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Can Investor Coalitions Drive Corporate Climate Action?

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Can Investor Coalitions Drive Corporate Climate Action?*

Nikolaus Hastreiter†

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Abstract

This paper investigates the effectiveness of collective investor engagement in driving corporate climate action. Empirically, I focus on Climate Action 100+ (CA100+), the world's largest investor coalition on climate change. To address common measurement issues in previous research, I conduct a multidimensional assessment of companies' climate action. In particular, I collect new primary data on the ambition of carbon emission reduction targets and use the ClimateBERT model to analyse climate-related disclosure. To isolate the causal impact of CA100+, I examine the selection of the coalition's focus companies and employ a Difference-in-Differences analysis. While the findings suggest that CA100+ has had no effect on companies' disclosures or reductions in carbon emissions, I observe a significant impact on targets. However, this effect holds only for medium- and long-term targets, not in the short-term, and is exclusively driven by companies potentially selected based on prior investor knowledge. Overall, this study finds limited effectiveness of collective engagement through CA100+. It raises questions about the importance of investor selectivity for engagement success and highlights the risk of companies backloading their decarbonisation efforts.

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1 Introduction

The transition to a low-carbon economy is a critical global challenge, necessitating substantial shifts in how entire industries operate. Financial actors play a key role in accelerating this transition by leveraging their influence over the allocation of financial resources. In particular, investors find themselves in a unique position to drive climate action[1] among their investees. However, they often hold only small individual stakes in companies. To strengthen their impact, investors have formed coalitions to collectively influence corporate behaviour.

Several reviews of the sustainable finance literature note a lack of empirical evidence regarding the the role of investors in driving change (Kölbel et al., 2020; Diener and Habisch, 2021). While recent studies have started to fill this gap (Azar et al., 2021; Heeb and Kölbel, 2024), many areas of investor impact remain under-researched. Notably, with the exception of Dimson et al. (2023), the role of investor coalitions has largely been overlooked. Given the substantial growth of investor coalitions in recent years[2], new evidence in this field is important to assess the potential of environmental governance through financial actors and to inform related policy-making.

In December 2017, Climate Action 100+ (CA100+), the world's largest investor coalition on climate change, was launched, representing the "biggest shareholder action plan ever" (Financial Times, 2017). At its peak in 2023, CA100+ was supported by over 700 investors with a combined 68 trillion US Dollars of assets under management (AUM).[3][4] CA100+

[1]In this study, I use the term corporate climate action to describe any measures companies can take to address climate change and reduce their climate impact. Other terms commonly used in the field include "climate performance", "carbon performance" and "environmental performance".

[2]To name a few examples across different themes in sustainable investing: the Net-Zero Asset Owner Alliance (NZAOA) (2019), the Investor Mining and Tailings Safety Initiative (2019), the Net-Zero Asset Manager Alliance (NZAMA) (2020), Climate Engagement Canada (2023) and the Good Work Coalition (2023).

[3]The combined AUM figures may include some instances of double counting, as CA100+ is supported by both asset owners and managers.

[4]In 2024, several large asset managers from the United States left the coalition. The author estimates the current combined AUM in August 2024 as 47 trillion US Dollars by deducting the AUM of BlackRock US, State Street Global Advisors, JP Morgan Asset Management, Invesco, Goldman Sachs Asset Management

engages with a focus group of approximately 170 large corporate polluters and aims "to ensure the world's largest corporate greenhouse gas emitters take necessary action on climate change" (Climate Action 100+, 2024). This constitutes a good case study to gain broader insights into the effectiveness of collaborative investor action. Given its size and significance, it can be expected that companies will react to the initiative's asks.

Indeed, there is ample anecdotal evidence for the success of CA100+. For instance, The Economist (2021) found in a comparative analysis that CA100+ companies improved their climate-related disclosure and target setting more than other firms. Moreover, the initiative's website features numerous success stories. One notable example is Shell's announcement of new carbon emission reduction targets in 2018 which was jointly declared with investors as a result of CA100+ engagement (Royal Dutch Shell, 2018). In fact, the CA100+ model is considered so successful by investors that it was adopted in 2022 to establish a similar coalition focused on engaging companies on biodiversity: Nature Action 100.

From a causal inference point of view, isolating the true impact of CA100+ presents several endogeneity challenges. Firstly, the measurement of corporate climate action is difficult due to limited data availability and reliability. Previous studies on investor impact typically use carbon intensities based on financial metrics which may induce measurement error. Secondly, CA100+ companies may have inherent differences in their climate strategies compared to other companies. There is a risk of selection bias, i.e., investors may have selected companies which would have strengthened their climate actions anyway. Thirdly, CA100+ operates in a dynamic environment where multiple external factors can influence firm behaviour. It is crucial to control for confounding factors, such as other regulatory policies, technological advancements and market forces.

This study addresses these challenges in three steps. First, I employ multi-dimensional and refined metrics for corporate climate actions. Specifically, I use carbon intensities based on sector-specific output metrics and collect new primary data on the ambition of forward-

and Morgan Stanley Investment Management. The recent departures lie outside of the period analysed in this study.

looking carbon reduction targets to augment an existing dataset from the Transition Pathway Initiative (TPI). Additionally, I apply the ClimateBERT-TCFD model developed by Bingler et al. (2022b) to analyse the extent to which companies report climate-related information in their Annual Reports (ARs). Second, I examine the CA100+ company selection process and identify two subgroups: the first addition to the CA100+ focus group (the "CA100 companies") which can be considered an exogenous shock and the second addition (the "Plus companies") for which endogeneity cannot be ruled out. Third, I isolate the causal impact of CA100+ on its focus companies using different Difference-in-Differences (DiD) specifications.

Overall, my findings do not align with the anecdotal evidence on CA100+ and suggest rather limited effectiveness. I find no empirical support for a statistically significant impact on the focus companies' climate-related disclosure. This result holds when using corporate responses to the CDP[5] as an alternative measure of corporate climate reporting. Yet, a further robustness check suggests that CA100+ may have improved companies' disclosure of carbon emissions.

In terms of more substantial climate action, I find no impact of CA100+ on the carbon intensities of the focus companies between 2014 and 2022. However, I observe a significant, yet heterogeneous, treatment effect on medium- and long-term target setting. All results are robust when controlling for varying regulatory environments and sectoral dynamics.

While the effect on carbon emission reduction targets is significant for the whole focus group, closer examination reveals that it is driven only by the Plus companies, for which endogeneity cannot be ruled out. Unpacking the effect on the Plus companies' targets further, it stands out that CA100+'s impact is absent on short-term target setting. Acknowledging that climate change depends on cumulative emissions, this finding raises concerns about the back-loading of corporate decarbonisation efforts, i.e. companies are relying on steeper emission reductions in the distant future. Setting long-term targets without short- and medium-term

[5] CDP, formerly known as the Carbon Disclosure Project, is a voluntary environmental disclosure platform for companies, investors, governments and cities.

milestones against which companies can be held accountable may also constitute a form of greenwashing.

This paper aims to advance the sustainable finance research on the measurement of corporate climate action. There is a recognised inconsistency in large datasets concerning companies' sustainability and climate actions. For instance, Berg et al. (2022) illustrate the divergent results from ESG rating agencies, Bingler et al. (2022a) discuss the differences in metrics used to assess transition risks, and Busch et al. (2022) emphasise the inconsistencies in measuring Scope 3 emissions across different providers. Due to a lack of more reliable information, the existing literature often still relies on such large N datasets. This research seeks to enhance the field by constructing new datasets of refined measures for corporate climate actions, albeit with a smaller sample size.

This paper also contributes to the literature on investor impact by providing new evidence on the impact of collaborative investor action. In their the pioneering study, Dimson et al. (2023) find that coordinated engagement through the United Nations Principles for Responsible Investing (PRI) can enhance corporate sustainability outcomes. While both PRI and CA100+ are key players in organising collective engagements, they differ in focus and approach. PRI engagements are broad, addressing a wide range of sustainability issues across many companies. In contrast, CA100+ focuses explicitly on decarbonisation objectives, targeting a smaller group of companies that account for a significant share of global carbon emissions.

Moreover, a common concern in research on the effectiveness of engagement is potential endogeneity in the selection of the engagement targets (Heeb and Kölbel, 2024). This underscores the need for studies that test for causality. By analysing the CA100+ company selection process, I present first empirical evidence that investor selectivity may indeed matter for engagement outcomes.

In the case of CA100+, a few existing studies suggest that the coalition may be effective in driving change. Bingler et al. (2024) demonstrate an association between CA100+

inclusion and more precise climate commitments by companies, while Colesanti Senni et al. (2024) show that CA100+ companies disclose more information on target-setting than on the implementation of their climate strategy. Focusing on investors, Zink (2024) finds that early CA100+ members support more climate-related shareholder proposals than non-signatories and late joiners. Unlike Atta-Darkua et al. (2023), Zink (2024) observes no portfolio decarbonisation among CA100+ investors. Yet, these studies measure only correlations.

Attempting a first causal analysis on the impact of CA100+ in China, Chang and Fang (2024) find a significant negative treatment effect on the carbon emissions of focus companies' customers and suppliers. However, their study does not focus on the engaged companies themselves and is limited to China. Moreover, they do not interrogate whether the company selection process of CA100+ constitutes an exogenous shock. This study aims to provide the first comprehensive causal assessment of the effects of CA100+ on its focus companies on a global level.

Additionally, this study is positioned within the rapidly growing subfield of climate finance, specifically examining how investors try to mitigate climate risks among their investees. Evidence from Ilhan et al. (2023) and Flammer et al. (2021) shows that institutional investors actively seek improved climate disclosures, aligning with one of CA100+'s engagement objectives. Furthermore, Azar et al. (2021) highlight that the Big Three asset managers actively engage their investee companies to lower their carbon footprint. However, the simultaneous impact of investor action on different aspects of companies' climate action, particularly forward-looking metrics such as the ambition of carbon emission reduction targets, has not been extensively researched.

In the following section 2, I derive my hypotheses from the existing literature on investor impact. In section 3, I analyse whether the CA100+ company selection process constitutes an exogeneous shock. Section 4 explains challenges in measuring corporate climate action and describes how this study tries to overcome those. Section 5 presents the research design and and section 6 evaluates the results. After showing a series of robustness checks in section 7, I discuss my findings, highlight limitations and point towards policy implications and future areas of research in section 8.

2 Hypotheses development

Why would companies respond to pressure by CA100+? Companies require continuous access to capital to fund their operations, making them financially dependent on financial actors. From a company perspective, this provides an incentive to actively engage with investors. Conversely, it gives investors the leverage to persuade or compel companies to undertake actions they might not otherwise consider.

However, on an individual level, an investor's influence is limited. While the world's largest asset managers can influence companies' carbon emissions (Azar et al., 2021), smaller investors may not hold the same power. Specifically, the influence of individual investors can be expected to be negligible if they do not own a significant stake in the targeted company. Their position may be further weakened if their specific demands significantly diverge from those of other investors. Therefore, the impact of investors is likely to depend on their total AUM and the consensus among investors regarding the actions that companies should implement.

In addition, individual investors must invest time and resources to influence firm behaviour. As benefits from improved company performance are shared among all shareholders, investors' incentives to act are limited, particularly if the outcome is uncertain. This represents a typical collective action problem in which individual action produces worse outcomes than coordinated action (Olson, 1965) and has been extensively discussed as free-riding in the literature (Serafeim, 2018; Doidge et al., 2019).

Investor coalitions are an opportunity to overcome these challenges. They provide an infrastructure for collective investor action by bringing together committed investors, reducing incentives to free-ride and offering an administrative structure (Gond and Piani, 2013). By bundling their expectations, pooling their financial resources and collectively targeting companies, investors may be significantly more powerful than when pursuing their agendas alone (Dimson et al., 2015, 2023). This is the fundamental idea behind CA100+. CA100+

emphasises the "business case" for investors to mitigate climate change. In the worst case, climate risks could lead to a systemic financial crisis. Thus, "[b]y working together through Climate Action 100+, investors can (. . .) help secure stable economies that are more resilient to the risks posed by climate change" (Climate Action 100+, 2024).

CA100+ aims to drive change in companies through engagement. Each investor member has signed a commitment to work with their investee companies to encourage them to take actions in line with the goals of the Paris Agreement. Each company targeted by CA100+ is assigned a team of lead and contributing investors. While investors can only take decisions on behalf of their own AUM over which they have fiduciary duty, they engage with companies as part of CA100+ (Climate Action 100+, 2023). The significant combined AUM of CA100+ investors, which translates into substantial collective ownership stakes in the focus companies, underpins the CA100+ engagement asks.

Investor engagement can be conducted in private and in public. Several studies provide evidence of improved sustainability outcomes following individual investor engagement with companies behind closed doors (Barko et al., 2022; Dimson et al., 2015; Hoepner et al., 2024; Bauer et al., 2023; Aguilera et al., 2021). Voting serves as a more coercive tool that investors can use publicly when companies do not comply with their demands. Through their voting rights, investors can file, support or oppose shareholder resolutions at companies' Annual General Meetings, trying to force them to adopt specific practices. Given that proposals are typically not filed in a vacuum, Dyck et al. (2019) suggest that institutional investors use them to support their private engagement.

Early studies on the effectiveness of shareholder resolutions in improving companies' sustainability performance did not observe a positive effect (David et al., 2007; Clark et al., 2008). However, the more recent literature shows tangible changes (Grewal et al., 2016; Wei, 2020), suggesting an increasing effectiveness of shareholder resolutions over time. Focusing specifically on companies' climate-related risks, Flammer et al. (2021) find that targeting firms with shareholder proposals led to significant improvements in disclosure. Similarly, Diaz-Rainey et al. (2023) show that companies targeted by climate-related proposals experience subsequent improvements in their environmental performance, although they do not observe a significant change in carbon emissions. In the context of CA100+, Zink (2024) observes that early signatories are more likely to support climate-related shareholder proposals than non-signatories and late signatories. This suggests that at least some CA100+ investors use proposals to influence the climate actions of the focus companies.

Given the complex debate around the effectiveness of investor engagement versus divestment (Broccardo et al., 2022), it is important to note that CA100+ does not publicly advocate for changes in capital allocation. Yet, besides coercing companies to make certain decisions through voting, the effectiveness of private engagement may ultimately depend on the potential threat of investors to divest. If a sufficient share of investors divests from companies over sustainability concerns, this can increase their cost of capital (Heinkel et al., 2001; Rohleder et al., 2022). Therefore, the collective financial size of CA100+ matters in engagement work, as companies may consider the impact of displeasing CA100+ on their ability to raise capital in the future.

CA100+ investors also hold significant reputational resources. They can publicly endorse the climate actions or, in contrast, stigmatise laggards. Although there is currently no empirical evidence, both effects could indirectly influence firm behaviour (Kölbel et al., 2020). Furthermore, CA100+ regularly publishes a Net Zero Company Benchmark which assesses the climate action of all the focus companies based on ten main indicators. Chatterji and Toffel (2010) demonstrate that the effect of benchmarking companies' performance in sustainability ratings can induce improvement. Sharkey and Bromley (2015) show that such improvements may be even more pronounced in the presence of rated competitors.

In summary, companies can be expected to manage their relationship with investors by responding to engagement asks by CA100+. I therefore derive the following baseline hypothesis:

H1: Inclusion in CA100+'s focus list improves companies' climate action relative to other comparable companies.

At its launch in December 2017, the 225 initial CA100+ signatories held a combined 26 trillion US dollars in AUM (Financial Times, 2017). Since then, the size of the coalition has grown considerably up to 68 trillion US dollars at its peak in 2023 (Climate Action 100+, 2024). As CA100+ has grown, its influence over companies may have similarly increased. Over time, CA100+ has also introduced significant new measures to publicly monitor companies' climate action, most notably the Net Zero Company Benchmark in 2021. Therefore, I propose a second hypothesis:

H2: The effectiveness of CA100+ in improving the climate performance of the focus companies increases over time.

Shifting perspectives, companies are rational actors that will carefully weigh up how to respond to CA100+ demands. In the context of environmental policies, corporates evaluate risks and costs when considering compliance with external environmental demands (Bansal and Roth, 2000). In an analysis of corporate responses to sustainability ratings, Gauthier and Wooldridge (2018) argue that companies may use "compensating tactics", aiming to satisfy requirements from sustainability rating agencies by focusing on changes in lower-cost and -effort practices that do not affect the core business. From a cost perspective, companies may therefore prioritise less expensive climate actions over more costly measures. Indeed, previous research indicates a discrepancy between environmental disclosure and more substantial measures of environmental performance, particularly among large firms (Drempetic et al., 2020; Aragón-Correa et al., 2016). Based on these observations, I derive a third hypothesis:

H3: CA100+ is more effective in improving companies' low-cost than high-cost climate actions.

In the above, I have argued that CA100+ is likely to improve the climate actions of its focus companies. However, its influence could go even further and potentially impact other companies. By articulating clear investor expectations on corporate climate action, CA100+ has the potential to establish decarbonisation standards in the real economy. In a comprehensive review, Marti et al. (2023) refer to such indirect effects as "field building". They argue that investors can create an impact by sharing expertise with other shareholders and thereby shifting the perception of sustainability issues. With its extensive and broad membership base, CA100+ holds significant influence over discussions on climate change in the financial sector and beyond and may create such effects.

From an empirical point of view, it is difficult to measure "field building" through CA100+. Causal inference methods inherently rely on comparisons. Since "field building" effects could affect the whole economy, it is challenging to draw a line between treated and untreated companies. This study refrains from imprecise attempts to approximate such an effect, for example, by comparing sectors covered by CA100+ with those that are not. Instead, it focuses on assessing CA100+'s direct and indirect impacts through collective engagement and public benchmarking. As only the focus companies were targeted, spillover effects can be ruled out for these two direct channels.

3 The CA100+ company selection process

When CA100+ was launched in December 2017, the initiative selected the 100 largest publicly listed corporate greenhouse gas emitters as their focus list (the "CA100 companies"). In June 2018, the focus list was extended to include an additional 61 companies which were considered "transition enablers" (the "Plus companies"), although no clear selection criterion was disclosed.[6] As of September 2024, the focus list comprises 170 companies, reflecting later additions of smaller groups and changes due to mergers and acquisitions. This study focuses on the CA100 and Plus companies (together the "CA100+ companies"), as these constitute the earliest and most significant additions. Figure 1 shows the distribution of the CA100 and Plus companies by sector and appendices A and B include the full lists of companies.

In 2020, Climate Action 100+ (2024) stated that the companies from the focus list accounted together for 80% of all global industrial emissions. There remain doubts about the accuracy of this calculated share due to double-counting of emissions across Scope 1, 2 and 3.[7] In their Carbon Majors work, Heede (2014, 2020) traces historical global industrial emissions from CO_2 and methane back to the 108 largest corporate polluters in the oil, gas, coal, and cement sectors, addressing double-counting.[8] Thirty-six CA100+ companies are covered by their work and account collectively for approximately 22% of global cumulative emissions from 1850 to 2018.[9] This estimate covers less than one-quarter of all focus companies but highlights the significant impact that CA100+ could have on the low-carbon transition, despite the relatively small focus group.

