A DYNAMIC, SURVIVORSHIP BIAS-FREE VIEW ON SCIENCE-BASED TARGETS: RESEARCH OPPORTUNITIES CONCERNING PRIVATE AND LISTED FIRMS

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ABSTRACT

The Science-Based Targets initiative (SBTi) presents numerous research opportunities, though empirical-archival studies remain scarce due to data access limitations. This chapter introduces a comprehensive, survivorship bias-free dataset of firms committed to or having set Science-Based Targets (SBTs), constructed from monthly snapshots of the SBTi dashboard (2015–2024) via the Internet Archive (Wayback Machine). This dataset, matched with S&P Capital IQ, provides granular insights into the target-setting process, including commitment, submission, validation and removal stages, offering a unique research setting due to SBTi's evolving transparency policies. Since February 2023, SBTi has adopted a 'name-and-shame' policy, flagging firms that withdraw or miss submission deadlines, in contrast to previous silent removals. This shift allows the examination of factors affecting firms' adherence to or withdrawal from climate commitments, such as peer influences and leadership traits within industries. Additionally, the dataset addresses challenges in firm identification, leveraging a fuzzy-matching process to link SBTi firms with S&P Capital IQ

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data, resulting in an 83.3% successful match rate and 8,298 matched firms. This method counters attrition inherent in current SBTi data. The research potential enabled by this dataset spans questions on industry dynamics, firm-level determinants of climate commitment, economic drivers and consequences.

1. INTRODUCTION

The Science-Based Targets initiative (SBTi) is a collaborative effort that helps firms set emission reduction targets aligned with the Paris Agreement. The initiative involves organizations such as the Carbon Disclosure Project (CDP), the United Nations Global Compact, the World Resources Institute (WRI) and the World Wide Fund for Nature (WWF). The data disclosed on the initiative's website offer numerous research opportunities; however, empirical-archival research on the topic has been limited. Only a handful of working papers from high-profile research groups (Bolton & Kacperczyk, 2024; Freiberg et al., 2021) and publications in reputable academic journals exist (Bendig et al., 2023; Bolay et al., 2024; Romito et al., 2024). I argue that this discrepancy between research potential and output is due to challenges related to accessing data on when firms join or withdraw from the initiative. To address these challenges, I present a monthly, survivorship-free dataset of firms, matched with S&P Capital IQ, that have committed to or set Science-Based Targets (SBTs). My objective is to ensure that this dataset will enable researchers to explore questions that may have previously seemed infeasible or too costly – due to the demands of data collection and cleaning.

SBTs provide a rich research environment, as they encompass managerial decisions – both actions and inactions – across multiple stages of the greenhouse gas (GHG) reduction target-setting process. This includes target validation and removal decisions made by the non-governmental SBTi. The SBTi itself experiences varying degrees of public support and criticism over time, which affects its perceived legitimacy (Tilsted et al., 2023). For instance, in December 2023, Reclaim Finance, a non-governmental organization and think tank focused on sustainable finance, criticized the SBTi for 'dumping science' by weakening its net-zero standards for financial institutions, thereby allowing banks and investors to continue financing fossil fuel projects (Burley & Shreiber, 2023).

The target-setting process typically involves four steps, of which the first and last are observable to the public: (1) firms commit to setting a target that is aligned with the Paris Agreement; (2) within 24 months of committing, firms submit their targets to the SBTi; (3) the SBTi provides feedback and may request revisions; and (4) after final approval by the SBTi, the target is officially set. Once firms commit to setting targets, they immediately appear on the SBTi dashboard, along with information about the type of target-setting commitment. Target types can broadly be categorized by their time horizons: near-term targets (by 2030) and long-term targets (such as 'net zero' by 2050). There are also distinctions in the level of reduction committed, such as whether the target aligns with a 1.5°C or a 'well below 2.0°C' pathway. While the SBTi dashboard provides no updates

when a firm submits its targets or during the approval process (steps 2 and 3), it acknowledges the final setting of targets. If a firm fails to submit and does not get its targets approved within 24 months, two outcomes are possible, depending on when this occurs. Before February 2023, firms were silently removed from the dashboard, leaving no record in the downloadable Excel file from the SBTi website. However, starting in February 2023, the SBTi began flagging firms that withdraw or are overdue on submitting near-term targets as 'commitment removed', while keeping them in the data. This policy has been extended to long-term targets starting in March 2024. This is a fascinating research setting, as the regime has shifted from a silent removal process to a transparent 'name-and-shame' approach. Firms can still submit their targets after being flagged and, upon approval, switch their status from 'commitment removed' to 'target set'.[1]

The primary challenge for researchers using SBTi data stems from the lack of archival data and SBTi's unresponsiveness to data requests.[2] The fact that, until February 2023, removals were performed silently, and the SBTi does not provide historical archives of its dashboard, presents a major challenge for research aimed at understanding why firms fail to meet their commitments or the consequences of dropping a commitment versus ultimately setting a target. Unsurprisingly, existing research focuses on the determinants of target commitment and setting, rather than the target removal process (Bolton & Kacperczyk, 2024).

However, as the saying goes, the internet never forgets – and this holds true for target commitments and removals as well. The main contribution of this chapter is the construction and description of a dataset based on monthly snapshots from the Internet Archive (Wayback Machine) of the SBTi dashboard, dating back to its inception in September 2015 and extending up to September 2024, thereby covering a full nine-year history. I anticipate that this dynamic and survivorship-bias free view on the target-setting process will enable researchers to address a wide range of relevant questions, such as whether peer effects exist between committing and withdrawing firms, and if so, whether there are industry leaders and followers. What management or firm characteristics determine leadership in this area? What are the economic factors driving these actions or inactions? These are just a few research ideas, which I will develop further and more systematically in the subsequent sections.

A secondary but significant challenge with SBTi data is the lack of consistent firm identifiers. The SBTi records firms by the names they provide, which often makes name-matching with financial databases difficult. These names may not even correspond to the firms' legal entity names but instead represent doing-business-as designations or product names. For example, the German firm 'Intelligent Apps GmbH' committed and validated targets under their brand name 'FREENOW', which is the name of their ride-hailing application. No purely text-based matching algorithm would reliably link such names. To address this issue, I match firm names in the SBTi data with those in S&P Capital IQ, a financial database that includes doing-business-as designations for both private and public firms. I complement the database provider's automatic matching algorithm with a fuzzy-matching process to compare SBTi firm names against the entire S&P Capital IQ universe. Then, I conduct thorough manual checks of any imperfect matches and fill gaps in SBTi firm coverage manually. This laborious process results in 9,417 matched firm names,

leaving only 1,885 unmatched firm names in the SBTi dataset. Thus, the overall matching success rate exceeds 83.3%.[3] These 9,417 matched firm names belong to 8,298 distinct legal entities as defined by S&P Capital IQ's Entity ID. The overall revenues of matched firms range up to 29.2 trillion US-dollar and the market capitalization of the public firms up to 57.0 trillion US-dollar. The population is composed of an almost equal mixture of private and public firms in the recent years, while listed firms dominate in the earlier years. 15.6% of firms are headquartered in the United Kingdom and 13.5% in the United States. Industrial and consumer discretionary are the most represented industries. Using only the currently available information on the SBTi website, a dataset could miss up to a quarter of the firms that participated in the initiative during its early years. My data collection methodology corrects for this potential source of survivorship bias.

The remainder of this chapter is structured as follows. In the following section, I outline existing empirical-archival research on SBTs. In Section III, I describe the data collection, matching and cleaning processes. In Section IV, I develop research ideas that could be addressed using the newly created dataset. Section V concludes this chapter.

2. PRIOR EMPIRICAL-ARCHIVAL RESEARCH USING SBTi DATA

To obtain a systematic overview of best practices in SBT data collection and research questions that have already been addressed, I conduct a systematic literature review of all empirical-archival studies found within the first 100 results of each Google Scholar search using the terms *Science-Based Targets*, *Science-Based Targets capital markets* or *Science-Based Targets determinants*. This results in 18 studies, whose literature review and reference list sections I scan for relevant titles, yielding 2 additional studies, totalling 20 studies of diverse academic quality (i.e. ranging from publications in high-quality peer-reviewed journals and working papers from high-profile research groups to student theses with interesting research questions, some with obvious methodological limitations) as displayed in Table 1. I discuss 10 studies in more detail, selected based on my assessment of the high quality of the publication outlets or the reputation of the research groups. This choice is subjective, which is why I display short quotes on the main results of all 20 studies in Table 2. To maintain focus on the quantitative literature, my review excludes otherwise noteworthy qualitative studies, such as Berger-Schmitz et al. (2023) and Privato et al. (2024).

The most general, and thus most relevant, studies on the determinants and effects of committing to or setting SBTs are Bolton and Kacperczyk (2024), Bendig et al. (2023) and Freiberg et al. (2021).

