Show & Tell

An Analysis of Corporate Climate Messaging and its Financial Impacts

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Abstract

As climate-induced physical and transition risks to corporations are becoming more and more material, investors are increasingly scrutinizing a patchwork of voluntary climate-related communications–namely public disclosures, emission reduction commitments, and soft information from earnings calls and other public announcements. We observe, for large-cap U.S. firms, a rise in the usage of all forms of climate communication from 2010-2020. We also find evidence that a majority of firms are not decarbonizing on a sufficient trajectory to meet committed emission reduction targets. In regard to financial effects, we show that increased transparency from disclosure can offset a significant portion of the price-to-earnings discount associated with carbon emissions, especially for firms in the energy and industrial sectors. A similar effect is observed for positive climate-related sentiment during the Q&A , but not the management update section of earnings calls. Commitments are shown to have a statistically insignificant impact on valuation.

Keywords

climate change | carbon emissions | disclosure | science based and CDP targets | earnings calls | financial cost of carbon

Introduction

Climate and environmental risks to corporations are becoming increasingly scrutinized by investors. The underlying sources of these risks are well understood in theory: climate change (induced by greenhouse gas emissions) imparts a physical impact on people, communities, capital, natural resources, and economies. This impact may materialize as acute events (e.g., wildfires, storms, heatwaves) or as longer-term climate phenomena (e.g., droughts, sea level rises). The transition to a decarbonized economy is also accompanied by changes in the regulatory and legal landscape, social norms, technological progress, customer preferences, and capital markets. Businesses face a range of growing challenges related to climate change, including reduced access to key inputs or infrastructure, inventory damage, supply chain disruptions, untenable insurance costs, regulatory, compliance, and litigation costs, shifts in product/service demand, and potential reputational damage.

Empirical evidence suggests that capital markets are already attentive to these risks and price relevant information on climate change risk exposure, where available. Investors have been shown to reward firms for better environmental performance with lower costs of capital (Friedman and Heinle, 2016; Bolton and Kacperczyk, 2021; Pástor et al., 2021) and higher financial valuations across economic sectors (Lazard Climate Center, 2021; Bolton et al., 2022).

Less evidence exists on the effects of how companies communicate their climate change-derived risks and mitigation strategies. This study focuses on the three most significant means by which firms provide transparency about their climate risks and goals: 1) disclosure of climate and environmental impacts from operations and supply chains, 2) commitments to reduce the carbon footprint of operations, supply chains, or investments, and 3) soft information messaging through earnings calls or press releases. Annual and sectoral trends of greenhouse gas (GHG) disclosure rates, commitment rates, and earnings call sentiment are examined for a sample of large U.S. companies[1] over 2010-2020. Novel findings on the effects of all three types of communication on financial valuation are presented and discussed, as well as implications for policies that mandate disclosure or require greater transparency around net-zero emission commitments.

1. Those that are in the Russell 3000, a market-cap weighted index of the 3000 largest U.S. equities, as of 06/25/21

Measuring and Communicating Climate Risk

In the absence of a standardized disclosure regime, investors can only view a firm's "greenness" through a glass darkly: that is, investors rely on the patchwork of voluntary climate-related communications that firms make. These include regulatory filings, public commitments, and soft information, like earnings call messaging and other forms of communication through the media. Each of these modes of communication provide incomplete assessments and present ambiguities. No single mode can deliver an informational "silver bullet" to the problems of transparency and comparability about climate and environmental impacts.

In the absence of a standardized measurement framework, firms may currently choose from a range of metrics to communicate their exposure to climate risk. These metrics include GHG emissions, water usage, total waste, green revenue, natural capital levels, ESG scores, and measurements of climate-related physical or regulatory risk exposure. Unsurprisingly, the choice of metric isn't altogether random: in a study of seven large firms' carbon emission reduction goals and reporting of their progress toward those objectives, Comello, Reichelstein, and Reichelstein (2021) found that firms' definition of certain metrics in their calculation of their carbon footprint are strategic, and their choices are typically tied to their emissions profile.

Through their efforts to promote standardized, comparable metrics of climate-related risks, the international Taskforce on Climate-Related Financial Disclosures ("TCFD") has recently proposed a framework to encourage companies to more systematically communicate their climate-related risks. This framework has been influential in shaping climate-related disclosure regulation in advanced economies. The TCFD, which was launched by the Financial Stability Board at the Paris COP21 in 2015, was founded "to develop consistent climate-related financial risk disclosures for use by companies, banks, and investors in providing information to shareholders[1]." Its recommended framework requires companies to provide transparency on governance, strategy, risk management protocols, and benchmarking for climate-related risks and opportunities[2]. In June 2021, finance ministers and central bank governors from the G7 countries agreed to require climate-related financial reporting consistent with the TCFD's standards[3]. In April 2022, the U.K. became the first of these countries to implement TCFD-aligned requirements in a new mandatory disclosure regime for over 1,300 of the U.K.'s biggest registered companies and financial institutions[4].

In April 2022, the U.S. Securities and Exchange Commission (SEC) formally proposed rule changes[5] that would require companies to make emissions and climate risk-related disclosures in their filings. The proposed risk disclosures are remarkably consistent with the TCFD framework discussed above, requiring companies to illuminate how climate risks affect their business strategy and operations, as well as the governance and risk management protocols employed to mitigate them. The SEC proposal on emissions disclosures has not been without controversy, however, with some commentators suggesting that the proposed disclosure requirements are too broad and that it represents administrative overreach. Under the proposed rules, companies would be required to provide estimates of GHG emissions associated with their operations and the energy they consume — respectively known as Scope 1 and Scope 2 disclosures. Companies would also be required to make Scope 3 disclosures — that is, they would be required to estimate emissions generated throughout their value chain, including suppliers and customers — if it is material or there is a target associated with it.

1. See: https://www.unepfi.org/climate-change/tcfd/#:~:text=The%20Task%20Force%20on%20Climate,in%20providing%20information%20to%20stakeholders
2. See: https://www.fsb-tcfd.org/recommendations/
3. See: https://www.fsb-tcfd.org/press/statement-of-michael-r-bloomberg-on-g7-finance-ministers-announcing-mandatory-climate-disclosure/
4. See: https://www.gov.uk/government/news/uk-to-enshrine-mandatory-climate-disclosures-for-largest-companies-in-law
5. Refer to the SEC proposed rule, "The Enhancement and Standardization of Climate-Related Disclosures for Investors," 87 FR 21334, April 11, 2022.

Measuring and Communicating Climate Risk (cont'd)

In addition to frameworks for corporate disclosure, since the 2015 Paris Agreement, most of the world's national governments have pledged to decarbonize their economies and have set targets accordingly. For any country to make good on its pledge, the private sector must participate in these efforts as well. To that end, progress may have already begun: many of the 500 largest global corporations — which are collectively responsible for one-third of global GDP and the same proportion of global GHG emissions — have made public pledges to become carbon neutral in so-called net-zero commitments (Bolton and Kacperczyk, 2021). The most common net-zero target programs for firms are the Carbon Disclosure Project ("CDP") initiative, the Science-Based Target Initiative ("SBTi"), and Climate Action 100+. SBTi is considered the gold standard for climate commitments, as firms are required to develop decarbonization targets that, at a minimum, exceed the ambition of limiting the global temperature increase to 1.5°C compared to pre-industrialized temperatures[1]. Shorter-term commitments must still maintain targets consistent with reaching net-zero emissions by 2050, and SBTi provides sector-specific guidance and requirements. Climate transition plans that are registered with CDP are not subject to the same degree of scrutiny and allow increased flexibility around targets and base emissions values. In fact, CDP asserted in March 2022 that less than 35% of company decarbonization targets are credible[2].

Ex ante, it's unclear whether these commitments are a cause for optimism or circumspection. Viewing the net-zero glass as half full, public pledges may help businesses hold themselves accountable to their decarbonization initiatives and, by bolstering a business's reputation for "greenness," can enable businesses to unlock cheaper financing that is increasingly tied to climate-friendlier assets. Unfortunately, it is also possible that net-zero commitments are mostly shallow promises — good on PR but with little action to match. There has been minimal empirical work to answer this question, but a recent study (Bolton and Kacperczyk, 2021) offers a mixed outlook: companies that make commitments do indeed reduce their subsequent emissions, but not by much. Moreover, the firms that are most likely to commit and make the most ambitious commitments are typically companies with lower carbon emissions in the first place. We will present findings that shed more light on this issue.

Corporate communications — in the form of quarterly earnings calls, firm announcements, or corporate sustainability reports — may also be an important channel for a firm to signal its "greenness". Earnings calls are a particularly important means of communication (Brown et al., 2015), though views vary as to whether the earnings call is an appropriate venue to discuss sustainability or ESG performance more broadly (Eccles & Serafeim, 2013; Eckerle et al., 2020; Setterberg et al., 2021). Chava et al. (2021) use natural language processing to analyze earnings calls of public companies and find that discussion of climate-related subjects is linked with better sustainability performance. However, Dzielinski et al. (2022) find that the relationship is more conditional: discussions of climate are linked to decreases in CO2 emissions in the year following the call, except in certain countries, including the U.S., where increased climate talk is correlated with ex-post lower stock returns.

1. See https://sciencebasedtargets.org/resources/files/SBTi-criteria.pdf
2. See https://www.cdp.net/en/articles/companies/just-a-third-of-companies-4002-13-100-that-disclosed-through-cdp-in-2021-have-climate-transition-plans

Empirical Trends in Climate Communication

In examining companies in the Russell 3000 over a 10-year period, we observe several patterns around climate communication. First, there has been a consistent and steady increase in GHG disclosure, across all scopes, from 2010 to 2020 (Table 1A). The timespan is characterized by a 174% and 163% rise in Scope 1 and 2 emissions disclosure, respectively. At present, about a quarter of all large cap U.S. firms provide some climate disclosure (Scope 3 rates still sit below 10%). However, major sectoral variation exists in disclosure rates. Carbon-intensive corporates in utilities, energy, and materials disclose at much greater rates (in 2020, the rates of disclosure covering operational emissions for these sectors were 69%, 62%, and 58%, respectively) than those in lower carbon-intensive sectors (Table 1B). Consumer staples firms are also among the most transparent, which is likely attributed to the heightened public visibility of consumer-facing entities.

Firm commitments on carbon reduction targets have also been on the rise in the past decade, with the number of CDP pledges more than doubling (Table 1A). At present, fewer firms have announced more stringent SBTi commitments (4%) compared to CDP pledges (15%). On a sectoral basis, utilities (46%), consumer staples (35%), and materials (31%) have the highest proportions of firm pledges (Table 1b). We should note that a large proportion of U.S. electric utilities have assets covered by either a state Renewable Portfolio Standard (RPS) and/or a state carbon price, and thus, it is possible that their CDP commitments may not be that ambitious, and that there is little additionality to what they are mandated to do under these policies.

Notably, the majority of commitments have been found to be short in length, with close to 50% of pledges stating targets of under five years (Figure 1A). Pledges to decarbonize by 2050 were observed, consisting of 6% of the sample, as were a few outlier pledges for 2100. The pledged terminal target rates of decarbonization are fairly dispersed, with 70% of firms pledging to cut emissions by 40% or less (Figure 1B). Only 7% of firms have committed to complete decarbonization.