[6] The Plus list includes one company that is not publicly listed, namely Eskom.

[7] Scope 1 emissions refer to direct greenhouse gas emissions from a company's owned or controlled sources. Scope 2 emissions are indirect emissions from purchased electricity, steam, heating and cooling. Scope 3 emissions are indirect emissions from the company's value chain (GHG Protocol Initiative, 2004).
Double counting of real-world emissions occurs when a company's direct emissions (Scope 1) are included in the indirect emissions of another company (Scope 2 and 3). Adding up direct and indirect carbon footprints across companies without accounting for emission overlaps in their value chains leads to an inflated total.

[8] Heede (2014) mitigate double-counting by incorporating only companies' emissions from production (Scope 1) and the use of produced products (Scope 3, category 11) in their calculations.

[9] Author's calculations based on the Carbon Major database 2020.

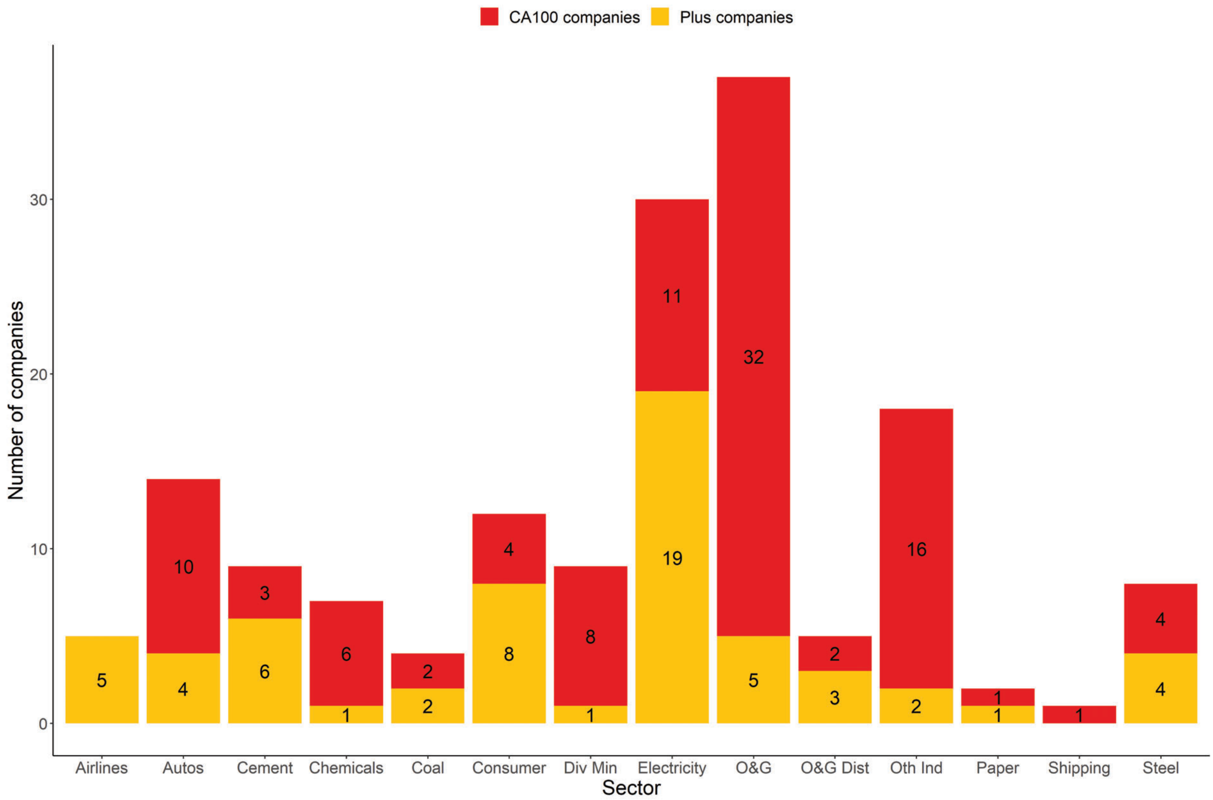

Figure 1: This figure shows the distribution of the CA100 and Plus companies by sector.[10]

Importantly, the focus companies could not self-select or opt-out. The initial CA100 companies were chosen solely based on reported and estimated Scope 1, 2 and 3 emissions from the CDP database. This clear cut-off represents an exogenous shock.

A company's carbon footprint is typically driven by sector and size. By definition, the majority of the initial focus group are therefore large companies in sectors considered hard to abate, such as oil and gas. However, there is no strong reason to believe that firm size is correlated with the likelihood of companies reducing their emissions. From an economic perspective, a company's capability or willingness to reduce carbon emissions is inversely proportional to marginal abatement costs (MACs) (Gillingham and Stock, 2018). Some aspects of MACs may depend on fixed costs, potentially giving larger companies an advantage due to economies of scale. However, MACs are influenced by various other factors such as

[10]Companies are only counted once, even if they operate in multiple sectors. The Aluminium sector, in which three Diversified Miners operate, is not listed separately.

the cost-effectiveness of different mitigation options which are often difficult to observe and likely unknown to investors. Even if such data were available, a comparison of MACs across companies would require an intensity-based analysis rather than sorting companies by their absolute carbon footprint.

A nuance to consider is that this argument holds for the propensity to reduce carbon emissions but may not apply as well to other measures of climate action. For example, larger companies may have more resources to enhance climate-related reporting due to their size (Drempetic et al., 2020). Thus, firm size remains an important factor when selecting appropriate counterfactuals.

On the other hand, there was no clear selection criterion for the Plus companies. Based on conversations the author had with CA100+ investors, these companies were selected due to their strategic importance in the low-carbon transition and with consideration given to regional balance. The process was therefore based on prior investor knowledge about the companies which constitutes a potential selection bias. Investors could have selected companies which they knew would respond to investor pressure. Given the differences in the selection process, I assess the impact of CA100+ on its whole focus group and on the CA100 and Plus companies separately.

4 Data and descriptive statistics

4.1 Challenges in measuring corporate climate action

Researchers find themselves between a rock and a hard place when attempting to measure corporate climate action. While there is broad awareness of the measurement issues in large off-the-shelf datasets, they are still often used out of necessity and due to a lack of alternatives.

Most studies rely on companies' carbon intensities based on financial and operational metrics (Rohleder et al., 2022; Bauckloh et al., 2023; Gantchev et al., 2022; Zink, 2024). However, due to limited data availability and reliability, the numerator often includes only operational Scope 1 and 2 carbon emissions. As several authors point out themselves (Bauckloh et al., 2023; Zink, 2024), Scope 3 emissions are of significant importance. For CA100+, this is particularly relevant in sectors where the majority of lifecycle emissions stem from the use of sold products, such as for oil and gas companies (Dietz et al., 2021a). Yet, reported and estimated Scope 3 figures in databases from third-party providers are highly inconsistent (Busch et al., 2022) which raises questions about their reliability.

Moreover, the metrics used in the denominator of carbon intensities can be volatile. For instance, fluctuations in financial metrics that are unrelated to carbon efficiency can distort carbon intensities. As an illustration, the surge in energy prices in 2022 decreased the carbon intensities of oil and gas companies based on revenue, profits or market capitalisation. Financial denominators can, therefore, introduce random variations leading to biased results.

In some cases, such measurement errors in carbon intensities may even be non-classical. For example, if companies with strong climate records aim for accurate Scope 3 reporting, while those with poor records strategically underreport, the resulting measurement errors would be correlated with companies' "true" climate performance. Consequently, research might mistakenly conclude that less committed companies are more carbon-efficient when, in reality, their carbon intensities are simply underestimated.

Alternatively, some studies examine companies' climate-related disclosures (Flammer et al., 2021; Ilhan et al., 2023). While these studies shed light on investor influence over firms' transparency regarding climate-related risks, there can be discrepancies between corporate reporting and actual climate outcomes. One significant concern pertains to greenwashing. Companies may strategically emphasise positive aspects of their environmental activities while downplaying or neglecting others (Lyon and Maxwell, 2011; Callery, 2023). This highlights the need for multidimensional measurement approaches which capture changes in disclosure alongside other more substantial actions.

Lastly, most of the commonly used metrics are inherently backward-looking. It is possible that investors create an impact which will only manifest in the medium- and long-term. As companies take time to change their operations, an assessment solely based on current and past metrics may prematurely find a non-effect.

4.2 Operationalising impact through CA100+

To overcome these challenges, this study collects new primary data which directly proxy the engagement asks of CA100+. CA100+ defined three formal engagement goals: board-level accountability and oversight of climate change, emission reduction targets aligned with the Paris Agreement and corporate climate change disclosure in line with the recommendations of the Task Force on Climate-related Financial Disclosure (TCFD).

This study begins by evaluating the least cost-intensive action from a company's perspective, i.e., climate-related disclosure, using a new dataset constructed with ClimateBERT. Next, I assess the most cost-intensive action, i.e., actual carbon emission reductions, which I proxy using data from TPI. TPI is an investor-led initiative with an independent research team based at the London School of Economics and Political Science that evaluates companies' plans to manage climate-related risks and emissions. Finally, I collect new primary data to augment an existing TPI dataset that evaluates the ambition of companies' carbon emission reduction targets, which likely fall in the mid-range of costliness.

4.2.1 TCFD disclosure on climate change

The TCFD published a detailed set of recommendations in June 2017, aiming to enhance reporting across four main areas: governance, strategy, risk management and metrics and targets. Since these recommendations were published only six months before the launch of CA100+, obtaining pre-treatment data that precisely follow the TCFD recommendations is challenging. Nonetheless, an overarching assessment of corporate disclosures, both before and after the launch of CA100+, is possible.

Isolating the causal impact of CA100+ first requires defining a baseline company universe. Given that CA100+ focus companies are among the largest publicly listed corporate polluters, I aim to include large listed Non-CA100+ companies from the same sectors to create a suitable pool of counterfactuals. The universe of companies assessed by TPI meets these requirements, as it selects companies following a top-down logic based on their total carbon emissions and market capitalisation, including all the CA100+ companies. Therefore, I collect data on the approximately 500 companies from CA100+ sectors in the TPI universe.[11]

I then follow Bingler et al. (2022b) to analyse companies' corporate disclosure using their ClimateBERT-TCFD model. This model distinguishes between climate-related and non-climate-related paragraphs or sentences and classifies them into the four TCFD categories. I also focus on companies' ARs due to their mandatory nature. Investors tend to rely more on mandatory disclosures when assessing sustainability information due to the inconsistency and incomparability of voluntary disclosures, such as Sustainability Reports (Ho, 2020).

I manually download all available ARs for the TPI companies for the period from 2014 to 2022.[12] After excluding companies with missing values, those that do not publish ARs due

[11] This count is as of October 2023.

[12] Public filing requirements vary by country, so companies publish ARs in different formats. In cases where ARs were unavailable, I select the most comparable annual disclosure in English, such as the Universal Registration Document in France or the Annual Integrated Report in Japan

to being unlisted, and those headquartered in Russia[13], I retain a sample of 402 companies, including 83 CA100+, 53 Plus, and 266 Non-CA100+ companies. I then extract the raw text from companies' ARs, split it into sentences and analyse them with ClimateBERT-TCFD.[14] Lastly, I measure the proportion of AR content (in percentage of total sentences) discussing climate-related information and each of the four TCFD categories.

Figure 2 shows that both CA100 and Plus companies reported more climate-related information than Non-CA100+ companies in the pre- and post-treatment periods.[15] In all groups, climate-related reporting increased in the post-treatment period. The proportions of ARs dedicated to climate-related content are similar to the findings on TCFD supporting companies by Bingler et al. (2022b). Yet, companies from the TPI universe report primarily on strategy rather than governance.

[13]CA100+ ceased engagement with Russian companies in 2022 following the war in Ukraine.

[14]I first apply the ClimateBERT base model to retain only climate-related sentences with an accuracy score of 99.5%. Then, I use the TCFD model to classify the climate content into the four categories.

[15]For CA100 companies, engagement began in December 2017, making 2018 the first post-treatment year. For Plus companies, engagement began in June 2018. Since ARs are published annually, I consider 2018 as the final pre-treatment year.

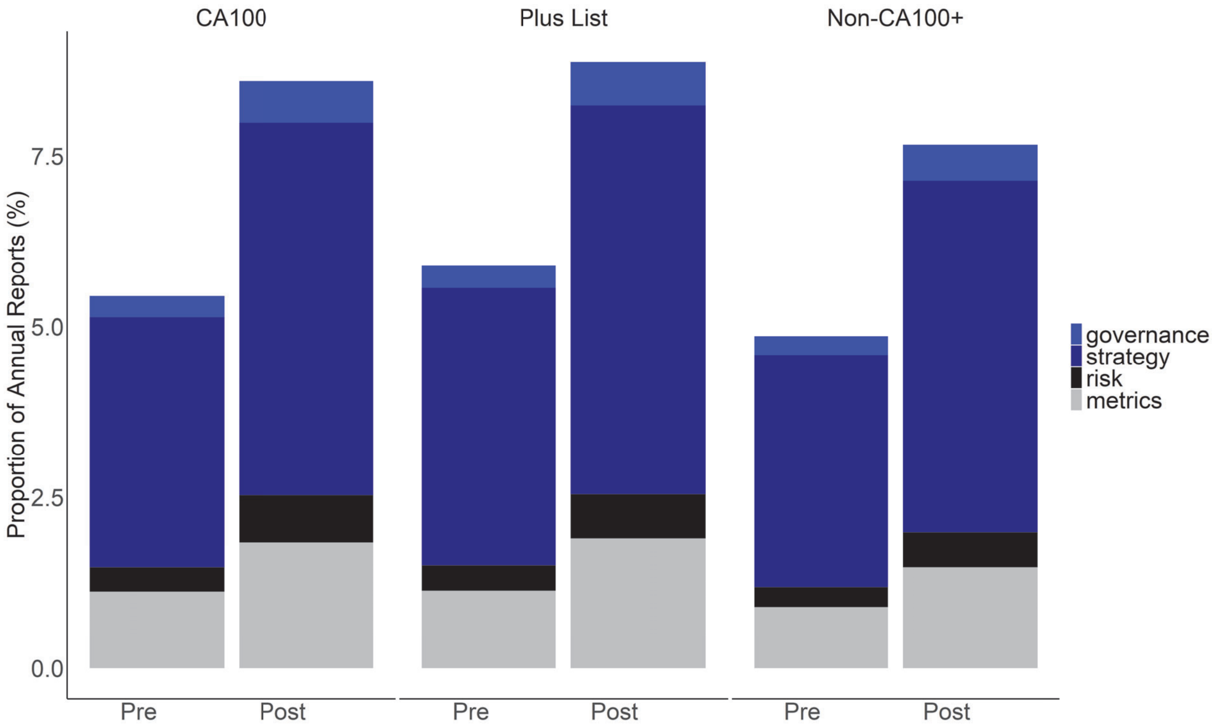

Figure 2: This figure shows the average proportions of CA100, Plus and Non-CA100+ companies' ARs that are dedicated to the four TCFD categories in the pre- and post-treatment periods.

4.2.2 Carbon emission reductions

A solution to address the measurement concerns regarding commonly used carbon intensities is offered by the Sectoral Decarbonisation Approach (SDA). The SDA calculates company-specific emission intensity pathways and compares them against sector-specific benchmarks representing different climate scenarios (Krabbe et al., 2015).

For each sector, the SDA identifies the most material emission categories from a life-cycle perspective. For example, in the electricity sector, the focus is on Scope 1 emissions from electricity generation, whereas in the oil and gas sector, it includes Scope 1, 2, and 3 (category 11, use of sold products) emissions (Dietz et al., 2021b, 2023). Absolute emissions are then divided by a sector-specific production output that is homogeneous across companies and time, e.g., generated megawatt hour in the electricity sector and sold energy in the oil and gas sector. Using a production-based denominator reduces non-carbon-related volatility and provides a more robust measure of carbon efficiency than financial metrics. The resulting carbon intensities enable consistent comparisons of companies' carbon efficiencies within their respective sectors.

The two main organisations that use the SDA to assess companies are the Science Based Targets Initiative (SBTi) and TPI. SBTi supports companies in establishing carbon emission reduction targets aligned with specific climate scenarios, subsequently certifying this alignment. However, the underlying carbon intensity data are not publicly disclosed and company assessments are not updated regularly. Additionally, companies self-select into SBTi certification.

TPI employs the SDA in its Carbon Performance (CP) assessment to evaluate the decarbonisation efforts of the largest publicly listed polluters. These companies cannot self-select or opt-out and undergo a yearly assessment. The TPI CP assessments offer therefore the most extensive database of carbon intensities derived from the SDA. Moreover, the TPI assessments underpin the CA100+ Net Zero Benchmark and are used by investors to evaluate focus companies' progress. This study uses the same data to evaluate the effectiveness of the coalition based on its own success metrics.

TPI calculates companies' emission pathways consisting of historical, current, and future carbon emission intensities over the period from 2014 to 2050. To address data availability and inconsistencies in reported Scope 3 emissions, TPI calculates company-specific Scope 3 emissions based on publicly available information. Appendix C provides further details on the methodology, including three exemplary company pathways, assessment process and data availability. As a first output of the TPI CP assessments, this study uses the historical carbon intensities which reflect past changes in companies' carbon efficiency between 2014 and 2022.

TPI CP data are available for approximately 500 companies from 11 sectors. A sufficient number of CA100+ and Non-CA100+ companies is covered in six sectors: airlines, automotives, cement, electricity, steel and oil and gas. These count among the world's highest-emitting sectors and comprise together 346 companies assessed by TPI. After removing companies with missing values, I retain a sample of 218 companies with at least one observation in the pre- and posttreatment periods for which figure 3 presents the average historical carbon intensities across the three groups.

I note no clear pattern in the levels of average carbon intensity in the pre-treatment period. Plus companies have a higher average carbon intensity in the electricity and airlines, CA100 companies in the steel and oil and gas sectors, and the Non-CA100+ companies in the cement sector. If carbon intenities may be considered as proxies for MACs, this suggests that the selection of the Plus list was not based on MACs.

Significant reductions in carbon intensity means between the pre- and post-treatment periods are noticeable only in the electricity and automotive sectors. The error bars, representing standard deviations, indicate the varying degrees of carbon efficiency within each sector. The electricity sector shows the highest dispersion, illustrating differences in business models and technologies used for electricity generation. Notably, in the airline sector, the carbon intensity increases over the two periods. This is largely attributable to the COVID-19 pandemic, during which many airlines were required to operate empty flights in 2020 and 2021.

A subset of 182 companies have complete historical pathways, including 45 CA100, 39 Plus and 99 Non-CA100+ companies. The distribution by sector is shown in Appendix C.

