive as more sustainable, those with positive changes in their ESG rating, and reduce their positions in firms that appear to have a downgrade in their rating, those with negative changes in their ESG rating.

13F institutions and ESG funds, on the other hand, do not rebalance their portfolios in response to the implementation of the new ESG rating methodology. The lack of 13F institutions' response is consistent with our hypothesis that 13F investors are aware and understand the changes in the rating methodology.

Since individual investor confusion creates a profit opportunity, we find that short-sellers take the other side of retail investors' trades. They increase their short positions for "upgraded" stocks and decrease their short positions for stocks with negative changes in their ESG ratings.

Overall, these results suggest that investors rely on sustainability ratings when choosing which securities to include or exclude from their portfolios. However, investors' short-comings in processing and understanding information may lead to sub-optimal allocation of capital in the markets. As investor interest in sustainability increases, their reliance on ESG ratings will also increase.

Regulators have become keenly interested in an oversight authority of ESG ratings as the demand for information on the sustainability of firms and investment companies increases. In particular, ESMA states "that increasing demand for assessments that provide insights on an entity's ESG profile should go hand in hand with safeguards that ensure the information referred to is robust and that the assessments are reliable."[27] While our analysis is agnostic on the merits of the change in Sustainalytics' methodology, it does highlight the importance of ratings in many investors' investment choices particularly

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[27]ESMA letter to EC on ESG Ratings on January 28, 2021.

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since the change in rating methodology we study affected a sizable portion of the U.S. stock market (70% of the total number of common stocks and 95% of U.S. market capitalization).[28] Given the unique setting of our paper, our results are informative to both market participants and regulators interested in how investors use third-party information providers, generally, and the role of ESG rating agencies, specifically. Our analysis clearly shows ESG ratings are salient to investors' decision-making and can be a determinant of firms' stock prices.

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[28]Our sample is limited to U.S. firms and therefore, the effect of the adoption of the change in methodology may be even greater than we document because it also affects those foreign stocks that are rated by Sustainalytics and available on Morningstar.

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Appendix A: List of ESG Funds

This table presents the ESG funds used in our analysis. Using textual analysis on key words, we classify all U.S. mutual funds actively invested in U.S. equities in the Morningstar database as an ESG fund if it has the following strings in its name: esg, sust, impact, rspnb, env, scl, eco (but not "econ"), social, and/or green.

Fund Name	Fund ID
AIG ESG Dividend W	FS0000CSRZ
AMG Boston Common Global Impact I	FSUSA0009F
AMG Managers Fairpointe ESG Equity I	FS0000B6BF
Aberdeen US Sust Ldrs Smlr Coms C	FSUSA04AWS
Aberdeen US Sustainable Leaders A	FSUSA004VL
American Century Sustainable Equity A	FSUSA067IH
BNY Mellon Sustainable US Eq Fd Z	FSUSA000MG
BlackRock Advantage ESG US Eq Instl Shrs	FS0000C0EV
Boston Common ESG Impact US Equity	FSUSA0B3Y9
Brown Advisory Sustainable Growth I	FS00009LFB
CCM Core Impact Equity Fund Advisor	FSUSA004R4
Calvert US Large Cap Core Rspnb Idx I	FSUSA002Y7
Calvert US Large Cap Growth Rspnb Idx I	FS0000BOXA
Calvert US Large Cap Value Rspnb Idx I	FS0000BOXB
Calvert US Mid Cap Core Rspnb Idx I	FS0000C13N
ClearBridge Sustainability Leaders I	FS0000BN1J
DFA US Social Core Equity 2 Portfolio	FSUSA08DNF
DFA US Sustainability Core 1	FSUSA08HSM
DWS ESG Core Equity Institutional	FSUSA06DZZ
Dana Epiphany ESG Equity Inst	FSUSA07XDP
Dana Epiphany ESG Small Cap Eq Instl	FS0000C28P
Domini Impact Equity Investor	FSUSA000KS
Domini Instl Social Equity	FSUSA06G6L
Fidelity® Select Envir and Alt Engy Port	FSUSA000U8
Fidelity® U.S. Sustainability Index	FS0000D38F
Glenmede Responsible ESG US Equity	FS0000C57P
Goldman Sachs U.S. Equity ESG Ins	FSUSA0A6XX
Gotham ESG Large Value Institutional	FS0000E3LF
Green Century Equity Individual Investor	FSUSA00DLL
Green Owl Intrinsic Value	FS00008N6C
Harbor Robeco US Conservative Eqs Ret	FS0000FLWB
Highland Socially Responsible Equity Y	FSUSA003PP
Integrity ESG Growth & Income A	FSUSA004LN
JHancock ESG All Cap Core R6	FS0000CF4D
JHancock ESG Large Cap Core R6	FS0000CF4E
JNL/Mellon MSCI KLD 400 Social Index A	FS0000D09B
JPMorgan US Sustainable Leaders I	FSUSA04CEA
Kennedy Capital ESG SMID Cap I	FS0000E0WL
Lateef Focused Sustainable Growth CL I	FSUSA08IEB
Mesirow Financial Sm Cp Value Sust Instl	FS0000DZLE
Neuberger Berman AMT Sustainable Eq I	FSUSA00D77
Neuberger Berman Sustainable Eq Investor	FSUSA000GZ
Northern US Quality ESG K	FS0000CSFC
Nuveen Winslow Large-Cap Growth ESG I	FSUSA09Q6S
Pax ESG Beta Dividend Fund Institutional	FS0000CSRX
Pax ESG Beta Quality Investor	FSUSA0034E
Putnam Sustainable Future A	FSUSA0098T
Putnam Sustainable Leaders A	FSUSA00250
Russell Inv Sustainable Equity Y	FSUSA002UB
Second Nature Thematic Growth I	FS0000D58H
TIAA-CREF Social Choice Eq Instl	FSUSA00I37
TIAA-CREF Social Choice Equity	FSUSA06GEV
TIAA-CREF Social Choice LwCrbn Eq Instl	FS0000BVON
Transamerica Sustainable Equity Inc I2	FS00009SYC
Trillium ESG Small/Mid Cap Inst	FS0000BVP7
UBS US Sustainable Equity P	FSUSA002ES
VALIC Company II U.S. Socially Rspnb	FSUSA06UJ2
Vanguard FTSE Social Index I	FSUSA003PD

Figure 1: Timeline of ESG rating adoption and changes in methodology

This figure presents the timeline of the Sustainanlytics ESG and ESG Risk ratings and their subsequent adoption by both Morningstar and Yahoo! Finance.

