The true ESG insurance effect in times of economic crisis

January 2023

Abstract

This paper examines the potential insurance effect of ESG performance during economic crisis. We use the COVID-19 health crisis as an exogenous shock that affected the economy to assess how ESG performance mitigated the stock price drop. The unexpected shock of COVID-19 mitigates endogeneity problems. Using a diff-in-diff methodology we find evidence that ESG performance is an insurance-like feature. We rely on short-sellers superior information processing ability to uncover potential omitted bias related to ESG misrepresentation and greenwashing. Further we rely on sub-pillar to show that the insurance effect is beyond the component directly affected by the health shock of Covid-19. We interpret that as an evidence that true ESG performance is about implementing efficient process in the firm.

Keywords: ESG; CSR; insurance; greenwashing; investor preferences; short selling; information processing; private information; Covid-19; financial crisis; economic crises

JEL classification code: G11, G12, G14, G32.

1. Introduction

In the wake of the COVID-19 pandemic, many topics surrounding environmental, social and governance issues received an increasing amount of attention both in society and financial markets. While researchers have been studying the consequences of ESG-related activities for some time now and generally agree that such activities create value for firms (Friede, Busch, and Bassen (2015)) and might provide insurance-like downside protection during crises (Hong and Liskovich (2015), Lins, Servaes, Tamayo (2017), Ding et al. (2021)), investors do not share a common preference on ESG even within their own investor group. As short sellers are widely perceived as well-informed and sophisticated investors (Desai, Ramesh, Thiagarajan, and Balachandran (2002), Asquith, Pathak, and Ritter (2005), Boehmer, Jones, and Zhang (2008), Diether, Lee, and Werner (2009), Boehmer, Jones, Wu and Zhang, (2020)) that possess informational advantages through superior information processing skills (Engelberg et al. (2012), Schattmann, Strych, and Westerholm (2021)) or access to private information (Boehmer et al. (2020)), we exploit short selling behavior during the COVID-19 pandemic to investigate the implications of firms' ESG activities and profiles.

Thus, our paper aims to provide empirical evidence that good ESG performance is value-creating in times of economic stress. The value creation is the consequence of various processes and mechanisms that insure a better interaction with different stakeholders. To quote Alex Edmans from the London Business School this is the result of "doing well by doing good". But if there could be mitigated results about the value creation of ESG performance overall, in times of economic crisis the ESG performance can act as an insurance-like feature that allows firms to continue to operate more smoothly (Lins, Servaes, Tamayo (2017), Ding et al. (2021)). This can be reflected in price drops mitigations. The COVID-19 crisis is a good exogenous shock that affected most of countries. Our hypothesis is that ESG performance acted as an insurance. This research question is joining the large body of literature on the value-relevance of ESG. But we decide to focus our analysis at the sub-pillars component level as aggregate scores are less informative and uncover different situations. Secondly, referring to the new strand of papers showing that there could be measurement errors (Aggregate Confusion Project from the MIT) or greenwashing in ESG score, we aim to exploit short sellers' informational advantages to uncover those issues. Indeed, this could lead to missing factors bias and endogeneity issue. Therefore, we assess daily US short sale volume in a difference-in-differences approach that uses the COVID-19 pandemic as exogenous shock mitigating endogeneity issues. We argue that the shock introduces new market dynamics with unprecedented levels of

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uncertainty both regarding firm-level and macro-level issues so that many risks that might impede firm performance but could easily be covered up before the crisis are now harder to cover up and impair business activities significantly. Instances of such impairment might be poor workforce treatment that causes low employee retention rates or bad reputation that causes customers to switch to substitute products. We use an ESG rating system with 14 distinct scores to identify firms with good ESG performances and bad ESG performances which act as treatment and control group, respectively. We assess daily abnormal returns associated with the treated group to identify the existence of the ESG insurance effect and if ESG is value-enhancing or value-destructing. In an additional analysis, we examine the relation of short selling and ESG to daily abnormal returns. Following the literature on short sellers and their superior abilities in processing information, we use them as a mean to detect greenwashing attempts by firms or measurement errors in ESG scores by third-party providers that could lead to missing factor bias. If ESG characteristics are positively linked to returns, we interpret this finding – in line with existing literature – as evidence that ESG is positively value-relevant and provides an insurance-like effect to firm performance during times of crisis.

For our analysis, we create daily panel data on US firms from 2 May 2018 throughout 31 Dec 2020 using publicly disclosed short volumes from FINRA, Capital IQ databases, and off-the-shelf ESG scores from Refinitiv. The COVID-19 shock that we employ in our main analysis is dated to 23 Feb 2022, the day on which the first-ever European casualty was reported by Italian authorities, which marks the start of the COVID-19 pandemic in the western world.

Consistent with our first hypothesis, we document a positive relationship between ESG performance and daily returns. Specifically, we find that good ESG performance is associated with a daily alpha of 1.7 bps that seems to be driven mainly by the SOC pillar (1.1 bps). However, we disentangle the ESG score into granular ESG subpillars and find a positive relation of returns to reduced emissions (1.0 bps), efficient resource use (1.2 bps), human rights compliance (1.7 bps), workforce treatment (1.1 bps) and Corporate Social Responsibility (1.4 bps). Thereto, we relate our findings to (1) the increased awareness for environmental topics during and after the pandemic, (2) the global workforce crisis that worsened labor conditions through quarantines, social distancing and lockdowns where firms with good human rights and workforce treatment benefited from greater employee retention and supply chain stability, and (3) the firms' abilities to convey trustworthiness through CSR. In particular, ESG activities are used to build trust with direct and indirect stakeholders[1] by

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[1] Direct stakeholders such as employees, suppliers and investors. Indirect stakeholders such as the society at large, communities or the environment.

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signaling the firms' willingness to satisfy implicit contracts with those stakeholders that cannot be efficiently contracted or enforced (e.g., Arrow (1972), Putnam (1993)). In turn, those stakeholders are more willing to support the firm during downturns such as through better employee motivation, employee retention or customer loyalty.

Next, we use the interaction of ESG performance and short volume to assess daily abnormal returns and find that high short selling activity in firms with good ESG performance is associated with significant positive alphas. With short-selling, positive alphas mean negative stock return because the short-sellers are betting on the price drops. In particular, for each 1% of increased short volume in firms with good ESG performance, short sellers generate a positive 1-day alpha of 5.7 bps using the general ESG score or 6.0 bps (ENV), 5.3 bps (SOC), and 5.4 bps (GOV) using level 2 ESG scores. Moreover, we disentangle the ESG scores on a more granular level within the ENV, SOC and GOV pillars and document significant outperformance in all subpillars, albeit with varying magnitudes. Our results indicate that short sellers uncover greenwashing or ESG measurement errors which they successively exploit for alphas, whereby other market participants learn about the true ESG characteristics of the firms when the short sellers' informational advantage is escomposed into stock prices through their trading behavior. Particularly, those firms may have high ESG scores on measurement scheme such as the Refinitiv ESG scores, however (1) firms might engage in moral hazard to boost their ESG scores through low-effort activities that yield little to no positive effect for stakeholders while representing the activities as highly effective, or (2) objective measurement schemes might not fully capture the true situation of a firm as information provided is often voluntary, hard to compare across firms and possibly hard to quantify in the case of qualitative information. We conjecture that short sellers – as the most sophisticated traders in the markets – are adept at identifying the true ESG characteristics and consequently transform their informational advantage into profitable trades.

Our findings are in line with the idea that ESG provides an insurance-like downside protection during crisis as brought forth by an emerging body of literature (e.g. Hong and Liskovich (2015), Lins, Servaes, Tamayo (2017), Ding et al. (2021)), thereby joining the literature consensus on the positive ESG value-link which poses an important assumption for our investigations.

One concern with this paper might be the documented divergence of ESG scores across the main providers KLD, Sustainalytics, Moody's ESG, S&P Global, Refinitiv, and MSCI. Chatterji et al. (2016) and Berg, Kölbel and Rigobon (2019) find differences in measurement scopes and measurement methods but still argue that analyses with different scores provide the same outcomes. This study

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specifically exploits short sale volume in interaction with ESG scores to circumvent the noise in ESG measurement and identify firms that use greenwashing or that are subject to measurement errors. Furthermore, this study employs daily firm-level short volume, but we cannot observe specific short positions which would enable more precise disentangling of ESG-related short selling performance.

Our paper contributes to several strands of literature. Firstly, we extent findings on the insurance-like characteristics of environmental, social and governance issues in the emerging field of ESG research.

The remainder of this paper is structured as follows: Section 2 outlines related literature and develops the hypotheses. Section 3 describes the sample construction and empirical strategy. Section 4 subsequently presents our findings. Lastly, section 5 concludes this paper.

2. Related Literature and Hypothesis

2.1 Related Literature

ESG definition and the link to firm value

While there is no uniform definition for ESG[2], the term generally refers to the integration of environmental, social and governmental issues into a firm's business model (Gillan, Koch, and Starks (2021))[3]. In particular, it is a category of overarching sustainability concerns that address consequences of a firm's activities in the form of positive or negative externalities on the environment, such as pollution or emission (Bansal and Roth (2000)), on the firm's social surroundings through good or bad corporate citizenship such as employee treatment or human rights violations (Campbell (2007)), and addresses corporate governance measures to facilitate monitoring and transactions (Williamson (1987)).

But what are the implications of ESG for firm value? The two prevalent ideas brought forth by numerous studies in this area of research view ESG either as value destructing or value enhancing. Specifically, some view ESG investments as the outcome of an agency problem whereby managers

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[2] Frequently, the term Corporate Social Responsibility (CSR) is used in similar context to ESG, often referring to identical topics and blurring definitions of both terms. Technically, CSR refers to a firm's endeavors to being a good corporate citizen, while ESG extends this definition by explicit environmental and governmental measures. In our paper, CSR refers to a subcategory of ESG scores (see Figure 1)

[3] The wording "ESG" was initially coined in a paper by the International Finance Corporation in 2004 with the intent to incorporate ESG value drivers into financial market research, analysis and investment (IFC (2004))

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might engage in such investments after a period of good firm performance to create private benefits for themselves, such as political goodness that remains associated with the managers' names even after their tenure at the firm ends. Such activities generally do not provide benefits to other shareholders, and – as they are financed by firm resources – ultimately drain shareholders value. This view, however, receives only little support from existing literature. Contrarily, in the light of ESG value creation, the vast majority of studies reports a positive relation of ESG activities to firm value or corporate financial performance (Friede, Busch, and Bassen (2015), Baron (2007), Fatemi, Fooladi, and Tehranian (2015)). Specifically, ESG activities create benefits for all stakeholders – as opposed to corporate activities that are focused solely on shareholder wealth maximization. Firms hereby build a positive corporate reputation, for instance through investments in communities or environmental protection, through good employee treatment or through high transparency. Once established, a firm can draw on its reputation to benefit it numerous ways, such as by charging premiums from customers and investors, or through greater talent attraction (Greening and Turban (2000), Richardson and Welker (2001), Lev, Petrovits, and Radhakrishnan (2010)). Moreover, many researchers find that ESG lowers firm risk[4] and cost of capital through a broadened investor base[5] or lower litigation probability (Chava (2014), Ng and Rezaee (2015), El Ghoul, Guedhami, Kwok, and Mishra (2011), Hong and Kacperczyk (2009)), albeit depending on the general level of ESG appreciation in the country of incorporation (Stellner, Klein, and Zwergel (2015)) and local investor protection laws (Breuer, Müller, Rosenbach, and Salzmann (2018)).