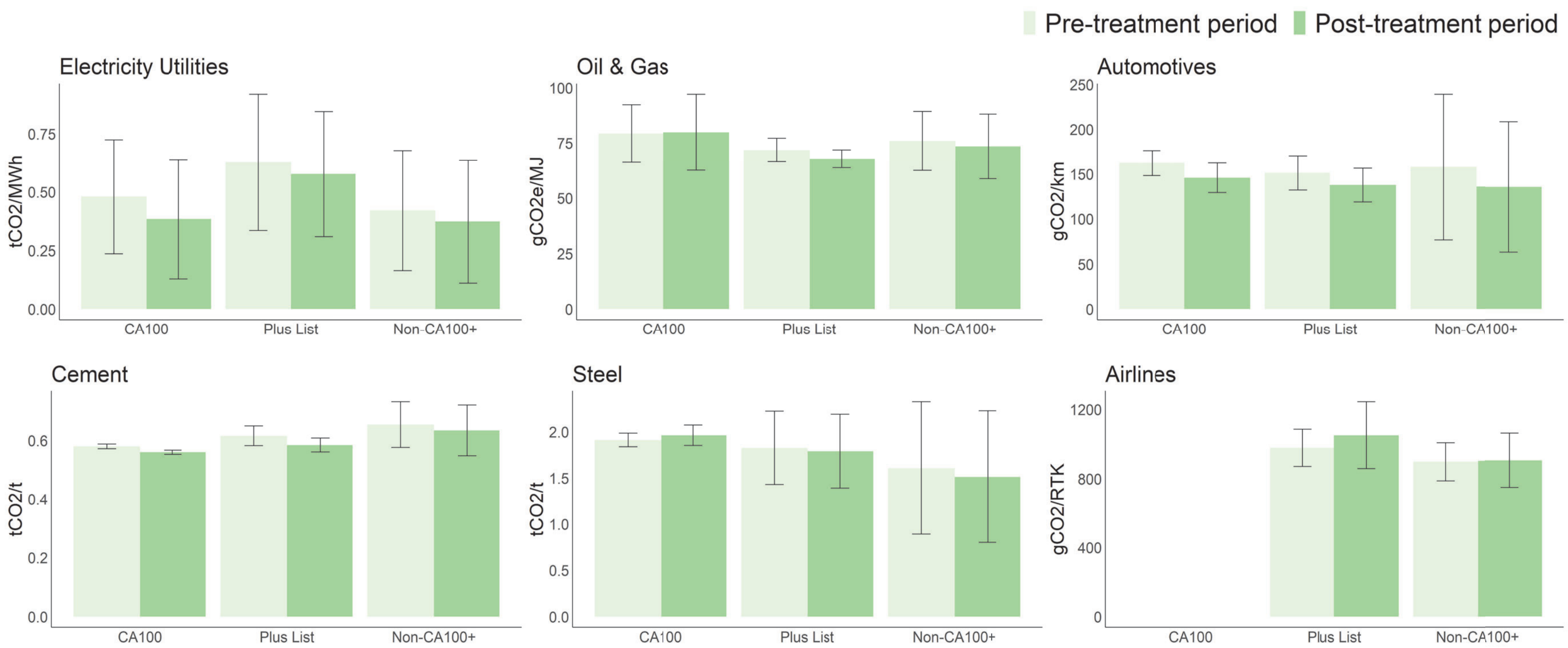

Figure 3: This figure shows the average carbon intensities in the pre- and post-treatment periods with standard deviations across the CA100, Plus and Non-CA100+ groups by sector.

4.2.3 Carbon emission reduction targets

The forward-looking part of TPI CP pathways is calculated based on companies' carbon emission reduction targets. The relevant outcome variable is the ambition of a company's new target, reflected by a reduction in the forward-looking carbon intensities. If a company does not disclose a carbon emission reduction target, TPI assumes that its latest available carbon intensity remains constant. The time variable is not the calendar year shown in the company's emission intensity pathway, but the year in which TPI conducted its research – the research cycle. Appendix C illustrates how the forward-looking emission pathway of the same company can change between research cycles. Importantly, TPI CP assessments allow for the analysis of short, medium- and long-term targets by examining future carbon intensities in different years. Since CA100+ tracks progress on companies' target for the years 2025, 2035 and 2050, I also focus on these years.

A challenge in using forward-looking TPI CP data is created by the fact that TPI was established in 2017, just a few months before CA100+. Additionally, TPI's company and sector coverage expanded gradually in subsequent years. As a result, there are almost no pre-treatment observations of the ambitions of companies' carbon emission reduction targets.

To overcome this data availability issue, I construct a new primary dataset on the forward-looking carbon intensities of the previously mentioned 346 companies, reaching back to a hypothetical research cycle 2015. In other words, I augment the existing TPI CP dataset with new "historical" CP assessments, following the same methodologies. These newly collected data points simulate the outcomes of the companies' assessments before TPI conducted them for the first time. Further details on the steps taken to adapt the historical assessment data for this study are provided in Appendix D.

Figure 4 shows the average forward-looking carbon intensities for 2025, 2035 and 2050, measured in TPI research cycles from 2015 to 2023. The targeted carbon intensities for nearly all target years are lower in the post- than in the pre-treatment period across almost all sectors. This indicates that companies' target setting has become more ambitious over time. Electricity utilities stand out with the most ambitious targets. The only sector with lower ambitions in the post-treatment period is aviation, which experienced a rebaselining of emissions targets post-Covid. Since no airlines were included in the initial CA100 list, I exclude this sector from further analysis to avoid a Covid-related bias which would only affect the Plus list. Following aviation, the oil and gas sector has established the least ambitious targets.

While it is uncertain whether companies will achieve their targets, anecdotal evidence suggests that these pledges are not published lightly. The *Milieudefensie versus Shell* case in the Netherlands exemplifies the heightened scrutiny and potential legal ramifications associated with climate targets. Furthermore, existing evidence suggests that ambitious climate targets are linked to reductions in carbon emissions (Dahlmann et al., 2019; Bolton and Kacperczyk, 2023a), although Jiang et al. (2023) find that companies were not penalised for failing their 2020 targets. This study does not seek to evaluate the binding nature of carbon emissions reduction targets or the likelihood of companies achieving them. Instead, it uses forward-looking carbon intensities to evaluate companies' self-declared decarbonisation ambitions.

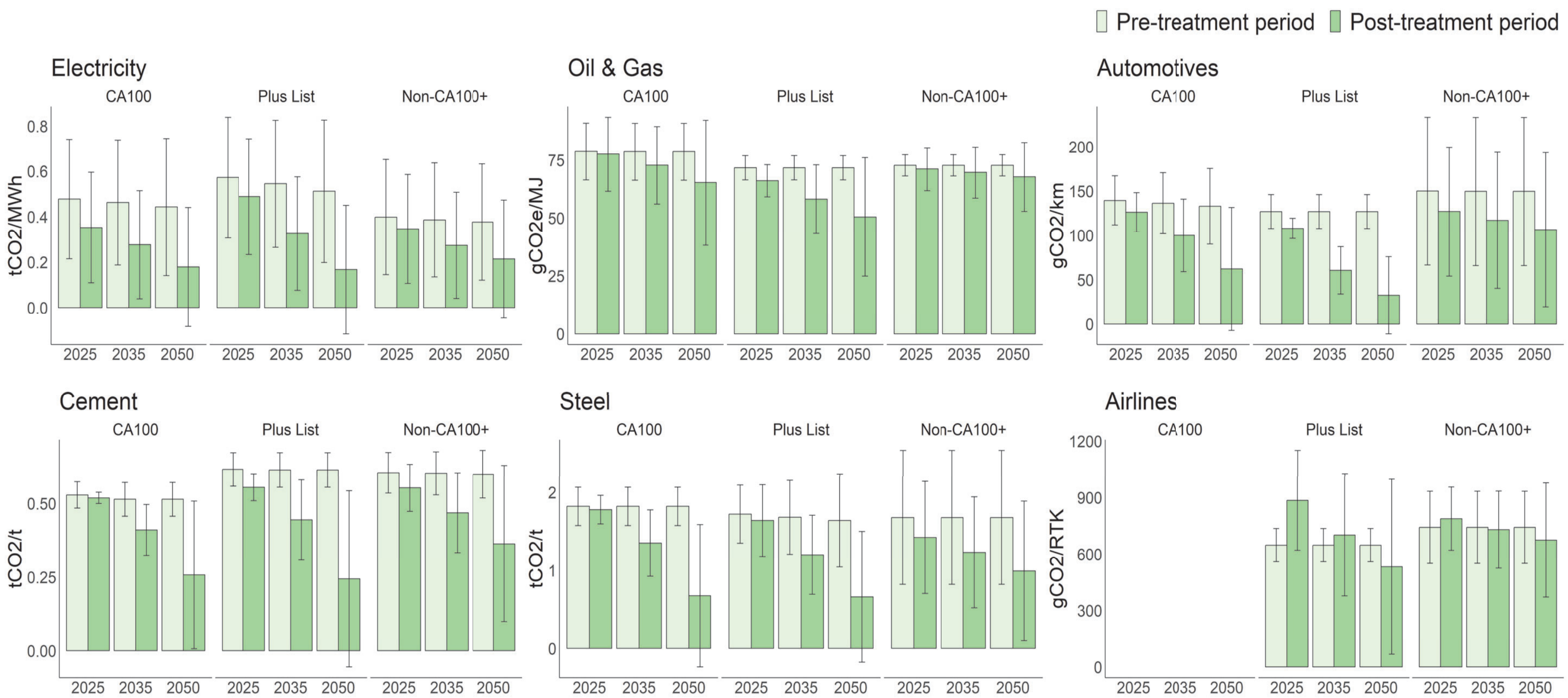

Figure 4: This figure shows the average targeted carbon intensities in the pre- and post-treatment periods with standard deviations for the years 2025, 20235 and 2050 across the CA100, Plus and Non-CA100+ groups by sector.

5 Research design

Determining the causal impact of CA100+ requires identifying suitable counterfactuals for the focus companies. One approach could be to match the CA100+ companies to Non-CA100+ companies based on a range of observable characteristics. However, this is challenging, as the CA100 companies constitute per definition the world's largest corporate polluters and the Plus list similarly includes companies with very large carbon footprints, such as BMW and Coca-Cola. Even within the TPI universe which selects companies based on size and pollution levels, many of the CA100+ companies remain "unique".

The DiD analysis offers a solution to this problem. Company fixed effects in the DiD hold differences in pollution levels and other time-invariant characteristics between CA100+ and Non-CA100+ companies constant. The most important assumption for the validity of the DiD analysis is parallel trends. An analysis of the combined treatment effect on the CA100+ companies requires parallel trends until 2017. For the separate assessment of the CA100 and the Plus list, parallel trends are required across the two groups and the Non-CA100+ companies until 2017 (Goodman-Bacon, 2021) and between the Plus companies and the Non-CA100+ companies until 2018. For each dependent variable and specification, I assess carefully whether the parallel trends assumption is plausible.

As a baseline specification, the following non-staggered two-way fixed effects (TWFE) analysis DiD regression model measures the impact of CA100+ on the climate action of the focus companies. The model is run together for all CA100+ companies and separately for the CA100 and Plus companies, comparing them against Non-CA100+ companies:

$$Y_{it} = \alpha + \beta CA100_i * Post_t + \gamma_i + \mu_t + \epsilon_{it}$$

Y is the climate action of company i in year t, $CA100_i$ is a dummy variable that takes the value of 1 for CA100+ companies, $Post_t$ is a time dummy that takes the value of 1 after the start of the treatment (2017 for the combined analysis, 2017 for CA100 companies and 2018 for Plus companies for the separate analysis). Company fixed effects, denoted by γ_i, control for any time-invariant differences between CA100+ and Non-CA100+ companies before the launch of the initiative. Year fixed effects, denoted by μ_t, account for shocks that affect CA100+ and Non-CA100+ companies alike in specific years, such as the Covid-19 crisis. The model is estimated using a linear OLS regression. Standard errors are clustered at the company level.

To analyse the effect of CA100+ on the CA100 companies and the Plus List simultaneously and to explore potential temporal changes in the effectiveness of CA100+ engagement, I run a staggered DiD specification. Given the limitations of the TWFE specification in estimating heterogeneous and dynamic treatment effects in staggered models (Goodman-Bacon, 2021), I use the robust estimator developed by Callaway and Sant'Anna (2021).

6 Results

6.1 TCFD reporting

While the parallel trends assumption cannot be tested empirically, a visual inspection can indicate whether the pre-treatment trends are similar. Figure 5 indicates that this is the case for climate-related reporting. The plot also suggests the absence of a strong treatment effect, as post-treatment trends remain largely unchanged.

This observation is further supported by the TWFE DiD analysis shown in table 2. The treatment effects are not statistically significant at any conventional level. Appendix E shows the plotted pathways and TWFE DiD results across the CA100, Plus and Non-CA100+ companies and the event study plots of the staggered DiD which confirm the absence of significant pre- or post-trends.

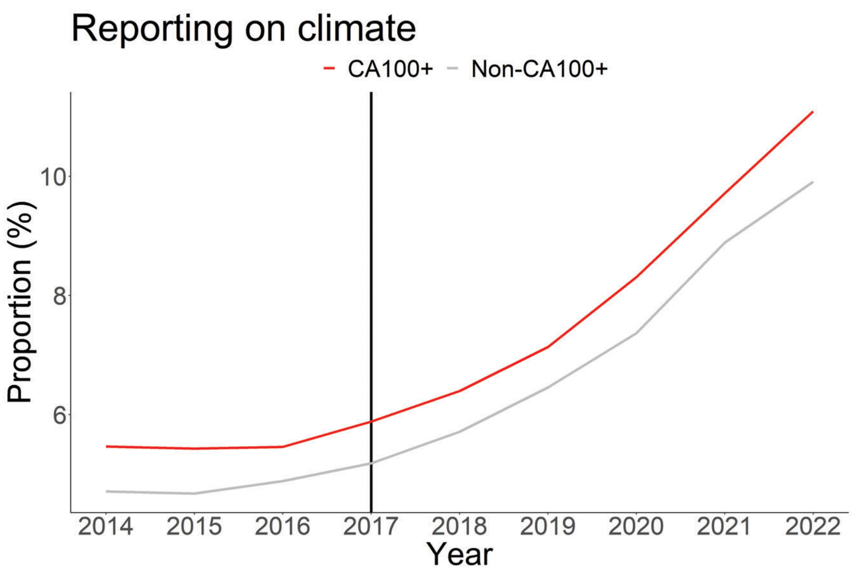

Figure 5: This figure shows the pre- and post-treatment trends on climate-related reporting across the CA100+ and Non-CA100+ companies for each year.

Appendix E presents the results for the individual TCFD categories. The effects remain insignificant which suggests that CA100+ did not have a notable impact on the specific topics on which companies choose to disclose information.

	CA100+
DiD	0.14
	(0.37)
Num. obs.	3,618
R^2	0.75
Adj. R^2	0.72

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 1: This table shows the results of the DiD analysis on climate-related reporting, comparing the CA100+ to Non-CA100+ companies.

6.2 Carbon emission reductions

Turning to more substantial climate action, I analyse the impact of CA100+ on companies' carbon intensities between 2014 and 2022. Since carbon intensity measures vary by sector, I standardise them using z-scores. Specifically, I standardise within each sector using all companies' average historical carbon intensities and the related standard deviation in 2014. The z-scores must, therefore, be interpreted as differences in standard deviations from the sector mean in 2014.

Figure 6 shows the carbon intensity pathways across the CA100+ and Non-CA100+ companies. There are no notable differences in the post-treatment period which is again supported by the TWFE DiD results shown in table 2. Appendix F shows the separate analysis across the three groups and the event study plots which confirm again the absence of a significant pre-trend or treatment effect.

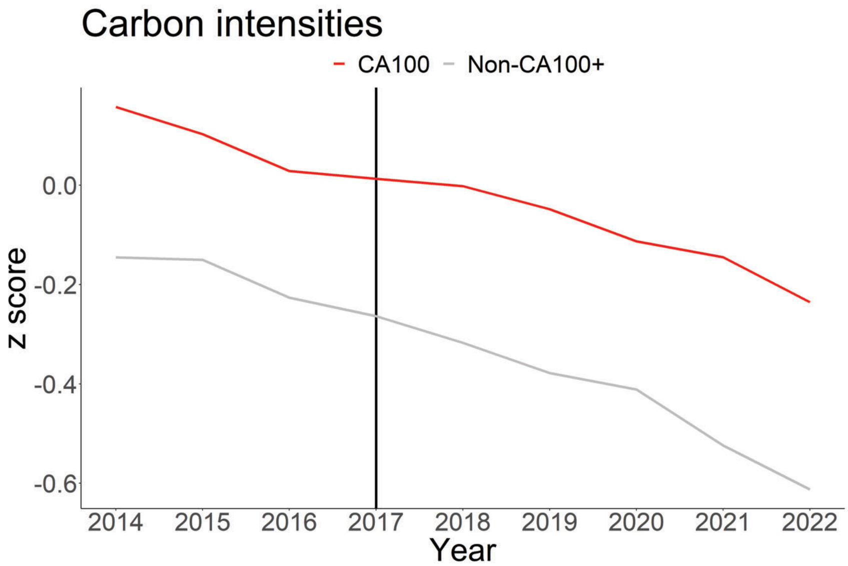

Figure 6: This figure shows the pre- and post-treatment trends on carbon intensities across the CA100+ and Non-CA100+ companies for each year.

	CA100+
DiD	0.06
	(0.05)
Num. obs.	1,491
R^2	0.93
Adj. R^2	0.92

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 2: This table shows the results of the DiD analysis on carbon intensities, comparing the CA100+ to Non-CA100+ companies.

6.3 Carbon emission reduction targets

Lastly, I analyse the difference in the ambition of carbon emission reduction targets. Recall that the time variable in the forward-looking analysis is TPI research cycles and the outcome variable companies' future carbon intensities in a given target year. Again, I standardise using the z-score. Specifically, I standardise within each sector using companies' average forward-looking carbon intensities and related standard deviation per target year from the

TPI research cycle 2015. The resulting z-scores must, therefore, be interpreted as differences in standard deviations from the forward-looking sector mean from research cycle 2015.

Figure 7 indicates similar trends over the period from research cycles 2015 to 2017 across the CA100+ and Non-CA100+ companies for all target years. A visual inspection suggests that CA100+ has so far had no impact on short-term targets. For medium- and long-term targets, the trends start to diverge.