October 2019
Yahoo! Finance and
Morningstar adopt Sustain-
alytics ESG Risk Ratings

February 2018
Yahoo! Finance makes
Sustainalytics ESG
Rating available for free

2016   2017   2018   2019   2020

March 2016
Morningstar Sustain-
ability Rating launched
(from Sustainalytics)

September 2018
Sustainalytics introduces
new ESG Risk Rating
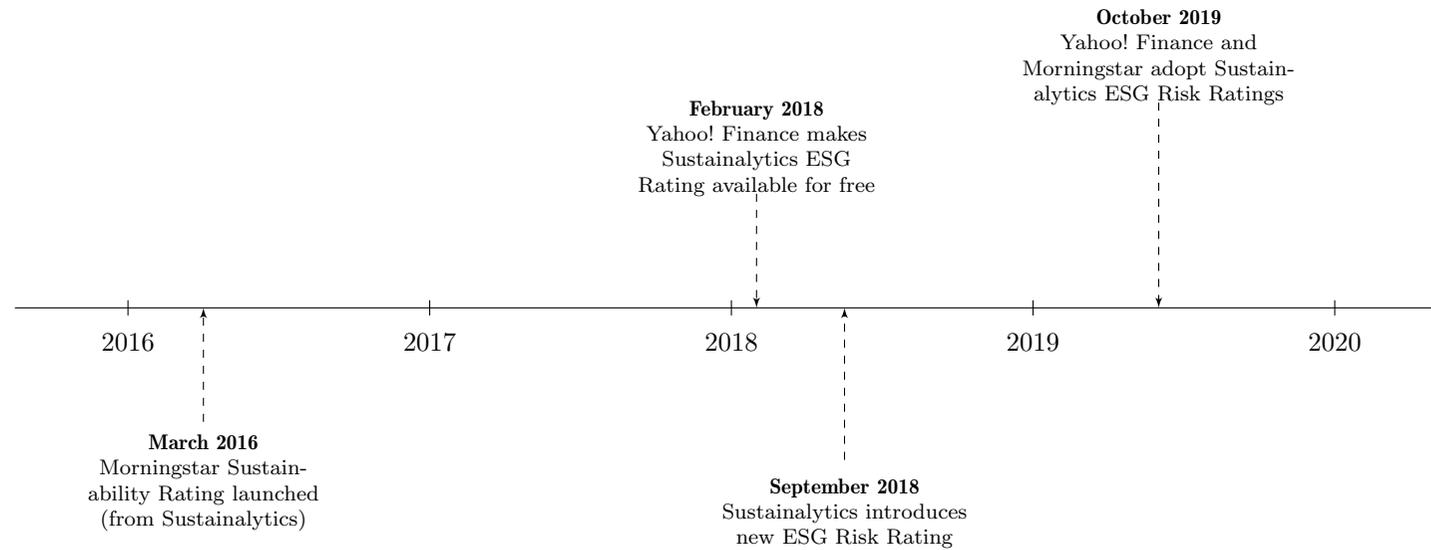
Figure 2: Comparison of Old ESG rating with New ESG Risk rating

This figure shows the distribution of the average old ESG rating in the three months (July-September 2019) before the adoption in Panel A and the average new ESG Risk rating in the three months (October-December 2019) after the adoption of the new methodology by Morningstar and Yahoo! Finance in Panel B.

Panel A

Panel B
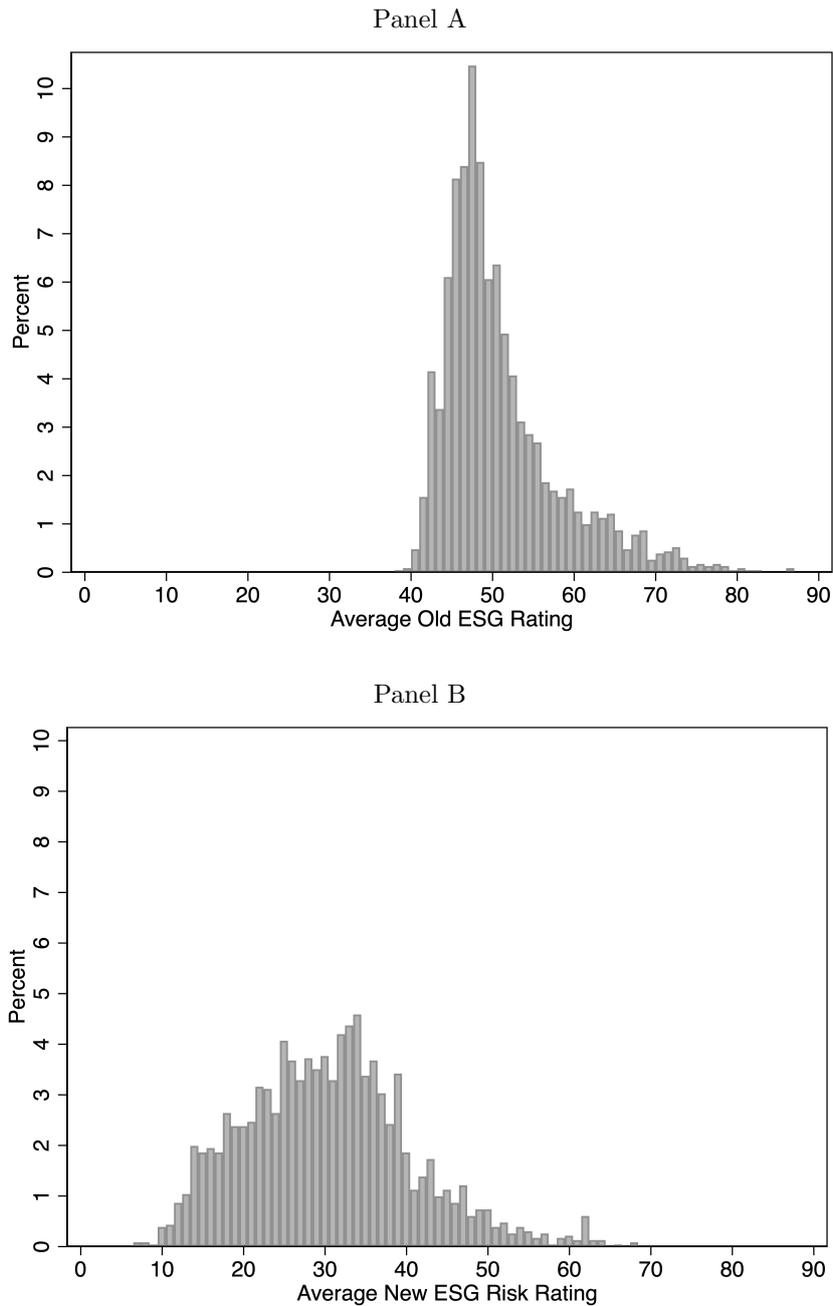
Figure 3: Change in ESG ratings

This figure shows the distribution of the change in the ESG rating, $\Delta\overline{\text{ESG}}_i$, defined as the difference between the average new ESG Risk rating in the three months (October-December 2019) after the adoption of the new methodology by Morningstar and Yahoo! Finance and the average old ESG rating in the three months (July-September 2019) before the adoption.