Bolton and Kacperczyk (2024) combine data from Trucost, FactSet and SBTi (and, for other tests, from the Carbon Disclosure Project – CDP) over the period 2015–2019 to show that firms making commitments subsequently reduce their emissions. The authors do not specify how they obtained data on SBTs in their working paper. Upon email request, they explained that they also relied on the

Table 1. Literature Overview on Empirical Archival Studies Using SBT (Highlighted Are the Studies That Are Discussed in Detail; Citation Count From Google Scholar as of 23 October 2024).

No.	Authors (Year)	Publication Outlet	Citations	Period of SBT Data	Private Firms	Firms With SBT	Data Source for SBTs	Surv Bias	Dependent Variable	SBTi variables (C = committing) (S = Setting)	Financial Database
(1)	Ben-Amar et al (2024)	*Bus. Strat. Environ.*	0	2019	No	99	CDP	No	Stock returns	C & S (jointly)	Eikon
(2)	Bendig et al. (2023)	*J. Ind. Ecol.*	33	2015–2020	No	465	SBTi snapshot end of 2020	Yes	Return on assets, Tobin's Q	C & S (jointly)	Eikon
(3)	Berg et al. (2024)	Working paper	2	2016–2021	No	616	SBTi snapshot likely from 2021	Yes	Emissions, emission intensity	C & S (separately)	Unknown
(4)	Bharali Saikia and Maji (2024)	*Int. J. Law Manag.*	0	2019–2023	No	7	SBTi snapshot March 2023	No	Tobin's Q	S	ACE
(5)	Bjørn et al (2022)	*Curr. Clim. Change Rep.*	78	2015–2021	Yes	1,039	SBTi snapshot December 2021	Yes	None	S	None
(6)	Bolay et al (2024)	*J. Clean. Prod.*	0	2020	Yes	17%	CDP	No	Target progress	S	None
(7)	Bolton and Kacperczyk (2024)	Working paper	119	2015–2019	No	455	SBTi snapshot and historical snapshots from the internet archive likely from 2021	No	Science-based targets; Future emissions	C & S (separately)	FactSet, I/B/ES
(8)	Dahlstroem et al. (2023)	Working paper	0	2017–2022	No	757	SBTi snapshot likely from 2022	Yes	Stock return	C & S (separately)	Eikon
(9)	Freiberg et al (2021)	Working paper	48	2016–2019	No	1752	CDP	No	Science-based targets; Target ambitiousness	S	Bloomberg
(10)	Gehrke et al (2024)	Working paper	0	2015–2022	No	15.%	CDP and SBTi	?	Emissions, emission intensity	C & S (jointly)	Eikon

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Table 1. (*Continued*)

No.	Authors (Year)	Publication Outlet	Citations	Period of SBT Data	Private Firms	Firms With SBT	Data Source for SBTs	Surv Bias	Dependent Variable	SBTi variables (C = committing) (S = Setting)	Financial Database
(11)	Giesekam et al (2021)	*Sustainability*	94	2015–2020	Yes	915	SBTi snapshot Jun 2020	Yes	Future emissions	C & S (separately)	Orbis
(12)	Guerrero-Escobar et al (2023)	Working paper	0	2015–2022	No	1,379	SBTi snapshots May 2021 and May 2022	Yes	Stock return, volatility	C & S (separately)	Bloomberg
(13)	Kacperczyk and Peydró (2024)	Working paper	172	2015–2018	No	28	SBTi snapshot likely from 2018 SBTi and historical snapshots from the internet archive	No	Emissions, emission intensity of borrowers	C	Compustat Capital IQ
(14)	Kaltenhauser (2023)	*Jun. Manag. Sci.*	0	2019–2021	No	<186	Media news	No	Science-based targets; Returns	C & S (jointly)	Eikon
(15)	Ko and Prakash (2024)	*npj Clim. Action*	0	2015–2023	No	188	SBTi snapshot Mar 2024	Yes	Stock return	C	CRSP, Compustat
(16)	Kuo and Chang (2021)	*Sustain. Prod. Consum.*	31	2016–2019	Yes	127	CDP	No	Carbon disclosure level	S	AsiaOne
(17)	Pindea Pérez (2023)	Master thesis	0	2015–2022	No	1,050	SBTi snapshot Mar 2023	Yes	Stock return, volatility, value-at-risk	C & S (jointly)	Eikon
(18)	Romito et al (2023)	*Bus. Strat. Environ.*	6	2015–2017	No	254	SBTi	Yes	Emissions, emission intensity	C & S (separately)	Eikon
(19)	Schuiling (2023)	Master thesis	0	2015–2021	No	962	SBTi snapshot May 2023	Yes	Emissions, ESG scores, environmental innovation	C & S (separately)	Eikon
(20)	Zhang (2022)	Master thesis	1	2018–2019	No	143	CDP	No	Emissions, emission intensity	S	Eikon

Table 2. Key Findings in the Literature.

No.	Authors (Year)	Results (Citation From the Abstract or Conclusion Section)
(1)	Ben-Amar et al (2024)	Using a sample of 336 US-based companies, our findings show that science-based targets are positively related to crash-period returns and negatively related to severity of loss
(2)	Bendig et al. (2023)	Our findings indicate a positive association between CCP and CFP for firms engaging in SBTs, implying a positive relation between decarbonization efforts and financial results
(3)	Berg et al (2024)	When controlling for assurance, we do not find evidence that SBTi target-setters reduce their future emissions. Instead, firms that obtain assurance reduce their future carbon intensity by 3.3%
(4)	Bharali Saikia and Maji (2024)	There is a negative relationship between corporate carbon emissions and financial performance. The findings support the 'win-win' hypothesis and confirm that reducing carbon emissions can improve the financial performance of Indian firms. Furthermore, the SBTi moderate the carbon emission and firm performance nexus
(5)	Bjørn et al (2022)	Descriptive study and review of prior literature
(6)	Bolay et al (2024)	Companies with more ambitious targets progress less than others, except when the ambitious targets are approved by the Science-Based Targets initiative
(7)	Bolton and Kacperczyk (2024)	While the companies that make commitments subsequently reduce their emissions, the effect on overall emissions of companies (including those that do not commit) has been small; the companies that commit, and those that make the most ambitious commitments, tend to have lower emissions
(8)	Dahlstroem et al. (2023)	Based on a sample of 757 SBTi committed international firms and a control group consisting of 748 peers as non-committed firms over the period 2018–2022, we find a positive SBTi transition premium
(9)	Freiberg et al (2021)	We find that firms with a track record of setting and achieving ambitious carbon targets are more likely to set science-based targets. Firms are also more likely to set science-based targets if they perceive climate change-related risks and have carbon-intensive operations. Using a difference-in-differences research design that compares the science and non-science targets of a firm, we find that targets become more difficult when firms adopt the science-based standard for the target, consistent with the standard increasing target difficulty and inconsistent with firms relabelling their existing targets. The increase in target difficulty is accompanied by more investment in carbon-reduction projects and higher expected emissions and monetary savings from these projects
(10)	Gehrke et al (2024)	One main finding is that firms with a science-based target achieve 4%–15% lower carbon emissions
(11)	Giesekam et al (2021)	Though the majority of targets assessed were on track and, in some cases, had already been achieved, just under half of the companies assessed were falling behind on one or more of their targets
(12)	Guerrero-Escobar et al (2023)	We find no evidence that committing or setting a target yields higher returns, while the impacts on price volatility are negative but short-lived
(13)	Kacperczyk and Peydró (2024)	Firms with higher carbon footprint previously borrowing from committed banks subsequently receive less bank credit. Affected firms also lower their total debt, leverage, size, and real investments, and increase their liquid assets

(Continued)

Table 2. *(Continued)*

No.	Authors (Year)	Results (Citation From the Abstract or Conclusion Section)
(14)	Kaltenhauser (2023)	The results reveal a significant correlation between a variety of determinants and a net-zero target announcement (e.g., industry profile, firm size) and show a significant negative capital market response irrespective of a target's individual attributes
(15)	Ko and Prakash (2024)	Our analysis of S&P 500 companies' quarterly stock prices for 2010–2023 finds little evidence that SBTi verification (of any type) increases stock prices
(16)	Kuo and Chang (2021)	The empirical results show that setting SBT or adopting ICP for carbon reduction have significantly positive effects on enhancing firms' CMR, respectively
(17)	Pindea Pérez (2023)	It has been found that there is a negative relationship when the financial variable is stock return. While when volatility and financial risk are measured, there is no statistically significant effect
(18)	Romito et al (2023)	The results showed that firms' participation led to lower levels of GHG emissions compared to similar non-participating counterparts, especially when they committed to the initiative with the intention to follow the proposed indications
(19)	Schuiling (2023)	The SBTi did not have any significant effect on emission no matter if we look at total emissions, scope one or scope two emissions, showing that setting the targets did not influence company action. ESG and Environmental Innovation Scores on the other hand were slightly negatively influenced, which could result from the SBTi's stricter regulations, time lags or the financial strain approval fees put on firms
(20)	Zhang (2022)	A difference-in-differences (DID) model is used in this study, which shows that firms setting SBTs reduce their absolute GHG emissions by about 5% and their carbon intensity by 8–10%

Internet Archive (Wayback Machine) to fill data gaps. As my later analysis will show, obtaining historical snapshots is important to avoid survivorship bias because firms silently are removed from the SBTi list of committed firms, either temporarily or permanently. The main finding of Bolton and Kacperczyk (2024) is that firms making commitments subsequently reduce their emissions, albeit with a small measured effect. Furthermore, firms that commit tend to be those with lower emissions in the first place.