To assess the degree of progress that has been made on commitments, we compare the effective committed annual abatement rates (under a linear reduction scheme) to the actual decarbonization rates post-commitment. Taking 10-year firm-level annual decarbonization averages, we observe that 72% of firms will need to reduce emissions at a more aggressive yearly rate to be able to reach their targets (Figure 2A). If we examine a more recent time frame (three-year average), 56% of firms did not decarbonize at the annual rate needed to meet their stated pledges (Figure 2B). In sum, we find that the growth in firm commitments has corresponded to a contemporaneous increase in tangible decarbonization (even though over half our sample is still not on a trajectory to meet committed targets). Additionally, in the past three years, the variance in the annual decarbonization differential has increased substantially, suggesting that firms which are behind on commitments are now behind by a larger margin.

To identify trends in soft information, we scrape transcripts from earnings call reports for relevant climate and environmental-related bigrams. In the vein of Sautner et al. (2022), the topics analyzed can be categorized into, 1) physical impacts and risks, 2) regulatory risks, and 3) transition opportunities. The frequencies and contextualized sentiments (how positively or negatively the bigrams are being discussed in the sentence) of these topics are examined in both the management update section and the investor Q&A section of the call. Climate topics are increasingly discussed, as the 2018-2020 average frequency in the management update section is 67% greater than the corresponding 2011-2013 average, and similarly, the 2018-2020 average frequency of climate topic discussion in the Q&A section is 75% greater than the corresponding 2011-2013 average (Table 1A). Still, earnings calls remain a more sporadic form of climate information signaling, with only 5% of companies using this channel, relative to disclosure (26%) and commitments (15%). A persistent exception is in the utilities sector, in which climate topics are raised in 37% of earnings calls, with an emphasis on emissions

1. Source: BloombergNEF, International Civil Aviation Organization, company press releases.
2. Source: International Energy Agency — Renewables 2022 (www.iea.org/reports/renewables-2022).

Empirical Trends in Climate Communication (cont'd)

and regulation (Table 1B). Other emissions-intensive sectors, like energy and industrials, have above-average rates as well. Sentiment scores (which are derived using a BERT-based classification model which quantifies how positive or negative the language is)[1], on average, remain consistent from 2010-2016 and then rise from 2017-2020, implying that firms have been more strategic in crafting and communicating their climate policies in recent years. As would be expected, sentiment from the management update section has invariably been more positive than that from the Q&A section through the 10-year sample.

While corporate climate messaging has incontrovertibly spread across disclosure, commitments, and earnings call communication, especially within the past five years, there is substantial variability in the relationships between different forms of climate messaging. Using a linear probability model, we assess disclosure as a predictor of net-zero commitments and earnings call climate-related discussions (Figure 3). Control variables include market cap, book-to-market ratio, capex, debt-to-equity ratio, PP&E, stock return momentum and volatility, and return on equity. Year-month, country, and industry fixed effects are also applied.

Disclosure is found to be a key predictor of future decarbonization commitments, as firms that have disclosed have a 48% greater probability of making a future pledge. The subsequent effect on earnings call communications, however, is found to be largely nonexistent. Disclosing firms are only 1% more likely to discuss climate topics in future earnings call updates, and less than 1% more likely to be questioned by investors during Q&A. The predictive effects of disclosure on the actual sentiment score are also minimal. Very similar results on forecasting earnings call climate topic frequency and sentiment are observed for firms making commitments.

Additionally, we examine whether the three forms of climate communication are predictors of future emissions. Firms disclosing emissions data have, on average, 21% lower emissions the following year than those which do not disclose (Figure 4). Initiating a CDP pledge has no statistically significant correlation with future emissions levels, though firms that have signed SBTi commitments, on average, have 21% lower emissions the following year than those which have not. These relationships are most likely a distributional byproduct of firms with lower emissions being more prone to disclose and make an SBTi commitment in the first place. We also find that there exists a positive correlation between commitment horizon and future emissions output, which implies that firms are less likely to take near-term action for longer-term pledges (although this effect is small in magnitude).

1. Traditional lexicon-based approaches to analysis of climate sentiment largely ignore the varying uses of climate-related terms and the rich contextual information contained in neighboring text. We apply FinBERT - an open-source BERT-based model featuring state-of-the-art performance on several financial sentiment benchmarks – considering our preference for a context-aware measure of sentiment. FinBERT inherits the core BERT architecture and pretrains a BERT encoder using a finance-related news corpus. A pooled representation of the input text is passed through a fully-connected layer for sentiment classification into three classes (positive, neutral and negative). We assign probabilities for each class by applying a softmax over the outputs of the classification layer. Our sentiment score is then given by the difference between the positive and negative class probabilities and reflects the relative likelihood that the input text sequence is on balance more positive than negative. We tokenize climate excerpts by sentence and separately aggregate scores across the presentation and Q&A sections by averaging over sentence-level sentiment.

Pricing Climate Messaging

Before we assess the valuation implications of different forms of climate communication, we briefly contextualize how disclosure, commitments, and soft-information transmission fit within a more holistic corporate strategy. Climate finance is, first and foremost, a form of risk management. Companies respond to investor concerns about the extent of the company's exposure to climate risk. They understand that a failure to allay these concerns could translate into a repricing of the company's valuation or cost or capital by investors, leading greater pressure to mitigate climate risk. The three forms of climate communication we analyze each reflect how investors may assess (and reprice) transition risk (or occasionally physical risk for certain earnings calls information). The absence of a standardized disclosure regime for transition risk muddies communication and sets up a complicated information revelation game between companies and investors. Firms must make strategic decisions on the methods of communication to maximize stock price and other impacts. Investors, in turn, face a complex information extraction problem from multiple, multidimensional, noisy signals to be able to assess these risks.

3 forms

of Climate Communication

- Disclosure
- Commitments
- Soft Information Dissemination

The challenge for investors, of course, is that corporate and investor objectives are not necessarily aligned. It is expected that those companies with positive climate policies and outlooks will seek to demonstrate their stance through information transparency, while companies with negative ESG impacts will attempt to obscure potential underlying exposure. To be sure, some companies largely ignore climate-related issues altogether, making it particularly challenging for investors to extract signals of ESG impacts. By assessing the valuation changes resulting from different forms of climate communications, we can not only predict how the market will receive disclosure, commitments, and climate messaging during earnings calls, but also infer the value investors ascribe to each signal as a genuine indicator of climate risk.

With this in mind, we undertake a set of controlled multivariate regressions to isolate the distinctive effect of each form of climate communication on price-to-earnings ratios. Year-month, country, and industry-fixed effects are employed, as are a set of financial controls including return on equity (past, present, and estimated one- and two-year future values), price momentum and volatility. For most regressions, firm-fixed effects are also used (contingent upon the sample having sufficient residual variation). This allows us to observe an aggregation of the direct valuation change firms experience before and after, say, disclosing climate related information for the first time.

In the baseline emissions regression model, we analyze the relationship between Scope 1 carbon emissions and price-to-earnings ratios (Table 2). Firm-level emissions data is sourced through S&P Trucost, which consists of disclosed values (when applicable) or estimated values. We observe a statistically significant negative relationship between Scope 1 emissions and P/E ratios, such that a firm with 10% higher emissions is expected to have, ceteris paribus, a little over a 1% lower P/E value. By adding in disclosure as an indicator variable and including firm-fixed effects, we can assess the degree to which investors value the greater transparency associated with disclosure.

We find that disclosing Scope 1 emissions offsets a portion of the valuation discount. The same firm is expected to have a 0.6% higher P/E value as a result of disclosure, meaning that the increased transparency was able to offset 48% of the P/E discount tied to emissions. The interpretation of this offsetting valuation effect is either that disclosure decreases associated firm-level climate-related financial risks, or that the informational uncertainty of firm-level climate-related financial risks is reduced. In the absence of disclosure, investors attempt to analyze emissions values through estimated data (typically from third-party providers, like S&P Trucost). The first explanation would imply that there exists

Pricing Climate Messaging (cont'd)

an upward bias with estimated emissions data, such that disclosed values would, on average, demonstrate a lower carbon footprint, which would induce a relative repricing of climate risk. The latter, and more likely, explanation is that the asymmetric distribution of climate risk exposures (and associated tail risk) causes investors to price in the uncertainty of the estimate. Removing that uncertainty through disclosure would result in the observed valuation impact.

The financial effects of disclosure vary significantly across sectors. Emissions-intensive sectors (energy, industrials, materials, and utilities) all show outsized valuation boosts from disclosure relative to less carbon-intensive industries (Figure 4). In the energy sector, a 3% P/E discount rate is associated with 10% higher emissions, but firms are able to fully offset the discount through disclosure, and in fact, receive a net financial benefit (under the same example, the disclosing firm would experience a 0.8% rise in P/E). Industrial firms can offset 82% of the emissions valuation discount through disclosure, while materials and utilities companies have respective 87% and 52% offsetting rates, though at a lower statistical significance.

Decarbonization commitments produce the same directional valuation effects as disclosure, but at a much smaller magnitude and with limited statistical significance. We find that participating in a CDP initiative can offset, on average, 15% of the firm's carbon valuation discount, though the lack of statistical significance suggests that this result is not robust (the same holds for SBTi pledges) (Table 5). Chosen parameters for pledges (length and targets) have no real impact on firm valuation either (Table 6). Sector results also display insignificant valuation effects, with the one outlier being financials: firms making pledges get a further valuation discount. This could be due to costs associated with the transition to net-zero financed emissions.

In theory, there are two opposing effects that underlie the financial decision-making around pledging to meet emissions targets. Making such a pledge could signal a near-term financial cost, as presumably decarbonizing operations or purchasing carbon offsets is costly. This would, however, decrease firms' exposure to transition risk, which would be value-accretive in the medium and long run. The lack of any noticeable valuation changes from commitments could be a consequence of these effects offsetting each other. More likely, based on our findings around the differential between actual decarbonization rates and pledged abatement rates, and given the increased public scrutiny of greenwashing, investors may not believe that many commitments are genuine signals of future emission reductions. Investors may not interpret pledges as bearing material weight, but rather as a public relations move.

In respect to earnings calls, we find interesting differences in valuation effects depending on whether climate topics are discussed during the management update section or during the investor Q&A section. First, examining the extensive margin, we observe a negative P/E effect when climate topics are brought up during the management update (Table 7), but no significant effect is found for the Q&A section. When exploring a hybrid extensive-intensive margin, so that we could capture possible valuation effects emanating from both frequency and sentiment in which climate-related topics are discussed, we find that there is no significant effect from the management section. Yet, climate sentiment during the Q&A section is a significant signal, and can offset (conditional on positive sentiment), on average, 81% of the emissions valuation discount. As with disclosure, carbon-intensive sectors, including energy, industrials, materials, and utilities are subject to the largest correlations between sentiment and valuation (Table 9). Positive climate sentiment during the Q&A section hints that either investors are asking questions about climate topics with an optimistic tilt, or management has answered climate-related questions in a favorable manner. Regardless, investors view climate sentiment during Q&A to be a valuable signal, perhaps because it is the only source of information that isn't entirely pre-scripted or controlled by the firm. The off-the-cuff nature of Q&A could buttress veracity.

Pricing Climate Messaging (cont'd)

Up until this point, we have examined each method of climate communication in isolation to assess its distinctive effect on financial valuation. However, in reality, when firms are constructing climate communication strategies, they are reviewing potential signals in tandem. When we estimate a given model with the full set of communication measures, it becomes apparent that disclosure and Q&A section sentiment are the most significant predictors of valuation (Table 10). Disclosure nullifies any valuation effect of making a commitment.