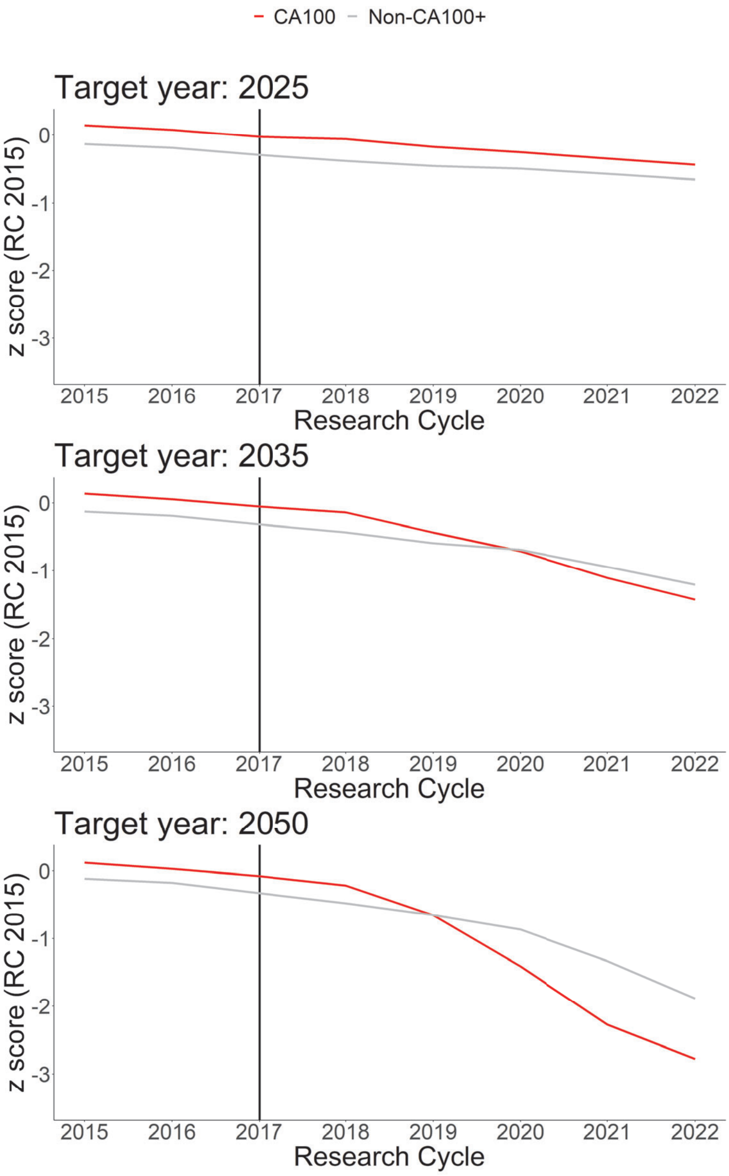

Figure 7: This figure shows the pre- and post-treatment trends across the CA100, Plus and Non-CA100+ companies for each target year across all sectors.

The DiD coefficients in table 3 confirm these observations. The effect on short-term targets is not statistically significant at any conventional level. On the other hand, CA100+ seems to have an impact which is significant at the 5% level on companies' medium- and long-term targets.

For further investigation, I analyse the impact of CA100+ on the targets of the CA100

	TY 2025	TY 2035	TY 2050
DiD	-0.02	-0.25^{**}	-0.60^{**}
	(0.07)	(0.12)	(0.23)
Num. obs.	1,480	1,480	1,480
R^2	0.89	0.75	0.61
Adj. R^2	0.87	0.72	0.56

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 3: This table shows the results of the DiD analysis on target-year-specific forward-looking carbon intensities (in z-scores), comparing the CA100+ to Non-CA100+ companies.

and Plus companies separately. Figure 8 plots the pathways and table 4 shows the TWFE DiD results. Interestingly, none of the coefficients is statistically significant for the CA100 companies at any conventional level. On the other hand, for the Plus companies, the size of the negative treatment effect grows the further the target year lies in the future and is significant at the 1% level for 2035 and 2050. This discrepancy between the two treated groups is striking.

Next, I examine the dynamic nature of the heterogeneous effect on targets using the staggered DiD specification. Figure 9 shows how the treatment effect varies by research cycle, with the top chart showing results for the CA100 companies and the bottom chart for the Plus companies. The confidence intervals are set for 95%. The effect remains insignificant for CA100 companies across all target years. For the Plus list, the effect is significant for target year 2035 in research cycles 2020 and 2021 and for target year 2050 in research cycle 2021, but insignificant for later research cycles. Notably, the effect is consistently significant only for medium- and long-term targets.

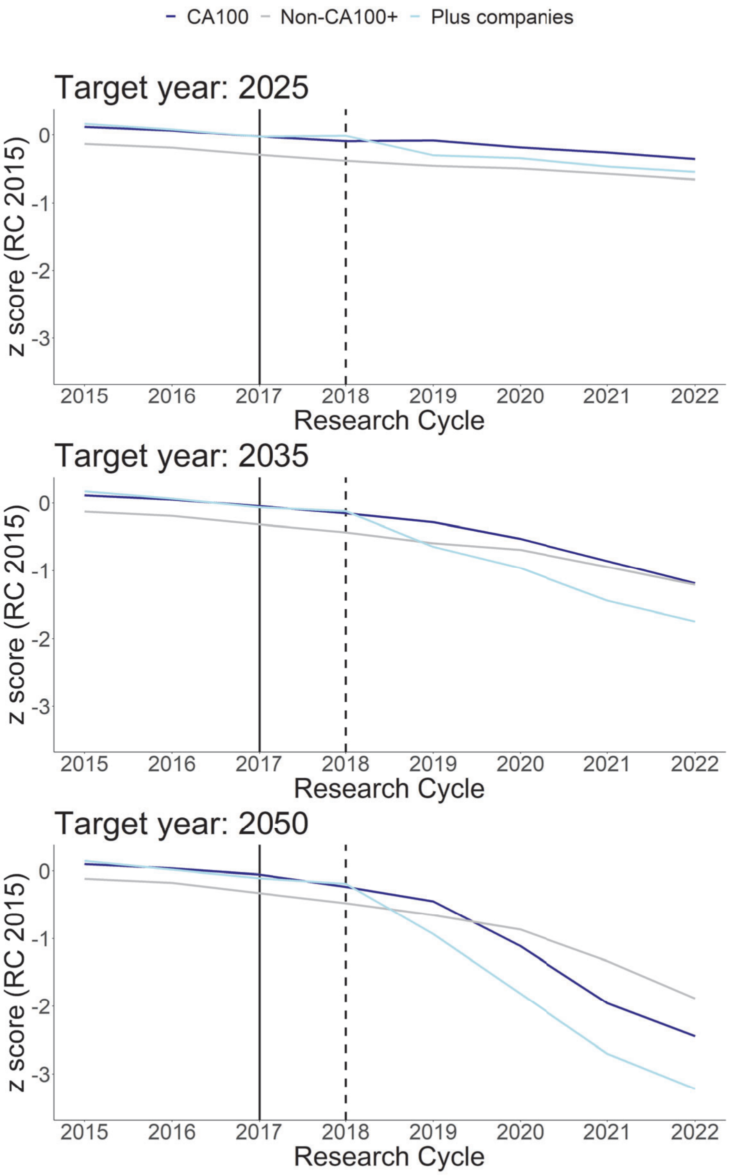

Figure 8: This figure shows the pre- and post-treatment trends across the CA100, Plus and Non-CA100+ companies for each target year across all sectors.

	CA100			Plus		
	TY: 2025	TY: 2035	TY: 2050	TY: 2025	TY: 2035	TY: 2050
DiD	0.04	-0.07	-0.37	-0.12	-0.55***	-1.06***
	(0.07)	(0.13)	(0.25)	(0.10)	(0.20)	(0.40)
Num. obs.	1,174	1,174	1,174	1,068	1,068	1,068
R^2	0.91	0.79	0.63	0.87	0.73	0.60
Adj. R^2	0.90	0.76	0.58	0.86	0.69	0.54

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 4: This table shows the results of the DiD conducted for the CA100-only and Plus-only analyses across all sectors using z-scores.

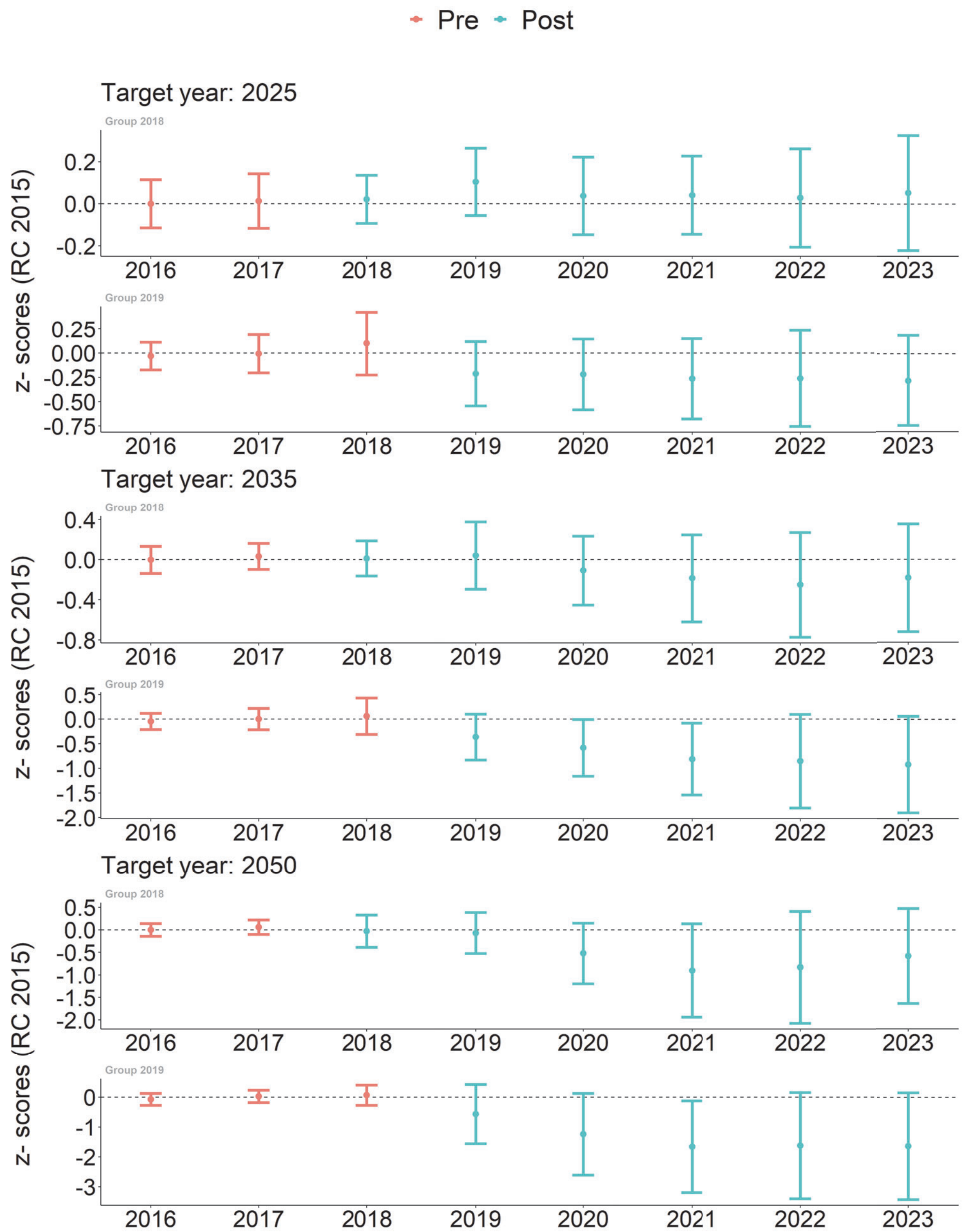

Figure 9: This figure shows the dynamic treatment effect of CA100+ on the CA100 and Plus companies' target setting.

7 Robustness checks

7.1 Additional proxies for companies' climate-related disclosure

A potential concern regarding the analysis of climate-related reporting is that the content in ARs may not comprehensively capture companies' disclosure. Therefore, I perform additional checks using two alternative outcome variables.

Firstly, I use companies' responses to the CDP questionnaire as a second proxy for alignment with the TCFD recommendations. CDP plays an important role in driving corporate transparency by annually sending questionnaires regarding climate change to companies. A crucial aspect of the CDP disclosure process is the choice companies have to respond or not respond. It is precisely this strategic decision to opt-in or opt-out which I exploit. If CA100+ increases the propensity of focus companies to report to CDP, this would indicate a positive impact on companies' disclosure practices. Appendix G provides more information on how I build a relevant dataset using CDP responses.

Secondly, I derive an indicator proxying the quality of companies' climate disclosure from the TPI CP assessments: the completeness of the historical carbon intensity pathway indicates companies' transparency on their climate impact. I calculate this variable using the average years with available historical carbon intensity data in the pre- and post-treatment periods. As the lengths of the periods vary between CA100, Non-CA100+ and Plus companies, I calculate the share of disclosed years over the total of years in which disclosure was possible for each group: *Carbon Intensity (CI) disclosure (%).* Appendix H plots the average CI disclosure across the CA100, Plus and Non-CA100+ groups in the pre- and post-treatment periods.

As neither of these two variables is continuous[16], I use a simplified DiD analysis by binning the data in the pre- and post-treatment periods. This approach compares the differences

[16] CI disclosure is a percentage but can only take certain values.

in means between CA100+ and Non-CA100+ companies before and after the launch of CA100+. The model is estimated as follows:

$$\overline{Y}_{it} = \alpha + \beta(CA100_i * Post_t) + \gamma_i + \epsilon_{it}$$

$\overline{Y}_{it}$ is the *binned* climate action of company i in either the pre- or post-treatment period t. $CA100_i$ is a dummy variable that takes the value of 1 for CA100+ companies. $Post_t$ is a time dummy that takes the value of 1 in the post-treatment period (after 2017 for CA100 companies and after 2018 for Plus companies)[17], and γ_i denotes company fixed effects. The model is estimated using a linear OLS regression with standard errors clustered at the company level.

The results of the binned DiD analyses in table 5 present a mixed picture, suggesting that CA100+ did not have a significant impact on companies' CDP disclosure but did influence CI disclosure, particularly among the Plus companies. This indicates that, although there is no effect on total climate-related reporting, CA100+ may have improved carbon emissions disclosure within the focus group. Appendices G and H show that the results hold when analysing the combined effect on the whole focus group.

	CDP reporting		CI disclosure	
	CA100	Plus List	CA100	Plus List
DiD	-0.03	-0.00	0.03^{*}	0.07^{**}
	(0.03)	(0.04)	(0.02)	(0.04)
Num. obs.	636	584	524	498
R^2	0.90	0.90	0.89	0.87
Adj. R^2	0.79	0.79	0.78	0.73

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 5: This table shows the results of the binned DiD analysis on CDP reporting and CI disclosure, comparing the CA100 and Plus to Non-CA100+ companies.

[17]For the CDP analysis, the last pre-treatment year for the CDP analysis is 2017 for both groups as CDP responses are published in October.

7.2 Varying regulatory environments

CA100+ companies represent an international sample subject to varying national regulations. Company fixed effects account for differences in climate-related regulation across operating countries, while year fixed effects control for regulatory changes affecting all companies in a given year. However, changes in climate regulation over the analysis period could bias the results. To address this concern, I integrate country-level data from the Climate Change Performance Index (2023) (CCPI) in the analysis. The CCPI annually rates countries' climate protection efforts and has been used in previous studies to control for the evolving stringency of national climate regulations (Bolton and Kacperczyk, 2023b). Appendix I provides details on how the CCPI data were used. Companies were matched to countries based on the location of their headquarters.

Table 6 shows that the results on target setting are robust to accounting for changing national regulatory environments. The CCPI estimators are not statistically significant.

	CA100			Plus		
	TY: 2025	TY: 2035	TY: 2050	TY: 2025	TY: 2035	TY: 2050
DiD	0.04	-0.07	-0.36	-0.12	-0.56***	-1.08***
	(0.07)	(0.13)	(0.25)	(0.10)	(0.20)	(0.40)
CCPI	-0.00	0.00	0.00	-0.00	-0.00	-0.01
	(0.00)	(0.00)	(0.10)	(0.00)	(0.00)	(0.01)
Num. obs.	1,174	1,174	1,174	1,068	1,068	1,068
R^2	0.91	0.79	0.63	0.87	0.73	0.60
Adj. R^2	0.90	0.75	0.58	0.86	0.69	0.54

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 6: This table shows the results of the DiD conducted for the CA100 and Plus analyses including CCPI scores across all sectors using z-scores.

Given the rather small sample size, conducting robustness checks that further subdivide the sample is challenging. Nevertheless, I perform an additional test to account for the impact of varying national regulations, focusing on the region with the highest sample size: North America. The sample includes 26 CA100, 22 Plus, and 92 Non-CA100+ companies for the analysis of climate-related reporting and 15 CA100, 11 Plus and 28 Non-CA100+ companies for the analysis of historical carbon intensities and carbon emission reduction targets. Table 7 shows that the effect on targets remains insignificant for CA100 companies, while the impact on medium- and long-term target setting among Plus companies persists, although only at the 10% significance level.

	CA100			Plus		
	TY: 2025	TY: 2035	TY: 2050	TY: 2025	TY: 2035	TY: 2050
DiD	-0.04	-0.08	-0.15	-0.19	-0.62*	-1.32*
	(0.13)	(0.17)	(0.23)	(0.22)	(0.36)	(0.68)
Num. obs.	385	385	385	351	351	351
R^2	0.88	0.79	0.70	0.81	0.63	0.54
Adj. R^2	0.87	0.76	0.65	0.78	0.57	0.47

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 7: This table shows the results of the DiD conducted for the CA100 and Plus analyses across all sectors within North America using z-scores.

Appendix J shows that the results for climate-related TCFD reporting and historical emission reductions do not change considerably when controlling for the CCPI and restricting the sample to North American companies.

7.3 Varying sectoral dynamics

Lastly, different sectors face different challenges in the low carbon transition. Consequently, the pace at which companies can improve their corporate climate action varies by sector. For example, in a 1.5 Degrees scenario, the electricity sector is expected to reach net zero CO2 emissions globally by 2040, whereas the cement sector remains slightly net positive even by 2050 (International Energy Agency, 2021). Hence, variations in the sector compositions across the three groups could bias the results.

To rule out this potential bias, I conduct a stringent test by repeating the analyses within a single sector: electricity utilities. This sector has the largest sample size with 9 CA100, 16 Plus and 43 Non-CA100+ companies for the analysis of climate-related reporting and 10

CA100, 18 Plus and 35 Non-CA100+ companies for the analysis of carbon intensities and targets.

Table 8 shows that the effect on targets remains insignificant for the CA100 companies, while the impact on medium-term targets for the Plus companies remains significant at the 10% level and on long-term targets at the 5% level. Appendix K shows that the non-effect on climate-related reporting, TCFD reporting, and carbon intensities also persists in the electricity sector.