Bendig et al. (2023) conduct an association study on the effects of decarbonization and financial performance, restricting their sample to firms that 'engage' (either commit to or set SBTs). They find a positive relationship between decarbonization efforts and financial results. Their consideration of whether a firm engages with SBTi is based on a snapshot of SBTi data from the end of 2020.

In an attempt to obtain panel data on SBTs that do not suffer from survivorship bias, Freiberg et al. (2021) consult CDP survey data on whether firms commit to or set SBTs. Freiberg et al. (2021, pp. 19–20) describe their data collection as follows: 'Starting in 2016, a new field was added to the CDP survey that allows us to identify emissions reduction targets as science-based. This new field asked "Is this a science-based target?" and permitted the following

responses: "Yes"; "No, but we are reporting another target that is science-based"; "No, but we anticipate setting one in the next two years"; "No, and we do not anticipate setting one in the next two years"; and "Don't know". Although it is possible that a firm could identify a target as being science-based in its CDP response when it is not, we cross-checked the CDP responses with a listing of firms with approved science-based targets from the SBTi and noted only nine discrepancies that were due to mismatched company names or identifiers'. As the authors correctly state, the validity of the CDP questionnaire hinges on the accuracy of the responses provided by the firms. While I share the authors' optimism regarding the validity of the responses provided by their sample of 1,752 listed firms in the early period, I am less optimistic about the more than 20,000 private and listed firms that respond to the CDP nowadays and the more than 8,000 firms that commit to or set SBTs. The consistency between CDP responses and SBTi data is a research topic on its own, for which the dataset I develop and describe in this chapter would be needed. Based on anecdotal evidence, we know that inferring SBTi status from CDP data introduces type II errors, as some listed firms did not participate in the CDP survey but were listed as SBT-committed firms on the SBTi dashboard.[4] I anticipate that the prevalence of private firms not responding to the CDP but committing to SBTs is comparatively higher, as putting one's firm name on a list is an almost costless action, while responding to a comprehensive questionnaire is a more complex and thus costlier task. The results in Freiberg et al. (2021) indicate, among other findings, that firms with a track record of setting and achieving ambitious carbon targets are more likely to set science-based targets. These results are challenged by Berg et al. (2024), who find that, when controlling for assurance, there is no evidence that SBTi target-setters reduce their future emissions.

An important aspect of research on SBTs is whether firms committing to or setting targets differ from peers in terms of accounting or stock market performance. Especially for any study addressing the latter research question, an unbiased dataset that contains only information available at the time is required. Testing portfolio strategies with any survivorship or hindsight bias is considered inadmissible (Garcia & Gould, 1993). Nonetheless, Dahlström et al. (2023) use a snapshot from the SBTi dashboard as of early 2020 to define a treatment group (SBT-setting firms) and a control group (SBT-committing but not target-setting firms). Their estimation involves data from 2018 onward, and the results show that there is an SBTi adoption premium. Ben-Amar et al. (2024) show that the stock returns of US firms with SBTs in place or committed to setting SBTs had higher returns during the COVID-19 crisis.

Further studies on the consequences of target-setting or commitment to target-setting lend support to the hypothesis that emissions or emissions intensities decrease after joining the SBTi list of firms (Bolay et al., 2024; Romito et al., 2024) or even trigger changes in bank lender preferences toward less carbon-intensive clients (Kacperczyk & Peydró, 2024).

With the exceptions of Bolton and Kacperczyk (2024) and Kacperczyk and Peydró (2024), the studies in Tables 1 and 2 have in common that they either use snapshots of SBTi data – a data collection strategy that is potentially vulnerable

to survivorship bias when firms silently drop from the list during the earlier years, before the flagging as 'commitment removed' was introduced by the SBTi – or rely on CDP questionnaire data, which is incomplete and possibly suffers from data input errors by the responding firms.

3. CREATING A SURVIVORSHIP BIAS-FREE SBTi DATASET

3.1 Overview on Procedural Steps

The data collection process consists of three key elements: (1) scraping all available snapshots of the SBTi dashboard website on the Internet Archive (Wayback Machine); (2) creating a matching list between the firm names found in those snapshots and S&P Capital IQ, including manual checking of machine-matched firm names; and (3) aligning the data onto a monthly timeline, i.e. creating a balanced dataset to identify gaps and manually research their causes. If any gap results from an error in the name-matching procedure, this error is corrected manually; if it arises from another reason, such as a firm disappearing from S&P Capital IQ due to bankruptcy or acquisition, the reason is recorded and not considered a silent dropping from the SBTi list. Researchers interested in investigating the phenomenon of firms dropping commitments to set SBTs will likely want these events separated from any other reason for a firm's disappearance. In other words, a silent dropping from the SBTi dashboard is only relevant if the respective firm continues to exist and the dropping is not confounded by other reasons for disappearance.

3.2 Scraping SBTi Data

I use a Python script with the Selenium and Beautiful Soup libraries to scrape all 1,379 snapshots (archived versions of a website that are stored by the Internet Archive) of the website 'sciencebasedtargets.org/companies-taking-action' in the Internet Archive. The Internet Archive takes snapshots at irregular intervals. Fig. 1 shows a screenshot of the overview of available snapshots over time. The Internet Archive reports 3,620 available snapshots, for 2,241 of them the data tables of the dashboard were not saved to the archive, potentially because the bot did not wait long enough for the table to load.

Except for the very early years of the SBTi, when data was stored in single-page HTML tables that can be read with Beautiful Soup, the data is generally held in multi-paginated, JavaScript-based tables that must be scraped page-by-page using Selenium. This process, while extremely time-intensive due to the long loading times of pages and IP-blocking/throttling, is remarkably stable, i.e. it runs without interruption and, in my experience, never misses any data. The last snapshot is available from 25 June 2024, after which SBTi introduced a CAPTCHA that prevents the Internet Archive from storing snapshots of the dashboard.[5]
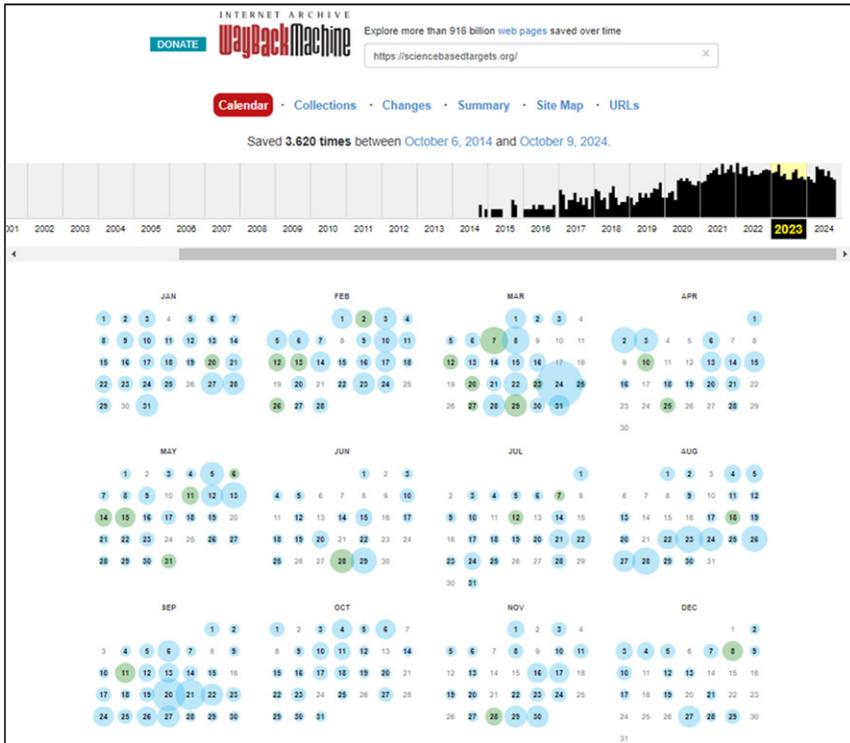
Fig. 1. Screenshot From the Internet Archive (as of 23 October 2024).