To understand the background of ESG consequences, theories of the firm offer valuable insights: firms can be viewed as a cluster of contracts with different stakeholders (Coase (1937), Jensen and Meckling (1976)) that provide the firms with resources in exchange for claims and are based on explicit formal contracts, however both contracting and legal enforcement cannot be done efficiently so that the relation relies on some form of trust (Arrow (1972), Putnam (1993), Porta et al. (1997), Knack and Keefer (1997), Guiso, Sapienza, and Zingales (2004)). Deng, Kang, and Low (2013) argue that CSR activities signal the firms' willingness to satisfy the implicit contracts which in turn increases the willingness of stakeholders to support the firms during difficult times. While this provides evidence for implicitly contracted stakeholders in a narrow sense, such as employees, suppliers or investors, the range of relevant stakeholders nowadays expands to include society at large as

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[4] Starks (2009) argues that ESG might affect systematic risk, regulatory risk, supply chain risk, product risk, technology risk, litigation risk, reputational risk, and physical risk.

[5] For instance, a good ESG profile makes firms eligible for ESG-linked bond financing.

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well as the environment. Even though these stakeholders in a broad sense share no direct connection to the firms, they are affected by the firms' ESG activities such as through environmental pollution or exploitation of municipality resources and might use instruments at hand to boycott or support firms, for instance through social media campaigns, citizen referendums or lawsuits. This implies that building trust goes beyond the narrow sense by signaling contractual satisfaction both to direct and indirect stakeholders, which in turn benefit the firms during times of crisis because a good ESG profile can provide insurance-like resilience that mitigates negative stock price reactions compared to peers with bad ESG profiles (Lins, Servaes, Tamayo (2017)), better and faster access to funding (Tamayo et al. (2021)), and greater customer loyalty that increases sales resilience during difficult times (Albuquerque, Koskinen, and Zhang (2018)). Ding, Levine, Lin and Xie (2021) are among the first to provide empirical evidence from the COVID-19 pandemic that the drop in stock prices was less severe for firms with more CSR activities and less entrenched executives as well as for less exposure to global supply chains and better pre-pandemic finances.

Short Sellers

Current literature provides no univocal understanding for investor ESG preferences to date. For instance, a wide body of literature aims to relate ESG profiles to institutional investor preferences but provides mixed evidence on the relationship and its interpretation (Friede, Busch, and Bassen (2015)). Short sellers might arguably be more adept at exploiting ESG information than the other market participants. They are generally perceived to be well-informed and sophisticated traders, evident by the large number of studies showing that short selling predicts future stock returns (e.g., Asquith et al. (2005); Boehmer et al. (2008); Desai et al. (2002); Diether et al. (2009)). Their informational advantage stems from either superior information processing capabilities (e.g., Boehmer et al. (2020), Engelberg (2008), Engelberg et. al (2012), Schattmann, Strych, and Westerholm (2021)) or access to private information (Agarwal et al. (2013), Kacperczyk and Seru (2007), Karpoff and Lout (2010), Desai, Ramesh, Thiagarajan, and Balachandran (2002); Diamond and Verrecchia (1987)). Similarly, short sellers might be superior at processing ESG information or possess access to private ESG information that helps assess if ESG activities create firm value. When short sellers subsequently trade on their informational advantages, two things are implied: (1) By incorporating value-relevant information into stock prices, short sellers facilitate price discovery and increase market efficiency (Chen and Singal (2003), Boehmer and Wu (2013), Miller (1977)), making it easier for other investors to monitor and disciple firm management (Drake, Rees, and Swanson (2011)). (2) Short sellers act

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as information intermediaries for other market participants to learn about the consequences of ESG activities with a time lag. Short selling is also seen as a channel to improve price efficiency (Saffi and Sigurdsson, 2011). Therefore, we use the short selling activity to cope with missing factor bias.

2.2 Hypothesis

Literature consensus states that good ESG performance generally enhances firm value and financial performance (Friede, Busch, and Bassen (2015)). Furthermore, during times of economic crisis, a good ESG profile might act as an insurance that should mitigate negative stock price reactions in those crisis times (Hong and Liskovich (2015), Ding et al. (2021)). While the main theoretical concepts of traditional insurance literature focus on asymmetrical information in the form of moral hazard and adverse selection to determine insurance premia (Denuit et al. (2007), Chiappori et al. (2006)), we argue that similarities exist to the extent that firms self-select their insurance tariff by employing specific ESG strategies to protect against adverse events through their choice of ESG investments. That is, ESG activities build trust through signaling the willingness to satisfy implicit contracts with direct and indirect stakeholders who then support the firms during difficult times such as through customer loyalty as well as high employee motivation or retention (e.g., Deng, Kang, and Low (2013), Ding et al. (2021)). We follow this idea in arguing that ESG performance relates to the COVID-19 shock in a sense that the pandemic is a healthcare crisis that directly impacts many aspects of the societal and environmental factors whereby firms with good ESG performance then become increasingly supported by stakeholders to alleviate adverse consequences of the pandemic. Therefore, when the economy faces a turmoil, good ESG performance is rewarded with greater business resilience as well as increased financial performance or firm value compared to lower ESG peers. This question has been discussed by Albuquerque, R. (2020), but we extend their analysis on two folds. First, we use sub-pillars components rather than overall scores that averages potentially different items. We also tests whether these results are driven by components directly related to the heath shock or can also be explained by other important sub-pillars not directly related to COVID-19. Second, we benefit from a longer time period allowing us to include the recovery of stock markets.

H1: Good ESG performance acts as an insurance-like feature that mitigates price drops during economic stress.

3. Methodology

3.1 Sample Construction

We combine data from FINRA[6], Capital IQ and Refinitiv to construct a daily panel of publicly traded U.S. firms. Our sample period spans from 2 May 2018 throughout 31 Dec 2020 to capture a time window before and after the COVID-19 shock as well as the recovery.

Since August 2009, FINRA discloses daily short sale volumes pertaining to trades that are reported to Trade Reporting Facilities, Alternative Display Facilities and Over-the-Counter Reporting Facilities under US regulatory authority. We extract daily short volumes and aggregate the data on a firm-level basis to create the log of short selling volume. Then, we create daily abnormal returns based on the stocks' daily dividend-adjusted closing price in excess of the Standard & Poor's 500 market index as provided by Capital IQ. Moreover, we add common firm-level controls from Capital IQ databases based on similar studies, such as market capitalization, market-to-book-ratio, spread, turnover, volatility and momentum. Finally, we merge our dataset with "off-the-shelf" ESG scores that are provided on an annual basis by Refinitiv.

In total, our final sample includes data on 3292 stocks and 596 trading days, constituting a total of 1,881,628 observations.

3.2 Empirical Strategy

To assess the relation between ESG, returns, short selling and the insurance-like features of ESG, we employ a difference-in-differences approach using the COVID-19 pandemic as exogenous shock to

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[6] United States Financial Industry Regulatory Authority (URL: https://www.finra.org/)

global financial markets and short sellers to identify firms with good and bad ESG performance. We argue that COVID-19 introduces unprecedented new market dynamics with highly increased levels of uncertainty due to the difficulty to assess the pandemic's impact on firms, as for instance suggested by the sheer quantity of management earnings withdrawals during the first wave of the pandemic (Hope, Li, Ma, and Su (2022)), as well as increased uncertainty about societal impacts and governmental actions to contain the pandemic outbreak. We argue that while ESG-related firm risk could be covered up to a certain extent before the crisis, the sudden change in market conditions proves to become a tear test for firms in which any existing problem has direct influence on business activities. To name some specific instances, firms with bad employee treatment might have trouble organizing and retaining their workforce given the difficult working conditions during curfews and social distancing rules. As supply chains were impeded, firms with bad supplier relations might be put at a disadvantage in purchasing goods with limited availability, ultimately delaying output. These Social sub-pillars can easily be understood as important feature to face the consequences of COVID-19. On the other hand good practices on the Environment pillar have a less direct influence on the resilience of the firm. Firms with bad reputation, such as through environmental pollution, might experience reduced customer loyalty and sales, but this effect will not be related to the panic caused by the health concerns. Firms might fully waiver environmental concerns in favor of price and availability of the goods. Moreover, firms with opaque reporting or bad investor relations might have difficulties refinancing during the crisis. These novel and exogenously introduced market dynamics cause all market participants to re-evaluate firm valuations and possibly invalidated ESG information, which – due to the inherent novelty of COVID-19 – requires more resources whilst yielding divergent and less precise assessments as the general uncertainty level is greatly elevated. Moreover, ESG cannot be measured correctly due to the lack of a universal ESG measurement system, and scores might be glossed over through greenwashing. Thus, we pose that short sellers have an edge over other market participants because their superior information processing skills enable them to assess and transform ESG-related information more quickly and precisely so that they increase or reduce positions in firms with good or bad ESG performance. Hence, short sellers' trading activity is integral to correctly identifying ESG firms in our difference-in-differences setting to establish causality of ESG characteristics.

Our treatment group is then characterized by the set of firms that show good ESG performance as represented by the ESG scores. Vice versa, firms with bad performance act as control group in this setting. To establish group affiliation, we classify the firms using the median score as separation

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threshold for each of the 14 different ESG scores so that firms with above-average score are labeled as treatment group.

Consequently, we formulate our fixed-effects regression model for the difference-in-differences estimation as follows:

$$(1)\ Abn\ Ret_{i,t} = \alpha_t + \beta_1\big(COVID_t\ x\ ESG_{i,t}\big) + \beta_2 COVID_t + \beta_3 ESG_{i,t} + \gamma_{i,t}X_{i,t} + \delta_i + \theta_t + \epsilon_{i,t}$$

$$(2)\ Abn\ Ret_{i,t} = \alpha_t + \beta_1\big(COVID_t\ x\ ESG_{i,t}\ x\ Ln\ SV\big) + \beta_2 COVID_t\ x\ ESG_{i,t} + \beta_3 COVID_t\ x\ Ln\ SV$$
$$+ \beta_4 ESG_{i,t}\ x\ Ln\ SV + \gamma_{i,t}X_{i,t} + \delta_i + \theta_t + \epsilon_{i,t}$$

Whereby the dependent variables are the 1-day abnormal returns in excess of the S&P 500 index. $ESG_{i,t}$ denotes the vector of ESG dummies that classify stocks as 1 (good ESG performance/treatment group) or 0 (bad ESG performance/control group) using the median ESG score as threshold. $COVID_t$ is a dummy variable that takes the value of 1 after the shock date, or 0 otherwise. $LnSV$ denotes the natural logarithm of short volume. $X_{i,t}$ denotes the control variable vector. δ_i denotes firm-fixed effects and θ denotes daily time-fixed effects.

Following current literature, we use an "off-the-shelf" scoring system for ESG rating (e.g., Jain, Jain and Rezaee (2016)) from Refinitiv. We argue that third-party scoring holds two important advantages for research: (1) Self-constructed measures are harder to compare across studies and might vary both in implementation and underlying data quality. (2) All market-leading providers, such as KLD, Sustainalytics, Moody's ESG, S&P Global, Refinitiv, and MSCI, provide "off-the-shelf" ESG scores which represent an important standardization to establish a uniform understanding of ESG activities for more comparable and in-depth analysis of ESG and its subcomponents. It should be noted, however, that ESG ratings systematically diverge across the providers. Chatterji et al. (2016) and Berg, Kölbel and Rigobon (2019) argue that differences in scope of measurement as well as measurement method are the main drivers of divergence. Still, Berg et al. (2019) find that analyses with scores from different sources lead to similar results which they attribute to the divergence being systematic, as the authors provide a common taxonomy that explains how the ESG scores diverge. [7]

Figure 1 then depicts the structure of the Refinitiv ESG rating system. Table A2 provides an explanation for the ESG subpillars.