Implications

Over the past decade, investors have raised greater concern over the carbon footprint of the firms they invest in. In part, this reflects the heightened salience of accelerating climate change and current and future climate change mitigation policy responses. In part, it reflects greater investor disquiet about the climate impact of their investment decisions. Both reasons would lead investors to demand better information about firms' current emissions, likely trajectory of emissions, and the actions they undertake to reduce their emissions. Voluntary disclosure of corporate emissions, voluntary commitments into the near- to medium-future to reduce emissions, and discussions about climate change implications in earnings calls each provide opportunities for firms to communicate information to these interested investors.

In communicating such information, firms may reduce the uncertainty investors face in terms of understanding the firms' emissions and the potential for such emissions to represent liabilities (e.g., under a carbon tax, cap-and-trade program, or conventional regulatory standard). In the absence of such information, investors may form expectations about a firm's emissions profile based on inaccurate imputations of emissions from various data sources. This noisy information may reduce their incentive to invest, or at least delay their investment until they secure more information (Bernanke, 1983; McDonald and Siegel, 1986; Dixit and Pindyck, 1994). By disclosing their emissions, firms improve the information set of investors and reduce some of the climate-policy related uncertainty about future returns.

The sectoral variation in how disclosure offsets some, and in some cases all, of the price-earnings ratio discount associated with emissions may reflect the extent to which the sector is facing (or likely to face) current or near-term regulatory costs. For example, energy firms that transition to emissions disclosure fully offset the equity price discount associated with their emissions, and industrial firms offset more than 80% of the discount. The less statistically precise estimates for firms in other industries and the incomplete offsetting of equity price discounts suggests greater residual climate policy uncertainty for the firms in these industries. In other words, investors may be more uncertain about what, if any, regulatory burdens firms outside of the energy and industrial sectors may face, given that most regulatory and carbon pricing policies to date — the EU Emissions Trading System, the California carbon dioxide cap-and-trade program, the Regional Greenhouse Gas Initiative, etc. — have focused on the energy, industrial, and electric utility sectors.

In our empirical analyses of the valuation effects of corporate disclosure, the utility sector stands apart from the energy and industrial sectors, with no incremental value of information associated with voluntary emissions disclosure. This may reflect the fact that every fossil fuel-powered electricity generating unit in the United States since the mid-1990s has reported its carbon dioxide emissions to the Environmental Protection Agency (EPA) through a continuous emissions monitoring system requirement[1]. The EPA regularly publishes these emissions data.

While investors have fairly easy access to data on utility emissions, they may not have as clear a sense of how to attribute those emissions to corporate customers across various industries. Corporate disclosure of Scope 2 emissions may therefore be informative for investors. The definition of Scope 2 is

1. Refer to 40 CFR §75.1.

Implications (cont'd)

clear and narrow, and the regulatory burden in the electricity sector – between carbon prices covering about one-quarter of U.S. power (under California and the Regional Greenhouse Gas Initiative cap-and-trade programs) and virtually all European power (under the EU ETS), as well as renewable portfolio standards applying to power in 30 U.S. states – is well established (Aldy, 2020). With relatively lower uncertainty about the costs of Scope 2 emissions, disclosing the quantity of Scope 2 emissions eliminates much of the uncertainty associated with this potential environmental liability for a firm. In contrast, the considerable variation in definitions of Scope 3 emissions, and the heterogeneity in composition of Scope 3 across industries even under a common Scope 3 definition, makes it less likely that Scope 3 disclosure is informative for an investor managing emissions risk across a broad portfolio of companies.

Corporate commitments appear to have less information value for investors than emissions disclosure. This may reflect a key ambiguity associated with these commitments, especially for those targets that are set well in the future (e.g., 2030 and beyond). A corporate emission target for 2040, may well be trumped by future federal and state regulatory policies and carbon pricing schemes. As a result, a firm may not be able to distinguish itself from its peers in its industry if all industry participants face a common regulatory regime in the future.

Understanding what actions a firm is undertaking, as well as the potential regulatory burdens and opportunities it faces, may help address this uncertainty. Corporate management and investors have demonstrated increasing interest in how climate change influences firm operations, strategy, and valuations, as reflected in quarterly earnings calls. Over 2018-2020, management raised climate change in earnings calls 67% more often than they did over 2011-2013, and investors raised climate change issues 75% more during the Q&A periods of these calls. While management has consistently been more positive in communicating about climate change during earning calls than investors have in the Q&A sessions, both management and investors have become more positive, as measured by our sentiment index, in more recent years. Management of firms that disclose and/or have made emission commitments have, on average, more positive communications about climate change in earnings calls, and investors tend to frame questions more positively about climate change for firms that have disclosed emissions or adopted emission commitments. As firms face climate policy transition risks and opportunities, communication by firms and questions from investors in earning calls complement the disclosure of emissions and the public commitment to emission reduction targets.

With about one in six of the Russell 3000 companies voluntarily disclosing their GHG emissions, the prospect of climate-related risk disclosure through an SEC regulatory mandate could substantially improve the information set for investors[1]. Moreover, a final disclosure regulation could clarify the information to be disclosed — and in a form to enable valuable comparisons across firms — in terms of Scope 1, 2, and 3 emissions, as well as the nature of — and progress toward — corporate emission commitments. This latter information could include the disclosure of actions to mitigate emissions within the corporate footprint, as well as the acquisition of emission offsets.

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1. Refer to the SEC proposed rule, "The Enhancement and Standardization of Climate-Related Disclosures for Investors," 87 FR 21334, April 11, 2022.

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Tables and Figures

Table 1. Summary Stats- Trends in Climate Communication

This table reports the rates of disclosure and commitments, as well as average earnings call sentiment scores for climate-related topics, for Russell 3000 companies. Panel A displays annual figures from 2011-2020 and Panel B shows sectoral figures from 2020. Data on disclosure is sourced from S&P Trucost, commitment data is sourced from CDP, and earnings calls transcripts are sourced from FactSet.

Panel A: Year-Over-Year Trends

Year	Disclosure-Scope 1	Disclosure-Scope 2	Disclosure-Scope 3 Downstream	Disclosure-Scope 3 Upstream	CDP Initiative	SBTi Signatory	Management Count	Q&A Count	Management Average Sentiment Score	Q&A Average Sentiment Score
2011	276 (9.5%)	263 (9.0%)	0 (0.0%)	135 (4.6%)	209 (7.2%)	0 (0.0%)	305 (2.6%)	144 (1.2%)	0.41	0.15
2012	313 (10.7%)	297 (10.2%)	0 (0.0%)	148 (5.1%)	230 (7.9%)	0 (0.0%)	265 (2.3%)	117 (1.1%)	0.38	0.16
2013	339 (11.6%)	324 (11.1%)	0 (0.0%)	160 (5.5%)	255 (8.7%)	0 (0.0%)	249 (2.1%)	125 (1.1%)	0.36	0.13
2014	362 (12.4%)	342 (11.7%)	0 (0.0%)	103 (3.5%)	267 (9.2%)	1 (0.0%)	245 (2.1%)	148 (1.3%)	0.39	0.19
2015	387 (13.3%)	368 (12.6%)	0 (0.0%)	98 (3.4%)	286 (9.8%)	12 (0.4%)	282 (2.4%)	136 (1.2%)	0.37	0.16
2016	427 (14.6%)	409 (14.0%)	6 (0.2%)	169 (5.8%)	312 (10.7%)	22 (0.8%)	294 (2.5%)	160 (1.4%)	0.40	0.16
2017	490 (16.8%)	467 (16.0%)	103 (3.5%)	177 (6.1%)	339 (11.6%)	38 (1.3%)	294 (2.5%)	159 (1.4%)	0.43	0.18
2018	555 (19.0%)	527 (18.1%)	149 (5.1%)	182 (6.2%)	370 (12.7%)	59 (2.0%)	345 (3.0%)	162 (1.4%)	0.48	0.19
2019	648 (22.2%)	609 (20.9%)	152 (5.2%)	130 (4.5%)	403 (13.8%)	75 (2.6%)	445 (3.8%)	209 (1.8%)	0.48	0.21
2020	755 (25.9%)	714 (24.5%)	126 (4.3%)	196 (6.7%)	428 (14.7%)	106 (3.6%)	575 (4.9%)	305 (2.6%)	0.49	0.21

Tables and Figures (cont'd)

Table 1. Summary Stats- Trends in Climate Communication (cont'd)

Panel B: Sectoral Trends (2020)

Sector	Disclosure-Scope 1	Disclosure-Scope 2	Disclosure-Scope 3 Downstream	Disclosure-Scope 3 Upstream	CDP Initiative	SBTi Signatory	Mgmt Count	Q&A Count	Mgmt Average Sentiment Score	Q&A Average Sentiment
Communication Services	15 (14.4%)	15 (14.4%)	8 (7.7%)	4 (3.8%)	8 (7.7%)	3 (2.9%)	46 (1.1%)	20 (0.5%)	0.33	0.19
Consumer Discretionary	82 (23.6%)	82 (23.6%)	25 (7.2%)	15 (4.3%)	55 (15.8%)	16 (4.6%)	98 (0.7%)	72 (0.5%)	0.51	0.23
Consumer Staples	50 (43.1%)	48 (41.4%)	12 (10.3%)	12 (10.3%)	40 (34.5%)	24 (20.7%)	68 (1.5%)	34 (0.7%)	0.49	0.23
Energy	71 (62.3%)	56 (49.1%)	4 (3.5%)	1 (0.9%)	16 (14.0%)	1 (0.9%)	281 (6.2%)	143 (3.1%)	0.37	0.16
Financials	63 (13.5%)	61 (13.1%)	25 (5.4%)	3 (0.6%)	48 (10.3%)	4 (0.9%)	310 (1.7%)	188 (1.0%)	0.37	0.17
Health Care	57 (9.3%)	55 (9.0%)	18 (2.9%)	13 (2.1%)	41 (6.7%)	9 (1.5%)	51 (0.2%)	31 (0.1%)	0.38	0.21
Industrials	140 (34.7%)	128 (31.7%)	30 (7.4%)	24 (5.9%)	69 (17.1%)	11 (2.7%)	892 (5.5%)	440 (2.7%)	0.45	0.18
Information Technology	97 (25.4%)	96 (25.1%)	42 (11.0%)	19 (5.0%)	60 (15.7%)	17 (4.5%)	287 (1.9%)	107 (0.7%)	0.49	0.24
Materials	75 (58.6%)	71 (55.5%)	14 (10.9%)	14 (10.9%)	40 (31.3%)	9 (7.0%)	178 (3.5%)	103 (2.0%)	0.40	0.16
Real Estate	58 (33.1%)	61 (34.9%)	12 (6.9%)	16 (9.1%)	20 (11.4%)	10 (5.7%)	75 (1.1%)	45 (0.6%)	0.54	0.18
Utilities	47 (69.1%)	41 (60.3%)	6 (8.8%)	5 (7.4%)	31 (45.6%)	2 (2.9%)	1013 (37.2%)	482 (17.7%)	0.43	0.17