In addition to the data from the website snapshots, I download the MS Excel files that SBTi offered for download alongside the data tables. These MS Excel files are stored by the Internet Archive considerably less frequently, i.e. 11 files during the period from 30 November 2021 to 5 June 2024. From 25 June 2024 onward, I archived these tables with a frequency of one download per week on Fridays because, according to information provided by SBTi, updates occur on Thursdays. In doing so, I maintain a survivorship bias-free, up-to-date data structure even after the introduction of the CAPTCHA in June 2024.

3.3 The Choice of S&P Capital IQ

My choice of S&P Capital IQ as the referential database to create a unique firm identifier for the SBTi firms is motivated by careful consideration of its features and those of alternative research database products. Compared to Bloomberg, Orbis (Bureau Van Dijk), FactSet and Eikon (Refinitiv), S&P Capital IQ stands out in terms of its broad coverage of listed and private firms, its coverage of financial data (accounting and stock price data), its integration of Trucost data (since 2016, Trucost has been a product of Standard & Poor's with cross-matched

firm identifiers) and its moderate cost.[6] The integration of Trucost is particularly appealing, as this is an established database for carbon emission data that includes data from the CDP.

3.4 Matching With S&P Capital IQ

The matching process is documented in Table 3. There is very limited coverage of firms with International Securities Identification Number (ISIN) and Legal Entity Identifier (LEI) identifiers in the SBTi data. I prioritize these ISINs and LEIs to request S&P Capital IQ Entity IDs. This yields 2,690 matches with Capital IQ out of a total of 11,302 distinct firm names in the entire SBTi universe. I run the remaining firm names, including their legal form extensions, through the SPG_IdentifierConverter_v1.xlsm tool of S&P Capital IQ, which fuzzy-matches firm names and considers doing-business-as designations alongside legal entity names. This yields 3,178 perfect matches. Since the residual matches are fuzzy, i.e. there are minor or even major deviations in the matched legal entity names,

Table 3. Firm Name Matching of SBTi Data With S&P Capital IQ.

	Step 1: ISIN/LEI Matching	Step 2: Fuzzy matching SPG_IdentifierConverter_v1		Step 3 Fuzzy matching reclink2.ado	Sum
Distinct firm names in SBTi data	11,302				
- thereof: matches based on ISIN/LEI	**2,690**				2,690
= remaining unmatched firm names for Step 2	8,612	⇒	8,612		
- thereof: perfect name matches		**3,178**			3,178
- thereof: approved fuzzy matches		**2,629**			2,629
= remaining unmatched firms for Step 3		2,805		⇒ 2,805	
- thereof: approved fuzzy matches				**920**	920
= total number of matched firm names					9,417
Matched modified firm names					8,352
- reductions due to manual corrections after reviewing gaps and disappearances					50
- short appearances and disappearances between the start and end of the month					4
= total number of matched firm names after corrections					8,298

they require manual checking. I perform this manual checking by also considering the country recorded in the SBTi data versus the headquarter country recorded in S&P Capital IQ, and the industry that firms self-report to SBTi versus what is recorded in S&P Capital IQ. Whenever necessary, I conduct in-depth research on firm histories to understand name changes and merger and acquisition transactions to judge whether a firm name in SBTi refers to the same entity as the suggested match in S&P Capital IQ. I remain conservative, i.e. I require certainty of a correct match beyond reasonable doubt to manually approve a fuzzy match. This procedure leads to 2,629 approved fuzzy matches. For the remaining unmatched firm names, I run another fuzzy matching procedure using the user-written Stata command reclink2.ado (Wasi & Flaaen, 2015) and the Foundation data file, which lists all firm names in S&P Capital IQ. This final step results in 920 additional manually checked matches. The total number of matches is 9,417, associated with 8,352 unique S&P Capital IQ Entity IDs. The excess of firm names over unique identifiers is due to the same firm reporting different names; sometimes these are nuances in legal entity designations, while in other cases they are significant name changes or switches between legal entity names and doing-business-as designations.

I pay particular attention to firms that presumably disappear from the SBTi list. First, I manually check any firm that temporarily disappears. Often, this phenomenon can be traced back to the matching algorithm failing to find a match because a firm temporarily appears under a different name. I correct these cases, which leads to an overall reduction of 50 distinct S&P Capital IQ Entity IDs. In other cases, the firm commitment was indeed silently removed. To ensure that I properly distinguish between these fundamentally different reasons for absence, I also search Google for any information I can find on this firm in connection with SBTi. A typical pattern indicating true absence is finding an announcement of SBTi in an earlier year, for example, 2021, but no evidence that the firm ever set a target, and no mention in later sustainability reports regarding SBTi. Sometimes, the information found in sustainability reports after disappearance from the SBTi list is subtle: firms state that their targets are oriented toward or aligned with SBT guidelines, but avoid mentioning that these targets have been approved by SBTi or that the firm is still committed to having them approved. Often, direct reference to SBTi is avoided, while the firm uses the general term 'science-based', which technically leaves open the question of to which branch of climate science the firm is referencing.

Finally, there are four instances where legal entities appear only between the start and end of a month. These 'mayflies' are cases where firms decided to shift the target quickly to a different level in the corporate tree or corrected the name reported to the SBTi to reflect the correct level within the corporate tree at which the target is situated. Since my dataset has a monthly frequency, these instances fall through the gaps.

In total, the dataset contains 8,298 S&P Capital IQ-matched firms. Researchers are naturally interested in knowing how many of these firms are private versus listed. Since listing status can change over time, I track the availability of the data point 'market value of equity' in S&P Capital IQ to proxy

for listing status. For 2,576 firms, I observe market value of equity at some point during the nine years of data coverage. The residual 5,722 firms remained private throughout the period covered by the dataset.

4. EVOLUTION OF SBTi COMMITMENTS AND TARGETS OVER TIME

4.1 Primer on SBTi Policy Changes

To understand the new dataset, it is imperative to review some important policy changes on the part of SBTi. Until January 2023, firms that did not submit targets within 24 months of making a commitment were silently removed from the dashboard. Since that time, SBTi has kept such firms on the dashboard but marks them as 'commitment removed' if they fail to submit their targets within the allotted time.

The 24-month deadline applies only to target submission, meaning that more than 24 months can elapse between target commitment and either commitment removal or target setting, as the target approval process itself may take several months. It is important to understand what happens if a firm submits within the 24-month deadline, but the approval process extends beyond this period and/or approval is not granted on the first attempt, requiring the application to be sent back for revision. For the period between April 2020 and January 2023, when the second version of the 'Protocol to Manage Expired Commitments' was effective (SBTi, 2020), this case was clearly defined: the firm would be removed from the list while preserving the possibility of getting back on it after having its revised targets ultimately approved. The wording of this scenario is less clear in the new policy effective from January 2023, which states that firms are flagged as 'commitment removed' if their commitment expired (24-month period) and they 'did not reach successful validation of their targets according to their commitment' (SBTi, 2022). When read together with the policy of 2020, it would be logical to assume that after a first unsuccessful attempt at validation extending beyond the 24-month period, the firm would be flagged as 'commitment removed' until successful resubmission and approval. I wonder, however, if SBTi would follow through with such a strict approach, as flagging a firm as 'commitment removed' despite an ongoing approval process could have legal implications and pose a litigation risk for SBTi – without having evaluated this aspect in depth, I envisage that a firm could challenge the non-approval in court and claim compensation for damage done to its reputation.

The 24-month deadline is subject to multiple exceptions, which depend on when the firm commits, i.e. which version of the three policies for commitment expires (SBTi, 2018, 2020, 2022) is in place at the time of committing, and also which of the three policies is effective at the time the commitment expires. Table 4 provides an overview containing key quotes from the three versions of the policy and my summary assessment.

Table 4. Expiring Commitment Policies.