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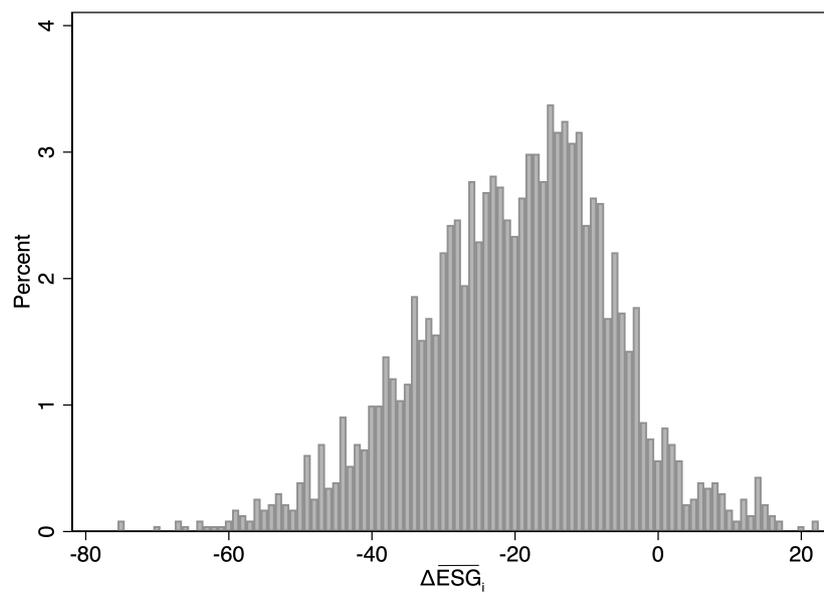
Figure 4: Change in Sustainability ESG Risk ratings around adoption of new methodology

This figure shows the distribution of the change in the Sustainanalytics ESG Risk rating, $\Delta\overline{\text{Sustainalytics Rating}}_i$, defined as the difference between the average ESG Risk rating in the three months (October-December 2019) after the adoption of the new methodology by Morningstar and Yahoo! Finance and the average old ESG rating in the three months (July-September 2019) before the adoption. Panel A presents the numerical change and Panel B shows the correlation between $\Delta\overline{\text{Sustainalytics Rating}}_i$ and $\Delta\overline{\text{ESG}}_i$, defined as the difference between the average new ESG Risk rating in the three months (October-December 2019) after the adoption of the new methodology by Morningstar and Yahoo! Finance and the average old ESG rating in the three months (July-September 2019) before the adoption.
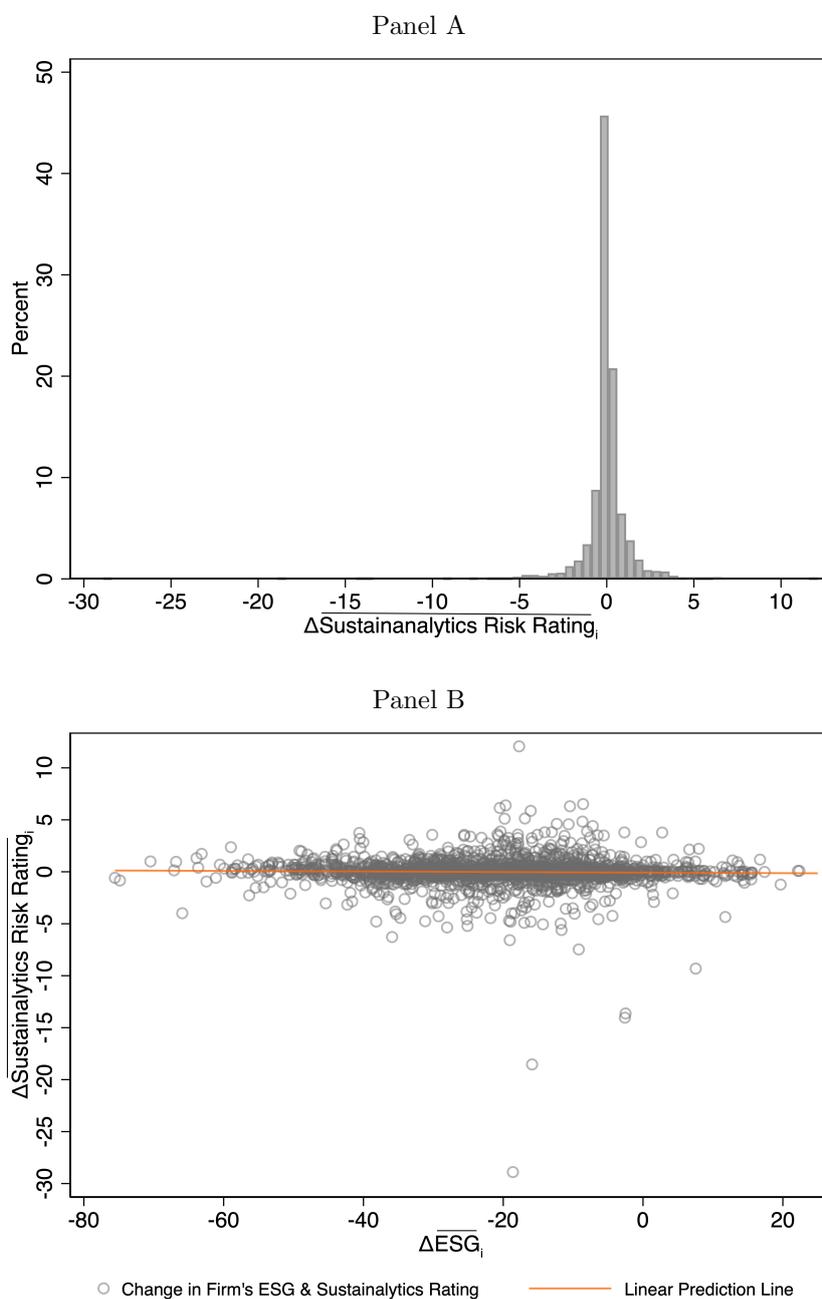
Panel A

Panel B

Figure 5: Change in ranking and Morningstar Classification

This figure shows the change in the relative ranking of the firms after the adoption of the new methodology by Morningstar and Yahoo! Finance. Panel A shows the change in ranking, ΔESG RANK$_i$, defined as the difference in the ranking, scaled by the number of firms, in the ranking in the first month (October) after the adoption and the last month (September) before the adoption. Panel B shows the change in firms' Morningstar Classification after the adoption of the new methodology. See Table 2 for the definitions of the classifications before and after adoption.

