Net Zero Emission Target Adoption as Market Signal: How Investors Screen Non-Financial Targets

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Abstract

In a dual test of signalling and screening theories, this study examines the capital market consequences of corporate net zero emission target adoption as a long-term climate risk management strategy. Consistent with signalling theory, it finds that investors, on average, react positively to corporate net zero target adoption. Integrating signalling theory with screening theory, the study does not observe significant investor reaction when such targets are adopted by firms with prior exposure to activist-driven net zero transition campaigns. However, this study identifies several screening mechanisms that investors consider in reacting to net zero target adoption, especially for firms that previously experienced net zero transition related activism. Investors are found to react positively to net zero targets that conform to investors' expectations, as reflected by the comprehensiveness of net zero target adoption and when the adopted targets are characterized by a higher level of emissions reduction targets. Investor reaction is also found to be positive when target adoption contains planned investment for decarbonization and to attain relevant targets. In the institutional analysis, the study finds that investor positive reaction is related to net zero targets adopted following the US federal and state government's shift toward net zero related policies. Conversely, investors' significant positive reaction disappears for targets adopted after the US legislative committee's attempt to delegitimize and constrain net zero activism by activist investors. Aligning with signalling and screening theories, this study illustrates the extent to which various information sources influence investors' perceptions regarding the adoption of net zero emission targets, particularly when firms have experienced net zero transition activism.

Keywords:

Net zero, targets, carbon emissions, climate change, investor reaction, signalling theory, screening theory, transition activism

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1. Introduction

A recent phenomenon in the carbon mitigation environment has been the rapid growth of net zero-aligned targets (Allen et al., 2022; Fankhauser et al., 2022).[1] By 2023, nearly 50% of the world's leading firms had adopted net zero targets, increasing more than 40% from 2022 (Net Zero Tracker, 2023). Setting a net zero emission target is regarded as the first and most important step in demonstrating a commitment to reduce emissions and transform business processes in line with a target of maintaining global warming to within 1.5^0C above pre-industrial levels (CDP, 2020). Despite their increasing significance, little academic research has explored the adoption of corporate net zero emission targets.

Prior accounting studies have identified various drivers, barriers and moderators influencing carbon emissions and associated issues, along with the ramifications of carbon emissions in capital markets (e.g., Bui et al., 2020; Choi & Luo, 2021; Clarkson et al., 2015; Cohen et al., 2023; Griffin et al., 2017; Matsumura et al., 2014; Schiemann & Sakhel, 2019). These studies focus on firms' emission levels, which represent a current risk with an immediate impact on business operations and financial performance (e.g., Choi & Luo, 2021; Griffin et al., 2017; Matsumura et al., 2014). Consequently, investors penalize firms for increased exposure to higher levels of emissions (e.g., Choi & Luo, 2021; Matsumura et al., 2014). Few studies have also examined carbon emissions reduction targets and the impact of target characteristics on emissions reductions (Dahlmann et al., 2019; Ioannou et al., 2016). A largely ignored issue, however, is the capital market consequences of net zero target adoption as a long-term climate risk management strategy, which is likely to generate long-term performance implications (Ioannou et al., 2016).

Investors are increasingly concerned with firms' climate risks associated with frequent extreme weather events, rising sea levels, and compliance with climate policies and associated regulations (Azar et al., 2021; Krueger et al., 2020; Ramelli et al., 2021).[2] Consequently, they may perceive that firms can generate significant benefits from adopting net zero emission targets. Net zero targets' future-oriented characteristics can indicate to investors that the firm is adequately equipped to adapt to forthcoming carbon emission regulations (Ramelli et al.,

[1] The World Economic Forum (WEF) defines the term "net zero emission" as "eliminating emissions to the greatest extent possible and offsetting any residual emissions with measurable removals" (WEF, 2021). The goal of a net zero target is to balance carbon emissions released against emissions removed from the atmosphere, so that any rise in global warming can be limited to 1.5^0C above pre-industrial levels (Fankhauser et al., 2022; IPCC, 2018).

[2] Alongside corporates, different investors are increasingly aligning their investment portfolios with net zero goal. More than 450 institutions (including large investors, banks and insurers) responsible for over US$130 trillion of capital pledged to transition the global economy to net zero (UNPRI, 2022). This is more than the estimated required investment of US$100 trillion to attain global net-zero goals by 2050 (Dhar & Davidson, 2022).

2021) and heightened climate risks in the long term (Delis et al., 2024).[3] Net zero target adoption can enable firms to capture major opportunities in new green markets and protect themselves from unanticipated reputational risks (WEF, 2021).[4] Few studies show that corporate emission reduction efforts are rewarded by investors (He et al., 2022; Johnson et al., 2020).

Investors may not perceive incremental benefit from corporate net zero aligned targets. A net zero target is an ambitious commitment to climate action, requiring that firms deeply abate emissions (CDP, 2020), internalize the costs of their emissions, increase future carbon liabilities and face potential litigation threats (He et al., 2022; Matsumura et al., 2014). Such a commitment could potentially result in restructuring business models, mergers and acquisitions, investment in clean technologies, and addressing financial and investment risks (Chapple et al., 2013; Monasterolo & de Angelis, 2020).[5] As a result, investors may perceive such target adoption as detrimental to firm value. However, net zero target adoption might not affect investor perception because such target adoption lacks credibility and does not reflect reality (Desai et al., 2023; Jiang et al., 2023; New Climate Institute, 2022). Therefore, it is unclear how investors perceive net zero emission target adoption, a special type of non-financial target. This study, therefore, seeks to answer the following research question:

RQ1: How do investors react to net zero emission target adoption?

A notable feature of the net zero transition landscape in recent years has been the proliferation of investor activism – via shareholder proposals on climate change (Diaz-Rainey et al., 2024; Flammer et al., 2021; Tindall, 2024). This is evidenced by a nearly 50 percent increase in climate-related shareholder proposals between 2021 and 2022 in the US, with a major shift in focus toward issues related to net zero target adoption and emissions reduction targets, aligning with the Paris Agreement (Melody, 2024; Papadopoulos, 2024). The growing number of proposals submitted to firms mainly by activist investors, who are environmentally and ethically motivated and perhaps prepared to forgo higher returns in favour of engagement

[3] A recent survey of 439 institutional investors indicates that the majority consider climate risk to be paramount to financial risk, with one-third asserting that climate risk is even more critical (Krueger et al., 2020).
[4] According to a survey by Oliver Wyman Forum (2021), 74% of respondents (consumers) in the US believe that firms should commit to net zero target; and this will positively influence respondents' buying decisions.
[5] For example, 3M and Amgen have announced investments of US$1 billion and US$200m, respectively, as a part of their pledges to attain their net zero goals (3M, 2021; Shrestha, 2021). Net zero target adopting firms have also started to implement associated activities, such as opening net zero restaurants by McDonalds (McDonalds, 2021), a net zero oil contract signed by Occidental Petroleum (Carbon Herald, 2022), issuance of green bonds by Union Pacific (Railway Technology, 2022), and halving of business travel by Aecom (Aecom, 2023).

on corporate climate strategies, is garnering significant attention (Diaz-Rainey et al., 2024).[6] Research indicates that shareholder proposals affect investor perception (Baloria et al., 2019; Diaz-Rainey et al., 2024) and can serve as an effective mechanism to engage firms on climate initiatives as well as enhance related performance (Diaz-Rainey et al., 2024; Flammer et al., 2021; Tindall, 2024). Desai et al. (2023) show that activist investors influence net zero pledges and this raises the question of whether and how firms' prior exposure to activist shareholder proposals on net zero issues (a proxy for net zero transition activism) affect investor perception toward net zero target adoption.[7] A firm's prior exposure to net zero transition activism can convey valuable information to investors, including the nature of relationships with activist investors, its quality and motivation to adopt net zero targets. This study, therefore, explores two further research questions:

RQ2: Do investors consider a firm's prior exposure to net zero transition related activism in reacting to net zero target adoption?

RQ3: How do investors assess net zero target adoption by firms with more or lesser exposure to net zero transition related activism?

This study draws upon signalling theory which posits that firms, as signal senders, transmit relevant information to recipients through different signals. These signals serve to reduce information asymmetry and improve the recipients' decision-making processes (Connelly et al., 2011). Because investors generally lack sufficient information to understand their portfolio firms' exposure to climate risks (Krueger et al., 2020), net zero target adoption may serve as a market signal to identify firms that are either more or less committed to long-term climate risk management strategy. In addition, this decision can serve to build or enhance reputation among stakeholders who value such initiatives. Consistent with signalling theory, this study predicts that investors positively react to the adoption of net zero emission target.

This study complements signalling theory with screening theory which takes the recipients' (investors') perspective (Gomulya & Mishina, 2017; Sanders & Boivie, 2004). Under signalling and related screening literature, how receivers perceive the signal depends on the nature of the signaller, signal attributes and other contextual factors (Connelly et al., 2011; Gomulya & Mishina, 2017; Sanders & Boivie, 2004). This study argues that firms' prior exposure to net zero transition activism at the time a signal is released may reflect the

[6] In proxy year 2022, activist investor As You Sow team filed 99 shareholder proposals demanding firms to address climate change and associated sustainability issues (As You Sow, 2022).
[7] This study uses the term shareholder proposal instead of resolution, as it regards all shareholder requests, regardless of their potential voting at the annual general meeting (e.g., Baloria et al., 2019; Michelon et al., 2020).

motivation of the signaller and affect the quality as well as credibility of the signal. It may serve as a screening filter which provides information pointing to prior poor performance in net zero issues, potential agency conflicts, and increased reputational risks (Baloria et al., 2019; Bourveau & Schoenfeld, 2017). However, it may also serve as a positive screening filter providing information about firms' intention to address climate change risks and reduce the risk of future activism (Bourveau & Schoenfeld, 2017). Thus, investor reaction to net zero emission target adoption may depend on firms' prior exposure to related activism.

In assessing firms with net zero transition activism, this study predicts that investors will further screen specific target attributes to assess whether the target adoption aligns with expectations of investors in general, and activist investors in particular. Net zero target adoption is argued to conform to investor expectations when such target adoption is accompanied by detailed disclosures (a proxy for the comprehensiveness of net zero target adoption). Increased disclosures reduce information asymmetry, enhances transparency and helps investors to evaluate investment opportunities (Blankespoor, 2018; Plumlee et al., 2015; Schiemann & Sakhel, 2019); which in turn results in a positive investor reaction. Investors also screen whether adopted targets are characterized by a higher level of emissions reduction targets and contain planned investment for decarbonization. These features help evaluate the credibility and alignment of targets with their expectations, including the goal of Paris Agreement. This in turn may result into a positive investor reaction, especially if firms previously experienced net zero transition activism.

This study tests the theoretical claims using an event study method and regression models to examine abnormal stock returns in a sample of 263 events of net zero emission target adoption by S&P 1500 firms from 2019 to 2024. It demonstrates that investors exhibit a favourable reaction to the adoption of net zero emission targets. However, investor reaction is not related to firm's prior exposure to net zero transition activism. For firms that previously experienced investor activism demanding that they address net zero related issues, this study shows that investors exhibit a more favourable reaction to the adoption of net zero targets when these targets are accompanied by enhanced relevant disclosures, and higher level of emissions reduction targets. Finally, this study finds that investors respond positively to net zero targets that involve explicit plan of investment for decarbonizing businesses and attaining targets. These results are consistent with the signalling and screening theories suggesting that investors consider the firm-level factor and target attributes in their assessment of net zero target adoption.

This study further explores how the institutional environment in the US shapes investor reaction to the adoption of net zero emission targets. The analysis shows that investors exhibit a more positive response to the adoption of net zero targets when these targets are adopted during the post-US federal and state-level net zero policy period. However, the significant positive reaction disappears for targets adopted following the US legislative committee's attempt to delegitimize and constrain net zero related activism by activist investors. In the analysis of target adoption determinants, this study finds that the salience of net zero target adoption in the institutional environment influences target adoption decision. The analysis shows that firms are more (less) likely to adopt net zero emission target in times of a higher (lower) salience of such target in the institutional environment. Taken together, this study shows that both firms and investors engage in institutional screening in the context of net zero emission issues in their decision to adopt related targets and react to such targets, respectively.

This study makes several contributions to the accounting literature. First, it contributes to the growing literature exploring carbon emissions and emissions reduction targets. The literature primarily focuses on the market valuation of carbon emissions (Choi & Luo, 2021; Clarkson et al., 2015; Griffin et al., 2017; Matsumura et al., 2014) and the impact of related reduction targets on carbon emissions (Ioannou et al., 2016), investment and related issues (Freiberg et al., 2021). An exception is an experimental study by Johnson et al. (2020) which examines the role of disclosures on firms' emissions management strategy in shaping nonprofessional investors' valuation assessments. This study extends this body of research by showing the market-wide response to the adoption of net zero emission target, an ambitious climate risk management strategy that typically spans several decades.

Second, this study complements to the results from recent studies on investor assessment of net zero emission targets (e.g., Desai et al., 2023; Kim, 2024). Desai et al. (2023) find that investor reaction is unrelated to net zero commitments but such reaction is negative relative to emission reduction commitments. The lack of investor reaction to net zero target adoption can be attributed to the small number of events (18) and focus of the study in a specific industry (oil & gas). However, they also document that such reaction is more negative for firms with longer target horizon, without board-level environmental committee, and absence of climate performance incentives in executive compensation. In addition, Kim (2024) find that investor responses to net zero commitments depend on the different types of investors. This study extends this line of research by illuminating how net zero transition activism interacts

with several target attributes and contextual factors in shaping investor responses to net zero target adoption.

Third, this study develops a theoretical model based on both signalling and screening theories that explains how investors consider firm-level factor and non-financial target attributes in responding to net zero emission targets. By doing so, it provides a refined understanding of investors' use of multiple information sources in assessing non-financial information. This study thus extends existing literature that predominantly examines investors' information acquisition process and the influence of alternative information sources on the effectiveness of financial information in providing decision-useful insights (Blankespoor, 2018; Cassar et al., 2015; Emett, 2019; Thayer, 2011).

Finally, this study indicates that changes in the institutional environment that are either supportive or unsupportive of net zero initiatives alter investor perception toward net zero emission targets, particularly for firms that experience sustained net zero transition activism. This result contributes to prior studies that consider the role of relevant climate policies in influencing investor valuation of corporate emissions and mitigation efforts (Choi & Luo, 2021; Clarkson et al., 2015; He et al., 2022). This finding further extends the evolving literature that studies investor activism – via shareholder proposals and shows investors view such activism negatively (Baloria et al., 2019; Diaz-Rainey et al., 2024). This study reveals that investors' reactions depends on how the issues of concern is addressed and their relevance in the broader institutional environment.

The remainder of this paper is organized as follows: Section 2 presents the theoretical model and hypotheses. Section 3 describes the research methods. Section 4 presents the results of the study. Section 5 provides the institutional analysis. Section 6 outlines the additional analysis and Section 7 concludes the paper.

2. Theoretical Model and Hypotheses

2.1 Signalling and screening processes

Signalling theory was originally used to explain how decision-makers recognize and react to situations characterised by incomplete and asymmetrically dispersed information across transaction parties (Akerlof, 1970; Spence, 1973). It posits that firms, as senders of signals, convey pertinent information to recipients through various signals, thereby, mitigating information asymmetry and enhancing the recipients' decision-making processes (Connelly et al., 2011). Corporate insiders typically possess superior access to information relative to other stakeholders, leading outsiders to interpret any supplementary information beyond the mandated financial information as signals to financial markets (Wong & Zhang, 2022).

Management scholars have applied signalling theory to explain variation in investor behaviour in different contexts, including CEO certifications of financial statements (Zhang & Wiersema, 2009), hiring of management consultants (Bergh & Gibbons, 2011), and violation of stakeholder expectations (Carberry et al., 2018; Gomulya & Mishina, 2017). Recently, accounting scholars have utilized this theory to explain investor reactions to events such as corporate reputation risks (Wong & Zhang, 2022).

Net zero emission target adoption and subsequent investor reactions can be interpreted through the lens of signalling theory because investors often lack adequate information to assess a firm’s exposure to climate change risks (Cohen et al., 2023; Krueger et al., 2020). From the investors’ perspective, this creates a need to differentiate firms that demonstrate a commitment to net zero emissions and those that do not.

Screening theory complements signalling theory by shifting the focus from the sender's (informed party) selection of signals to the receiver's (uninformed party) prioritisation of various signal types and/or interpretation of the same signal based on that signal’s attributes and contextual factors (Connelly et al., 2011; Gomulya & Mishina, 2017; Zheng et al., 2024). Screening theory highlights the processes by which uninformed individuals evaluate information to sort unobservable differences (Sanders & Boivie, 2004). For example, Sanders and Boivie (2004) indicate that in the valuation of new firms within uncertain (e.g. emerging) markets, investors utilise governance attributes as screening mechanisms. These attributes are presumed to correlate with desirable yet unobservable characteristics and behaviours, thereby mitigating the risks of adverse selection and moral hazard. Similarly, Zheng et al. (2024) show that analysts' recommendations entail a screening process wherein analysts gather and analyse

signals (i.e., firms' relative CSR performance) indicative of firms' capacity and intention to participate in CSR. The screening process, therefore, leads to additional information sources that may provide more decision relevant information and shape investors' opinions regarding new information.

This study utilizes screening theory to evaluate several screening filters that may shape investor perception regarding the adoption of net zero emission targets. Mercer (2004) suggests that situational incentives of the source at the time of disclosure influence the credibility of disclosures to investors. As activist investors and/or climate activism push firms to undertake more stringent practices, including net zero emission pledges (Desai et al., 2023; Diaz-Rainey et al., 2024; Reid & Toffel, 2009), prior exposure to net zero transition activism can be an indicator of the quality of the firm and perceived incentives for adopting a net zero target. Firms generally experience social and/or environmental activism due to their poor performance on related issues (David et al., 2007; Hadani et al., 2018). This suggests that net zero target adoption and subsequent implementation are more likely to be costlier for these firms (e.g., Desai et al., 2023; Diaz-Rainey et al., 2024). However, net zero target adoption by firms with prior exposure to net zero transition activism may convey additional information about their genuine intention to address the concern of activist investors and avoid future related activism. This may lead to a positive investor reaction to target adoption.

