Research Note

Exploring the Role of Businesses in Polycentric Climate Governance with Large-*N* Data Sets

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Abstract

Much existing empirical research on polycentric climate governance (PCG) systems examines small-*N* examples. In response, we aim to advance studies of PCG by exploring, and reflecting on, the use of large-*N* data sets for analyzing PCG. We use Python (a programming language) to create a novel data set from the United Nations' Global Climate Action Portal. This method allows us to quantify key variables for 12,568 businesses located in Organization for Economic Co-operation and Development countries: the number of businesses' climate commitments, their progress toward meeting those commitments, and businesses' memberships in "more polycentric" networks via transnational climate initiatives (TCIs). Our analysis of these data reveals that greater interconnectedness may strengthen climate policy performance, since businesses with memberships in TCIs more commonly achieved their commitments. Additional research using these data, and/or similar methods, could be conducted on climate governance and on other areas of international environmental governance, such as mining and oil production.

Keywords: businesses, climate change, companies, Global Climate Action Portal, polycentric climate governance, transnational climate initiatives, UNFCCC

The 2015 Paris Agreement prioritized greater participation in climate governance by nonstate actors, including businesses (Coen et al. 2023; Falkner 2016). These activities contribute to a multilevel, multiactor global climate landscape that Gajevic Sayegh (2020) has described as a "now internationally recognized system of polycentric climate governance [PCG]" (485; see also Falkner 2016; Jernnäs and Lövbrand 2022; Oberthür 2016). PCG entails voluntary self-organization by a diverse range of actors, which undertake site-specific

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activities, experiment, and build trust, through interactions and mutual adjustment, within a context of overarching rules (Dorsch and Flachsland 2017; Jordan et al. 2018; Ostrom 2010). Yet, most empirical investigations of PCG are small-*N* and focus on one geographical region (e.g., Gillard et al. 2017; Morrison 2017; de Wit and Mourato 2022), meaning that there is a paucity of empirical research on large-*N* PCG systems, especially in transnational contexts (Kellner et al. 2024; Morrison et al. 2023). Hence there is a need to conduct exploratory analyses of transnational, large-*N* PCG systems, although doing so risks lessening the conceptual nuances derived from small-*N* scholarship on polycentric governance, and there are limited comparative data for conducting such multiactor analyses. Usefully, computer programming languages increasingly enable politics and policy scholars to obtain large-*N* data sets and unlock previously unidentifiable patterns within them (e.g., Brandsma et al. 2023).

The primary contribution of this article is a large-*N* comparative analysis of *businesses'* climate mitigation commitments. As "business has frequently propagated the adoption of voluntary agreements and 'self-regulation' which theoretically fits polycentric approaches" (Wurzel et al. 2019, 5), there is utility in analyzing businesses' activities from a PCG perspective. Ostrom (2010) proposed that a PCG system would entail "commitments" to reduce emissions by "small- to medium-scale units" that are linked together through "diverse information networks" (556). We seek to operationalize this description of PCG via large-*N* data sets, while building on previous research that depicts PCG as a matter of degree (Dorsch and Flachsland 2017). To do so, we interpret transnational climate initiatives (TCIs) as a manifestation of "diverse information networks" and businesses as "small- to medium-scale units." Hence we understand that businesses' membership in larger numbers of TCIs approximates as a *greater degree of polycentric governance* within a transnational system, and we assess changes in businesses' public climate commitments according to these changes in membership levels. We later reflect on this operationalization.

To undertake this exploratory analysis, we analyze data from the United Nations' (UN's) Global Climate Action Portal (GCAP): an online repository for collating actors' carbon disclosure activities, which, at the time of data collection (February 2023), contained 30,763 actors. Businesses in the GCAP can share "carbon disclosure" activities, such as their current greenhouse gas (GHG) emissions, commitments to future reductions, and membership of TCIs. However, although the GCAP played an important discursive and momentum-building role around the 2015 Paris Agreement, its contents have not underpinned large-*N* comparative research (see Bäckstrand and Kuyper 2017; Mai and Elsässer 2022). This lack of use is a consequence of the GCAP not providing the option to export data at the click of a button, necessitating the use of computer programming languages, such as Python (Munzert et al. 2014; Wilkerson and Casas 2017), to scrape pertinent data from the website. Because the GCAP contains heavy industry corporations, fossil fuel companies, mining groups, and

more, the data within the GCAP are a rich but as-yet neglected resource for comparative research in global environmental politics.[1]