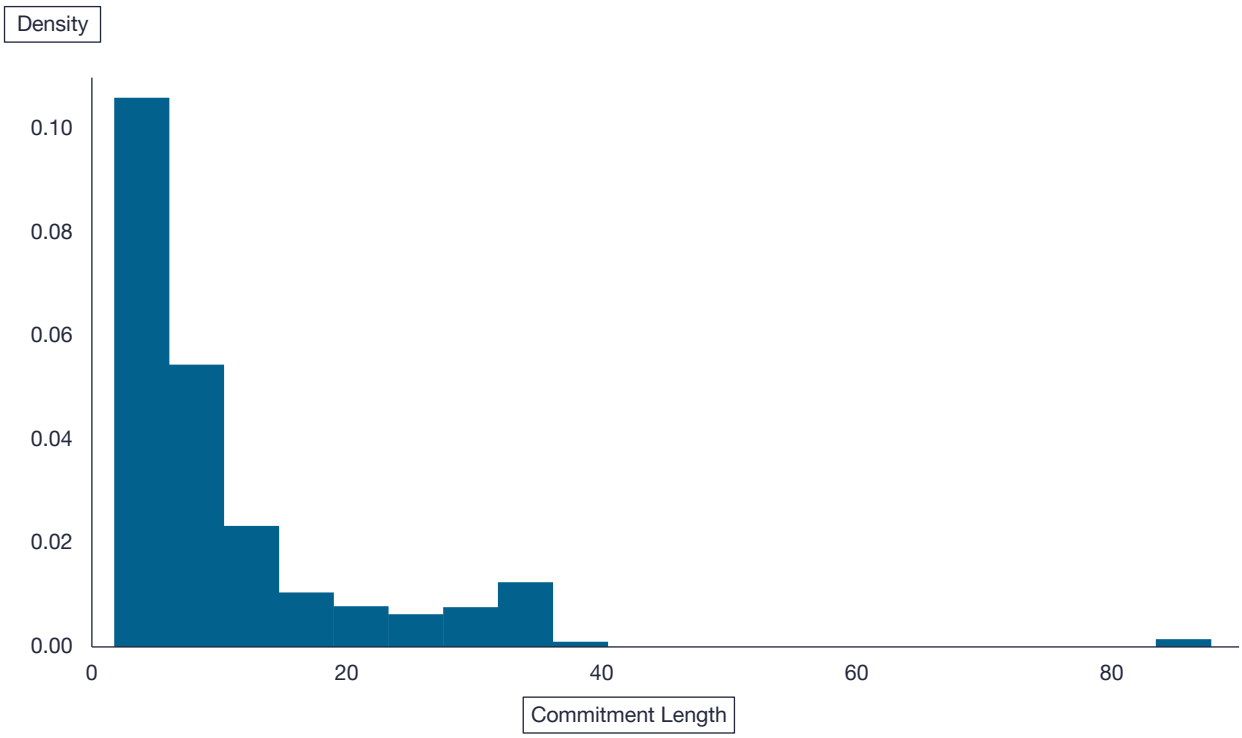
Tables and Figures (cont'd)

Figure 1. Distributions of CDP Commitment Attributes

This figure displays histograms of commitment attributes from a sample of Russell 3000 companies that have made a listed CDP pledge prior to 2020. Figure 1A shows a histogram of

commitment length, Figure 1B shows a histogram of the terminal emissions reduction target, and Figure 1C shows a histogram of the assumed annual abatement rate if the company is to decarbonize linearly over time. All data is sourced from CDP.

Figure 1A: Commitment Length



Tables and Figures (cont'd)

Figure 1. Distributions of CDP Commitment Attributes (cont'd)

Figure 1B. Terminal Emissions Reduction Target

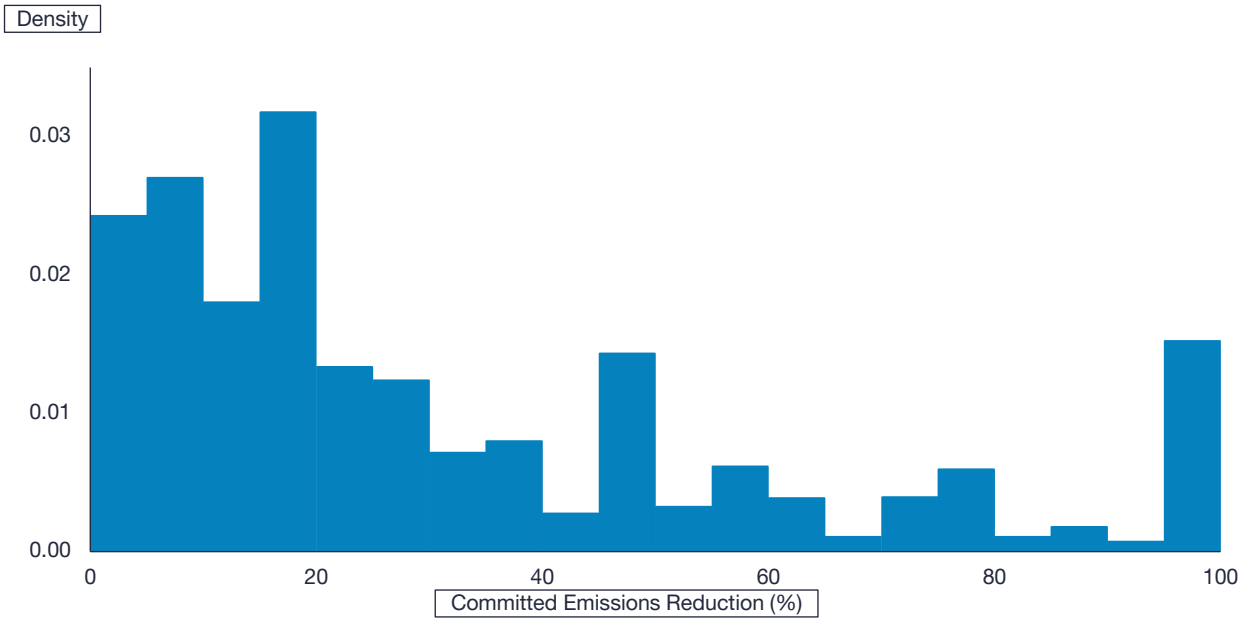
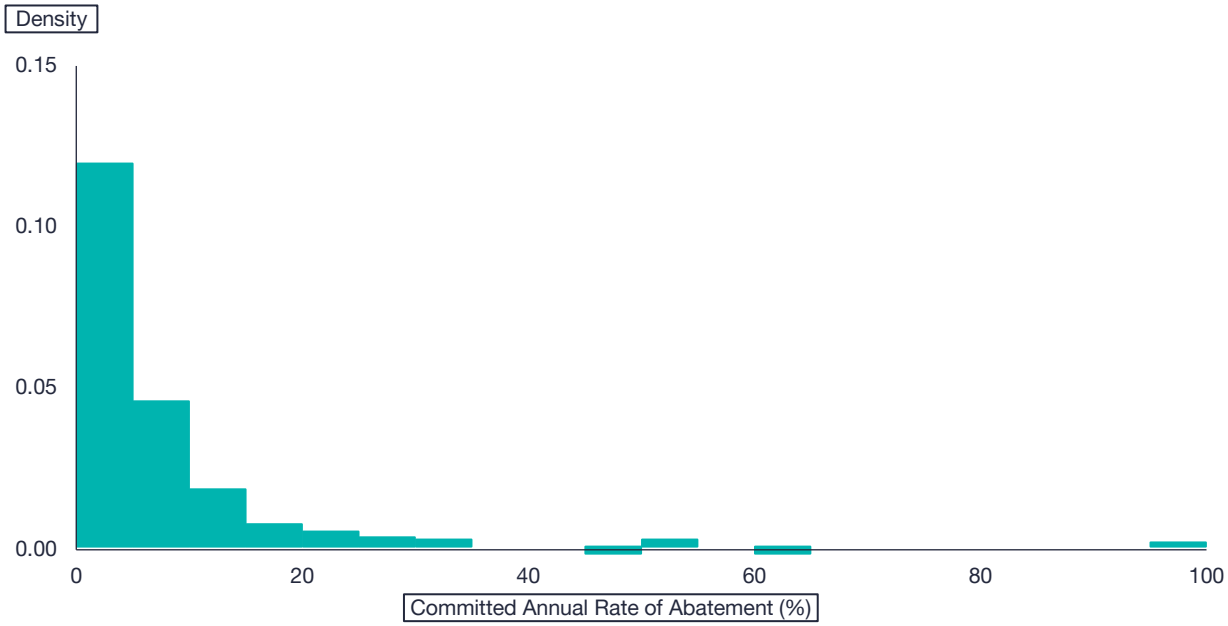


Figure 1C. Committed Annual Abatement Rates Under a Linear Decarbonization Scheme

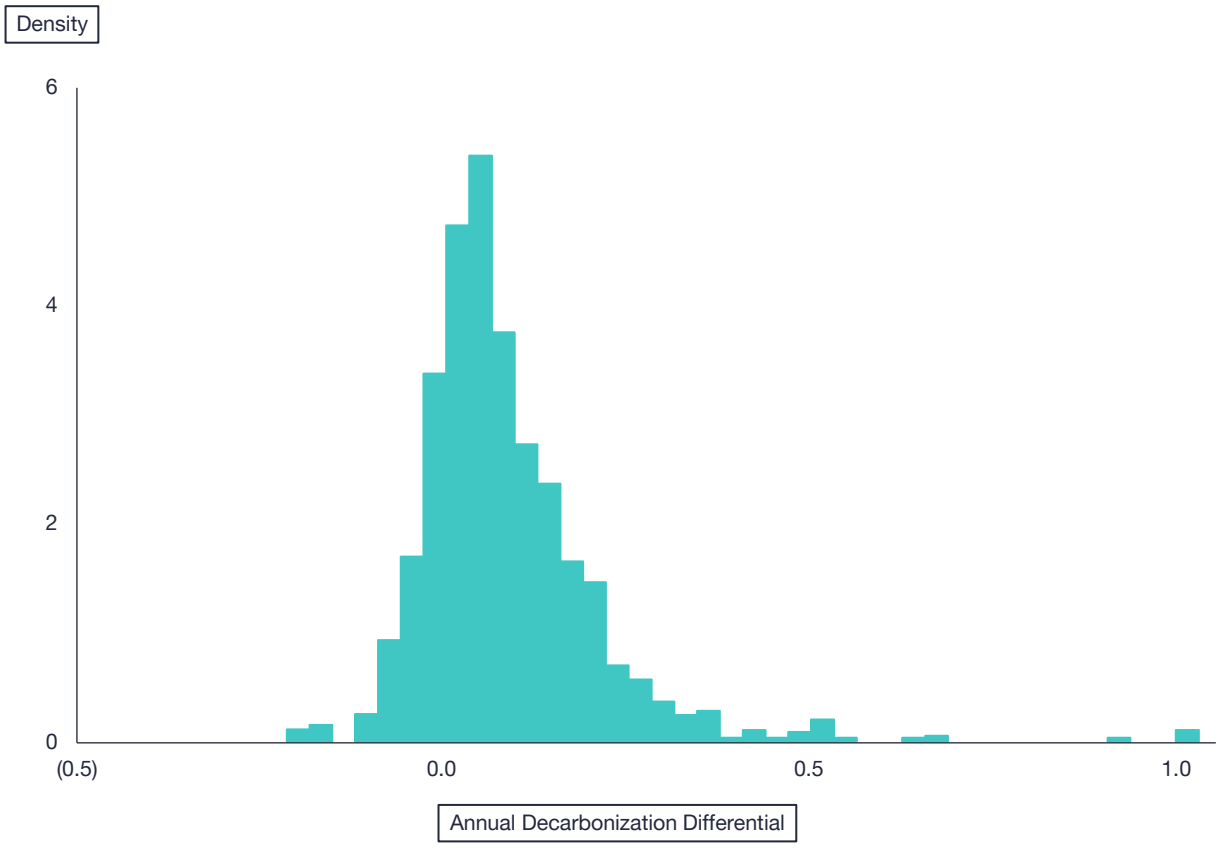


Tables and Figures (cont'd)

Figure 2. Differences Between Pledged Emission Abatement Rates and Actual Decarbonization Rates