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[7] We are currently negotiating a budget to get access to a second provider (Sustainalytics) which also give access to detailed levels of sub-pillars components.

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[Figure 1 about here]

The issue raised by the score divergence exposes us to omitted variable bias problem that could lead to endogeneity. Whether the problem comes from score divergence or greenwhashing, the effect will be the same. In a robustness check, we use the short seller activity to tackle this problem. To identify if the insurance effect is acknowledged by market participants, we assume that short sellers – as the most sophisticated and well-informed traders – generally avoid those firms with good ESG performance as there are lower returns to be gained due to the ESG insurance-like effect that mitigates price drops. Instead, short sellers increasingly take positions in firms with bad ESG performance because such firms as associated with greater firm risk (Chava (2014), Ng and Rezaee (2015), El Ghoul, Guedhami, Kwok, and Mishra (2011), Hong and Kacperczyk (2009)). Using "off-the-shelf" ESG scores, Jain, Jain and Rezaee (2016) document a strong negative relation of short selling to ESG scores, indicating that short sellers consider ESG information in their investment decisions and focus on short selling firms with bad ESG performance which are associated with greater firm risk and cost of capital[8]. Following this line of reasoning, if short sellers then actively take positions in firms with good ESG performances as opposed to bad ESG performances, we conjecture that the traders most likely identified misrepresented information in the form of greenwashing or ESG measurement errors. These trades show a higher risk-reward profile because they contradict the positive ESG value-link and pose the risk of sever losses for short sellers. However, if these trades yield positive returns, we interpret this as evidence for the uncovering of greenwashing or ESG measurement errors.

We suggest that our empirical approach holds important advantages through the difference-in-differences design that allows for causal interpretation of this effect. Moreover, the exploitation of short sales during the COVID-19 pandemic holds three distinct advantages: (1) Markets became highly inefficient during the COVID-19 pandemic which limits the validity of using plain returns in an empirical setting. By exploiting short selling returns in our second step, we evade noisy returns through omitted variables. (2) We argue that short sellers are more likely adept at identifying

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[8] Jain et al. (2016) argue that such low ESG firms intentionally reduce transparency and reliability of reported financial statements to overshadow potential ESG risks, thereby creating an exploitable trading opportunity for well-informed short sellers

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greenwashing in firms than other market participants, thereby avoiding bias in our empirical studies through deception activities.

Noteworthy, a critical issue to our approach is characterized by the choice of shock date: We propose that 23 February 2020, the day on which Italy published news on the first European casualty followed by Europe-wide lockdowns, characterizes the point in time when market conditions change as all market participants reevaluate their trading strategies. Arguably, short sellers could possess knowledge about COVID-19 by 03 January 2022 already, as the AAAS[9] released the first ever virus-related publication on ScienceMag.org[10]. But at that time betting on a global pandemic was extremely risky because the Chinese government could have contained the outbreak. Still, we argue that short sellers' trading pandemic-adapted trading strategies are dependent on the actual change of the market conditions which only come into effect at the end of February. Alternatively, another possible shock date is on 11 March 2020 when the WHO[11] officially declared the outbreak as pandemic, however we refrain from employing this option as the declaration happens too late to capture relevant effects of the short sellers' informational advantage.

Identifying assumption

For identification purposes, we employ tests for parallel pre-trends. Firstly, we provide graphical evidence in table A3 of the Appendix. Secondly, we assess pre-shock trends in abnormal returns as well as short volume and report statistically insignificant results. Thus, we fail to reject parallel pre-trends (see Kahn-Lang and Lang (2019); Roth (2018), Dimick and Ryan (2014), Ryan and Dimick (2015)) and therewith assume that the identifying assumptions are met within our research design.

4. Empirical Results

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[9] American Association for the Advancement of Science

[10] See Mackenzie, James (2020): First Italian patient dies of coronavirus: Ansa news agency; URL: https://www.reuters.com/article/us-china-health-italy-death/first-italian-patient-dies-of-coronavirus-ansa-news-agency-idUKKBN20F2W5 [May 31, 2022].

[11] See Farge, Emma, and Michael Shields (2020): World Health Organization calls coronavirus outbreak 'pandemic' for first time; URL: https://www.reuters.com/article/us-health-coronavirus-who-idUSKBN20Y2OI [May 31, 2022].

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4.1. Summary Statistics

[Figure 2 about here]

Figure 2 shows the time trend of the S&P 500 and the aggregate short volume in terms of shares sold short from May 2018 throughout December 2020. Before the pandemic, a large part of short selling activity appears to take place within a bandwidth of c. 400 to 600 mn shares with a median daily volume of 506 mn shares. Noticeably, the short volume increases strongly after the shock in March 2020[12] in synchronization with the downward plunge of the S&P 500 index, albeit inverse. A maximum of 1,103 mn shares are sold short on 12 March 2020, exactly 11 days before the S&P 500 reaches its lowest point before the turnaround on 23 March 2020. Thereafter again, the index performance and short volume inverse each other, showing a continuous downward trend in volume shorted with singular extreme peaks on several days. Still, the median volume shorted after the shock appears to remain higher at around 737 mn shares shorted, underlining the immense uncertainty that COVID-19 introduced into global financial markets and provides short sellers with trading opportunities to exploit mispricing in what is arguably one of the most favorable short selling environments since the financial crisis. Moreover, short sellers might have profited from the severe increase in daily returns – both positive and negative - as indicated by the bar chart at the top of figure 2.

[Table 1 about here]
[Table 2 about here]

Detailed summary statistics are reported in table 1 and ESG correlations are reported in table 2. Our data set is characterized by negative abnormal returns (A), in line with similar studies dissecting effects of the COVID-19 pandemic (e.g. Hüfner and Strych (2021)) but contrasting related ESG studies that cover earlier time windows and mainly report positive returns (e.g. Jain et al. (2016)) due to the substantially different market conditions surrounding the virus outbreak. Noticeably, there is no significant difference in mean returns when comparing statistics pre-COVID-19 and post-COVID-19

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[12] Given the evident increase in short selling activity in March 2020, question arises if the chosen shock date on 3 Jan 2020 should be moved to a later date. However, we argue that short sellers adjust trading strategies as soon as they possess knowledge about COVID-19 and frequently implement such strategies that capitalize on momentum and increase short volume once the downward plunge commences

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in (B), however it is notable that the negative median returns more than quadruple after the shock which might be due to the unparalleled V-recovery of the S&P 500 index that offsets the mean statistics. Post-COVID-19, all control variables shift as expected with spread, volatility, turnover, and beta increasing while valuations as represented by MarketCap and Market-2-Book decrease. Generally, the magnitudes and directions of the variables are in line with comparable COVID-19 studies (Schattmann et al. (2021), Pástor and Vorsatz (2020)).

4.2. Main Results

[Table 3 about here]

Returns

First, we analyze the relation of ESG performance to returns. Hereto, table 3 presents the results of our first difference-in-differences estimation using the daily returns as dependent variable.

As shown in model (1), the general level 1 ESG score shows a positive and statistically significant relation to returns. In particular, daily returns are 1.7 bps higher for firms with good ESG performance. Models (2) to (4) employ the level 2 ESG pillars separately and in turn find that the positive association remains strong and statistically significant for the SOC pillar at 1.1 bps while the ENV and GOV pillar show no statistical significance. Model (5) employs a Horse Race between all level 2 ESG scores but we do not find that any of the scores is more prevalent than the others.

In line with our first hypothesis, these findings suggest that good ESG performance is positively value relevant and benefits stock performance after the shock which strongly supports the idea of the ESG insurance effect. Moreover, our results indicate that the SOC pillar might be more value-relevant than the ENV and GOV pillar. Considering that the COVID-19 pandemic rapidly changed work conditions on a global scale, we argue that higher commitment to social issues might results in greater stakeholder support, ultimately providing the firm with greater resilience to steer through the crisis. Lins et al. (2017) document such insurance-like protection against negative shocks during the financial crisis, albeit only considering CSR performance. Nonetheless, CSR is a subcomponent of the SOC pillar that also shows significant associations in model (4). These findings are generally in line with related studies on the positive value-relevance of ESG and the related insurance effect (Jain et al. (2016), Albuquerque et al. (2020)).

[Table 4 about here]

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[Table 5 about here]

To disentangle which factors mainly drive the value-relevance of ESG performance, we subsequently assess daily returns using the level 3 ESG subpillars in Tables 4 and 5. Again, we employ daily returns as the dependent variable.

Firstly, in terms of the ENV subpillar, we find that firms with lower emissions as well as firms with a more efficient use of resources benefit from the ESG insurance effect as indicated by the statistically significant outperformance of 1.0 bps and 1.2 bps, respectively. Hereto, we propose a possible explanation: environment responsible management process improve the quality and the efficiency of the firm providing it with the means to face economic turnmoils. Moreover, investors might anticipate the efficient handling of supply chains – as reflected in the ENV resource use subpillar – to be a key factor during the aftermath of the pandemic.

Secondly, the SOC subpillars provide strong evidence that compliance with human rights and better workforce treatment increases outperformance by 1.7 bps and 1.5 bps, respectively. These results align with the overall idea of increased stakeholder support through better SOC performance. We propose that the information captured in SOC human rights relates to the workforce crisis that emerged alongside COVID-19, especially in countries with bad general working conditions: infected workers were forced to quarantine, and lockdowns prevented healthy employees from commuting to work which left them non-productive until remote working infrastructure was set up. Moreover, each firm has a varying number of tasks and professions that are constrained to on-site execution - such as container handling, medical care or physical server management – that either had no way of fulfilling their duties or were forced to work under severely aggravated working conditions. Since every job on the globe was hereby impeded in some way – some more than others - we argue that firms with better human rights compliance might have benefited from greater employee retention and loyalty so that those firms systematically suffered less from business disruptions due to workforce shortage. Similarly, firms with better ESG performance in terms of workforce treatment might have benefitted in a similar way. During and after the crisis, a growing number of employees became less hesitant to quit or change their job, as suggested by anecdotal evidence about the wave of resignations that followed the widespread return-to-office call when pandemic conditions eased[13].

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[13] A study by Robert Half, a talent company, reports that half of employees would rather quit their job instead of giving up working from home. See Robert Half (2022): "Half Of Workers Would Rather Quit Than Return To

As new hires are costly and require a training period before becoming effective workers, we argue that employees might be willing to stay with their employer for longer even in times of crisis – such as in the style of a worker's goodwill towards the firm – which causes the firm to overperform. Contrastingly, if firms with bad workforce treatment suffer from too much staff reduction, daily operations and supply chains might collapse.