This article is structured as follows. First, we outline our approximation of PCG for large-*N* transnational business systems via TCI membership. In the second section, we explain our methods for data collection and analysis. We describe how we used Python to build our data set of 12,568 businesses from the thirty-eight economically developed Organization for Economic Cooperation and Development (OECD) countries, distributed across four continents (Asia, Europe, North America, and South America). Third, in our analysis section, we find that three-quarters of businesses do not track their progress in achieving their commitments and that within a subset of those businesses that do, more than one-third of tracked commitments had not been accomplished despite reaching their deadlines (n = 621/1,663). However, via regression analyses, we find that businesses that are members of more TCIs achieved a larger percentage of their commitments and more commonly fully accomplished those goals. Fourth, we discuss three aspects of our findings, namely, large-*N* data sets in global environmental politics, operationalizing large-*N* PCG systems, and businesses as climate actors within PCG systems. Additional research using the GCAP could expand our analysis of climate governance and examine other areas of global environmental politics, including mining, fossil fuels, and other forms of resource extraction.

Businesses Within Polycentric Climate Governance

The central promise of PCG is that a policy system with multiple overlapping and interacting actors will be better equipped than a more monocentric, hierarchical system to deliver climate mitigation and withstand disturbances, experiment, and facilitate policy learning (Dorsch and Flachsland 2017, 55–56; Jordan et al. 2018, 16–17; Ostrom 2010, 556). Every article in this special issue draws from the same understanding of polycentric systems outlined by Ostrom (2010, 552; see Tobin et al. 2024). In that article, Ostrom envisioned polycentric systems as manifesting via the creation of emissions reduction "commitments" by "small- to medium-scale units that are linked together through diverse information networks" (556). Existing empirical research on PCG provides detailed understandings of contemporary climate governance but is predominantly small-*N* in nature and locally situated rather than transnational (e.g., de Wit and Mourato 2022; Gillard et al. 2017; Morrison 2017). There is a paucity of research on multiactor PCG systems (Morrison et al. 2023, 6). Large-*N* systems merit inquiry because of the transboundary and multiactor nature of climate mitigation, where different dynamics may be at play compared to those within single case studies. Moreover, operationalizing PCG systems via extant empirical data is challenging because of

1. Global Climate Action Portal, available at: https://climateaction.unfccc.int/, last accessed July 8, 2024.

the need to juggle the prioritization of rich qualitative insights around polycentric governance with multiactor, quantitative data. As such, this Research Note explores the operationalization of PCG via large-*N* data sets and complements the other studies within this special issue, particularly the work by Tosun et al. (2024), who also build on Ostrom's (2010, 556) vision for polycentric systems in climate governance.

We operationalize businesses' involvement in PCG systems as manifesting through membership in TCIs. TCIs provide a set of institutional rules that aim to facilitate collective action among members and rely on reputational costs and benefits for securing active involvement by individual members (Berliner and Prakash 2015; Hickmann 2017). Important for our understanding of how TCIs fit within PCG systems is the fact that they undertake a range of activities, such as encouraging carbon disclosure among their members and providing examples of best practice regarding how to achieve climate commitments (Hermwille 2018). In line with conceptualizations of PCG, TCIs can combine different types, sizes, and origins of actors, increasing the diversity of these information networks. Some TCIs also provide monitoring mechanisms for tracking the extent to which actors are living up to their pledges, but TCIs do not provide substantial mechanisms for punishing failure to reach targets (Berliner and Prakash 2015; Michaelowa and Michaelowa 2017). Following the assumptions of Ostrom's (2010) article, we expect businesses' climate performances to be of higher standards if they are operating within transnational governance activities that are "more polycentric," through their membership in a greater number of diverse information networks (operationalized as TCIs), as compared to businesses that make commitments but are members of fewer, or zero, TCIs.