Panel A

Panel B

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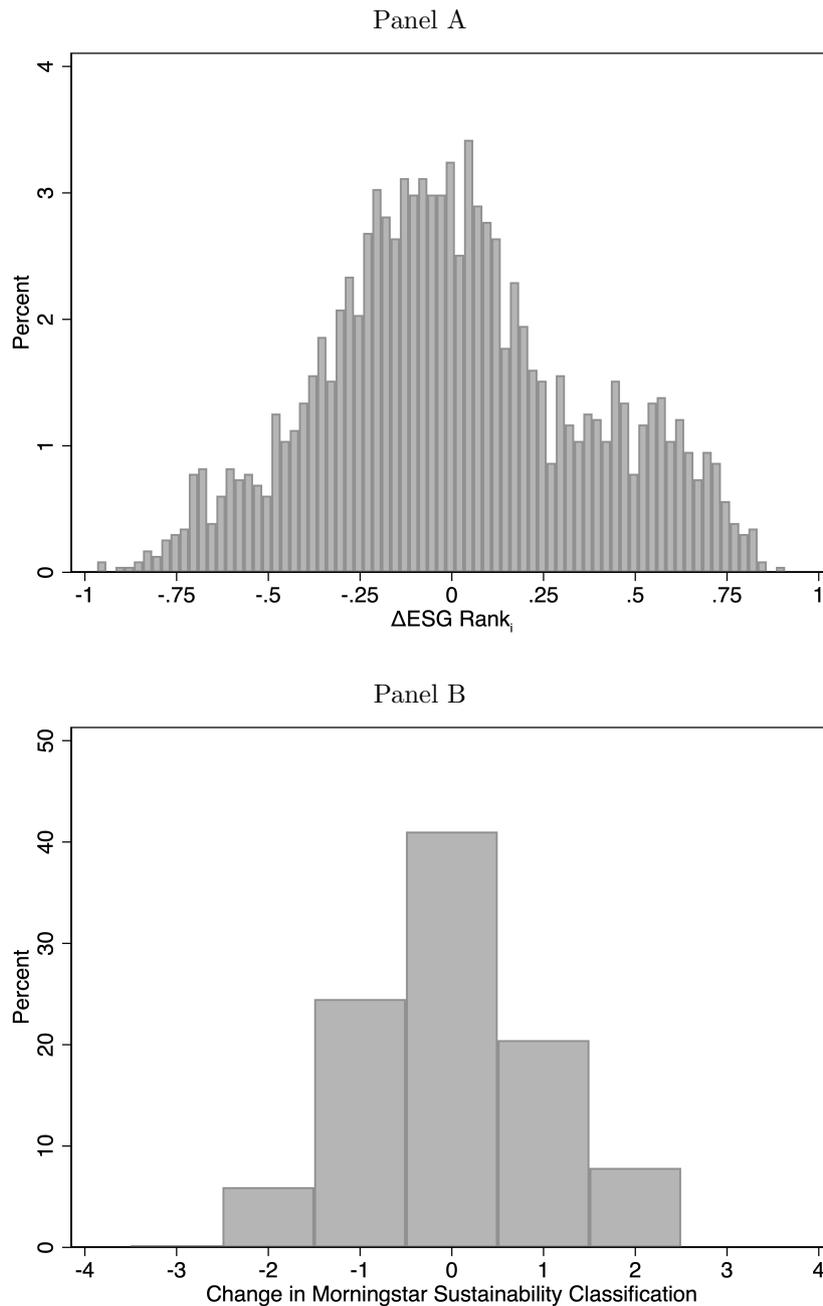
Figure 6: Abnormal return response to the change in ESG rating methodology

This figure depicts the relation between a change in ESG ratings due to the adoption of the new ESG risk rating methodology and subsequent abnormal returns using a semi-parametric regression. We define the change in a firm's single-factor abnormal return as the difference between the stock's average abnormal return the three months (October-December 2019) after the adoption and the three months (July-September 2019) before the adoption of the new methodology by Morningstar and Yahoo! Finance. The change in the ESG rating, $\Delta\overline{\text{ESG}}_i$, is the difference between the average new ESG Risk rating in the three months (October-December 2019) after the adoption of the new methodology by Morningstar and Yahoo! Finance and the average old ESG rating in the three months (July-September 2019) before the adoption. The shaded areas represent 95% confidence intervals. The horizontal dashed orange line represents a zero change in firm's abnormal returns. The vertical dashed orange line represents the mean change in the ESG ratings.

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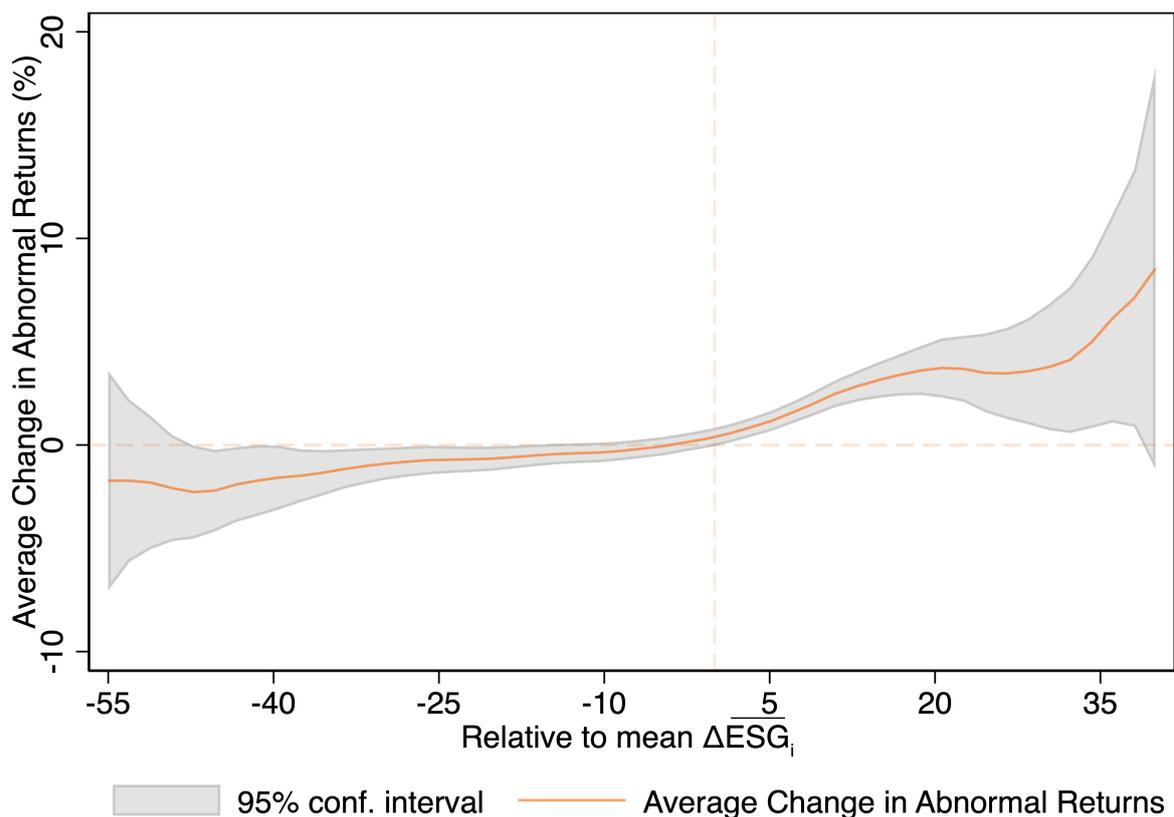
Figure 7: Change in ESG rating methodology and abnormal returns using dynamic difference-in-difference analysis

This figure shows the relative effect of the new ESG rating methodology by Morningstar and Yahoo! Finance on the abnormal returns of firms that experience a quasi-downgrade of their sustainability ratings. We plot γ_e regression coefficients on the interaction terms from the following specification:

$$\text{ARET}_{i,t} = \gamma_0 + \sum_{e=-4,\, e\neq-1}^{5} \gamma_e \text{ESG PSEUDO-DOWNGRADE}_i \times \text{D}(e)_t + \text{D}_i + \text{D}_t + \varepsilon_{i,t}.$$

