

# Imposing Sustainability Disclosure on Investors: Does it Lead to Portfolio Decarbonization?

Finance Working Paper N° 945/2023 December 2023 Jiyuan Dai University of Navarra

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# Abstract

Using a wide sample of international investment funds, we document that the recent introduction of the EU Sustainable Finance Disclosure Regulation (SFDR)—the first wide-ranging sustainability disclosure mandate ever imposed on investment funds—was followed by a decarbonization of the investment portfolios of EU funds that claim to invest based on sustainability criteria. Additional tests suggest that the lower level of emissions is due to changes in funds' investment decisions as well as to changes in firm-level emissions. Our results inform the debate on the role of mandatory disclosure for institutional investors on the current efforts to decarbonize the economy.

Keywords: SFDR, Institutional Investors, Mutual Funds, Disclosure, Carbon Emissions, Greenwashing

JEL Classifications: G28, M10, M41, M48, Q51

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# **Imposing Sustainability Disclosure on Investors: Does it Lead to Portfolio Decarbonization?**

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# ABSTRACT

Using a wide sample of international investment funds, we document that the recent introduction of the EU Sustainable Finance Disclosure Regulation (SFDR)—the first wide-ranging sustainability disclosure mandate ever imposed on investment funds—was followed by a decarbonization of the investment portfolios of EU marketed funds that claim to invest based on sustainability criteria. Additional tests suggest that the lower level of emissions is due to changes in funds' investment decisions as well as to changes in firm-level emissions. Our results inform the debate on the role of mandatory disclosure for institutional investors on the current efforts to decarbonize the economy.

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# 1. Introduction

There is an ongoing debate over the role of institutional investors in the current efforts to decarbonize the economy (Andersson, Bolton, and Samama, 2016; OECD, 2017). While some contend that asset managers can contribute significantly to push companies to reduce their carbon footprint, others are more skeptical and recommend that authorities focus on regulatory tools.<sup>1</sup> This skepticism is fueled by the perception that a substantial number of institutional investors do not honor their sustainability commitments (Raghunandan and Rajgopal 2022, Kim and Yoon 2022).

This paper contributes to this debate by studying whether disclosure regulation affects asset managers' incentives to decarbonize their portfolios. To address our research question, we exploit the recent introduction of the EU Sustainable Finance Disclosure Regulation (SFDR). This regulation is unique because it is the first wide-ranging sustainability disclosure mandate ever imposed on investment funds.<sup>2</sup> According to the regulatory text, the SFDR aims to reduce information asymmetry regarding sustainability risks, impacts, the promotion of environmental or social characteristics, and sustainability investment.<sup>3</sup>

It is plausible that -beyond the provision of information- the SFDR has meaningful real effects. As shown by prior literature, disclosure regulation often induces behavior on the reporting entities, which in this case are investment funds (Kanodia and Sapra, 2016). While the EU SFDR

<sup>&</sup>lt;sup>1</sup> Regulatory tools include carbon pricing mechanisms (i.e., cap-and-trade schemes and carbon taxes) as well as "command and control" approaches.

<sup>&</sup>lt;sup>2</sup> To the best of our knowledge existing disclosure regulations do not provide wide-ranging sustainability disclosure mandates for investment funds. This is consistent with Paragraph 24 of the SFDR which states current disclosure requirements "do not require the disclosure of all the information necessary to properly inform end investors about the sustainability-related impacts of their investments." This is not to say that no prior sustainability disclosure regulation impacting investment companies exists. One example is Article 173 of the French Energy Transition Law from 2015, which we exploit in supplemental analyses.

<sup>&</sup>lt;sup>3</sup> See point (10) of the preamble of the Regulation (EU) 2019/2088 of the European Parliament and of the Council of 27 November 2019.

could affect several dimensions of the sustainability performance of investors' portfolios, we focus our analysis on carbon emissions. A decrease in emissions is commonly perceived as an improvement in sustainability performance, whereas the interpretation of a decrease in other sustainability metrics could be more contentious. Moreover, given the current concerns about climate change, a large proportion of the environmental efforts are centered around decarbonization, including several initiatives sponsored by investors. As such, it is likely that a disconnect between sustainability disclosures and emission performance is perceived negatively by investment clients.

Nonetheless, there are several reasons why one could not expect any observable effect of the introduction of the SFDR on the average emissions of funds' investment portfolios. To begin, it is possible that EU funds that claim to invest based on sustainability criteria were already maximizing efforts to decarbonize their portfolios before the introduction of the SFDR. Critics also argue that the SFDR is not specific enough and could open the door for greenwashing (Negrin Ochoa, 2021).<sup>4</sup> Moreover, it is unclear ex-ante whether funds bear significant costs from a perceived disconnect between their sustainability claims and their environmental performance measured in terms of carbon emissions. The stakeholders of investment funds differ significantly from those of non-financial firms. Investment clients might not understand or process information on carbon emissions and might instead focus on ESG ratings or other sustainability claims the fund emphasizes in its marketing materials. At the same time, regulators might not find sufficient grounds for conducting enforcement actions against a perceived disconnect between sustainability disclosures and emission performance.

<sup>&</sup>lt;sup>4</sup> In the context of our study we would consider greenwashing to be claiming to invest based on sustainability criteria without maximizing efforts to improve the portfolio's sustainability performance.

Our analysis is based on a wide sample of mutual funds across Europe, the US, and the rest of the world. We exploit the variation induced by the SFDR, which prescribes that asset managers classify their funds based on whether the investment strategy has a sustainability dimension and, if it does, mandates detailed disclosures supporting how promoted sustainability characteristics or objectives are met. We define as our "treatment" group the funds that claim to integrate sustainability criteria in their investment strategy (i.e., funds classified as Article 8 or Article 9 by the SFDR; see description in Section 2). We compare changes in the weighted average carbon emissions of the firms in the portfolio of these funds with those of the portfolios of funds from non-SFDR funds (i.e., funds not impacted by the SFDR) managed by UN Principles for Responsible Investment ("PRI") signatories.<sup>5</sup> In supplemental analyses, we demonstrate the robustness of our findings using a variety of alternative control groups.<sup>6</sup>

We find that, relative to the control funds, the portfolios of the funds in our treatment group exhibit significantly lower emissions following the implementation of the SFDR. We observe this pattern for all three types of emissions: Scope 1, 2, and 3.<sup>7</sup> A dynamic analysis around the introduction of the new rule shows that the portfolios of treatment and control funds experienced similar (parallel) trends in carbon emissions prior to the implementation of the SFDR but diverged in the years following. The magnitude of the documented patterns is not negligible. The funds in

<sup>&</sup>lt;sup>5</sup> The UN Principles for Responsible Investment ("PRI") was initiated in 2006 as a voluntary mechanism for asset manager's to signal their commitment to sustainable investing. PRI signatories voluntarily make a commitment to incorporate ESG issues into their investment analysis, decision making, and ownership practices.

<sup>&</sup>lt;sup>6</sup> Alternative control groups considered include (1) EU funds that do not claim to invest based on sustainability criteria (i.e., Article 6 funds), (2) US domiciled non-SFDR PRI signatories, (3) ESG funds according to Morningstar, (4) propensity score matched non-SFDR PRI signatory funds (matched on fund size and emissions), and (5) funds from within the same fund family (i.e., funds managed by the same asset manager) that were not impacted by the SFDR.

<sup>&</sup>lt;sup>7</sup> Scope 1 are emissions of green-house gases from sources that a company owns or controls directly (e.g., from running its machinery). Scope 2 emissions are indirect emissions from purchased energy. Scope 3 emissions are all indirect emissions (not included in Scope 2) from the company's upstream and downstream value chains.

our treatment group reduce annual Scope 1 (total Scope 1, 2 and 3) portfolio carbon emissions by 13.7% (6.6%) more than our control funds.

To better understand these patterns, we explore the sources of changes in emissions. Our analysis reveals that the lower emission levels under the SFDR are partly attributable to changes in portfolio weights due to differences in firm returns. However, our results show that the documented patterns are also driven by changes in funds' investment decisions (i.e., SFDR impacted funds divest from firms with higher (invest in firms with lower) emissions), and by changes in firms' environmental performance, potentially due to pressure from investors.

We conduct additional tests to explore each of these channels in greater detail. First, we hold portfolio composition and investment weights constant across the sample period and exclude portfolio entries and exits entirely from the analysis and re-estimate our main test. We continue to see a post-SFDR incremental decreases in average portfolio emissions for Scope 1, Scope 2, and Scope 3. This is also consistent with the notion that investors exert pressure on firms to reduce emissions. Switching to a fund-firm level analysis, we find that treated funds reduce their holdings in sample firms with the highest pre-SFDR emissions by an incremental 22% to 29% compared to the control group. This provides corroborating evidence that the SFDR materially changed funds' investment decisions around firm's emission levels.<sup>8</sup>

To further sharpen identification, we examine three sources of cross-sectional variation in treated funds' disclosure costs. We find that the effect of the SFDR is significantly reduced for funds that were already exposed to mandated sustainability disclosures prior to the new rule. In

<sup>&</sup>lt;sup>8</sup> Institutional investors can exert pressure on firms to reduce emissions directly, through engagement, or indirectly, through the threat of divestment (e.g., Azar et al., 2021). Empirically disentangling these two channels is not feasible in our setting. However, addressing our research question does not require establishing which of these channels is most prevalent in practice. If more data on investor engagement becomes available, future research could address such distinction as a separated research question.

contrast, we observe that the emission decreases are more pronounced for funds with higher levels of portfolio emissions prior to the SFDR. Finally, we find that our results are more pronounced for funds domiciled in countries with higher sensitivity towards sustainability.

We conduct a series of additional tests to explore the sensitivity of our inferences to measurement choices and the validity of alternative explanations. We use four variants of the dependent variable: average carbon emissions intensity, aggregate carbon emissions, equally weighted emissions, and average total emissions footprint. Our inferences are unaltered.

We explore the validity of potential alternative explanations. We repeat our main analysis excluding EU firms from the computation of portfolio emissions. This avoids the potential confounding effect of contemporaneous sustainability disclosure rules for non-financial firms. Next, we restrict both our treatment and control groups to funds domiciled in the US and repeat our main analysis. This addresses concerns that our results may be capturing an unidentified contemporaneous pressure causing European domiciled funds to diverge from funds domiciled outside of Europe. We also restrict our analysis to Article 8/9 funds that were PRI signatories before the SFDR to ensure that the "treated" funds claimed to invest based on sustainability criteria prior to the SFDR). Finally, we include a variety of additional control variables that capture fund and firm characteristics potentially correlated with portfolio-level and firm-level emissions estimates. Our inferences are unaltered.

Our paper advances the burgeoning literature studying the real effects of mandated sustainability disclosures. Several papers provide evidence that disclosure mandates are associated with firms' subsequent reductions in emissions (e.g., Chen et al. 2018, Downar et al. 2021, Krueger et al. 2023). However, the potential impact of sustainability disclosure mandates on investors' environmental performance remains largely unexplored. To the best of our knowledge, this is the

first paper that examines the impact of sustainability disclosure mandates for investment funds on decarbonization.

Several considerations suggest that our results cannot be inferred from prior literature on regulation of sustainability reporting for non-financial firms. To begin, the costs and benefits of such mandates for asset managers are likely to be different vis-à-vis those for managers and directors of non-financial firms. For example, it is unclear ex-ante whether clients of asset management firms are more sensitive towards environmental issues than clients of non-financial firms (such sensitivity is likely related to disclosure costs and thus can induce behavior). Investment funds also generally do not have direct operational control over the firm's they invest in, altering the potential channels and costs of reducing portfolio emissions. Moreover, the enforcement of disclosure regulation for asset management firms could vary from that for non-financial firms. Among other things, the two settings exhibit substantial differences in terms of verifiability and standardization of the disclosed information, which could affect enforcement efficacy. Funds may have diverse portfolios with varying degrees of exposure to different industries, each with its own emission measurement challenges and disclosure practices. This diversity can make standardization and verifiability of fund disclosures more challenging.

In terms of regulatory implications, understanding the effects of the implementation of the SFDR can inform the worldwide debate around mandating investment fund sustainability representations and performance disclosure. Other jurisdictions —notably, the US and the UK— are also exploring legislation related to this topic.<sup>9</sup> In essence, this regulatory debate differs from that on sustainability reporting for non-financial firms.

<sup>&</sup>lt;sup>9</sup> In September of 2023 the SEC approved changes to the Investment Company Act's "Names Rule" that broadened the rule's scope to include funds with names featuring terms like ESG, green, or sustainable. The changes also included enhanced disclosure requirements (<u>https://www.sec.gov/news/press-release/2023-188</u>). In the UK, the Financial

# 2. Background, Hypothesis, and Prior Literature

# 2.1. Background

The EU Sustainable Finance Disclosure Regulation (SFDR) was approved in November of 2019 and came into effect in March of 2021.<sup>10</sup> The regulation mandates all funds disclose the extent to which sustainability risks are considered in their investment decisions and imposes specific additional disclosure requirements based on whether the fund self-classifies as "Article 6", "Article 8", or "Article 9" in reference to the corresponding articles of the regulatory text (included in Appendix B).

Article 6 funds, which are not meant to promote sustainability performance, do not have specific sustainability requirements. Article 8 funds, which are meant to promote sustainability performance, are required to disclose the methodologies they use to assess the environmental or social characteristics of the investments and how levels of sustainability are achieved by the fund. Article 9 funds are meant to invest in companies that contribute to specific environmental or social objectives, such as reducing carbon emissions or promoting gender diversity.<sup>11</sup> As such, they must also disclose how they measure and monitor the impact of their investments on these objectives.

Conduct Authority is developing regulation on sustainability disclosures and the labeling of sustainability products (<u>https://www.fca.org.uk/news/news-stories/fca-updates-sustainability-disclosure-requirements-and-investment-labels-consultation</u>).

<sup>&</sup>lt;sup>10</sup> See "Regulation (EU) 2019/2088 of the European Parliament and of the Council of 27 November 2019 on sustainability-related disclosures in the financial services sector". Available at <u>https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32019R2088</u>

<sup>&</sup>lt;sup>11</sup> Examples of investments that could be considered Article 9 include: (i) renewable energy infrastructure, such as solar power plants, wind farms, or hydroelectric facilities that contribute to the reduction of greenhouse gas emissions. (ii) sustainable infrastructure projects, including public transportation systems, green buildings, or water and waste management facilities. (iii) investments addressing social issues, such as affordable housing, healthcare, education, or initiatives supporting underprivileged communities. (iv) companies involved in developing and deploying clean technologies, sustainable agriculture practices, or waste management solutions. (v) initiatives focused on biodiversity conservation, habitat restoration, or sustainable land use practices. (vi) activities that contribute to mitigating climate change, such as carbon capture and storage projects, emissions reduction programs, or sustainable forestry.