Studies on TCIs have examined how initiatives function, where they come from, and how effective they are (Bulkeley et al. 2014; Hale and Roger 2014; Roger et al. 2017), but much of the comparative research on TCIs was conducted in the mid- to late 2010s, prior to a global expansion in the number of TCIs (Hale and Roger 2014, 70; Widerberg and Pattberg 2014). As of February 2023, the UN's GCAP contained 150 TCIs, reflecting the "cumulatively additive," or expanding, nature of PCG systems, that Ostrom (2010, 555) expected. Research on businesses' membership in TCIs is small in number (Hickmann 2017), especially regarding businesses' simultaneous membership in multiple TCIs, let alone from a perspective that emphasizes PCG systems. Hence we seek to contribute to these gaps by exploring the utility of large-*N* data sets for providing new insights about system-level dynamics.

Data

In February 2023, we used Python to systematically track through, and scrape pertinent data from, the web addresses of each OECD business on the public GCAP. We highlight Brooker (2020) as an accessible guide for social scientists to learn Python and note that the programming language is known for its

accessibility and supportive online community (see also Munzert et al. 2014; Wilkerson and Casas 2017). We scraped data from the GCAP website pertaining to businesses, commitments, and TCI membership. We describe these data in this section.

We operationalized businesses as actors that define themselves as either companies or investors in the GCAP,[2] for example, Japan's Mazda Motor Corporation (a "company"), and the United States' Bank of America (an "investor"). We selected all 12,568 such businesses from the thirty-eight OECD states. We also collated descriptive data about each business according to its home country and economic sector, to reflect on the diversity within our data set. Regarding the generalizability of the data, because the actors included in the portal are self-selected, as Bäckstrand and Kuyper (2017, 778) note, we cannot generalize our findings beyond those 12,568 businesses we analyzed. Likewise, we do not know by how much businesses in our study would have altered their emissions in the absence of the GCAP and TCIs—the counterfactual outcome is simply unknown. Nevertheless, we consider our results to be valid for the 12,568 OECD businesses within the GCAP, especially when considering that we base our analysis on data for the entire population (and not a sample) of these OECD businesses.

We collected the climate commitments of our 12,568 businesses, which are divided in the GCAP into two categories. *Announced commitments* may play an important role in building momentum around nonstate climate action but are not tracked regarding their progress. In contrast, *tracked commitments* are updated through annual disclosures to one of the GCAP's data partners, thereby enabling the determination of whether each tracked commitment has been accomplished (United Nations Climate Change 2022). Tracked commitments follow a common descriptive structure, which can then be used to analyze the resultant data set in more detail.[3] As such, by analyzing tracked commitments within the GCAP, we can examine, for example, the policy density (number of commitments; see Bauer and Knill 2014), the policy intensity of the outputs (the size of the commitment), and policy achievement via one data set.

We began by determining which of the 12,568 businesses produced only announced commitments ('group 1') and which produced at least one tracked commitment ('group 2'). A key finding is that within the 12,568 OECD businesses listed in the GCAP, 2,849 businesses created no climate commitment, and 7,085 (group 1) created only announced, and no tracked commitments. We return to this point in our discussion. In contrast, 2,634 businesses made tracked commitments (group 2). Next, we narrowed down group 2 to comprise businesses with

2. The GCAP features six types of actors: countries, regions, cities, companies, investors, and other "organizations" (such as educational establishments).
3. These are the free text aspects of the data used to generate additional variables: verbs associated with emission reductions (*reduce, fulfill, halve, achieve,* or *produce*); descriptions of a pursued outcome (such as reducing CO_2e [carbon dioxide equivalent] emissions intensity or fulfilling electricity consumption from renewable sources); a percentage change to be accomplished; a starting year for the commitment; and a deadline year for the commitment.

tracked commitments for which the deadline had already elapsed. Of those 2,634 group 2 businesses, 1,258 created tracked commitments with pre-2023 deadlines, and hence these commitments should have been accomplished at the time that we undertook our analysis.[4] Hereinafter we use the word *achieved* to refer to the percentage of the commitment that is achieved and the word *accomplished* to mean that the totality of the stated objective, regardless of the size of that commitment, was fulfilled. Next, we filtered further to select only the 1,158 businesses with tracked commitments for reducing emissions (hereinafter group 3), totaling 1,663 such commitments. Hence group 3 is a subset of group 2.