Thirdly, in terms of the GOV subpillars, we find strong evidence that good Corporate Social Responsibility (CSR) drives outperformance as depicted by the statistically significant daily returns of 1.4 bps in model (8). A high level of Corporate Social Responsibility facilitates both the firms' aspirations to do good in society and environment as well as their ability to communicate their aspirations efficiently to stakeholders and investors, making it easier for market participants to evaluate ESG-related activities. Following Deng, Kang and Low (2013) in the idea that CSR activities signal the firms' willingness to satisfy implicit contracts with stakeholders – both with close and indirect stakeholders – we argue that CSR might have been a key tool to convey trustworthiness during the crisis when firms required outside help or competed for scarce resources from suppliers. Likewise, since the lion's share of everyday life was entirely shifted to remote living, social media became even more prevalent which is where news about particularly good and bad CSR performances are quickly spread – representing the compliance or breach implicit contracts with broad stakeholders.

In summary, we find strong evidence that ESG is positively value-relevant and provides an insurance-like effect during times of crisis, however the SOC pillar holds more explanatory power. We disentangle the subpillars to find that the insurance-like effect is most likely driven by reduced emissions, more efficient resources usage, better human rights compliance and workforce treatment as well as better CSR performance.

[Table 6 about here]

Controlling for Short Selling Volumes

As ESG scores starts to raise some concerns such as measurement error or greenwashing, we are facing an omitted bias risk. To takle this risk, we rely on the short selling activity captured by the log of short selling volume. As mentioned earlier, short sellers literature show evidence of their superior

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The Office Full Time, Robert Half Research Shows", URL: https://www.prnewswire.com/news-releases/half-of-workers-would-rather-quit-than-return-to-the-office-full-time-robert-half-research-shows-301507519.html [22 June, 2020]

ability in treating ambiguous information and shying away from good ESG firms. Ensuing, we assess short selling returns in firms with good ESG profiles after the COVID-19 shock. Our model – as presented in Table 6 – employs 1-day abnormal returns as dependent variable. We interact the ESG score with both the Covid dummy and the logarithm of short sale volumes ($C \times ESG_1 \times LnSV$). The interaction term $C \times ESG_1 \times LnSV$ in specification (1) represents a statistically significant 1-day alpha of 5.7 bps per 1% of increased short volume in firms with good ESG performance, constituting the average 1-day outperformance of short sellers in good ESG firms as a function of short volume. Adding the triple interaction doesn't not alter the results mentioned in the previous tables. The signs and magnitude of the interaction between the COVID-19 dummy and the ESG grade are qualitatively similar. We notice that the triple interaction term has a negative sign which indicate a positive return for the short-sellers. Short sellers trading on good ESG score firms are able to get positive returns. Assuming that they usually shy away from true good ESG firms, we can conjecture that they were able to screen between true high score and measurement error.

Subsequently, we employ each of the level 2 pillars – environmental (ENV), governance (GOV) and social (SOC) - separately in model (2) to (4) and again report statistically significant alphas of 6.0 bps (ENV), 5.3 bps (SOC) and 5.4 bps (GOV) per 1% of increased short volume, respectively.

These findings show that high short selling activity in firms with good ESG profiles yield an outperformance, holding true for all of the ENV, SOC and GOV pillars. This lends some support to the presumption that short sellers could uncover greenwashing in firms or correctly assess the firms' true ESG profiles. Short sellers then continue to exploit their informational advantage and other market participants successively learn about the true ESG profiles of the firms in question. This is in line with related studies (e.g., Jain et al. (2016)) that generally find short selling to be inversely related to ESG performance.

Our findings imply possible greenwashing or ESG measurement errors in all subpillars, whereby the following interesting thoughts come to mind: (1) The ENV emissions, innovation and resource usage subpillars refer to the same underlying topic of environmental firm risk. While during the COVID-19 crisis these topics experienced anecdotical attention, they were not the focus on investors and citizen[14]. With the increased probability of environmental problems surfacing and resulting in negative consequences because of these straining market conditions, such risks might be escomposed with strong negative price reactions if greenwashing or measurement errors are revealed, as evident by

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[14] One can see the google trend index and compare keywords related to the pandemic vs environmental issues such as the climate change. There is a strong focus on health risk.

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our results. (2) In terms of GOV CSR, we argue that there is intuitive reasoning for the pillar's value-relevance: CSR represents the firms' repertoire of practices to communicate their integration of ESG into daily decision making as well as management best practices to facilitate corporate transparency. Although many studies use the term CSR in varying definitions and oftentimes interchangeably with the term ESG, prior literature generally recognizes the incorporation of ESG-related activities into day-to-day decision making as value enhancing (Friede, Busch, and Bassen (2015)). We argue that good CSR performance is especially helpful in the context of the COVID-19 setting, as those firms succeed in communicating their ESG strategies so that market participants can more easily assess if those ESG activities create value and consider their impact on the magnitude of the insurance effect. Moreover, those firms that communicate their ESG strategies more efficiently might be those that have better strategies in the first place, so that they are willing to communicate them proactively. The high amount of available information on CSR activities makes it then easier for short sellers to uncover greenwashing and measurement errors. (4) As argued before, we propose that the information captured in SOC human rights relates to the workforce crisis that emerged alongside COVID-19. In contrast to workforce treatment, which is rather easy to assess in industrialized countries due to the vast amount of information available from governance reports, social media and general information efficiency, we argue that supply chains and labor conditions in supplier countries are more opaque and relevant information is oftentimes withheld from public release. As short sellers are perceived as more well-informed than other market participants and better skilled to process more opaque and qualitative information (Blau et al, 2015), we argue that they might be more adept at uncovering and trading on human rights as well as on supply chain and labor issues in important supplier countries.

Our final model (5) then employs a Horse Race between all of the level 2 ESG pillars and yields interesting results: while ENV is associated with 2.7 bps of outperformance for the short sellers and a 6.8 bps performance for the interaction COVID-19 and ENV, there is no evidence for a significant relation of the SOC pillar and the GOV is even associated with 2.6 bps of negative returns. This might indicate that short sellers are more adept at uncovering greenwashing and error measurements in relation to environmental topics while firms with good GOV performances might offer less exploitable trading opportunities for short sellers, albeit contradicting evidence presented in model (4). But it also show that controlling for the short selling activity, firms with good ENV scores were able to recover more after the COVID-19 shock. This is in line with the insurance effect that covers not

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only the risks directly related to the health issue affecting the firm, but the whole resilience of the firm.

[Table 7 about here]

[Table 8 about here]

Following, we again disentangle the driving factors of short sellers' outperformance using the level 3 ESG subpillars. The results of our analysis are presented in Tables 7 and 8. As before, we use 1-day returns as dependent variable.

Consistent with former findings in terms of the level 2 ESG pillars, we find negative and statistically significant relations for each of the ENV, SOC, and GOV level 3 subpillars. The results vary in magnitude, showing an average 5.2 to 5.5 bps outperformance for the EVN subpillars, 3.8 to 4.8 bps for the SOC subpillars and 5.3 bps to 5.6 bps for the GOV subpillars. The slightly lower outperformance in SOC might relate to the generally increased awareness for social topics during and after the pandemic, through which society might already uncover many grievances and issues to improve price discovery, ultimately reducing exploitable opportunities for short sellers.

Taken together, we document strong evidence that short sellers are more adept at assessing ESG information. When short sellers increase their positions in a good ESG firm, they generate high alphas which we interpret as the revelation and exploitation of greenwashing or ESG measurement errors by third party ESG-score providers. Especially during the pandemic when the frequency of surfacing problems and internal failures within firms is highly elevated, average market participants might not have the resources or information processing skills to differentiate between COVID-19-induced problems and pre-existing self-conjured problems, nor might they be able to differentiate between valuable ESG activities and greenwashing ESG activities with little to no positive impact on environment, society or governance.

4.3 Robustness

We employ a range of robustness tests to validate our findings. Hereto, we alter our regression model to employ a permanent Horse Race with the general level 1 ESG pillar. Moreover, we exclude the continuous ESG score form the control vector $X_{i,t}$. Our new model takes the following form:

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$$(1) \; Abn \; Ret_{i,t} = \alpha_t + \boldsymbol{\beta_{1R}}(\boldsymbol{COVID_t \; x \; ESG_{1,i,t}}) + \boldsymbol{\beta_{3R}ESG_{1,i,t}} + \beta_1(COVID_t \; x \; ESG_{i,t})$$
$$+ \beta_2 COVID_t + \beta_3 ESG_{i,t} + \gamma_{i,t}X_{i,t} + \delta_i + \theta_t + \epsilon_{i,t}$$

$$(2) \; Abn \; Ret_{i,t} = \alpha_t$$
$$+ \boldsymbol{\beta_{1R}}(\boldsymbol{COVID_t \; x \; ESG_{1,i,t} \; x \; Ln \; SV_{i,t}}) + \boldsymbol{\beta_{2R}}(\boldsymbol{COVID_t \; x \; ESG_{1,i,t}})$$
$$+ \boldsymbol{\beta_{4R}}(\boldsymbol{ESG_{1,i,t} \; x \; Ln \; SV_{i,t}}) + \beta_1(COVID_t \; x \; ESG_{i,t} \; x \; Ln \; SV_{i,t})$$
$$+ \beta_2(COVID_t \; x \; ESG_{i,t}) + \beta_3(COVID_t \; x \; Ln \; SV_{i,t}) + \beta_4(ESG_{i,t} \; x \; Ln \; SV_{i,t})$$
$$+ \gamma_{i,t}X_{i,t} + \delta_i + \theta_t + \epsilon_{i,t}$$

[Table 9 about here]

[Table 10 about here]

[Table 11 about here]

Returns

We repeat the main analyses and subpillar decompositions with our new regression model. The results for level 1 and level 2 ESG pillars are reported in Table 9, the results of the level 3 subpillars decompositions are reported in Tables 10 and 11. Throughout all models, the general level 1 ESG score remains the strongest and statistically significant ESG pillar, albeit with varying magnitudes in the range of 1.8 bps to 2.0 bps (Table 9). Interestingly, we do find positive associations of +1.8 bps for human rights and +1.5 bps for workforce within the models (Table 10). The CSR is also associated with a +1.3 bps. However we argue that these results should be treated with caution. Moreover, we do not find any further indications on which of the subpillars might hold elevated explanatory power.

Short Selling Returns

Likewise, we repeat all analyses for short selling returns using the new regression model. The results for level 1 and level 2 ESG sub-pillars are reported in Table 11. In line with our main findings, we see negative and statistically significant alphas for both the level 1 ESG pillar only (unreported for sake of space) and each of the level 2 and level 3 subpillars, which strongly supports our previous results.

Triple interaction term shows some interesting results. After Covid-19, firms with high innovation score facing high short selling volume are associated with a negative coefficient -1.9 bps.

5. Conclusion

We use publicly available data on daily short volume across all US exchanges – as reported by FINRA – before and during the COVID-19 pandemic to assess (1) if ESG activities provide insurance-like mitigation against price drops during times of crisis and (2) if short sellers uncover greenwashing by firms or ESG measurement errors by third-party ESG score providers. We exploit the COVID-19 shock to provide causal evidence for the existence of the ESG insurance effect and short sellers' uncovering of greenwashing an measurement errors in a difference-in-differences approach.

Consistent with our first hypothesis, we find strong evidence in favor of the ESG insurance effect as depicted by systematic daily alphas of 1.7 bps for firms with good ESG performance. Our subpillar decompositions indicate that the outperformance is most likely driven by (1) reduced emissions, (2) efficient resource use, (3) human rights compliance, (4) good workforce treatment and (5) good CSR. These findings are in line with existing literature and support the consensus that ESG is generally value-enhancing.