In addition, Article 9 funds must publish a detailed sustainable investment policy, which outlines the specific environmental and social objectives they aim to achieve.

SFDR Articles 10 and 11 require that financial market participants publish and maintain disclosures on their websites and in periodic reports. As clarified in the additional materials published by the Joint Committee of the EU Supervisory Authorities, disclosures by means of periodic reports should be carried out annually (JC 2023 18). Usually, funds disclose this information on websites, monthly factsheets, and/or prospectuses. Appendix C presents an example.

The initial provisions of the SFDR, also commonly referred to as SFDR Level 1, delegated clarification of disclosure content and presentation for Article 8 and Article 9 funds to the European Banking Authority (EBA), the European Insurance and Occupational Pensions Authority (EIOPA), and the European Securities and Markets Authority (ESMA). This clarifying information, commonly referred to as SFDR Level 2, was to be published via two sets of Regulatory Technical Standards ("RTS"). The first draft RTS for climate and environment-related topics was targeted for December 2020 and the first draft RTS for social, employee, human rights and anti-corruption topics was targeted for December 2021. The final consolidated RTS covering both sets of topics was ultimately published in July of 2022. The first annual reference period for disclosures to comply with the Level 2 guidance is January 1 through December 31 of 2022, with disclosures related to this period required by June of 2023.<sup>12</sup> However, as noted by the European

<sup>&</sup>lt;sup>12</sup> Post SFDR Level 2, Article 8 and 9 funds continue to need to disclose qualitative and quantitative indicators in periodic reports that demonstrate how they meet promoted characteristics or objectives. Such disclosures are organized around the consideration of Principal Adverse Impact (PAI) indicators, which are intended to identify potential adverse impacts portfolio holdings may have on sustainability factors relating to environmental performance and other sustainability factors.

Commission, "in terms of substance, the application of the [SFDR] is not conditional on the formal adoption and entry into force or application of the [RTS]" (European Commission 2020).

The SFDR applies to a broad range of financial market participants and financial products covering all types of investment funds promoted in the EU. This includes financial products registered outside Europe if they are promoted in the EU. Penalties for non-compliance with the SFDR include fines and loss of authorization to operate in the EU. Enforcement of the SFDR is entrusted to national competent authorities and coordinated by ESMA at the European level.

#### 2.2. Hypothesis Development

We hypothesize that the introduction of mandatory sustainability disclosure for investment funds is followed by a decarbonization of the investment portfolios of funds that claim to invest based on sustainability criteria. As explained in section 2.1, the new regulation increases the level of transparency regarding sustainability performance of investment portfolios. Higher transparency could highlight potential inconsistencies between sustainability claims and sustainability performance. It is thus plausible that, to avoid any negative reaction among investment clients triggered by such inconsistencies, funds have an incentive to increase the sustainability performance of the portfolio. Consistent with this possibility, some prominent EU regulators and commentators view the SFDR as a tool to check whether investment funds honor their sustainability commitments (ESMA 2023; Negrin Ochoa, 2021).

Decarbonization is likely to be at the heart of investors' efforts to increase sustainability performance. A decrease in emissions is commonly perceived as an improvement in sustainability performance, whereas the interpretation of a decrease in other sustainability metrics could be more contentious.<sup>13</sup> Moreover, there is ample evidence that, given the current concerns about climate change, a large proportion of investors' environmental efforts are centered around decarbonization.<sup>14</sup> Survey evidence also shows that a growing number of investment funds are embedding net zero goals and strategies into their portfolio decisions, which implies that investment clients appreciate decarbonization efforts.<sup>15</sup>

The SFDR prioritizes development of detailed disclosures for environmental impacts above other facets of sustainability (see SFDR Article 4(6)). Moreover, the SFDR "Principal Adverse Impact" disclosures place a heavy emphasis on carbon emissions (CDR 2022), which potentially facilitates related enforcement actions.

We envision two primary channels through which funds could decarbonize their investment portfolios. A fund can either (i) make changes in portfolio composition via purchases and sales of assets, or (ii) it can engage with portfolio firms to push improvements in portfolio firm's environmental performance. Funds have been shown to exert significant influence over portfolio company environmental performance (Tsang et. al 2019, Azar et al 2021, Flammer and Viswanathan, 2021) and have discretion over investment related changes to their portfolios.

Nonetheless, there are several reasons why one could not expect any observable effect of the SFDR on the average emissions of funds' investment portfolios. To begin, it is possible that the

<sup>&</sup>lt;sup>13</sup> For Example: A decrease in water usage could be due to improved water efficiency or cutting corners in processes that might compromise quality or lead to other environmental issues. A decrease in land use could imply less habitat destruction or if the reduction is due to intensification of land use it might lead to other environmental or social issues.

<sup>&</sup>lt;sup>14</sup> See for example the Net Zero Asset Owner Alliance, Climate Action 100+ initiative, or the ShareAction Investor Decarbonization Initiative.

<sup>&</sup>lt;sup>15</sup> In 2021, 733 institutional investors representing over \$52 trillion in assets under management signed the 2021 Global Investor Statement to Governments on the Climate Crisis, which urged governments to work with institutional investors to accelerate action to tackle the climate crisis. The signatories observed more investors than ever are embedding Net Zero goals and strategies into their portfolio decisions, engaging with companies to cut emissions and calling on policymakers to deliver climate action (see the 2021 Global Investor Statement to Governments on the Climate Crisis, coordinated by the seven founding partners of The Investor Agenda <a href="https://theinvestoragenda.org/wp-content/uploads/2021/09/2021-Global-Investor-Statement-to-Governments-on-the-Climate-Crisis.pdf">https://theinvestor-Statement-to-Governments-on-the-Climate-Crisis.pdf</a>).

incentives to decarbonize investment portfolios generated by the disclosure rule are not first order. While there is evidence that some investment clients have intrinsic ESG preferences, many others -perhaps a majority- could be more focused on traditional metrics related to the fund's economic performance (Barber et. al 2016). Moreover, the disclosure mandate could generate incentives to increase sustainability performance in dimensions other than decarbonization. This would be the case, for example, if investment clients focus on ESG ratings or other sustainability claims the fund emphasizes in its marketing materials.

Regarding enforcement, some critics argue that the SFDR is not specific enough to enable successful prosecutions and thus could open the door for greenwashing (Negrin Ochoa, 2021). Funds may have diverse portfolios with varying degrees of exposure to different industries, each with its own emission measurement challenges and disclosure practices. This diversity can make standardization and verifiability of fund disclosures more challenging. Moreover, litigation and prosecution on grounds of sustainability are still rare, although the number of such cases is increasing.<sup>16</sup>

Yet a final possibility is that EU funds were already maximizing efforts to improve sustainability performance before the introduction of the SFDR (Dikolli et al. 2022). This would be the case if, absent disclosure regulation, the benefits of maximizing efforts towards improving sustainability outweigh the costs for investors. There is some evidence in support of this possibility. On the benefit side, survey evidence suggests that institutional investors believe climate risks have financial implications for their portfolio firms and that reducing carbon

<sup>&</sup>lt;sup>16</sup> In May 2022, German prosecutors raided asset manager DWS and the headquarters of its majority owner Deutsche Bank over allegations of misleading investors about "green" investments (<u>https://www.reuters.com/business/german-police-raid-deutsche-banks-dws-unit-2022-05-31/</u>). In July 2023, ESMA (i.e., the EU's financial markets regulator and supervisor) launched a Common Supervisory Action with NCAs to assess the compliance of supervised asset managers with the relevant provisions in the SFDR (<u>https://www.esma.europa.eu/press-news/esma-news/esma-and-ncas-assess-disclosures-and-sustainability-risks-investment-fund</u>).

emissions is beneficial (Krueger et al. 2020). On the cost side, there is mixed evidence that managing a portfolio in a sustainable way imposes substantial costs (Pastor and Vorsatz 2020, Kim and Yoon 2022, Liang et. al 2022).

#### 2.3. Prior Literature

Our paper adds to the burgeoning literature on the effects of mandating disclosures on carbon (and carbon equivalent) emissions, which is mainly focused on non-financial firms. Downar et al. (2021) study the mandate to disclose Scope 1 and 2 emissions introduced by the UK in 2013 (the requirement was applicable to listed firms). They document that -relative to a control group of European firms- the regulated firms reduced their carbon emissions by around 8% without a significant effect on gross margins. Using the same setting, Jouvenot and Krueger (2021) find a higher reduction in emissions (16%) accompanied by costly operational adjustments.

Yang et al. (2021) study the US Greenhouse Gas Reporting Program (GHGRP) for electric power plants, which since 2010 requires the reporting of greenhouse gas emissions. These authors show that regulated firms experienced a reduction in carbon emissions of 7%. They also find evidence that firms owning both GHGRP and non-GHGRP plants strategically reallocate production between the two types of plants, presumably to manage emission reports. Tomar (2023) finds a reduction in emissions (8%) for GHGRP plants and attributes the results to benchmarking (i.e., firms comparing their emissions performance with that of their peers). Cheng et al. (2018) investigate the impact of a 2008 Chinese law mandating disclosure of CSR activity. Although the mandate did not require firms to spend on CSR, they find that firms required to report CSR activities experience a decrease in profitability after the mandate. However, the cities most affected by the mandate experienced material reductions in emissions.

While this prior work is generally consistent with the notion that mandatory disclosure induces firms to decrease carbon emissions, these papers focus on regulatory sustainability reporting for *non-financial* firms. In contrast, we study mandatory sustainability disclosure for investment funds. The effects of these two types of rules likely differ in several important dimensions. Critically, the costs and benefits of sustainability disclosure mandates for asset managers are likely to be different vis-à-vis those for managers and directors of non-financial firms. For example, it is unclear ex-ante whether clients of asset management firms are more sensitive towards environmental issues than clients of non-financial firms (such sensitivity is likely related to disclosure costs and thus can induce behavior).

Moreover, investment funds are often focused on portfolio composition and investment strategies rather than on influencing the types of direct operational changes that resulted in emission reductions in prior work on non-financial firm mandatory disclosure. In this regard, we also note that investment funds generally do not have direct operational control over the firm's they invest in, altering the potential channels and costs of reducing portfolio emissions. Finally, the enforcement of disclosure regulation for asset management firms could vary from that for nonfinancial firms. Among other things, the two settings exhibit substantial differences in terms of verifiability and standardization of the disclosed information, which could affect enforcement efficacy.

At a higher level, our research is also related to prior work studying the consequences of other non-financial disclosure mandates around the world. Christensen et al. (2017) examine the effects of US mandatory disclosure of mine-safety records and find that including such disclosures in the financial reports is associated with an increase in mine safety but also with a reduction in productivity. Grewal et al. (2019) and Fietchter et al. (2022) investigate the EU Directive 2014/95

requiring large, listed EU firms to prepare annual nonfinancial reports with CSR information. Grewal et al. (2019) document that firms more exposed to this directive experienced lower stock returns around key regulatory dates. Fietchter et al. (2022) find that regulated firms increase their CSR activities before the implementation of the disclosure mandate. Finally, Krueger et al. (2023) collect country-level data on the presence ESG disclosure mandates. They find that such mandates enhance stock liquidity, a result that is stronger in jurisdictions with higher levels of enforcement and in weaker information environments.

Our paper differs from this prior work in two fundamental ways. First, we focus on nonfinancial disclosures by investment funds (rather than non-financial firms). Second, we study the effect of mandatory disclosure on decarbonization (rather than other consequences).

Our results could also be linked to prior research on voluntary sustainability claims by investment funds. Raghunandan and Rajgopal (2022) investigate whether self-defined ESG mutual funds genuinely invest in companies with positive impact on sustainability. They find little evidence that these funds invest in companies with stronger sustainability records. Kim and Yoon (2022) analyze a sample of US mutual funds that signed the PRI initiative. Their results suggest that PRI signatories attract large inflows, but they do not deliver improvements in fund-level ESG scores or fund returns. In a similar vein, Gibson Brandon et al. (2022) also study a sample of international funds that joined the PRI initiative. They show that US signatories exhibit similar or lower ESG ratings. However, non-US PRI signatories appear to have higher ESG scores than non-signatories.

Unlike our paper, this prior research does not study mandatory reporting for investment funds (rather, the focus is on voluntary claims). Moreover, the results of these prior papers are generally consistent with the notion that *voluntary* sustainability disclosures are not clearly related to improved sustainability performance. In contrast, our findings suggest that *mandatory* sustainability disclosures are accompanied by meaningful reductions in portfolio emissions.

# **3.** Empirical Analysis

# 3.1. Sample and Descriptive Statistics

To construct our sample, we start with the universe of mutual funds in FactSet, which covers portfolio equity holdings data for institutional investors worldwide (Ferreira and Matos, 2008; Gibson et al. 2022). We first remove index funds and non-equity funds.<sup>17</sup> Next, we keep the funds with available FactSet Ownership data on equity portfolio holdings at each calendar year end between 2018 and 2021. We exclude funds created during our sample period and funds with total net assets (*TNA*) under management less than \$15 million (Pastor and Vorsatz, 2020).<sup>18</sup> We also require portfolio holdings to have Trucost carbon emissions data for all years in which the asset is held by a fund to avoid potential distortions related to availability of emissions data (Bolton and Kacperczyk 2021). Finally, we require that the ratio *AUM/TNA* (i.e., assets under management to total net assets) is between 0.1 and 2 to ensure reasonable fund portfolio coverage after imposing data restrictions to facilitate our fund level analyses.<sup>19</sup>

We define the "treatment" group as the subset of funds classified as Article 8 and Article  $9.^{20}$  We expect the effect of the SFDR on greenwashing to be concentrated among these funds, as

<sup>&</sup>lt;sup>17</sup> Following Humphrey and Li (2021), we remove observations that FactSet flags as "index funds" and observations where the name of the fund contains the words "index", "S&P", "Dow Jones", "NASDAQ", "Vanguard", "ETF", and "ETN".

 $<sup>^{18}</sup>$  Total net assets (*TNA*) is calculated as the sum of net asset value of different share classes of a fund. Total net assets is the total value of assets owned by a fund after subtracting its liabilities. The data is obtained from Morningstar.