In the Appendix, we show the home countries (Table A1) and economic sectors (Table A2) for all businesses in groups 1, 2, and 3. The most frequently occurring home countries of businesses in group 3 are the United States (263/1,158), Japan (228/1,158), and the United Kingdom (137/1,158). The most frequent economic sectors in group 3 are banks, diverse financials, and insurance (121/1,158); technology hardware and equipment (76/1,158); and food and beverage processing (75/1,158). Tables A1 and A2 show that there is notable sectoral variation between the group 1 businesses that did not track their commitments compared to groups 2 and 3, and so we encourage future research, perhaps fruitfully using network analysis, to examine this variation.

We also recorded the TCI memberships of our 12,568 businesses. The TCIs in the GCAP range in size from three members to more than 10,000; focus on "mainly adaptation," "mainly mitigation," or "equally mitigation and adaptation"; and undertake functions related to PCG including "knowledge dissemination," "policy planning," "technical implementation," and "institutional capacity building." Hence we understand them as *diverse information networks*. We do not analyze the differences in institutional design between different TCIs, but this topic is promising for future research. Figure 1 shows the percentage distribution of all 12,568 OECD businesses by number of TCIs joined. Most businesses are members of only one TCI (68%), and a small fraction of businesses (0.22%) are members of more than ten TCIs.

Analysis

We analyze the group 3 businesses, which are the subset of group 2 businesses that created pre-2023 deadlines for tracked commitments on reducing emissions. Of the 1,663 tracked commitments, 1,042 commitments (62.7% of the total) were fully accomplished (by 777 of the 1,158 group 3 businesses). The remaining 621 tracked commitments (37.3% of the total) were not accomplished by their pre-2023 deadlines.

From here we found that TCI membership was significantly associated with a higher degree of achievement for emission reductions. Figure 2 plots

4. Businesses may have already accomplished commitments that held deadlines later than 2023, but this performance is not included within our analysis.

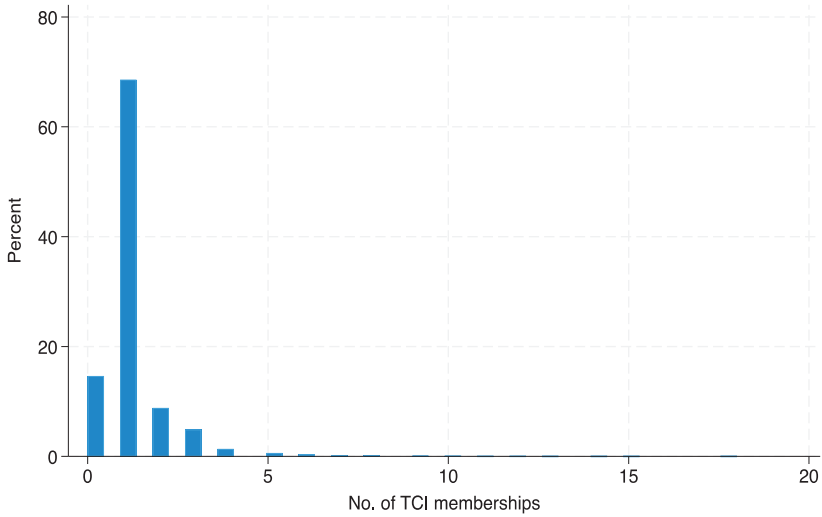
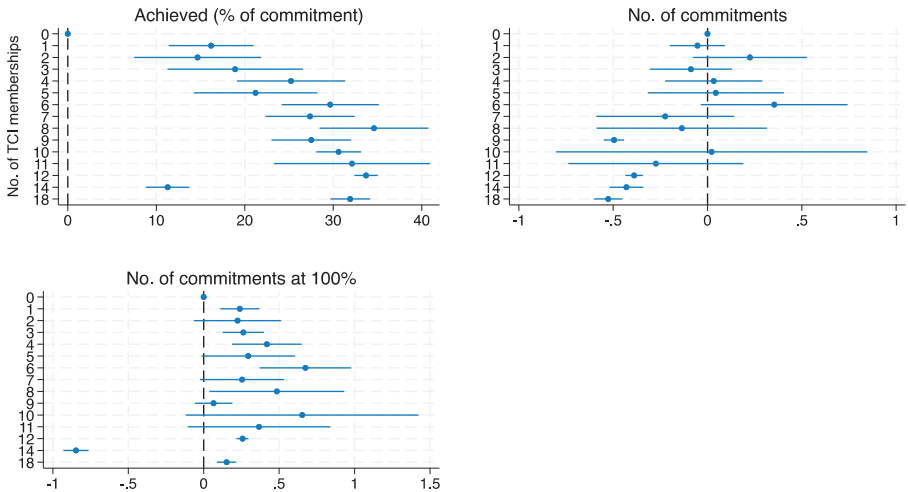