Following, we document supporting evidence for our second hypothesis: When short sellers take large positions in firms with good ESG profiles, we find strong negative 1-day returns of 5.7 bps for each 1% of elevated short volume, posing strong evidence that short sellers uncover greenwashing or ESG measurement errors so that other market participants can successively learn about the true underlying ESG characteristics of the firm. These findings hold true for the ENV (6.0 bps), SOC (5.3 bps), and GOV (5.4 bps) pillars, as well for all level 3 subpillars, with varying magnitudes.

Altogether, we provide strong evidence that ESG is positively linked to firm value creation and provides strong downside protection during times of crises which is consistent with prior literature. In particular, the exogenous shock caused market participants to re-assess firm valuations and devalued any private information that market participants might have possess while introduced unprecedented levels of uncertainty. We argue that many problems that surfaced during the pandemic could be covered up to a certain extent before the crisis, however the COVID-19 stress test limited the firms' abilities to cover up these issues going forward which became apparent with the widespread lockdowns, curfews, labor shortages, missing shipments and more. In this context, short

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sellers through their superior information processing abilities are an important tool to identify which firms engaged in value-creating ESG activities that create important trust with stakeholders so that these show higher willingness to support the firm during the crisis, as opposed to firms that engaged in greenwashing ESG activities "for the looks" or have measurement errors in their ESG scores, so that there might not be ab insurance effect. In this context, firms might exploit the opaqueness of the COVID-19 pandemic to attribute internal failures and pre-existing scandals to the pandemic[15] whereas short sellers are adept at disentangling deception tactics from the true ESG characteristics.

This paper is relevant to both market participants and researchers. We extend on the understanding of the inherent value-relevance of ESG and the existence of an ESG-related insurance effect built through stakeholder trust. Our work fully aligns with the literature consensus in the notion that ESG is generally value-enhancing.

For future research we want to expand the analysis to include scores of different ESG providers as we only obtained scores from Refinitiv as a single source. Of course those providers needs to propose a sub-pillars level of details.

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[15] See Big Bath Theory

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Figure 1
Refinitiv ESG Scoring System (Asset4)

	ESG Score	
Environment	Social	Governance
Emissions	Community	Corporate Social Responsibility
Innovation	Human Rights	Management
Resource Use	Responsible Product	Shareholders
	Workforce	

ESG$_1$

ESG$_2$

ESG$_3$
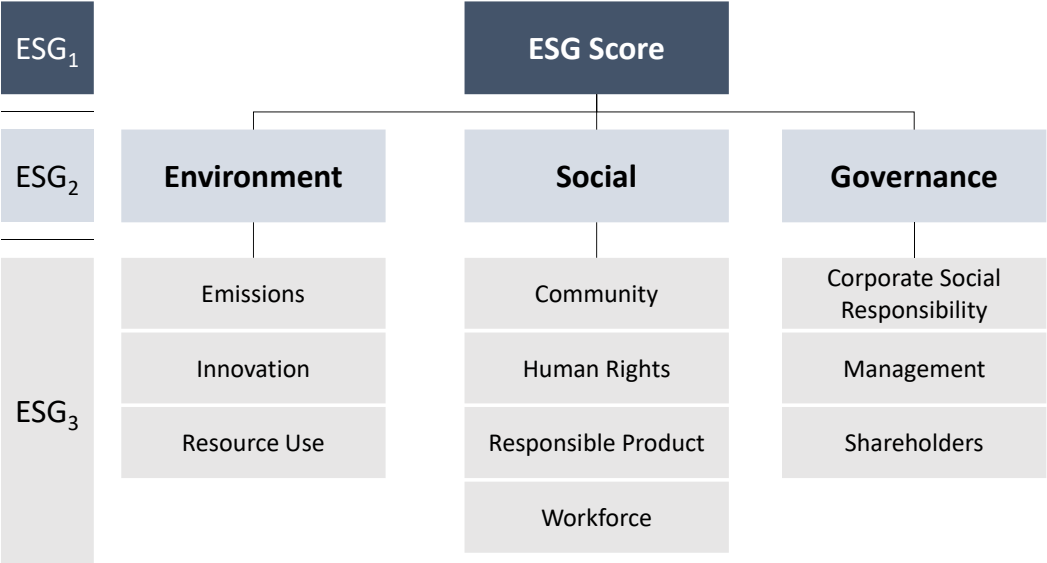
Figure 2

Time Series of the S&P 500 index and Aggregate Short Volume

Figure 1 depicts the development of the S&P 500 index using 02 May 2018 as baseline (left axis) as well as the aggregate volume of shares shorted in millions throughout the sample period (right axis). Moreover, the median 1-day abnormal returns are illustrated in the form of indication bars on the top side of the graph.
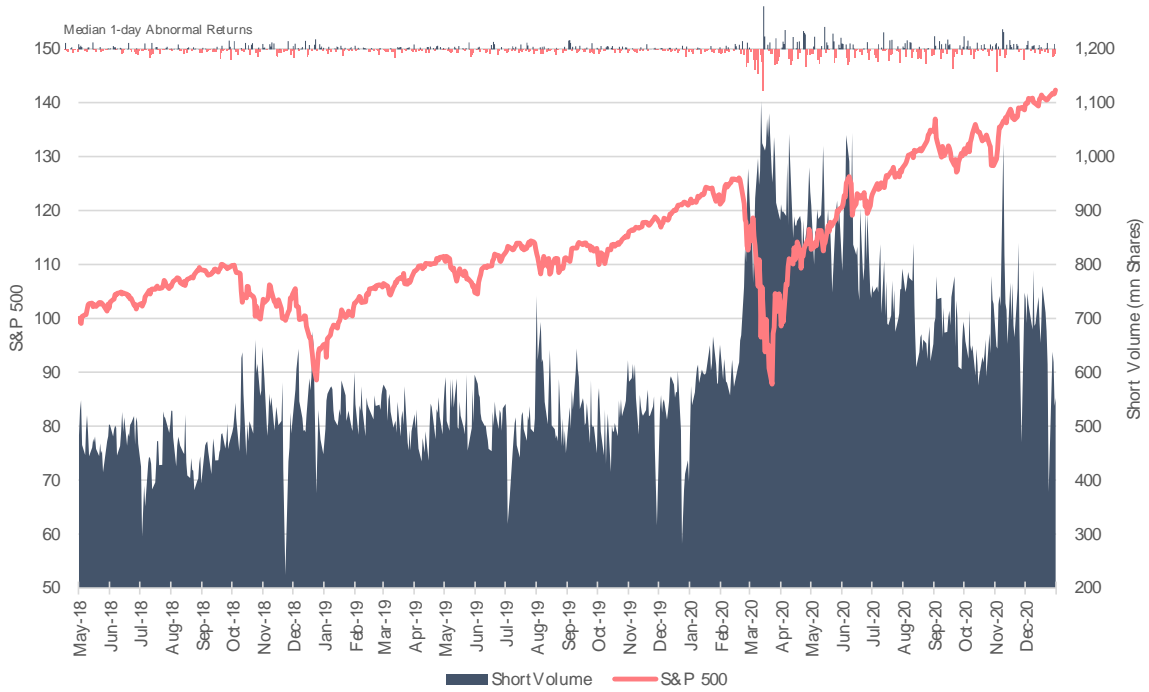
Table 1 (to be updated)
Summary Statistics

Table 1 reports detailed summary statistics for (A) the full sample during the observation period as well as (B) a juxtaposition of pre-COVID-19 and post-COVID-19 summary statistics. Variable definitions are presented in Table A1.

A: Full Sample

	n	Mean	Mdn	S.D.	Min	Max
AbnReturns 1-day	1,804,239	-0.02	-0.05	2.68	-8.32	9.52
LnShortVolume	1,740,646	2.71	1.11	8.04	0.00	64.90
ShortVolume	1,740,646	3.14	1.12	10.89	0.00	91.36
MarketCap	1,881,628	8,730.46	1,461.51	23,106.67	6.33	160,000.00
Market-2-Book	1,871,173	2.35	1.47	2.34	0.53	14.97
LnSpread$_{[-5,-1]}$	1,801,238	0.24	0.09	0.38	0.01	2.15
Spread$_{[-5,-1]}$	1,801,238	0.41	0.09	1.03	0.01	7.56
LnVolatility	1,805,450	0.60	0.63	0.61	0.00	2.61
Volatility	1,805,450	1.20	0.88	1.41	0.00	12.62
Turnover$_{[-5,-1]}$	1,795,716	60.18	10.58	138.05	0.00	909.05
Beta 1-Year	1,788,893	1.01	0.98	0.64	-0.88	3.49
Momentum$_{[-5,-1]}$	1,803,262	-0.05	-0.14	6.09	-18.64	21.68

B: Pre-COVID-19 vs Post-COVID-19

	Pre-Covid			Post-Covid	
	Mean	Mdn		Mean	Mdn
AbnReturns 1-day	-0.02	-0.03		-0.03	-0.12
LnShortVolume	2.72	1.09		2.67	1.18
ShortVolume	3.16	1.10		3.09	1.19
MarketCap	8,810.89	1,550.73		8,525.41	1,249.55
Market-2-Book	2.38	1.51		2.28	1.37
LnSpread$_{[-5,-1]}$	0.23	0.08		0.27	0.11
Spread$_{[-5,-1]}$	0.39	0.08		0.47	0.12
LnVolatility	0.56	0.62		0.71	0.67
Volatility	1.05	0.85		1.59	0.96
Turnover$_{[-5,-1]}$	57.20	10.42		67.76	11.00
Beta 1-Year	0.94	0.92		1.18	1.12
Momentum$_{[-5,-1]}$	-0.06	-0.11		0	-0.3

Table 2

Correlation matrix: ESG scores

Table 2 reports correlations between ESG scores of level 1 and 2. ESG levels are illustrated in Figure 1.