$\text{ARET}_{i,t}$ is a four-factor abnormal return estimated by using market beta from 12-month rolling-window regression. ESG PSEUDO DOWNGRADE$_i$ is an indicator variable equal to one if the change in $\Delta\overline{\text{ESG}}_i$ is in the lower quartile, and zero otherwise. We use October 2019 as month 0. D_i and D_t denote stock and year-month fixed effects. The grey circles represent point estimates and the dash line is the 95% confidence interval with standard errors clustered at the stock level.
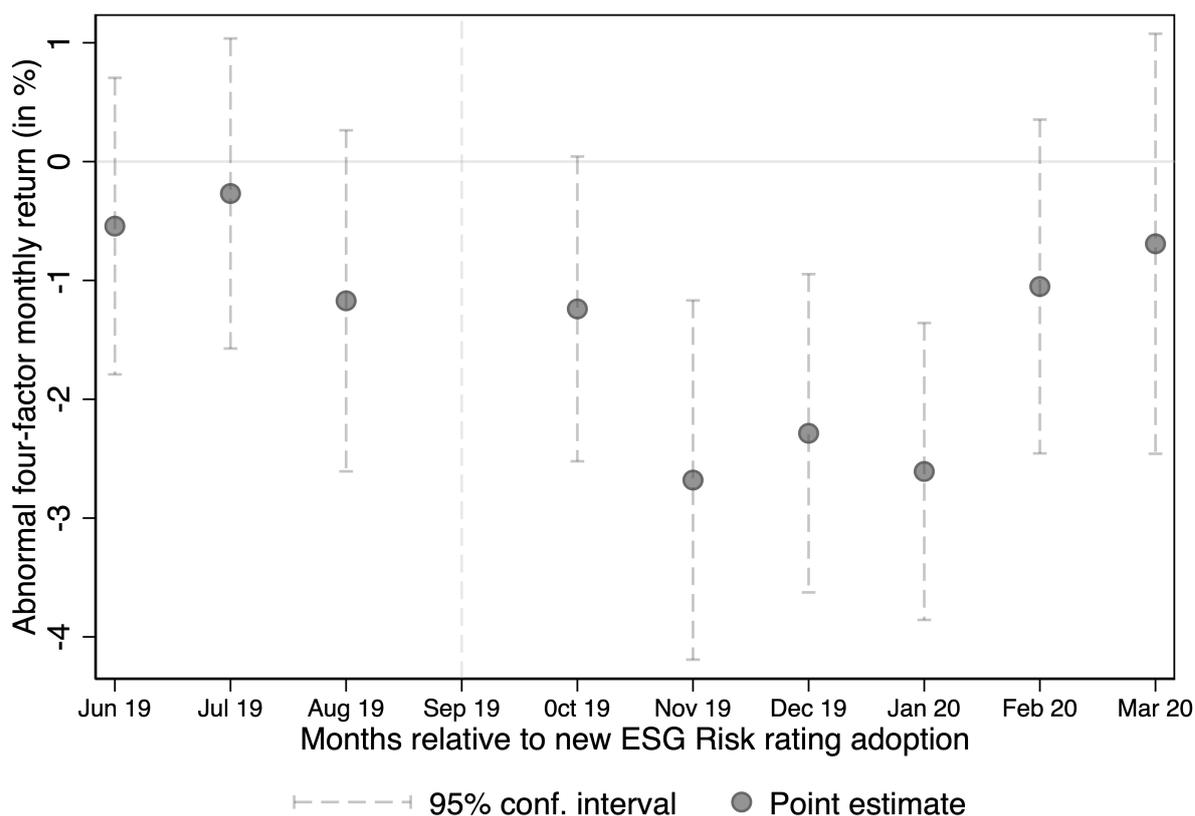
Table 1: Summary statistics

This table reports summary statistics of the main variables used in this paper. We report the variables in levels (Panel A) and in changes (Panel B). In Panel C, we report pairwise correlations between the main variables. Our sample includes U.S. common stocks during two sub-periods: from July 2019 to September 2019 (three months before the adoption) and October 2019 to December 2019 (three months after the adoption by Morningstar of the new methodology). For the period before the adoption, ESG denotes the old ESG rating and for the period after the adoption, ESG denotes the new ESG Risk rating. Both ratings have values between 0 and 100. 1-F ARET, 3-F ARET, 4-F ARET are stock i's abnormal return in month t using single-factor, three-factor, and Carhart four-factor model, respectively. # RETAIL is a number of retail investors holding a given stock through the Robinhood trading platform. % 13F OWN is the percentage of shares outstanding held by 13F institutions. ESG FUNDS (%) is the percentages of shares outstanding held by active U.S. equity ESG funds domiciled in U.S. SHORT INT (%) is the percentage of shares outstanding that have been sold short. ΔESG_i is defined as the difference in firm i's ESG rating between the first month after the adoption (October 2019) and the last month (September 2019) before the adoption of the new methodology by Morningstar and Yahoo! Finance. $\Delta ESG\ RANK_i$ is the difference in the firm's relative ranking in the first month (October 2019) after the adoption and in the last month (September 2019) before the adoption. $\Delta MORNINGSTAR\ CLASSIFICATION_i$ is a change in Morningstar Sustainability Classification in the first month (October 2019) after the adoption and in the last month (September 2019) before the adoption. $\Delta\overline{SUSTAINALYTICS\ RATING}_i$ is the change in firm i's Sustainanalytics average ESG Risk rating in the three months (October-December 2019) after the adoption and the three months (July-September 2019) before the adoption of the new methodology by Morningstar and Yahoo! Finance.

	PRE (JUL 2019 – SEP 2019)					POST (OCT 2019 – DEC 2020)				
Panel A: Levels	Mean	P50	SD	P5	P95	Mean	SD	P50	P5	P95
ESG	50.51	48.00	7.23	42.00	65.00	30.38	30.02	10.36	14.59	49.05
1-F ARET (%)	-0.90	-0.32	6.15	-12.09	7.77	0.10	-0.29	6.24	-8.76	10.37
3-F ARET (%)	0.41	0.68	6.20	-10.05	9.85	-0.02	-0.38	6.23	-9.09	10.23
4-F ARET (%)	0.45	0.65	6.26	-9.95	10.12	-0.08	-0.31	6.22	-9.08	10.17
# RETAIL ('00s)	27.50	2.91	153.20	0.18	75.67	29.20	3.09	164.63	0.18	78.73
% 13F OWN	52.38	58.11	32.29	0.00	95.54	51.59	51.93	32.23	0.00	95.45
ESG FUNDS (%)	0.07	0.04	0.14	0.00	0.22	0.07	0.04	0.14	0.00	0.22
SHORT INT (%)	5.72	3.34	6.34	0.58	19.13	5.58	3.27	6.36	0.44	18.32

	POST minus PRE				
Panel B: Changes	Mean	P50	SD	P5	P95
ΔESG_i	-20.17	-19.13	14.20	-45.81	1.53
$\Delta\overline{ESG}_i$	-20.13	-18.97	14.02	-44.54	1.19
$\Delta\overline{SUSTAINALYTICS\ RATING}_i$	-0.02	-0.01	1.41	-1.66	1.62
$\Delta ESG\ RANK_i$	-0.00	-0.02	0.36	-0.60	0.64
$\Delta MORNINGSTAR\ CLASSIFICATION_i$	-0.01	0.00	1.01	-2.00	2.00