<sup>&</sup>lt;sup>19</sup> AUM is the sum of the market value of all portfolio holdings of a fund that remains after imposing other data requirements. AUM/TNA provides an indication of the percentage of TNA that we capture. The lower threshold of 10% is meant to ensure we capture a material portion of sample funds' portfolios. The upper threshold of 2x is based on the UCITS Directive Article 51(3) which sets leverage limitations at 1x assets, implying that the max ratio of assets to net assets should be 2x.

<sup>&</sup>lt;sup>20</sup> We obtain this information from Refinitiv. SFDR Article 8 and 9 fund indicators were retrieved on February 6, 2023.

they are the ones claiming to invest based on sustainability criteria and are subject to detailed disclosures supporting how promoted sustainability characteristics or objectives are met. The "control" group in our primary tests contains non-SFDR funds (i.e., funds not impacted by the SFDR) that were signatories to the United Nations PRI before the ratification of the SFDR in 2019. Non-SFDR PRI signatories are similar to Article 8/9 funds in that they publicly make a commitment to incorporate sustainability considerations into their investment analysis, decision making, and ownership practices. However, these funds were not required to publicly disclose the actual outcomes of such commitment or how promoted sustainability characteristics or objectives are met.

Using this procedure, we identify a comprehensive list of portfolio holdings for 4,021 active equity mutual funds, spanning 16,084 fund-years between 2018 and 2021. Table 1, Panel A, presents the sample selection procedure and the sample composition. As shown in Table 1, Panel B, our treatment group funds are heavily concentrated in the European Union, although a significant number of US and UK funds market their products in the European Union and are subject to the disclosure mandate. We also note that some European Union domiciled funds do not market their funds within the European Union and are not subject to the disclosure mandate.<sup>21</sup> Table 1, Panel C, provides descriptive statistics of the variables we use in our tests. The average fund in our sample invests in firms that have total emissions (sum of Scope 1, 2, and 3) of over 173 million tons of CO<sub>2</sub> equivalents, highlighting the materiality of emissions that originate from the firms in our sample fund's portfolios.

<sup>&</sup>lt;sup>21</sup> It is possible that some of these funds could be SFDR funds that were misclassified as non-SFDR by Refinitiv. To ensure that EU domiciled non-SFDR funds are not driving results, we conduct several robustness tests where we exclude these funds from the control group. Inferences are unaltered. It is also worth noting that including some SFDR funds in our control group would likely bias against finding our main decarbonization results.

# 3.2. Main Tests and Results

Our measure of carbon emissions at the portfolio level follows prior literature (e.g., Raghunandan and Rajgopal, 2022). For each mutual fund *i* in year *t*, we compute the weighted average of portfolio emissions (*Avg. Portfolio Emissions*<sub>it</sub>):

Avg. Portfolio Emissions<sub>it</sub> = 
$$log(\sum_{n=1}^{N} w_{int} * Firm Emissions_{nt})$$
 (1)

where  $w_{int}$  is the weight of firm *n* in the portfolio of fund *i* in year *t* (the weights are the annual average market value of a fund's shareholdings in each firm) and *Firm Emissions*<sub>nt</sub> is the amount of emissions of firm *n* in year *t* (in tons of carbon equivalents). For instance, if a fund with \$100 in assets under management owns \$60 worth of shares in Firm A and \$40 worth of shares in Firm B in a given year, and if Firm A has 200 metric tons of emissions and Firm B has 100 metric tons of emissions, *Avg. Portfolio Emissions*<sub>nt</sub> is computed as log(0.6\*200 + 0.4\*100). For completeness, we compute *Avg. Portfolio Emissions*<sub>nt</sub> separately for each of the three types of emissions considered in the GHG Protocol, namely Scope 1, 2, and 3, but we caution that the measurement of Scope 3 emissions is a particularly contentious issue (Condon 2023; Ducoulombier 2021).

To test the potential impact of the SFDR on portfolio-level emissions, we estimate the following model:

Avg. Portfolio Emissions<sub>it</sub> = 
$$\beta I(Article \ 8/9)_i *Post + \delta_i + \phi_t + \varepsilon_{it}$$
 (2)

where *I(Article\_8/9)* is an indicator variable that equals one if the fund is labeled as Article 8 or 9, and zero otherwise.<sup>22</sup> *Post* is an indicator variable that equals one if the year is 2020 or 2021.<sup>23</sup>  $\delta_t$  and  $\phi_t$  represent fund and year fixed effects, respectively.

<sup>&</sup>lt;sup>22</sup> Testing whether there is a differential effect among Article 8 and Article 9 funds is difficult, as our sample contains a small number of Article 9 funds. However, our inferences are unchanged if we drop Article 9 funds from the sample entirely.

<sup>&</sup>lt;sup>23</sup> The SFDR was ratified at the end of 2019 and became effective in January 2021. It is thus likely that, in anticipation of the impending rule, some funds changed their behavior in 2020. That said, we repeat the analysis in Table 2 redefining the "post" period as starting in 2021. We also conduct the test excluding year 2020. Inferences are unaltered.

As shown in Table 2, Panel A, the average amount of emissions of Article 8/9 funds' portfolios is relatively lower after the introduction of the SFDR compared to those of control funds. In terms of Scope 1, the estimated magnitude of  $\beta$  suggests a relative decrease of 13.7% with respect to control funds. The reductions in Scope 2 and Scope 3 are 5.8% and 6.7%, respectively. In Table 2, Panel B, we conduct a dynamic version of equation (2), in which we take 2018 as our reference year. The results indicate that, prior to the implementation of the SFDR, the treated and control funds experienced similar (parallel) trends in Scope 1 and 2 emissions (i.e., the coefficients on *I(Article 8/9)\*2019* are insignificant), but not in Scope 3.

To ensure that the patterns in Table 2 do not hinge on the control group, we repeat the analysis using five alternative control groups. This additional analysis also helps alleviate concerns regarding potentially confounding factors such as common shocks and fund heterogeneity.

In Panel A of Table 3 we use SFDR Article 6 funds as the control group, which enables us to compare decarbonization using a control group with a European centric distribution of fund domiciles similar to our treatment group. In Panel B we limit the control group to US domiciled PRI funds. This eliminates EU domiciled, non-SFDR funds, addressing concerns that some of observations could represent missed SFDR funds. It also eliminates funds from smaller markets that could be less comparable to a large market like the European Union. In Panel C we examine non-SFDR Sustainable funds as designated by Morningstar as the control group. This allows us to demonstrate robustness using an alternative metric for identifying sustainable funds not subject to a disclosure mandate.<sup>24</sup> In Panel D, we examine Non-SFDR PRI funds matched based on pre-

<sup>&</sup>lt;sup>24</sup> Morningstar considers a fund to be a sustainable investment product if the in the prospectus or other regulatory filings it is described as focusing on sustainability, impact investing, or environmental, social or governance factors. Funds must claim to have a sustainability objective, and/or use binding ESG criteria for their investment selection. Funds that employ only limited exclusions or only consider ESG factors in a non-binding way are not considered to be a sustainable investment product.

SFDR size and environmental performance, which provides additional comfort (beyond our parallel trends tests) that potential differences between treatment and control funds before the SFDR do not drive decarbonization effects. Finally, in Panel E we limit our sample to funds from within the same fund family (i.e. funds managed by the same asset manager), addressing concerns that the results could be driven by heterogeneity in asset managers. As shown in Table 3, our inferences are unaffected using these alternative control groups.

# 3.3. Sources of the results

We next explore the sources of the documented patterns. We contemplate three possible sources of the decrease in average portfolio emissions documented in Tables 2 and 3: (i) changes in portfolio weights due to divergent returns, (ii) changes in funds' investment decisions (i.e., funds divest from firms with higher (invest in firms with lower) emissions), and (iii) changes in corporate carbon emissions potentially due to pressure from investors. The pressure could be direct (i.e., investor-firm engagements) or indirect (i.e., firms react to the threat of divestment and/or higher cost of capital). Cheema-Fox et al. (2021) refer to (i), (ii), and (iii) as "*Return*", "*Flow*", and "*Impact*", respectively, and propose a mathematical procedure to compute the three components (see Appendix D for additional details). We follow their methodology to provide an initial analysis of the source of documented decarbonization.

Table 4, Panel A column (2) shows that part of the decrease in average portfolio emissions is driven by changes in portfolio weights associated with variation in stock returns (see (i) above). However, the results in columns (3) and (4) for Scope 1 (see Table 4, Panel A) are consistent with the notion that the emission patterns are also driven by changes in funds' investment decisions (see (ii) above) and by changes in firms' environmental performance (see (iii) above). The results are not uniform across Scope 1, 2, and 3. We find no significant "*Flow*" effect for Scope 2 emissions (see Table 4, Panel B, column 3), and the "*Impact*" effect for Scope 3 exhibits a positive sign (see Table 4, Panel C, column 4). This last result needs to be interpreted with caution, as Scope 3 measurements are often considered unreliable or incomplete (Bolton and Kacperczyk 2021).<sup>25</sup>

To provide further evidence on the above-mentioned sources of decarbonization, we conduct two additional analyses. First, we follow Kim and Yoon (2022) and hold portfolio composition and investment weights constant for each fund and re-compute *Avg. Portfolio Emissions*<sub>it</sub> using only the firms that remain in the portfolio of the fund over the whole sample period (i.e., from 2018 to 2021). We then repeat the analysis in Table 2 using this modified version of *Avg. Portfolio Emissions*<sub>it</sub>,which excludes firms that enter and exit the portfolio during the sample period and controls for "return effects" (see point (i) above) by freezing portfolio weights. As shown in Table 5, we obtain the same inferences as in Table 4 for Scope 1 and Scope 2 emissions, providing corroborating evidence that our main results are at least partially driven by differential changes in portfolio firm emissions. We also see evidence in Table 5 of greater decarbonization for Scope 3 emissions within the subset of firms that remains in the fund portfolio over the whole sample period.

We conduct a second additional analysis in order to explore in greater detail decarbonization related to changes in fund's investment decisions around firm's emission levels. We conduct the analysis at the fund-firm-year level. The dependent variable, *Sharesint*, is the number of shares of firm n owned by fund i in year t. We code *Sharesint* as zero in the period immediately prior to (after) a firm's entry into (exit from) a fund's portfolio. After excluding singletons (i.e., fund-firm groups with only one observation), the test includes 1,873,146 fund-firm-year observations.

<sup>&</sup>lt;sup>25</sup> With this caveat in mind, one could argue that this result is consistent with portfolio firms "outsourcing" emissions to the supply chain (e.g. Ben-David et al., 2021, Dechezleprêtre et al., 2022; Naegele and Zaklan, 2019; Borghesi et al., 2020). Alternatively, one could argue that funds are potentially engaging with firms to improve reporting around Scope 3 emissions. That said, a deep analysis of the validity of such conjectures is beyond the scope of our study.

We estimate the following model:

$$Log(1+Shares_{int}) = \beta_1 I(Article_8/9)_i *Post *Higher_FirmEmissions_{in} + \beta_2 Post *HigherFirmEmissions_{in} + \beta_3 I(Article_8/9)_i *Post + \sum \beta_k I(Article_8/9)_i *Post *FirmControls_{nt} + \sum \beta_k Post *FirmControls_{nt} + \sum \beta_k I(Article_8/9)_i *FirmControls_{nt} + \sum \beta_k FirmControls_{nt} + \delta_{in} + \phi + \varepsilon_{it}$$
(3)

where *Higher FirmEmissions* is an indicator variable that equals one if firm *n* emissions are in the highest decile of emissions of firms in the fund *i* portfolio of at the end of 2019, and zero otherwise. We include this variable to identify firms contributing the largest emissions per dollar of investment to a specific fund's portfolio. FirmControls is a vector of firm characteristics related to performance, risk and growth that includes Log(revenues), Leverage, ROE, EPS growth, BM and SalesGrowth (see Appendix A for variable definitions). We include FirmControls and interact these controls with (Article 8/9)<sub>i</sub>\*Post to provide additional comfort that changes in firm performance, risk or growth are not driving any observed changes in fund share ownership.  $\delta_{in}$ represent fund-firm fixed effects, which are included to control for unobserved characteristics of each fund-firm pairing.  $\phi$  represents either year fixed effects or fund-year fixed effects (we include them alternatively in the specifications). Year fixed effects control for unobserved characteristics in each year that impacted all funds (e.g. differing market conditions) and fund-year fixed effects are included to control for unobserved characteristics that impacted each fund specifically in each year (e.g. capital inflows and outflows, management changes). All other variables are as previously defined.

The primary coefficient of interest is  $\beta_1$ , which measures the differential change in ownership between our treatment and control funds for the firms with the greatest per dollar emissions at the end of 2019. A negative coefficient for  $\beta_1$  is consistent with treated funds reducing their holdings of the highest emission firms to a greater extent after the SFDR than the control funds. Table 6 presents selected coefficients from estimations of equation (3). In column (1) we document a significant negative coefficient for  $\beta_1$  estimating a model with fund-firm and year fixed effects and no additional *FirmControls*. The  $\beta_1$  coefficient is consistent with the SFDR treated funds reducing their holdings in portfolio firms with the highest emissions by 21.8% more than control funds. When we alternatively include fund-year fixed effects in column (2) and then repeat the analyses with the inclusion of *FirmControls* and additional interaction terms in columns (3) and (4), the magnitude of the differential reduction in holdings increases up to 28.5%. In untabulated analyses we repeat these tests looking alternatively at firms in the top quartile and top half of portfolio emissions at the end of 2019. We continue to see evidence of greater reductions in high emissions firms by *Article 8/9* funds in the *Post* period. However, we observe a decline in the significance and magnitude of the  $\beta_1$  coefficient consistent with funds focusing trading on the upper tail of firms with high emissions.

### 3.4. Cross sectional variation in funds' disclosure costs

To further sharpen identification, we examine variation in effects across three settings where we expect cross-sectional variation in treated funds' disclosure costs. First, we analyze whether the patterns in Table 2 vary depending on whether the funds in our treatment sample were previously subject to mandated sustainability disclosures. In this regard, we exploit variation generated by the French Energy Law of 2015. Article 173-VI of this law requires that institutional investors domiciled in France provide information on how they consider environmental, social, and governance factors in their strategies and decision making. Accordingly, the French domiciled funds in our sample were already operating under a disclosure mandate in advance of the SFDR. We expect a reduced (or no) decarbonization effect for these funds compared to the SFDR funds domiciled outside of France. We define an indicator *Prior Disclosure Rule* equal to 1 for firms domiciled in France, and 0 otherwise. Consistent with expectations, when we re-estimate equation (2) interacting *I(Article\_8/9)\*Post* with *Prior Disclosure Rule*, we see that the decarbonization effect is significantly smaller for those funds previously exposed to a sustainability disclosure mandate in (Table 7, Panel A).