Figure 1
Distribution of TCI Membership, by the Number of TCIs Joined by Businesses, as a Percentage of the Total 12,568 OECD Businesses in the GCAP



N=1158

Figure 2
TCI Membership and the Percentage Achievement of Commitment, Number of Commitments, and Number of Accomplished (100% of the Goal Achieved) Commitments for the 1,158 Group 3 Businesses

coefficients from three separate ordinary least squares regression models using as dependent variables the proportion of achieved emission reduction as a percentage of pledged emission reductions (policy achievement), the count of pre-2023 commitments (policy density), and the count of pre-2023 commitments fully accomplished. All models include fixed effects (countries) and clustered standard errors (countries), and Figure 2 shows the effect of number of TCIs joined, compared to membership of 0 TCIs (see the vertical dotted line within each figure). First, the effect of TCI membership is significant, $p < 0.001$, and each additional TCI membership is associated with an average increase of approximately 4.5 percent of achieved emission reductions (compared to pre-2023 emission reduction pledge). Second, TCI membership does not seem to affect the number of commitments that businesses make, which suggests that TCI membership does not use commitments as "cheap" signaling. Third, TCI membership is associated with a higher rate of commitment accomplishment: each additional membership leads to an average increase of 0.05 commitments successfully accomplished. This effect is small, but significant, $p < 0.001$. Taken together, these findings suggest that businesses achieve more of their commitments as a function of participating in more TCIs. We encourage further research to examine this dynamic—and the possible opposite direction of causality—through detailed qualitative research on businesses' motivations for joining TCIs (see Orsato et al. 2015).

Discussion and Conclusions

Ostrom (2010) proposed that "it is important to recognize the evolving polycentric system both for its strengths and weaknesses" (555), and we have sought to respond to this call. Yet, one main obstacle to examining evolving PCG systems—considering the large number of actors involved—is the methodological difficulty associated with unpacking these systems. The data collection and analysis demonstrated in this article explored the use of large-*N* data for providing insights into transnational PCG. In particular, using computer programming languages to data-scrape large-*N* data sets can enable new analyses into the effects of engagement in PCG-related institutions on actors' willingness to make, achieve, and even fully accomplish environmental goals. We reflect upon, and propose future research regarding, three aspects of our study, namely, the use of large-*N* data sets in global environmental politics, operationalization of PCG via TCI membership, and considerations of businesses' roles in PCG and in climate action more broadly.

First, we have explored the potential utility of large-*N* data sets for examining global environmental politics. Our approaches can be used and built on in myriad ways. Other programming languages could likewise be used to undertake this process, and the GCAP offers multiple dimensions for analysis within global environmental politics by measuring policy density, intensity, and achievement. As shown in the Appendix, there is wide variation in the home

countries, and economic sectors, of the OECD businesses in the GCAP that produce announced commitments versus those that track them. The reality that some countries—such as the United States, Japan, and the United Kingdom—are heavily represented within the data set is, presumably, influenced by the number of transnational businesses in these states but may also suggest that in certain national contexts, businesses perceive greater rewards for involvement in transnational climate action. By examining the diversity of home countries among businesses that participate in transnational climate action, future research can compare the influence of pro-climate norms between states, providing insights on climate performance that are distinct to the existing comparative focus on national governments' policy activities (e.g., Tobin 2017).

The discovery of such diversity in businesses' national origins was only possible through analysis of a large-*N* data set. As such, these findings beg similar such inquiries into other aspects of global environmental politics. Research could also compare the performances of businesses from different sectors. For example, as shown in Table A2, the GCAP provides data for OECD businesses from three different mining sectors (coal; precious metals; and iron, aluminum, and other metals), which in turn hold important implications for global environmental politics more broadly than climate governance. The GCAP could also be used to provide insights regarding other types of actors contained within the portal, particularly cities, which possess distinct capacities and motivations from profit-driven businesses. Scholars can use Python or similar programming languages (Brooker 2020; Munzert et al. 2014; Wilkerson and Casas 2017) to produce and analyze their own data sets.