Table 1: Summary statistics (continued)

Panel C: Correlations	ΔESG_i	$\Delta\overline{\text{ESG}}_i$	$\Delta\overline{\text{SUSTAINALYTICS RATING}}_i$	$\Delta\text{ESG RANK}_i$	$\Delta\text{MORNINGSTAR CLASSIFICATION}_i$
ΔESG_i	1.0000				
$\Delta\overline{\text{ESG}}_i$	0.9956	1.0000			
$\Delta\overline{\text{SUSTAINALYTICS RATING}}_i$	-0.0968	-0.0254	1.0000		
$\Delta\text{ESG RANK}_i$	0.1812	0.1843	-0.0146	1.0000	
$\Delta\text{MORNINGSTAR CLASSIFICATION}$	0.3390	0.3383	-0.0821	0.7257	1.0000

Table 2: Morningstar Classifications definitions and the transition matrix from old to new Morningstar Classifications

Panel A: Definitions

Old Morningstar Classification (Score relative to industry peers)		New Morningstar Classification (Risk relative to all firms)	
Industry Leader	(highest 5%)	Negligible	(Risk rating between 0-10)
Outperformer	(next 11%)	Low	(Risk rating between 10-20)
Average Performer	(next 68%)	Medium	(Risk rating between 20-30)
Underperformer	(next 11%)	High	(Risk rating between 30-40)
Industry Laggard	(lowest 5%)	Severe	(Risk rating above 40)

Panel B: Transition matrix

Old Morningstar Classification	New Morningstar Classification				
	Negligible	Low	Medium	High	Severe
Industry Leader	**1**	9	5	1	0
Outperformer	3	**29**	23	5	0
Average Performer	5	265	**538**	320	167
Underperformer	0	66	124	**295**	112
Industry Laggard	0	5	64	164	**68**

Table 3: ESG rating methodology change and abnormal returns

This table reports difference-in-difference regressions of the adoption of the new ESG Risk rating methodology by Morningstar on abnormal returns. The dependent variables include in columns (1)-(4), a single-factor abnormal return estimated by using market beta from 12-month rolling-window regression, in columns (5)-(8), three-factor abnormal returns and in columns (9)-(12), Carhart four-factor abnormal returns. Our sample includes U.S. common stocks during two sub-periods: from July 2019 to September 2019 (three months before the adoption) and October 2019 to December 2019 (three months after the adoption by Morningstar of the new methodology). ΔESG_i is defined as the difference in firm i's ESG rating between the first month after the adoption (October 2019) and the last month (September 2019) before the adoption of the new methodology by Morningstar and Yahoo! Finance. $\Delta \overline{\text{ESG}}_i$ is the difference between the average new ESG Risk rating in the three months (October-December 2019) after the adoption and the average old ESG rating in the three months (July-September 2019) before the adoption of the new methodology by Morningstar and Yahoo! Finance. ESG PSEUDO-DOWNGRADE$_i$ is an indicator variable equal to one if the change in $\Delta \overline{\text{ESG}}_i$ is in the lower quartile, and zero otherwise. ESG PSEUDO-UPGRADE$_i$ is an indicator variable equal to one if $\Delta \overline{\text{ESG}}_i$ is positive, zero otherwise. POST$_t$ is an indicator variable equal to one in the time period after the new ESG rating methodology is introduced, zero otherwise. $\Delta \overline{\text{SUSTAINALYTICS RATING}}_i$ is the change in firm i's Sustainanalytics average ESG Risk rating in the three months (October-December 2019) after the adoption and the three months (July-September 2019) before the adoption of the new methodology by Morningstar and Yahoo! Finance. $\Delta \text{ESG RANK}_i$ is the difference in the firm's relative ranking in the first month (October 2019) after the adoption and in the last month (September 2019) before the adoption. CLASSIFICATION UPGRADE$_i$ (CLASSIFICATION DOWNGRADE$_i$) is an indicator variable equal to one if the firm has an increase (decrease) in its Morningstar Classification after the adoption of the new methodology. Standard errors are clustered at the firm level and t-statistics are reported in parentheses below the coefficient estimates. ***, **, and * denote significance at the 1%, 5%, and 10%, respectively.

	SINGLE-FACTOR ABNRET				THREE-FACTOR ABNRET				CARHART ABNRET			
Panel A: Baseline	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$\Delta \text{ESG}_i \times \text{POST}_t$	0.1117***				0.0789***				0.0790***			
	(7.53)				(5.27)				(5.32)			
$\Delta \overline{\text{ESG}}_i \times \text{POST}_t$		0.1125***				0.0796***				0.0799***		
		(7.45)				(5.22)				(5.28)		
ESG PSEUDO DOWNGRADE$_i \times \text{POST}_t$			-2.2530***	-1.9206***			-1.3469***	-1.0429***			-1.5677***	-1.3214***
			(-5.98)	(-5.15)			(-3.54)	(-2.77)			(-4.08)	(-3.47)
ESG PSEUDO UPGRADE$_i \times \text{POST}_t$				4.3403***				3.9692***				3.2153**
				(3.16)				(2.88)				(2.35)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12914	12914	12914	12914	12914	12914	12914	12914	12914	12914	12914	12914
R^2	0.142	0.142	0.139	0.141	0.138	0.138	0.136	0.137	0.139	0.139	0.137	0.138

Table 3: ESG rating methodology change and abnormal returns (continued)

Panel B: Including change in ranking	SINGLE-FACTOR AbnRet				THREE-FACTOR AbnRet				CARHART AbnRet			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ΔESG$_i$ × Post$_t$	0.1178***				0.0792***				0.0816***			
	(7.75)				(5.18)				(5.37)			
$\Delta\overline{\text{ESG}}_i$ × Post$_t$		0.1185***				0.0798***				0.0823***		
		(7.69)				(5.15)				(5.34)		
ESG Pseudo Downgrade$_i$ × Post$_t$			-2.2809***	-1.9504***			-1.3263***	-1.0442***			-1.5698***	-1.3330***
			(-6.03)	(-5.22)			(-3.48)	(-2.77)			(-4.07)	(-3.49)
ESG Pseudo Upgrade$_i$ × Post$_t$				4.6584***				3.9776***				3.3378**
				(3.34)				(2.83)				(2.40)
ΔESG Rank$_i$ × Post$_t$	-1.2920**	-1.3055**	-0.6068	-1.1630**	-0.0533	-0.0637	0.4220	-0.0529	-0.5305	-0.5417	-0.0553	-0.4537
	(-2.29)	(-2.31)	(-1.08)	(-2.04)	(-0.09)	(-0.11)	(0.75)	(-0.09)	(-0.94)	(-0.96)	(-0.10)	(-0.80)
$\Delta\overline{\text{Sustainalytics Rating}}_i$ × Post$_t$	0.0354	-0.0495	-0.0692	-0.0567	0.0069	-0.0502	-0.0636	-0.0529	0.0274	-0.0313	-0.0450	-0.0361
	(0.27)	(-0.38)	(-0.52)	(-0.43)	(0.06)	(-0.41)	(-0.52)	(-0.44)	(0.23)	(-0.27)	(-0.38)	(-0.31)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12914	12914	12914	12914	12914	12914	12914	12914	12914	12914	12914	12914
R^2	0.143	0.143	0.139	0.142	0.138	0.138	0.136	0.137	0.139	0.139	0.137	0.138