For firms with exposure to net zero activism, investors may involve in screening of target characteristics to examine whether such target adoption aligns with or deviate from global net zero goals and their expectations. It can be understood from a shareholder proposal filed by As You Sow (2023a) against Constellation Energy:

> 'Constellation Energy Corporation remains substantially unaligned with global Net Zero goals and investor expectations. While it has set interim and net zero emission reduction targets for its Scope 1 and 2 operational emissions, this leaves at least 90% of its value chain emissions unaddressed.'

In another shareholder proposal against Lockheed Martin Inc., As You Sow (2023b) claimed that Lockheed Martin's existing target related disclosures lack specificity, forward-looking, and quantitative action plans that are sufficient to achieve alignment with the Paris Agreement and investor expectations. The proposal includes specific demand for setting Paris-aligned near-term emission reduction targets, long-term net zero goals, a transition plan and annual reporting of progress. Activist investors do not file proposal demanding for only reporting and target setting issues, they also demand for decarbonization of products and

business processes in line with the Paris Agreement. As such, General Electric Co. faced shareholder proposal demanding for decarbonizing its energy sector, reducing their investment in carbon intensive products and increasing investment for renewables (As You Sow, 2023c). As activist investors highlight specific demands in their proposal, investors may further analyse target adoption to understand whether the target is being adopted in line with their expectations (see Appendix 1 for examples).

Applying screening theory and considering shareholder proposals, this study identifies several factors that indicate that adoption of net zero target conforms to investors' expectations. First, as firms generally face shareholder proposals asking to comprehensively set net zero emissions targets, , investors are more likely to reward firms that adopt targets with detailed target-relevant information. The comprehensive adoption of net zero target can serve as an additional screening source because greater disclosures of target-relevant information may facilitate investors' assessment of the quality and credibility of net zero target adoption. It can also facilitate investors to assess whether the adopted target is more or less aligned with the goal of Paris Agreement.

Second, firms face shareholder proposals asking for setting different levels of emissions reduction targets in line with the Paris Agreement (see Appendix 1). When the adopted target contains, on average, higher emission reduction targets, it may elicit positive investor response. Third, explicit reference to the amount of planned investment for decarbonization and to attain relevant targets may increase the credibility and transparency of net zero emission target adoption. Thus, this can be an additional source of information, which investors may utilize in forming their positive assessment of net zero target adoption by firms with exposure to related activism. Each of these predictions and the hypotheses to be tested is summarised in Figure 1.

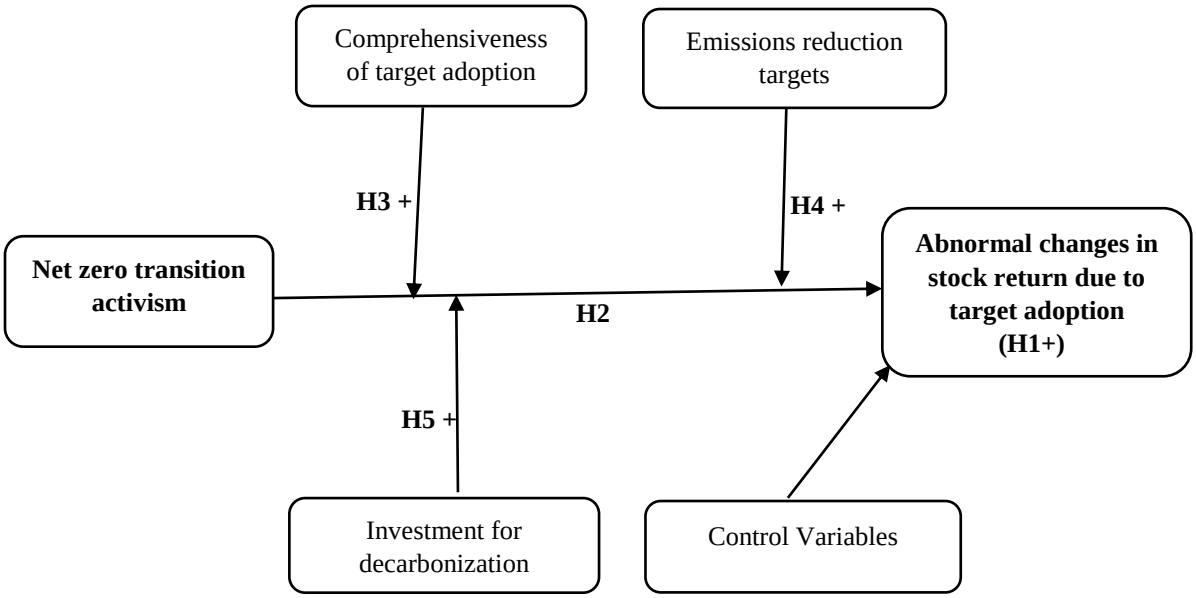

Figure 1. Theoretical Model

2.2 Hypothesis development

2.2.1 Investor reaction to the adoption of net zero emission targets

Investors need sufficient information to effectively assess a firm's efforts to mitigate its emission levels (Cohen et al., 2023; Krueger et al., 2020; PwC, 2021; Panfil & Victor, 2022). As such, investors need to be able to distinguish between firms that have adopted a net zero emission target and those that have not. This suggests that net zero target adoption may serve as a credible signal of a firm's long-term commitment to managing its emissions. While emission reduction target could lead to a reduction in firms' emissions (Dahlmann et al., 2019), implementation of such target is relatively costly (South Pole, 2022; Wang & Sueyoshi, 2018). As a result, investors may perceive such target adoption as detrimental to firm value.

However, net zero target setting can be important for investors because a firm's emissions level represents a material risk, and investors demand compensation for increased exposure to carbon risk (Bolton & Kacperczyk, 2021). The importance of managing carbon emissions to investors is also evident in prior studies that demonstrate that the market positively values firms' decision to disclose carbon emissions (Griffin & Sun, 2013) and related carbon management strategies (Johnson et al., 2020).

The future-oriented nature of the target can signal to investors that the firm is well-prepared to adjust to future carbon emission regulations (Ramelli et al., 2021) and increased

climate change risk (Baldauf et al., 2020; Delis et al., 2024). Consistent with signalling theory, this study, therefore, predicts that investors are more likely to reward net zero target adopting firms for signalling their intention to improve their carbon footprint and reduce long-run climate change risks. This leads to the following hypothesis:

H1: Investors react positively to the adoption of net zero emission target.

2.2.2 Net zero emission related transition activism and investor reactions

Screening theory posits that relations with specific stakeholders may inadvertently affect the perception of other stakeholders. Qian et al. (2021) show that borrowers' favourable relationships with employees positively affect lenders' perceptions about the quality of the firm and ability to repay loans. By contrast, Fremeth et al. (2022) report that confrontational relationships with external stakeholders negatively affect regulator's perceptions. These studies suggest that firms' relationships with relevant stakeholders can provide information cues for other stakeholders regarding their quality, credibility of practice adoption, as well as subsequent implementation of such practices (Fremeth et al., 2022; Qian et al., 2021).

In net zero context, investors might use firms' prior exposure to net zero emission activism as a screening filter and this can provide additional decision-relevant information. The sustained exposure to net zero activism via shareholder proposals may indicate to the market that management has been reluctant to address activist investors' concerns (David et al., 2007). This also indicates a lack of managerial willingness to take required actions to avoid the submission of the proposal (David et al., 2007). This helps investors to assess the underlying quality of firms since activists prefer to target firms exhibiting potential agency conflicts and heightened political as well as reputational risks (Baloria et al., 2019; Bourveau & Schoenfeld, 2017). In particular, activists typically target poorly performing firms regarding the underlying issue (Hadani et al., 2018), suggesting that such firms will have to allocate more financial resources to implement net zero target adoption compared to firms that have not been exposed to related activism.[8] Thus, exposure to net zero related activism may negatively shape investor perception toward target adoption.

However, investors might positively interpret net zero emission target adoption by firms with prior exposure to related activism. As addressing shareholder activism reduces the risk of future activism (Bourveau & Schoenfeld, 2017), investors might interpret it as firms'

[8] Diaz-Rainey et al. (2024) show that investors negatively react to climate related shareholder proposals because they perceive such proposals costly, if implemented.

genuine intention to reduce carbon risks and future reputational losses. As a result, investors might perceive incremental benefits from net zero emission target adoption by firms that have been exposed to related activism. Taken together, it is not obvious how investors perceive firms' prior exposure to net zero transition activism at the time of net zero target adoption. This study therefore proposes the following hypothesis in bidirectional form:

H2: Investor reaction to the adoption of net zero emission targets depend on firms' exposure to net zero transition activism.

2.2.3 Comprehensiveness of net zero target adoption

The screening theory posits that investors combine prior information about the firm with the attributes in the newly released information to sort firms' underlying differences (Sanders & Boivie, 2004). This suggests that the detailed voluntary disclosures in net zero target announcement can be informative for investors, specifically for evaluating the target alignment with the expectations of broader investors and the goal of Paris Agreement.

Greater level of voluntary disclosures may enhance investors' awareness, reduce information asymmetry (Schiemann & Sakhel, 2019), and lead to timelier integration of information into pricing arguably because of the greater accessibility to information (Blankespoor, 2018). Prior voluntary disclosure research finds that increased disclosures in terms of quantity and/or quality reduces information asymmetry (Blankespoor, 2018; Schiemann & Sakhel, 2019), lowers cost of equity and increases firm value (Clarkson et al., 2008; Plumlee et al., 2015). These studies suggest that voluntary disclosures can provide additional information relevant for valuation purposes (i.e., information benefits) and this can enable investors to assess the impact of target adoption on firms' future performance and/or clearer expectations of firms' exposure to climate risks.

Further, increased disclosures enhance the credibility of the adopted targets and the effectiveness of monitoring, including through assessment of climate performance (Wang & Sueyoshi, 2018). Greater disclosures may indicate a firm's attempt to address investors' concerns about emissions management (Krueger et al., 2020). Given the long-term nature of the target and the uncertainty associated with target attainment (Jiang et al., 2023), increased disclosures in target announcements should conform to investor expectations. This study, therefore, argues that investors' positive reaction to net zero target adoption by firms with exposure to related activism depends on the level of disclosures in the target announcement. This leads to the following hypothesis:

H3: Investors positive reaction to the adoption of net zero emission targets that contain detailed target relevant information is more pronounced for firms with exposure to net zero transition activism.

2.2.4 Emissions reduction targets

Targets function as a crucial tool for decision-making in planning, coordination, and the allocation of financial resources (Hansen & Van der Stede, 2004; Widener, 2006). Targets are frequently adopted to guide activities in accordance with the expectations of key stakeholders (Balakrishnan et al., 2023). Higher level of targets drives target-oriented action through directing attention to relevant activities and leads to a higher rate of target completion (Ioannou et al., 2016). As a result, higher emissions reduction targets enable firms to reduce carbon emissions (Dahlmann et al., 2019) and improve operational efficiencies through reduced energy consumption.

Drawing upon screening theory, this study argues that investors are more likely to consider a firm's exposure to net zero transition activism in combination with emissions reduction targets to make sense of investment opportunities. If investors perceive a positive association between firms' emissions reduction targets and their carbon emissions management, observing emissions reduction targets may help them infer additional information about firms' intention to mitigate climate change risks and address activist demand. In particular, this may reflect firms' credible intention to establish targets aligning with the Paris agreement and investor expectations. This study therefore proposes the following hypothesis:

H4: Investors positive reaction to the adoption of net zero emission targets that contain higher level of planned emissions reduction targets is more pronounced for firms with exposure to net zero transition activism.

2.2.5 Investment for decarbonization

Prior studies document that investors value credible disclosures and evaluate the credibility of management disclosures by assessing the characteristics of the disclosure itself (Blankespoor, 2018; Elliott et al., 2012; Hennig et al., 2023; Mercer, 2004). Some studies indicate that information recipients place greater reliance on quantitative information over qualitative information, leading to increased trust in the communicated content (Hutton et al., 2003; Jerez-Fernandez et al., 2014; Mercer, 2004).

Nevertheless, Blankespoor (2018) argues that investors can concurrently utilise both quantitative and qualitative information in their pursuit of credibility signals. In financial reporting context, Hutton et al. (2003) suggest that managers can provide verifiable forward-looking financial information to convince investors regarding their forecasts. Similarly, investors demand sustainability information that can be verified in the later stage. For instance, PwC's (2022) recent survey reveals that investors want firms to report associated costs and investments to attain firms' sustainability commitment because they predominantly perceive that corporate sustainability information includes unsubstantiated assertions on a company's sustainability performance (PwC, 2022).[9]

Moreover, Martin and Moser (2016) shows that investors positively view green investment when managers make such disclosures reflecting societal benefits. This study argues that net zero target adoption with explicit mention of planned investment to decarbonize business processes and attain targets is more likely to be informative and credible due to its objective and verifiable nature at a later stage (Hennig et al., 2023; Plumlee et al., 2015). This is more likely to be the case for firms with a history of net zero transition activism and this leads to the following hypotheses:

H5: Investors positive reaction to the adoption of net zero emission targets that explicitly mention the amount of investment for decarbonization is more pronounced for firms with exposure to net zero transition activism.

3. Research Methods

3.1 Sample and data sources

Sample selection begins with S&P 1500 firms for the period 2019 to 2024.[10] To ensure the sample is similar and avoids confounds from different tax and environmental laws globally, firms (i) not headquartered or incorporated in the US and (ii) not traded on AMEX, NYSE, or NASDAQ are removed. As shown in Panel A of Table 1, these filters reduce the sample to 1,436 firms, which is used to manually identify the target announcement event and its date. The event is the public announcement of net zero target adoption by sample firms between 2019 and 2024 (see Appendix 1 for examples).[11]

[9] PwC reveals that 87% of surveyed investors believe that sustainability information includes unsupported claims regarding sustainability performance. The survey further documents that 73% of investors expect companies to disclose the expenses and investment associated with fulfilling their sustainability commitments.
[10] The study period starts from 2019, which is a year when sample firms generally started adopting net zero emission targets.
[11] This study identifies all events up to 7 January 2025. Firms committing to net zero or related targets use different terms such as net zero, carbon neutral, climate neutral, climate positive, and climate negative. These terms are closely related to each

Following Desai et al. (2023), the event dates are identified from both Google Search and Factiva. Google Search, used initially, led to multiple sources, including PR Newswire (PRN), Business Wire (BW), CSR Wire, media articles, corporate press releases and websites.[12] Factiva is primarily used for events whose date cannot be identified using Google Search. While identifying event dates, a total of 535 firms that have set net zero emission targets over the sample period are identified. The number of identified firms with event dates are 297 after excluding those without net zero target adoption dates (170), and those with ambiguous targets or claims of target achievement (68). Due to the missing data in the CRSP database (5), the sample further reduced to 292 firms (see Panel A of Table 1). Sample firms are spread across 25 industries (Panel B of Table 1), with a majority belonging to the utility industry (10.96%).

This study uses data from a wide range of sources. In addition to the sources mentioned for events, data to measure variable of interest, moderator and control variables are obtained from the Centre for Research in Security Prices (CRSP) database, Institutional Shareholder Services, Thomson Reuters Institutional (13f) Holdings database, Compustat, Trucost, United Nations Climate Change, and the US Department of State.

[Insert Table 1 Here]

3.2 Dependent variable

This study employs an event study methodology to capture investor reaction to the adoption of net zero emission target (McWilliams & Siegel, 1997). Conventional cumulative abnormal return (CAR) calculations are used whereby, for each firm, j is the sum of daily abnormal returns (AR_{jt}) for the event window T_1 to T_2.

$$CAR_j = \sum_{t=T_1}^{T_2} AR_{jt}$$

Where $AR_{jt} = R_{jt} - \widehat{R_{jt}}$, and represents the difference between the actual return and the expected return. The daily expected return, $\widehat{R_{jt}}$ is based on an estimation period of 300 days (-300 to -50 days) before the net zero emission target announcement date (Bergh & Gibbons, 2011).[13]

other, and they indicate the different ways in which sources of emissions and emission sinks are accounted for (for details, see https://netzeroclimate.org/what-is-net-zero/). All these terms are considered in this study as firms setting net zero emission targets.

[12] These news sources mainly report business-related news and are widely used sources of announcements in the event study literature because of their reliability in identifying the time when a firm first makes an announcement (Arora et al., 2020).

[13] The specified length and the defined beginning and ending points align with other conservative event studies and adhere to established procedures (McWilliams & Siegel, 1997).

Expected returns are estimated from a market model, such that daily returns (R_{jt}) are regressed against a market index corresponding to the equally-weighted CRSP index (Flammer, 2013; Renneboog & Szilagyi, 2011; Werner, 2017).[14] In line with prior studies (Bhagwat et al., 2020; Christensen, 2016), event windows are computed for the average 3-day announcement period abnormal return (0, 2).

Different event windows such as (-3, 3), (-2, 2), (-1, 1), (0, 1), (0, 2), and (0, 3) are also reported. The 3-day window (0, 2) provides the most significant CAR (see Table 3) and thus CAR from this 3-day event window (0, 2) is used as the dependent variable (Bhagwat et al., 2020). The cross-sectional t-test and Cowan's (1992) generalized sign test are used to determine the statistical significance of CARs (e.g., Krüger, 2015; Renneboog & Szilagyi, 2011). Data to calculate CAR is obtained from CRSP.

3.3 Variable of interest

Shareholder activism is the practice of socially conscious investors using their ownership stakes to demand improved reporting, greater transparency or, in certain cases, changes to corporate policies (King & Gish, 2015). Such activism primarily focuses on social and environmental concerns, differentiating it from comparable initiatives motivated exclusively by financial interests (Lee & Lounsbury, 2011). One way through which socially and/or environmentally conscious investors express their concerns regarding how firms manage and report social and/or environmental issues is shareholder proposals (Michelon et al., 2020; Vasi & King, 2012).[15] Consistent with Michelon et al. (2020), this study views shareholder proposals as activist investors' public, collective and organized effort to seek changes in corporate practices (see Appendix 2 for examples).

The extent of net zero emission related transition activism (NZTRANS) is captured via the number of shareholder proposals initiated by the activist investors. Shareholder proposals are retrieved from the Institutional Shareholder Services (ISS) database, which contains comprehensive data on shareholder proposals relating to governance, climate change, environmental, social issues, including human rights, diversity and so on. The proposals are

[14] The market model is widely used in event studies and assumes a linear relationship between the return on a stock and the return on the market index (i.e., market return) (e.g., Bergh & Gibbons, 2011; Carberry et al., 2018). Using an estimation period prior to the event, the market model estimates return using ordinary least squares (OLS) model.