	ESG_1	ESG_2 (Env)	ESG_2 (Gov)	ESG_2 (Soc)
ESG_1	1			
ESG_2 (Env)	0.8635	1		
ESG_2(Gov)	0.7065	0.4411	1	
ESG_2 (Soc)	0.8748	0.7459	0.3736	1

Table 3
Main Analysis: Returns

Table 3 reports the main results of the Difference-in-Differences estimations using the 1-day abnormal returns as dependent variable. ESG levels are illustrated in Figure 1. Variables are defined in Table A1. We interact the ESG scores with the Covid-19 dummy. This interaction is done respectively with the global ESG score, the environment pillar, the social pillar and the governance pillar. Model 5 include all pillars. We include time-fixed and firm-fixed effects. All standard errors are clustered robust at the firm-level and reported in parentheses. *, **, *** denote significance at the 10%, 5%, 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
Dependent Variable	1-day AbnRet	1-day AbnRet	1-day AbnRet	1-day AbnRet	1-day AbnRet
C x ESG_1	0.017***				
	(0.005)				
ESG_1	-0.001				
	(0.005)				
C x $ESG_{2.ENV}$		0.008			0.004
		(0.005)			(0.006)
$ESG_{2,ENV}$		-0.005			0.005
		(0.005)			(0.006)
C x $ESG_{2,SOC}$			0.011**		0.004
			(0.005)		(0.005)
$ESG_{2,SOC}$			-0.018***		0.004
			(0.005)		(0.006)
C x $ESG_{2,GOV}$				0.008	0.005
				(0.005)	(0.006)
$ESG_{2,GOV}$				-0.006*	0.004
				(0.004)	(0.005)
$ESG_{1\,(Continuous)}$	-0.000	0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LnSV	-0.086***	-0.086***	-0.086***	-0.086***	-0.086***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Covid	-1.078***	-1.073***	-1.073***	-1.073***	-1.076***
	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)
MarketCap	0.002***	0.002***	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market-2-Book	0.015***	0.015***	0.015***	0.015***	0.015***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$LnSpread_{[5,-1]}$	0.037*	0.037	0.036	0.036	0.037
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
LnVola	0.043***	0.043***	0.043***	0.043***	0.043***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
$Turnover_{[-5,-1]}$	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Beta 1-year	0.020***	0.020***	0.020***	0.020***	0.020***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$Momentum_{[-5,-1]}$	0.182***	0.182***	0.182***	0.182***	0.182***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	1.032***	1.028***	1.025***	1.026***	1.029***
	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)
Time FE	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Observations	1,475,493	1,475,493	1,475,493	1,475,493	1,475,493
R-squared	0.226	0.226	0.226	0.226	0.226

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Table 4
Subpillar Analysis: Returns (1/2)

Table 4 and 5 report the results of the ESG subpillar analysis using 1-day abnormal Returns as dependent variable. ESG levels are illustrated in Figure 1. Variables are defined in Table A1. We interact the ESG sub-pillar scores with the Covid-19 dummy. We include time-fixed and firm-fixed effects. All standard errors are clustered robust at the firm-level and reported in parentheses. *, **, *** denote significance at the 10%, 5%, 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
Dependent Variable	1-day AbnRet	1-day AbnRet	1-day AbnRet	1-day AbnRet	1-day AbnRet
C x $ESG_{3,ENV\ (Emissions)}$	0.010**				
	(0.005)				
$ESG_{3,ENV\ (Emissions)}$	-0.004				
	(0.005)				
C x $ESG_{3,ENV\ (Innovation)}$		0.006			
		(0.005)			
$ESG_{3,ENV\ (Innovation)}$		-0.004			
		(0.007)			
C x $ESG_{3,ENV\ (Resource\ Use)}$			0.012**		
			(0.005)		
$ESG_{3,ENV\ (Resource\ Use)}$			-0.001		
			(0.005)		
C x $ESG_{3,SOC\ (Community)}$				-0.005	
				(0.005)	
$ESG_{3,SOC\ (Community)}$				0.000	
				(0.005)	
C x $ESG_{3,SOC\ (Human\ Rights)}$					0.017***
					(0.005)
$ESG_{3,SOC\ (Human\ Rights)}$					-0.006
					(0.005)
$ESG_{1\ (Continuous)}$	0.000	0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Controls	YES	YES	YES	YES	YES
Constant	1.029***	1.027***	1.029***	1.026***	1.029***
	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)
Time FE	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Observations	1,475,493	1,475,493	1,475,493	1,475,493	1,475,493
R-squared	0.226	0.226	0.226	0.226	0.226

Table 5
Subpillar Analysis: Returns (2/2)

Tables 4 and 5 report the results of the ESG subpillar analysis using 1-day abnormal Returns as dependent variable. ESG levels are illustrated in Figure 1. Variables are defined in Table A1. We include time-fixed and firm-fixed effects. All standard errors are clustered robust at the firm-level and reported in parentheses. *, **, *** denote significance at the 10%, 5%, 1% levels, respectively.

	(6)	(7)	(8)	(9)	(10)
Dependent Variable	1-day AbnRet	1-day AbnRet	1-day AbnRet	1-day AbnRet	1-day AbnRet
C x $ESG_{3,SOC\ (Resp.\ Product)}$	0.001				
	(0.005)				
$ESG_{3,SOC\ (Resp.\ Product)}$	0.007				
	(0.006)				
C x $ESG_{3,SOC\ (Workforce)}$		0.015***			
		(0.005)			
$ESG_{3,SOC\ (Workforce)}$		0.003			
		(0.004)			
C x $ESG_{3,GOV\ (CSR)}$			0.014***		
			(0.005)		
$ESG_{3,GOV\ (CSR)}$			-0.004		
			(0.005)		
C x $ESG_{3,GOV\ (Management)}$				0.007	
				(0.005)	
$ESG_{3,GOV\ (Management)}$				0.001	
				(0.004)	
C x $ESG_{3,GOV\ (Shareholders)}$					-0.004
					(0.005)
$ESG_{3,GOV\ (Shareholders)}$					0.001
					(0.004)
$ESG_{1\ (Continuous)}$	0.000	0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Controls	YES	YES	YES	YES	YES
Constant	1.026***	1.030***	1.028***	1.029***	1.026***
	(0.048)	(0.048)	(0.048)	(0.048)	(0.049)
Time FE	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Observations	1,475,493	1,475,493	1,475,493	1,475,493	1,475,493
R-squared	0.226	0.226	0.226	0.226	0.226

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Table 6
Main Analysis: With Short Selling Volume

Table 6 reports the main results of the Difference-in-Differences estimations using 1-day abnormal returns as dependent variable and triple interaction terms (Covid, ESG, natural logarithm of short volume). ESG levels are illustrated in Figure 1. Variables are defined in Table A1. We include time-fixed and firm-fixed effects. All standard errors are clustered robust at the firm-level and reported in parentheses. *, **, *** denote significance at the 10%, 5%, 1% levels, respectively.

Dependent Variable	(1) 1-day AbnRet	(2) 1-day AbnRet	(3) 1-day AbnRet	(4) 1-day AbnRet	(5) 1-day AbnRet
C x ESG_1 x LnSV	-0.057***				
	(0.005)				
C x ESG_1	0.181***				
	(0.021)				
ESG_1 x LnSV	0.093***				
	(0.005)				
ESG_1	-0.340***				
	(0.019)				
C x $ESG_{2,Env}$ x LnSV		-0.060***			-0.027***
		(0.005)			(0.007)
C x $ESG_{2,Env}$		0.174***			0.068***
		(0.021)			(0.026)
$ESG_{2,Env}$ x LnSV		0.105***			0.031***
		(0.006)			(0.003)
$ESG_{2,Env}$		-0.405***			-0.010*
		(0.024)			(0.006)
C x $ESG_{2,Soc}$ x LnSV			-0.053***		0.002
			(0.005)		(0.025)
C x $ESG_{2,Soc}$			0.148***		0.024***
			(0.021)		(0.002)
$ESG_{2,Soc}$ x LnSV			0.096***		-0.013**
			(0.005)		(0.005)
$ESG_{2,Soc}$			-0.374***		0.037*
			(0.020)		(0.022)
C x $ESG_{2,Gov}$ x LnSV				-0.054***	0.026***
				(0.005)	(0.002)
C x $ESG_{2,Gov}$				0.180***	-0.027***
				(0.021)	(0.007)
$ESG_{2,Gov}$ x LnSV				0.092***	0.068***
				(0.005)	(0.026)
$ESG_{2,Gov}$				-0.348***	0.031***
				(0.019)	(0.003)

ESG$_{1\ (Continuous)}$	-0.001*	-0.000	-0.000	-0.000*	-0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Controls	YES	YES	YES	YES	YES
Constant	1.147***	1.158***	1.150***	1.161***	1.147***
	(0.050)	(0.051)	(0.051)	(0.051)	(0.050)
Time FE	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Observations	1,475,493	1,475,493	1,475,493	1,475,493	1,475,493
R-squared	0.226	0.226	0.226	0.226	0.226

Table 7
Subpillar Analysis: With Short Selling Volume (1/2)

Table 7 and 8 report the main results of the Difference-in-Differences estimations using 1-day abnormal returns as dependent variable and triple interaction terms (Covid, ESG, natural logarithm of short volume). ESG levels are illustrated in Figure 1. Variables are defined in Table A1. We include time-fixed and firm-fixed effects. All standard errors are clustered robust at the firm-level and reported in parentheses. *, **, *** denote significance at the 10%, 5%, 1% levels, respectively.

Dependent Variable	(1) 1-day AbnRet	(2) 1-day AbnRet	(3) 1-day AbnRet	(4) 1-day AbnRet	(5) 1-day AbnRet
C x $ESG_{3,Env Emissions}$ x LnSV	-0.052***				
	(0.005)				
C x $ESG_{3,Env Emissions}$	0.150***				
	(0.021)				
$ESG_{3,Env Emissions}$ x LnSV	0.097***				
	(0.006)				
$ESG_{3,Env Emissions}$	-0.360***				
	(0.022)				
C x $ESG_{3,Env Innovation}$ x LnSV		-0.054***			
		(0.005)			
C x $ESG_{3,Env Innovation}$		0.174***			
		(0.021)			
$ESG_{3,Env Innovation}$ x LnSV		0.106***			
		(0.006)			
$ESG_{3,Env Innovation}$		-0.410***			
		(0.028)			
C x $ESG_{3,Env Resource Use}$ x LnSV			-0.055***		
			(0.005)		
C x $ESG_{3,Env Resource Use}$			0.163***		
			(0.021)		
$ESG_{3,Env Resource Use}$ x LnSV			0.102***		
			(0.006)		
$ESG_{3,Env Resource Use}$			-0.379***		
			(0.023)		
C x $ESG_{3,Soc Community}$ x LnSV				-0.048***	
				(0.006)	
C x $ESG_{3,Soc Community}$				0.133***	
				(0.022)	
$ESG_{3,Soc Community}$ x LnSV				0.124***	
				(0.006)	
$ESG_{3,Soc Community}$				-0.498***	
				(0.026)	
C x $ESG_{3,Soc Human Rights}$ x LnSV					-0.044***

	(1)	(2)	(3)	(4)	(5)
					(0.005)
C x $ESG_{3,Soc\ Human\ Rights}$					0.129***
					(0.021)
$ESG_{3,Soc\ Human\ Rights}$ x LnSV					0.105***
					(0.006)
$ESG_{3,Soc\ Human\ Rights}$					-0.421***
					(0.024)
$ESG_{1\ (Continuous)}$	-0.000	-0.000	-0.001**	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Controls	YES	YES	YES	YES	YES
Constant	1.150***	1.134***	1.155***	1.259***	1.154***
	(0.051)	(0.050)	(0.051)	(0.053)	(0.051)
Time FE	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Observations	1,475,493	1,475,493	1,475,493	1,475,493	1,475,493
R-squared	0.226	0.226	0.226	0.226	0.226

Table 8
Subpillar Analysis: With Short Selling Volume (2/2)

Table 7 and 8 report the main results of the Difference-in-Differences estimations using 1-day abnormal returns as dependent variable and triple interaction terms (Covid, ESG, natural logarithm of short volume). ESG levels are illustrated in Figure 1. Variables are defined in Table A1. We include time-fixed and firm-fixed effects. All standard errors are clustered robust at the firm-level and reported in parentheses. *, **, *** denote significance at the 10%, 5%, 1% levels, respectively.