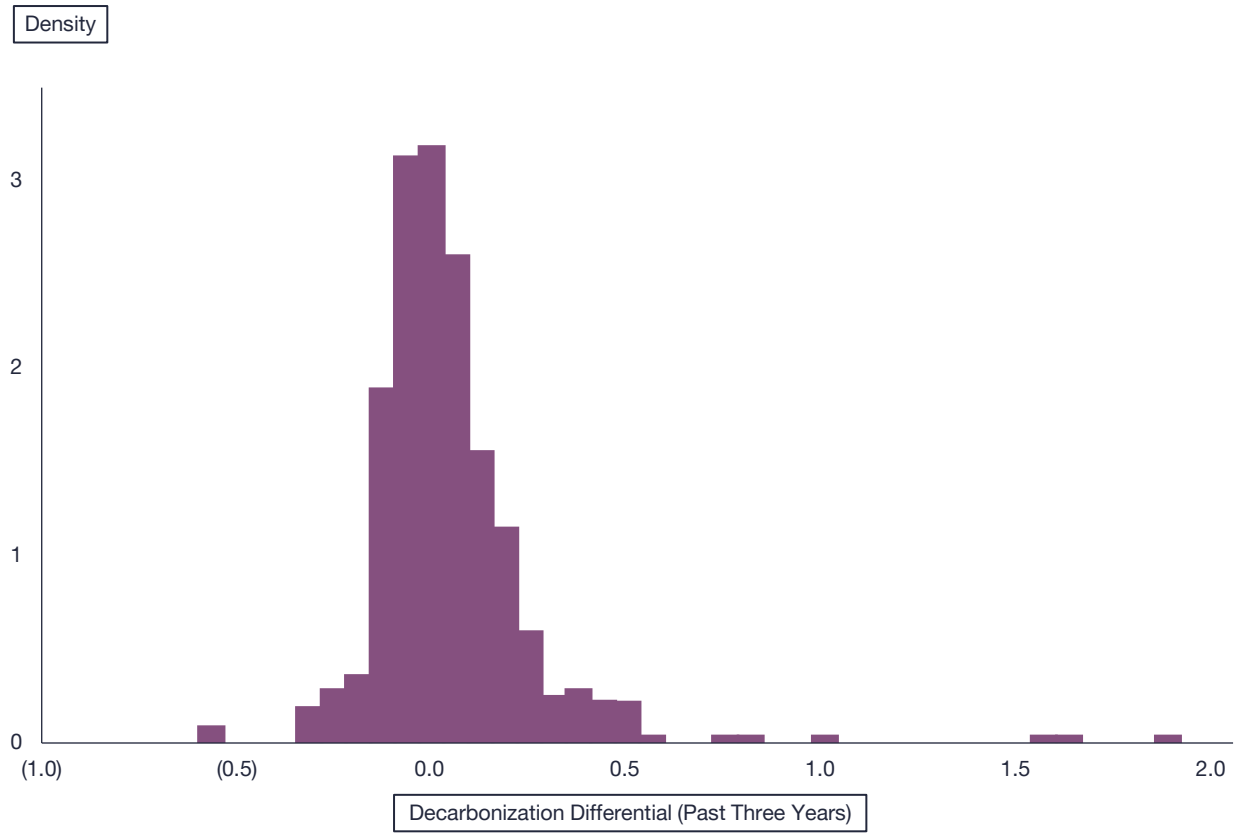
This figure displays histograms of firm-level differentials between the committed annual rate of abatement (assuming a linear reduction scheme) and the actual annual rate of decarbonization. Figure 2A has a sample period of 2011-2020 and Figure 2B has a sample period of 2018-2020. Emissions data is sourced from S&P Trucost, and commitment data is sourced from CDP.

Figure 2A. Ten-Year Sample Period (2011-2020)



Tables and Figures (cont'd)

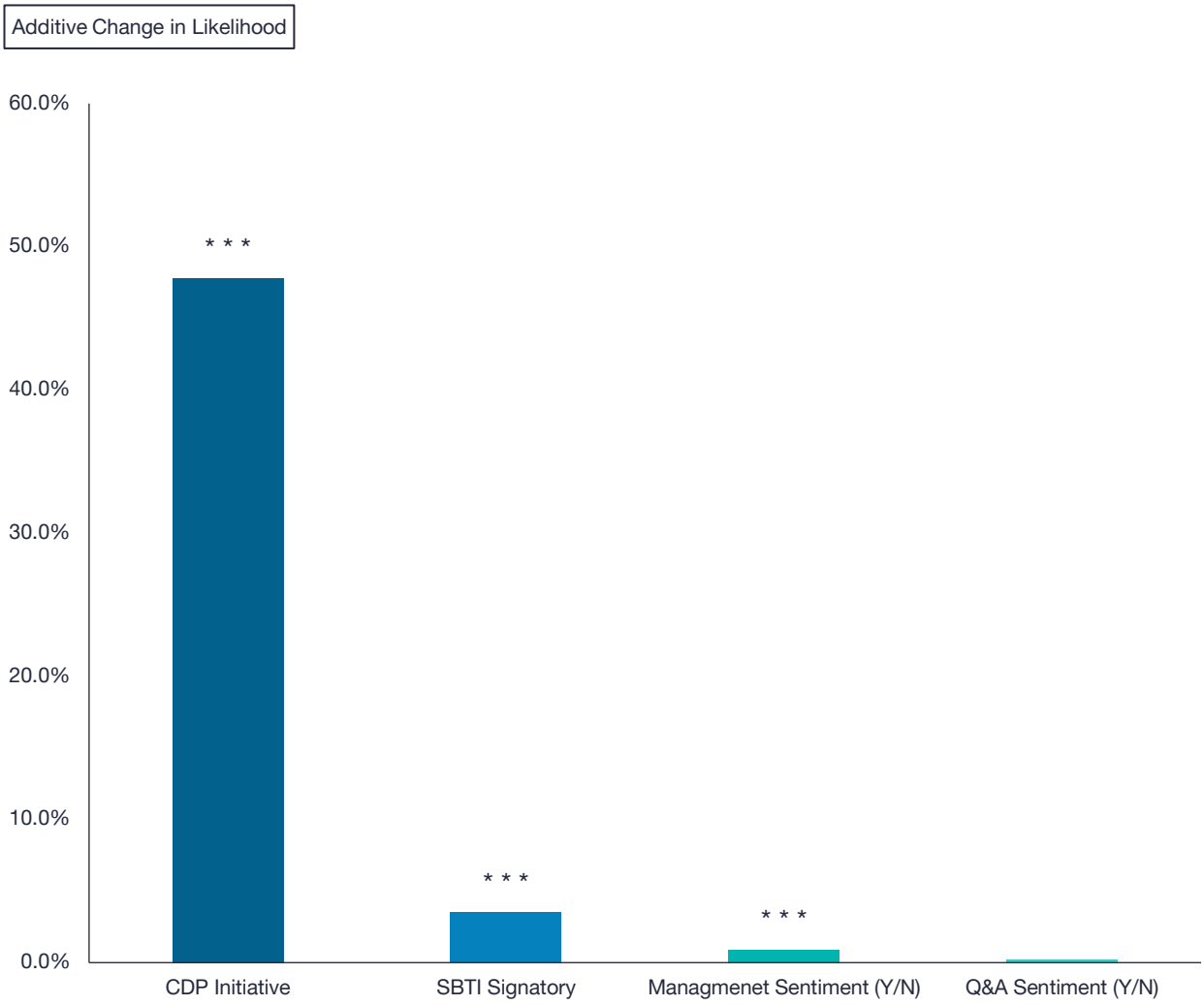
Figure 2B. Three-Year Sample Period (2018-2020)



Tables and Figures (cont'd)

Figure 3. Effect of Disclosure on Commitments or Earnings Call Sentiment

This figure reports the additive change in probability that a disclosing firm makes a commitment or discusses a climate-related topic during an earnings call (during the management update section or investor Q&A). The sample is Russell 3000 companies from 2011-2020. Results are determined through multivariate regressions in which the dependent variables are either binary indicators of CDP or SBTi commitments, or binary indicators of earnings call topics. The independent variable is a binary indicator of disclosure. Control variables include the natural logarithm of market cap (in $ millions), the cumulative stock return over the past year (momentum), the book value of equity divided by market value of equity (B/M ratio), the CapEx divided by book value, the book value of debt divided by the book value of assets (leverage), the natural logarithm of plant, property, and equipment (PP&E), the monthly stock return volatility calculated over the past year, and the return on equity (ROE). Year-month, country, and industry-fixed effects are used. We note that *** p<0.01, ** p<0.05, * p<0.1. Emissions, financial, and disclosure data is sourced from S&P Trucost, commitment data is sourced from CDP, and earnings calls transcripts are sourced from FactSet.

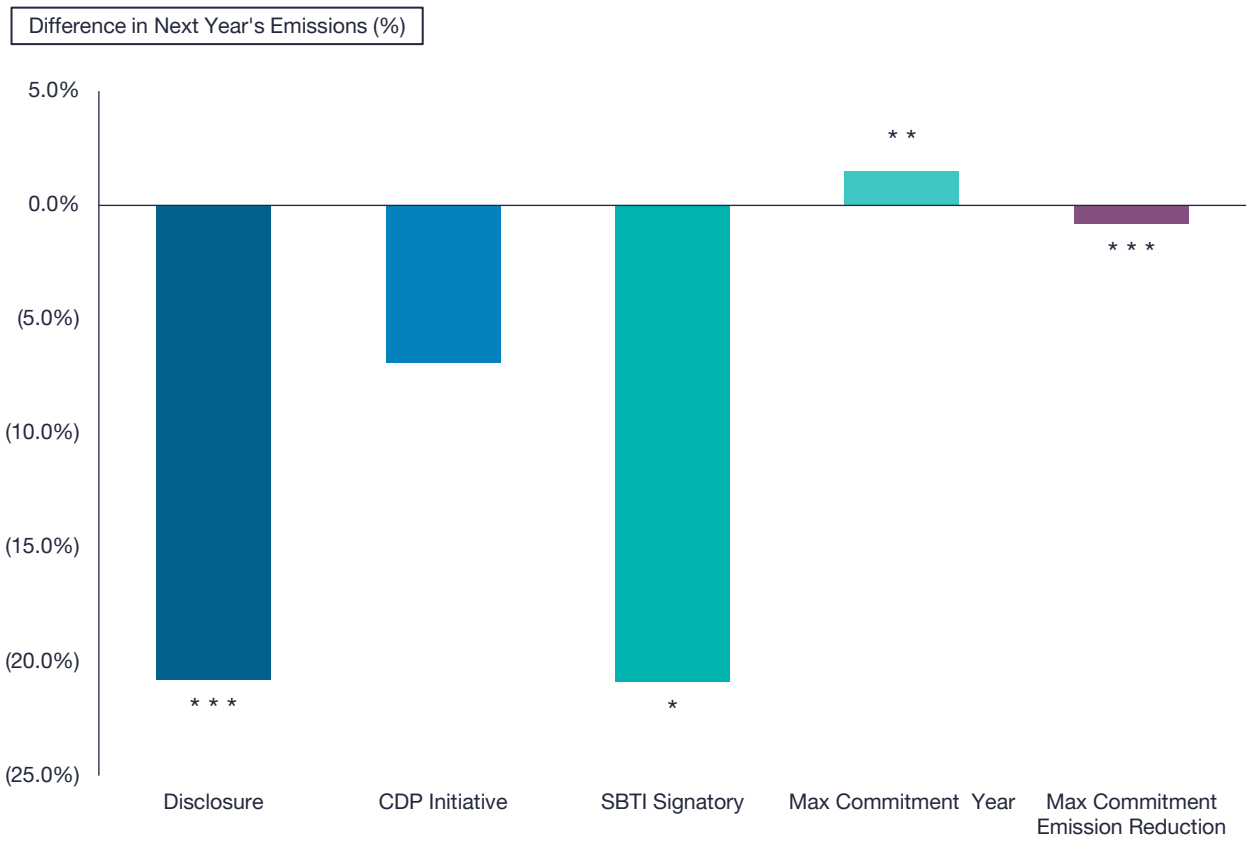


Tables and Figures (cont'd)

Figure 4. Effect of Communication Signals on Future Emissions

This figure reports the difference in the predicted value of next year's emissions associated with disclosure and commitments. The sample is Russell 3000 companies from 2011-2020. Results are determined through multivariate regressions in which the dependent variable is one-year ahead carbon emission levels and the independent variables are either binary indicators of disclosure or commitments, or attributes of commitments. Results for Max Commitment Year and Max Commitment Emission Reduction are based on unit changes in 1 year and 1%, respectively.