Version of Policy	Effective Date	Quotes/Summary Assessments
1	6-Dec-18	'[…], if a company shows **good faith** to develop a science-based target or where companies are waiting for a sector development to be completed (e.g. financial institutions), t**he 24-month requirement may be waived. [**…]' under certain circumstances, extensions can be discussed […]'
		'For companies in **sectors without a science-based target setting methodology, no action** will be taken'
		'[…], an **extension of up to six months** can be offered, provided that the company agrees to submit targets for official validation within this period'
		'For committed companies that have **submitted targets** for official validation within the 24-month period and **have not fulfilled the SBTi criteria**, **an extension of up to twelve months** can be granted, provided that the company agrees to re-submit their target within this period'
		'Any request for extensions beyond the time frames indicated in this Protocol will be approved by the Steering Committee of the SBTi on a **case-by-case basis**'
		Summary assessment: Commitment extensions of 6 months, 12 months, or longer could be awarded at the **discretion of the SBTi.**
2	15-Apr-20	'**All companies** committed to the SBTi before April 15th, 2020 **that have not been offered an extension will be granted 12 months** to complete the four step process of the Call to Action, if needed'
		'Under **special circumstances** the SBTi may grant companies **additional time** to publish their targets'
		'Companies that have publicly committed to set SBTs through the SBTi and joined the Business Ambition for 1.5°C campaign will have until the end of their existing commitment period to set targets. An **extension up to 12 months** may be offered'
		'**No action** to be taken for any company in a **sector without a science-based target setting methodology**; companies classified as Financial Institutions or Oil and Gas, as per the definitions provided by the SBTi, will have 24 months to submit targets for validation from the date the methodologies become available'
		Summary assessment: Automatic commitment extensions of **12 months for essentially all firms**; no deadline for financial firms and oil and gas firms. Further prolongations possible '**under special circumstances'.**

(Continued)

Table 4. *(Continued)*

Version of Policy	Effective Date	Quotes/Summary Assessments
3	31-Jan-23	'**No extensions will be granted on a case-by-case basis**'. 'Companies with **previously granted extensions** will have those extensions **honored**' 'Companies with commitments that expire before the new policy enters into force [31 January 2023] will **automatically be granted a one-off six-month grace period** to fulfill their commitment. […] with the deadline for target submission of **31 July 2023**' **Business Ambition for 1.5C:** **Corporates: 31 Jan 2024** **Financial Institutions: 24 months from Financial Institutions Net-Zero launch [not yet launched]**
		Summary assessment: no more catch-all clauses such as 'case-by-case', 'special circumstance', or 'good faith' that would allow SBTi to extend commitment periods at their discretion. First **commitment removals foreseen for 31 July 2023**. For firms that joined the **Business Ambition for 1.5C campaign** between June 2019 and October 2021, removals are expected to occur soon **after January 2024.**

Versions 1.0 and 2.0 are governed by a set of automatic and loosely defined subjective criteria under which SBTi can offer commitment period extensions. In essence, it was at the discretion of SBTi, on a case-by-case basis, whether a firm was granted an extension. The tone became slightly more decisive in Version 2.0 ('under special circumstances') relative to the prior version ('showing good faith'). A fundamental shift occurred with Version 3.0, which was released in November 2022 and became effective on 31 January 2023. It explicitly abandoned case-by-case decisions and introduced two fixed deadlines (apart from legacy extensions):

- *31 July 2023* for any firms that have surpassed the 24-month commitment period without submitting targets for approval.
- *31 January 2024* for any firms that joined the SBTi via its Business Ambition for 1.5°C campaign, which firms could sign up for during the period from June 2019 to October 2021.

    With this new policy, which also became effective for firms that joined the SBTi earlier under the old versions, the SBTi changed the information retained on its dashboard. While Versions 1.0 and 2.0 reassured firms that no announcement of removal would be made and that they would silently disappear from the dashboard, Version 3.0 threatens to flag removed firms as 'commitment removed'. In return, SBTi offered legacy firms a withdrawal period from the announcement of the policy up until 31 January 2023:

- *In the time window from November 2022 to 31 January 2023*, firms learned about the new policy and could withdraw silently from their commitment without being flagged as 'commitment removed'.

    This is an interesting feature of the target-setting process, as vigilant managers could have anticipated the implications of this regime shift and minimized damage to their firms by silently withdrawing rather than remaining flagged as 'commitment removed' indefinitely or until the target was finally approved. There was also no downside to a silent removal, as this would have still left open the option to submit targets later. In fact, the data show an increase in silently removed firms in February 2023, from 68 to 79. In July 2023, 'commitment removed' flags for near-term targets surged from 7 to 35, and then rose to 114 in December 2024. For long-term targets, the jump occurred in March 2024, from 0 to 245, while near-term removals reached 208. Who were the handful of managers who anticipated that it would be better to withdraw early? Why did other managers miss this opportunity and get trapped in the status of 'commitment removed'? Were they less attentive? Did they overestimate their ability to successfully set targets? Fig. 2 displays the timeline of commitment removal policies together with the three key months when a noticeable impact of these policy changes is visible on the dashboard. While changes in the dashboard are happening continuously, the months of February 2023 (silent withdrawals before lock-in), June 2023 (removal of some commitments not from the Business Ambition for 1.5°C campaign), December 2023 (further removals) and March 2024 (removal of many commitments from the Business Ambition for 1.5°C campaign) appear to show the clearest impact of the policy changes.
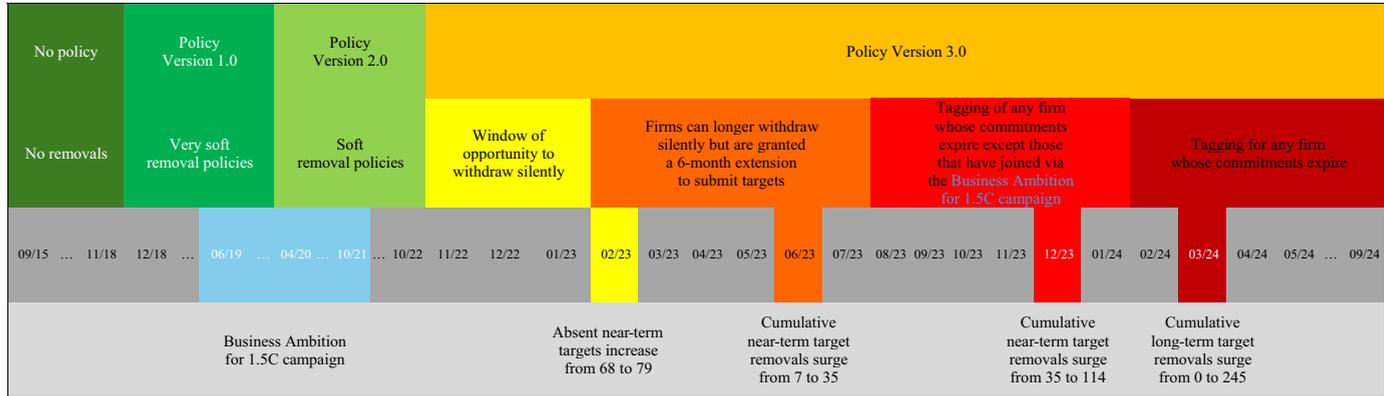
Fig. 2 Timeline of Expiring Commitment Policies. *Note:* Policy versions refer to the version of the 'Protocol to manage expired commitments' (SBTi, 2018, 2020) and the 'Commitment Compliance Policy' (SBTi, 2022).

4.2 Data Structure

The newly created dataset has a strongly balanced monthly structure, with a time series for each firm that has appeared on the SBTi dashboard at least once and for which the matching algorithm, including manual verification, finds an S&P Capital IQ Entity ID. This yields 109 months (September 2015–September 2024) × 8,298 unique Entity IDs = 904,482 observations. The two panels in Table 5 provide breakdowns by countries and sectors for the 8,298 firms. Firms from the United Kingdom are overrepresented (15.6%) relative to those from the United States (13.5%). I attribute this to some home bias, as the offices of the SBTi are in London. Of course, other more nuanced explanations, such as differences in regulations or culture, are possible and should be the subject of future research.

Based on the information scraped from the SBTi dashboard, I determine the status of the near-term and long-term (net zero) targets for each observation. The status categories are: (1) Has not yet committed to anything; (2) Committed with intermittent absence (silent removal); (3) Final absence (silent removal; no target set as of September 2024); (4) Final absence due to other reasons, e.g. disappearance of the firm or removal of oil and gas firms due to lacking standards; (5) Commitment removed; (6) Set; and only for long-term targets: (7) Has never committed to a long-term target; (8) Will commit to a long-term target later. These categorizations enable me to draw the three graphs in Fig. 3.