[15] Regulation 14a-8 of the Securities and Exchange Commission (SEC) allows shareholders to submit a written proposal of up to 500 words to US-listed firms. Any shareholder with $2,000 in shares for at least one year can make a proposal, although submission does not ensure inclusion in the proxy statement and AGM voting (for details, see https://www.ecfr.gov/current/title-17/chapter-II/part-240/subpart-A/subject-group-ECFR8c9733e13b955d6/section-240.14a-8).

mainly filed by socially motivated activist investors, including (but not limited to) As You Sow, Arjuna Capital, Follow This, Green Century Capital Management, Mercy Investment Services, Sierra Club Foundation, and Trillium Asset Management. This data source is used in prior research (e.g., Werner, 2017). This study, specifically, considers proposals that seek to influence firms to adopt or report on net zero/carbon emission reduction and climate transition related issues. The keywords include: 'net zero' 'GHG emissions reduction targets', '2-degreee scenario analysis' 'Paris-aligned', and 'transition plan' (see Appendix 2). These proposals are considered in this study as an expression of activist investors' demands to adopt corporate net zero emission targets and associated activities, and are consequently classified as net zero emission-related transition activism.

The relevant shareholder proposals are identified from 2018, the year prior to the study period, to 2023, the date of the latest available year in the ISS database.[16] NZTRANS is determined from the cumulative number of relevant proposals filed from 2018 to the year immediately preceding the target adoption. This allows consideration of the repeated proposals which generally have a higher likelihood of receiving a vote in favour and potentially reflect increased persistence of activist investors for meaningful changes (Diaz-Rainey et al., 2024). This led to a total of 116 identified net zero emission related proposals over the period 2018-2023.

3.4 Moderators

The comprehensiveness of net zero target adoption disclosure (TARDISC) is measured from the extent of target relevant disclosures made in a target announcement. Consistent with prior disclosure research (Islam & van Staden, 2018) and following Climate Action 100+'s net zero disclosure framework, this study develops a disclosure index to capture the extent of target relevant disclosures. As reported in Table 2, the disclosure index is classified into four categories: net zero targets (six items), short-term targets to be attained by 2025 (seven items), medium-term targets to be attained between 2026 and 2035 (seven items), long-term targets to be attained between 2036 and 2050 (seven items), and general disclosures (three items). The disclosure index is thus comprehensive enough as it consists of 30 items capturing different aspects of disclosures in target announcement. Each item is coded as 1 for a disclosed item and

[16] In addition, the year preceding 2018 was marked by uncertainty around investors' capacity to submit shareholder proposals, after the approval of the Financial CHOICE Act in 2017 (Nobel, 2017).

0 for no disclosure. The total number of disclosed items are then divided by the maximum possible score of 30 to calculate TARDISC.[17]

Given that this is the first study that measures the extent of disclosures in net zero emission target announcements, detailed disclosure scores are provided in Table 2. It shows that when a sample firm announces net zero emission target, majority of the disclosures are made in relation to the net zero target (33.27%, Panel A) and medium-term target (32.97%) covering the period 2026-2035 (Panel C). Within these categories, the commonly disclosed item is related to the target year for publicly announced net zero target (100%) and medium-term target (58.75%). Among the coverage of scopes, sample firms are predominately disclosing target related information covering Scope 1 and Scope 2 emissions (32.32% in Panel A), while the disclosures covering Scope 3 are limited (for example 13.31% for net zero targets) across all categories as in Table 2. This reflects the concerns about the lack of targets for Scope 3 emissions raised by activist investors (As You Sow, 2023d).

Table 2 further shows that while sample firms prefer to disclose their target years, they appear to be reluctant to disclose the base year.[18] This indicates the lack of transparency in setting emission reduction targets. The disclosures related to the commitment to validate the target by the Science-Based Targets initiative are mainly concentrated on net zero targets (14.83%) and medium-term targets (18.68%).[19] Nevertheless, there is a general lack of interest in validating short-term (2.67%, Panel B) and long-term targets (0.46%, Panel D). Within long-term targets (Panel D), the average long-term target related disclosures are only 2.49%. This can be further understood under the general disclosure categories (Panel E) that represent disclosures related to programs or activities related to attaining scope-level emissions. Within general disclosures, this disclosure category remains around 5%. Overall, the average target relevant disclosure is 17.60%. Table 2 indicates that the is a general lack of disclosures in net zero emission target announcement.

[Insert Table 2 Here]

[17] However, the maximum possible score varies depending on the year of attaining net zero targets. For example, when a firm sets a net zero emission target to be attained by 2030, this study does not consider the disclosures items under the long-term targets (2036-2050) to calculate the maximum possible score. This process allows to calculate an average disclosure score that remains unaffected by the net zero target year set by a firm.

[18] The year utilized by the firm for benchmarking carbon emissions in establishing a specific objective (CDP, 2023).

[19] Science-based targets offer a well-defined framework for firms to diminish carbon emissions, aiding in the mitigation of severe climate change effects and ensuring sustainable company growth. Targets are deemed 'science-based' if they align with the current climate science requirements to achieve the objectives of the Paris Agreement, which aims to restrict global warming to 1.5°C over pre-industrial levels (for details see https://sciencebasedtargets.org/how-it-works).

The emission reduction target (EMISRED) is measured as the percentage of carbon emissions reduction target relative to a baseline year, to be accomplished by a target year. Since a firm sets emission reduction targets for interim and long-term targets and across different scopes of emissions, the targets are averaged at the firm level (see Appendix 3 for details). This approach is consistent with Ioannou et al. (2016). Finally, a firm's planned amount of investment to decarbonize business and attain targets (INVEST) is quantified as a binary variable, where a value of 1 is assigned to instances where target announcement explicitly mentions the intended investment and a value of 0 in all other cases.[20] All three variables (TARDISC, EMISRED and INVEST) are manually collected from the net zero emission target announcement statements (see Appendix 1 for examples).[21]

3.5 Empirical Model

The event study methodology does not allow researchers to analyse the impacts of multiple factors simultaneously within a multivariate framework (Carberry et al., 2018). As a result, this study uses ordinary least squares (OLS) regression to test hypotheses H2-H5 (e.g., Bergh & Gibbons, 2011; Carberry et al., 2018). The OLS model is proposed as follows:

$$CAR_{i,t} = \alpha + \beta_1 InteractionTerm_{i,t} + \beta_2 NZTRANS_{i,t} + \beta_3 TARDISC_{i,t} + \beta_4 EMISRED_{i,t} + \beta_5 INVEST_{i,t} + \beta_6 CO2OFF_{i,t} + \beta_7 STAKEINV_{i,t} + \beta_8 TARHOR_{i,t} + \beta_9 REPOR_{i,t} + \beta_{10} INSOWN_{i,t} + \beta_{11} SIZE_{i,t} + \beta_{12} ROA_{i,t} + \beta_{13} FLEV_{i,t} + \beta_{14} ESG_{i,t} + \Theta_1 IndustryFixedEffects + \Theta_2 YearFixedEffects + \Theta_2 EventtypeFixedEffects + \varepsilon_{i,t} \quad (1)$$

Where *CAR* is the dependent variable representing the cumulative abnormal returns in the three-day event window (0, 2). The variable of interest is the net zero emission related transition activism (NZTRANS) (H2). The interaction term (InteractionTerm) represents the interaction between net zero transition activism (NZTRANS) and either comprehensiveness of net zero target adoption (TARDISC) (H3), emission reduction targets (EMISRED) (H4), or the use of the planned amount of investment to decarbonize and attain targets (INVEST) (H5). Following Flammer (2013), event type fixed effects are included to control for differences in the size of the events across categories (e.g., other event news such as earnings announcement may be more informative than net zero target events and therefore generate more positive CARs). Equation 1 is estimated with robust standard errors to minimize heteroskedasticity

[20] For example, FedEx Corporation commits to be carbon-neutral by 2040. To attain this goal, it mentions in its target announcement that it allocates over $2 billion in initial investments across three primary sectors: vehicle electrification, renewable energy, and carbon sequestration (FedEx, 2021).

[21] This measurement approach is consistent with prior event studies where specific information corresponding to an event is coded as a binary measure (see, Desai et al., 2023; Rhee & Fiss, 2014).

(Gomulya & Mishina, 2017). Finally, one-tailed tests for directional hypotheses are used (Baloria et al., 2019).

Equation 1 includes several target related control variables that could influence how investors interpret the adoption of net zero emission targets. A firm's explicit intention to use carbon offsets to attain targets (CO2OFF) is controlled and it is quantified as a binary variable, where a value of 1 is assigned to instances where target announcement explicitly mentions the intended use of carbon offsets and a value of 0 in all other cases. Prior research documents that stakeholders influence carbon emissions disclosures (Liesen et al., 2015) and thus stakeholder involvement may affect investor perception to net zero target adoption. STAKEINV is captured as the number of external stakeholders who express positive views in target announcement regarding the determined net zero emission targets. STAKINV is measured by taking one plus the log of the number of stakeholders to account for skewness.

Target horizon (TARHOR) is controlled because investors may perceive that longer target horizon enable firms to better manage carbon emissions over time. The TARHOR measurement represents the average number of years the firm has set to achieve a given carbon emissions reduction target from the year the target was set.[22] The reporting aspect of net zero emission target is also controlled. With net zero emission target announcement, firms generally commit to report on the progress of the targets, and in some instances, they commit to report in line with the Task Force on Climate-Related Financial Disclosures (TCFD) and Sustainability Accounting Standard Board (SASB). For each of these categories, a binary variable is used and then an aggregate variable capturing the future reporting commitment (REPOR) is included in Equation 1.

Institutional ownership (INSOWN) is controlled and it is calculated as the proportion of shares owned by institutional investors. This variable is collected from the Thomson Reuters Institutional (13f) Holdings database. Firm-level financial variables that are traditionally controlled in multivariate analysis are also controlled for: firm size (SIZE) measured as the natural logarithm of total assets, firm performance (ROA) measured as the ratio of net income to total assets, and financial leverage (FLEV) calculated as the ratio of total debts to total assets. The financial variables are obtained from Compustat database. Finally, investors may consider a firm's corporate social and environmental performance (ESG) in assessing net zero emission

[22] This measurement differs from Ioannou et al. (2016) which is based on the base year. As shown in Table 2, there is a lack of disclosure on the base year for the targets adopted. This study addresses this issue by calculating it as the number of years to attain the net zero emissions reduction targets.

target adoption, and hence ESG performance is also controlled. This data is retrieved from the Trucost. These variables are measured in the year preceding to the year of target adoption. All the variables are defined in Appendix 4.

4. Results

4.1 Event study results

Table 3 presents CARs around the announcement of net zero emission targets. Panel A reports the results with potential confounding events occurred around the date of target announcement, such as earnings and dividend announcement identified from the IBES and CRSP, respectively.[23] This allows to assess investor reactions to 292 net zero target announcement events. For each event window, Table 3 reports the mean CAR in percentage (with corresponding t-statistics) as well as the percentage of positive individual CARs from total positive and negative abnormal CARs (with corresponding generalized sign test). As is shown, the mean CAR in the event window (0, 2) is 0.546% and significant at the 1% level for both cross-sectional t-test and Cowan's (1992) generalized sign test.[24] This provides evidence supporting H1 that suggests investors react positively to the adoption of net zero emission target. Compared to other event windows, Panel A shows that most firms (55.82%) experience a positive CAR for the chosen event window (0, 2). The positive CARs suggest that the investors respond positively to the adoption of net zero emission targets.

Panel B of Table 3 reports results excluding confounding events (i.e., earnings and dividend announcements) around the event window. This reduces the events to 259. Panel B shows that the mean CAR in the event window (0, 2) is 0.519% and significant at the 5% level and 10% level for both t-test and Cowan's (1992) generalized sign test, respectively. This again provides evidence in support of H1. Panel C reports the significance of CARs, eliminating occurrences where net zero target announcements coincide with the release date of sustainability reports, in addition to earnings and dividend announcement events. This reduces the number of events to 204. The mean CAR in the event window (0, 2) is 0.466% and significant at the 5% level. For both in Panel B and C, all other windows before and after this event window (0, 2) yield smaller CARs. This indicates that the results are not driven by

[23] As in Cousins et al. (2020), the results (untabulated) remain similar even after considering further material announcements. Material announcements encompass mergers and acquisitions, share issuances, (convertible) bond issuances, loan initiations, debt redemptions, and stock splits. These announcements are identified using a manual search in Factiva for each of the 891 firm event combinations (297 multiplied by 3).

[24] The mean CAR is within the range generally observed in prior environmental studies (e.g., Flammer, 2013; Griffin & Sun, 2013).

unrelated trends around the event date. Similar to Panel B, Panel C shows that most firms experience positive CARs during the event window (0, 2). These results suggest that investors attribute some benefits to the adoption of net zero emissions targets.

[Insert Table 3 Here]

4.2 Cross-sectional variation in abnormal returns

This study uses CARs during the event window (0, 2) as the dependent variable to test hypotheses H2-H5. Due to missing values for some control variables, total observations reduce to 263 in the cross-sectional analysis.

4.2.1 Descriptive Statistics

Table 4 presents descriptive statistics. Notably, Table 4 shows that average CAR 0.006 (0.60%) during the event window (0, 2) for 263 firms. The mean net zero transition activism (NZTRANS) score is 0.186 with a range between 0 and 10. The comprehensiveness of net zero target adoption disclosure (TARDISC) score is 0.176 which indicates that the average percentage of disclosures in target announcement is 17.60%.

The proportion of emissions reduction target (EMISRED) is 0.328, suggesting that, on average, firms set around 33% carbon emissions reduction targets over the target horizon. The mean of INVEST is 0.183 suggesting that 18.30% of sample firms explicitly mentioned the amount of planned investment to decarbonize their businesses and attain targets.

Among the controls, the mean of CO2OFF is 0.186, suggesting that 18.60% of the sample firms mention the usage of carbon offsets to attain relevant targets. The mean score of stakeholder involvement (STAKEINV) is 0.161. The mean score of target horizon (TARHOR) is 3.063 and this ranges from 0.693 to 3.466. The reporting measure (REPOR) ranges from 0 to 3 with an average score of 0.567. All other controls are reported in Table 4.

[Insert Table 4 Here]

4.2.2 Cross-sectional results

Table 5 reports cross-sectional analyses with the estimation of Equation 1 (Columns 1-4). To address concerns related to multicollinearity, the continuous variables for each interaction term are mean-centred (Aiken & West, 1991), and each moderated relationship is included in the model one at a time. Table 5 also reports the highest value of the variance inflation factor (VIF) which remains well below the recommended cut-off of 10 (Gujarati & Porter, 2009), suggesting that multicollinearity is unlikely to be an issue.

Column 1 of Table 5 presents the results without the interaction terms. The coefficient on net zero transition activism (NZTRANS) is positive and not significant at the conventional level and thus H2 is not supported. Column (2) shows that the coefficient on the interaction term (NZTRANS × TARDISC) is positive and significant at the 5% level, supporting H3. These results suggest that investors favourably view the adoption of net zero targets by firms with heightened exposure to the net zero transition activism, particularly when such adoption is accompanied by enhanced disclosures. The economic significance of the joint effect of NZTRANS and TARDISC is evident. In particular, a one standard deviation increases in NZTRANS from the sample mean, the effect of TARDISC on CAR is more than two times larger.[25]

Column 3 reveals that the coefficient on the interaction term between NZTRANS × EMISRED is positive and significant at the 1% level, supporting H4. This suggests that investors reward firms, specifically those with increased exposure to NZTRANS, for adopting net zero emissions targets characterized by a higher level of emissions reduction targets. The economic significance of the joint effect is that a one standard deviation increases in NZTRANS from the sample mean, the effect of EMISRED on CAR is nearly doubled. Column 4 of Table 5 shows a significant (at 5% level) and positive coefficient on the interaction term between NZTRANS and INVEST. The coefficient suggests that in presence of intended investment to decarbonize businesses and to attain relevant targets, investors positively react to firms with increased exposure to net zero transition related activism. This provides evidence in support of H5.

Overall, the cross-sectional analysis indicates that firms adopting net zero targets, which are more exposed to net zero transition activism, realise higher abnormal returns when they provide comprehensive information about their targets, disclose higher, on average, emissions reduction targets, and explicitly mention planned investment for decarbonization and to attain targets.

[Insert Table 5 Here]

[25] Coefficient of *TARDISC* + Coefficient of *NZTRANS* × *TARDISC* (Mean of *NZTRANS* + *SD* of *NZTRANS*) = -0.019 + 0.040(0.186 + 0.819) = 0.021.

5. Institutional analysis

5.1 The US federal and state-level net zero policy adoption

Investors may generally find it difficult to evaluate the value of a firm's net zero emission target due to uncertainty arising from the long-term nature of such a target. In the face of this uncertainty, their judgments are frequently influenced by normative and/or regulatory standards governing the institutional environment concerning organisational conduct (Flammer, 2013; Huang, 2018; Zajac & Westphal, 2004; Zhang, 2020). Prior research shows that investors appear to value institutionally accepted practices such as CSR and gender diversity (Flammer, 2013; Zhang, 2020). Accordingly, this study explores whether the US federal and state-level net zero or related emission reduction policies can serve as additional filters, particularly when evaluating firms with exposure to net zero transition activism.

The US federal and state government's shift toward addressing net zero emission issues may increase public awareness of how these issues impact specific firms (e.g., Cousins et al., 2020). This may lead investors to perceive that carbon emission management, including net zero target setting, enable firms to mitigate regulatory risks (Ramelli et al., 2021). This is more likely to be the case for firms that are subject to net zero transition activism because prior exposure to activism intensifies regulatory scrutiny on related issues (Fremeth et al., 2022). This study, therefore, predicts that investors reward firms, specifically those with net zero transition activism, for adopting net zero targets that conform to institutional expectations.

On 1 November 2021, the US government released the Long-Term Strategy of the US outlining the pathways to net-zero GHG emissions by 2050.[26] The Strategy outlines various pathways and a clearer set of assumptions aimed at achieving net zero emissions by 2050 at the latest (US Department of State, 2021).[27] It covers various measures and actions across multiple sectors, including (but not limited to) agriculture, electricity, transportation, buildings and industrial. It is referred to in this study as the US federal-level net zero emission transition policy (POST_USNTZ) and is measured as a binary variable taking a value of 1 for net zero emission targets adopted after the release date of net zero policy (i.e., 1 November 2021), and 0 otherwise. In a similar way, a binary variable (POST_STATENET) is created taking a value of 1 for net zero emission targets adopted subsequent to the the adoption of net zero emission or related policies in the state of the firm's incorporation, and 0 otherwise (see Appendix 5 for

[26] See, https://unfccc.int/documents/308100
[27] For details, see https://unfccc.int/sites/default/files/resource/US-LongTermStrategy-2021.pdf

states with relevant policies). This study thus separately interacts these binary variables with the transition activism (NZTRANS) variable to test the predictions.