Next, we analyze whether the patterns in Table 2 vary with the level of average portfolio emissions prior to the implementation of the SFDR. Funds with relatively worse emissions performance prior to the SFDR could face greater costs from the mandate to disclose emissions and accordingly have a stronger incentive to decarbonize their portfolio. We re-estimate equation (2) interacting  $I(Article_8/9)*Post$  with *Higher\_Emissions*, an indicator variable that equals one if *Avg. Portfolio Emissions* in 2019 (i.e., right before the entry into force of the regulation) is above the median for the treatment sample, and zero otherwise. Table 7 Panel B shows that the results in Table 2 are concentrated among funds with relatively higher portfolio emissions prior to the SFDR. One possible interpretation of this result is that the effect of the new rule is stronger among funds that were more likely to engage in greenwashing before the regulatory change.

We also examine whether the patterns in Table 2 vary with the importance of sustainability issues to a fund. We expect that disclosing greater carbon emissions is more costly for funds that claim to invest based on sustainability criteria in countries with a higher sensitivity towards sustainability. We re-estimate equation (2) interacting *I(Article\_8/9)\*Post* with *Higher Sensitivity*, an indicator variable that equals one if *Sustainability\_Sensitivity* in 2019 is above the median for the treatment sample, and zero otherwise. *Sustainability\_Sensitivity* is a country-year measure that follows prior literature (Cohen et al. (2023), Dyck et al. (2019)) and is generated from the Environmental Performance Index ("EPI"). Consistent with expectations, Table 7 Panel C shows

that results are more pronounced among funds domiciled in countries that are relatively more sensitive to sustainability issues.<sup>26</sup>

### 3.5. Alternative Measures of Decarbonization

To explore the sensitivity of the previous results to measurement choices, we repeat the analysis in Table 2 using four variants of the dependent variable that capture alternative perspectives on decarbonization measurement. First, we compute the portfolio level value weighted average of carbon emissions *intensity* for portfolio firms. Carbon emission intensity is calculated for each portfolio firm as emissions scaled by sales. It provides a measure of carbon emissions in relation to volume and is useful for evaluating emission reductions relative to economic or firm specific growth (e.g., Aswani et al., 2023). As shown in Panel A of Table 8, our inferences are unaltered using carbon emissions *intensity*.

Next, we *aggregate* firm carbon emissions to the portfolio level by calculating the sum of carbon emissions for the firms in the fund's portfolio (in tons of CO2 equivalents) without applying any weighting metric. This measure provides a global perspective of aggregate carbon emissions originating from firms that a fund is directing capital to. As shown in Panel B of Table 8, our inferences are unaltered using *aggregate* emissions.

Third, we compute the *equally* weighted average of emissions at the portfolio level by averaging carbon emissions for the firms in the fund's portfolio. This measure provides an average perspective of carbon emissions originating from firms that a fund is directing capital after controlling for variation in the number of firms in the portfolio across time. As shown in Panel C of Table 8, our inferences are unaltered using *equally* weighted emissions.

<sup>&</sup>lt;sup>26</sup> Our sample size is reduced slightly in Table 7 Panel C because EPI data is not available for the following domiciles Bermuda, Caymen Islands, Guernsey, Hong Kong, Isle of Man, Jersey and Liechtenstein.

Finally, we compute the portfolio level value weighted average of firm's *total* footprint of emissions. Total emissions for each firm are computed as either the sum of Scope 1 and 2 emissions (total emissions controlled by the firm) or as the sum of Scope 1, 2 and 3 emissions (total emissions attributable to the firm's value chain). These measures provide an indication of the total carbon footprint of a firm. This contrasts with our primary analysis where we separately analyze Scope 1, Scope 2, and Scope 3 emissions. Analyzing total emissions can be useful as prior research has shown that firms can engage in outsourcing of Scope 1 and Scope 2 emissions to their supply chains in a form of carbon leakage (e.g. Ben-David et al., 2021, Dechezleprêtre et al., 2022; Naegele and Zaklan, 2019; Borghesi et al., 2020). As shown in Panel D of Table 8 our inferences are unaltered using *total* emissions.

# 4. Alternative explanations

# 4.1. Contemporaneous sustainability disclosure mandates

One potential concern about our interpretation of Table 2 is the possibility that our inferences are confounded by other sustainability disclosure mandates in the EU. During our sample period, significant firm sustainability disclosure changes occurred in the EU related to, for example, the European Green Deal.<sup>27</sup> The Corporate Sustainability Reporting Directive (CSRD), which includes a firm disclosure mandate related to carbon emissions, was proposed in April of 2021. Prior to the CSRD, the European Commission approved the Non-financial Regulating Directive (NFRD), which was set into force in 2016 and had reporting requirements for firms from the 2018 financial year onwards. The funds in our treatment sample are more exposed to the NFRD/CSRD, as they allocate a greater proportion of capital to EU firms compared to the funds in our primary

<sup>&</sup>lt;sup>27</sup> The European Green Deal is a set of policy initiatives introduced by the European Union with the aim of making Europe climate neutral by 2050. Key elements include a significant reduction in greenhouse gas emissions, investment in green technologies, and the promotion of sustainable energy, finance, industry and transportation.

control group. As such, our results could capture an aggregation of decarbonization by EU firms driven by the NFRD/CSRD (or other European specific firm events) and thus be unrelated to the SFDR.

Several considerations suggest it is unlikely that European specific firm events affect our inferences. First, the timing of the introduction of these regulations is different from that of the SFRD. Reporting required under the NFRD preceded our sample period and the first reporting under the CSRD will not occur until between 2025 and 2027. Second, the potential confounding effect of the NFRD/CSRD is not consistent with the "*Flow*" effect documented in Table 4 nor with the results using Article 6 funds as an alternative control group (the firms in the portfolios of Article 6 funds are also tilted towards European firms).

That said, we conduct additional tests to further mitigate this potential concern. We repeat the analyses in Tables 2 and 4 using only non-EU portfolio firms. We exclude all portfolio firms domiciled in the EU and re-calculate value weighted average emissions for each fund using just the non-EU firms. We again require that the ratio of captured assets under management to total net assets be between 0.1 and 2 to ensure reasonable fund portfolio coverage, which reduces our sample size. Tables 9 and 10 provide strong evidence that the results in Tables 2 and 4 are not explained by contemporaneous firm-level disclosure changes in the EU. We continue to find evidence of significant incremental decarbonization for treated funds across all three Scopes of emissions excluding EU portfolio firms. Further, we find evidence of *Flow* decarbonization effects across all three Scopes and *Impact* decarbonization effects for Scope 1 and 2 emissions.

#### 4.2. European Fund Effect

Another potential concern with our interpretation of Table 2 is the possibility that European funds decarbonization diverges from that of funds domiciled in the rest of the world for an unidentified contemporaneous reason unrelated to the SFDR. Prior research has demonstrated material differences in fund sustainability behavior based on fund domicile country (Gibson et al. 2022). We view this alternative explanation as unlikely given that the SFDR disclosure mandate depends on where a fund is marketed and not where it is domiciled. Additionally, we see significant variation in country domiciles across both our treatment and control samples.

That said, to further address this concern we conduct additional tests limiting both the treatment group of Article 8/9 funds and the control group of non-SFDR funds to only funds domiciled in the US. As shown in Table 11, inferences are unchanged. This test also provides interesting evidence of the impact the SFDR -an EU regulation- on investment funds domiciled outside of the EU.

#### 4.3. Funds Beginning to Market as Sustainable Post SFDR

Another potential concern with our interpretation of Table 2 is the possibility that the SFDR created an incentive for funds that were previously not marketed (nor managed) as sustainable to switch both their investment strategy and fund marketing towards a more sustainable product. Such a shift to invest based on sustainability criteria could also cause a decarbonization of the fund's portfolio unrelated to the SFDR disclosure mandate.

We view this alternative explanation as unlikely for two primary reasons. First, funds already had strong fundraising incentives to have their products perceived as "sustainable" prior to the SFDR (Kim and Yoon 2022, Liang et. al 2022) and the SFDR was not expected to shift the importance of sustainability to potential or existing investment clients. Second, the SFDR imposed greater reporting and disclosure requirements on Article 8/9 funds than on Article 6 funds, which means that the relative cost of claiming to invest based on sustainability criteria increased post SFDR, creating a potential disincentive to begin marketing a fund as sustainable relative to the pre-period.

That said, we conduct additional tests to explore the empirical validity of this potential concern. Identifying whether treated funds claimed to invest based on sustainability criteria prior to the SFDR is challenging because there are a myriad of channels that an asset manager can use to voluntarily identify their fund as sustainable. For purposes of this additional test, we use the PRI signatory channel and re-estimate Table 2 requiring that treatment firms were PRI signatories prior to 2018. This likely eliminates a number of funds that choose other ways to identify as sustainable, but provides strong evidence discrediting this alternative explanation. As shown in Table 12, inferences are unchanged after imposing this additional restriction on our treatment group.

#### 4.4. Other Contemporaneous Events or Changes

Another potential concern with our interpretation of Table 2 is the possibility that our inferences are confounded by some other unidentified contemporaneous change correlated with portfolio-level emissions that influenced investment fund's decision making or portfolio company emissions performance but is unrelated to the SFDR.

Several considerations suggest it is unlikely that other contemporaneous events affect our inferences. First, our use of year fixed effects helps account for common shocks experienced across the sample in any given year. Second, our use of a generalized difference in difference research design controls for contemporaneous shocks experienced by both the treatment and control groups of investment funds. Third we conduct analyses where we freeze portfolio weights/compositions and analyses where we control for observable characteristics at the fund level and unobservable characteristics at the fund-firm and fund-year level. Finally, we demonstrate the robustness of our

findings using a variety of alternative control groups that account for a wide variety of potential common shocks and sources of heterogeneity.

That said, to provide additional comfort in our results, we repeat the analysis from Table 2 including control variables that capture fund and firm characteristics potentially correlated with portfolio-level emissions, firm level Trucost emissions data, and firm performance, growth, and risk characteristics (e.g., Raghunandan and Rajgopal, 2022; Aswani et al. 2023). Results are presented in Table 13. For fund characteristics, we include the *Log(fund AUM)*, *Log(number of stocks)*, and *Industry concentration* which help control for changes in emissions related to capital inflows or outflows and investment strategy shifts. We also include value weighted averages of portfolio firm characteristics including *Log(revenues)*, *Avg. Leverage, Avg. ROE, Avg. EPS growth*, and *Avg. BM*. All variables are defined in Appendix A.

The generalized differences in differences design with fund fixed effects means the coefficients for the additional control variables reflect within fund variation of each variable over the sample period. One concern with including these variables is that changes could also be associated with efforts by the investment fund or by portfolio firms to improve emissions, resulting in a miss specified model. However, when we include the additional control variables, our main inferences are unchanged.

# 5. Conclusions

In this paper, we document that the introduction of the EU SFDR—the first wide-ranging sustainability disclosure rule ever imposed on investment funds—was followed by a decrease in the average portfolio emissions of EU funds that claim to invest based on sustainability criteria. This result is robust to using a variety of control groups. The lower level of portfolio emissions is partially explained by changes in portfolio weights due to divergent returns. However, —

critically— the effect is also driven by changes in funds' investment decisions (i.e., SFDR impacted funds divest from firms with higher (invest in firms with lower) emissions), and by changes in corporate carbon emissions (presumably induced by direct or indirect investor pressure). Funds already subject to sustainability disclosure mandates prior to the SFDR have significantly less decarbonization compared to funds being exposed to a sustainability disclosure mandate for the first time and decarbonization patterns are more pronounced for funds with higher levels of portfolio emissions prior to the SFDR and for funds domiciled in countries that are more sensitive to sustainability issues.

Overall, our results support the notion that mandatory disclosure can incentivize decarbonization by asset managers. Nonetheless, more research is needed to reinforce this conclusion. We view this study as a first step to understand the potentially far-reaching consequences of regulating sustainability disclosure for investment funds, some of which might not be desirable. We focus on carbon emissions, but the SFDR could affect in different ways other dimensions of sustainability performance not contemplated in this paper. Our analysis is restricted to active equity mutual funds, but the type of regulation we study extends (at least in the EU) to a wide range of institutions and agents in the financial industry such as index funds, non-equity mutual funds, credit institutions, and financial advisers. Finally, our results call for more research on the market-wide effects of the type of regulation studied in this paper. For example, one might wonder whether the mandate imposed on investment funds induces unintended behaviors by non-financial firms, some of which might be questionable (e.g., "carbon leakage", outsourcing of emissions or short-term myopia on emission reduction). One might also wonder whether the mandate triggers a cascade effect down the supply chain, and/or a spillover effect from public

firms to private firms. Understanding the welfare implications of sustainability disclosure regulation requires evidence on the presence and magnitude of these market-wide effects.