	(6)	(7)	(8)	(9)	(10)
Dependent Variable	1-day AbnRet	1-day AbnRet	1-day AbnRet	1-day AbnRet	1-day AbnRet
$C \times ESG_{3,Soc\ Responsible\ Product} \times LnSV$	-0.038***				
	(0.005)				
$C \times ESG_{3,Soc\ Responsible\ Product}$	0.101***				
	(0.020)				
$ESG_{3,Soc\ Responsible\ Product} \times LnSV$	0.104***				
	(0.006)				
$ESG_{3,Soc\ Responsible\ Product}$	-0.399***				
	(0.024)				
$C \times ESG_{3,Soc\ Workforce} \times LnSV$		-0.051***			
		(0.005)			
$C \times ESG_{3,Soc\ Workforce}$		0.149***			
		(0.021)			
$ESG_{3,Soc\ Workforce} \times LnSV$		0.095***			
		(0.005)			
$ESG_{3,Soc\ Workforce}$		-0.357***			
		(0.021)			
$C \times ESG_{3,Gov\ CSR} \times LnSV$			-0.054***		
			(0.005)		
$C \times ESG_{3,Gov\ CSR}$			0.165***		
			(0.021)		
$ESG_{3,Gov\ CSR} \times LnSV$			0.097***		
			(0.006)		
$ESG_{3,Gov\ CSR}$			-0.389***		
			(0.025)		
$C \times ESG_{3,Gov\ Management} \times LnSV$				-0.056***	
				(0.005)	
$C \times ESG_{3,Gov\ Management}$				0.191***	
				(0.021)	
$ESG_{3,Gov\ Management} \times LnSV$				0.085***	
				(0.005)	
$ESG_{3,Gov\ Management}$				-0.319***	
				(0.018)	
$C \times ESG_{3,Gov\ Shareholders} \times LnSV$					-0.053***
					(0.005)
$C \times ESG_{3,Gov\ Shareholders}$					0.167***
					(0.021)
$ESG_{3,Gov\ Shareholders} \times LnSV$					0.100***
					(0.005)
$ESG_{3,Gov\ Shareholders}$					-0.372***
					(0.020)
$ESG_{1\ (Continuous)}$	-0.000	-0.000	-0.000	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Controls	YES	YES	YES	YES	YES
Constant	1.166***	1.146***	1.136***	1.159***	1.170***
	(0.051)	(0.051)	(0.050)	(0.051)	(0.051)
Time FE	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Observations	1,475,493	1,475,493	1,475,493	1,475,493	1,475,493
R-squared	0.226	0.226	0.226	0.226	0.226

Table 9

Robustness: Returns

Table 9 reports the results of the Difference-in-Differences estimations using 1-day abnormal Returns as dependent variable and the adjusted robustness regression model. The estimation employs a Horse Race between ESG level 1 and each ESG level 2 pillar. ESG levels are illustrated in Figure 1. Variables are defined in Table A1. We include time-fixed and firm-fixed effects. All standard errors are clustered robust at the firm-level and reported in parentheses. *, **, *** denote significance at the 10%, 5%, 1% levels, respectively.

	(1)	(2)	(3)	(4)
Dependent Variable	1-day AbnRet	1-day AbnRet	1-day AbnRet	1-day AbnRet
C x ESG_1	0.018***	0.020***	0.018***	0.019***
	(0.005)	(0.006)	(0.006)	(0.006)
ESG_1	-0.005	-0.005	0.001	-0.004
	(0.004)	(0.004)	(0.004)	(0.004)
C x $ESG_{2.ENV}$		-0.003		
		(0.006)		
$ESG_{2,ENV}$		-0.001		
		(0.004)		
C x $ESG_{2,SOC}$			0.001	
			(0.006)	
$ESG_{2,SOC}$			-0.011***	
			(0.004)	
C x $ESG_{2,GOV}$				-0.002
				(0.006)
$ESG_{2,GOV}$				-0.002
				(0.003)
LnSV	-0.099***	-0.099***	-0.099***	-0.099***
	(0.005)	(0.005)	(0.005)	(0.005)
Covid	-1.137***	-1.136***	-1.138***	-1.137***
	(0.063)	(0.063)	(0.063)	(0.063)
MarketCap	0.002***	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Market-2-Book	0.013***	0.013***	0.013***	0.013***
	(0.002)	(0.002)	(0.002)	(0.002)
$LnSpread_{[5,-1]}$	-0.000	-0.000	-0.000	-0.000
	(0.016)	(0.016)	(0.016)	(0.016)
LnVola	0.048***	0.048***	0.048***	0.048***
	(0.008)	(0.008)	(0.008)	(0.008)
$Turnover_{[-5,-1]}$	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Beta 1-year	0.019***	0.019***	0.019***	0.019***
	(0.003)	(0.003)	(0.003)	(0.003)
$Momentum_{[-5,-1]}$	0.183***	0.183***	0.183***	0.183***
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	1.109***	1.109***	1.111***	1.109***
	(0.044)	(0.044)	(0.044)	(0.044)
Time FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Observations	1,756,661	1,756,661	1,756,661	1,756,661
R-squared	0.222	0.222	0.222	0.222

Table 10
Robustness: Returns (Horse Races)

Table 10 reports the results of the Difference-in-Differences estimations using 1-day abnormal Returns as dependent variable. For each of the level 2 pillars, the estimation employs Horse Races between the level 3 subpillars and the complementary level 2 pillars. ESG levels are illustrated in Figure 1. Variables are defined in Table A1. We include time-fixed and firm-fixed effects. All standard errors are clustered robust at the firm-level and reported in parentheses. *, **, *** denote significance at the 10%, 5%, 1% levels, respectively.

	(1)	(2)	(3)
Dependent Variable	1-day AbnRet	1-day AbnRet	1-day AbnRet
C x $ESG_{2,Env}$		-0.006	-0.004
		(0.007)	(0.007)
C x $ESG_{2,Soc}$	0.006		0.006
	(0.006)		(0.006)
C x $ESG_{2,Gov}$	0.004	0.004	
	(0.005)	(0.005)	
C x $ESG_{3,ENV\ (Emissions)}$	0.003		
	(0.007)		
C x $ESG_{3,ENV\ (Innovation)}$	-0.002		
	(0.006)		
C x $ESG_{3,ENV\ (Resource\ Use)}$	0.006		
	(0.008)		
C x $ESG_{3,SOC\ (Community)}$		-0.009	
		(0.006)	
C x $ESG_{3,SOC\ (Human\ Rights)}$		0.018***	
		(0.006)	
C x $ESG_{3,SOC\ (Resp.\ Product)}$		-0.006	
		(0.006)	
C x $ESG_{3,SOC\ (Workforce)}$		0.015**	
		(0.006)	
C x $ESG_{3,GOV\ (CSR)}$			0.013*
			(0.007)
C x $ESG_{3,GOV\ (Management)}$			0.005
			(0.005)
C x $ESG_{3,GOV\ (Shareholders)}$			-0.006
			(0.005)
ESG_i	YES	YES	YES
$ESG_{1\ (Continuous)}$	0.000*	0.000	0.000
	(0.000)	(0.000)	(0.000)
Controls	YES	YES	YES
Constant	1.024***	1.025***	1.026***
	(0.048)	(0.048)	(0.049)
Time FE	YES	YES	YES
Firm FE	YES	YES	YES
Observations	1,475,493	1,475,493	1,475,493
R-squared	0.226	0.226	0.226

Table 11

Table 11
Robustness: With Short Selling Volume (Horse Races)

Table 11 reports the results of the Difference-in-Differences estimations using 1-day abnormal Returns as dependent variable and triple interaction terms (Covid, ESG, natural logarithm of short volume). For each of the level 2 pillars, the estimation employs Horse Races between the level 3 subpillars and the complementary level 2 pillars. ESG levels are illustrated in Figure 1. Variables are defined in Table A1. We include time-fixed and firm-fixed effects. All standard errors are clustered robust at the firm-level and reported in parentheses. *, **, *** denote significance at the 10%, 5%, 1% levels, respectively.

	(1)	(2)	(3)
Dependent Variable	1-day AbnRet	1-day AbnRet	1-day AbnRet
C x $ESG_{2,Env}$ x LnSV		-0.031***	-0.022***
		(0.007)	(0.008)
C x $ESG_{2,Soc}$ x LnSV	-0.010		-0.006
	(0.007)		(0.007)
C x $ESG_{2,Gov}$ x LnSV	-0.014**	-0.011**	
	(0.006)	(0.005)	
C x $ESG_{3,ENV (Emissions)}$ x LnSV	-0.008		
	(0.007)		
C x $ESG_{3,ENV (Innovation)}$ x LnSV	-0.019***		
	(0.006)		
C x $ESG_{3,ENV (Resource Use)}$ x LnSV	-0.010		
	(0.008)		
C x $ESG_{3,SOC (Community)}$ x LnSV		-0.015***	
		(0.006)	
C x $ESG_{3,SOC (Human Rights)}$ x LnSV		0.011	
		(0.007)	
C x $ESG_{3,SOC (Resp. Product)}$ x LnSV		-0.004	
		(0.006)	
C x $ESG_{3,SOC (Workforce)}$ x LnSV		-0.007	
C x $ESG_{3,GOV (CSR)}$ x LnSV			-0.006
			(0.008)
C x $ESG_{3,GOV (Management)}$ x LnSV			-0.016***
			(0.005)
C x $ESG_{3,GOV (Shareholders)}$ x LnSV			-0.013**
			(0.005)
C x ESG_i	YES	YES	YES
ESG_i x LnSV	YES	YES	YES
ESG_i	YES	YES	YES
C x LnSV	YES	YES	YES
$ESG_{1 (Continuous)}$	-0.006***	-0.007***	-0.006***
	(0.000)	(0.000)	(0.000)
Controls	YES	YES	YES
Constant	1.200***	1.210***	1.208***
	(0.052)	(0.052)	(0.052)
Time FE	YES	YES	YES
Firm FE	YES	YES	YES
Observations	1,475,493	1,475,493	1,475,493
R-squared	0.226	0.226	0.226

Table A1
Variable Definitions

Variables

AbnReturns 1-day	1-day returns in excess of the S&P 500 index based on daily dividend-adjusted close prices
$CxESG_i$	Interaction term of Covid and specific ESG score of level i
Covid	Dummy variable (1 after shock date on 3 Jan 2022)
ESG_i	ESG classification variable (1 above median score, 0 below median score)
$ESG_{i\,(Continuous)}$	ESG scores as continuous value between 0 and 100 (100 being the best score)
LnShortVol	Natural logarithm of daily firm-level short volume as reported by FINRA
ShortVol	Daily firm-level short volume as reported by FINRA
MarketCap	Market Capitalizion
Market-2-Book	(MarketCap +Total Assets – Book Value of Common Equity) over Total Assets
$LnSpread_{[-5,-1]}$	
$Spread_{[-5,-1]}$	5-day preceding average bid-ask spread
LnVola	Natural Logarithm of 6-month return volatility
Vola	6-month return volatility
$Turnover_{[-5,-1]}$	5-day preceding average turnover relative to WASO
Beta 1-Year	Beta 1-Year
$Momentum_{[-5,-1]}$	5-day preceding average cumulative abnormal returns

ESG Scores

|	
ESG_1	Level 1: Aggregate ESG Score
ESG_2 (Env)	Level 2: Environment
ESG_2 (Gov)	Level 2: Governance
ESG_2 (Soc)	Level 2: Social
ESG_3 (Env) Emis	Level 3: Environment – Emissions
ESG_3 (Env) Innov	Level 3: Environment – Innovation
ESG_3 (Env) ResUse	Level 3: Environment – Resource Use
ESG_3 (Gov) CSR	Level 3: Governance – Corporate Social Responsibility
ESG_3 (Gov) Mgmt	Level 3: Governance – Management
ESG_3 (Gov) Shareh	Level 3: Governance – Shareholder
ESG_3 (Soc) Cmnty	Level 3: Social – Community
ESG_3 (Soc) HumanR	Level 3: Social – Human Rights
ESG_3 (Soc) ResProd	Level 3: Social – Responsible Product
ESG_3 (Soc) Workf	Level 3: Social – Workforce