Given the pre and post period of analysis, this study employs entropy balancing approach which also alleviates the concern that the observed relationships are influenced by differences in distributions of firm characteristics between treatment and control firms (Hainmueller, 2012).[28] This approach is appropriate for the data as it ensures covariate balance without losing sample observations (Hainmueller, 2012; McMullin & Schonberger, 2015). The treatment firms are those that adopted targets after the relevant period (POST_USNTZ, POST_STATENET), while the control firms are those that adopted targets prior to the relevant period. Columns 1 and 2 of Table 6 show that the coefficients on the interaction terms (NZTRANS × POST_USNTZ; NZTRANS × POST_STATENET) are positive and significant at the 5% level. This suggests that investors reward firms, specifically those with increased exposure to NZTRANS, for adopting net zero emissions targets after the US federal-level and state-level adoption of net zero related policies.

[Insert Table 6 Here]

5.2 The US House Judiciary Committee intervention on net zero transition activism

While the policy shift towards net zero or related issues may promote related practices and favourably impact investor perception, legislative initiatives to limit investor activism on related matters may have the opposite effect. The US House Judiciary Committee, a legislative committee within the US House of Representatives, alleges that major activist investors (As You Sow, Ceres, CalPERS), who are campaigning in favour of net zero transition, are violating US antitrust laws. The committee claims that activist investors are working with other organisations to exert pressure on firms to decarbonize their assets and commit to net zero emissions targets (As You Sow, 2023e).

The committee further claims that such coordinated efforts may restrict competition or manipulate market dynamics – both critical concerns in antitrust regulations. It demands activist investors provide documents related to activism against firms regarding climate issues (As You Sow, 2023e). This kind of anti-climate intervention not only restricts net zero transition activism and weakens activist investors' influence (Fransen et al., 2021; Hadani et al., 2018) but also reduces the acceptance of net zero target adoption in the institutional

[28] Samples are balanced based on the all three moments (mean, variance and skewness) of the covariate distributions (Hainmueller, 2012).

environment. This may lead to a downward shift in investors' expectations with respect to net zero target adoption, and such target adoption may be perceived as meaningless.

The US House Judiciary Committee issued a letter on 1 August 2023 to activist investors including (but not limited to) As You Sow, Engine No.1, Trillium Asset Management, and Arjuna Capital alleging that they are potentially infringing under US antitrust legislation by forming agreements to 'decarbonise' company assets and achieve net-zero emissions, which might adversely impact the freedom and economic welfare of Americans.[29] This allegation clearly reflects the US policy makers and legislators' attempt to delegitimize net zero activism and an unfavourable view toward the activist investors involved in net zero transition activism. Therefore, POST_RENTRANS is measured as a binary variable taking a value of 1 for net zero targets adopted after 1 January 2023 and 0 otherwise.[30] Using entropy balanced samples, column 3 of Table 6 shows that the coefficient on the interaction term (NZTRANS × POST_RENZTRANS) is positive but statistically insignificant. Hence, for firms with prior exposure to activism, investors' reaction to the adoption of net zero targets is not related to targets adopted after the legislative committee's attempts to constrain and delegitimize net zero activism.

5.3 Institutional determinants of net zero emission target adoption

The previous section demonstrates that investors favourably view net zero emission targets, adopted following the post-US federal and state-level net zero policy, specifically for those firms with heightened exposure to net zero transition activism. It is also demonstrated that the legislative committee's intervention on net zero related activism appears to affect investor perception toward net zero target adoption by firms with exposure to activism. These results suggest that institutional environment shapes investor reaction to net zero emission targets. Acknowledging this, this study further explores whether the adoption of net zero emission target depends on the nature of institutional acceptance of such practices.

[29] See the letter: https://judiciary.house.gov/sites/evo-subsites/republicans-judiciary.house.gov/files/evo-media-document/letters.pdf

[30] It is worth noting that the US House Judiciary Committee initiated investigation in December 2022 (US Judiciary House, 2022) and it led to further allegations and actions targeting broader activist groups in the years 2023 and 2024. For example, the US House Judiciary Committee issued subpoena demanding documents related to climate activism in November 2023 (As You Sow, 2023f) and its Subcommittee held a hearing on investors' activism in June 2024 (US House Judiciary, 2024) As this happened in the end of 2022 and this year coincides with the year of Inflation Reduction Act, this study considers years from the beginning of the year 2023 and onwards as a period of the US legislative's committee's intervention to delegitimate and constrain net zero activism. The same period is considered as the low net zero salience period as defined in subsection 5.3.

Figure 2 outlines the trend of net zero emission targets adoption based on the data used in this study. During the study period (2019-2024), Figure 2 shows that majority of the sample firms adopted net zero emission targets in 2021 (148) and 2022 (55). In particular, the number of sample firms adopting net zero emission targets significantly increased (42 to 148) from 2020 to 2021. This proliferation of net zero emission target adoption in the years 2021 and 2022 can be attributed to the US federal government's several initiatives and actions to accelerate net zero targets,

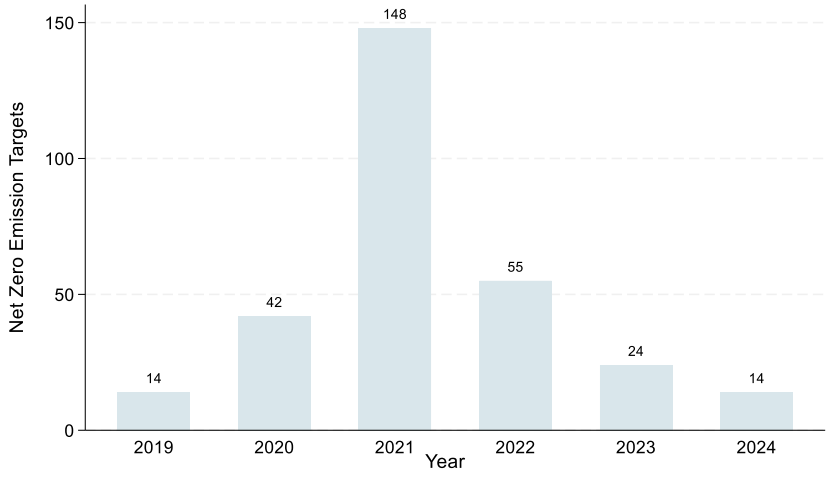

Figure 2. Trend of net zero emission targets (based on full sample of 297 events)

Major US initiatives and actions include: (i) decision to re-join Paris Agreement (2021) (ii) introduction of net zero transition policy (2021) and (iii) enactment of Inflation Reduction Act (2022).[31] This study, therefore, considers the years 2021 and 2022 as a period of high salience net zero period (HIGH_NETZERO_SALIENCE). Figure 2 also shows that net zero emission target adoption substantially decreased to 24 in 2023 and further decreases to 14 in 2024. This can be attributed to the US House Judiciary Committee's antitrust investigation in 2023 and onwards against climate and ESG movement groups, including activist investors. Thus, this study classifies the years 2023 and 2024 as a period of low salience net zero period (LOW_NETZERO_SALIENCE).

Given qualitative analysis of the institutional environment, this study empirically explores whether net zero target adoption depends on its prominence in the institutional

[31] On August 16, 2022, the US enacted the Inflation Reduction Act (IRA) which includes ambitious climate change targets (https://climateactiontracker.org/countries/usa/).

environment. In doing so, this study creates a binary variable identifying high (HIGH_NETZERO_SALIENCE) and low net zero salience periods (LOW_NETZERO_SALIENCE). This analysis is based on the S&P 1500 firms and the dependent variable is NZERO which takes the value of 1 for firms adopting net zero emission targets and 0 otherwise.

As in Table 6, this study also estimates the models in Table 7 based on the entropy balanced samples that are matched on each of the binary variables. Column 1 of Table 7 reports that the coefficient on HIGH_NETZERO_SALIENCE is positive, while the coefficient on LOW_NETZERO_SALIENCE is negative at the 1% significance level. Thus, Table 7 provides evidence supporting arguments that firms are more (less) likely to adopt net zero emission target adoption in times when net zero emission target setting enjoys a higher (lower) salience in the institutional environment.

[Insert Table 7 Here]

6. Additional Analysis

6.1 Additional target characterises

This section explores several additional target characteristics that may shape investor perception toward net zero emission targets. As higher emissions reduction targets have a greater impact on the target completion for longer-term target horizon (Ioannou et al. 2016), investors are more likely to positively view net zero targets with longer target horizon. This is specifically for firms that have been subject to net zero transition activism due to the lack of initiatives and targets to transition their businesses to net zero.

Investors might perceive that target adoption forces such firms to internalize negative externalities imposed on environment and such firms require longer time to prepare for transition to low carbon economy. Thus, investors are more likely to reward firms with exposure to net zero transition if they perceive that longer target horizon (TARHOR) enable such firms to better manage carbon emissions and absorb negative externalities over time. As argued, Column 1 of Table 8 shows that the coefficient on the interaction term (NZTRANS × TARHOR) is positive and significant at the 5% level, providing evidence in line with the expectation.

Investors increasingly demand for and assess progress on targets and associate issues (see Appendix 2), thereby making explicit commitment to report on the progress of targets

(REPOR) in net zero emission target announcement is more likely to be credibly perceived by investors. Column 2 of Table 8 shows that the interaction term (NZTRANS × REPOR) is positive and significant. Column 3 reports that the result holds even after using an alternative measure of commitment to report (COMREPORT), which is a binary measure taking the value of 1 for targets that explicitly commit to report on targets and 0 otherwise.

While hand-collecting the net zero emission target announcement events, it was also observed that some firms announce targets using online video, which can attract investors' attention and allow them to assess the credibility of the communicator (Short et al., 1976). This implies that the video announcement of corporate information has the potential to favourably affect investors' information processing and judgement (Elliott et al., 2012). It is therefore proposed that the announcement of net zero target adoption through video will more favourably impact investors' perceptions, particularly for firms with a history of net zero transition activism, compared to announcements made without video. The video announcement of a target (VIDEO) is captured by assigning a value of 1 for net zero emission target announcement via video and 0 otherwise. As argued, Column 4 of Table 8 reveals a positive and significant coefficient of NZTRANS × VIDEO, suggesting that video announcements of net zero emission target favourably influence investor perception toward net zero target adoption specifically for firms with a track record of net zero transition activism.

[Insert Table 8 Here]

6.2 Controlling for carbon intensity

In the main analysis, this study does not control for carbon intensity (measured as the ratio of total carbon emissions to total revenues) as it further reduces the observations. The main analysis in Table 5 is repeated to control for carbon intensity, with results reported in Panel A of Table 9. Columns 1 – 4 presents that the main results hold even after controlling for carbon intensity (CO2INT).

[Insert Table 9 Here]

6.3 Alternative event window and market index

This study examines whether the main results are robust to alternative event window. In doing so, the CAR is used during the event window (0, 1) as dependent variable. Panel B of Table 9 shows that the main results hold even after using CAR from an alternative event window (0, 1).

In the main analysis, the equally-weighted CRSP index is used to generate expected returns based on a market model. The value-weighted CRSP index is also used as a proxy for the market portfolio. As in the main analysis, the average 3-day announcement period abnormal return (0, 2) is used as a dependent variable (Baloria et al., 2019). Panel C of Table 9 reveals that the main results remain unaffected even after using an alternative market index.

6.4 Robustness of CARs

In the main analysis, the market model is used to estimate abnormal returns. A concern is that the abnormal returns may represent other factors (e.g., size, book to market) that are priced during the sample period. Panel A of Table 10 reports the results from Fama and French (1993) three-factor model.[32] While the cross-sectional t-test is not significant, the Cowan's (1992) generalized sign test is significant at the event window (0, 2).

As in Flammer (2013), the event study is conducted using industry-adjusted returns at the four-digit SIC code level.[33] Panel B shows that Cowan's (1992) generalized sign test remains significant at the chosen event window (0, 2).[34] This provides some evidence that the results are less likely to be driven by industry effects.

[Insert Table 10 Here]

6.5 Alternative measure of investor reaction

This study's sample comprises the S&P 1500 firms and the adoption of net zero emission targets is mainly driven by larger firms (Table 7). The sample also encompasses a diverse array of industries and financial attributes (Table 1), whose beta risk factor is approximately one by construction (Griffin et al., 2017). In this context, a market-adjusted measure of excess return is more appropriate than a complicated estimation based on several risk factors such as Fama and French (1993) three-factor model (Griffin et al., 2017).

Following Griffin et al. (2017), investor reaction is measured based on the daily stock return for trading day t (RET_t) in excess of the day t return on the CRSP equal-weighted market index (MKT_t), that is, $EXCRET_t = RET_t - MKT_t$. This study then tests whether the average $EXCRET_t$ during the event window (0, 2) is positive and exceeds the average $EXCRET_t$ on different days within the window (-10, 10) but excludes the days in the event window (0, 2).

[32] The results (untabulated) remains quite similar even after using Carhart (1997) four-factor model.
[33] Flammer (2013) uses SIC code level and it is available with the stock data in the CRSP database. Following Flammer (2013), industry-adjusted returns are calculated by subtracting the average return across all stocks on a given trading day and in a given four-digit SIC industry.
[34] As CARs from this model are skewed, Cowan's (1992) generalized sign test is more reliable than t-test.

Panel A of Table 11 shows that the three-day mean $EXCRET_{0\ to\ 2}$ is positive and significantly different from zero at the 1% level. Panel A further shows that mean $EXCRET_{0\ to\ 2}$ (0.20%) is significantly higher than the average $EXCRET_{-10\ to\ 10}$ (0.031%). This study further uses the market-adjusted return ($EXCRET_{0\ to\ 2}$) as a dependent variable and repeats the main analysis in Panel B. Panel B of Table 11 shows that the main results hold even after using a market-adjusted return (EXCRET).

[Insert Table 11 Here]

6.6 Placebo research design

This study further validates the evidence of the main analysis using a placebo research design. The event dates (i.e., net zero target adoption) are randomly assigned and the main analysis is repeated in Table 12.[35] As the event dates are randomly assigned, it is expected that the main results disappear. This would suggest that the main results are not subject to pre-existing trends or alternative explanations. As expected, Panel A of Table 12 shows that the placebo CARs are not significantly different from zero in any of the reported event windows. Panel B of Table 12 reports that the coefficients on NZTRANS × TARDISC, NZTRANS × EMISRED and NZTRANS × INVEST are not statistically significant. These insignificant results provide additional support that the main results are likely attributable to the net zero target adoption events rather than pre-existing trends or any other confounding factors.

[Insert Table 12 Here]

7. Conclusion

This study sheds light on corporate net zero emissions target setting, a recent phenomenon in carbon emissions mitigation efforts, examining how investors respond to the adoption of net zero emission targets. It finds that investors respond positively to the announcement of net zero emission targets. It also finds that firms' prior exposure to net zero transition related activism do not affect investor reaction to net zero target adoption. However, this study identifies several target relevant factors that explain variation in investor reaction to net zero target adoption, specifically for firms with exposure to related activism. The investor reaction is more positive when the target adoption contains detailed target relevant disclosures, characterized by higher level of emissions reduction targets, and when it explicitly mentions planned amount of investment to decarbonize business to attain targets. Finally, the institutional analysis in the

[35] As the net zero emission target adoption dates range from January 2019 to August 2024, random dates are generated covering this period.

context of the US net zero environment shows that firms adopt net zero emission targets when such targets are valued by investors and when the institutional expectations of such targets are high.

The results are consistent with both signalling and screening theories: by adopting net zero emission targets, firms credibly signal their commitment toward carbon emissions management. As firms generally adopt net zero targets due to activist investors' pressure (Desai et al., 2023), investors consider firms' prior exposure to net zero transition activism as a screening filter that is argued to negatively affect investor perception regarding the credibility and quality of net zero target adoption. As a result, investors further involve in screening process to assess whether the adopted targets are credible and aligns with the expectations of broader stakeholders, including investors and institutional environment.

This study argues that net zero target adoption conforms to investors' expectations when such target adopted contains credibility enhancing features and when the policy environment promotes such target adoption. By contrast, when the policy environment delegitimizes activist investors' demand, investors do not perceive net zero target adoption sufficiently valuable. This is reflected in insignificant investor reaction. Taken together, this study reveals circumstances under which investors perceive net zero target more, or less, valuable. It, therefore, advances both signalling and screening theories by demonstrating how the combination of prior information about the firm with either the attributes of non-financial information (i.e., net zero target) or contextual factors (i.e., policy environment) shape investor perception in capital market context.

This study is timely, novel, and of practical value, being conducted at a time when there is a growing concern regarding the transparency and accountability of emissions reduction targets (Jiang et al., 2023; NewClimate Institute, 2022). This concern is primarily intensified due to the substantial heterogeneity in non-financial target setting across firms (Ioannou et al., 2016; Wang & Sueyoshi, 2018); and to the long-term nature of the target that spans over several decades into the future (Desai et al., 2023). This study provides evidence that investors perceive detailed disclosures on targets and higher emissions reduction targets and intended investment as more valuable. This evidence will encourage managers, specifically those with exposure to net zero activism, to adopt targets with increased target-relevant information and encourage them to demonstrate planned investment for decarbonization.

The results are also relevant to investors and other stakeholders as this study provides evidence of when their activism can be more, or less, value enhancing in a net zero transition context. Finally, the findings inform the debate regarding legislative intervention to constrain and delegitimize net zero transition activism in the US. The findings seem to indicate that net zero target adoption is value enhancing, specifically for firms that are subject to net zero transition activism when target is adopted in a way that addresses activist investors' concern. However, the investors' perception seems to change after the legislative committee's intervention. Therefore, any regulatory/legislative action should consider how the market may interpret such actions and the subsequent revision of investors' expectations.