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Variable	Description	Source
Avg. Portfolio Emissions	Logarithm of the weighted average of the carbon emissions of the firms in the fund's portfolio (expressed in tons of $CO_2$ equivalents). Weights are based on the fund's reported value of portfolio firm holdings.	FactSet & Trucost
Article_8/9	Indicator variable that equals one if the fund is labeled as an Article 8 or 9 fund, and zero otherwise.	Refinitiv
Post	Indicator variable that equals one for observations after 2019 (i.e., the year when the SFDR was ratified), and zero otherwise.	
Year 20XX	Indicator variable that equals one for observations from year 20XX (19, 20, or 21) and zero otherwise.	
∆ Avg. Portfolio Emissions	Annual change in <i>Avg. Portfolio Emissions</i> calculated as weighted average emissions from year <i>t</i> less weighted average emissions from year <i>t</i> -1. See Appendix D for additional detail.	FactSet & Trucost
Return	The part of $\triangle$ Avg. Portfolio Emissions attributed to changes in portfolio weights due to divergent returns. See Appendix D for additional detail.	FactSet & Trucost
Flow	The part of $\triangle$ Avg. Portfolio Emissions attributed to changes in funds' investment decisions. See Appendix D for additional detail.	FactSet & Trucost
Impact	The part of $\triangle$ Avg. Portfolio Emissions attributed to changes in portfolio firms' environmental performance. See Appendix D for additional detail.	FactSet & Trucost
Higher Emissions	Indicator variable that equals one if <i>Avg. Portfolio Emissions</i> in 2019 (i.e., right before the entry into force of the regulation) is above the sample median in 2019 for treated firms, and zero otherwise.	FactSet & Trucost
Higher Sensitivity	Indicator variable that equals one if <i>Sustainability_Sensitivity</i> is above the sample median in 2019 for treated firms, and zero otherwise. <i>Sustainability_Sensitivity</i> is the 2019 country-year EPI score from the Environmental Performance Index ("EPI"). The EPI is developed through a collaborative effort by Yale and Columbia Universities and ranks 180 countries based on performance indicators across a variety of policy categories related to environmental health and ecosystem vitality.	https://epi.yal e.edu/
Higher FirmEmissions	Indicator variable that equals one if a firm $n$ 's emissions are in the highest decile of emissions of the firms in the portfolio of fund $i$ at the end of 2019.	FactSet & Trucost
Log (1+ Shares)	Logarithm of one plus the number of shares of a firm held by a fund. Missing <i>Shares</i> are coded to zero in the period immediately prior to (after) a firm's entry into (exit from) a fund's portfolio.	FactSet

# Appendix A. Variable Definitions

Lower AUM	Indicator variable that equals one if <i>AUM</i> is above the sample median in 2019 for treated firms, and zero otherwise.	
Higher LargeCap	Indicator variable that equals one if the value weighted average of large cap firms in a fund's portfolio is above the sample median in 2019 for treated firms, and zero otherwise.	Factset
Avg. Emission Intensity	Value weighted average of the carbon emission intensity of the firms in the fund's portfolio (in tons of $CO_2$ equivalents per dollar). Carbon emission intensity is calculated as emission amounts scaled by sales expressed in millions of US dollars.	FactSet & Trucost
Aggregated Portfolio Emissions	Logarithm of the sum of the carbon emissions of the firms in the fund's portfolio (in tons of $CO_2$ equivalents).	FactSet & Trucost
Avg. Portfolio Emissions (EW)	Logarithm of the equally weighted average of the carbon emissions of the firms in the fund's portfolio (in tons of $CO_2$ equivalents).	FactSet & Trucost
Log(fund AUM)	The logarithm of total assets under management (AUM) by the fund expressed in US dollars.	FactSet
Log(number of stocks)	The logarithm of the number of unique stocks held by the fund.	FactSet
Industry concentration	Indicator variable that equals one if a fund holds stocks from two or less different industries, and zero otherwise.	FactSet
Pct. Technology stocks	Percentage of fund's AUM that is invested in high-technology stocks.	FactSet
Pct. Energy stocks	Percentage of fund's AUM that is invested in oil, gas, and coal stocks (FactSet industry codes: oil and gas production, integrated oil, oil refining/marketing, coal, contract drilling, oil and gas pipelines).	FactSet
Pct. Sin stocks	Percentage of fund's AUM that is invested in "sin" stocks (FactSet industries: casinos/gaming, alcoholic beverages, and tobacco).	FactSet
Log(Avg. revenues)	Logarithm of the value weighted average of the revenues of the firms in the fund's portfolio expressed in US dollars.	Compustat
Avg. Leverage	Value weighted average of <i>Leverage</i> of the firms in the fund's portfolio. <i>Leverage</i> is defined as long-term debt over total assets.	Compustat
Avg. ROE	Value weighted average of <i>ROE</i> of the firms in the fund's portfolio. <i>ROE</i> is defined as net income divided by book value of equity.	Compustat
Avg. EPS growth	Value weighted average of <i>EPS Growth</i> of the firms in the fund's portfolio. <i>EPS Growth</i> is defined as growth in earnings per share (basic), excluding extraordinary items.	Compustat

Value weighted average of *BM* of the firms in the fund's portfolio. Compustat *BM* is defined as book value of equity divided by market value of equity.

#### Appendix B: Articles 6, 8 and 9 from REGULATION (EU) 2019/2088

#### Article 6

#### Transparency of the integration of sustainability risks

- 1. Financial market participants shall include descriptions of the following in pre-contractual disclosures:
- (a) the manner in which sustainability risks are integrated into their investment decisions; and
- (b) the results of the assessment of the likely impacts of sustainability risks on the returns of the financial products they make available.

Where financial market participants deem sustainability risks not to be relevant, the descriptions referred to in the first subparagraph shall include a clear and concise explanation of the reasons therefor.

- Financial advisers shall include descriptions of the following in pre-contractual disclosures:
- (a) the manner in which sustainability risks are integrated into their investment or insurance advice; and
- (b) the result of the assessment of the likely impacts of sustainability risks on the returns of the financial products they advise on.

Where financial advisers deem sustainability risks not to be relevant, the descriptions referred to in the first subparagraph shall include a clear and concise explanation of the reasons therefor.

#### Article 8

#### Transparency of the promotion of environmental or social characteristics in pre-contractual disclosures

1. Where a financial product promotes, among other characteristics, environmental or social characteristics, or a combination of those characteristics, provided that the companies in which the investments are made follow good governance practices, the information to be disclosed pursuant to Article 6(1) and (3) shall include the following:

- (a) information on how those characteristics are met;
- (b) if an index has been designated as a reference benchmark, information on whether and how this index is consistent with those characteristics.

2. Financial market participants shall include in the information to be disclosed pursuant to Article 6(1) and (3) an indication of where the methodology used for the calculation of the index referred to in paragraph 1 of this Article is to be found.

#### Article 9

#### Transparency of sustainable investments in pre-contractual disclosures

1. Where a financial product has sustainable investment as its objective and an index has been designated as a reference benchmark, the information to be disclosed pursuant to Article 6(1) and (3) shall be accompanied by the following:

(a) information on how the designated index is aligned with that objective;

(b) an explanation as to why and how the designated index aligned with that objective differs from a broad market index.

2. Where a financial product has sustainable investment as its objective and no index has been designated as a reference benchmark, the information to be disclosed pursuant to Article 6(1) and (3) shall include an explanation on how that objective is to be attained.

3. Where a financial product has a reduction in carbon emissions as its objective, the information to be disclosed pursuant to Article 6(1) and (3) shall include the objective of low carbon emission exposure in view of achieving the long-term global warming objectives of the Paris Agreement.

By way of derogation from paragraph 2 of this Article, where no EU Climate Transition Benchmark or EU Paris-aligned Benchmark in accordance with Regulation (EU) 2016/1011 of the European Parliament and of the Council (<sup>20</sup>) is available, the information referred to in Article 6 shall include a detailed explanation of how the continued effort of attaining the objective of reducing carbon emissions is ensured in view of achieving the long-term global warming objectives of the Paris Agreement.

# Appendix C. Example of Disclosure by an "Article 8" Fund

This appendix presents excerpts from an Article 8 Fund's according to the SFDR. Panel A includes a disclosure statement on the incorporation of sustainability factors into investment decision-making. Panel B includes a detailed disclosure on emissions performance.

#### Panel A. Incorporation of sustainability factors into investment decision-making



Financial market participant: Nordea Investment Funds S.A. (549300LCQUXMRSWPKT48)

#### Summary

Nordea Investment Funds S.A. (549300LCQUXMRSWPKT48) considers principal adverse impacts of its investment decisions on sustainability factors. The present statement is the consolidated statement on principal adverse impacts on sustainability factors of Nordea Investment Funds S.A.<sup>1</sup> Nordea Investment Funds S.A. delegated the investment management function for the funds managed by it to Nordea Investment Management AB, collectively referred to as "we", "us" or "our".

This statement on principal adverse impacts on sustainability factors covers the reference period from 1 January to 31 December 2022.

We consider principal adverse impact as part of our investment due diligence process and procedures. At entity level, we consider principal adverse impact by measuring and monitoring the aggregated negative impact of our investments on sustainability factors. We consider the mandatory principal adverse impact indicators and two voluntary indicators defined by the Sustainable Finance Disclosure Regulation (SFDR)<sup>2</sup>, subject to data availability and quality. In the absence of mandatory data reporting requirements for investee companies, we are still facing challenges in identifying all principal adverse impacts of our investments.

This statement includes the reported principal adverse impact of our investments measured using these indicators. Comparability between the principal adverse impact of our investments and industry benchmarks is challenging due to the diversity of our portfolios (asset class, nature of the instruments, sectors we invest into etc.). Without comparative data from previous reference periods, it is difficult to estimate on which sustainability factors our investments have the most significant negative impact. However, given that climate change is a large threat to the global economy and implies specific risks to the companies and other entities we invest in, reducing the climate impact of our investments is a cornerstone of our ESG (environmental, social and governance) strategy alongside our other core areas of interest - biodiversity loss

#### Panel B. Disclosure on emissions performance

#### Indicators applicable to investments in investee companies

Adverse sustainability indic	ator	Metric	Impact 2022 (year n)	lmpact [year n -1]⁴	Explanation <sup>5</sup>	Actions taken, and actions planned and targets set for the next reference period
		CLIMATE AND OTHER ENVIRONMEN	T-RELATED IN	DICATORS		
Greenhouse gas emissions	1. GHG emissions	Scope 1 GHG emissions	3,368,336 tCO2e <sup>6</sup>	N/A	N/A	We are a signatory to the Net Zero Asset Managers Initiative and committed to
		Scope 2 GHG emissions	983,988 tCO2e	N/A	N/A	supporting the goal of net zero greenhouse gas emissions by 2050 or scoper in line with global efforts to limit
		Scope 3 GHG emissions	23,780,378 tCO2e	N/A	N/A	warming to 1.5°C. We have an organisational-wide target to reduce the
		Total GHG emissions <sup>7</sup>	4,352,325 tCO2e	N/A	N/A	weighted average carbon intensity (WACI) of our investments; a set of pattering approximation for the set of
	2. Carbon footprint	Carbon footprint	45.49 tCO2e/million EUR invested	N/A	N/A	portfolio-specific carbon footprint reduction targets, and a complementary target to ensure that individual companies are engaged to become 1.5° aligned.
	3. GHG intensity of investee companies	GHG intensity of investee companies	134.85 tCO2e/million EUR of owned revenue	N/A	N/A	We have set a 2025 target to ensure that 80% of our top 200 largest carbon footprint contributors are on a Paris- aligned trajectory or else subject to engagement to become aligned.
	<ol> <li>Exposure to companies active in the fossil fuel sector</li> </ol>	Share of investments in companies active in the fossil fuel sector	2.87% investments in fossil fuels	N/A	N/A	Investment products that have been categorised as Article 8 or Article 9 under the SFDR may be subject to our Paris Aligned Fossil Fuel Policy, which prohibits investments in fossil fuel

<sup>4</sup> Information on impact compared to previous year will be initially reported by 30 June 2024, and continuously on an annual basis <sup>5</sup> Explanation of difference in impact reported will be published initially by 30 June 2024, and continuously on an annual basis. <sup>6</sup> tCO2e means tonnes of carbon dioxide equivalent.

#### **Appendix D. Decomposition of Change in Average Portfolio Emissions**

This exhibit describes the decomposition of changes in average portfolio emissions used in the analysis of Table 4, as proposed by Cheema-Fox et al. (2021). As explained in section 3.3 of the main body of the paper, for each mutual fund i in year t, the weighted average of portfolio emissions is computed as:

Avg. Portfolio Emissions<sub>it</sub> = 
$$log\left(\sum_{n}^{N} w_{int} * Firm Emissions_{nt}\right)$$

where  $w_{int}$  is the weight of firm *n* in the portfolio of fund *i* in year *t* and *Firm Emissions*<sub>nt</sub> is the amount of emissions of firm *n* in year *t* (in tons of carbon equivalents). Specifically,  $w_{int}$  is computed as:

$$w_{int} = \frac{P_{nt} * sh_{int}}{AUM_{it}}$$

where  $P_{nt}$  is the price per share of firm *n* at time *t*,  $sh_{int}$  are the shares of firm *n* held by fund *i* at time *t* and  $AUM_{it}$  is the AUM of fund *i* at time *t*.

For each firm n, the contribution to the fund level change in emissions for fund i in year t can be computed as:

$$\Delta FirmEmissions_{int} = w_{int} * FirmEmissions_{nt} - w_{int-1} * FirmEmissions_{nt-1}$$

The previous equation can be rearranged as follows:

$$\begin{split} \Delta FirmEmissions_{int} &= FirmEmissions_{nt-1} * sh_{int-1} * (\frac{P_{nt}}{AUM_{it}} - \frac{P_{nt-1}}{AUM_{it-1}}) \\ &+ FirmEmissions_{nt-1} * \frac{P_{nt}}{AUM_{it}} * (sh_{int} - sh_{int-1}) \\ &+ \frac{P_{nt} * sh_{int}}{AUM_{it}} * (FirmEmissions_{nt} - FirmEmissions_{nt-1}) \end{split}$$

Thus:

$$\Delta Avg. \ Portfolio \ Emissions_{it} = \\ \left( \sum_{n}^{N} FirmEmissions_{nt-1} * sh_{int-1} * \left( \frac{P_{nt}}{AUM_{it}} - \frac{P_{nt-1}}{AUM_{it-1}} \right) \right) \\ + \left( \sum_{n}^{N} FirmEmissions_{nt-1} * \frac{P_{nt}}{AUM_{it}} * \left( sh_{int} - sh_{int-1} \right) \right) \\ + \left( \sum_{n}^{N} \frac{P_{nt} * sh_{int}}{AUM_{it}} * \left( FirmEmissions_{nt} - FirmEmissions_{nt-1} \right) \right)$$

The first, second, and third terms of the above expression are denoted as "*Return*", "*Flow*" and "*Impact*", respectively. That is:

$$\Delta Avg. Portfolio Emissions_{it} = Return_{it} + Flow_{it} + Impact_{it}$$

# **Table 1. Sample and Descriptive Statistics**

Table A presents the sample selection process and the composition of the sample funds. Panel B provides descriptive statistics of the variables used in the analysis. All variables are defined in Appendix A.