The first graph in Fig. 3 displays the cumulative number of firms appearing on the SBTi dashboard as either having committed to setting a target or having directly set a target (committing is not mandatory; firms can directly submit targets for approval). 'Cumulative' here means that these sub-graphs are monotonically increasing, i.e. the disappearance of firms is disregarded. To assess the success of the matching procedure with S&P Capital IQ graphically, I show the evolution of matched firms plus the number of unmatched firm names. Assuming that each unmatched firm name represents a unique firm (a conservative assumption), the distance between the dotted line and the solid black line for near-term target firms

Table 5. Country (Left-Hand Side) and Sector Composition (Right-Hand Side) of Firms in the Dataset.

| Panel A: Country	Share (%)	Panel B: Sector	Share (%)
United Kingdom	15.62	Industrials	28.47
United States	13.52	Consumer discretionary	14.87
Japan	10.23	Information technology	10.73
Germany	6.50	Consumer staples	10.25
France	5.27	Materials	10.23
Sweden	4.62	Financials	6.54
China	3.82	Health care	5.40
India	3.63	Other	4.59
Netherlands	3.15	Real estate	3.68
Denmark	2.75	Utilities	2.03
Other	30.9%	Energy	0.28
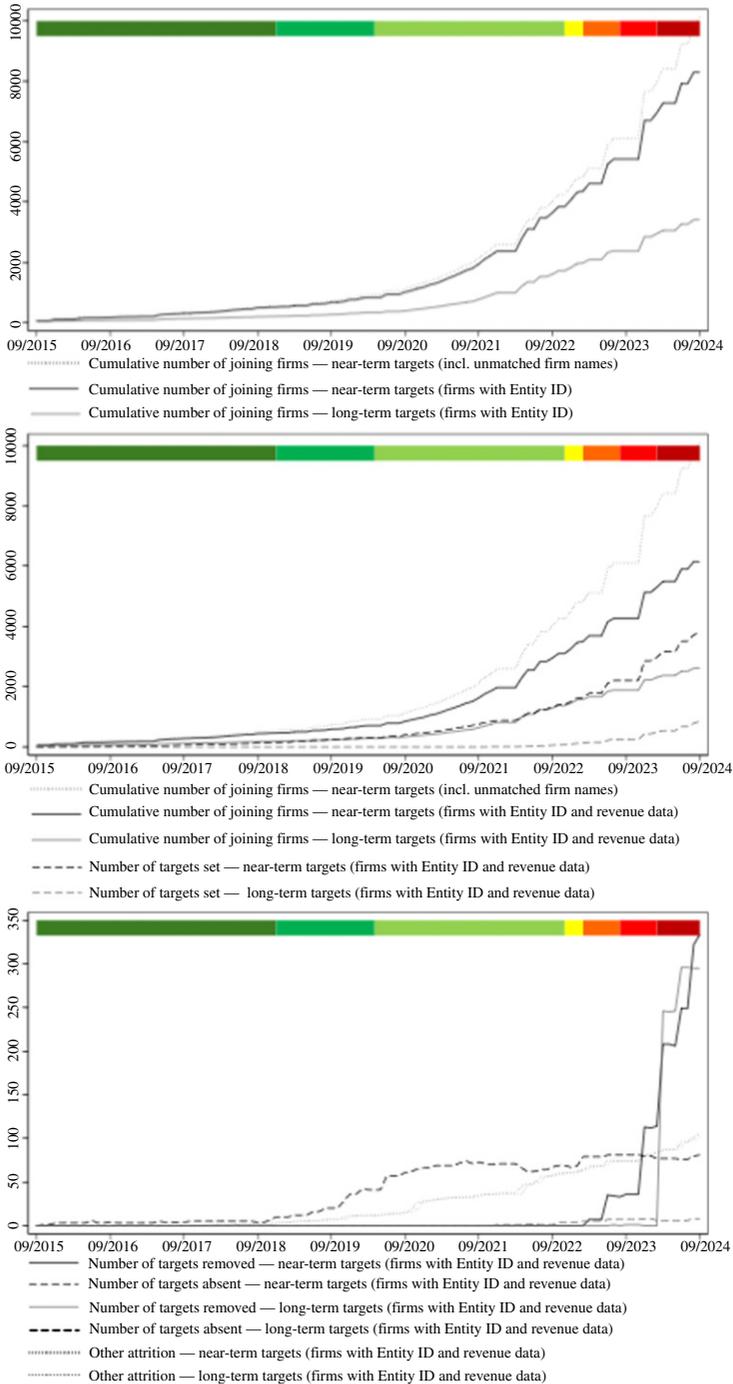
Fig. 3.   Evolution of Firms With SBT Commitments, Set Targets and Target
Removal (Colours Indicate the Strictness of Expiring Commitment Policies
(SBTi, 2018, 2020, 2022) as Displayed in Fig. 2).

represents the matching gap, which remains moderate at any point in time. Interestingly, there is a plateau of new firms joining the SBTi dashboard from July 2023 to November 2023, which coincides with the introduction of Version 3.0 of the policy for expiring commitments, marking a fundamental shift from silently removing firms that failed to set a target to tagging them permanently as 'commitment removed'. I am curious, and this could be the subject of future research, whether this plateau is of a purely technical nature, i.e. the SBTi halted additions to the dashboard because it knew it was about to release the new policy, or whether firms could have still joined the dashboard but experienced a hold-up due to the new policy and the uncertainty surrounding its implementation.

The second graph in Fig. 3 differs from the first in that it restricts the analysis to firms with revenue data in S&P Capital IQ at some point in time. The idea is to disregard ultra-small firms that lack the basic information required for any empirical setup. S&P Capital IQ is comprehensive in that it includes records of legal entities with no disclosure requirements for financial information, which explains the high matching success with SBT data. Additionally, the second graph demonstrates the success rate of transitioning from committing to setting a target to having the target approved and set. For near-term targets, the graph of set targets (dashed black line) runs at slightly less than half the level of the cumulative number of joining firms (solid black line). The approval rate is substantially lower for long-term targets (gray dashed line vs. gray solid line) and is around one-third.

The third graph in Fig. 3 displays several aspects of attrition in SBTi data. The analysis remains restricted to firms that fulfil the minimum requirements to enter any empirical-archival study, i.e. availability of revenue data and a successful match with S&P Capital IQ. The solid black and gray lines represent the explicit tagging of firms as 'commitment removed' following the introduction of Version 3.0 of the policy for handling expiring commitments. These removals amount to 333 for near-term targets and 296 for long-term targets. With the introduction of the new policy, survivorship bias should no longer be an issue for recent sample periods. However, the third graph also shows two other types of attrition that can impact any study using data from earlier periods. These two types are silently removed targets (target absenteeism; black dashed line for near-term targets and gray dashed line for long-term targets) and other attrition as known in the accounting and finance literature, e.g. firms disappearing due to mergers and acquisitions or the end of going concern for economic reasons. In that category, I also include 17 firms from the oil and gas sector, which were removed by SBTi in early 2023 due to a lack of a sector-specific standard. This is a qualitatively different removal compared to firms not submitting a target within the commitment period (SBTi, 2023). The other attrition reaches 105 and 101 firms for near-term and long-term targets, respectively.

Figs. 4 and 5 show the evolution of the previous graphs in terms of revenue and market capitalization, respectively. The takeaway from these graphs is that target removal is more substantial when assessed in economic terms. For both revenue and market capitalization, the impact is on the order of magnitude of 10%; for example, 6.7 trillion US dollars of market capitalization experienced a 'commitment removed' event by September 2024. The total market capitalization of any firm that had ever joined the SBTi dashboard at that time was 57 trillion
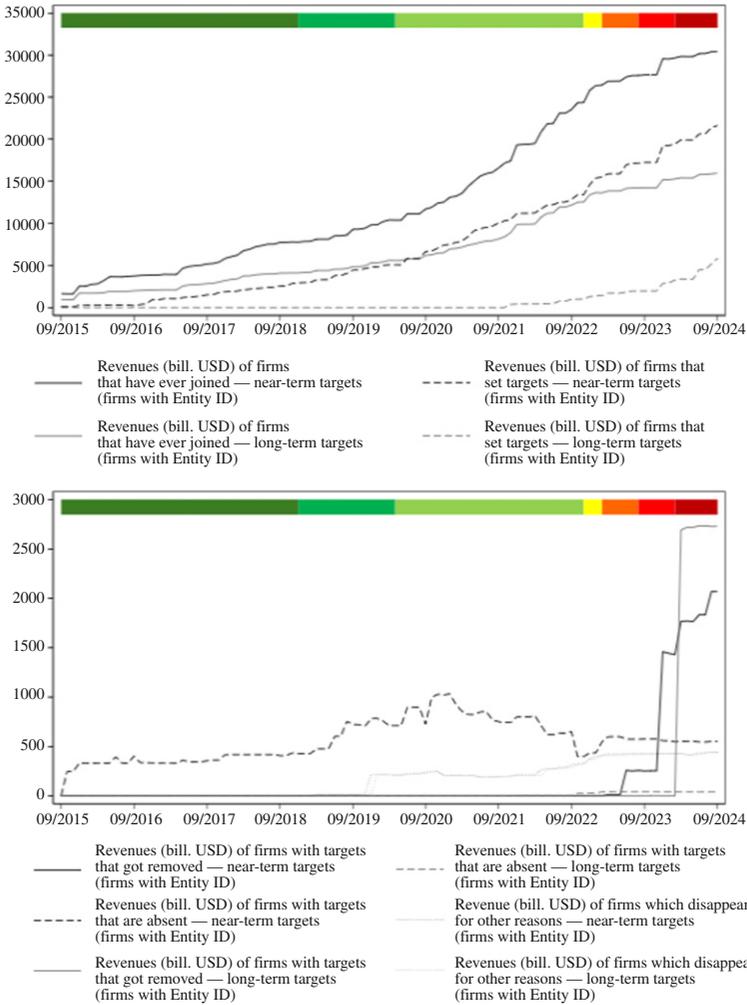
Fig. 4.   Evolution of Revenues of Firms With SBT Commitments, Set Targets
and Target Removal (Colours Indicate the Strictness of Expiring Commitment
Policies (SBTi, 2018, 2020, 2022) as Displayed in Fig. 2).