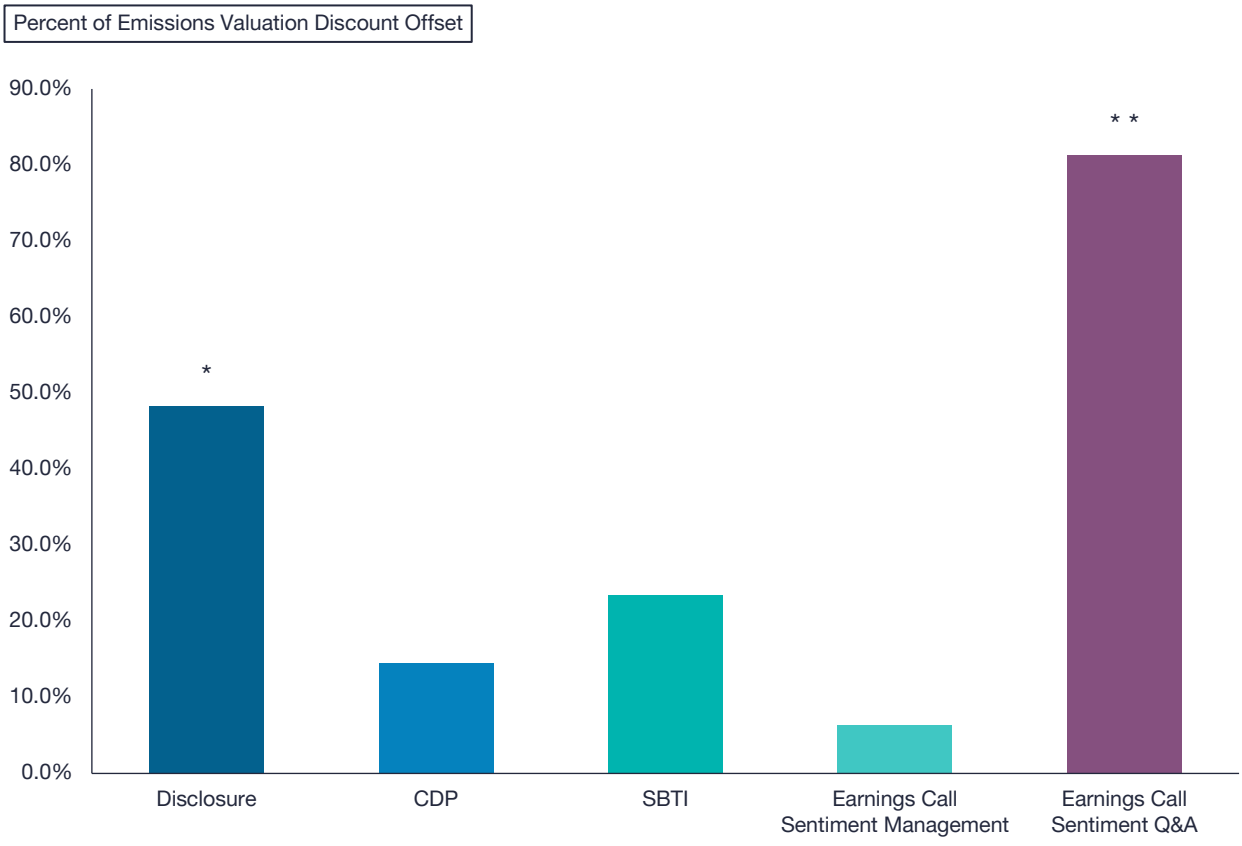
All regression models include the controls of Figure 3 (unreported for brevity). Year-month, country, and industry-fixed effects are used. We note that *** p<0.01, ** p<0.05, * p<0.1. Emissions, financial, and disclosure data is sourced from S&P Trucost, commitment data is sourced from CDP, and earnings calls transcripts are sourced from FactSet.



Tables and Figures (cont'd)

Figure 5. Percent of the Emissions Valuation Discount that is Offset by Different Forms of Climate Communication

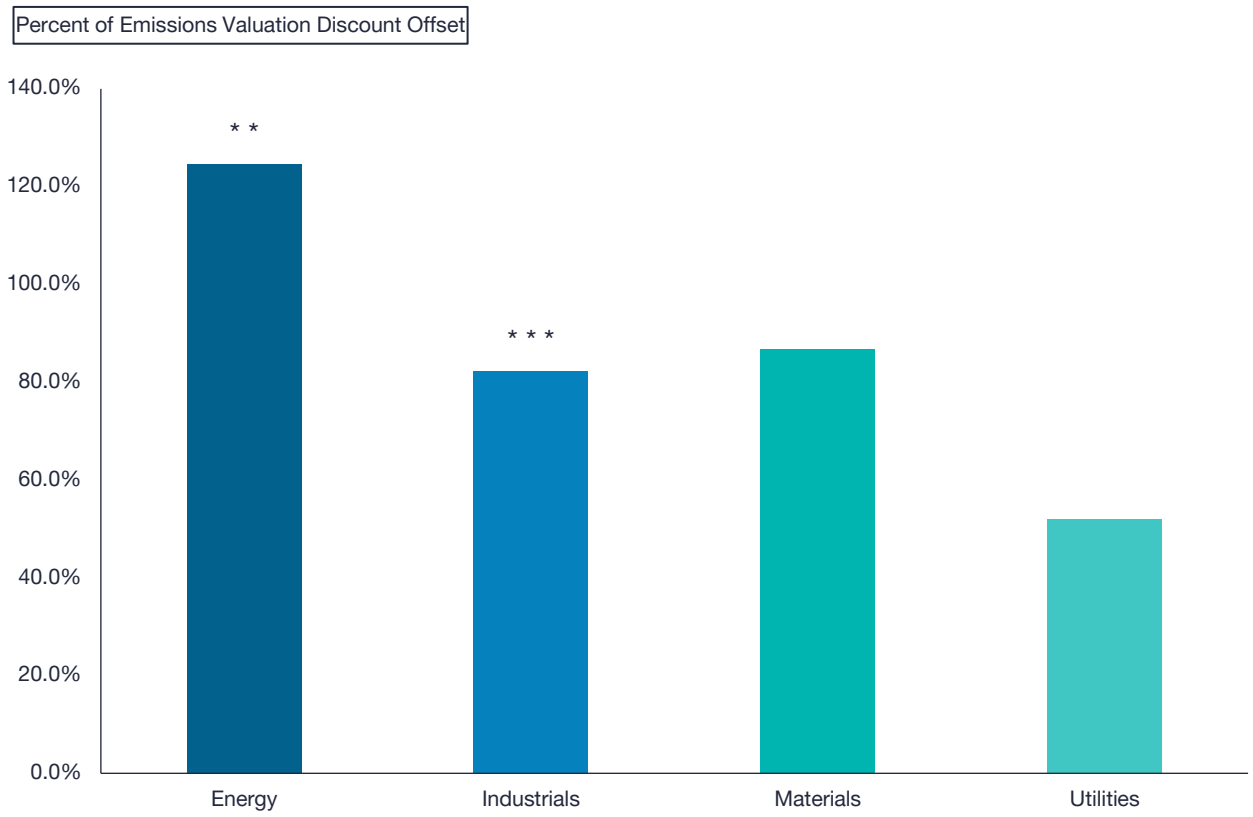
This figure reports the degree to which disclosure, commitments, and earnings call sentiment affect price-to-earnings (P/E) valuations. The sample is Russell 3000 companies from 2011-2020. Results are determined through multivariate regressions in which the dependent variable is P/E. The independent variables are carbon emission levels, and either binary indicators of disclosure or commitments, or earnings call sentiment. Control variables include the cumulative stock return over the past year (momentum), the monthly stock return volatility calculated over the past year (volatility), past return on equity (ROE(t-1)), present return on equity (ROE(t)), and estimated one- and two-year future values of return of equity (ROE(t+1) and ROE(t+2)). Year-month, country, and firm-fixed effects are used. The offset percentage is the ratio of the P/E valuation discount due to greenhouse gas emissions when the firms utilize an idiosyncratic form of climate communication compared to the valuation discount when the firms do not use the communication form. We note that *** p<0.01, ** p<0.05, * p<0.1. Emissions, financial, and disclosure data is sourced from S&P Trucost, commitment data is sourced from CDP, and earnings calls transcripts are sourced from FactSet.



Tables and Figures (cont'd)

Figure 6. Percent of the Emissions Valuation Discount that is Offset by Disclosure for High-Emitting Industries

This figure reports the degree to which disclosure affect price-to-earnings (P/E) valuations for energy, industrials, materials, utilities companies. The sample is Russell 3000 companies from 2011-2020. Results are determined through multivariate regressions in which the dependent variable is P/E. The independent variables are carbon emission levels, and either binary indicators of disclosure and commitments, or earnings call sentiment. All regression models include the controls of Figure 5 (unreported for brevity). Year-month, country, and firm-fixed effects are used. The offset percentage is the ratio of the P/E valuation discount due to greenhouse gas emissions when the firms disclose compared to the valuation discount when the firms do not disclose. We note that *** p<0.01, ** p<0.05, * p<0.1. Emissions, financial, and disclosure data is sourced from S&P Trucost, commitment data is sourced from CDP, and earnings calls transcripts are sourced from FactSet.



Tables and Figures (cont'd)

Table 2. Disclosure-P/E Regressions: By Scope

The sample is Russell 3000 companies from 2011-2020. The dependent variable is P/E. The independent variables are carbon emission levels and binary indicators of disclosure. All regression models include the controls of Figure 5. We report the results of the pooled regression with standard errors (in parentheses) double clustered at the firm and year level. Year-month, country, and firm-fixed effects are used. We note that *** p<0.01, ** p<0.05, * p<0.1.