Second, we reflect on our exploratory analysis of large-*N* PCG. We approximated greater polycentricity via membership in TCIs, which significantly improved the achievement of commitments. Yet, while our approach sought to address the lack of large-*N* studies of PCG, we reflect that conceptualizations within other literatures, such as that on complex systems analysis (Duit and Galaz 2008), and voluntary business initiatives (Hickmann 2017) offer fruitful conceptual means for analyzing such data sets. That said, we suggest that future research may benefit from using large-*N* data sets to examine how different types of TCIs can influence climate action in different ways, as they would enable assessment of degrees of diversity within information networks, which Ostrom (2010, 556) envisioned to be a feature of a polycentric system acting on climate change.

Third, we reflect on businesses as climate mitigation actors (see Clapp 2005; Jones and Phillips 2016; Pinkse and Kolk 2009), especially within PCG systems. A key mechanism of PCG is trust building (Jordan et al. 2018, 19), and it is implicit that this mechanism underpins the GCAP too. Likewise, the voluntary nature of participation is a key feature of both PCG (Abbott 2018) and the post–Paris Agreement transnational governance landscape that includes businesses. Yet, businesses are distinct from other types of nonstate actors within climate governance (Coen et al. 2023; Falkner 2008). If

businesses—which may be competitors of other businesses within the same sector—fail to accomplish their public commitments, this trust may rapidly be eroded, impacting voluntary participation. As such, our finding that more than one-third of group 3 businesses (n = 621/1,663) failed to accomplish their goals by elapsed deadlines aligns with Southworth's (2009) argument that voluntary corporate action may be a "useful, but insufficient mechanism" (329) for responding to climate change. Without accountability mechanisms, actors may participate in carbon disclosure activities by being listed on the GCAP—and benefit from any positive boosts to their green credentials with the public and government (Berliner and Prakash 2015)—yet ultimately not achieve these pledges. Moreover, because our findings relate to a self-selecting sample of businesses that had chosen to publicly participate in carbon disclosure, less committed actors may yet be even less successful at accomplishing commitments and/or may pursue smaller emissions reduction commitments in the first place.

The exploratory insights provided by this article are intended to facilitate future research on global environmental politics, PCG systems, and businesses as climate actors by using large-N data sets. We found that greater TCI membership significantly improved commitment achievement by businesses. However, emission reductions must still be ratcheted up dramatically to limit global temperature increases to 1.5°C. The growing numbers and sizes of public data sets, and accessibility of computer programming languages, offer opportunities for conducting previously impossible analyses of complex systems, which can provide new comparative explanations of variations in actors' climate performance.

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Appendix

Table A1

Table showing the home country for three Groups within our data: the OECD businesses that produced 'announced' commitments (Group 1); the OECD businesses that produced tracked commitments (Group 2); and a subset of Group 2, which is the OECD businesses that produced tracked commitments with a pre-2023 deadline and that pertained to reducing emissions (Group 3). The data are sorted to be in descending order according to the absolute number of businesses in Group 3.

Home country	*Group 1, absolute number of businesses*	*Group 1, number of businesses expressed as a % of the total*	*Group 2, absolute number of businesses*	*Group 2, number of businesses expressed as a % of the total*	*Group 3, absolute number of businesses*	*Group 3, number of businesses expressed as a % of the total*
United States of America	706	9.96	632	23.99	263	22.71
Japan	46	0.65	482	18.3	228	19.69
United Kingdom of Great Britain and Northern Ireland	4342	61.28	264	10.02	137	11.83
Germany	138	1.95	119	4.52	58	5.01
France	151	2.13	138	5.24	44	3.8
Spain	151	2.13	79	3	43	3.71
Canada	160	2.26	90	3.42	42	3.63
Italy	102	1.44	76	2.89	42	3.63
Republic of Korea	20	0.28	120	4.56	38	3.28
Netherlands	148	2.09	53	2.01	30	2.59

Table A1
(Continued)