Table 3: ESG rating methodology change and abnormal returns (continued)

Panel C: Including change in	Single-Factor AbnRet				Three-Factor AbnRet				Carhart AbnRet			
Morningstar classification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$\Delta \text{ESG}_i \times \text{Post}_t$	0.1034*** (7.22)				0.0677*** (4.70)				0.0709*** (4.97)			
$\Delta \overline{\text{ESG}}_i \times \text{Post}_t$		0.1037*** (7.15)				0.0681*** (4.67)				0.0714*** (4.93)		
ESG Pseudo Downgrade$_i \times \text{Post}_t$			-1.9016*** (-5.19)	-1.7130*** (-4.68)			-0.9480** (-2.57)	-0.7800** (-2.11)			-1.2307*** (-3.30)	-1.0935*** (-2.93)
ESG Pseudo Upgrade$_i \times \text{Post}_t$				3.9121*** (2.83)				3.4851** (2.51)				2.8469** (2.07)
$\Delta \overline{\text{Sustainalytics Rating}}_i \times \text{Post}_t$	0.0528 (0.40)	-0.0219 (-0.17)	-0.0220 (-0.16)	-0.0238 (-0.18)	0.0295 (0.24)	-0.0195 (-0.16)	-0.0177 (-0.14)	-0.0194 (-0.16)	0.0432 (0.36)	-0.0081 (-0.07)	-0.0077 (-0.06)	-0.0090 (-0.08)
Classification Upgrade$_i \times \text{Post}_t$	-0.2994 (-0.72)	-0.3016 (-0.72)	-0.3628 (-0.86)	-0.2474 (-0.59)	-0.5238 (-1.25)	-0.5244 (-1.25)	-0.6163 (-1.46)	-0.5135 (-1.22)	-0.6492 (-1.54)	-0.6495 (-1.54)	-0.7052* (-1.66)	-0.6212 (-1.46)
Classification Donwgrade$_i \times \text{Post}_t$	0.6609 (1.27)	0.6519 (1.25)	1.2668** (2.38)	0.8669* (1.66)	0.7660 (1.48)	0.7585 (1.47)	1.1982** (2.27)	0.8419 (1.63)	0.3711 (0.72)	0.3625 (0.71)	0.7952 (1.52)	0.5042 (0.98)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12914	12914	12914	12914	12914	12914	12914	12914	12914	12914	12914	12914
R^2	0.143	0.143	0.140	0.142	0.138	0.138	0.137	0.138	0.139	0.139	0.138	0.139

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Table 4: Change in abnormal returns for firms that have a decline in their ESG ratings and either no change or increase in ranking

This table reports difference-in-difference regressions of the adoption of the new ESG Risk rating methodology by Morningstar on abnormal returns. The sample is restricted to only those firms that have a decline in their ESG ratings and either no change or increase in ranking. The dependent variables include in columns (1)-(4), a single-factor abnormal return estimated by using market beta from 12-month rolling-window regression, in columns (5)-(8), three-factor abnormal returns and in columns (9)-(12), Carhart four-factor abnormal returns. Our sample includes U.S. common stocks during two sub-periods: from July 2019 to September 2019 (three months the adoption) and October 2019 to December 2019 (three months after the adoption by Morningstar of the new methodology). ΔESG_i is defined as the difference in firm i's ESG rating between the first month after the adoption (October 2019) and the last month (September 2019) before the adoption of the new methodology by Morningstar and Yahoo! Finance. $\Delta\overline{\text{ESG}}_i$ is the difference between the average new ESG Risk rating in the three months (October-December 2019) after the adoption and the average old ESG rating in the three months (July-September 2019) before the adoption of the new methodology by Morningstar and Yahoo! Finance. ESG Pseudo-Downgrade$_i$ is an indicator variable equal to one if the change in $\Delta\overline{\text{ESG}}_i$ is in the lower quartile, and zero otherwise. Post$_t$ is an indicator variable equal to one in the time period after the new ESG rating methodology is introduced, zero otherwise. Standard errors are clustered at the firm level and t-statistics are reported in parentheses below the coefficient estimates. ***, **, and * denote significance at the 1%, 5%, and 10%, respectively.

	Single-Factor AbnRet			Three-Factor AbnRet			Carhart AbnRet		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\Delta\text{ESG}_i \times \text{Post}_t$	0.1740***			0.1359***			0.1392***		
	(6.59)			(5.12)			(5.25)		
$\Delta\overline{\text{ESG}}_i \times \text{Post}_t$		0.1773***			0.1391***			0.1427***	
		(6.69)			(5.22)			(5.35)	
ESG Pseudo Downgrade$_i \times \text{Post}_t$			-2.5181***			-1.8742***			-2.1123***
			(-4.22)			(-3.11)			(-3.45)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6493	6493	6493	6493	6493	6493	6493	6493	6493
R^2	0.144	0.145	0.140	0.145	0.145	0.142	0.147	0.147	0.144

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Table 5: ESG rating methodology change and change in ownership

This table reports OLS regressions of the adoption of the new ESG Risk rating methodology by Morningstar on the change in share ownership or investor participation. The dependent variables are measured as the percentage change from the three month period (or quarter) after the adoption to the three month period (or quarter) before the adoption of the new methodology by Morningstar and Yahoo! Finance. The dependent variables include in columns (1)-(4), the change in retail participation measured as the change in the average number of Robinhood investors holding a stock divided by the average dollar trading volume between April and June 2019, in columns (5)-(8), the quarterly change in holdings by 13F institutions, in columns (9)-(12), the change in the holdings of funds identified as ESG-oriented funds, and in columns (13)-(15), the change in short interest. Our sample includes U.S. common stocks during two sub-periods: from July 2019 to September 2019 (three months before the adoption) and October 2019 to December 2019 (three months after the adoption by Morningstar of the new methodology). ΔESG_i is defined as the difference in firm i's ESG rating between the first month after the adoption (October 2019) and the last month (September 2019) before the adoption of the new methodology by Morningstar and Yahoo! Finance. $\Delta\overline{\text{ESG}}_i$ is the difference between the average new ESG Risk rating in the three months (October-December 2019) after the adoption and the average old ESG rating in the three months (July-September 2019) before the adoption of the new methodology by Morningstar and Yahoo! Finance. ESG PSEUDO-DOWNGRADE$_i$ is an indicator variable equal to one if the change in $\Delta\overline{\text{ESG}}_i$ is in the lower quartile, and zero otherwise. ESG PSEUDO-UPGRADE$_i$ is an indicator variable equal to one if $\Delta\overline{\text{ESG}}_i$ is positive, zero otherwise. Standard errors are adjusted for heteroscedasticity and t-statistics are reported in parentheses below the coefficient estimates. ***, **, and * denote significance at the 1%, 5%, and 10%, respectively.