Dependent Variable- Log P/E	Disclosure- Scope 1 Levels	Disclosure- Scope 2 Levels,	Disclosure- Scope 3 Upstream Levels	Disclosure- Scope 3 Downstream Levels
Log Scope 1 Levels	-0.116***			
	(0.028)			
Disclosure Scope 1*Log Scope 1 Levels	0.056*			
	(0.033)			
Log Scope 2 Levels		-0.069***		
		(0.016)		
Disclosure Scope 2*Log Scope 2 Levels		0.004		
		(0.005)		
Log Scope 3 Upstream Levels			-0.187***	
			(0.034)	
Disclosure Scope 3 Up*Log Scope 3 Up Levels			-0.002	
			(0.001)	
Log Scope 3 Downstream Levels				0.007
				(0.005)
Disclosure Scope 3 Down*Log Scope 3 Down Levels				0.001
				(0.002)
Momentum	4.673***	4.669***	4.643***	4.565***
	(0.207)	(0.208)	(0.219)	(0.256)
Volatility	-0.444*	-0.421*	-0.450*	-0.413
	(0.250)	(0.250)	(0.255)	(0.312)
ROE (t-1)	-0.005***	-0.005***	-0.006***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
ROE (t)	-0.003***	-0.003***	-0.002***	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
ROE (t+1) (Est)	0.000	0.000	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
ROE (t+2) (Est)	0.001	0.001	0.001	0.000
	(0.000)	(0.000)	(0.000)	(0.001)
Constant	3.997***	3.779***	5.380***	3.000***
	(0.182)	(0.160)	(0.421)	(0.074)
Yr/mo fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	112,813	111,622	100,064	60,485
R-squared	0.735	0.734	0.745	0.794

Tables and Figures (cont'd)

Table 3. Disclosure-P/E Regressions: By Sector

The sample is Russell 3000 companies from 2011-2020. The dependent variable is P/E. The independent variables are carbon emission levels and binary indicators of disclosure. All regression models include the controls of Figure 5. We report the results of the pooled regression with standard errors (in parentheses) double clustered at the firm and year level. Year-month, country, and firm-fixed effects are used. We note that *** p<0.01, ** p<0.05, * p<0.1.

Dependent Variable-Log P/E	Communication Services	Consumer Discretionary	Consumer Staples	Energy	Financials	Health Care	Industrials	Information Technology	Materials	Real Estate	Utilities
Log Scope 1 Levels	0.053	-0.107	0.171	-0.305***	0.001	-0.220**	-0.339***	-0.173**	-0.098	-0.123	-0.158
	(0.109)	(0.075)	(0.122)	(0.088)	(0.028)	(0.093)	(0.066)	(0.073)	(0.089)	(0.125)	(0.120)
Disclosure Scope 1*Log Scope 1 Levels	-0.121	0.053	-0.313*	0.380**	-0.077	0.053	0.279***	0.143	0.085	0.188	0.082
	(0.130)	(0.076)	(0.177)	(0.180)	(0.069)	(0.100)	(0.075)	(0.086)	(0.098)	(0.128)	(0.123)
Momentum	3.324***	4.232***	4.816***	5.923***	3.515***	4.878***	5.060***	4.175***	4.712***	2.929***	4.296***
	(1.114)	(0.491)	(0.620)	(1.339)	(0.449)	(0.584)	(0.460)	(0.527)	(0.735)	(1.029)	(1.109)
Volatility	1.623	0.087	-2.229*	-1.156	-0.275	-1.516***	-0.622	0.063	-0.528	0.480	-5.222***
	(1.084)	(0.451)	(1.158)	(1.068)	(0.358)	(0.574)	(0.427)	(0.609)	(0.563)	(1.125)	(1.648)
ROE (t-1)	-0.006**	-0.004***	-0.000	-0.008***	-0.011***	-0.004***	-0.004***	-0.003**	-0.007***	-0.019***	-0.003
	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.004)	(0.003)
ROE (t)	-0.001	-0.003***	0.001	-0.003	-0.008***	-0.003**	-0.002**	-0.001	-0.004***	-0.012***	-0.002
	(0.003)	(0.001)	(0.001)	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.004)	(0.002)
ROE (t+1) (Est)	0.004	0.001	-0.001	-0.002	0.000	-0.003**	0.001**	-0.002	0.006***	0.004**	-0.012
	(0.003)	(0.001)	(0.001)	(0.006)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.012)
ROE (t+2) (Est)	-0.003	0.001	0.000	0.000	0.001	0.002	0.001	0.001	-0.000	-0.000	0.001
	(0.003)	(0.001)	(0.002)	(0.004)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.004)	(0.010)
Constant	3.182***	3.955***	3.824***	4.208***	2.985***	5.366***	5.441***	4.275***	3.491***	4.393***	4.646***
	(0.682)	(0.606)	(0.979)	(1.420)	(0.194)	(0.571)	(0.483)	(0.424)	(0.552)	(0.807)	(0.620)
Yr/mo fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,163	15,491	5,274	4,384	25,701	9,926	17,349	13,569	6,331	6,745	4,868
R-squared	0.704	0.717	0.774	0.559	0.686	0.779	0.700	0.847	0.602	0.655	0.651

Tables and Figures (cont'd)

Table 4. Commitment-P/E Regressions: Extensive Margin

The sample is Russell 3000 companies from 2011-2020. The dependent variable is P/E. The independent variables are carbon emission levels and binary indicators of CDP pledges. All regression models include the controls of Figure 5. We report the results of the pooled regression with standard errors (in parentheses) double clustered at the firm and year level. Year-month, country, and firm-fixed effects are used. We note that *** p<0.01, ** p<0.05, * p<0.1.

Dependent Variable- Log P/E	CDP Initiative	SBTi Signatory
Log Scope 1 Levels	-0.062***	-0.047***
	(0.015)	(0.012)
Commitment (Y/N)*Log Scope 1 Levels	0.009	0.011
	(0.024)	(0.085)
Momentum	4.755***	4.776***
	(0.205)	(0.207)
Volatility	-0.470*	-0.460*
	(0.245)	(0.245)
ROE (t-1)	-0.006***	-0.005***
	(0.001)	(0.001)
ROE (t)	-0.003***	-0.003***
	(0.001)	(0.001)
ROE (t+1) (Est)	0.000	0.000
	(0.001)	(0.001)
ROE (t+2) (Est)	0.001	0.001
	(0.000)	(0.000)
Constant	3.684***	3.553***
	(0.126)	(0.122)
Yr/mo fixed effects	Yes	Yes
Country fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Observations	114,495	114,495
R-squared	0.726	0.724

Tables and Figures (cont'd)

Table 5. Commitment-P/E Regressions: Intensive Margin

The sample is Russell 3000 companies from 2011-2020. The dependent variable is P/E. The independent variables are carbon emission levels and attributes of CDP pledges. All regression models include the controls of Figure 5. We report the results of the pooled regression with standard errors (in parentheses) double clustered at the firm and year level. Year-month, country, and firm-fixed effects are used. We note that *** p<0.01, ** p<0.05, * p<0.1.

Dependent Variable-Log P/E	Max Commitment Year	Max Commitment Reduction	Effective Abatement
Max Commitment Year	-0.010		
	(0.007)		
Max Commitment Emission Reduction		-0.002	
		(0.002)	
Effective Commitment Annual Abatement			-0.000
			(0.003)
Log Scope 1 Levels	-0.043	-0.039	-0.031
	(0.040)	(0.043)	(0.042)
Max Commitment Year*Log Scope 1 Levels	0.001		
	(0.000)		
Max Commitment Emission Reduction*Log Scope 1 Levels		0.000	
		(0.000)	
Effective Commitment Annual Abatement*Log Scope 1 Levels			0.000
			(0.000)
Momentum	4.734***	4.921***	5.363***
	(0.660)	(0.669)	(0.562)
Volatility	-1.307	-0.111	0.236
	(1.025)	(0.594)	(0.583)
ROE (t-1)	-0.002	-0.003**	-0.003**
	(0.002)	(0.001)	(0.002)
ROE (t)	0.001	0.001	0.000
	(0.001)	(0.001)	(0.001)
ROE (t+1) (Est)	-0.001	-0.000	-0.000
	(0.001)	(0.001)	(0.001)
ROE (t+2) (Est)	0.003***	0.002**	0.002**
	(0.001)	(0.001)	(0.001)
Constant	3.360***	3.263***	3.144***
	(0.485)	(0.514)	(0.505)
Yr/mo fixed effects	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Observations	13,173	13,101	11,687
R-squared	0.713	0.720	0.755

Tables and Figures (cont'd)

Table 6. Commitment-P/E Regressions (By Sector)

The sample is Russell 3000 companies from 2011-2020. The dependent variable is P/E. The independent variables are carbon emission levels and binary indicators of CDP pledges. All regression models include the controls of Figure 5. We report the results of the pooled regression with standard errors (in parentheses) double clustered at the firm and year level. Year-month, country, and industry-fixed effects are used for all regressions. Firm-fixed effects are used when the sample has sufficient residual variation. We note that *** p<0.01, ** p<0.05, * p<0.1.

Dependent Variable-Log P/E	Communication Services	Consumer Discretionary	Consumer Staples	Energy	Financials	Health Care	Industrials	Information Technology	Materials	Real Estate	Utilities
Log Scope 1 Levels	0.055	-0.066	0.089***	-0.086	0.008	-0.143***	-0.083***	-0.061*	-0.050	-0.017	-0.017
	(0.064)	(0.048)	(0.029)	(0.087)	(0.026)	(0.049)	(0.029)	(0.033)	(0.045)	(0.072)	(0.030)
CDP Initiative*Log Scope 1 Levels	-0.109	0.009	-0.117	-0.281	-0.164**	0.025	0.068	0.042	0.056	0.121	-0.074
	(0.132)	(0.063)	(0.072)	(0.235)	(0.067)	(0.069)	(0.057)	(0.046)	(0.080)	(0.075)	(0.048)
Momentum	3.330***	4.194***	4.770***	5.933***	3.520***	4.929***	5.195***	4.334***	4.384***	3.411***	4.176***
	(1.119)	(0.488)	(0.720)	(1.231)	(0.439)	(0.587)	(0.462)	(0.542)	(0.751)	(1.027)	(0.846)
Volatility	1.909*	0.112	-1.616*	-1.189	-0.247	-1.424**	-0.744*	0.015	-0.631	0.093	-4.546***
	(1.091)	(0.457)	(0.818)	(0.965)	(0.349)	(0.569)	(0.433)	(0.605)	(0.569)	(1.136)	(1.166)
ROE (t-1)	-0.006**	-0.004***	-0.000	-0.010***	-0.010***	-0.004***	-0.004***	-0.002*	-0.007***	-0.019***	0.000
	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.005)	(0.001)
ROE (t)	-0.002	-0.003***	0.001	-0.003	-0.007***	-0.002*	-0.003**	-0.001	-0.004***	-0.012***	-0.001
	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.004)	(0.002)
ROE (t+1) (Est)	0.004	0.001	-0.003*	-0.004	0.001	-0.004**	0.001	-0.002	0.005**	0.003	-0.028***
	(0.003)	(0.001)	(0.002)	(0.005)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.005)
ROE (t+2) (Est)	-0.003	0.001	0.002	-0.001	0.002	0.002	0.000	0.001	-0.000	-0.000	0.018***
	(0.003)	(0.001)	(0.002)	(0.004)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.004)	(0.004)
Constant	2.949***	3.659***	2.891***	5.683***	3.026***	4.702***	3.739***	3.643***	3.349***	3.852***	4.180***
	(0.584)	(0.429)	(0.549)	(1.126)	(0.173)	(0.392)	(0.289)	(0.238)	(0.561)	(0.574)	(0.356)
Yr/mo fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Observations	3,175	15,611	5,430	4,517	25,857	10,190	17,638	13,797	6,415	6,745	5,120
R-squared	0.701	0.710	0.769	0.516	0.683	0.778	0.688	0.847	0.594	0.629	0.698

Tables and Figures (cont'd)

Table 7. Earnings Call Sentiment-P/E Regressions

The sample is Russell 3000 companies from 2011-2020. The dependent variable is P/E. The independent variables are carbon emission levels, binary indicators of earnings call climate sentiment, and earnings call climate sentiment values. All regression models include the controls of Figure 5. We report the results of the pooled regression with standard errors (in parentheses) double clustered at the firm and year level. Year-month, country, and firm-fixed effects are used. We note that *** p<0.01, ** p<0.05, * p<0.1.