Home country	*Group 1, absolute number of businesses*	*Group 1, number of businesses expressed as a % of the total*	*Group 2, absolute number of businesses*	*Group 2, number of businesses expressed as a % of the total*	*Group 3, absolute number of businesses*	*Group 3, number of businesses expressed as a % of the total*
Sweden	146	2.06	77	2.92	29	2.5
Switzerland	97	1.37	56	2.13	28	2.42
Turkey	19	0.27	50	1.9	23	1.99
Denmark	78	1.1	42	1.59	21	1.81
Mexico	80	1.13	36	1.37	19	1.64
Australia	224	3.16	44	1.67	18	1.55
Finland	31	0.44	52	1.97	13	1.12
Ireland	57	0.8	36	1.37	11	0.95
Norway	33	0.47	43	1.63	11	0.95
Belgium	45	0.64	28	1.06	9	0.78
Austria	12	0.17	20	0.76	7	0.6
Colombia	49	0.69	14	0.53	7	0.6
Portugal	30	0.42	17	0.65	7	0.6
Israel	2	0.03	8	0.3	5	0.43
Poland	7	0.1	11	0.42	5	0.43

Table A1
(Continued)

Home country	*Group 1, absolute number of businesses*	*Group 1, number of businesses expressed as a % of the total*	*Group 2, absolute number of businesses*	*Group 2, number of businesses expressed as a % of the total*	*Group 3, absolute number of businesses*	*Group 3, number of businesses expressed as a % of the total*
Greece	6	0.08	7	0.27	4	0.35
Luxembourg	13	0.18	3	0.11	3	0.26
New Zealand	37	0.52	16	0.61	3	0.26
Czechia	2	0.03	4	0.15	2	0.17
Hungary	7	0.1	2	0.08	2	0.17
Lithuania	7	0.1	2	0.08	2	0.17
Slovakia	1	0.01	2	0.08	2	0.17
Costa Rica	16	0.23	2	0.08	1	0.09
Slovenia	1	0.01	1	0.04	1	0.09
Chile	116	1.64	5	0.19	0	0
Estonia	2	0.03	1	0.04	0	0
Iceland	3	0.04	2	0.08	0	0
Latvia	0	0	0	0	0	0
	7,085	**100**	**2,634**	**100**	**1,158**	**100**

Table A2

Table showing the economic sector for three Groups within our data: the OECD businesses that produced 'announced' commitments (Group 1); the OECD businesses that produced tracked commitments (Group 2); and a subset of Group 2, which is the OECD businesses that produced tracked commitments with a pre-2023 deadline and that pertained to reducing emissions (Group 3). The data are sorted to be in descending order according to the absolute number of businesses in Group 3.

Economic sector	*Group 1, absolute number of businesses*	*Group 1, number of businesses expressed as a % of the total*	*Group 2, absolute number of businesses*	*Group 2, number of businesses expressed as a % of the total*	*Group 3, absolute number of businesses*	*Group 3, number of businesses expressed as a % of the total*
Banks, Diverse Financials, and Insurance	28	0.4	276	10.48	121	10.45
Technology Hardware and Equipment	21	0.3	144	5.47	76	6.56
Food and Beverage Processing	79	1.12	150	5.69	75	6.48
Chemicals	22	0.31	175	6.64	74	6.39
Electrical Equipment and Machinery	44	0.62	149	5.66	73	6.3
Automobiles and Components	18	0.25	106	4.02	64	5.53
Mining - Iron, Aluminum, Other Metals	4	0.06	108	4.1	55	4.75

Table A2
(Continued)

Economic sector	*Group 1, absolute number of businesses*	*Group 1, number of businesses expressed as a % of the total*	*Group 2, absolute number of businesses*	*Group 2, number of businesses expressed as a % of the total*	*Group 3, absolute number of businesses*	*Group 3, number of businesses expressed as a % of the total*
Containers and Packaging	18	0.25	119	4.52	53	4.58
Trading Companies, Distributors, Commercial Services and Supplies	3	0.04	82	3.11	44	3.8
Forest, Paper, and Rubber Products	1	0.01	79	3	42	3.63
Software and Services	162	2.29	101	3.83	40	3.45
BLANK	5895	83.2	47	1.78	33	2.85
Oil and Gas	0	0	79	3	33	2.85
Construction and Engineering	149	2.1	69	2.62	32	2.76
Electric Utilities, Independent Power Producers, and Energy Traders	6	0.08	105	3.99	31	2.68

Table A2
(Continued)