	RETAIL				13F				ESG FUNDS				SHORT SELLERS			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
ΔESG_i	0.0041*** (4.85)				0.0026 (0.27)				0.0001 (0.96)				0.0120*** (4.42)			
$\Delta\overline{\text{ESG}}_i$		0.0042*** (4.85)				0.0026 (0.27)				0.0001 (0.95)				0.0124*** (4.47)		
ESG PSEUDO DOWNGRADE$_i$			-0.0828*** (-4.43)	-0.0765*** (-3.90)			-0.0079 (-0.02)	-0.0089 (-0.03)			0.0003 (0.07)	0.0012 (0.29)			-0.2164** (-2.19)	-0.1739* (-1.74)
ESG PSEUDO UPGRADE$_i$				0.0806* (1.94)				-0.0131 (-0.02)				0.0114*** (2.61)				0.5472*** (2.88)
Observations	2310	2310	2310	2310	2310	2310	2310	2310	2310	2310	2310	2310	2310	2310	2310	2310
R^2	0.010	0.010	0.004	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.007	0.007	0.002	0.006

Table 6: Change in ownership for firms that have a decline in their ESG ratings and either no change or increase in ranking

This table reports OLS regressions of the adoption of the new ESG Risk rating methodology by Morningstar on the change in share ownership or investor participation. The sample is restricted to only those firms that have a decline in their ESG ratings and either no change or increase in ranking. The dependent variables are measured as the percentage change from the three month period (or quarter) after the adoption to the three month period (or quarter) before the adoption of the new methodology by Morningstar and Yahoo! Finance. The dependent variables include in columns (1)-(4), the change in retail participation measured as the change in the average number of Robinhood investors holding a stock divided by the average dollar trading volume between April and June 2019, in columns (5)-(8), the quarterly change in holdings by 13F institutions, in columns (9)-(12), the change in the holdings of funds identified as ESG-oriented funds, and in columns (13)-(15), the change in short interest. Our sample includes U.S. common stocks during two sub-periods: from July 2019 to September 2019 (three months before the adoption) and October 2019 to December 2019 (three months after the adoption by Morningstar of the new methodology). ΔESG_i is defined as the difference in firm i's ESG rating between the first month after the adoption (October 2019) and the last month (September 2019) before the adoption of the new methodology by Morningstar and Yahoo! Finance. $\Delta \overline{\text{ESG}}_i$ is the difference between the average new ESG Risk rating in the three months (October-December 2019) after the adoption and the average old ESG rating in the three months (July-September 2019) before the adoption of the new methodology by Morningstar and Yahoo! Finance. ESG PSEUDO-DOWNGRADE$_i$ is an indicator variable equal to one if the change in $\Delta \overline{\text{ESG}}_i$ is in the lower quartile, and zero otherwise. Standard errors are clustered at the firm level and t-statistics are reported in parentheses below the coefficient estimates. ***, **, and * denote significance at the 1%, 5%, and 10%, respectively.

	RETAIL			13F			ESG FUNDS			SHORT SELLERS		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ΔESG_i	0.0086***			0.0344*			0.0002			0.0175***		
	(3.38)			(1.90)			(0.83)			(3.00)		
$\Delta \overline{\text{ESG}}_i$		0.0086***			0.0347*			0.0002			0.0182***	
		(3.36)			(1.89)			(0.81)			(3.06)	
ESG PSEUDO DOWNGRADE$_i$			-0.1172***			-0.7114			-0.0005			-0.3234*
			(-3.37)			(-1.22)			(-0.07)			(-1.82)
Observations	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190
R^2	0.016	0.016	0.004	0.003	0.003	0.002	0.001	0.001	0.000	0.007	0.007	0.003

Table 7: ESG rating methodology change and high institutional ownership

This table reports triple difference-in-difference regressions of the adoption of the new ESG Risk rating methodology by Morningstar on abnormal returns for firms with high and firms with low institutional ownership. High Inst_i is an indicator variable equal to one if the stock's ownership is in both the highest quartile of institutional ownership and the lowest quartile of retail participation, zero otherwise. The dependent variables include in columns (1)-(2), a single-factor abnormal return estimated by using market beta from 12-month rolling-window regression, in columns (3)-(4), three-factor abnormal returns and in columns (5)-(6), Carhart four-factor abnormal returns. Our sample includes U.S. common stocks during two sub-periods: from July 2019 to September 2019 (three months before the adoption) and October 2019 to December 2019 (three months after the adoption by Morningstar and Yahoo! Finance of the new methodology). ΔESG_i is defined as the difference in firm i's ESG rating between the first month after the adoption (October 2019) and the last month (September 2019) before the adoption of the new methodology by Morningstar and Yahoo! Finance. $\Delta\overline{\text{ESG}}_i$ is the difference between the average new ESG Risk rating in the three months (October-December 2019) after the adoption and the average old ESG rating in the three months (July-September 2019) before the adoption of the new methodology by Morningstar and Yahoo! Finance. Post_t is an indicator variable equal to one in the time period after the new ESG rating methodology is introduced, zero otherwise. $\Delta\text{ESG Rank}_i$ is the difference in the firm's relative ranking in the first month (October 2019) after the adoption and in the last month (September 2019) before the adoption. $\Delta\overline{\text{Sustainalytics Rating}}_i$ is the change in firm i's Sustainanalytics average ESG Risk rating the three months (October-December 2019) after the adoption and in the three months (July-September 2019) before the adoption of the new methodology by Morningstar and Yahoo! Finance. We include firm and year-month fixed effects. Standard errors are clustered at the firm level. t-statistics are reported in parentheses below the coefficient estimates. ***, **, and * denote significance at the 1%, 5%, and 10%, respectively.

	Single-Factor AbnRet		Three-Factor AbnRet		Carhart AbnRet	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta\overline{\text{ESG}}_i \times \text{Post}_t \times \text{High Inst}_i$	-0.0696**	-0.0700**	-0.0670**	-0.0671**	-0.0688**	-0.0690**
	(-2.41)	(-2.42)	(-2.32)	(-2.33)	(-2.43)	(-2.44)
$\Delta\overline{\text{ESG}}_i \times \text{Post}_t$	0.1236***	0.1296***	0.0924***	0.0925***	0.0936***	0.0961***
	(6.90)	(7.15)	(5.09)	(5.04)	(5.18)	(5.26)
$\Delta\text{Post}_t \times \text{High Inst}_i$	-2.3857***	-2.3398***	-1.8377**	-1.8448**	-1.7378**	-1.7199**
	(-2.93)	(-2.88)	(-2.28)	(-2.29)	(-2.19)	(-2.17)
$\Delta\text{ESG Rank}_i \times \text{Post}_t$		-1.2546**		-0.0438		-0.5340
		(-2.23)		(-0.08)		(-0.95)
$\Delta\overline{\text{Sustainalytics Rating}}_i \times \text{Post}_t$		-0.0593		-0.0557		-0.0353
		(-0.45)		(-0.46)		(-0.30)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12914	12914	12914	12914	12914	12914
R^2	0.143	0.143	0.138	0.138	0.139	0.139

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