This study has several limitations that can potentially open future research opportunities. It focuses on the firm announcement of net zero emission targets based on the assumption that firm-level, target attributes and the policy environment influence investor reactions to target adoption. It will be meaningful for future research to consider how media, including social media shapes investor reactions to net zero emission targets. Future research examining other signals such as concurrent social and/or environmental misconduct that may also influence investor perception toward net zero target adoption are encouraged. This study also examines reaction from one stakeholder group – investors, and future studies could examine how different stakeholders react and interpret net zero emission targets. Notwithstanding these limitations, this study provides some of the first evidence on the value of target-setting in non-financial context, and demonstrates the importance of evaluating the alternative sources of information in the context of the firm's transition to low carbon economy.

References

Aiken, L. S. & West, S. G. (1991). *Multiple Regression: Testing and Interpreting Interactions*. London, U.K.: Sage.

Akerlof. G. A. (1970). The market for 'lemons': Quality uncertainty and the market mechanism. *Quarterly Journal of Economics, 84*(3), 488-500.

Allen, M. R., Friedlingstein, P., Girardin, C. A. J., Jenkins, S., Malhi, Y., Mitchell-Larson, E., Peters, G. P., & Rajamani, L. (2022). Net Zero: Science, Origins, and Implications. *Annual Review of Environment and Resources*, *47*(Volume 47, 2022), 849–887. https://doi.org/10.1146/annurev-environ-112320-105050

Anderson, K. (2012). The inconvenient truth of carbon offsets. *Nature*, *484*(7392), 7–7. https://doi.org/10.1038/484007a

Arora, P., Hora, M., Singhal, V., & Subramanian, R. (2020). When do appointments of corporate sustainability executives affect shareholder value? *Journal of Operations Management*, *66*(4), 464–487. https://doi.org/10.1002/joom.1074

As You Sow. (2022). 2022 *Shareholder impact review: Changing corporations for good.* https://www.asyousow.org/2022-shareholder-impact-review. Retrieved 20 October 2024.

As You Sow. (2023a). *Constellation Energy Corp: Adopt scope 3 targets*. https://www.asyousow.org/resolutions/2023/11/15-constellation-energy-adopt-scope-3-targets Retrieved 15 December 2024.

As You Sow. (2023b). *Lockheed Martin Inc: Net zero targets & climate transition planning.* https://www.asyousow.org/resolutions/2023/11/13-lockheed-martin-net-zero-targets-climate-transition-planning. Retrieved 15 December 2023.

As You Sow. (2023c). *General Electric Co: Adopt a climate transition plan*. https://www.asyousow.org/resolutions/2023/11/22-general-electric-adopt-climate-transition-plan. Retrieved 15 December 2024.

As You Sow. (2023d). *Road to zero emissions*. https://www.asyousow.org/report-page/2023/road-to-zero-emissions. Retrieved 16 October 2024.

As You Sow. (2023e). *House Judiciary Committee issues subpoena to silence shareholders*. https://www.asyousow.org/press-releases/2023-11-1-house-judiciary-committee-silence-shareholders. Retrieved 22 October 2024.

As You Sow. (2023f). House Judiciary Committee issues subpoena to silence shareholders. https://www.asyousow.org/press-releases/2023-11-1-house-judiciary-committee-silence-shareholders. Retrieved 30 December 2024.

Azar, J., Duro, M., Kadach, I., & Ormazabal, G. (2021). The Big Three and corporate carbon emissions around the world. *Journal of Financial Economics*, *142*(2), 674–696. https://doi.org/10.1016/j.jfineco.2021.05.007

Balakrishnan, R., Huang, J., & Xuan, Y. (2023). The influence of institutional pressure on target setting. *Accounting, Organizations and Society*, *108*, 101453. https://doi.org/10.1016/j.aos.2023.101453

Baldauf, M., Garlappi, L., & Yannelis, C. (2020). Does Climate Change Affect Real Estate Prices? Only If You Believe In It. *The Review of Financial Studies*, *33*(3), 1256–1295. https://doi.org/10.1093/rfs/hhz073

Baloria, V. P., Klassen, K. J., & Wiedman, C. I. (2019). Shareholder Activism and Voluntary Disclosure Initiation: The Case of Political Spending. *Contemporary Accounting Research*, *36*(2), 904–933. https://doi.org/10.1111/1911-3846.12457

Bergh, D. D., & Gibbons, P. (2011). The Stock Market Reaction to the Hiring of Management Consultants: A Signalling Theory Approach. *Journal of Management Studies*, *48*(3), 544–567. https://doi.org/10.1111/j.1467-6486.2010.00957.x

Bhagwat, Y., Warren, N. L., Beck, J. T., & Watson, G. F. (2020). Corporate Sociopolitical Activism and Firm Value. *Journal of Marketing*, *84*(5), 1–21. https://doi.org/10.1177/0022242920937000

Blankespoor, E. (2018). Firm communication and investor response: A framework and discussion integrating social media. *Accounting, Organizations and Society*, *68–69*, 80–87. https://doi.org/10.1016/j.aos.2018.03.009

Bolton, P., & Kacperczyk, M. (2021). Do investors care about carbon risk? *Journal of Financial Economics*, *142*(2), 517–549. https://doi.org/10.1016/j.jfineco.2021.05.008

Bourveau, T., & Schoenfeld, J. (2017). Shareholder activism and voluntary disclosure. *Review of Accounting Studies*, *22*(3), 1307–1339. https://doi.org/10.1007/s11142-017-9408-0

Bui, B., Houqe, M. N., & Zaman, M. (2020). Climate governance effects on carbon disclosure and performance. *The British Accounting Review*, *52*(2), 100880. https://doi.org/10.1016/j.bar.2019.100880

Carberry, E. J., Engelen, P.-J., & Essen, M. V. (2018). Which Firms Get Punished for Unethical Behavior? Explaining Variation in Stock Market Reactions to Corporate Misconduct. *Business Ethics Quarterly*, *28*(2), 119–151. https://doi.org/10.1017/beq.2017.46

Carhart, M. M. (1997). On Persistence in Mutual Fund Performance. *The Journal of Finance*, *52*(1), 57–82. https://doi.org/10.1111/j.1540-6261.1997.tb03808.x

Cassar, G., Ittner, C. D., & Cavalluzzo, K. S. (2015). Alternative information sources and information asymmetry reduction: Evidence from small business debt. *Journal of Accounting and Economics*, *59*(2), 242–263. https://doi.org/10.1016/j.jacceco.2014.08.003

CDP. (2020). *Foundations for science-based net-zero target setting in the corporate sector*. https://sciencebasedtargets.org/resources/files/foundations-for-net-zero-full-paper.pdf. Retrieved 12 August, 2022.

CDP. (2023). CDP climate change 2023 reporting guidance. https://guidance.cdp.net/en/guidance?ctype=ExternalRef&idtype=RecordExternalRef&cid=C4.1b&otype=Guidance&incchild=0%C2%B5site=0&gettags=0. Retrieved 15 March 2024.

Chapple, L., Clarkson, P. M., & Gold, D. L. (2013). The Cost of Carbon: Capital Market Effects of the Proposed Emission Trading Scheme (ETS). *Abacus*, *49*(1), 1–33. https://doi.org/10.1111/abac.12006

Choi, B., & Luo, L. (2021). Does the market value greenhouse gas emissions? Evidence from multi-country firm data. *The British Accounting Review*, *53*(1), 100909. https://doi.org/10.1016/j.bar.2020.100909

Christensen, D. M. (2016). Corporate Accountability Reporting and High-Profile Misconduct. *The Accounting Review*, *91*(2), 377–399. https://doi.org/10.2308/accr-51200

Clarkson, P. M., Li, Y., Pinnuck, M., & Richardson, G. D. (2015). The Valuation Relevance of Greenhouse Gas Emissions under the European Union Carbon Emissions Trading Scheme. *European Accounting Review*, *24*(3), 551–580. https://doi.org/10.1080/09638180.2014.927782

Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2008). Revisiting the relation between environmental performance and environmental disclosure: An empirical analysis. *Accounting, Organizations and Society*, *33*(4), 303–327. https://doi.org/10.1016/j.aos.2007.05.003

Cohen, S., Kadach, I., & Ormazabal, G. (2023). Institutional investors, climate disclosure, and carbon emissions. *Journal of Accounting and Economics*, *76*(2), 101640. https://doi.org/10.1016/j.jacceco.2023.101640

Connelly, B. L., Certo, S. T., Ireland, R. D., & Reutzel, C. R. (2011). Signaling Theory: A Review and Assessment. *Journal of Management*, *37*(1), 39–67. https://doi.org/10.1177/0149206310388419

Cousins, P., Dutordoir, M., Lawson, B., & Neto, J. Q. F. (2020). Shareholder Wealth Effects of Modern Slavery Regulation. *Management Science*, *66*(11), 5265–5289. https://doi.org/10.1287/mnsc.2019.3456

Dahlmann, F., Branicki, L., & Brammer, S. (2019). Managing Carbon Aspirations: The Influence of Corporate Climate Change Targets on Environmental Performance. *Journal of Business Ethics*, *158*(1), 1–24. https://doi.org/10.1007/s10551-017-3731-z

David, P., Bloom, M., & Hillman, A. J. (2007). Investor activism, managerial responsiveness, and corporate social performance. *Strategic Management Journal*, *28*(1), 91–100. https://doi.org/10.1002/smj.571

Delis, M. D., Greiff, K. de, Iosifidi, M., & Ongena, S. (2024). Being stranded with fossil fuel reserves? Climate policy risk and the pricing of bank loans. *Financial Markets, Institutions & Instruments*, *33*(3), 239–265. https://doi.org/10.1111/fmii.12189

Desai, H., Lam, P., Li, B., & Rajgopal, S. (2023). An Analysis of Carbon-Reduction Pledges of U.S. Oil and Gas Companies. *Management Science*, *69*(6), 3748–3758. https://doi.org/10.1287/mnsc.2023.4765

Dhar, S., & Davidson, B. (2022). *An investor's guide to net zero by 2050*. https://www.bnymellonim.com/uploads/2022/10/199282df7040ecf5ac02b1e950e7ffa0/bny-mellon-investment-management-fathom-consulting-net-zero-report-oct-2022.pdf. Retrieved 15 October 2022.

Diaz-Rainey, I., Griffin, P. A., Lont, D. H., Mateo-Márquez, A. J., & Zamora-Ramírez, C. (2024). Shareholder Activism on Climate Change: Evolution, Determinants, and Consequences. *Journal of Business Ethics*, *193*(3), 481–510. https://doi.org/10.1007/s10551-023-05486-x

Elliott, W. B., Hodge, F. D., & Sedor, L. M. (2012). Using Online Video to Announce a Restatement: Influences on Investment Decisions and the Mediating Role of Trust. *The Accounting Review*, *87*(2), 513–535. https://doi.org/10.2308/accr-10202

Emett, S. A. (2019). Investor Reaction to Disclosure of Past Performance and Future Plans. *The Accounting Review*, *94*(5), 165–188. https://doi.org/10.2308/accr-52343

Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, *33*(1), 3–56. https://doi.org/10.1016/0304-405X(93)90023-5

Fankhauser, S., Smith, S. M., Allen, M., Axelsson, K., Hale, T., Hepburn, C., Kendall, J. M., Khosla, R., Lezaun, J., Mitchell-Larson, E., Obersteiner, M., Rajamani, L., Rickaby, R., Seddon, N., & Wetzer, T. (2022). The meaning of net zero and how to get it right. *Nature Climate Change*, *12*(1), 15–21. https://doi.org/10.1038/s41558-021-01245-w

FedEx. (2021). *FedEx commits to carbon-neutral operations by 2040*. https://newsroom.fedex.com/newsroom/asia-english/sustainability2021. Retrieved 11 January 2025.

Flammer, C. (2013). Corporate Social Responsibility and Shareholder Reaction: The Environmental Awareness of Investors. *Academy of Management Journal*, *56*(3), 758–781. https://doi.org/10.5465/amj.2011.0744

Flammer, C., Toffel, M. W., & Viswanathan, K. (2021). Shareholder activism and firms' voluntary disclosure of climate change risks. *Strategic Management Journal*, *42*(10), 1850–1879. https://doi.org/10.1002/smj.3313

Fransen, L., Dupuy, K., Hinfelaar, M., & Zakaria Mazumder, S. M. (2021). Tempering Transnational Advocacy? The Effect of Repression and Regulatory Restriction on Transnational NGO Collaborations. *Global Policy*, *12*(S5), 11–22. https://doi.org/10.1111/1758-5899.12972

Freiberg, D., Grewal, J., & Serafeim, G. (2021). *Science-Based Carbon Emissions Targets* (SSRN Scholarly Paper 3804530). Social Science Research Network. https://doi.org/10.2139/ssrn.3804530

Fremeth, A. R., Holburn, G. L. F., & Piazza, A. (2022). Activist Protest Spillovers into the Regulatory Domain: Theory and Evidence from the U.S. Nuclear Power Generation Industry. *Organization Science*, *33*(3), 1163–1187. https://doi.org/10.1287/orsc.2021.1473

Gomulya, D., & Mishina, Y. (2017). Signaler Credibility, Signal Susceptibility, and Relative Reliance on Signals: How Stakeholders Change their Evaluative Processes After Violation of Expectations and Rehabilitative Efforts. *Academy of Management Journal*, *60*(2), 554–583. https://doi.org/10.5465/amj.2014.1041

Griffin, P. A., & Sun, Y. (2013). Going green: Market reaction to CSRwire news releases. *Journal of Accounting and Public Policy*, *32*(2), 93–113. https://doi.org/10.1016/j.jaccpubpol.2013.02.002

Griffin, P. A., Lont, D. H., & Sun, E. Y. (2017). The Relevance to Investors of Greenhouse Gas Emission Disclosures. *Contemporary Accounting Research*, *34*(2), 1265–1297. https://doi.org/10.1111/1911-3846.12298

Gujarati, D. N., & Porter, D. C. (2009). *Basic econometrics*. McGraw-Hill. https://thuvienso.hoasen.edu.vn/handle/123456789/8914

Hadani, M., Doh, J. P., & Schneider, M. A. (2018). Corporate Political Activity and Regulatory Capture: How Some Companies Blunt the Knife of Socially Oriented Investor Activism. *Journal of Management*, *44*(5), 2064–2093. https://doi.org/10.1177/0149206316638162

Hainmueller, J. (2012). Entropy Balancing for Causal Effects: A Multivariate Reweighting Method to Produce Balanced Samples in Observational Studies. *Political Analysis*, *20*(1), 25–46. https://doi.org/10.1093/pan/mpr025

Hansen, S. C., & Stede, W. A. V. der. (2004). Multiple facets of budgeting: An exploratory analysis. *Management Accounting Research*, *15*(4), 415–439. https://doi.org/10.1016/j.mar.2004.08.001

He, R., Luo, L., Shamsuddin, A., & Tang, Q. (2022). The Value Relevance of Corporate Investment in Carbon Abatement: The Influence of National Climate Policy. *European Accounting Review*, *31*(5), 1233–1261. https://doi.org/10.1080/09638180.2021.1916979

Hennig, J. C., Firk, S., & Wolff, M. (n.d.). Credibility Signals from Soft Information: Evidence from Investor Reactions to Tone in Earnings Conference Calls. *European Accounting Review*, *0*(0), 1–33. https://doi.org/10.1080/09638180.2023.2244009

Huang, L. (2018). The Role of Investor Gut Feel in Managing Complexity and Extreme Risk. *Academy of Management Journal*, *61*(5), 1821–1847. https://doi.org/10.5465/amj.2016.1009

Hutton, A. P., Miller, G. S., & Skinner, D. J. (2003). The Role of Supplementary Statements with Management Earnings Forecasts. *Journal of Accounting Research*, *41*(5), 867–890. https://doi.org/10.1046/j.1475-679X.2003.00126.x

Ioannou, I., Li, S. X., & Serafeim, G. (2016). The Effect of Target Difficulty on Target Completion: The Case of Reducing Carbon Emissions. *The Accounting Review*, *91*(5), 1467–1492. https://doi.org/10.2308/accr-51307

IPCC, (2018). *Summary for policy makers*. Available at: https://www.ipcc.ch/site/assets/uploads/

Islam, M. A., & van Staden, C. J. (2018). Social movement NGOs and the comprehensiveness of conflict mineral disclosures: Evidence from global companies. *Accounting, Organizations and Society*, *65*, 1–19. https://doi.org/10.1016/j.aos.2017.11.002

Jerez-Fernandez, A., Angulo, A. N., & Oppenheimer, D. M. (2014). Show Me the Numbers: Precision as a Cue to Others' Confidence. *Psychological Science*, *25*(2), 633–635. https://doi.org/10.1177/0956797613504301

Jiang, X., Kim, S., & Lu, S. (2023). *Accountability of Corporate Emissions Reduction Targets* (SSRN Scholarly Paper 4676649). Social Science Research Network. https://doi.org/10.2139/ssrn.4676649

Johnson, J. A., Theis, J., Vitalis, A., & Young, D. (2020). The Influence of Firms' Emissions Management Strategy Disclosures on Investors' Valuation Judgments. *Contemporary Accounting Research*, *37*(2), 642–664. https://doi.org/10.1111/1911-3846.12545

Kim, S. (2024), Investor Preferences and Responses to Disclosure: Evidence from Carbon Net-Zero Pledges (March 8, 2024). https://ssrn.com/abstract=4846045.

King, L., & Gish, E. (2015). Marketizing Social Change: Social Shareholder Activism and Responsible Investing. *Sociological Perspectives*, *58*(4), 711–730. https://doi.org/10.1177/0731121415576799

Krueger, P., Sautner, Z., & Starks, L. T. (2020). The Importance of Climate Risks for Institutional Investors. *The Review of Financial Studies*, *33*(3), 1067–1111. https://doi.org/10.1093/rfs/hhz137

Krüger, P. (2015). Corporate goodness and shareholder wealth. *Journal of Financial Economics*, *115*(2), 304–329. https://doi.org/10.1016/j.jfineco.2014.09.008

Lee, M.-D. P., & Lounsbury, M. (2011). Domesticating Radical Rant and Rage: An Exploration of the Consequences of Environmental Shareholder Resolutions on Corporate Environmental Performance. *Business & Society*, *50*(1), 155–188. https://doi.org/10.1177/0007650310394640

Liesen, A., Hoepner, A. G., Patten, D. M., & Figge, F. (2015). Does stakeholder pressure influence corporate GHG emissions reporting? Empirical evidence from Europe. *Accounting, Auditing & Accountability Journal*, *28*(7), 1047–1074. https://doi.org/10.1108/AAAJ-12-2013-1547

Martin, P. R., & Moser, D. V. (2016). Managers' green investment disclosures and investors' reaction. *Journal of Accounting and Economics*, *61*(1), 239–254. https://doi.org/10.1016/j.jacceco.2015.08.004

Matsumura, E. M., Prakash, R., & Vera-Muñoz, S. C. (2014). Firm-Value Effects of Carbon Emissions and Carbon Disclosures. *The Accounting Review*, *89*(2), 695–724. https://doi.org/10.2308/accr-50629

McMullin, J. L., & Schonberger, B. (2020). Entropy-balanced accruals. *Review of Accounting Studies*, *25*(1), 84–119. https://doi.org/10.1007/s11142-019-09525-9

McWilliams, A., & Siegel, D. (1997). Event Studies In Management Research: Theoretical And Empirical Issues. *Academy of Management Journal*, *40*(3), 626–657. https://doi.org/10.5465/257056

Melody, V. (2024). *Emerging trends and early outcomes signal impactful 2024 proxy season for climate-related proposals*. https://www.ceres.org/resources/news/emerging-trends-and-early-outcomes-signal-impactful-2024-proxy-season-for-climate-related-proposals. Retrieved 10 October 2024.