#### Panel A. Sample composition

	# of unique funds
Universe of mutual funds from FactSet	59,134
Remove index funds and funds without equity portfolio holdings data	-41,594
Select Article 8/9 funds and funds issued by Non-SFDR PRI Signatories	-9,874
Require min AUM (>\$15 million) and AUM coverage between 0.1 and 2	-1,984
Keep funds with Trucost environmental data over the sample period	-1,661
Final Sample of Unique Funds	4,021
Article 8 funds	1,881
Article 9 funds	187
Non-SFDR PRI funds	1,953
Total sample funds	4,021

## Panel B. Domicile Country

Country of Domicile	Article_8/9	Non-SFDR PRI	Total
Australia	0	172	172
Austria	180	0	180
Belgium	48	188	236
Denmark	232	28	260
Finland	172	40	212
France	608	104	712
Germany	308	4	312
Ireland	392	84	476
Luxembourg	1,840	96	1,936
Norway	232	44	276
Sweden	592	4	596
Switzerland	56	300	356
Taiwan	0	216	216
United Kingdom	96	476	572
United States	3,252	5,856	9,108
EU Other	264	28	292
Non-EU Other	0	172	172
Total	8,272	7,812	16,084

# Panel C. Descriptive statistics

Fund-Level Emission MeasuresAvg. Portfolio Emissions (Scope 1)16,08413.771.7112.5714.1615.12Avg. Portfolio Emissions (Scope 2)16,08413.041.2412.2913.3613.90Avg. Portfolio Emissions (Scope 3)16,08414.711.2514.1815.1015.57A vg. Portfolio Emissions (Scope 1)16,084-0.131.46-0.42-0.010.22Return (Scope 1) Decomposition16,084-0.281.34-0.55-0.070.02Flow (Scope 1) Decomposition16,084-0.020.46-0.060.000.09A vg. Portfolio Emissions (Scope 2)16,0840.000.39-0.11-0.010.07Return (Scope 2) Decomposition16,084-0.060.34-0.060.020.03A vg. Portfolio Emissions (Scope 3)16,0840.010.24-0.030.000.03A vg. Portfolio Emissions (Scope 3)16,0840.211.84-0.270.080.85Impact (Scope 3) Decomposition16,0840.170.98-0.020.290.43Avg. Emission Intensity (Scope 1)16,0841.211.420.471.13 <th>Variable</th> <th>Obs.</th> <th>Mean</th> <th>SD</th> <th>P25</th> <th>P50</th> <th>P75</th>	Variable	Obs.	Mean	SD	P25	P50	P75
Avg. Portfolio Emissions (Scope 1)16,08413.771.7112.5714.1615.12Avg. Portfolio Emissions (Scope 2)16,08413.041.2412.2913.3613.90Avg. Portfolio Emissions (Scope 2)16,08414.711.2514.1815.1015.57A Avg. Portfolio Emissions (Scope 1)16,084-0.131.46-0.42-0.010.22Return (Scope 1) Decomposition16,084-0.281.34-0.55-0.070.02Flow (Scope 1) Decomposition16,084-0.020.46-0.060.000.09A Avg. Portfolio Emissions (Scope 2)16,0840.000.39-0.11-0.010.07Return (Scope 2) Decomposition16,084-0.040.38-0.060.020.17Impact (Scope 2) Decomposition16,0840.010.24-0.030.000.03A vg. Portfolio Emissions (Scope 3)16,0840.010.24-0.030.010.58Return (Scope 3) Decomposition16,0840.211.84-0.270.080.85Impact (Scope 3) Decomposition16,0840.170.98-0.080.040.39Avg. Emission Intensity (Scope 1)16,0841.211.420.270.080.85Impact (Scope 3) Decomposition16,0840.170.98-0.080.440.39Avg. Emission Intensity (Scope 2)16,0841.211.420.260.220.43Avg. Emission Intensity (Scope 2)16,08	Fund-Level Emission Measures						
Avg. Portfolio Emissions (Scope 2)16,08413.041.241.22913.3613.90Avg. Portfolio Emissions (Scope 3)16,08414,711.2514.1815.1015.57A Avg. Portfolio Emissions (Scope 1)16,084-0.131.46-0.42-0.010.22Return (Scope 1) Decomposition16,084-0.281.34-0.55-0.070.02Flow (Scope 1) Decomposition16,084-0.220.46-0.060.000.09A Avg. Portfolio Emissions (Scope 2)16,084-0.020.46-0.060.000.09A Avg. Portfolio Emissions (Scope 2)16,084-0.000.39-0.11-0.010.07Return (Scope 2) Decomposition16,084-0.040.38-0.060.020.17Impact (Scope 2) Decomposition16,0840.010.24-0.030.000.03A Avg. Portfolio Emissions (Scope 3)16,0840.010.24-0.030.000.03Return (Scope 3) Decomposition16,084-0.221.62-0.88-0.130.13Flow (Scope 3) Decomposition16,0840.211.84-0.270.080.85Impact (Scope 3) Decomposition16,0840.211.84-0.270.080.85Impact (Scope 3) Decomposition16,0840.260.200.290.43Avg. Emission Intensity (Scope 1)16,0841.211.420.280.721.55Avg. Emission Intensity (Scope 2)16,0841.42	Avg. Portfolio Emissions (Scope 1)	16,084	13.77	1.71	12.57	14.16	15.12
Avg. Portfolio Emissions (Scope 3)16,08414,711.2514.1815.1015.57A vg. Portfolio Emissions (Scope 1)16,084-0.131.46-0.42-0.010.22Return (Scope 1) Decomposition16,084-0.281.34-0.55-0.070.02Flow (Scope 1) Decomposition16,084-0.020.46-0.060.000.09A vg. Portfolio Emissions (Scope 2)16,084-0.000.39-0.11-0.010.07Return (Scope 2) Decomposition16,084-0.060.34-0.16-0.020.03Flow (Scope 2) Decomposition16,0840.040.38-0.060.020.17Impact (Scope 2) Decomposition16,0840.010.24-0.030.000.03A vg. Portfolio Emissions (Scope 3)16,0840.051.78-0.430.010.58Return (Scope 3) Decomposition16,0840.211.84-0.270.080.85Impact (Scope 3) Decomposition16,0840.170.98-0.080.040.39Avg. Emission Intensity (Scope 1)16,0841.211.420.280.721.55Avg. Emission Intensity (Scope 2)16,0841.601.4615.9017.0217.83Aggregated Portfolio Emissions (Scope 2)16,0841.702.0316.3818.0419.28Aggregated Portfolio Emissions (Scope 2)16,0841.420.471.131.391.67Avg. Emission Intensity (Scope 3)<	Avg. Portfolio Emissions (Scope 2)	16,084	13.04	1.24	12.29	13.36	13.90
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Avg. Portfolio Emissions (Scope 3)	16,084	14.71	1.25	14.18	15.10	15.57
Return (Scope 1) Decomposition16,084 $-0.28$ $1.34$ $-0.55$ $-0.07$ $0.02$ Flow (Scope 1) Decomposition16,084 $0.15$ $1.65$ $-0.12$ $0.03$ $0.49$ Impact (Scope 1) Decomposition16,084 $-0.02$ $0.46$ $-0.06$ $0.00$ $0.09$ A Ave, Portfolio Emissions (Scope 2)16,084 $0.00$ $0.39$ $-0.11$ $-0.01$ $0.07$ Return (Scope 2) Decomposition16,084 $0.04$ $0.38$ $-0.06$ $0.02$ $0.17$ Impact (Scope 2) Decomposition16,084 $0.01$ $0.24$ $-0.03$ $0.00$ $0.03$ A veg. Portfolio Emissions (Scope 3)16,084 $0.05$ $1.78$ $-0.43$ $0.01$ $0.58$ Return (Scope 3) Decomposition16,084 $0.21$ $1.84$ $-0.27$ $0.08$ $0.85$ Impact (Scope 3) Decomposition16,084 $0.21$ $1.84$ $-0.27$ $0.08$ $0.85$ Impact (Scope 3) Decomposition16,084 $0.17$ $0.98$ $0.04$ $0.39$ Avg. Emission Intensity (Scope 1) $16,084$ $1.42$ $0.47$ $1.13$ $1.39$ $1.67$ Aggregated Portfolio Emissions (Scope 1) $16,084$ $1.42$ $0.47$ $1.13$ $1.39$ $1.67$ Aggregated Portfolio Emissions (Scope 1) $16,084$ $1.42$ $0.47$ $1.13$ $1.39$ $1.67$ Aggregated Portfolio Emissions (Scope 1) $16,084$ $1.42$ $0.47$ $1.13$ $1.39$ $1.67$ Aggregated Portfolio Emissions (Scope 2) <td< td=""><td><math>\Delta</math> Avg. Portfolio Emissions (Scope 1)</td><td>16,084</td><td>-0.13</td><td>1.46</td><td>-0.42</td><td>-0.01</td><td>0.22</td></td<>	$\Delta$ Avg. Portfolio Emissions (Scope 1)	16,084	-0.13	1.46	-0.42	-0.01	0.22
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Return (Scope 1) Decomposition	16,084	-0.28	1.34	-0.55	-0.07	0.02
Impact (Scope 1) Decomposition $16,084$ $-0.02$ $0.46$ $-0.06$ $0.00$ $0.09$ $A$ vg. Portfolio Emissions (Scope 2) $16,084$ $0.00$ $0.39$ $-0.11$ $-0.01$ $0.07$ Return (Scope 2) Decomposition $16,084$ $0.06$ $0.34$ $-0.16$ $-0.02$ $0.03$ Flow (Scope 2) Decomposition $16,084$ $0.04$ $0.38$ $-0.06$ $0.02$ $0.17$ Impact (Scope 2) Decomposition $16,084$ $0.01$ $0.24$ $-0.03$ $0.00$ $0.03$ $A$ Avg. Portfolio Emissions (Scope 3) $16,084$ $0.05$ $1.78$ $-0.43$ $0.01$ $0.58$ Return (Scope 3) Decomposition $16,084$ $-0.32$ $1.62$ $-0.88$ $-0.13$ $0.13$ Flow (Scope 3) Decomposition $16,084$ $0.21$ $1.84$ $-0.27$ $0.08$ $0.85$ Impact (Scope 3) Decomposition $16,084$ $0.21$ $1.42$ $0.28$ $0.72$ $1.55$ Avg. Emission Intensity (Scope 1) $16,084$ $1.21$ $1.42$ $0.28$ $0.72$ $1.55$ Avg. Emission Intensity (Scope 3) $16,084$ $17.70$ $2.03$ $16.38$ $18.04$ $19.28$ Aggregated Portfolio Emissions (Scope 3) $16,084$ $1.46$ $1.590$ $17.02$ $17.83$ Aggregated Portfolio Emissions (Scope 3) $16,084$ $18.47$ $1.49$ $17.60$ $18.66$ $19.54$ Avg. Portfolio Emissions (EW) (Scope 3) $16,084$ $18.47$ $1.49$ $17.60$ $18.66$ $19.54$ Avg. Portf	Flow (Scope 1) Decomposition	16,084	0.15	1.65	-0.12	0.03	0.49
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Impact (Scope 1) Decomposition	16,084	-0.02	0.46	-0.06	0.00	0.09
Return (Scope 2) Decomposition $16,084$ $-0.06$ $0.34$ $-0.16$ $-0.02$ $0.03$ Flow (Scope 2) Decomposition $16,084$ $0.04$ $0.38$ $-0.06$ $0.02$ $0.17$ Impact (Scope 2) Decomposition $16,084$ $0.01$ $0.24$ $-0.03$ $0.00$ $0.03$ A Avg. Portfolio Emissions (Scope 3) $16,084$ $0.05$ $1.78$ $-0.43$ $0.01$ $0.58$ Return (Scope 3) Decomposition $16,084$ $0.21$ $1.84$ $-0.27$ $0.08$ $0.85$ Impact (Scope 3) Decomposition $16,084$ $0.21$ $1.84$ $-0.27$ $0.08$ $0.85$ Impact (Scope 3) Decomposition $16,084$ $0.17$ $0.98$ $-0.08$ $0.04$ $0.39$ Arg. Emission Intensity (Scope 1) $16,084$ $1.21$ $1.42$ $0.28$ $0.72$ $1.55$ Avg. Emission Intensity (Scope 2) $16,084$ $1.42$ $0.47$ $1.13$ $1.39$ $1.67$ Aggregated Portfolio Emissions (Scope 1) $16,084$ $17.70$ $2.03$ $16.38$ $18.04$ $19.28$ Aggregated Portfolio Emissions (Scope 1) $16,084$ $18.47$ $1.49$ $17.60$ $18.66$ $19.54$ Arg. Portfolio Emissions (EW) (Scope 1) $16,084$ $13.68$ $1.69$ $12.56$ $14.08$ $15.00$ Avg. Portfolio Emissions (EW) (Scope 2) $16,084$ $12.79$ $1.12$ $12.15$ $13.08$ $13.57$ Avg. Portfolio Emissions (EW) (Scope 3) $16,084$ $14.45$ $1.17$ $13.94$ $14.75$ $12.56$ <	$\Delta$ Avg. Portfolio Emissions (Scope 2)	16,084	0.00	0.39	-0.11	-0.01	0.07
Flow (Scope 2) Decomposition16,0840.040.38-0.060.020.17Impact (Scope 2) Decomposition16,0840.010.24-0.030.000.03 $\Delta$ Arg. Portfolio Emissions (Scope 3)16,0840.051.78-0.430.010.58Return (Scope 3) Decomposition16,084-0.321.62-0.88-0.130.13Flow (Scope 3) Decomposition16,0840.211.84-0.270.080.85Impact (Scope 3) Decomposition16,0840.170.98-0.080.040.39Arg. Emission Intensity (Scope 1)16,0840.360.260.200.290.43Arg. Emission Intensity (Scope 2)16,0841.420.471.131.391.67Aggregated Portfolio Emissions (Scope 1)16,08417.702.0316.3818.0419.28Aggregated Portfolio Emissions (Scope 2)16,08418.471.4917.6018.6619.54Arg. Portfolio Emissions (Scope 1)16,08413.681.6912.5614.0815.00Arg. Portfolio Emissions (EW) (Scope 2)16,08412.791.1212.1513.0813.57Arg. Portfolio Emissions (EW) (Scope 2)16,08414.451.1713.9414.7515.26Other VariablesLog(fund AUM)16,08419.641.5618.4619.5720.72Log(fund AUM)16,0849.821.199.2510.2310.69Arg. Everage	Return (Scope 2) Decomposition	16,084	-0.06	0.34	-0.16	-0.02	0.03
Impact (Scope 2) Decomposition16,0840.010.24-0.030.000.03 $A$ Avg. Portfolio Emissions (Scope 3)16,0840.051.78-0.430.010.58Return (Scope 3) Decomposition16,084-0.321.62-0.88-0.130.13Flow (Scope 3) Decomposition16,0840.211.84-0.270.080.85Impact (Scope 3) Decomposition16,0840.170.98-0.080.040.39Avg. Emission Intensity (Scope 1)16,0841.211.420.280.721.55Avg. Emission Intensity (Scope 2)16,0841.360.260.200.290.43Avg. Emission Intensity (Scope 3)16,0841.420.471.131.391.67Aggregated Portfolio Emissions (Scope 1)16,08417.702.0316.3818.0419.28Aggregated Portfolio Emissions (Scope 2)16,08418.6612.5614.0815.00Avg. Portfolio Emissions (EW) (Scope 1)16,08413.681.6912.5614.0815.00Avg. Portfolio Emissions (EW) (Scope 2)16,08412.791.1212.1513.0813.57Avg. Portfolio Emissions (EW) (Scope 3)16,08419.641.5618.4619.5720.72Log(fund AUM)16,08419.641.5618.4619.5720.72Log(fund AUM)16,0840.010.080.000.00Log(Avg. revenues)16,0840.210.070.16 <td>Flow (Scope 2) Decomposition</td> <td>16,084</td> <td>0.04</td> <td>0.38</td> <td>-0.06</td> <td>0.02</td> <td>0.17</td>	Flow (Scope 2) Decomposition	16,084	0.04	0.38	-0.06	0.02	0.17
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Impact (Scope 2) Decomposition	16,084	0.01	0.24	-0.03	0.00	0.03
Return (Scope 3) Decomposition $16,084$ $-0.32$ $1.62$ $-0.88$ $-0.13$ $0.13$ Flow (Scope 3) Decomposition $16,084$ $0.21$ $1.84$ $-0.27$ $0.08$ $0.85$ Impact (Scope 3) Decomposition $16,084$ $0.17$ $0.98$ $-0.08$ $0.04$ $0.39$ Avg. Emission Intensity (Scope 1) $16,084$ $1.21$ $1.42$ $0.28$ $0.72$ $1.55$ Avg. Emission Intensity (Scope 2) $16,084$ $0.36$ $0.26$ $0.20$ $0.29$ $0.43$ Avg. Emission Intensity (Scope 3) $16,084$ $1.42$ $0.47$ $1.13$ $1.39$ $1.67$ Aggregated Portfolio Emissions (Scope 1) $16,084$ $1.70$ $2.03$ $16.38$ $18.04$ $19.28$ Aggregated Portfolio Emissions (Scope 2) $16,084$ $16.80$ $1.46$ $15.90$ $17.02$ $17.83$ Aggregated Portfolio Emissions (Scope 3) $16,084$ $18.47$ $1.49$ $17.60$ $18.66$ $19.54$ Avg. Portfolio Emissions (EW) (Scope 1) $16,084$ $12.79$ $1.12$ $12.15$ $13.08$ $13.57$ Avg. Portfolio Emissions (EW) (Scope 3) $16,084$ $19.64$ $1.56$ $18.46$ $19.57$ $20.72$ Log(fund AUM) $16,084$ $19.64$ $1.56$ $18.46$ $19.57$ $20.72$ Log(number of stocks) $16,084$ $0.01$ $0.08$ $0.00$ $0.00$ Log(revenues) $16,084$ $0.21$ $0.79$ $3.95$ $4.34$ $4.88$ Industry concentration $16,084$	$\Delta$ Avg. Portfolio Emissions (Scope 3)	16,084	0.05	1.78	-0.43	0.01	0.58
Flow (Scope 3) Decomposition $16,084$ $0.21$ $1.84$ $-0.27$ $0.08$ $0.85$ Impact (Scope 3) Decomposition $16,084$ $0.17$ $0.98$ $-0.08$ $0.04$ $0.39$ Avg. Emission Intensity (Scope 1) $16,084$ $1.21$ $1.42$ $0.28$ $0.72$ $1.55$ Avg. Emission Intensity (Scope 2) $16,084$ $0.36$ $0.26$ $0.20$ $0.29$ $0.43$ Avg. Emission Intensity (Scope 3) $16,084$ $1.42$ $0.47$ $1.13$ $1.39$ $1.67$ Aggregated Portfolio Emissions (Scope 1) $16,084$ $17.70$ $2.03$ $16.38$ $18.04$ $19.28$ Aggregated Portfolio Emissions (Scope 2) $16,084$ $16.80$ $1.46$ $15.90$ $17.02$ $17.83$ Aggregated Portfolio Emissions (Scope 3) $16,084$ $18.47$ $1.49$ $17.60$ $18.66$ $19.54$ Avg. Portfolio Emissions (EW) (Scope 1) $16,084$ $13.68$ $1.69$ $12.56$ $14.08$ $15.00$ Avg. Portfolio Emissions (EW) (Scope 2) $16,084$ $14.45$ $1.17$ $13.94$ $14.75$ $15.26$ Other VariablesLog(fund AUM) $16,084$ $19.64$ $1.56$ $18.46$ $19.57$ $20.72$ Log(number of stocks) $16,084$ $0.01$ $0.08$ $0.00$ $0.00$ Log(revenues) $16,084$ $0.21$ $0.79$ $3.95$ $4.34$ $4.88$ Industry concentration $16,084$ $0.21$ $0.07$ $0.16$ $0.21$ $0.25$ Avg. ROE<	Return (Scope 3) Decomposition	16,084	-0.32	1.62	-0.88	-0.13	0.13