US dollars, thus the ratio of commitment removal exceeds 10%. This ratio was
considerably lower in Fig. 3 when assessing the number of firms. I conclude that
big firms were disproportionately affected by the new commitment removal
policy, whether self-inflicted or an inherent feature of the commitment-making
and removal process (e.g. smaller firms are less likely to commit but more likely
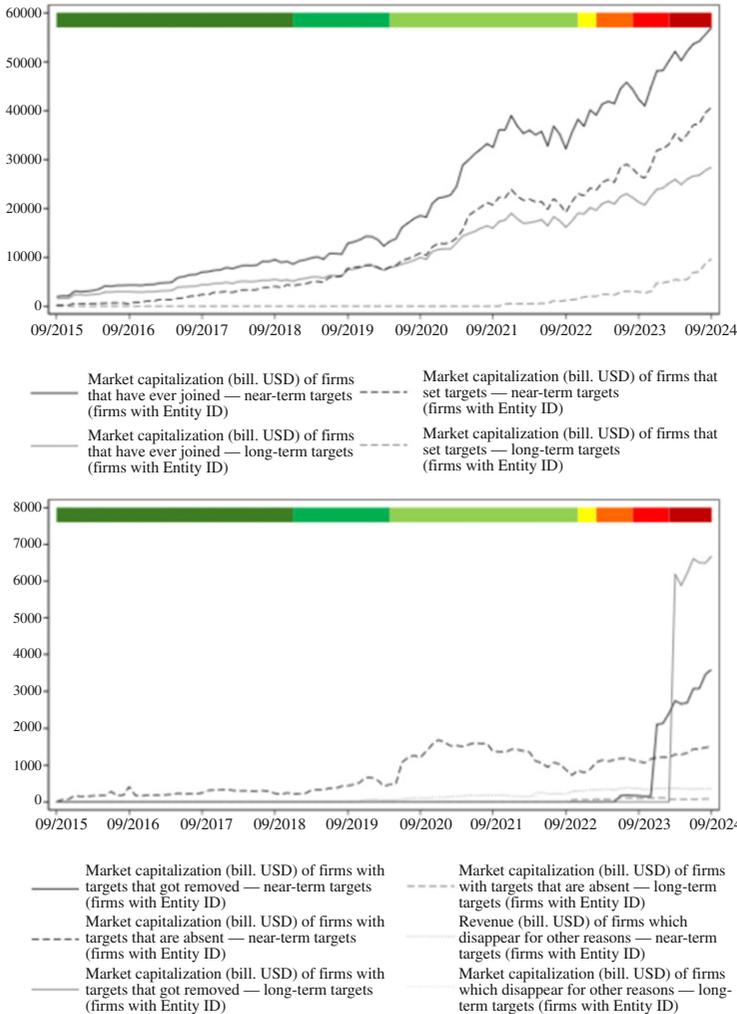to directly submit targets).

Fig. 5   Evolution of Market Capitalization of Firms With SBT
Commitments, Set Targets and Target Removal (Colours Indicate the Strictness of
Expiring Commitment Policies (SBTi, 2018, 2020, 2022) as Displayed in Fig. 2).

4.3 How Severe Is Attrition and the Potential Survivorship Bias in SBTi Dashboard Data?

The literature review in Section 2 has revealed that recent studies using SBTi data either use snapshot data from the dashboard or rely on CDP. While the former strategy potentially introduces survivorship bias, the latter risks not capturing SBT commitments fully or accurately. I argue that my new dataset overcomes

survivorship bias and includes private firms. Now that the new dataset has been built, it allows me to quantify the potential attrition of firms in snapshotted SBTi dashboard data. The magnitude of attrition depends on two points in time: (1) the point in time when a researcher draws the data from its source, which I label 'month_obtained', and (2) the point in time (or sample period) for which the researcher conducts their analysis, which I label 'month_analysis'. I then define attrition as the percentage of missing observations due to non-representation at the time of data retrieval:

$$\text{Attrition}\big[\text{month\_obtain}, \text{month\_analysis}\big] =$$

$$1 - \frac{\text{observed firms for month\_analysis}[\text{month\_obtain}]}{\text{true number of firms for month\_analysis}\big[\text{month\_analysis}\big]} \qquad (1)$$

Attrition is a necessary but not sufficient condition for survivorship bias, as bias implies that the result of an analysis is affected by attrition. In econometric terms, this occurs when the likelihood of attrition is correlated with the error term in the analysis in question. For research on SBT commitment, there are good reasons to assume that attrition also fulfils this criterion, as dropping a commitment is a managerial (in)decision, which, in my opinion, is at least as important as committing itself and is likely to be correlated with outcome variables such as financial performance, which have been dependent variables in prior research (see Table 1). Fig. 6 visualizes the attrition a researcher would face if relying exclusively on single snapshot data from the SBTi dashboard.

The graph in Panel A in Fig. 6 shows that attrition can reach up to 25.3%, which is attained for the combination of January 2021 as 'month_obtained' and November 2021 as 'month_analysis'. The fact that this peak occurs about a year after the outbreak of the COVID-19 pandemic might suggest the explanation that some firms did not follow through with the target-setting processes during the pandemic crisis and were silently removed from the dashboard. The impact of the COVID-19 pandemic on emission reduction targets may thus be another avenue for future research.

Surprisingly, the graph in Panel B in Fig. 6 shows a very similar proportion of attrition when the perspective is restricted to firms for which market value of equity data is available for at least one month during the sample period. I had expected that attrition and vulnerability to survivorship bias would be substantially lower. The fact that this is not the case can be explained by the high share of listed firms joining the initiative in the early years of the SBTi, as displayed in Fig. 7. Thus, any attrition measured relative to these early years captures the attrition of listed firms. In addition – but this notion would still need to be established by proper empirical testing in future research – listed firms are more likely to be scrutinized by the SBTi, while smaller unlisted firms might fly under the radar or not commit in the first place but directly submit targets.
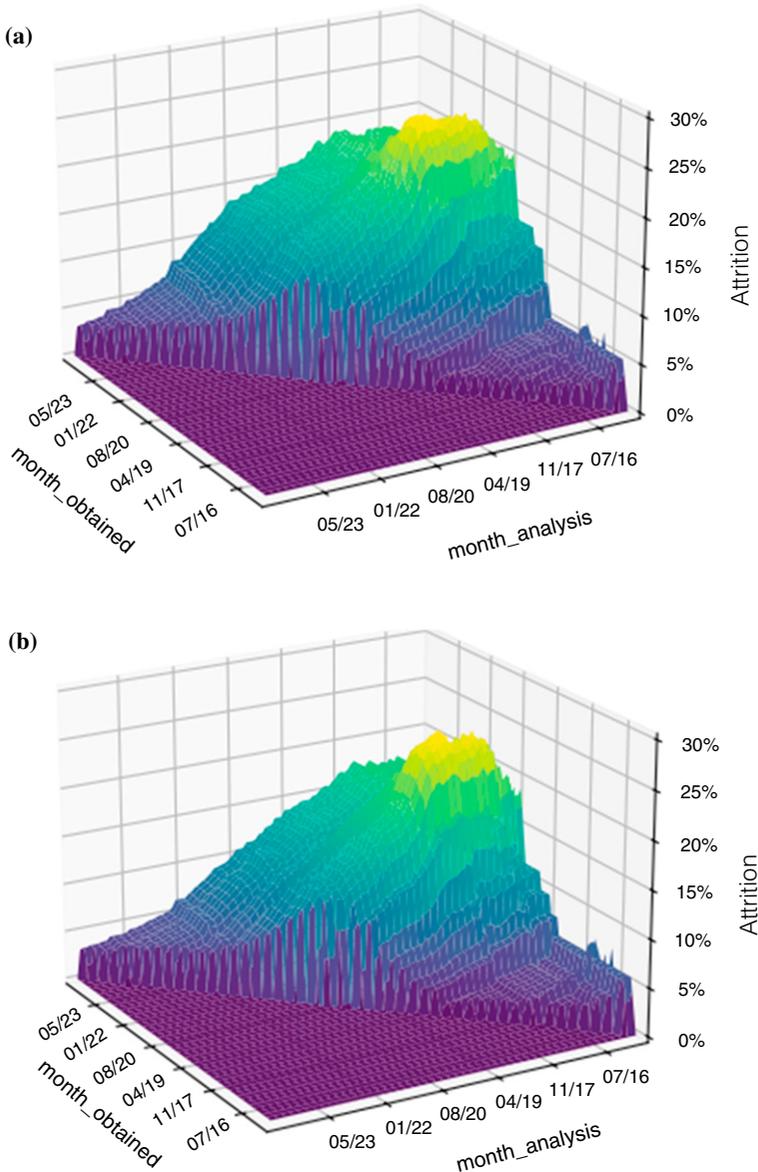
(a)

(b)

Fig. 6.   Attrition for all Firms (Panel A) and Listed Firms (Panel B).