Mercer, M. (2004). How Do Investors Assess the Credibility of Management Disclosures? *Accounting Horizons*, *18*(3), 185–196. https://doi.org/10.2308/acch.2004.18.3.185

Michelon, G., Rodrigue, M., & Trevisan, E. (2020). The marketization of a social movement: Activists, shareholders and CSR disclosure. *Accounting, Organizations and Society*, *80*, 101074. https://doi.org/10.1016/j.aos.2019.101074

Monasterolo, I., & de Angelis, L. (2020). Blind to carbon risk? An analysis of stock market reaction to the Paris Agreement. *Ecological Economics*, *170*, 106571. https://doi.org/10.1016/j.ecolecon.2019.106571

Net Zero Tracker (2023*). New analysis: Half of the world's largest companies are committed to net zero*. https://zerotracker.net/analysis/new-analysis-half-of-worlds-largest-companies-are-committed-to-net-zero. Retrieved 12 August 2024.

NewClimate Institute, (2022). *Corporate climate responsibility monitor 2022*. https://carbonmarketwatch.org/wpcontent/uploads/2022/02/CMW_CCRM2022_v08_FinalStretch2.pdf. Retrieved 20 March, 2023.

Nobel, C. (2017). *New research highlights the value of shareholder proposals from small investors*. https://www.forbes.com/sites/hbsworkingknowledge/2017/10/13/new-research-highlights-the-value-of-shareholder-proposals-from-small-investors/. Retrieved 12 January 2025.

Oliver Wyman Forum. (2021). *Consumers want companies to take a stand on climate*. https://www.oliverwymanforum.com/climate-sustainability/2021/apr/consumers-want-companies-to-take-a-stand-on-climate.html. Retrieved 15 November 2022.

Panfil, M., & Victor, D. G. (2022). *Climate change creates financial risks: Investors need to know what those are*. Available at: https://www.brookings.edu/blog/planetpolicy/2022/03/29/climate-change-creates-financial-risks-investors-need-to-know-what-those-are/. Retrieved 10 January 2023.

Papadopoulos, K. (2024). *Climate shareholder proposals: A more sophisticated discourse*. https://www.iss-corporate.com/library/climate-shareholder-proposals-a-more-sophisticated-discourse/. Retrieved 25 October 2024.

Pham, L., Hao, W., Truong, H., & Trinh, H. H. (2023). The impact of climate policy on U.S. environmentally friendly firms: A firm-level examination of stock return, volatility, volume, and connectedness. *Energy Economics*, *119*, 106564. https://doi.org/10.1016/j.eneco.2023.106564

Pittard, C. (2023). *What are carbon offsets & why are they controversial*. https://watchwire.ai/what-are-carbon-offsets-why-are-they-controversial/. Retrieved 23 October 2024.

Plumlee, M., Brown, D., Hayes, R. M., & Marshall, R. S. (2015). Voluntary environmental disclosure quality and firm value: Further evidence. *Journal of Accounting and Public Policy*, *34*(4), 336–361. https://doi.org/10.1016/j.jaccpubpol.2015.04.004

PricewaterhouseCoopers (PwC), (2021). *PwC's global investor survey: The economic realities of ESG*. https://www.pwc.com/gx/en/corporate-reporting/assets/pwc-global-investor-survey-2021.pdf. Retrieved 25 November 2022.

PricewaterhouseCoopers (PwC), (2022). *Investors continue to prioritise climate action despite lacking trusted information.* https://www.pwc.com/gx/en/news-room/press-releases/2022/investors-continue-to-prioritise-climate-action-despite-lacking-trusted-information.html. Retrieved 10 December 2024.

Qian, C., Crilly, D., Wang, K., & Wang, Z. (2021). Why Do Banks Favor Employee-Friendly Firms? A Stakeholder-Screening Perspective. *Organization Science*, *32*(3), 605–624. https://doi.org/10.1287/orsc.2020.1400

Railway Technology, (2022). *Union Pacific launches $600m bond offering in decarbonization push*. https://www.railway-technology.com/news/union-pacific-bond-decarbonisation/. Retrieved 12 September 2022.

Ramelli, S., Wagner, A. F., Zeckhauser, R. J., & Ziegler, A. (2021). Investor Rewards to Climate Responsibility: Stock-Price Responses to the Opposite Shocks of the 2016 and 2020 U.S. Elections. *The Review of Corporate Finance Studies*, *10*(4), 748–787. https://doi.org/10.1093/rcfs/cfab010

Reid, E. M., & Toffel, M. W. (2009). Responding to public and private politics: Corporate disclosure of climate change strategies. *Strategic Management Journal*, *30*(11), 1157–1178. https://doi.org/10.1002/smj.796

Renneboog, L., & Szilagyi, P. G. (2011). The role of shareholder proposals in corporate governance. *Journal of Corporate Finance*, *17*(1), 167–188. https://doi.org/10.1016/j.jcorpfin.2010.10.002

Rhee, E. Y., & Fiss, P. C. (2014). Framing Controversial Actions: Regulatory Focus, Source Credibility, and Stock Market Reaction to Poison Pill Adoption. *Academy of Management Journal*, *57*(6), 1734–1758. https://doi.org/10.5465/amj.2012.0686

Sanders, Wm. G., & Boivie, S. (2004). Sorting things out: Valuation of new firms in uncertain markets. *Strategic Management Journal*, *25*(2), 167–186. https://doi.org/10.1002/smj.370

Schiemann, F., & Sakhel, A. (2019). Carbon Disclosure, Contextual Factors, and Information Asymmetry: The Case of Physical Risk Reporting. *European Accounting Review*, *28*(4), 791–818. https://doi.org/10.1080/09638180.2018.1534600

Short, J. L., & Toffel, M. W. (2010). Making Self-Regulation More Than Merely Symbolic: The Critical Role of the Legal Environment. *Administrative Science Quarterly*, *55*(3), 361–396. https://doi.org/10.2189/asqu.2010.55.3.361

Short, J., Williams, E., & Christie, B. (1976). *The social psychology of telecommunications*. Wiley. https://cir.nii.ac.jp/crid/1130282268777950720

Shrestha, P. (2021). *Amgen to invest $200m to become carbon-neutral by 2027*. https://www.futurenetzero.com/2021/01/13/amgen-to-invest-200m-to-become-carbon-neutral-by-2027/. Retrieved 11 September 2022.

South Pole. (2022). *Net zero and beyond: A deep-dive on climate leaders and what's driving them*. https://www.southpole.com/publications/net-zero-and-beyond. Retrieved 20 October, 2024.

Spence, M. (1973). Job market signaling. *Quarterly Journal of Economics*, *87*, 355-374.

Thayer, J. (2011). Determinants of Investors' Information Acquisition: Credibility and Confirmation. *The Accounting Review*, *86*(1), 1–22. https://doi.org/10.2308/accr.00000015

Tindall, G. (2024). A real effect of climate-related shareholder proposals: Diversification. *The British Accounting Review*, 101450. https://doi.org/10.1016/j.bar.2024.101450

UNPRI, (2022). *Investor climate action plans & net zero targets: opportunities for progress in 2022.* Available at: https://www.unpri.org/pri-blog/investor-climate-action-plans-and-net-zero-targets-opportunities-for-progress-in-2022/9560.article. Retrieved 11 September 2022.

US Department of State. (2021). *The Long-term strategy of the United States: Pathways to net-zero greenhouse gas emissions by 2050*. https://unfccc.int/sites/default/files/resource/US-LongTermStrategy-2021.pdf. Retrieved 22 October 2022.

US Judiciary House. (2022). *Republicans launch antitrust investigation into climate-obsessed corporate 'Cartel'*. https://judiciary.house.gov/media/in-the-news/republicans-launch-antitrust-investigation-into-climate-obsessed-corporate-cartel. Retrieved 25 December 2024.

Vasi, I. B., & King, B. G. (2012). Social Movements, Risk Perceptions, and Economic Outcomes: The Effect of Primary and Secondary Stakeholder Activism on Firms' Perceived Environmental Risk and Financial Performance. *American Sociological Review*, *77*(4), 573–596. https://doi.org/10.1177/0003122412448796

Wang, D. D., & Sueyoshi, T. (2018). Climate change mitigation targets set by global firms: Overview and implications for renewable energy. *Renewable and Sustainable Energy Reviews*, *94*, 386–398. https://doi.org/10.1016/j.rser.2018.06.024

Werner, T. (2017). Investor Reaction to Covert Corporate Political Activity. *Strategic Management Journal*, *38*(12), 2424–2443. https://doi.org/10.1002/smj.2682

Widener, S. K. (2007). An empirical analysis of the levers of control framework. *Accounting, Organizations and Society*, *32*(7), 757–788. https://doi.org/10.1016/j.aos.2007.01.001

Wong, J. B., & Zhang, Q. (2022). Stock market reactions to adverse ESG disclosure via media channels. *The British Accounting Review*, *54*(1), 101045. https://doi.org/10.1016/j.bar.2021.101045

World Economic Forum (WEF). (2021). *Aligning to net zero: How CEOs can get on board with the transition*. https://www3.weforum.org/docs/WEF_Aligning_to_net_zero_2021.pdf. Retrieved 17 August, 2022.

Zajac, E. J., & Westphal, J. D. (2004). The Social Construction of Market Value: Institutionalization and Learning Perspectives on Stock Market Reactions. *American Sociological Review*, *69*(3), 433–457. https://doi.org/10.1177/000312240406900306

Zhang, L. (2020). An Institutional Approach to Gender Diversity and Firm Performance. *Organization Science*, *31*(2), 439–457. https://doi.org/10.1287/orsc.2019.1297

Zhang, Y., & Wiersema, M. F. (2009). Stock market reaction to CEO certification: The signaling role of CEO background. *Strategic Management Journal*, *30*(7), 693–710. https://doi.org/10.1002/smj.772

Zheng, J., Ghorbani, M., Yan, Y., & Cao, Y. (2024). Signals from CSR competition: The influence of relative CSR performance on analysts' recommendations. *The British Accounting Review*, *56*(5), 101298. https://doi.org/10.1016/j.bar.2023.101298

TABLES

TABLE 1 Sample selection and industry composition.

Panel A: Sample selection		
		Firms
Initial sample (S&P 1500) from 2019 to 2024		1,500
Excluding:		
Not incorporated and headquartered in the US	(63)	
Not traded in the AMEX, NYSE or NASDAQ	(1)	
Sample (S&P 1500) firms		1436
Firms without net zero target adoption	(901)	
Firms with net zero targets		535
No dates of net zero target adoption	(170)	
Ambiguous targets or targets achieved	(68)	
Firms with identified event dates		297
Missing data in the CRSP database	(5)	
Final sample for event study		292
Panel B: Industry composition		
Industry name	**Firms**	**Percentage**
Automobiles & Components	10	3.42
Banks	8	2.74
Capital Goods	17	5.82
Commercial & Professional Services	10	3.42
Consumer Durables & Apparel	15	5.14
Consumer Services	9	3.08
Diversified Financials	14	4.79
Energy	14	4.79
Food & Staples Retailing	3	1.03
Food, Beverage & Tobacco	12	4.11
Health Care Equipment & Services	9	3.08
Household & Personal Products	4	1.37
Insurance	7	2.4
Materials	29	9.93
Media & Entertainment	7	2.4
Pharmaceuticals, Biotechnology & Life Sciences	12	4.11
Real Estate	15	5.14
Real Estate Management & Development	3	1.03
Retailing	11	3.77
Semiconductors & Semiconductor Equipment	9	3.08
Software & Services	16	5.48
Technology Hardware & Equipment	12	4.11
Telecommunication Services	3	1.03
Transportation	11	3.77
Utilities	32	10.96
Total	292	100

Note: This table presents the sample selection procedure (Panel A) and industry composition based on the four-digit Global Industry Classification Standard (GICS) (Panel B).

TABLE 2 Net zero emission target adoption disclosures

No.	Disclosure Items	Mean (%)
Panel A: Net Zero Target		
1.	Target year for publicly reported net-zero target	100
2.	Base year for publicly reported net-zero target	6.84
3.	Scope (coverage) of net-zero target for Scope 1 emissions	32.32
4.	Scope (coverage) of net-zero target for Scope 2 emissions	32.32
5.	Scope (coverage) of net-zero target for Scope 3 emissions	13.31
6.	Commitment to validate the target by the Science-Based Targets initiative	14.83
	Average net zero target related disclosures	33.27
Panel B: Short-term Target (by 2025)		
7.	Target year for publicly reported short-term target	12.93
8.	Base year for publicly reported short-term target	9.51
9.	Scope (coverage) of short-term target for Scope 1 emissions	5.73
10.	Scope (coverage) of short-term target for Scope 2 emissions	5.73
11.	Scope (coverage) of short-term target for Scope 3 emissions	1.15
12.	Commitment to validate the target by the Science-Based Targets initiative	2.67
13.	Short-term emission reduction target percentage	10.65
	Average short-term target related disclosures	6.91
Panel C: Medium-term Target (2026-2035)		
14.	Target year for publicly reported medium-term target	58.75
15.	Base year for publicly reported medium-term target	30.74
16.	Scope (coverage) of medium-term target for Scope 1 emissions	28.79
17.	Scope (coverage) of medium-term target for Scope 2 emissions	28.02
18.	Scope (coverage) of medium-term target for Scope 3 emissions	14.45
19.	Commitment to validate the target by the Science-Based Targets initiative	18.68
20.	Medium-term emission reduction target percentage	51.36
	Average medium-term target related disclosures	32.97
Panel D: Long-term Target (2036-2050)		
21.	Target year for publicly reported long-term target	6.88
22.	Base year for publicly reported long-term target	2.75
23.	Scope (coverage) of long-term target for Scope 1 emissions	0.46
24.	Scope (coverage) of long-term target for Scope 2 emissions	0.92
25.	Scope (coverage) of long-term target for Scope 3 emissions	0.00
26.	Commitment to validate the target by the Science-Based Targets initiative	0.46
27.	Long-term emission reduction target percentage	5.96
	Average long-term target related disclosures	2.49
Panel E: General Disclosures		
28.	Programs or activities to achieve the emission reduction targets defined or implemented covers Scope 1 emissions	5.32
29.	Programs or activities to achieve the emission reduction targets defined or implemented covers Scope 2 emissions	5.32
30.	Programs or activities to achieve the emission reduction targets defined or implemented covers Scope 3 emissions	6.08
	Average general disclosures on targets	5.58
	Average target relevant disclosures	17.60

TABLE 3 CARs around the announcement of net zero emission targets

Panel A: With confounding events					
Event window	**N**	**Mean (%)**	**t-stat**	**Positive returns (%)**	**Sign test**
(-3, 3)	292	0.484	1.407*	55.822	1.985**
(-2, 2)	292	0.614	2.113**	54.452	1.517*
(-1, 1)	292	0.422	1.875**	52.055	0.698
(0, 1)	292	0.403	2.197**	53.082	1.049
(0, 2)	292	0.546	2.425***	55.822	1.985**
(0, 3)	292	0.434	1.672**	50.000	-0.005
Panel B: Excluding earnings and dividend announcement events					
Event window	**N**	**Mean (%)**	**t-stat**	**Positive returns (%)**	**Sign test**
(-3, 3)	259	0.258	0.703	54.054	1.316*
(-2, 2)	259	0.485	1.567*	51.737	0.570
(-1, 1)	259	0.391	1.631*	52.124	0.694
(0, 1)	259	0.385	1.971**	54.054	1.316*
(0, 2)	259	0.519	2.164**	54.054	1.316*
(0, 3)	259	0.354	1.279	48.263	-0.549
Panel C: Excluding confounding events					
Event window	**N**	**Mean (%)**	**t-stat**	**Positive returns (%)**	**Sign test**
(-3, 3)	204	0.179	0.447	54.412	1.266
(-2, 2)	204	0.425	1.256	53.922	1.126
(-1, 1)	204	0.305	1.162	52.451	0.706
(0, 1)	204	0.314	1.469*	54.412	1.266
(0, 2)	204	0.466	1.776**	55.392	1.546*
(0, 3)	204	0.250	0.826	49.020	-0.274

Note: This table presents percent cumulative abnormal returns around net zero emission target announcements. Market model parameters are estimated over the 300-day period ending 50 days before the target announcement date, using the CRSP equal-weighted index. Panel A includes confounding events which are earnings and dividend announcement and the release of sustainability reports. Panel B excludes only earnings and dividend announcement dates but retains sustainability report publication events. Panel C excludes all the confounding events. The significance of the means is tested using the cross-sectional t-test and Cowan's (1992) generalized sign test, respectively. ***, **, and * represent significance at the 1%, 5% and 10% levels (one-tailed), respectively.

TABLE 4 Descriptive statistics.