	CA100			Plus		
	TY: 2025	TY: 2035	TY: 2050	TY: 2025	TY: 2035	TY: 2050
DiD	-0.15	-0.13	-0.17	-0.06	-0.31*	-0.50**
	(0.14)	(0.17)	(0.24)	(0.14)	(0.17)	(0.20)
Num. obs.	402	402	402	476	476	476
R^2	0.89	0.82	0.71	0.89	0.79	0.70
Adj. R^2	0.88	0.79	0.67	0.87	0.76	0.66

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 8: This table shows the results of the DiD conducted for the CA100-only and Plus-only analyses within the electricity sector using z-scores.

8 Conclusion

8.1 Discussion

Overall, this study provides only partial support for *H1*, positing that inclusion in CA100+'s focus list significantly improves companies' climate actions. I find no effect on climate-related reporting in line with the TCFD recommendations or historical carbon intensities for the focus companies five years after the launch of CA100+. These findings neither align with the anecdotal evidence surrounding CA100+, nor with Chang and Fang (2024) who report a positive relationship with carbon emissions reductions along the supply chain of focus companies in China.

The absence of a positive effect on the least-costly climate action, i.e., climate-related reporting, also suggests a rejection of *H3* which posits that companies prioritise low-cost over high-cost measures. Regarding the non-effect on carbon emissions, it is important to note that operational changes may take time. Additionally, this study evaluates phase 1 of CA100+ engagement, which focused primarily on carbon emission reduction targets. Since 2023, CA100+ has entered its second engagement phase, which emphasises actual carbon emission reductions. Therefore, it is possible that CA100+'s impact on carbon intensities will show only over a longer time horizon.

The study does find a significant effect on companies' carbon emission reduction targets, which is consistent with Bingler et al. (2024) who measure a correlation between inclusion in CA100+'s focus group and more precise climate commitments. However, by examining the company selection process and isolating the causal impact of CA100+, I reveal that this effect holds interestingly only for companies on the Plus list, where endogeneity cannot be ruled out. This raises questions about the selectivity of investor engagement, suggesting that investors may have chosen the Plus companies for specific reasons that made them more likely to set targets. While Heeb and Kölbel (2024) highlight the possibility of investor selectivity, this is, to my knowledge, the first study to provide empirical evidence that this factor can impact engagement outcomes.

The heterogeneous treatment effect could be explained by prior investor knowledge about carbon emission reduction targets the Plus companies were going to set anyway. Along similar lines, investors might have anticipated "easy wins" with Plus companies, making them more likely to adopt stringent targets. However, these explanations may be overly sceptical. Based on conversations the author had with CA100+ and Non-CA100+ investors, selecting the right target is considered a crucial element of a successful engagement process. Some even described it as part of the "art of engagement."

Investors have limited resources for stewardship work and must focus on companies where they believe they can make a meaningful impact. From this perspective, it is logical that investors selected companies for the Plus list that they believed would be more responsive to investor pressure. Dimson et al. (2015) show that, generally, the likelihood of investors engaging companies on sustainability issues depends on factors such as prior performance, potential reputational damage, and ownership stakes.

While it is unclear exactly how CA100+ investors defined the Plus list, I try to identify differences between the CA100 and Plus companies by comparing them using an independent two-sample t-test. I use variables that could have been known to investors when selecting companies for the Plus list. I obtained average Scope 1, 2 and 3 emissions for the years 2017 and 2018 from Trucost[18] and the remaining operational and financial metrics for the financial year 2017 from the Orbis database.

Table 9 indicates that CA100 companies are nearly twice as large as the Plus companies across various variables. The results are significant at conventional levels. This is not surprising, as companies' absolute carbon emissions strongly correlate with firm size. However, it might suggest that investors find it easier to influence the slightly smaller companies among the largest global corporate polluters.

[18]To fill in gaps in the Trucost database, I use the average between 2017 and 2018.

Variable	CA100	Plus	Difference	p-Value
Average emissions (Mt)	65.8	30.7	35***	0.00
Market cap (bn USD)	56.7	31.9	24.8***	0.00
Revenue (bn USD)	76.2	33	43.2***	0.00
Fixed assets (bn USD)	46.8	23.5	23.3***	0.00
EBIT (bn USD)	57.8	30	27.8***	0.00
Tobin's Q	0.71	0.83	−0.12	0.30
Number of employees (k)	114.2	94	20.2	0.68

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 9: This table presents independent two-sample t-test results across a range of variables, comparing the CA100 and Plus companies prior to the launch of CA100+.

Lastly, one might argue that companies from the Plus list may have anticipated the engagement asks. However, the Plus list was added only six months after the launch of CA100+, making this hypothesis unlikely.

Further examining CA100+'s effect on Plus companies' targets, it stands out that the effect is strong and significant only on medium- and long-term target setting. The impact on target setting for 2050 becomes statistically significant starting from research cycle 2021 which coincides with the increasing prominence of "net zero" targets in public discourse. For example, the Business Ambition for 1.5 Degrees campaign[19] was launched in 2019 and closed in 2021. However, the finding that the effect is no longer significant after research cycle 2021 leads to the rejection of the hypothesis that CA100+'s impact increases over time (*H2*).

While it is important to acknowledge companies' challenges in reducing their carbon footprint in the near future, setting medium- and long-term targets that are not underpinned by short-term milestones raises questions about their credibility. Such target setting may reflect strategic corporate behaviour aimed at creating the appearance of climate responsibility without committing to immediate, tangible actions. Furthermore, the further carbon emission reduction targets are set in the future, the less clear the assignment of responsibility becomes, both within firms and among investors. This lack of accountability could be perceived as a form of greenwashing.

[19]This campaign by a coalition of UN agencies, companies, and civil society actors, urged companies to set carbon emission reduction targets aligned with limiting global warming to 1.5°C.

Recognising that climate change depends on cumulative emissions, achieving significant reductions in the short-term is crucial for meeting global climate targets. The less emphasis is placed on near-term abatement efforts, the steeper the decarbonisation curve will need to be in the medium- and long-term. The findings of this paper highlight a potential risk of investor engagement strategies focusing – intentionally or unintentionally – insufficiently on the near-term which may lead to backloading of corporate decarbonisation efforts.

8.2 Limitations

This study acknowledges several limitations. Firstly, as discussed in section 2, there could be spillover effects between CA100+ companies and Non-CA100+ companies. It is possible that CA100+ contributes to a shift in the institutional context in which companies operate (Matisoff, 2015). For example, the CA100+ Net Zero Benchmark may set new decarbonisation standards for all companies to follow. In this case, collective investor action through CA100+ may have affected CA100+ and Non-CA100+ companies alike. While it is difficult to control for such general equilibrium effects – a limitation which would also caveat findings from other studies on investor engagement (Barko et al., 2022; Hoepner et al., 2024) – we can assume that they would lead to an underestimation of the measurable treatment effects.

While acknowledging this conceptual possibility, this study offers a key insight. Despite the potential presence of spillover effects, only focus companies were subject to the collective and coordinated engagement efforts of CA100+. As the study reveals, there are no noticeable differences between CA100+ and Non-CA100+ companies, except for the medium- and long-term targets set by the Plus companies. If CA100+ is still having an impact on companies across the real economy, this would prompt a reconsideration of the role broad engagement coalitions play in the sustainable finance ecosystem. While recognising that one cannot exist without the other, their impact as agenda or standard setters might be greater than as collective engagement platforms.

Secondly, the current specifications estimate the average treatment effect on the treated, assuming a homogeneous treatment effect across the CA100 and Plus companies. Yet, it is possible that CA100+'s "true" treatment effect is heterogeneous. This heterogeneity could arise from differences in the importance of CA100+ investors for each company. One potential approach to explore this would be to calculate the collective ownership held by CA100+ investors in the focus companies. Unfortunately, CA100+ does not disclose the signature dates of its investor members, nor further details of their engagement work.

Thirdly, as CA100+ engages with the largest publicly listed corporate polluters in the world, the findings may not hold for smaller polluters that could react differently to engagement with investor coalitions. However, from a mitigation perspective, the climate actions of the world's largest corporate polluters matter the most.

8.3 Implications and further research

Overall, this study sounds a note of caution regarding the impact of investor coalitions on corporate climate action. The findings suggests that collaborative engagement cannot replace the need for more direct policy measures, such as the implementation and strengthening of carbon pricing mechanisms.

However, this should not be interpreted as a blanket conclusion on the ineffectiveness of investor coalitions. They may simply require more time to significantly influence corporate behaviour. In the context of CA100+, it would be interesting to repeat this study in the future, once the second phase of engagement has concluded. Notably, CA100+ has recently become smaller, following the departures of several large US-based asset managers in 2024. A follow-up study could examine this "reverse" treatment effect, investigating whether a smaller, but potentially more ambitious, CA100+ is more effective.

There are several areas for further research. Investor coalitions may have indirect effects that are difficult to quantify. For instance, investor engagement might encourage board-level discussions, introduce climate expertise, or reshape internal corporate culture towards sustainability. These outcomes may not immediately reflect in currently available metrics but could be foundational in driving longer-term climate action. Qualitative research could help unpack such dynamics.

Additionally, a promising area for future research is to explore whether investor action has spurred other financial actors (e.g., insurance companies, lenders, or even regulators) to adopt stricter climate risk management policies. This would help assess the broader financial ecosystem's response to investor coalitions, such as CA100+.

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A Appendix - CA100 companies

Airbus	Exxon Mobil	Philips
American Electric Power	Fiat Chrysler	Phillips 66
Anglo American	Ford	Posco
Anhui Conch Cement	Formosa Petrochemical	Procter & Gamble
AP Moller - Maersk	Gas Natural	PTT
Arcelor Mittal	Gazprom	Raytheon Technologies
BASF	General Electrics	Reliance Industries
Bayer	General Motors	Repsol
Berkshire Hathaway	Glencore	Rio Tinto
BHP	Hitachi	Rolls-Royce
Boeing	Holcim	Rosneft Oil
BP	Hon Hai Precision Industry	SAIC Motor
Canadian Natural Resources	Honda	Sasol
Caterpillar	Imperial Oil	Shell
Centrica	International Paper	Siemens
Chevron	KEPCO	Sinopec
China Shenhua Energy	Lockheed Martin	SK Innovation
CNOOC	Lukoil	Southern Company
Coal India	LyondellBasell Industries	Suncor Energy
ConocoPhillips	Marathon Petroleum	Suzuki
Cummins	Martin Marietta Materials	Teck Resources
Daikin Industries	Naturgy Energy	Tesoro
Dow	Nestle	ThyssenKrupp
Duke Energy	Nippon Steel	Toray Industries
Dupont	Nissan	TotalEnergies
E.ON	Nornickel	Toyota
Ecopetrol	NTPC	Trane Technologies
EDF	Oil & Natural Gas	United Technologies
Enel	OMV	Vale
Eneos	PACCAR	Valero Energy
Engie	Panasonic	Vedanta
Eni	Pepsico	Volkswagen
Equinor	Petrobras	Volvo
Exelon		

Table 10: This table shows the list of CA100 companies.

B Appendix - Plus companies

ADBRI	Delta Air Lines	Renault
AES	Devon Energy	RWE
AGL Energy	Dominion Energy	Santos
Air France KLM	Enbridge	Severstal
Air Liquide	Eskom	South 32
American Airlines	FirstEnergy	SSAB
ANTAM	Fortum	SSE
Bluescope Steel	Groupe PSA	St Gobain
BMW	Heidelberg Cement	Suzano
Boral	Iberdrola	TC Energy
Bumi	Kinder Morgan	Unilever
Bunge	National Grid	United Continental
Cemex	NextEra Energy	United Tractors
CEZ	NRG Energy	Vistra Energy
China Steel	Occidental Petroleum	Walmart
Coca-Cola	Origin Energy	WEC Energy Group
Colgate-Palmolive	PGE	Weyerhaeuser
CRH	Power Assets	Woodside Petroleum
Daimler	PPL	Woolworths
Dangote Cement	Qantas	XCEL Energy
Danone		

Table 11: This table shows the list of Plus companies.

C Appendix - TPI CP methodology, process and data

TPI CP assessments are exclusively disclosure-based. Therefore, the length of a company's emission pathway depends on two main factors. First is the availability of historical emissions and production data. While some companies have complete carbon emission pathways with historical carbon intensities ranging from 2014 to 2022, others have shorter pathways or even no pathway at all. Figure 10 shows the past carbon intensities of a company with limited disclosure.

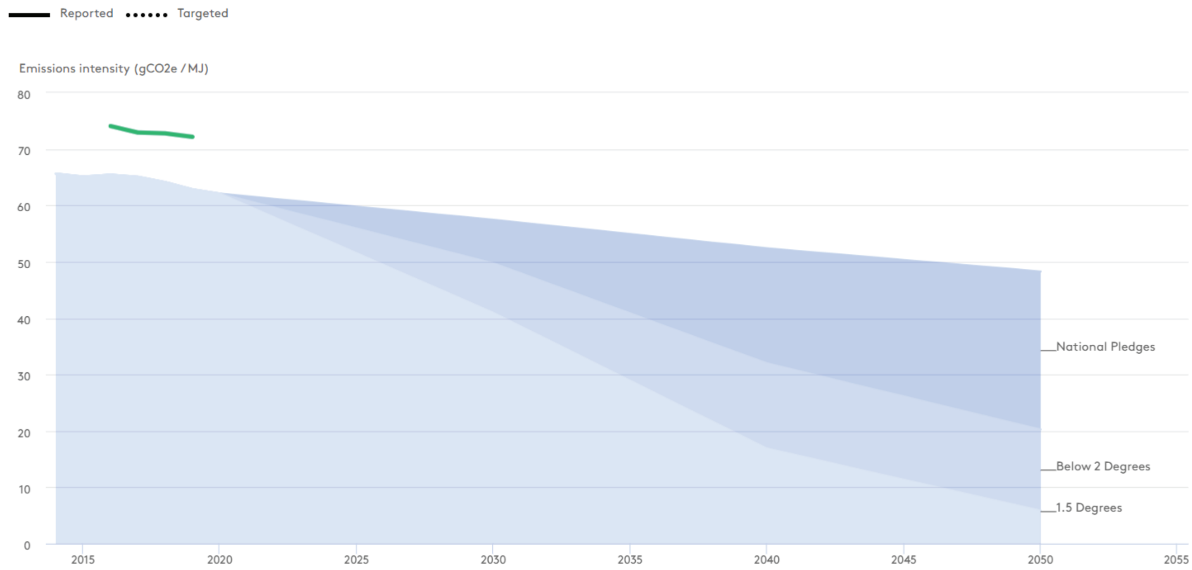

Figure 10: This figure shows an exemplary TPI CP pathway for Oil and Natural Gas from research cycle 2022.

Second, the forward-looking part of the pathway until 2050 is calculated based on companies' carbon emission reduction targets. Figures 11 and 12 illustrate how the forward-looking emission pathway of the same company, Eni, changed between RCs 2020 and 2021. For example, in the TPI research cycle 2020, Eni had set a target to reduce its carbon intensity to 29.46 gCO2e/MJ by 2050. In the TPI research cycle 2021, Eni had set a target to reach a carbon intensity of 0 gCO2e/MJ by 2050. The reduction of 29.46 gCO2e/MJ for Eni's targeted 2050 carbon intensity between TPI RCs 2020 and 2021 reflects the strengthened ambition of the company's new carbon emission reduction target. The carbon intensities between the year of the current intensities and the year for which a carbon emission reduction target was set are linearly interpolated. Similarly, in the rare cases where there are gaps between years of calculated historical intensities, the missing values are linearly interpolated.

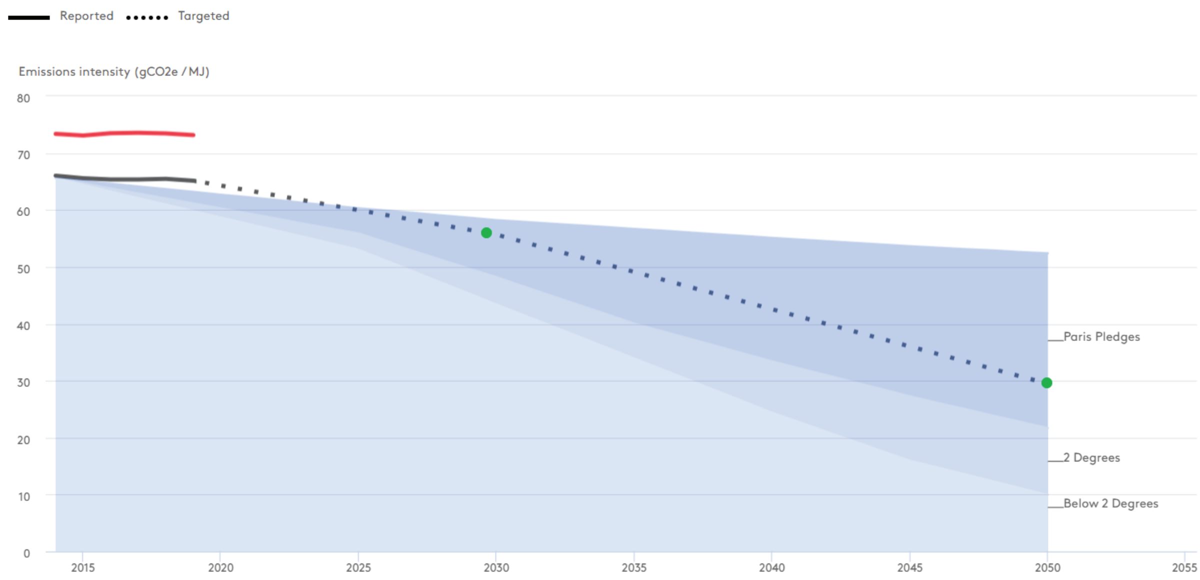

Figure 11: This figure shows an exemplary TPI CP pathway for Eni from research cycle 2020.