5. OPPORTUNITIES FOR FUTURE RESEARCH

5.1 Determinants of Commitment Removals

The newly created dataset offers a multitude of research opportunities. The most obvious one, in my opinion, is the analysis of which factors correlate with the
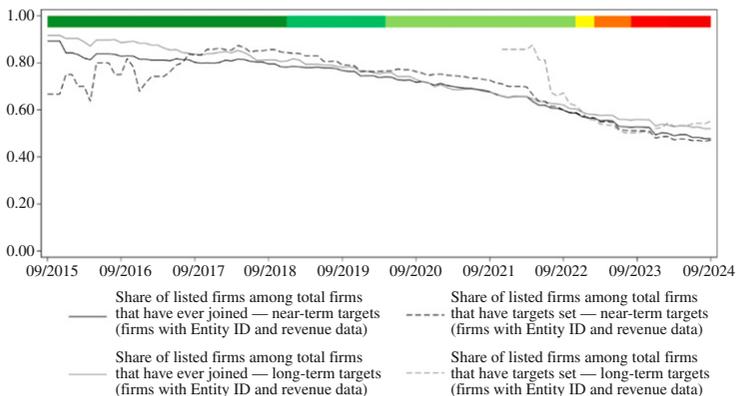
Fig. 7.   Evolution of the Share of Listed Firms Among all Firms in the
Dataset (Colours Indicate the Strictness of Expiring Commitment Policies (SBTi,
2018, 2020, 2022) as Displayed in Fig. 2).

removal of commitment. Are there managerial traits or governance characteristics (e.g. compensation tied to environmental performance) that explain the removal versus target submission in the aftermath of the fundamental shift in the policy for expiring commitments? A research group at the University of Cagliari is investigating this while focusing on listed firms and a static view (Wasli, 2024). This project could be extended to private firms.

5.2 Peer Group Dynamics

Bolton and Kacperczyk (2024), using data on listed firms and an annual data structure, provide initial evidence of peer effects in the context of target commitments. This research can be expanded to private firms, refined using data with monthly frequency and rerun on a dataset free from survivorship bias. Particularly promising is the analysis of individual firms' peer group leadership in terms of committing to or removing a commitment. What implications does it have for peers when leading firms set targets or withdraw them? For example, in 2023, four major banks – Standard Chartered, HSBC, ABN Amro and BNP Paribas – each withdrew their commitments in separate actions, but the business press picked this up as a joint event and cited similar justifications, such as targets preventing the financing of still-needed fossil fuels (Wilkes, 2023).

5.3 Shifting the Targets Up and Down the Corporate Tree, and Doing-Business-As Designations

While performing the manual corrections, particularly while checking whether gaps in the data represent true absenteeism of a previous commitment or can be explained by other phenomena, I realized that firms, more often than I would have expected, shift target commitments up or down the corporate hierarchy or

make commitments at a lower corporate level even though there is already a commitment at a higher level. I have not yet fully understood this phenomenon, but I can envision that there may be more behind it than simple inaccuracies in reporting legal entity names to SBTi. For example, firms might use targets at lower levels as test balloons and elevate them to higher levels if they lead to desired outcomes. A more negative interpretation could be that firms commit to setting targets at lower levels, using them as marketing instruments, knowing that failure to set or comply with these targets would not have a direct backlash at the group level. My thoughts go in a similar direction with regard to doing-business-as designations. Since these designations are not fixed but tied to brands and businesses, if a brand reaches the end of its life cycle, the firm is no longer truly bound to its commitment. This is an aspect that could be of interest to research in the domain of marketing.

5.4 SBTi's Own Legitimacy

The SBTi itself is subject to criticism, and its perception and perceived legitimacy vary over time. A major discussion arose over whether it should allow the use of carbon certificates to offset Scope 3 emissions (SBTi, 2024). It would be intriguing to capture the initiative's own perceived legitimacy by analyzing the sentiment of news streams related to SBTi announcements and correlating it with firms' commitment and target-setting behaviour. From this, researchers could learn about the trade-offs faced by such an important non-governmental organization, which lists the Bezos Earth Fund, the IKEA Foundation and Bloomberg Philanthropies, among others, as its main funding sources.

5.5 Climate Change and Constitutional Law

Constitutional law often incorporates aspects of climate change targets as non-fixed governmental commitments, i.e. vague guidance for legislators that is hardly enforceable through legal actions. However, in some jurisdictions, courts have derived fixed commitments from such high-level articles, granting plaintiffs relief on very specific aspects. For example, in a landmark ruling in 2021, Dutch courts ordered Shell to reduce its carbon emissions by 45% by 2030 compared to 2010 levels.[7] The plaintiffs' arguments were based on high-level articles in the Dutch Civil Code and the European Convention on Human Rights (e.g. the right to life). An interesting research question is whether these landmark decisions lead to more or less commitment to carbon emission reductions at the corporate level.

5.6 Replications

The analysis of the newly created dataset has revealed that data drawn as a snapshot from the SBTi website can suffer from attrition of up to 25%, even for a sample of listed firms. Prior research by Easton et al. (2022a, 2022b) has shown how attrition can profoundly impact empirical results. Thus, the results of the

studies discussed in Section 2 could be replicated and verified using the newly created dataset to check whether attrition indeed leads to survivorship bias in these settings.

6. CONCLUSION

The SBTi and its multi-stage process of first committing to set a target, and then either setting, withdrawing from, or getting removed from a commitment, create a rich research environment. This richness is amplified by the dynamic evolution of the SBTi's expiring commitment policies from 'silent removal' to tagging as 'commitment removed', resembling a name-and-shame scheme. Why is research in this domain still relatively underdeveloped, with few published papers in peer-reviewed field journals and a handful of outstanding working papers that, despite their overall high quality, rely on outdated data? My explanation for this is the lack of a comprehensive historical database with firm identifiers that link SBTi data to financial data.

In this chapter, I outline how such a database can be constructed. The costs are significant. I started this project in mid-June 2024 and finished it in mid-October 2024, dedicating half of my working time to it. Thus, the overall working time was about two months. To enable individual researchers to estimate their own costs for setting up this database, it is important to understand that I incurred no material learning costs; at the time of starting, I was already familiar with coding techniques and could draw on many years of experience from similar projects where firm names needed to be matched to financial databases. Therefore, depending on a researcher's experience level and coding skills, I estimate the cost of constructing such a dataset to be between two and six months of intensive work (full-time equivalents). Unfortunately, I am not permitted to make the dataset publicly available, as the S&P Capital IQ Entity ID represents proprietary data of Standard & Poor's. My request to publish a list of firm names alongside Entity IDs was denied by the data vendor.

Given these significant costs and the fact that I am not allowed to publish the newly created dataset, I invite researchers to collaborate on joint projects. This would require that the collaborator's institution has a licence to access S&P Capital IQ. Alternatively, my institution can host visiting researchers if they bring their own funding.[8] I would be delighted to receive applications by email, stating the research idea and how it can be executed using the newly created dataset.[9]

FUNDING NOTICE

NOTES

1. When accessing the current version of the SBTi dashboard (https://scienceba-sedtargets.org/target-dashboard), a pop-up window with the following message appears: 'The dashboard shows organizations that have had greenhouse gas (GHG) emissions reduction targets validated as science-based by the SBTi. It also shows organizations that have committed to set science-based targets, as well as those that have had their commitments removed in accordance with our Commitment Compliance Policy. The information in the dashboard is updated every Thursday, with commitment removals taking place once a month, ordinarily on the first Thursday of the month'.

2. Within another research project, my co-author requested archival data from SBTi and received no response.

3. It exceeds 83.3% because the 1885 unmatched firm names likely include variations of the same entity written differently.

4. I thank Nouha Wasli from the University of Cagliari for compiling the list of the following examples: CAF Group, Globant España S.A. and Byggmax Group AB. This list is not exhaustive.

5. CAPTCHA stands for 'completely automated public Turing test' to tell computers and humans apart. It refers to various authentication methods that validate users as humans, not bots, by presenting a challenge that is simple for humans but difficult for machines (https://www.ibm.com/topics/captcha).

6. I am not allowed to disclose the terms of my institution's contract with Standard & Poor's. Nevertheless, I can state that the annual fees are likely affordable for any academic institution in an economically developed environment. In addition, Standard & Poor's allows an unlimited number of users in our research department without charging extra fees.

7. https://climatecasechart.com/non-us-case/milieudefensie-et-al-v-royal-dutch-shell-plc/

8. The process of hosting holders of EU passports is straightforward. The process for holders of other passports is less so, but still feasible.

9. Interested researcher can use the 'Pitching Research' form of Faff (2021).

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