	Observations	Mean	SD	Min	Max
CAR	263	0.006	0.032	-0.123	0.105
NZTRANS	263	0.186	0.819	0.000	10.000
TARDISC	263	0.176	0.122	0.033	0.567
EMISRED	263	0.328	0.096	0.250	0.871
INVEST	263	0.183	0.387	0.000	1.000
CO2OFF	263	0.186	0.390	0.000	1.000
STAKEINV	263	0.161	0.481	0.000	3.258
TARHOR	263	3.063	0.480	0.693	3.466
REPOR	263	0.567	0.834	0	3
INSOWN	263	0.811	0.139	0.162	1.000
SIZE	263	9.766	1.430	6.099	13.967
ROA	263	0.042	0.077	-0.437	0.313
FLEV	263	0.673	0.256	0.122	3.106
ESG	263	3.400	0.655	1.609	4.477

Note: CAR represents the average cumulative abnormal return in the event window (0, 2). STAKEINV and TARHOR is measured as one plus the natural log of number of stakeholders. In terms of the actual values, the average STAKEINV is 0.463 and the range is 0 to 25. The average TARHOR is 22.35 years and it varies from 1 to 31 years. SIZE and ESG is natural log transformed. In terms of the actual values, the average value of ESG is 36.27 and the range is 5 to 88. The average total assets (SIZE) is US$ 50,468.23 million and it varies from $445.402 to $1,163,028 million. Refer to Appendix 4 for variable definitions.

TABLE 5 Cross-sectional analysis – net zero transition activism and target characteristics

Variables	(1) CAR Coef.	(2) CAR Coef.	(3) CAR Coef.	(4) CAR Coef.
NZTRANS × TARDISC		0.040**		
NZTRANS × EMISRED			0.060***	
NZTRANS × INVEST				0.008**
NZTRANS	0.003	-0.002	0.001	-0.002
TARDISC	-0.019	-0.019	-0.022	-0.018
EMISRED	0.058*	0.058*	0.063**	0.055*
INVEST	0.005	0.005	0.004	0.003
CO2OFF	0.011*	0.011*	0.011*	0.011*
STAKEINV	0.005	0.005	0.004	0.005
TARHOR	0.005	0.004	0.004	0.005
REPOR	0.005*	0.005*	0.005*	0.004*
INSOWN	0.010	0.011	0.010	0.009
SIZE	0.000	0.000	0.001	0.000
ROA	-0.009	-0.019	-0.015	-0.017
FLEV	-0.002	-0.001	-0.002	-0.002
ESG	-0.003	-0.003	-0.003	-0.003
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Eventtype FE	Yes	Yes	Yes	Yes
Observations	263	263	263	263
R-squared	0.133	0.142	0.142	0.142
Highest VIF	2.49	3.64	2.08	3.49

Note: The dependent variable is the cumulative abnormal return (CAR). All the models are estimated using ordinary least square (OLS) regression model. Robust standard errors are used to minimize heteroskedasticity. ***, **, and * represent significance at the 1%, 5% and 10% levels, respectively. The p-values are one-tailed for directional hypotheses and two-tailed otherwise. Refer to Appendix 4 for variable definitions.

Table 6 The role of US federal and state-level net zero policy, and intervention on net zero activism

Variables	(1) CAR Coef.	(2) CAR Coef.	(3) CAR Coef.
NZTRANS × POST_USNTZ	0.005**		
NZTRANS × POST_STATENET		0.015**	
NZTRANS × POST_RENZTRANS			0.005
NZTRANS	-0.001	-0.002	0.006**
POST_USNTZ	-0.002	-0.002	0.013
STATENET	-0.005	-0.009**	-0.007
POST_RENZTRANS	-0.000	-0.002	0.001
TARDISC	-0.012	-0.048*	-0.001
EMISRED	0.056	0.055	-0.040
INVEST	0.007*	-0.001	0.011**
CO2OFF	0.020***	0.007	0.024***
STAKEINV	-0.001	0.004	-0.002
TARHOR	0.005	0.006	0.009*
REPOR	0.003	0.002	0.004
INSOWN	0.025	0.022	0.092**
SIZE	0.000	-0.002	0.002
ROA	-0.005	-0.030	-0.114***
FLEV	-0.005	0.002	-0.002
ESG	-0.003	0.006	-0.000
Industry FE	Yes	Yes	No
Year FE	No	No	No
Eventtype FE	Yes	Yes	Yes
Observations	263	263	263
R-squared	0.189	0.233	0.266

Note: The dependent variable is the cumulative abnormal return (CAR). All columns are estimated based on weights (pweights) derived from an entropy balancing estimation, matching on the indicator variable in each column In all columns, the year-fixed effects (Year FE) are excluded due to high multicollinearity issues. For the same reason, Column 3 excludes industry fixed effects (Industry FE). Standard errors are clustered at the state-level (Bertrand & Mullainathan, 2003). ***, **, and * represent significance at the 1%, 5% and 10% levels, respectively. The p-values are one-tailed for directional hypotheses and two-tailed otherwise. Refer to Appendix 4 for variable definitions.

TABLE 7 Institutional determinants of net zero emission target adoption

Variables	(1) NZERO Coef.	(2) NZERO Coef.
HIGH_NETZERO_SALIENCE	0.068***	
LOW_NETZERO_SALIENCE		-0.061***
STATENET	0.001	0.020**
CO2INT	3.529***	3.177**
NZTRANS	-0.013	-0.000
INSOWN	-0.030	-0.004
SIZE	0.024***	0.008**
ROA	-0.086***	-0.061
FLEV	0.020***	-0.009
ESG	0.033***	0.038***
Industry FE	Yes	Yes
Year FE	Yes	Yes
Observations	4,287	4,287
R-squared	0.079	0.078

Note: The dependent variable is whether the firm as net zero emission target (NZERO). All columns are estimated based on weights (pweights) derived from an entropy balancing estimation, matching on the binary variable in each column. The control variables are lagged by one year. Standard errors are clustered at the state-level ((Bertrand & Mullainathan, 2003). ***, **, and * represent significance at the 1%, 5% and 10% levels, respectively. The p-values are one-tailed for directional hypotheses and two-tailed otherwise. Refer to Appendix 4 for variable definitions.

TABLE 8 Cross-sectional analysis – additional target characteristics

Variables	(1) CAR Coef.	(2) CAR Coef.	(3) CAR Coef.	(4) CAR Coef.
NZTRANS × TARHOR	0.013**			
NZTRANS × REPOR		0.009**		
NZTRANS × COMREPORT			0.012***	
NZTRANS × VIDEO				0.014**
NZTRANS	0.000	0.001	-0.005	0.003
TARDISC	-0.023	-0.014	-0.016	-0.021
EMISRED	0.059*	0.054*	0.049	0.059*
INVEST	0.005	0.003	0.004	0.005
CO2OFF	0.010*	0.011*	0.010*	0.012**
STAKEINV	0.004	0.005	0.005	0.005
TARHOR	0.004	0.005	0.005	0.004
REPOR	0.005*	0.005**		0.004*
COMREPORT			0.003	
VIDEO				0.008
INSOWN	0.010	0.008	0.008	0.011
SIZE	0.000	-0.000	0.000	0.000
ROA	-0.020	-0.013	-0.015	0.002
FLEV	0.000	-0.003	-0.003	-0.002
ESG	-0.002	-0.003	-0.003	-0.004
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Eventtype FE	Yes	Yes	Yes	Yes
Observations	263	263	263	263
R-squared	0.145	0.145	0.144	0.146
Highest VIF	2.49	2.50	3.63	2.52

Note: The dependent variable is the cumulative abnormal return (CAR). All the models are estimated using ordinary least square (OLS) regression model. Robust standard errors are used to minimize heteroskedasticity. ***, **, and * represent significance at the 1%, 5% and 10% levels, respectively. The p-values are one-tailed for directional hypotheses and two-tailed otherwise. Refer to Appendix 4 for variable definitions.

TABLE 9 Controlling for carbon intensity, alternative event window, and market index

Panel A: Controlling for carbon intensity				
	(1)	**(2)**	**(3)**	**(4)**
Variables	**CAR**	**CAR**	**CAR**	**CAR**
	Coef.	**Coef.**	**Coef.**	**Coef.**
NZTRANS × TARDISC		0.037**		
NZTRANS × EMISRED			0.066***	
NZTRANS × INVEST				0.008**
NZTRANS	0.003	-0.002	0.001	-0.002
TARDISC	-0.011	-0.011	-0.014	-0.010
EMISRED	0.045	0.046	0.051*	0.043
INVEST	0.005	0.005	0.005	0.003
CO2INT	-0.710*	-0.712*	-0.729*	-0.652
Observations	257	257	257	257
R-squared	0.140	0.148	0.152	0.149
Highest VIF	2.49	3.75	2.51	3.58
Panel B: CARs from alternative event window (0, 1)				
	(1)	**(2)**	**(3)**	**(4)**
Variables	**CAR**	**CAR**	**CAR**	**CAR**
	Coef.	**Coef.**	**Coef.**	**Coef.**
NZTRANS × TARDISC		0.043***		
NZTRANS × EMISRED			0.060***	
NZTRANS × INVEST				0.005*
NZTRANS	0.001	-0.005	-0.001	-0.002
TARDISC	-0.006	-0.005	-0.008	-0.005
EMISRED	0.045**	0.045**	0.050**	0.043*
INVEST	0.006	0.006	0.005	0.005
Observations	263	263	263	263
R-squared	0.132	0.145	0.143	0.137
Highest VIF	2.49	3.64	2.51	3.49
Panel C: CARs based on alternative market index				
	(1)	**(2)**	**(3)**	**(4)**
Variables	**CAR**	**CAR**	**CAR**	**CAR**
	Coef.	**Coef.**	**Coef.**	**Coef.**
NZTRANS × TARDISC		0.036**		
NZTRANS × EMISRED			0.049**	
INVEST × NZTRANS				0.006**
NZTRANS	0.004	-0.001	0.002	-0.001
TARDISC	-0.019	-0.018	-0.021	-0.018
EMISRED	0.045	0.044	0.049*	0.042
INVEST	0.003	0.003	0.002	0.001
Observations	263	263	263	263
R-squared	0.097	0.104	0.103	0.103
Highest VIF	2.49	3.64	2.08	3.49

Note: The dependent variable is the cumulative abnormal return (CAR). All the models are estimated using ordinary least square (OLS) regression model. Robust standard errors are used to minimize heteroskedasticity. All models include control variables, industry fixed-effects, year fixed-effects and event type fixed effects. ***, **, and * represent significance at the 1%, 5% and 10% levels, respectively. The p-values are one-tailed for directional hypotheses and two-tailed otherwise. Refer to Appendix 4 for variable definitions.

TABLE 10 Robustness of CARs around the adoption of net zero emission targets

Panel A: Fama and French three-factor model

Event window	N	Mean (%)	t-stat	Positive returns (%)	Sign test
(-3, 3)	204	-0.089	-0.241	52.451	0.738
(-2, 2)	204	0.162	0.519	51.471	0.458
(-1, 1)	204	0.072	0.296	48.039	-0.522
(0, 1)	204	0.194	0.983	52.941	0.878
(0, 2)	204	0.272	1.125	55.882	1.718**
(0, 3)	204	0.077	0.275	53.431	1.018

Panel B: Industry-adjusted CARs

Event window	N	Mean (%)	t-stat	Positive returns (%)	Sign test
(-3, 3)	204	-0.204	-0.878	45.775	3.413***
(-2, 2)	204	-0.059	-0.304	46.479	3.553***
(-1, 1)	204	0.146	0.964	52.817	4.813***
(0, 1)	204	0.195*	1.581	57.746	5.793***
(0, 2)	204	0.081	0.536	54.225	5.093***
(0, 3)	204	-0.043	-0.246	52.817	4.813***

Note: This table presents percent cumulative abnormal returns around net zero emission target announcements. All panels exclude all the confounding events. Model parameters are estimated over the 300-day period ending 50 days before the target announcement date, using the CRSP equal-weighted index. The significance of the means is tested using the cross-sectional t-test and Cowan's (1992) generalized sign test, respectively. ***, **, and * represent significance at the 1%, 5% and 10% levels (one-tailed), respectively.

TABLE 11 Using alternative measure of investor reaction

Panel A: Market-adjusted return (EXCRET)				
Variable	**Mean (%) (0, 2)**	**Mean (%) (-10, 10)**	**Difference (%)**	**t-stat**
EXCRET	0.200			2.993***
EXCRET	0.200	0.031	0.168	2.398***
Panel B: Market-adjusted return as dependent variable				
Variables	**(1) EXCRET Coef.**	**(2) EXCRET Coef.**	**(3) EXCRET Coef.**	**(4) EXCRET Coef.**
NZTRANS × TARDISC		0.013**		
NZTRANS × EMISRED			0.024***	
NZTRANS × INVEST				0.002**
NZTRANS	0.001	-0.001	-0.000	-0.001
TARDISC	-0.006	-0.006	-0.007	-0.006
EMISRED	0.013	0.013	0.014	0.012
INVEST	0.002	0.002	0.002	0.001
Observations	261	261	261	261
R-squared	0.118	0.126	0.130	0.125
Highest VIF	2.49	3.64	2.51	3.49

Note: Panel A reports the mean market-adjusted return (excess over the market return) for event window (0, 2) and for other days (-10, 10) excluding the days in the event window. The t test represents the significance of whether the mean market-adjusted during the event window differs significantly from/higher than the mean return over days -10 to 10 excluding days 0 to 2. The dependent variable is the mean market-adjusted return (EXCRET) for the event window (0, 2). All the models are estimated using ordinary least square (OLS) regression model. Robust standard errors are used to minimize heteroskedasticity. All models include control variables, industry fixed-effects, year fixed-effects and event type fixed effects. ***, **, and * represent significance at the 1%, 5% and 10% levels, respectively. The p-values are one-tailed for directional hypotheses and two-tailed otherwise. Refer to Appendix 4 for variable definitions.

Table 12 Placebo CARs and cross-sectional analysis based on placebo CARs

Panel A: Placebo CARs around the randomly assigned event dates				
Event window	**Mean**	**t-test**	**Positive returns (%)**	**Sign test**
(-3, 3)	0.363	0.291	53.608	1.013
(-2, 2)	0.211	0.467	53.265	0.896
(-1, 1)	-0.082	0.714	51.203	0.192
(0, 1)	-0.128	0.484	50.515	-0.042
(0, 2)	-0.039	0.861	48.454	-0.746
(0, 3)	0.174	0.503	52.234	0.544

Panel B Using Placebo CARs as dependent variable				
Variables	**(1) P_CAR Coef.**	**(2) P_CAR Coef.**	**(3) P_CAR Coef.**	**(4) _P_CAR Coef.**
NZTRANS × TARDISC		-0.003		
NZTRANS × EMISRED			-0.005	
NZTRANS × INVEST				0.004
NZTRANS	-0.002	-0.002	-0.002	-0.005
TARDISC	0.014	0.014	0.015	0.015
EMISRED	-0.020	-0.020	-0.021	-0.021
INVEST	-0.002	-0.002	-0.002	-0.003
Observations	260	260	260	260
R-squared	0.138	0.138	0.138	0.139
Highest VIF				

Note: Panel A presents placebo cumulative abnormal returns (%) around the randomly assigned event dates and based on 291 observations. Market model parameters are estimated over the 300-day period ending 50 days before the target announcement date, using the CRSP equal-weighted index. The significance of the means is tested using cross-sectional t-test and Cowan's (1992) generalized sign test, respectively. ***, **, and * represent significance at the 1%, 5% and 10% levels (one-tailed), respectively. In Panel B, the dependent variable is the placebo cumulative abnormal return (P_CAR). All the models are estimated using ordinary least square (OLS) regression model. Robust standard errors are used to minimize heteroskedasticity. ***, **, and * represent significance at the 1%, 5% and 10% levels, respectively. The p-values are one-tailed for directional hypotheses and two-tailed otherwise. Refer to Appendix 4 for variable definitions.

APPENDICES

APPENDIX 1: ILLUSTRATIVE EXAMPLES OF NET ZERO EMISSION TARGET ANNOUNCMENT

May 24, 2024

CLIFFS

Cleveland-Cliffs Announces New Greenhouse Gas Emissions Reduction Goals

CLEVELAND--(BUSINESS WIRE)-- Cleveland-Cliffs Inc. **(NYSE: CLF)** announced today that it has set new greenhouse gas (GHG) emissions reduction targets. The Company's prior commitment to reduce absolute Scope 1 (direct) and Scope 2 (indirect) GHG emissions by 25% by 2030, relative to 2017 levels, has already been successfully achieved well ahead of schedule.

Cleveland-Cliffs' new goals set forth below, relative to 2023 levels, are all supported by ongoing and planned technological developments to its ironmaking and steelmaking practices:

- A target to reduce Scope 1 and 2 GHG emissions intensity per metric ton of crude steel by 30% by 2035;
- A target to reduce material upstream Scope 3 GHG emissions intensity per metric ton of crude steel by 20% by 2035; and
- A long-term target aligned with the Paris Agreement's 1.5 degrees Celsius scenario to reduce Scope 1, 2 and material upstream 3 emissions intensity per metric ton of crude steel to near net zero by 2050.

The GHG emissions reduction from 2023 to 2035 will be driven primarily by the Middletown, OH and Butler, PA projects – both to be developed in cooperation with the U.S. Department of Energy, as previously announced – as well as by other operational initiatives and energy efficiency enhancement projects, all included in Cliffs' previously announced capital expenditure plans. As a result, Cliffs' capex outlook remains unchanged.

Lourenco Goncalves, Cleveland-Cliffs' Chairman, President, and Chief Executive Officer said:

"Through the deployment of meaningful investments and our unwavering commitment to our employees and to the communities in which we operate, Cleveland-Cliffs has achieved unquestionable success in reducing GHG emissions, by more than we anticipated and way ahead of our original 2030 target date. Our outperformance has given us the ability to further pursue more ambitious and very relevant new challenges. As a manufacturing leader in America providing good paying middle-class jobs in sustainable ironmaking and steelmaking, Cleveland-Cliffs will, one more time, prove that GHG emissions reduction can and will be done preserving employment, enhancing middle-class and benefiting communities. That is our ultimate goal: to demonstrate to others in our business – in the United States and abroad – that we can be simultaneously a technological and a social leader, with goals driven by our people and for the people. Once it is done, Cliffs' shareholders and all other stakeholders will have won together."

Source: Extract of press release from Cleveland-Cliffs Inc.'s website (https://www.clevelandcliffs.com/news/news-releases/detail/639/cleveland-cliffs-announces-new-greenhouse-gas-emissions)

Crown Castle Sets Carbon Neutral Goal by 2025

October 20, 2021 at 4:15 PM EDT

HOUSTON, Oct. 20, 2021 (GLOBE NEWSWIRE) -- Crown Castle International Corp. (NYSE: CCI) ("Crown Castle") announced today that it has set a goal to be carbon neutral by 2025 in Scope 1 and 2 emissions through a combination of continued investment in energy reduction initiatives, sourcing renewable energy, and, to a lesser extent, utilizing carbon credits or offsets.