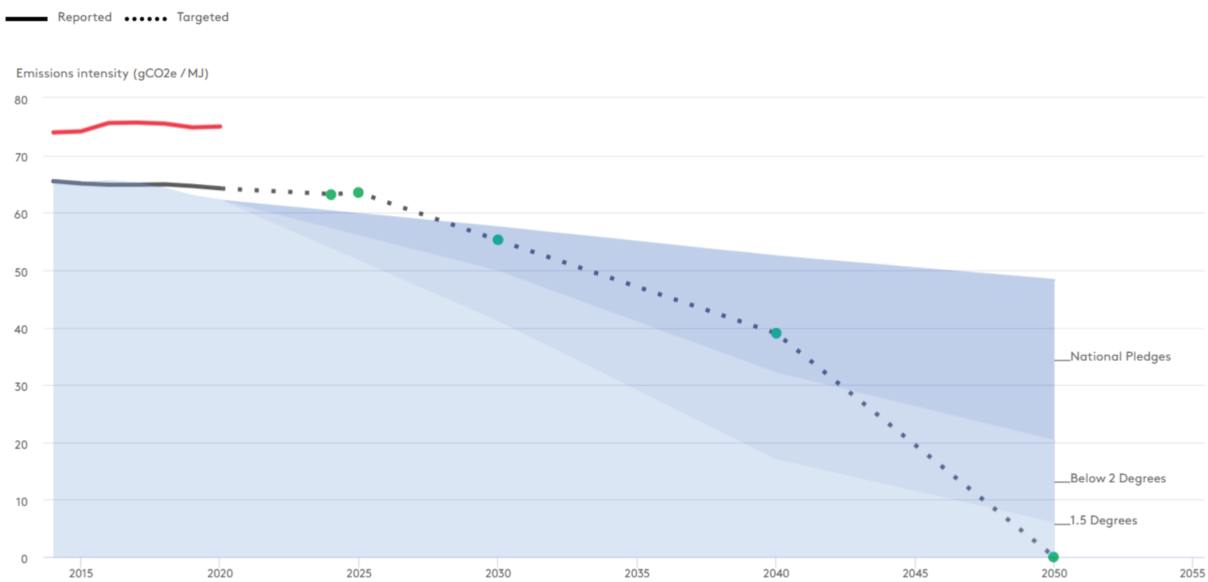

Figure 12: This figure shows an exemplary TPI CP pathway for Eni from research cycle 2021.

Data reliability in CP assessments is ensured through the TPI quality assurance process. Initially, a TPI analyst prepares the CP assessment, which is subsequently reviewed by another analyst not involved in the initial drafting. The assessments are then sent to the respective companies for feedback. Following a comprehensive analysis of the feedback and an additional internal review, the assessments are published on the TPI tool.

Figure 13 shows the data for CA100+ and Non-CA100+ companies from TPI's research cycle 2023. TPI's sector rules match the CA100+ sector definitions and rely on various GICS and ICB filter settings and additional manual company research. The goal of TPI's sector allocation is to ensure that companies from the same sector face similar challenges in the low-carbon transition.

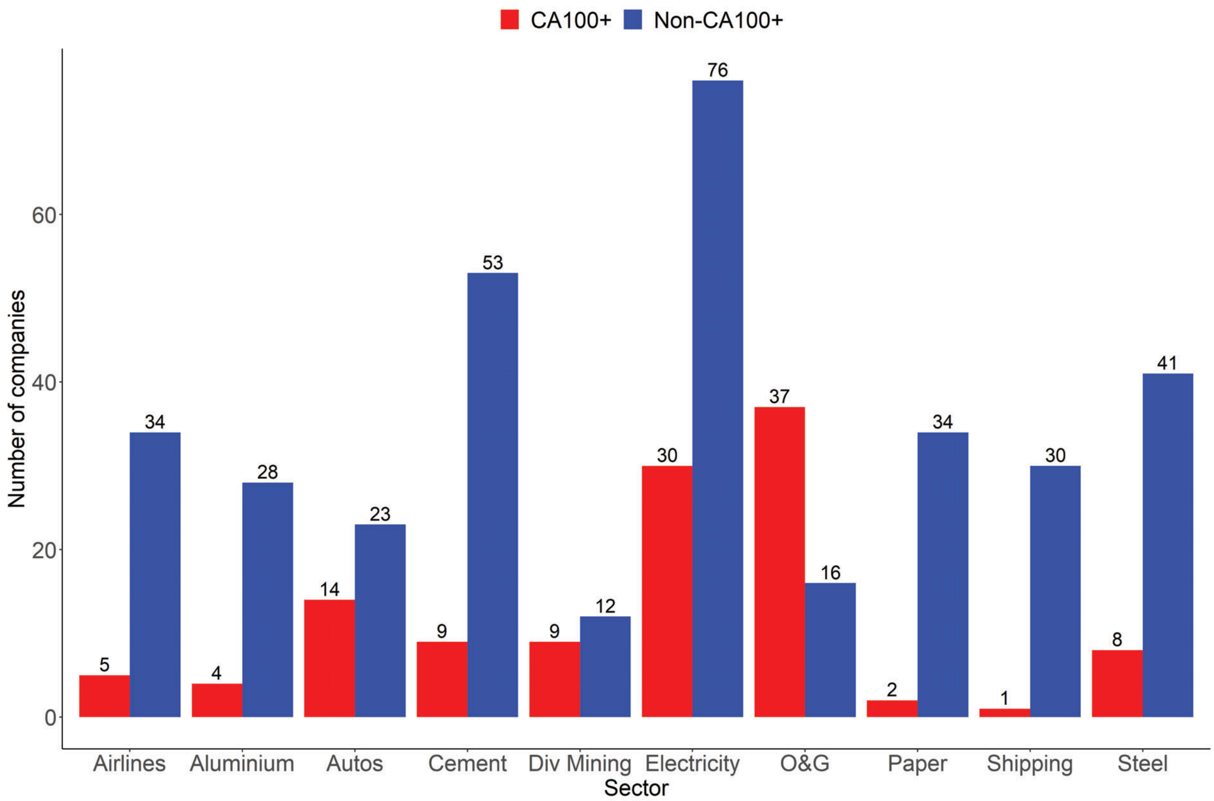

Figure 13: This figure shows the split of CA100+ and Non-CA100+ companies with available CP data by sector. CA100+ companies are highlighted in red, Non-CA100+ companies are highlighted in blue. Note that companies are counted more than once if they operate in multiple sectors.

Six CA100+ sectors, namely chemicals, coal, consumer goods, oil and gas distribution, other industrials and services, are not yet covered by TPI's assessments. Moreover, there are no more than four CA100+ companies in the aluminium, paper, and shipping sectors and the carbon intensities in the diversified mining sector are calculated starting only from 2016. Hence, the analysis of CA100+'s impact on companies' emission pathways is conducted for the six remaining sectors: airlines, automotives, cement, electricity, steel and oil and gas.

Table 12 shows the sample of companies with complete historical carbon intensity pathways from 2014 to 2022.

Sector	**CA100**	**Plus**	**Non-CA100+**	**Total**
Electricity	9	18	34	61
Autos	9	4	15	28
Oil and gas	22	5	13	40
Cement	1	4	9	14
Steel	4	3	13	20
Airlines	NA	5	15	20
Total	45	39	99	**183**

Table 12: This table shows the sample size for TPI companies with complete historical carbon intensity pathways by sector.

D Appendix - Methodological note on constructing new primary CP data

The goal of the new primary data collection is to replicate forward-looking emissions intensity pathways for companies prior to their initial assessment by TPI. However, since TPI was launched in 2017, the sectoral methodologies have undergone several revisions to enhance their robustness. Additionally, several companies experienced changes due to mergers, acquisitions and other factors affecting how TPI assessed them. This note outlines the potential impacts of such changes on the paper's analysis and explains which further adjustments were necessary to ensure the final database remains usable for the paper's analysis. These adjustments, affecting both existing CP assessments and new "historical" assessments, were discussed with and reviewed by the TPI team.

Aside from the notes below, the "historical" CP assessments follow the same methodologies and process as standard TPI assessments to ensure data quality. Initial drafts were prepared by a TPI analyst and reviewed by myself between May 2023 and May 2024. Although this study utilises pre-feedback data, the "historical" assessments will be sent to companies for feedback in the future.

Removals from the sample

I removed all companies that TPI stopped assessing during the research period from the sample. This decision primarily impacted Russian companies, as TPI discontinued assessments of Russian companies during research cycle 2022.

Extending the length of emission intensity pathways

During the early TPI RCs from 2017 to 2019, companies' forward-looking emission intensity pathways were calculated until 2030. However, in research cycle 2020, the assessments in all sectors were expanded to cover projections until 2050. Consequently, the early TPI CP assessments from RCs 2017 to 2019 do not allow for an evaluation of companies' carbon emission reduction targets beyond 2030. To enable this long term analysis, I prolonged the assessments for companies that had established targets reaching beyond 2030 in the early RCs, employing the following methodology:

1. I identified companies with 2030 targets in RCs 2017 to 2020.
2. I verified TPI internal assessments to confirm if these companies had set targets extending beyond 2030.

3. I adopted the targeted intensities beyond 2030 if already calculated in early TPI assessments. Otherwise, I calculated the targets myself in adherence to the TPI sectoral methodologies.

4. I conducted all new "historical" assessments with emission intensity pathways extending until 2050.

Completing carbon intensity pathways from previous research cycles

In some cases, companies began reporting historical carbon intensities after their initial assessments by TPI. For example, a company may have been assessed in research cycle 2017 as having "No or unsuitable disclosure", but then published sufficient information to calculate an emission intensity pathway from 2014 to 2019 in research cycle 2020. In such cases, I complete the pathways for research cycles 2017-2019 with the new carbon intensities that became available in research cycle 2020. I also complete historical carbon intensities with newly found information where available.

In cases where methodological changes by the company or TPI resulted in significant shifts in companies' pathways (see some sector-specific explanations below), I adjust the previously reported intensities to align with the new methodologies, assuming that the conversion ratio remained constant over time. For example, if a company reported intensities using an old methodology for 2015 and 2016 but changed its methodology in 2017, providing newly calculated historical intensities only for 2016, I assume that the 2016 conversion factor can also be applied to 2015. I apply the same approach if emissions intensities are available from either company disclosures or TPI calculations for all years, but available for both only for some years.

Automotive sector

The TPI automotive methodology uses gCO_2/km as the emission intensity metric. Initially, this intensity was based on the New European Driving Cycle (NEDC) test cycle. However, with the gradual phasing out of the NEDC test cycle in the European Union and other regions, TPI transitioned to the Worldwide harmonized Light vehicles (WLTP) test cycle in a methodology update during R 2022. The adoption of WLTP resulted in an upward adjustment of emission intensities for nearly all automotive companies, except for pure electric vehicle manufacturers. Since this transition affected both CA100+ and Non-CA100+ companies equally and at the same, it does not introduce bias into my analysis.

Additionally, Fiat Chrysler and Groupe PSA, two CA100+ companies, merged to form Stellantis in January 2021. TPI last assessed Fiat and PSA as separate entities in R 2021, after which it began assessing only Stellantis. To preserve a larger sample size, I include assessments for both Fiat Chrysler and Groupe PSA in my analysis. After R 2021, I applied Stellantis' carbon emission reduction targets to both Fiat Chrysler and Groupe PSA for consistency.

Airlines sector

TPI's methodology for airlines underwent significant changes between research cycle 2018 and 2019. The emission intensity metric shifted from gCO_2/Revenue-passenger-kilometer (RPK) to gCO_2/Revenue-tonne-kilometers (RTK) to include cargo in the assessments. Airlines assessed in research cycle 2018, the inaugural year of TPI's airline assessments, initially had their assessments in gCO_2/RPK and subsequently in gCO_2/RTK.

The change in the emission intensity metric caused substantial jumps the pathways of individual companies, such as from approximately 120 gCO_2/RPK to 650 gCO_2/RTK. To mitigate the impact of this methodological change, I converted the gCO_2/RPK pathways into gCO_2/RTK pathways using TPI's conversion factor of 150 kilograms per passenger. In research cycle 2020, TPI updated the conversion factor for RPK to RTK from 150kg per person to 95kg per person. Therefore, I converted all assessments from RCs prior to 2020 again using the updated conversion factor. Starting from R 2021, the airline assessments are used as available in the TPI database.

Cement sector

TPI assessments use intensities reported in tCO_2/t cementitious products to enable accurate comparisons with the TPI decarbonisation benchmarks. This metric was introduced by the Cement Sustainability Initiative, the precursor of the Global Cement and Concrete Association, in 2011. Before TPI was established, a significantly higher number of companies reported their carbon footprints in tCO_2/t cement. Since this study does not rely on comparisons with TPI decarbonisation benchmarks, and given the minor differences between the two metrics (approximately 1% globally), I also use reported tCO_2/t cement for historical assessments.

Oil and Gas sector

TPI assessments in the oil and gas sector include Scope 1, 2, and 3 (category 11) emissions. While Scope 3 (category 11) emissions are calculated by TPI based on a company's sold products, Scope 1 and 2 emissions are sourced from company disclosures. If a company does not report its Scope 1 and 2 emissions, TPI does not publish historical carbon intensities. For companies where Scope 3 (category 11) emissions can be calculated and Scope 1 and 2 emissions were disclosed for most but not all years, I apply the company-specific Scope 1&2 relative to Scope 3 emission intensity ratio to obtain carbon intensities for the remaining years.

E Appendix - DiD results on climate-related and TCFD reporting

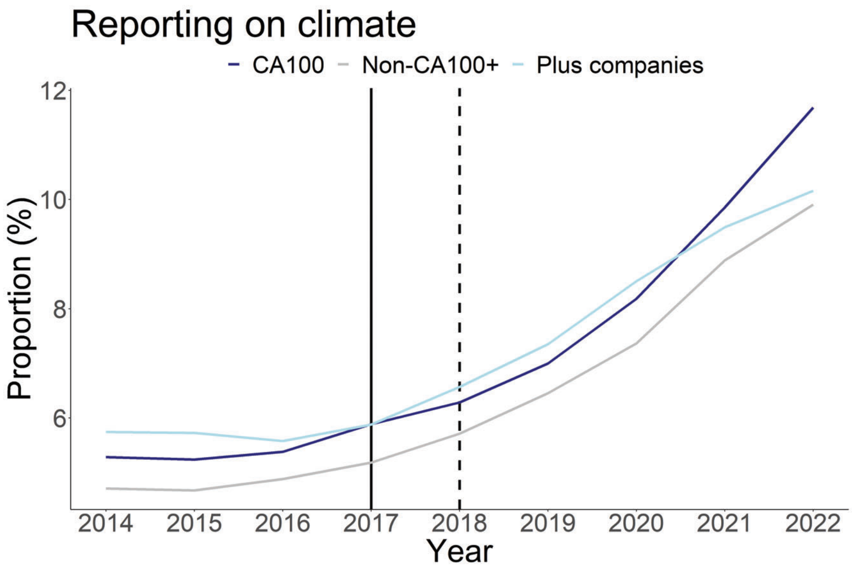

Figure 14: This figure shows the pre- and post-treatment trends on climate-related reporting across CA100, Plus and Non-CA100+ companies for each year.

	CA100	Plus
DiD	0.35	−0.12
	(0.48)	(0.43)
Num. obs.	3,141	2,871
R^2	0.74	0.76
Adj. R^2	0.71	0.73

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 13: This table shows the results of the DiD analysis on climate-related reporting, comparing the CA100 and the Plus companies to Non-CA100+ companies.

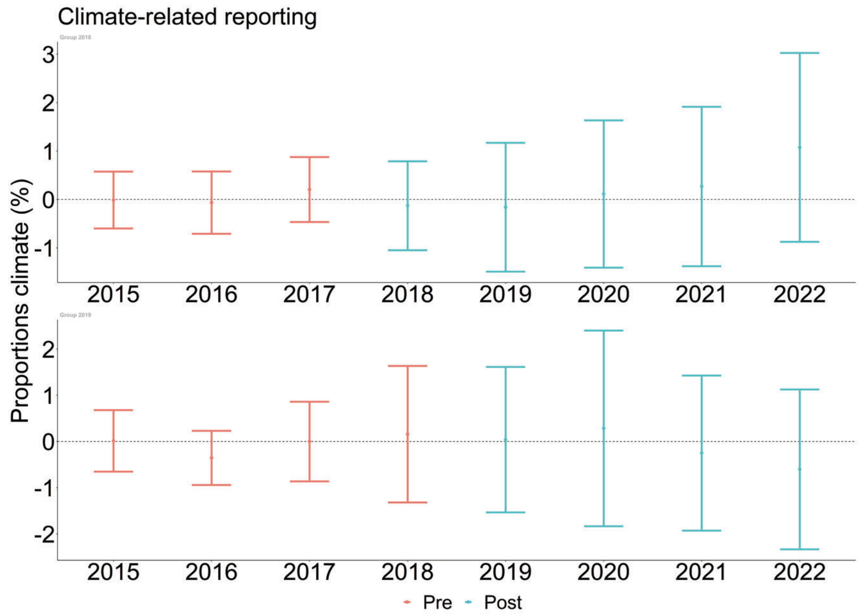

Figure 15: This figure shows the dynamic treatment effect of CA100+ on CA100 and Plus companies' climate-related reporting using a staggered DiD specification.

For risk-related reporting, the DiD results indicate a significant positive effect, in particular for the CA100 companies. However, risk-related reporting comprises only 1% of companies' total ARs, as shown in Figure 2. Moreover, this effect is neither significant in the staggered DiD results nor consistently robust after conducting the checks in Section 7.2.

	Governance	Strategy	Risk	Metrics & Targets
DiD	0.06	-0.13	0.08^{*}	0.13
	(0.04)	(0.24)	(0.04)	(0.09)
Num. obs.	3,618	3,618	3,618	3,618
R^2	0.65	0.75	0.59	0.67
Adj. R^2	0.60	0.71	0.54	0.63

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 14: This table shows the results of the DiD analysis on TCFD reporting, comparing the CA100+ to Non-CA100+ companies.

Figure 16: This figure shows the pre- and post-treatment trends on reporting on the four TCFD categories across the CA100+ and Non-CA100+ companies for each year.