Impact (Scope 3) Decomposition $16,084$ $0.17$ $0.98$ $-0.08$ $0.04$ $0.39$ Avg. Emission Intensity (Scope 1) $16,084$ $1.21$ $1.42$ $0.28$ $0.72$ $1.55$ Avg. Emission Intensity (Scope 2) $16,084$ $0.36$ $0.26$ $0.20$ $0.29$ $0.43$ Avg. Emission Intensity (Scope 3) $16,084$ $1.42$ $0.47$ $1.13$ $1.39$ $1.67$ Aggregated Portfolio Emissions (Scope 1) $16,084$ $17.70$ $2.03$ $16.38$ $18.04$ $19.28$ Aggregated Portfolio Emissions (Scope 2) $16,084$ $18.60$ $1.46$ $15.90$ $17.02$ $17.83$ Aggregated Portfolio Emissions (Scope 3) $16,084$ $18.47$ $1.49$ $17.60$ $18.66$ $19.54$ Avg. Portfolio Emissions (EW) (Scope 1) $16,084$ $13.68$ $1.69$ $12.56$ $14.08$ $15.00$ Avg. Portfolio Emissions (EW) (Scope 2) $16,084$ $12.79$ $1.12$ $12.15$ $13.08$ $13.57$ Avg. Portfolio Emissions (EW) (Scope 3) $16,084$ $14.45$ $1.17$ $13.94$ $14.75$ $15.26$ Other VariablesLog(fund AUM) $16,084$ $0.01$ $0.08$ $0.00$ $0.00$ $0.00$ Log(rumber of stocks) $16,084$ $0.21$ $0.07$ $0.16$ $0.21$ $0.25$ Avg. ROE $16,084$ $0.21$ $0.07$ $0.16$ $0.21$ $0.25$ Avg. ROE $16,084$ $0.16$ $0.12$ $0.10$ $0.37$ Avg. ROE	Flow (Scope 3) Decomposition	16,084	0.21	1.84	-0.27	0.08	0.85
Avg. Emission Intensity (Scope 1) $16,084$ $1.21$ $1.42$ $0.28$ $0.72$ $1.55$ Avg. Emission Intensity (Scope 2) $16,084$ $0.36$ $0.26$ $0.20$ $0.29$ $0.43$ Avg. Emission Intensity (Scope 3) $16,084$ $1.42$ $0.47$ $1.13$ $1.39$ $1.67$ Aggregated Portfolio Emissions (Scope 1) $16,084$ $17.70$ $2.03$ $16.38$ $18.04$ $19.28$ Aggregated Portfolio Emissions (Scope 2) $16,084$ $16.80$ $1.46$ $15.90$ $17.02$ $17.83$ Aggregated Portfolio Emissions (Scope 3) $16,084$ $18.47$ $1.49$ $17.60$ $18.66$ $19.54$ Avg. Portfolio Emissions (EW) (Scope 1) $16,084$ $13.68$ $1.69$ $12.56$ $14.08$ $15.00$ Avg. Portfolio Emissions (EW) (Scope 2) $16,084$ $12.79$ $1.12$ $12.15$ $13.08$ $13.57$ Avg. Portfolio Emissions (EW) (Scope 3) $16,084$ $14.45$ $1.17$ $13.94$ $14.75$ $15.26$ Other VariablesLog(fund AUM) $16,084$ $19.64$ $1.56$ $18.46$ $19.57$ $20.72$ Log(number of stocks) $16,084$ $4.49$ $0.79$ $3.95$ $4.34$ $4.88$ Industry concentration $16,084$ $0.21$ $0.07$ $0.16$ $0.21$ $0.25$ Avg. ROE $16,084$ $0.21$ $0.07$ $0.16$ $0.21$ $0.25$ Avg. ROE $16,084$ $0.16$ $0.12$ $0.10$ $0.37$ Avg. EPS growth <td< td=""><td>Impact (Scope 3) Decomposition</td><td>16,084</td><td>0.17</td><td>0.98</td><td>-0.08</td><td>0.04</td><td>0.39</td></td<>	Impact (Scope 3) Decomposition	16,084	0.17	0.98	-0.08	0.04	0.39
Avg. Emission Intensity (Scope 2) $16,084$ $0.36$ $0.26$ $0.20$ $0.29$ $0.43$ Avg. Emission Intensity (Scope 3) $16,084$ $1.42$ $0.47$ $1.13$ $1.39$ $1.67$ Aggregated Portfolio Emissions (Scope 1) $16,084$ $17.70$ $2.03$ $16.38$ $18.04$ $19.28$ Aggregated Portfolio Emissions (Scope 2) $16,084$ $16.80$ $1.46$ $15.90$ $17.02$ $17.83$ Aggregated Portfolio Emissions (Scope 3) $16,084$ $18.47$ $1.49$ $17.60$ $18.66$ $19.54$ Avg. Portfolio Emissions (EW) (Scope 1) $16,084$ $13.68$ $1.69$ $12.56$ $14.08$ $15.00$ Avg. Portfolio Emissions (EW) (Scope 2) $16,084$ $12.79$ $1.12$ $12.15$ $13.08$ $13.57$ Avg. Portfolio Emissions (EW) (Scope 3) $16,084$ $14.45$ $1.17$ $13.94$ $14.75$ $15.26$ Other VariablesLog(fund AUM) $16,084$ $19.64$ $1.56$ $18.46$ $19.57$ $20.72$ Log(number of stocks) $16,084$ $9.82$ $1.19$ $9.25$ $10.23$ $10.69$ Avg. Leverage $16,084$ $0.21$ $0.07$ $0.16$ $0.21$ $0.25$ Avg. ROE $16,084$ $0.16$ $0.12$ $0.15$ $0.20$ $0.10$ $0.37$ Avg. BM $16,084$ $0.15$ $0.48$ $-0.09$ $0.10$ $0.37$ Avg. BM $16,084$ $2.31$ $2.89$ $0.43$ $1.14$ $2.85$ Sustainability Sensitivity	Avg. Emission Intensity (Scope 1)	16,084	1.21	1.42	0.28	0.72	1.55
Avg. Emission Intensity (Scope 3) $16,084$ $1.42$ $0.47$ $1.13$ $1.39$ $1.67$ Aggregated Portfolio Emissions (Scope 1) $16,084$ $17.70$ $2.03$ $16.38$ $18.04$ $19.28$ Aggregated Portfolio Emissions (Scope 2) $16,084$ $16.80$ $1.46$ $15.90$ $17.02$ $17.83$ Aggregated Portfolio Emissions (Scope 3) $16,084$ $18.47$ $1.49$ $17.60$ $18.66$ $19.54$ Avg. Portfolio Emissions (EW) (Scope 1) $16,084$ $13.68$ $1.69$ $12.56$ $14.08$ $15.00$ Avg. Portfolio Emissions (EW) (Scope 2) $16,084$ $12.79$ $1.12$ $12.15$ $13.08$ $13.57$ Avg. Portfolio Emissions (EW) (Scope 3) $16,084$ $14.45$ $1.17$ $13.94$ $14.75$ $15.26$ Other VariablesLog(fund AUM) $16,084$ $19.64$ $1.56$ $18.46$ $19.57$ $20.72$ Log(number of stocks) $16,084$ $4.49$ $0.79$ $3.95$ $4.34$ $4.88$ Industry concentration $16,084$ $9.82$ $1.19$ $9.25$ $10.23$ $10.69$ Avg. ROE $16,084$ $0.21$ $0.07$ $0.16$ $0.21$ $0.25$ Avg. ROE $16,084$ $0.16$ $0.12$ $0.10$ $0.37$ Avg. BM $16,084$ $2.31$ $2.89$ $0.43$ $1.14$ $2.85$ Sustainability Sensitivity $16,008$ $73.14$ $6.06$ $69.30$ $69.30$ $79.60$	Avg. Emission Intensity (Scope 2)	16,084	0.36	0.26	0.20	0.29	0.43
Aggregated Portfolio Emissions (Scope 1) $16,084$ $17.70$ $2.03$ $16.38$ $18.04$ $19.28$ Aggregated Portfolio Emissions (Scope 2) $16,084$ $16.80$ $1.46$ $15.90$ $17.02$ $17.83$ Aggregated Portfolio Emissions (Scope 3) $16,084$ $18.47$ $1.49$ $17.60$ $18.66$ $19.54$ Avg. Portfolio Emissions (EW) (Scope 1) $16,084$ $13.68$ $1.69$ $12.56$ $14.08$ $15.00$ Avg. Portfolio Emissions (EW) (Scope 2) $16,084$ $12.79$ $1.12$ $12.15$ $13.08$ $13.57$ Avg. Portfolio Emissions (EW) (Scope 3) $16,084$ $14.45$ $1.17$ $13.94$ $14.75$ $15.26$ Other VariablesLog(fund AUM) $16,084$ $19.64$ $1.56$ $18.46$ $19.57$ $20.72$ Log(number of stocks) $16,084$ $4.49$ $0.79$ $3.95$ $4.34$ $4.88$ Industry concentration $16,084$ $9.82$ $1.19$ $9.25$ $10.23$ $10.69$ Avg. ROE $16,084$ $0.21$ $0.07$ $0.16$ $0.21$ $0.25$ Avg. ROE $16,084$ $0.16$ $0.12$ $0.10$ $0.37$ Avg. BM $16,084$ $2.31$ $2.89$ $0.43$ $1.14$ $2.85$ Sustainability Sensitivity $16,008$ $73.14$ $6.06$ $69.30$ $69.30$ $79.60$	Avg. Emission Intensity (Scope 3)	16,084	1.42	0.47	1.13	1.39	1.67
Aggregated Portfolio Emissions (Scope 2) $16,084$ $16.80$ $1.46$ $15.90$ $17.02$ $17.83$ Aggregated Portfolio Emissions (Scope 3) $16,084$ $18.47$ $1.49$ $17.60$ $18.66$ $19.54$ Avg. Portfolio Emissions (EW) (Scope 1) $16,084$ $13.68$ $1.69$ $12.56$ $14.08$ $15.00$ Avg. Portfolio Emissions (EW) (Scope 2) $16,084$ $12.79$ $1.12$ $12.15$ $13.08$ $13.57$ Avg. Portfolio Emissions (EW) (Scope 3) $16,084$ $14.45$ $1.17$ $13.94$ $14.75$ $15.26$ Other VariablesLog(fund AUM) $16,084$ $19.64$ $1.56$ $18.46$ $19.57$ $20.72$ Log(number of stocks) $16,084$ $4.49$ $0.79$ $3.95$ $4.34$ $4.88$ Industry concentration $16,084$ $0.01$ $0.08$ $0.00$ $0.00$ $0.00$ Log(Avg. revenues) $16,084$ $0.21$ $0.07$ $0.16$ $0.21$ $0.25$ Avg. ROE $16,084$ $0.16$ $0.12$ $0.10$ $0.15$ $0.20$ Avg. BM $16,084$ $2.31$ $2.89$ $0.43$ $1.14$ $2.85$ Sustainability Sensitivity $16,008$ $73.14$ $6.06$ $69.30$ $69.30$ $79.60$	Aggregated Portfolio Emissions (Scope 1)	16,084	17.70	2.03	16.38	18.04	19.28
Aggregated Portfolio Emissions (Scope 3) $16,084$ $18.47$ $1.49$ $17.60$ $18.66$ $19.54$ Avg. Portfolio Emissions (EW) (Scope 1) $16,084$ $13.68$ $1.69$ $12.56$ $14.08$ $15.00$ Avg. Portfolio Emissions (EW) (Scope 2) $16,084$ $12.79$ $1.12$ $12.15$ $13.08$ $13.57$ Avg. Portfolio Emissions (EW) (Scope 3) $16,084$ $14.45$ $1.17$ $13.94$ $14.75$ $15.26$ Other VariablesLog(fund AUM) $16,084$ $19.64$ $1.56$ $18.46$ $19.57$ $20.72$ Log(number of stocks) $16,084$ $4.49$ $0.79$ $3.95$ $4.34$ $4.88$ Industry concentration $16,084$ $0.01$ $0.08$ $0.00$ $0.00$ $0.00$ Log(Avg. revenues) $16,084$ $0.21$ $0.07$ $0.16$ $0.21$ $0.25$ Avg. ROE $16,084$ $0.16$ $0.12$ $0.10$ $0.15$ $0.20$ Avg. BM $16,084$ $2.31$ $2.89$ $0.43$ $1.14$ $2.85$ Sustainability Sensitivity $16,008$ $73.14$ $6.06$ $69.30$ $69.30$ $79.60$	Aggregated Portfolio Emissions (Scope 2)	16,084	16.80	1.46	15.90	17.02	17.83
Avg. Portfolio Emissions (EW) (Scope 1) $16,084$ $13.68$ $1.69$ $12.56$ $14.08$ $15.00$ Avg. Portfolio Emissions (EW) (Scope 2) $16,084$ $12.79$ $1.12$ $12.15$ $13.08$ $13.57$ Avg. Portfolio Emissions (EW) (Scope 3) $16,084$ $14.45$ $1.17$ $13.94$ $14.75$ $15.26$ Other VariablesLog(fund AUM) $16,084$ $19.64$ $1.56$ $18.46$ $19.57$ $20.72$ Log(number of stocks) $16,084$ $4.49$ $0.79$ $3.95$ $4.34$ $4.88$ Industry concentration $16,084$ $0.01$ $0.08$ $0.00$ $0.00$ $0.00$ Log(Avg. revenues) $16,084$ $0.21$ $0.07$ $0.16$ $0.21$ $0.25$ Avg. ROE $16,084$ $0.16$ $0.12$ $0.10$ $0.15$ $0.20$ Avg. BM $16,084$ $2.31$ $2.89$ $0.43$ $1.14$ $2.85$ Sustainability Sensitivity $16,008$ $73.14$ $6.06$ $69.30$ $69.30$ $79.60$	Aggregated Portfolio Emissions (Scope 3)	16,084	18.47	1.49	17.60	18.66	19.54
Avg. Portfolio Emissions (EW) (Scope 2) $16,084$ $12.79$ $1.12$ $12.15$ $13.08$ $13.57$ Avg. Portfolio Emissions (EW) (Scope 3) $16,084$ $14.45$ $1.17$ $13.94$ $14.75$ $15.26$ Other VariablesLog(fund AUM) $16,084$ $19.64$ $1.56$ $18.46$ $19.57$ $20.72$ Log(number of stocks) $16,084$ $4.49$ $0.79$ $3.95$ $4.34$ $4.88$ Industry concentration $16,084$ $0.01$ $0.08$ $0.00$ $0.00$ $0.00$ Log(Avg. revenues) $16,084$ $0.21$ $0.07$ $0.16$ $0.21$ $0.25$ Avg. ROE $16,084$ $0.16$ $0.12$ $0.10$ $0.15$ $0.20$ Avg. EPS growth $16,084$ $0.15$ $0.48$ $-0.09$ $0.10$ $0.37$ Avg. BM $16,084$ $2.31$ $2.89$ $0.43$ $1.14$ $2.85$ Sustainability Sensitivity $16,008$ $73.14$ $6.06$ $69.30$ $69.30$ $79.60$	Avg. Portfolio Emissions (EW) (Scope 1)	16,084	13.68	1.69	12.56	14.08	15.00
Avg. Portfolio Emissions (EW) (Scope 3)16,08414.451.1713.9414.7515.26Other VariablesLog(fund AUM)16,08419.641.5618.4619.5720.72Log(number of stocks)16,0844.490.793.954.344.88Industry concentration16,0840.010.080.000.000.00Log(Avg. revenues)16,0849.821.199.2510.2310.69Avg. Leverage16,0840.210.070.160.210.25Avg. ROE16,0840.150.48-0.090.100.37Avg. BM16,0842.312.890.431.142.85Sustainability Sensitivity16,00873.146.0669.3069.3079.60	Avg. Portfolio Emissions (EW) (Scope 2)	16,084	12.79	1.12	12.15	13.08	13.57
Other Variables $Log(fund AUM)$ 16,08419.641.5618.4619.5720.72 $Log(number of stocks)$ 16,0844.490.793.954.344.88Industry concentration16,0840.010.080.000.000.00 $Log(Avg. revenues)$ 16,0849.821.199.2510.2310.69Avg. Leverage16,0840.210.070.160.210.25Avg. ROE16,0840.160.120.100.150.20Avg. EPS growth16,0840.150.48-0.090.100.37Avg. BM16,0842.312.890.431.142.85Sustainability Sensitivity16,00873.146.0669.3069.3079.60	Avg. Portfolio Emissions (EW) (Scope 3)	16,084	14.45	1.17	13.94	14.75	15.26
Log(fund AUM)16,08419.641.5618.4619.5720.72 $Log(number of stocks)$ 16,0844.490.793.954.344.88Industry concentration16,0840.010.080.000.000.00 $Log(Avg. revenues)$ 16,0849.821.199.2510.2310.69Avg. Leverage16,0840.210.070.160.210.25Avg. ROE16,0840.160.120.100.150.20Avg. EPS growth16,0840.150.48-0.090.100.37Avg. BM16,0842.312.890.431.142.85Sustainability Sensitivity16,00873.146.0669.3069.3079.60	Other Variables						
$\begin{array}{cccc} Log(number of stocks) & 16,084 & 4.49 & 0.79 & 3.95 & 4.34 & 4.88 \\ Industry concentration & 16,084 & 0.01 & 0.08 & 0.00 & 0.00 \\ Log(Avg. revenues) & 16,084 & 9.82 & 1.19 & 9.25 & 10.23 & 10.69 \\ Avg. Leverage & 16,084 & 0.21 & 0.07 & 0.16 & 0.21 & 0.25 \\ Avg. ROE & 16,084 & 0.16 & 0.12 & 0.10 & 0.15 & 0.20 \\ Avg. EPS growth & 16,084 & 0.15 & 0.48 & -0.09 & 0.10 & 0.37 \\ Avg. BM & 16,084 & 2.31 & 2.89 & 0.43 & 1.14 & 2.85 \\ Sustainability Sensitivity & 16,008 & 73.14 & 6.06 & 69.30 & 69.30 & 79.60 \\ \end{array}$	Log(fund AUM)	16,084	19.64	1.56	18.46	19.57	20.72
Industry concentration16,0840.010.080.000.000.00Log(Avg. revenues)16,0849.821.199.2510.2310.69Avg. Leverage16,0840.210.070.160.210.25Avg. ROE16,0840.160.120.100.150.20Avg. EPS growth16,0840.150.48-0.090.100.37Avg. BM16,0842.312.890.431.142.85Sustainability Sensitivity16,00873.146.0669.3069.3079.60	Log(number of stocks)	16,084	4.49	0.79	3.95	4.34	4.88
Log(Avg. revenues)16,0849.821.199.2510.2310.69Avg. Leverage16,0840.210.070.160.210.25Avg. ROE16,0840.160.120.100.150.20Avg. EPS growth16,0840.150.48-0.090.100.37Avg. BM16,0842.312.890.431.142.85Sustainability Sensitivity16,00873.146.0669.3069.3079.60	Industry concentration	16,084	0.01	0.08	0.00	0.00	0.00
Avg. Leverage16,0840.210.070.160.210.25Avg. ROE16,0840.160.120.100.150.20Avg. EPS growth16,0840.150.48-0.090.100.37Avg. BM16,0842.312.890.431.142.85Sustainability Sensitivity16,00873.146.0669.3069.3079.60	Log(Avg. revenues)	16,084	9.82	1.19	9.25	10.23	10.69
Avg. ROE16,0840.160.120.100.150.20Avg. EPS growth16,0840.150.48-0.090.100.37Avg. BM16,0842.312.890.431.142.85Sustainability Sensitivity16,00873.146.0669.3069.3079.60	Avg. Leverage	16,084	0.21	0.07	0.16	0.21	0.25
Avg. EPS growth16,0840.150.48-0.090.100.37Avg. BM16,0842.312.890.431.142.85Sustainability Sensitivity16,00873.146.0669.3069.3079.60	Avg. ROE	16,084	0.16	0.12	0.10	0.15	0.20
Avg. BM16,0842.312.890.431.142.85Sustainability Sensitivity16,00873.146.0669.3069.3079.60	Avg. EPS growth	16,084	0.15	0.48	-0.09	0.10	0.37
Sustainability Sensitivity 16,008 73.14 6.06 69.30 69.30 79.60	Avg. BM	16,084	2.31	2.89	0.43	1.14	2.85
	Sustainability Sensitivity	16,008	73.14	6.06	69.30	69.30	79.60