"Our strategy is to provide profitable solutions to connect communities and people, and our carbon neutral goal furthers our commitment to deploy our strategy sustainably," stated Jay Brown, Crown Castle's Chief Executive Officer. "Our business model is inherently sustainable, as shared infrastructure solutions limit the proliferation of infrastructure and minimizes the use of natural resources. We are taking action to improve on our strong foundation, including proactive work to reduce our energy consumption and source renewable energy."

Crown Castle has one of the most expansive portfolios of communications infrastructure in the US. Its business model results in a significantly smaller environmental footprint and a low carbon intensity. Each of our shared infrastructure assets are designed to host multiple Crown Castle customers and support their operations, reducing the need for redundant infrastructure and the impact on the environment.

"We have made significant progress this year by including commitments to energy reduction initiatives and renewable energy in our credit facility and now by targeting a carbon-neutral future. While we work to accomplish our goal, we will continue to work alongside many of our customers and suppliers to report and reduce emissions across our entire value chain and align our goals with the Science-Based Target initiative," added Mr. Brown.

Source: Extract of a press release from Crown Castle's website (https://investor.crowncastle.com/news-releases/news-release-details/crown-castle-sets-carbon-neutral-goal-2025)

APPENDIX 2: ILLUSTRATIVE EXAMPLES OF ACTIVIST INVESTORS' SHAREHOLDER PROPOSALS

As You Sow	**2024 Shareholder Proposals** **Public Storage | GHG Target Setting**

WHEREAS: According to the Intergovernmental Panel on Climate Change, the window for limiting global warming to 1.5 degrees Celsius (1.5°C) is quickly narrowing. Investor demand for science-aligned greenhouse gas (GHG) emission reductions reflects the reality that climate change poses a systemic risk to companies and investor portfolios. Failure to reach Net Zero emissions by 2050 is projected to have dramatic economic consequences. Immediate and significant emissions reduction is therefore required of all market sectors.

Shareholders are increasingly concerned about the growing material climate risk to their companies and to their portfolios. The Climate Action 100+ initiative, a coalition of more than 700 investors with over $68 trillion in assets, has issued a Net Zero Benchmark outlining metrics that create climate accountability for companies and transparency for shareholders. The Benchmark requires that companies set short, medium, and long-term GHG reduction targets and create quantitative forward-looking action plans to achieve targets.

As the world's leading owner and operator of self-storage facilities, Public Storage faces a variety of material climate-related risks. As stated in the Company's 2022 10-K, in addition to the physical risks posed to company facilities by "increased destructive weather events," the "transition to a low-carbon economy presents certain risks…including stranded assets, increased costs, lower profitability, lower property values, lower household wealth, and macroeconomic risks related to high energy costs and energy shortages."

Although Public Storage discloses a 12% by 2025 GHG reduction goal for its operations, this goal is not 1.5°C-aligned, nor is it inclusive of its full value chain emissions. Despite a nearly 35% vote on a 2023 shareholder proposal requesting 1.5°C targets, the Company has failed to act. In contrast, 58 North American companies in the real estate sector have committed to establishing science-aligned GHG targets through the Science Based Targets initiative.

By setting 1.5°C, Paris-aligned GHG reduction targets for its entire value chain, disclosing a climate transition plan, and demonstrating progress toward achieving such goals, Public Storage can provide investors with assurance that management is addressing material climate-related risks and capitalizing on the value-creating opportunities presented by a net zero economy.

BE IT RESOLVED: Shareholders request that the Board issue short- and long-term Scope 1 through 3 greenhouse gas reduction targets aligned with the Paris Agreement's 1.5°C goal requiring Net Zero emissions by 2050.

SUPPORTING STATEMENT: Proponents suggest, at management discretion, the Company:

- Take into consideration approaches used by advisory groups such as the Science Based Targets initiative;
- Disclose a timeline for setting a Net Zero by 2050 GHG reduction target and 1.5°C-aligned interim targets;
- Discloses an enterprise-wide climate transition plan to achieve 1.5°C-aligned emissions; and
- Discloses annual progress towards meeting its emissions reduction goals.

Source: Extract from As You Sow Resolution Tracker (https://www.asyousow.org/resolutions/2023/11/20-public-storage-ghg-target-setting)

Follow This	**2022 Shareholder Proposal** **Chevron | GHG Target Setting**

WHEREAS: We, the shareholders, must protect our assets against devastating climate change, and we therefore support companies to substantially reduce greenhouse gas (GHG) emissions.

RESOLVED: Shareholders request the Company to set and publish medium- and long-term targets to reduce the greenhouse gas (GHG) emissions of the Company's operations and energy products (Scope 1, 2, and 3) consistent with the goal of the Paris Climate Agreement: to limit global warming to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C.

You have our support.

SUPPORTING STATEMENT: The policies of energy companies - the largest greenhouse gas (GHG) emitters - are crucial to confronting the climate crisis. Therefore, shareholders support oil and gas companies to substantially reduce their emissions. We, the shareholders, understand this support to be essential in protecting all our assets in the global economy from devastating climate change.

We therefore support the Company to set emission reduction targets for all emissions: the emissions of the company's operations and the emissions of its energy products (Scope 1, 2, and 3). Reducing Scope 3 emissions, the vast majority, is essential to limiting global heating.

SCIENTIFIC CONSENSUS: The world's leading international scientific bodies recently released reports which clearly state the need for deep cuts in emissions in order to limit global warming to safe levels.

FINANCIAL MOMENTUM: A growing international consensus has emerged among financial institutions that climate-related risks are a source of financial risk, and therefore limiting global warming is essential to risk management and responsible stewardship of the economy.

Backing from investors that insist on targets for all emissions continues to gain momentum: 2021 saw unprecedented investor support for climate resolutions. In the US, three of these climate resolutions passed with a historic majority. In Europe, support for these climate resolutions continued to build.

LEGAL RISK: In 2021, a Dutch court ordered Shell to severely reduce their worldwide emissions (Scope 1, 2, and 3) by 2030. This indicates that oil majors and large investors have an individual legal responsibility to combat dangerous climate change by reducing emissions and confirms the risk of liability.

We believe that the Company could lead and thrive in the energy transition. We therefore encourage you to set targets that are inspirational for society, employees, shareholders, and the energy sector, allowing the company to meet an increasing demand for energy while reducing GHG emissions to levels consistent with curbing climate change.

You have our support.

Source: Extract from Follow This Resolution Tracker (https://www.follow-this.org/wp-content/uploads/2021/12/Follow-This-Chevron-Climate-Resolution-2022.pdf)

APPENDIX 3: MEASURING AVERAGE EMISSIONS REDUCTION TARGETS

To demonstrate the measurement process, the Cleveland-Cliffs Inc.'s target announcement example in Appendix 1 is used.

Particulars	Targets
Scope 1 and 2 GHG emissions	30%
Scope 3 GHG emissions	20%
Net zero emissions	100%
Average emissions reduction targets	50%

Assumptions:

- Net zero emissions are assumed 100% emissions reduction.
- If the target is achieved (as is the case for Cleveland-Cliffs Inc.), it is not considered. Only future targets are considered.
- When a firm sets both absolute and intensity-based targets, the average is considered.

APPENDIX 4: SUMMARY OF THE VARIABLES

Variable	Designation	Source	Calculation
Panel A: Variables for Main Analysis			
Cumulative Abnormal Return	CAR	CRSP	Cumulative abnormal return over the event window of (0, 2). Abnormal return is the difference between the actual return and the expected return estimated from a market model, where the parameters are estimated over the (-300, -50) trading days relative to a firm's public announcement date of the net zero target. The market index is the equally-weighted CRSP Index.
Net Zero Transition Activism	NZTRANS	Institutional Shareholder Services	The cumulative number of activist shareholder proposals on different net zero related issues filed from 2018 to the preceding year of net zero emission target adoption.
Comprehensiveness of Net Zero Target Adoption	TARDISC	Net Zero Target Announcement Statement	The ratio of total disclosed score to the maximum possible disclosure score. Each disclosure item is coded as a binary measure where 1 is coded for a disclosed item and 0 for no disclosure.
Emissions Reduction Targets	EMISRED	Net Zero Target Announcement Statement	The average percentage of carbon emissions reduction target relative to a baseline year, to be accomplished by a target year. This score is divided by 100.
Planned Investment for Decarbonization and to Attain Targets	INVEST	Net Zero Target Announcement Statement	Binary variable taking the value of 1 if the target announcement contains explicit mention of investment in monetary terms and 0 otherwise.
Intended Use of Carbon Offsets	CO2OFF	Net Zero Target Announcement Statement	Binary variable of 1 if a firm's net zero target announcement contains explicit intention to use carbon offsets to attain targets and otherwise 0.
Stakeholder Involvement in Net Zero Target Announcement	STAKEINV	Net Zero Target Announcement Statement	One plus the log of the number of external stakeholders who express positive views regarding the adoption of net zero emission target.
Target Horizon	TARHOR	Net Zero Target Announcement Statement	The average number of years the firm has set to achieve a given carbon emissions reduction target from the year the target is set.
Reporting on Target Progresses and Related Issues	REPOR	Net Zero Target Announcement Statement	The sum of explicit commitment to report progresses, alignment of reporting with TCFD, and SASB standards.
Institutional Ownership	INSOWN	Thomson Reuters Institutional (13f) Holdings	The proportion of shares owned by institutional investors. It is based on the year preceding the year of net zero target adoption.
Firm Size	SIZE	Compustat	The natural log of total assets for the year preceding the year of net zero target adoption.
Firm Performance	ROA	Compustat	The ratio of net income to total assets for the year preceding the year of net zero target adoption.
Financial Leverage	FLEV	Compustat	The ratio of total liabilities to total assets for the year preceding the year of net zero target adoption.

ESG Performance	ESG	Trucost	The ESG score ranges from 0 to 100 and is calculated based on the environmental, social and governance categories and for the year preceding the year of net zero target adoption.
US Regulator's Intervention to Restrict Net Zero Transition Activism	POST_RENZTRANS	Committee on the Judiciary, US House of Representatives	Binary variable of 1 if a firm has adopted net zero target on or after the US regulator's intervention to constrain net zero transition activism and otherwise 0.
Panel B: Variables for Institutional Analysis			
US Government's Adoption of Net Zero Transition Strategy Period	POST_USNTZ	United Nations Climate Change and US Department of State	Binary variable of 1 if a firm has adopted net zero target after the US government's adoption of net zero transition policy and otherwise 0.
State-level Adoption of Net zero or emissions reduction policies	POST_STATENET	Centre for Climate and Energy Solutions	Binary variable of 1 if a firm has adopted net zero target after the adoption of net zero emission or related policies in the state of its incorporation and otherwise 0.
US Legislative Committee's Intervention to Delegitimize Net Zero Transition Activism	POST_RENZTRANS	Committee on the Judiciary, US House of Representatives	Binary variable of 1 if a firm has adopted net zero target on or after the US legislative committee's intervention to delegitimize and constrain activist investors' net zero transition activism and otherwise 0.
High Net Zero Salience Period	HIGH_NETZERO SALIENCE	Self-developed	Binary variable of 1 for the years 2021 and 2022 and otherwise 0.
Low Net Zero Salience Period	LOW_NETZERO SALIENCE	Self-developed	Binary variable of 1 for the years 2023 and 2024 and otherwise 0.
Firm incorporate in states with net zero or related policies	STATENET	Centre for Climate and Energy Solutions	Binary variable of 1 if a firm is incorporated in a state with net zero or related policies and otherwise 0.
Carbon Emission Intensity	CO2INT	Trucost	The ratio of total carbon emissions to revenues.
Panel C: Variables for Additional Analysis			
Commitment to Report on Target Progress and related Issues	COMREPORT (Alternative Measure of REPOR)	Net Zero Target Announcement Statement	Binary variable taking the value of 1 if the target announcement contains explicit mention of commitment to report on target progress and related issues and 0 otherwise.
Video Announcement of Targets	VIDEO	Net Zero Target Announcement Statement	Binary variable taking the value of 1 if the target is announcement uses video and otherwise 0.
Market-adjusted return	EXCRET	CRSP	The average difference between the daily stock return (RET) and the CRSP equal-weighted market index return (MKT) over the event window of (0, 2).
Placebo cumulative abnormal returns	P_CAR	CRSP	Placebo cumulative abnormal return over the placebo event window of (0, 2). Abnormal return is the difference between the actual return and the expected return estimated from a market model, where the parameters are estimated over the (-300, -50) trading days relative to a firm's placebo event date. The market index is the equally-weighted CRSP Index.

APPENDIX 5: STATE-LEVEL NET ZERO/CARBON EMISSIONS REDUCTION POLICIES

States	State Code	Adoption Year	Policy Details
California	CA	2016	In 2018, California established a target to attain carbon neutrality as soon as possible, and no later than 2045. In 2022, the California Air Resources Board established a target to decrease GHG emissions by 48% below 1990 levels by 2030, augmenting the statutory target set in 2016 to reduce GHG emissions 40% below 1990 levels by 2030.
Colorado	CO	2019	Colorado established statutory targets to decrease GHG emissions 26% by 2025, 50% by 2030, 65% by 2035, 75% by 2040, 90% by 2045, and 100% by 2050, all relative to 2005 levels, initially set in 2019 and then elevated to present targets in 2023.
Connecticut	CT	2008	Connecticut established a statutory goal to decrease GHG emissions 45% below 2001 levels by 2030, enacted in 2018 and codified in 2022. The state has established statutory targets to decrease GHG emissions by at least 10% below 1990 levels by 2020 and by 80% below 2001 levels by 2050, as adopted in 2008.
Delaware	DE	2023	In 2023, Delaware adopted a target to reduce GHG emissions 50% below 2005 levels by 2030, and to achieve net-zero GHG emissions by 2050.
Florida	FL	2007	In 2007, Florida established targets to decrease GHG emissions to 2000 levels by 2017, to 1990 levels by 2025, and to decrease emissions by 80% of 1990 levels by 2050.
Kentucky	KY	2011	The Kentucky Climate Action Plan Council, established by a Governor-issued report, set a target in 2011 to attain a 20% reduction in GHG emissions below 1990 levels by 2030.
Louisiana	LA	2020	In 2020, Louisiana established targets to decrease net GHG emissions 26-28% by 2025 and 40-50% by 2030, relative to 2005 levels. The targets also seek to achieve net-zero GHG emissions by 2050.
Maine	ME	2019	In 2019, Maine established a target of attaining net-zero GHG emissions by 2050, and statutory targets to decrease GHG emissions 45% below 1990 levels by 2030 and 80% below 1990 levels by 2050.
Maryland	MD	2022	In 2022, Maryland established statutory targets to reduce GHG emissions 60% below 2006 levels by 2031 and to attain net-zero greenhouse gas emissions by 2045.
Massachusetts	MA	2021	Massachusetts enacted statutory targets to decrease GHG emissions 85% below 1990 levels and to attain net-zero emissions by 2050, as well as interim targets of at least 50% reductions by 2030 and at least 75% by 2040, set in 2021.
Michigan	MI	2019	Michigan established a target to attain economy-wide carbon neutrality by no later than 2050 and to maintain net negative GHG emissions thereafter. These targets were established in 2020. In 2019, the state also established a target of decreasing GHG emissions 26-28% below 2005 levels by 2025.
Minnesota	MN	2023	In 2023, Minnesota enacted statutory targets to decrease GHG emissions 50% below 2005 levels by 2030 and to attain net-zero emissions by 2050.

Montana	MT	2019	In 2019, the Montana Climate Solutions Council, initiated by the Governor, established a target to achieve economy-wide GHG neutrality at a date to be fixed. In 2020, the state announced its target to reach economy-wide GHG neutrality between 2045-2050.
Nevada	NV	2019	Nevada established statutory targets in 2019 to decrease GHG emissions 28% by 2025 and 45% by 2030, relative to 2005 levels, and achieve zero or near-zero by 2050.
New Hampshire	NH	2009	In 2009, The New Hampshire Climate Action Plan, led by the Governor, established targets to decrease GHG emissions 20% below 1990 levels by 2025 and 80% below 1990 levels by 2050.
New Mexico	NM	2019	In 2019, New Mexico established a target to decrease GHG emissions 45% below 2005 levels by 2030.
New York	NY	2019	In 2019, New York established statutory targets to decrease GHG emissions 40% below 1990 levels by 2030 and by no less than 85% below 1990 levels by 2050. The targets seek to attain net-zero GHG emissions by 2050.
North Carolina	NC	2021	North Carolina established a target in 2022 to decrease GHG emissions 50% below 2005 levels by 2030 and attain net-zero emissions at the earliest opportunity, but no later than 2050. In 2021, North Carolina established a statutory target to decrease carbon emissions in the power sector 70% below 2005 levels by 2030 and to attain carbon neutrality by 2050.
Oregon	OR	2007	Oregon established targets of decreasing GHG emissions 45% below 1990 levels by 2035 and 80% below 1990 levels by 2050, as determined in 2020. The state has established statutory targets of decreasing emissions by 10% below 1990 levels by 2020 and 75% below 1990 levels by 2050, as adopted in 2007.
Pennsylvania	PA	2019	In 2019, Pennsylvania established targets to decrease GHG emissions 26% below 2005 levels by 2025 and 80% below 2005 levels by 2050.
Rode Island	RI	2021	In 2021, Rhode Island established statutory targets to decrease GHG emissions 10% by 2020, 45% by 2030, 80% by 2040, all relative to 1990 levels. The target also seeks to attain net-zero emissions by 2050.
Vermont	VT	2020	In 2020, Vermont established statutory targets to decrease GHG emissions 26% below 2005 emissions by 2025, 40% below 1990 levels by 2030, and 80% below 1990 levels by 2050.
Virginia	VA	2020	In 2020, Virginia established a statutory target to attain net-zero GHG emissions for all sectors by 2045.
Washington	WA	2020	In 2020, Washington established statutory targets to decrease GHG emissions 45% by 2030, 70% by 2040, and 95% by 2050, all relative to 1990 levels. The targets also seek to attain net-zero GHG emissions by 2050.

Note: This table presents a summary of state-level (24 US states) net zero and/or carbon emissions reduction policies as of 7 January 2025. The adoption year represents the year of first-time adoption of relevant policies. The data are sourced from Centre for Climate and Energy Solutions (https://www.c2es.org/content/state-climate-policy/).