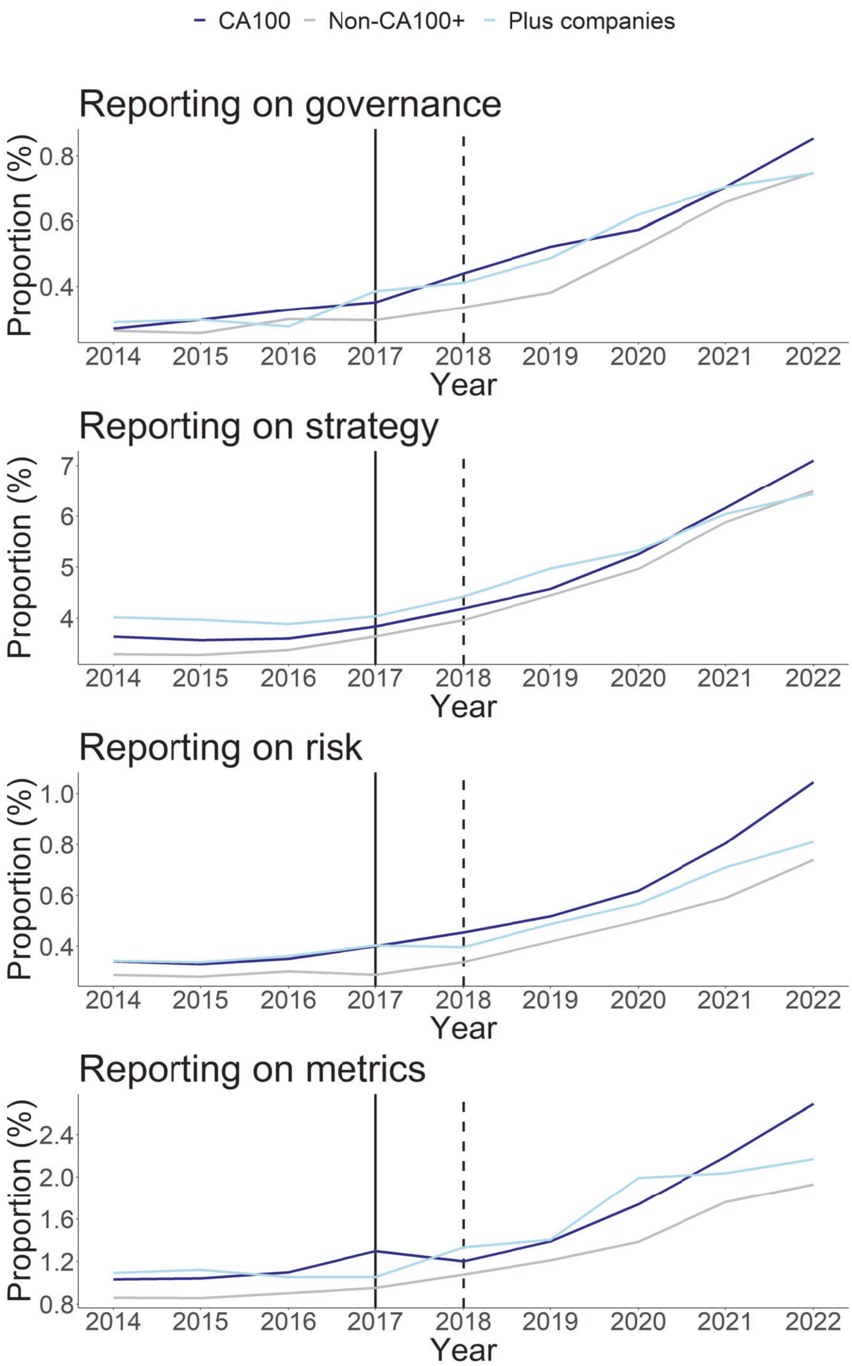

Figure 17: This figure shows the pre- and post-treatment trends on reporting on the four TCFD categories across CA100, Plus and Non-CA100+ companies for each year.

	Governance	Strategy	Risk	Metrics & Targets
DiD	0.06	0.00	0.11^{**}	0.18
	(0.05)	(0.31)	(0.05)	(0.12)
Num. obs.	3,141	3,141	3,141	3,141
R^2	0.65	0.73	0.60	0.70
Adj. R^2	0.61	0.70	0.55	0.66

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 15: This table shows the results of the DiD analysis on TCFD reporting, comparing the CA100 to Non-CA100+ companies.

	Governance	Strategy	Risk	Metrics & Targets
DiD	0.03	−0.29	0.01	0.13
	(0.06)	(0.28)	(0.05)	(0.13)
Num. obs.	2,871	2,871	2,871	2,871
R^2	0.64	0.76	0.59	0.69
Adj. R^2	0.60	0.73	0.54	0.64

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 16: This table shows the results of the DiD analysis on TCFD reporting, comparing the Plus to Non-CA100+ companies.

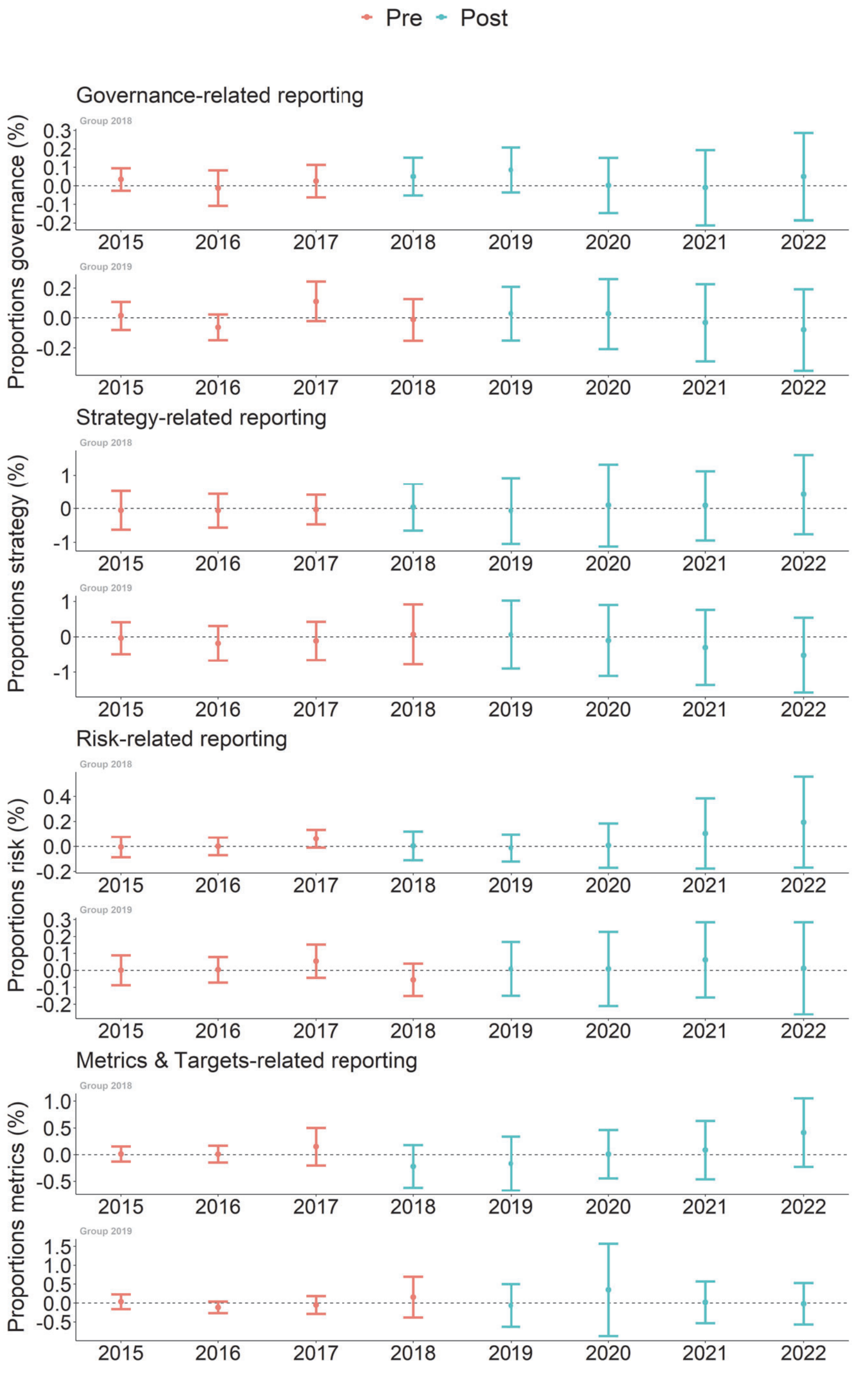

Figure 18: This figure shows the dynamic treatment effect of CA100+ on CA100 and Plus companies' reporting on the four TCFD categories using a staggered DiD specification.

F Appendix - DiD results on historical carbon intensities

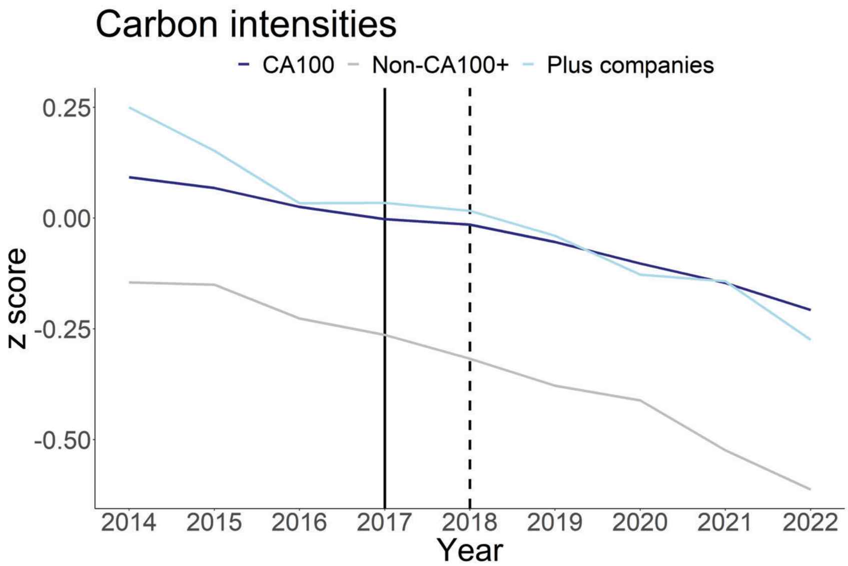

Figure 19: This figure shows the pre- and post-treatment trends on carbon intensities across CA100, Plus and Non-CA100+ companies for each year.

	CA100	Plus
DiD	0.09*	−0.02
	(0.05)	(0.08)
Num. obs.	1,185	1,060
R^2	0.94	0.93
Adj. R^2	0.93	0.92

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 17: This table shows the results of the DiD analysis on carbon intensities, comparing the CA100 and the Plus companies to Non-CA100+ companies.

The DiD results show a significant positive effect of CA100+ on the carbon intensities of CA100 companies. This would indicate that CA100+ engagement increased the carbon intensities of this subgroup. However, the effect is neither significant in the staggered DiD results nor consistently robust after conducting the checks in Section 7.2.

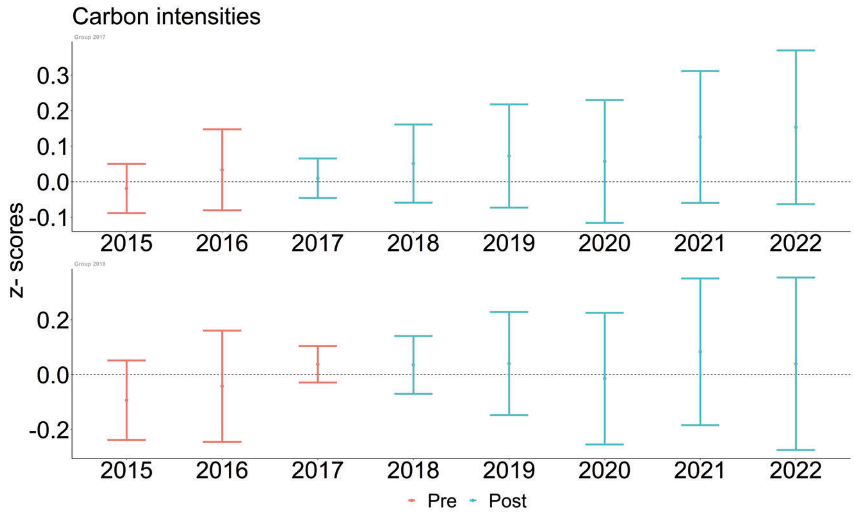

Figure 20: This figure shows the pre- and post-treatment trends on carbon intensities between 2014 and 2022 across CA100, Plus and Non-CA100+ companies for each year.

G Appendix - CDP responses

CDP questionnaires allow companies to disclose relevant information which will then be made public on the CDP website. Since 2018, the CDP climate questionnaire is aligned with the TCFD recommendations. Yet, even previous versions required companies to broadly disclose information on the four TCFD categories. Therefore, I employ a binary metric indicating whether companies report to CDP as an indirect measure of their disclosures' alignment with TCFD guidelines in the pre- and post-treatment periods.

A more granular analysis was tested to assess whether companies respond to specific questions that address the four TCFD themes in the CDP questionnaires. However, it appears that companies that decide to participate in the CDP process largely address most or all questions. While the quality of the responses may vary, measuring companies' decision to disclose information on a question level does not add much value compared to a binary assessment of whether companies submit their CDP questionnaire or not.

As for the ClimateBERT-TCFD analysis, I use the TPI companies as my baseline universe. Since the CDP datasets prior to 2018 do not include companies that were contacted by CDP but chose not to respond, I manually collect the data on which TPI companies decided to opt-out from the CDP website for the period 2016 to 2022.[20] Since CDP questionnaires usually reflect the disclosures of the previous year, this period effectively spans from 2015 to 2021.

After excluding companies that were not contacted by CDP in each year, I retain a sample of 70 CA100, 44 Plus and 246 Non-CA100+ companies. Figure 21 shows that treated companies were considerably more responsive to CDP before and after the launch of CA100+. Moreover, it appears that CDP reporting increased in the Non-CA100+ group but decreased slightly among the CA100 and remained largely stable among the Plus companies.

[20] CDP's outreach to companies was considerably less extensive prior to 2016.

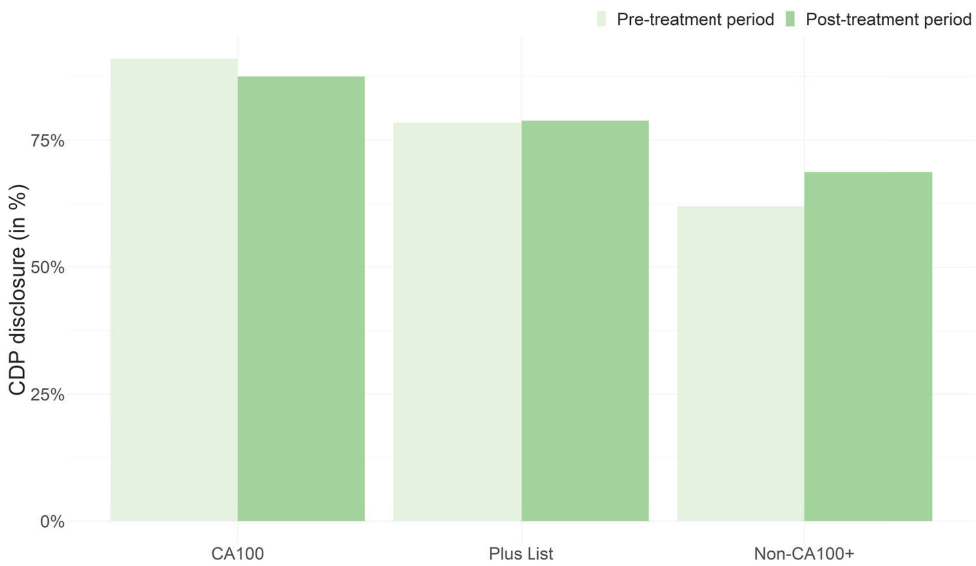

Figure 21: This figure shows the share of CA100, Plus and Non-CA100+ companies responding to CDP in the pre- and post-treatment periods.

	CA100+
DiD	−0.02
	(0.02)
Num. obs.	724
R^2	0.90
Adj. R^2	0.79

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 18: This table shows the results of the binned DiD analysis on CDP responses, comparing the CA100+ to Non-CA100+ companies.

H Appendix - Carbon Intensity disclosure

For the CI disclosure analysis, all TPI companies with historical assessments are included, even those without carbon intensity observations in the pre- or post-treatment periods, which are assigned a value of 0%. The assessed period covers the years from 2014 to 2022. Figure 22 presents the average CI disclosure across the CA100, Plus, and Non-CA100+ groups.

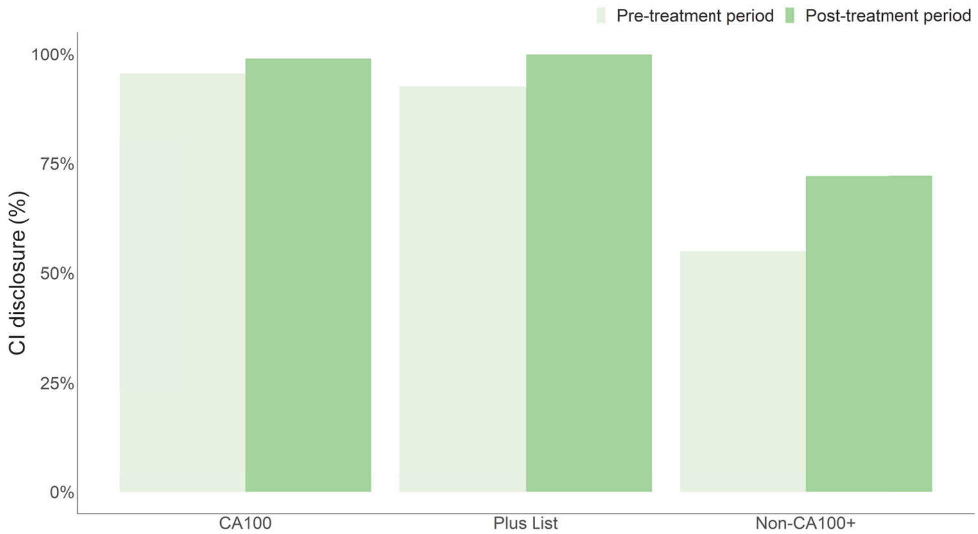

Figure 22: This figure shows the average carbon intensity disclosure across the CA100, Plus and Non-CA100+ groups in the pre- and post-treatment periods.

	CA100+
DiD	0.05***
	(0.02)
Num. obs.	610
R^2	0.89
Adj. R^2	0.78

***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

Table 19: This table shows the results of the binned DiD analysis on CI dislosure, comparing the CA100+ to Non-CA100+ companies.

I Appendix - Climate Change Performance Index (CCPI) data

The CCPI data were sourced from CCPI annual reports available for download on the Climate Change Performance Index (2023) website. The CCPI rating aggregates scores from four main categories: greenhouse gas emissions (40%), renewable energy deployment (20%), energy use efficiency (20%), and climate policy (20%). Within these categories, the CCPI assesses 14 indicators in total. The final score ranges from 0 to 100%.

The CCPI covers approximately sixty countries, with slight variations in coverage by year. To address minor data gaps for countries where included companies are headquartered but lack CCPI ratings, the following assumptions were made:

1. Values from China were used for Hong Kong.
2. For Singapore, data is available until 2016, and its index evolution post-2016 is assumed to match Malaysia's.
3. The United Arab Emirates have no data before 2023; its index is assumed to evolve similarly to Saudi Arabia's.
4. Qatar's indices are assumed to mirror the UAE's.
5. Nigeria's evolution until 2023 mirrors South Africa's.
6. Chile mirrors Brazil's index evolution until 2019.
7. Colombia mirrors Brazil's index evolution until 2021.
8. The EU's evolution is assumed to be the average of all European countries in the sample until 2017.

These assumptions affect only one company each from Chile, Colombia, Hong Kong, Nigeria, Singapore and the United Arab Emirates, and two companies from the European Union. For most companies, complete time series data from CCPI are available.

Table 20 shows the final CCPI data used for the robustness checks.