Economic sector	*Group 1, absolute number of businesses*	*Group 1, number of businesses expressed as a % of the total*	*Group 2, absolute number of businesses*	*Group 2, number of businesses expressed as a % of the total*	*Group 3, absolute number of businesses*	*Group 3, number of businesses expressed as a % of the total*
Healthcare Providers, Services, and Technology	0	0	58	2.2	25	2.16
Retailing	76	1.07	70	2.66	24	2.07
Telecommunication Services	18	0.25	62	2.35	24	2.07
Pharmaceuticals, Biotechnology, and Life Sciences	4	0.06	55	2.09	22	1.9
Professional Services	204	2.88	39	1.48	18	1.55
Air Freight Transportation and Logistics	12	0.17	34	1.29	16	1.38
Consumer Durables, Household and Personal Products	34	0.48	44	1.67	15	1.3
Air Transportation -	7	0.1	20	0.76	15	1.3

Table A2
(Continued)

Economic sector	*Group 1, absolute number of businesses*	*Group 1, number of businesses expressed as a % of the total*	*Group 2, absolute number of businesses*	*Group 2, number of businesses expressed as a % of the total*	*Group 3, absolute number of businesses*	*Group 3, number of businesses expressed as a % of the total*
Airlines						
Textiles, Apparel, Footwear, and Luxury Goods	27	0.38	56	2.13	14	1.21
Media	55	0.78	36	1.37	14	1.21
Specialized Consumer Services	6	0.08	41	1.56	14	1.21
Food and Staples Retailing	17	0.24	33	1.25	12	1.04
Hotels, Restaurants, Leisure, and Tourism	7	0.1	35	1.33	11	0.95
Building Products	12	0.17	20	0.76	10	0.86
Ground Transportation - Railroads Transportation	3	0.04	22	0.84	9	0.78
Ground Transportation - Trucking Transportation	7	0.1	14	0.53	7	0.6

Table A2
(Continued)

Economic sector	*Group 1, absolute number of businesses*	*Group 1, number of businesses expressed as a % of the total*	*Group 2, absolute number of businesses*	*Group 2, number of businesses expressed as a % of the total*	*Group 3, absolute number of businesses*	*Group 3, number of businesses expressed as a % of the total*
Real Estate	43	0.61	31	1.18	7	0.6
Agricultural Food Production	0	0	12	0.46	5	0.43
Water Transportation	1	0.01	21	0.8	5	0.43
Tires	1	0.01	12	0.46	5	0.43
Homebuilding	5	0.07	19	0.72	5	0.43
Mining - Other (Precious Metals and Gems)	0	0	10	0.38	5	0.43
Construction Materials	18	0.25	15	0.57	4	0.35
Healthcare Equipment and Supplies	11	0.16	7	0.27	4	0.35
Semiconductors and Semiconductors Equipment	4	0.06	10	0.38	4	0.35
Water Utilities	6	0.08	15	0.57	4	0.35
Aerospace and Defense	1	0.01	10	0.38	3	0.26

Table A2
(Continued)

Economic sector	*Group 1, absolute number of businesses*	*Group 1, number of businesses expressed as a % of the total*	*Group 2, absolute number of businesses*	*Group 2, number of businesses expressed as a % of the total*	*Group 3, absolute number of businesses*	*Group 3, number of businesses expressed as a % of the total*
Tobacco	2	0.03	12	0.46	3	0.26
Education Services	23	0.32	2	0.08	2	0.17
Air Transportation - Airport Services	3	0.04	8	0.3	2	0.17
Gas Utilities	0	0	11	0.42	2	0.17
Ground Transportation - Highways and Railtracks	17	0.24	8	0.3	1	0.09
Mining - Coal	0	0	2	0.08	1	0.09
Environmental & Facilities Services	2	0.03	0	0	0	0
Ports and Services	0	0	0	0	0	0
Public Agencies	1	0.01	0	0	0	0
Solid Waste Management Utilities	6	0.08	0	0	0	0
Animal Source Food Production	0	0	1	0.04	0	0

Table A2
(Continued)

Economic sector	*Group 1, absolute number of businesses*	*Group 1, number of businesses expressed as a % of the total*	*Group 2, absolute number of businesses*	*Group 2, number of businesses expressed as a % of the total*	*Group 3, absolute number of businesses*	*Group 3, number of businesses expressed as a % of the total*
Asset Owner	2	0.03	0	0	0	0
TOTAL =	**7,085**	**100%**	**2,634**	**100%**	**1,158**	**100%**