Dependent Variable- Log P/E	Management-Extensive Margin	Management-Extensive Margin	Q&A- Hybrid Extensive-Intensive Margin	Q&A- Hybrid Extensive-Intensive Margin
Management Climate Sentiment Hybrid Score		0.007		
		(0.118)		
Q&A Climate Sentiment Hybrid Score				-0.483**
				(0.234)
Log Scope 1 Levels	-0.047***	-0.048***	-0.048***	-0.048***
	(0.012)	(0.012)	(0.012)	(0.012)
Management Climate Sentiment (Y/N)*Log Scope 1 Levels	-0.073***			
	(0.025)			
Q&A Climate Sentiment (Y/N)*Log Scope 1 Levels			-0.016	
			(0.025)	
Management Climate Sentiment Hybrid Score*Log Scope 1 Levels		0.003		
		(0.008)		
Q&A Climate Sentiment Hybrid Score*Log Scope 1 Levels				0.039**
				(0.017)
Momentum	4.826***	4.825***	4.821***	4.821***
	(0.209)	(0.209)	(0.209)	(0.209)
Volatility	-0.475*	-0.474*	-0.485*	-0.485*
	(0.250)	(0.250)	(0.251)	(0.251)
ROE (t-1)	-0.006***	-0.006***	-0.006***	-0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
ROE (t)	-0.003***	-0.003***	-0.003***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
ROE (t+1) (Est)	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
ROE (t+2) (Est)	0.001	0.001	0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	3.571***	3.565***	3.565***	3.565***
	(0.122)	(0.123)	(0.123)	(0.123)
Yr/mo fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	114,331	114,331	114,354	114,354
R-squared	0.721	0.721	0.721	0.721

Tables and Figures (cont'd)

Table 8. Earnings Call Sentiment-P/E Regressions: By Sector (Management)

The sample is Russell 3000 companies from 2011-2020. Communication services was omitted due to insufficient sample size. The dependent variable is P/E. The independent variables are carbon emission levels and earnings call climate sentiment values. All regression models include the controls of Figure 5. We report the results of the pooled regression with standard errors (in parentheses) double clustered at the firm and year level. Year-month, country, and industry-fixed effects are used for all regressions. Firm-fixed effects are not used because of a lack of residual variation. We note that *** p<0.01, ** p<0.05, * p<0.1.

Dependent Variable-Log P/E	Consumer Discretionary	Consumer Staples	Energy	Financials	Health Care	Industrials	Information Technology	Materials	Real Estate	Utilities
Management Climate Sentiment Hybrid Score	0.820	0.571	-0.885	0.469	1.569	-0.566**	0.970	-1.329**	-1.652	-0.111
	(0.820)	(0.650)	(0.825)	(0.582)	(2.076)	(0.246)	(0.785)	(0.544)	(1.429)	(0.246)
Log Scope 1 Levels	-0.052	-0.117***	-0.021	-0.049***	-0.143***	-0.065***	-0.070**	-0.092***	-0.020	-0.038***
	(0.035)	(0.021)	(0.023)	(0.010)	(0.028)	(0.012)	(0.027)	(0.016)	(0.034)	(0.012)
Management Climate Sentiment Hybrid Score*Log Scope 1 Levels	-0.095	-0.041	0.066	-0.060	-0.135	0.044**	-0.095	0.095**	0.200	0.005
	(0.071)	(0.044)	(0.054)	(0.073)	(0.177)	(0.020)	(0.078)	(0.040)	(0.133)	(0.015)
Momentum	7.565***	6.801***	5.603***	5.057***	8.230***	6.412***	8.074***	4.575***	7.886***	5.404***
	(0.761)	(1.387)	(1.173)	(0.935)	(0.948)	(0.556)	(1.077)	(0.744)	(1.536)	(1.423)
Volatility	-0.676	-2.679**	-2.671***	-1.081*	-1.129	-2.291***	0.473	-0.157	-0.954	-4.350**
	(0.566)	(1.240)	(0.950)	(0.561)	(0.911)	(0.472)	(0.911)	(0.740)	(1.490)	(1.710)
ROE (t-1)	-0.005***	-0.002	-0.008***	-0.007***	-0.004**	-0.004***	-0.005***	-0.007***	-0.023***	0.000
	(0.001)	(0.001)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.005)	(0.003)
ROE (t)	-0.002**	0.000	-0.002	-0.004**	0.001	-0.001	-0.006***	-0.004***	-0.015***	-0.001
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.004)	(0.002)
ROE (t+1) (Est)	-0.001	-0.004	-0.007*	0.002	-0.007**	-0.001	-0.003	0.002	0.002	-0.019
	(0.001)	(0.003)	(0.004)	(0.001)	(0.003)	(0.001)	(0.003)	(0.002)	(0.003)	(0.013)
ROE (t+2) (Est)	-0.000	0.002	-0.002	-0.001	0.001	0.002**	0.001	-0.002	-0.002	0.001
	(0.001)	(0.003)	(0.003)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.005)	(0.013)
Constant	3.627***	4.719***	3.728***	3.171***	4.751***	3.846***	3.882***	4.266***	4.252***	3.877***
	(0.371)	(0.341)	(0.346)	(0.091)	(0.339)	(0.153)	(0.291)	(0.237)	(0.321)	(0.221)
Yr/mo fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	No	No	No	No	No	No	No	No	No
Observations	15,613	5,431	4,517	25,858	10,195	17,640	13,800	6,417	6,745	5,120
R-squared	0.360	0.355	0.310	0.305	0.346	0.329	0.494	0.381	0.334	0.484

Tables and Figures (cont'd)

Table 9. Earnings Call Sentiment-P/E Regressions: By Sector (Q&A)

The sample is Russell 3000 companies from 2011-2020. Communication services was omitted due to insufficient sample size. The dependent variable is P/E. The independent variables are carbon emission levels and earnings call climate sentiment values. All regression models include the controls of Figure 5. We report the results of the pooled regression with standard errors (in parentheses) double clustered at the firm and year level. Year-month, country, and industry-fixed effects are used for all regressions. Firm-fixed effects are not used because of a lack of residual variation. We note that *** p<0.01, ** p<0.05, * p<0.1.

Dependent Variable- Log P/E	Consumer Discretionary	Consumer Staples	Energy	Financials	Health Care	Industrials	Information Technology	Materials	Real Estate	Utilities
Q&A Climate Sentiment Hybrid Score	0.396	0.203	-4.684**	-0.167	1.872	-1.365***	-2.224**	-3.380***	-2.937	-1.662**
	(2.696)	(1.176)	(1.984)	(0.579)	(2.002)	(0.521)	(0.931)	(1.141)	(3.935)	(0.655)
Log Scope 1 Levels	-0.052	-0.117***	-0.022	-0.049***	-0.143***	-0.064***	-0.071**	-0.092***	-0.018	-0.040***
	(0.035)	(0.021)	(0.023)	(0.010)	(0.028)	(0.012)	(0.027)	(0.016)	(0.034)	(0.013)
Q&A Climate Sentiment Hybrid Score*Log Scope 1 Levels	-0.064	-0.004	0.330**	0.020	-0.137	0.110**	0.219**	0.253***	0.318	0.101**
	(0.226)	(0.087)	(0.142)	(0.068)	(0.166)	(0.042)	(0.099)	(0.086)	(0.389)	(0.041)
Momentum	7.566***	6.802***	5.627***	5.060***	8.233***	6.407***	8.069***	4.590***	7.939***	5.431***
	(0.761)	(1.386)	(1.157)	(0.935)	(0.948)	(0.556)	(1.077)	(0.742)	(1.547)	(1.411)
Volatility	-0.678	-2.677**	-2.654***	-1.079*	-1.130	-2.291***	0.471	-0.157	-0.995	-4.376**
	(0.566)	(1.242)	(0.949)	(0.561)	(0.912)	(0.472)	(0.911)	(0.740)	(1.493)	(1.703)
ROE (t-1)	-0.005***	-0.002	-0.008***	-0.007***	-0.004**	-0.004***	-0.005***	-0.007***	-0.023***	-0.000
	(0.001)	(0.001)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.005)	(0.003)
ROE (t)	-0.002**	0.000	-0.002	-0.004**	0.001	-0.001	-0.006***	-0.004***	-0.015***	-0.001
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.004)	(0.002)
ROE (t+1) (Est)	-0.001	-0.004	-0.007*	0.002	-0.007**	-0.001	-0.003	0.002	0.002	-0.019
	(0.001)	(0.003)	(0.004)	(0.001)	(0.003)	(0.001)	(0.003)	(0.002)	(0.003)	(0.013)
ROE (t+2) (Est)	-0.000	0.002	-0.002	-0.001	0.001	0.002**	0.001	-0.002	-0.002	0.001
	(0.001)	(0.003)	(0.003)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.005)	(0.013)
Constant	3.631***	4.722***	3.731***	3.172***	4.752***	3.841***	3.886***	4.267***	4.240***	3.898***
	(0.370)	(0.342)	(0.345)	(0.091)	(0.339)	(0.152)	(0.291)	(0.237)	(0.325)	(0.224)
Yr/mo fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	No	No	No	No	No	No	No	No	No
Observations	15,613	5,431	4,517	25,858	10,195	17,640	13,800	6,417	6,745	5,120
R-squared	0.360	0.355	0.310	0.305	0.346	0.329	0.494	0.381	0.333	0.485

Tables and Figures (cont'd)

Table 10. Disclosure, Commitments, Earnings Call Sentiment- P/E Partial Regressions

The sample is Russell 3000 companies from 2011-2020. The dependent variable is P/E. The independent variables are carbon emission levels, binary indicators of disclosure, binary indicators of CDP pledges and SBTi commitments, and earnings call climate sentiment values. All regression models include the controls of Figure 5. We report the results of the pooled regression with standard errors (in parentheses) double clustered at the firm and year level. Year-month, country, and industry-fixed effects are used for all regressions. We note that *** p<0.01, ** p<0.05, * p<0.1.

Dependent Variable- Log P/E	Disclosure, CDP Initiative, SBTi Signatory, Management Sentiment Hybrid Score, Q&A Sentiment Hybrid Score
Disclosure Scope 1 (Y/N)	-0.384***
	(0.114)
CDP Initiative (Y/N)	0.053
	(0.108)
SBTi Initiative (Y/N)	0.122
	(0.200)
Management Climate Sentiment Hybrid Score	0.027
	(0.109)
Q&A Climate Sentiment Hybrid Score	-0.544***
	(0.199)
Log Scope 1 Levels	-0.074***
	(0.010)
Disclosure Scope 1*Log Scope 1 Levels	0.024**
	(0.010)
CDP Initiative (Y/N)*Log Scope 1 Levels	-0.002
	(0.009)
SBTi Initiative (Y/N)*Log Scope 1 Levels	-0.009
	(0.016)
Management Climate Sentiment Hybrid Score*Log Scope 1 Levels	-0.002
	(0.008)
Q&A Climate Sentiment Hybrid Score*Log Scope 1 Levels	0.041***
	(0.016)
Momentum	7.346***
	(0.356)
Volatility	-0.978***
	(0.299)
ROE (t-1)	-0.006***
	(0.001)
ROE (t)	-0.002***
	(0.001)
ROE (t+1) (Est)	-0.001
	(0.001)
ROE (t+2) (Est)	0.001
	(0.001)
Constant	3.915***
	(0.102)
Yr/mo fixed effects	Yes
Country fixed effects	Yes
Industry fixed effects	Yes
Firm fixed effects	No
Observations	112,832
R-squared	0.407