Table 20: Climate Change Performance Index (CCPI) Scores by Country (2013-2023)

Country	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Australia	41.53	35.57	36.56	40.66	25.03	31.27	30.75	28.82	30.06	36.26	45.72
Austria	57.19	55.39	50.69	52.00	49.49	48.78	44.74	48.09	52.35	51.56	58.17
Belgium	64.65	61.89	68.73	62.08	49.60	50.63	45.73	45.11	45.90	48.38	55.00
Brazil	55.53	48.51	51.90	52.46	57.86	59.29	55.82	53.26	54.86	48.39	61.74
Canada	40.39	38.81	38.74	43.06	33.98	34.26	31.01	24.82	26.03	26.47	31.55
Chile	62.55	54.65	58.46	59.10	65.18	66.79	62.88	64.05	69.51	69.54	68.74
China	52.41	51.77	48.60	47.49	45.84	49.60	48.16	48.18	52.20	38.80	45.56
Colombia	58.58	51.17	54.75	55.34	61.03	62.54	58.88	56.18	57.87	54.50	58.68
Czechia	53.93	57.99	57.03	58.52	45.13	49.72	42.93	38.98	42.15	44.16	45.41
Denmark	75.23	77.76	71.19	61.87	59.49	61.96	71.14	69.42	76.67	79.61	75.59
EU	65.21	65.05	63.90	62.25	56.89	60.65	55.82	57.29	59.21	59.96	64.71
Finland	56.57	56.76	58.27	56.28	66.55	62.61	63.25	62.63	62.41	61.24	61.11
France	65.90	64.11	65.97	66.17	59.80	59.30	57.90	53.72	61.01	52.97	57.12
Germany	61.90	59.60	58.39	56.58	56.58	55.18	55.78	56.39	63.53	61.11	65.77
Hong Kong	52.41	51.77	48.60	47.49	45.84	49.60	48.16	48.18	52.20	38.80	45.56
India	57.16	56.97	58.19	59.08	60.02	62.93	66.02	63.98	69.20	67.35	70.25
Indonesia	56.24	59.57	58.21	58.86	48.94	48.68	44.65	53.59	57.17	54.59	57.20
Ireland	65.01	65.15	62.65	59.02	38.74	40.84	44.04	45.47	47.86	48.47	51.42
Italy	62.90	61.75	62.98	60.72	59.65	58.69	53.92	53.05	55.39	52.90	50.60
Japan	47.21	45.07	37.23	35.93	35.76	40.63	39.03	42.49	48.53	40.85	42.08
Malaysia	47.06	46.84	53.49	50.96	32.61	38.08	34.21	27.76	33.74	33.51	38.57
Mexico	61.5	61.3	57.04	57.02	54.77	56.82	47.01	48.76	56.05	51.77	55.81
Netherlands	56.99	53.27	54.84	57.1	49.49	54.11	50.89	50.96	60.44	62.24	69.98
New Zealand	53.49	52.56	52.41	50.48	49.57	44.61	45.67	51.3	54.03	50.55	57.66
Nigeria	69.70	70.46	69.34	72.44	52.38	62.23	58.90	59.49	65.94	58.93	63.88
Norway	59.32	57.88	54.65	52.9	67.99	62.8	61.14	65.45	73.29	64.47	67.48
Poland	52.69	54.36	56.09	53.68	46.53	47.59	39.98	38.94	40.63	37.94	44.4
Portugal	68.38	67.26	59.52	62.47	59.16	60.54	54.1	56.8	61.11	61.55	67.39
Saudi Arabia	25.17	24.19	21.08	25.45	11.2	8.82	22.03	22.46	24.25	22.41	19.33
Singapore	50.32	47.27	42.81	43.97	28.14	32.85	29.52	23.95	29.11	28.91	33.28
South Africa	54.04	54.63	53.76	56.17	40.61	48.25	45.67	46.13	51.13	45.69	49.53
South Korea	46.66	44.15	37.64	38.11	25.01	28.53	26.75	29.76	26.74	24.91	29.98
Spain	60.37	57.34	52.63	56.14	48.19	48.97	46.03	45.02	54.35	58.59	63.37
Sweden	68.1	71.44	69.91	66.15	74.32	76.28	75.77	74.42	74.22	73.28	69.39
Switzerland	66.17	65.05	62.09	61.66	61.2	65.42	60.61	60.85	61.7	58.61	61.94
Taiwan	46.81	45.03	45.45	44.76	29.43	28.8	23.33	27.11	30.7	28.35	36.94
Thailand	54.51	50.61	48.16	51.91	49.07	48.71	46.76	53.18	55.01	47.23	61.38
Turkey	46.47	46.95	47.25	45.54	41.02	40.22	40.76	43.47	50.53	43.32	43.82
UAE	31.97	30.72	26.77	32.32	14.22	11.20	27.98	28.53	30.79	28.46	24.55
UK	69.66	70.79	70.13	66.1	66.79	65.92	69.8	69.66	73.09	63.07	62.336
USA	52.93	52.33	54.91	51.04	25.86	18.82	18.6	19.75	37.39	38.53	42.79

J Appendix - Robustness checks regarding varying regulatory environments

	CA100+
DiD	0.17
	(0.35)
CCPI	0.05^{***}
	(0.01)
Num. obs.	3,618
R^2	0.75
Adj. R^2	0.72

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 21: This table shows the results of the DiD analysis on climate-related reporting including CCPI, comparing the CA100+ to Non-CA100+ companies.

	CA100	Plus
DiD	0.30	−0.00
	(0.47)	(0.40)
CCPI	0.05^{***}	0.05^{***}
	(0.01)	(0.01)
Num. obs.	3,141	2,871
R^2	0.75	0.77
Adj. R^2	0.71	0.74

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 22: This table shows the results of the DiD analysis on climate-related reporting including CCPI scores, comparing the CA100 and the Plus companies to Non-CA100+ companies.

	CA100+
DiD	-0.07
	(0.38)
Num. obs.	$1,260$
R^2	0.73
Adj. R^2	0.70

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 23: This table shows the results of the DiD analysis on climate-related reporting, comparing the CA100+ to Non-CA100+ companies within North America.

	CA100	Plus
DiD	-0.11	0.20
	(0.52)	(0.47)
Num. obs.	$1,062$	$1,026$
R^2	0.74	0.76
Adj. R^2	0.70	0.73

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 24: This table shows the results of the DiD analysis on climate-related reporting, comparing the CA100 and the Plus companies to Non-CA100+ companies within North America.

	Governance	Strategy	Risk	Metrics & Targets
DiD	0.06	-0.11	0.08^{**}	0.14
	(0.04)	(0.23)	(0.04)	(0.09)
CCPI	0.00^{***}	0.03^{***}	0.00^{***}	0.01^{***}
	(0.00)	(0.01)	(0.00)	(0.00)
Num. obs.	$3,618$	$3,618$	$3,618$	$3,618$
R^2	0.65	0.75	0.60	0.67
Adj. R^2	0.61	0.72	0.54	0.63

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 25: This table shows the results of the DiD analysis on TCFD reporting including CCPI scores, comparing the CA100+ to Non-CA100+ companies.

	Governance	Strategy	Risk	Metrics & Targets
DiD	0.02	−0.21	0.02	0.10
	(0.03)	(0.24)	(0.03)	(0.14)
Num. obs.	1,260	1,260	1,260	1,260
R^2	0.34	0.76	0.66	0.55
Adj. R^2	0.25	0.73	0.62	0.49

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 26: This table shows the results of the DiD analysis on TCFD reporting, comparing the CA100+ to Non-CA100+ companies within North America.

	Governance	Strategy	Risk	Metrics & Targets
DiD	0.06	−0.03	0.11**	0.17
	(0.05)	(0.30)	(0.05)	(0.12)
CCPI	0.00***	0.03***	0.00***	0.01***
	(0.00)	(0.01)	(0.00)	(0.00)
Num. obs.	3,141	3,141	3,141	3,141
R^2	0.65	0.74	0.60	0.70
Adj. R^2	0.61	0.70	0.55	0.66

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 27: This table shows the results of the DiD analysis on TCFD reporting including CCPI scores, comparing the CA100 to Non-CA100+ companies.

	Governance	Strategy	Risk	Metrics & Targets
DiD	0.04	−0.21	0.02	0.15
	(0.06)	(0.26)	(0.05)	(0.12)
CCPI	0.00***	0.03***	0.00***	0.01***
	(0.00)	(0.01)	(0.00)	(0.00)
Num. obs.	2,871	2,871	2,871	2,871
R^2	0.64	0.77	0.59	0.69
Adj. R^2	0.60	0.74	0.54	0.65

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 28: This table shows the results of the DiD analysis on TCFD reporting including CCPI scores, comparing the Plus to Non-CA100+ companies.

	Governance	Strategy	Risk	Metrics & Targets
DiD	-0.00	-0.27	0.06	0.11
	(0.04)	(0.32)	(0.03)	(0.19)
Num. obs.	1,062	1,062	1,062	1,062
R^2	0.33	0.74	0.66	0.64
Adj. R^2	0.24	0.71	0.61	0.60

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 29: This table shows the results of the DiD analysis on TCFD reporting, comparing the CA100 to Non-CA100+ companies within North America.

	Governance	Strategy	Risk	Metrics & Targets
DiD	0.06	-0.03	-0.01	0.18
	(0.05)	(0.29)	(0.04)	(0.21)
Num. obs.	1,026	1,026	1,026	1,026
R^2	0.33	0.78	0.68	0.57
Adj. R^2	0.24	0.75	0.63	0.52

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 30: This table shows the results of the DiD analysis on TCFD reporting, comparing the Plus to Non-CA100+ companies within North America.

	CA100+
DiD	0.06
	(0.05)
CCPI	0.00
	(0.00)
Num. obs.	1,491
R^2	0.93
Adj. R^2	0.92

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 31: This table shows the results of the DiD analysis on carbon intensities including CCPI, comparing the CA100+ to Non-CA100+ companies.

	CA100+
DiD	0.08
	(0.10)
Num. obs.	503
R^2	0.92
Adj. R^2	0.91

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 32: This table shows the results of the DiD analysis on carbon intensities, comparing the CA100+ to Non-CA100+ companies within North America.

	CA100	Plus
DiD	0.09	0.02
	(0.05)	(0.08)
CCPI	−0.00	−0.00
	(0.00)	−0.00
Num. obs.	1,185	1,060
R^2	0.94	0.93
Adj. R^2	0.93	0.92

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 33: This table shows the results of the DiD analysis on carbon intensities including CCPI, comparing the CA100 and the Plus companies to Non-CA100+ companies.

	CA100	Plus
DiD	0.11	0.03
	(0.09)	(0.16)
Num. obs.	404	350
R^2	0.93	0.92
Adj. R^2	0.92	0.90

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 34: This table shows the results of the DiD analysis on carbon intensities, comparing the CA100 and the Plus companies to Non-CA100+ companies within North America.

	TY 2025	TY 2035	TY 2050
DiD	-0.03	-0.25^{**}	-0.60^{**}
	(0.07)	(0.12)	(0.23)
CCPI	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.01)
Num. obs.	1,480	1,480	1,480
R^2	0.89	0.75	0.61
Adj. R^2	0.87	0.72	0.56

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 35: This table shows the results of the DiD analysis on target-year-specific forward-looking carbon intensities (in z-scores) including CCPI scores, comparing the CA100+ to Non-CA100+ companies.

	TY 2025	TY 2035	TY 2050
DiD	-0.12	-0.31	-0.61^{*}
	(0.13)	(0.19)	(0.31)
Num. obs.	484	484	484
R^2	0.84	0.67	0.56
Adj. R^2	0.82	0.62	0.49

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 36: This table shows the results of the DiD analysis on target-year-specific forward-looking carbon intensities (in z-scores), comparing the CA100+ to Non-CA100+ companies within North America.

K Appendix - Robustness check regarding varying sectoral dynamics

	CA100+
DiD	-1.16
	(1.22)
Num. obs.	612
R^2	0.63
Adj. R^2	0.58

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 37: This table shows the results of the DiD analysis on climate-related reporting, comparing the CA100+ to Non-CA100+ companies within the electricity sector.

	CA100+
DiD	-0.92
	(1.14)
CCPI	0.09^{**}
	(0.04)
Num. obs.	612
R^2	0.64
Adj. R^2	0.59

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 38: This table shows the results of the DiD analysis on climate-related reporting including CCPI scores, comparing the CA100+ to Non-CA100+ companies within the electricity sector.

	CA100	Plus
DiD	0.71	−1.65
	(2.21)	(1.16)
Num. obs.	468	531
R^2	0.63	0.65
Adj. R^2	0.57	0.59

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 39: This table shows the results of the DiD analysis on climate-related reporting, comparing the CA100 and the Plus companies to Non-CA100+ companies within the electricity sector.

	CA100	Plus
DiD	1.03	−1.48
	(2.07)	(1.04)
CCPI	0.11^{**}	0.09^{**}
	(0.04)	(0.04)
Num. obs.	468	531
R^2	0.64	0.66
Adj. R^2	0.58	0.61

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 40: This table shows the results of the DiD analysis on climate-related reporting including CCPI scores, comparing the CA100 and the Plus companies to Non-CA100+ companies within the electricity sector.

	Governance	Strategy	Risk	Metrics & Targets
DiD	0.05	−1.06	0.11	−0.27
	(0.11)	(0.84)	(0.13)	(0.29)
Num. obs.	612	612	612	612
R^2	0.60	0.61	0.56	0.63
Adj. R^2	0.54	0.55	0.49	0.58

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 41: This table shows the results of the DiD analysis on TCFD reporting, comparing the CA100+ to Non-CA100+ companies within the electricity sector.

	Governance	Strategy	Risk	Metrics & Targets
DiD	0.07	−0.89	0.12	−0.22
	(0.11)	(0.80)	(0.12)	(0.27)
CCPI	0.01**	0.06**	0.01**	0.02**
	(0.00)	(0.03)	(0.00)	(0.01)
Num. obs.	612	612	612	612
R^2	0.60	0.62	0.56	0.64
Adj. R^2	0.55	0.56	0.49	0.58

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 42: This table shows the results of the DiD analysis on TCFD reporting including CCPI scores, comparing the CA100+ to Non-CA100+ companies within the electricity sector.

	Governance	Strategy	Risk	Metrics & Targets
DiD	0.03	0.23	0.34	0.11
	(0.18)	(1.57)	(0.27)	(0.44)
Num. obs.	468	468	468	468
R^2	0.59	0.59	0.57	0.65
Adj. R^2	0.53	0.53	0.51	0.60

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 43: This table shows the results of the DiD analysis on TCFD reporting, comparing the CA100 to Non-CA100+ companies within the electricity sector.

	Governance	Strategy	Risk	Metrics & Targets
DiD	0.06	0.45	0.36	0.17
	(0.17)	(1.52)	(0.26)	(0.41)
CCPI	0.01**	0.07**	0.00	0.02**
	(0.00)	(0.03)	(0.00)	(0.01)
Num. obs.	468	468	468	468
R^2	0.60	0.60	0.57	0.66
Adj. R^2	0.54	0.54	0.51	0.60

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 44: This table shows the results of the DiD analysis on TCFD reporting including the CCPI scores, comparing the CA100 to Non-CA100+ companies within the electricity sector.

	Governance	Strategy	Risk	Metrics & Targets
DiD	0.05	−1.31	−0.05	−0.34
	(0.15)	(0.75)	(0.11)	(0.33)
Num. obs.	531	531	531	531
R^2	0.58	0.64	0.56	0.64
Adj. R^2	0.52	0.58	0.50	0.58

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 45: This table shows the results of the DiD analysis on TCFD reporting, comparing the Plus to Non-CA100+ companies within the electricity sector.

	Governance	Strategy	Risk	Metrics & Targets
DiD	0.06	−1.20	−0.04	−0.31
	(0.15)	(0.68)	(0.11)	(0.31)
CCPI	0.01**	0.06**	0.01**	0.02
	(0.00)	(0.03)	(0.00)	(0.01)
Num. obs.	531	531	531	531
R^2	0.58	0.65	0.57	0.64
Adj. R^2	0.52	0.59	0.50	0.59

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 46: This table shows the results of the DiD analysis on TCFD reporting including the CCPI scores, comparing the Plus to Non-CA100+ companies within the electricity sector.

	CA100+
DiD	0.02
	(0.10)
Num. obs.	548
R^2	0.94
Adj. R^2	0.93

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 47: This table shows the results of the DiD analysis on carbon intensities, comparing the CA100+ to Non-CA100+ companies within the electricity sector.

	CA100+
DiD	0.02
	(0.10)
CCPI	0.00
	(0.00)
Num. obs.	548
R^2	0.94
Adj. R^2	0.93

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 48: This table shows the results of the DiD analysis on carbon intensities including CCPI scores, comparing the CA100+ to Non-CA100+ companies within the electricity sector.

	CA100	Plus
DiD	−0.09	0.10
	(0.11)	(0.12)
Num. obs.	386	467
R^2	0.93	0.94
Adj. R^2	0.92	0.93

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 49: This table shows the results of the DiD analysis on carbon intensities, comparing the CA100 and the Plus companies to Non-CA100+ companies within the electricity sector.

	CA100	Plus
DiD	−0.09	0.10
	(0.11)	(0.12)
CCPI	0.00	0.00
	(0.00)	(0.00)
Num. obs.	386	467
R^2	0.93	0.94
Adj. R^2	0.92	0.93

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 50: This table shows the results of the DiD analysis on carbon intensities including the CCPI scores, comparing the CA100 and the Plus companies to Non-CA100+ companies within the electricity sector.

	TY 2025	TY 2035	TY 2050
DiD	-0.09	-0.23^{*}	-0.35^{**}
	(0.11)	(0.13)	(0.16)
Num. obs.	564	564	564
R^2	0.90	0.81	0.71
Adj. R^2	0.88	0.78	0.67

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 51: This table shows the results of the DiD analysis on target-year-specific forward-looking carbon intensities (in z-scores), comparing the CA100+ to Non-CA100+ companies from the electricity sector.

	TY 2025	TY 2035	TY 2050
DiD	-0.08	-0.20	-0.31^{**}
	(0.11)	(0.13)	(0.16)
CCPI	0.00	0.01^{*}	0.01^{**}
	(0.00)	(0.00)	(0.00)
Num. obs.	564	564	564
R^2	0.90	0.81	0.72
Adj. R^2	0.89	0.78	0.68

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 52: This table shows the results of the DiD analysis on target-year-specific forward-looking carbon intensities (in z-scores) including CCPI scores, comparing the CA100+ to Non-CA100+ companies from the electricity sector.

	CA100			Plus		
	TY: 2025	TY: 2035	TY: 2050	TY: 2025	TY: 2035	TY: 2050
DiD	-0.15	-0.13	-0.15	-0.05	-0.29^{*}	-0.48^{**}
	(0.14)	(0.18)	(0.23)	(0.14)	(0.17)	(0.17)
CCPI	0.00	0.00	0.01	-0.00	-0.01^{*}	-0.01^{**}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Num. obs.	402	402	402	476	476	476
R^2	0.89	0.82	0.72	0.89	0.79	0.71
Adj. R^2	0.88	0.79	0.67	0.88	0.79	0.66

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 53: This table shows the results of the DiD including CCPI conducted for the CA100 and Plus analyses within the electricity sector using z-scores.