Table A2
ESG Subpillars

This table provides detailed explanations for the ESG subpillar categorizes. All info is directly cited from the official Asset 4 Guide by Refinitiv (2020): "Environmental, Social and Governance (ESG) Scores from Refinitiv"

ESG Subpillar	Explanation
ESG_3 (Env) Emis	The emission reduction score measures a company's commitment and effectiveness towards reducing environmental emissions in its production and operational processes.
ESG_3 (Env) Innov	The innovation score reflects a company's capacity to reduce the environmental costs and burdens for its customers, thereby creating new market opportunities through new environmental technologies and processes or eco-designed products.
ESG_3 (Env) ResUse	The resource use score reflects a company's performance and capacity to reduce the use of materials, energy or water, and to find more eco-efficient solutions by improving supply chain management.
ESG_3 (Gov) CSR	The CSR strategy score reflects a company's practices to communicate that it integrates economic (financial), social and environmental dimensions into its day-to-day decision-making processes
ESG_3 (Gov) Mgmt	The management score measures a company's commitment and effectiveness towards following best practice corporate governance principles.
ESG_3 (Gov) Shareh	The shareholders score measures a company's effectiveness towards equal treatment of shareholders and the use of anti-takeover devices.
ESG_3 (Soc) Cmnty	The community score measures the company's commitment to being a good citizen, protecting public health and respecting business ethics.
ESG_3 (Soc) HumanR	The human rights score measures a company's effectiveness in terms of respecting fundamental human rights conventions.
ESG_3 (Soc) ResProd	The product responsibility score reflects a company's capacity to produce quality goods and services, integrating the customer's health and safety, integrity and data privacy
ESG_3 (Soc) Workf	The workforce score measures a company's effectiveness in terms of providing job satisfaction, a healthy and safe workplace, maintaining diversity and equal opportunities and development opportunities for its workforce

Table A3
Parallel Pre-Trends

Table A2 illustrates graphical representation of parallel pre-trends for our variables of interest. We use 10-month measurement windows around our shock date on 23 Feb 2020 to compute mean daily abnormal returns and mean daily LnShortVolume as reported by FINRA. The pointed line represents the COVID-19 shock.
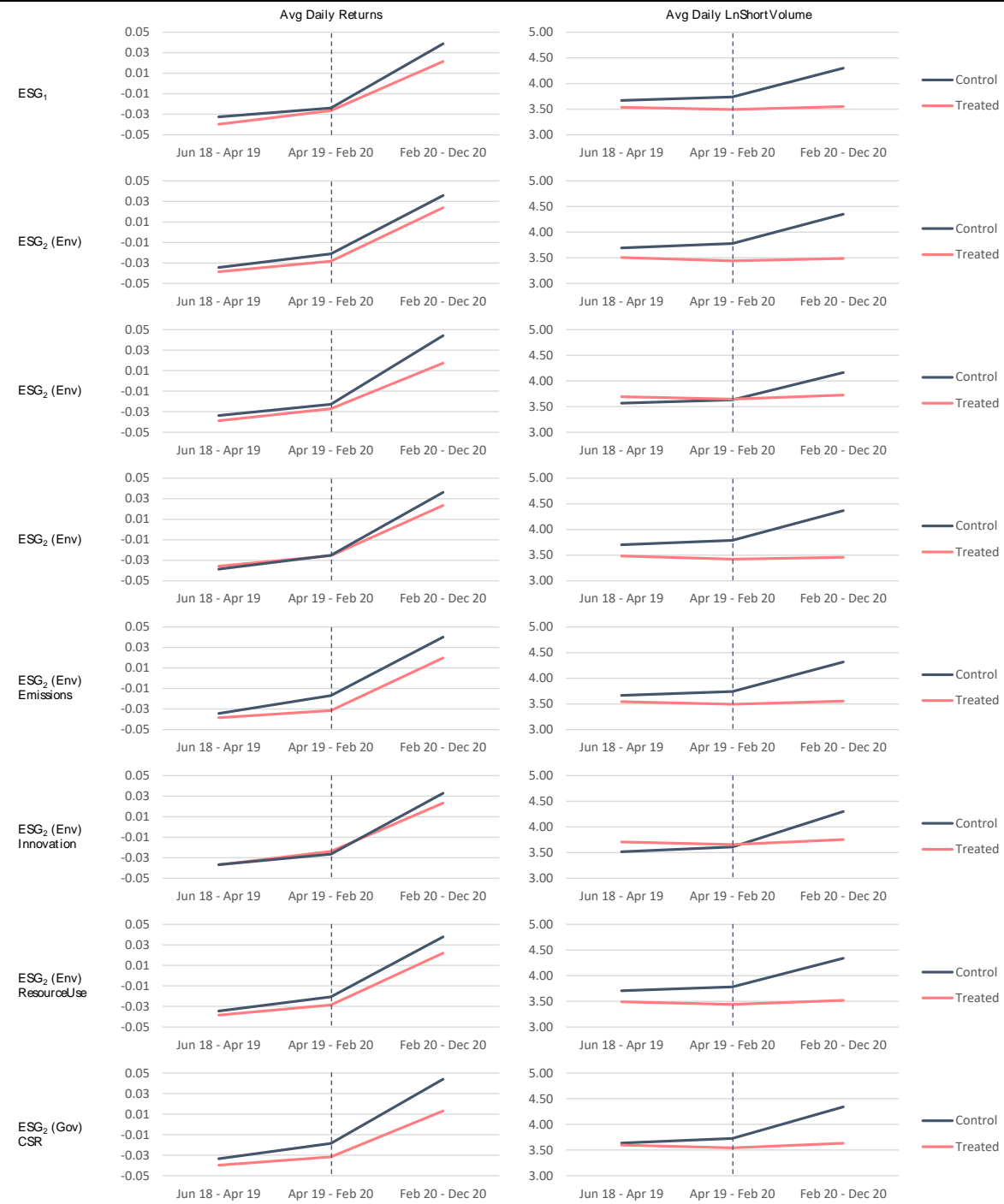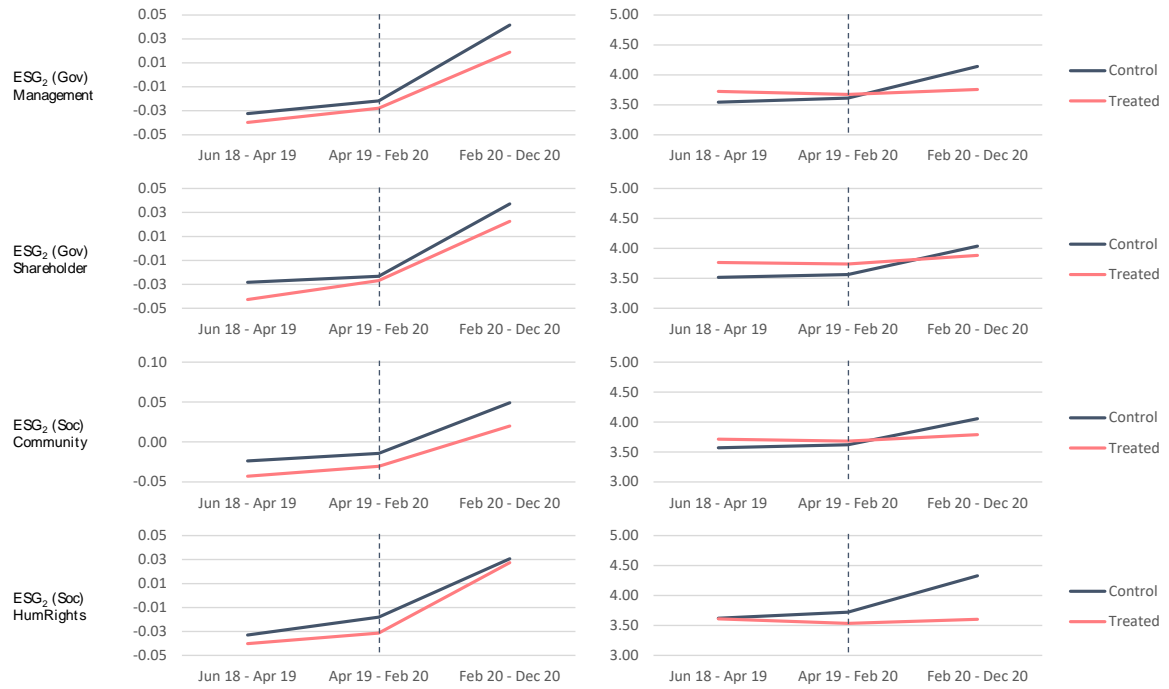
Table A4
Extended Correlation matrix: ESG scores

Table A4 reports correlations between ESG scores of level 1,2 and 3. ESG levels are illustrated in Figure 1.

	ESG_1	$ESG_{2,Env}$	$ESG_{2,Gov}$	$ESG_{2,Soc}$	$ESG_{3,Env\,Emiss}$	$ESG_{3,Env\,Innov}$	$ESG_{3,Env\,Re\text{-}suse}$	$ESG_{3,Gov\,CSR}$	$ESG_{3,Gov\,Mgmt}$	$ESG_{3,Gov\,Share}$	$ESG_{3,Soc\,Cmnty}$	$ESG_{3,Soc\,HumanR}$	$ESG_{3,Soc\,Resprod}$	$ESG_{3,Soc\,Workf}$
ESG_1	1													
$ESG_{2,Env}$	0.87	1												
$ESG_{2,Gov}$	0.6978	0.4382	1											
$ESG_{2,Soc}$	0.8759	0.7513	0.3646	1										
$ESG_{3,Env\,Emiss}$	0.8293	0.9195	0.4263	0.7308	1									
$ESG_{3,Env\,Innov}$	0.5922	0.7481	0.2922	0.4703	0.5513	1								
$ESG_{3,Env\,Resuse}$	0.8496	0.9226	0.4282	0.7659	0.8618	0.5645	1							
$ESG_{3,Gov\,CSR}$	0.7848	0.8315	0.4491	0.6918	0.8325	0.5356	0.8164	1						
$ESG_{3,Gov\,Mgmt}$	0.571	0.2908	0.9442	0.2478	0.2756	0.2024	0.2837	0.2613	1					
$ESG_{3,Gov\,Share}$	0.2537	0.1307	0.4584	0.0842	0.1315	0.0749	0.127	0.1412	0.2133	1				
$ESG_{3,Soc\,Cmnty}$	0.6483	0.5241	0.3092	0.7333	0.5111	0.3351	0.5261	0.4695	0.2301	0.0922	1			
$ESG_{3,Soc\,HumanR}$	0.7274	0.7006	0.3359	0.759	0.6468	0.4619	0.7339	0.6437	0.2208	0.1091	0.4374	1		
$ESG_{3,Soc\,Resprod}$	0.6034	0.508	0.2248	0.706	0.479	0.3628	0.5006	0.4409	0.1534	0.0357	0.3464	0.4299	1	
$ESG_{3,Soc\,Workf}$	0.7674	0.6943	0.3345	0.8319	0.7146	0.3983	0.7028	0.6788	0.2172	0.0739	0.5091	0.5708	0.4894	1