#### Table 2. Average Portfolio Emissions around the Implementation of the SFDR

This table presents results from examining average portfolio emissions around the implementation of the SFDR. The analysis is conducted at the fund-year level. Panel A compares the periods before and after the entry into force of the regulation. Panel B shows the results by year taking 2018 as the reference year. Avg. Portfolio Emissions is the logarithm of the weighted average of the carbon emissions of the firms in the fund's portfolio (expressed in tons of CO<sub>2</sub> equivalents). Weights are based on the fund's reported value of portfolio firm holdings. The variable is computed separately for Scope 1, 2, and 3. Article 8/9 is an indicator variable that equals one if the fund is labeled as an Article 8 or 9 fund, and zero otherwise. Post is an indicator variable that equals one for observations after 2019 (i.e., the year when the SFDR was ratified), and zero otherwise. Year 2019, Year 2020, Year 2021 are indicator variables for years 2019, 2020, and 2021, respectively. Standard errors are clustered by fund. t-statistics are in parentheses. \*, \*\* and \*\*\* denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

#### Panel A. Pre-Post

	Depende	nt variable: Avg. Portfolio E	Emissions
	Scope 1	Scope 2	Scope 3
Independent variables:	(1)	(2)	(3)
Article_8/9 * Post	-0.137***	-0.058***	-0.068***
	(-5.80)	(-3.92)	(-5.14)
Fund Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
adj R–squared	0.892	0.916	0.939
Observations	16,084	16, 084	16, 084

# Panel B. Analysis by year

	Dependent variable: Avg. Portfolio Emissions				
	Scope 1	Scope 2	Scope 3		
Independent variables:	(1)	(2)	(3)		
<i>Article 8/9 * Year 2019</i>	-0.013	0.005	-0.039***		
—	(-0.70)	(0.48)	(-4.11)		
<i>Article 8/9 * Year 2020</i>	-0.103***	-0.057***	-0.108***		
_	(-3.92)	(-3.26)	(-7.17)		
Article 8/9 * Year 2021	-0.184***	-0.055***	-0.067***		
_	(-5.83)	(-2.78)	(-3.88)		
Fund Fixed Effects	Yes	Yes	Yes		
Year Fixed Effects	Yes	Yes	Yes		
adj R–squared	0.892	0.916	0.939		
Observations	16,084	16, 084	16, 084		

# **Table 3. Alternative Control Groups**

This table repeats the analysis in Table 2 using five alternative control groups: (i) SFDR Article 6 funds (Panel A), (ii) US based PRI funds (Panel B), (iii) ESG funds as designated by Morningstar (Panel C), (iv) Non-SFDR PRI funds matched based on pre-SFDR size and environmental performance (Panel D), (v) funds in the same fund family (i.e. funds managed by the same asset manager) that were not impacted by the SFDR (Panel E). The variables and the specifications are as in Table 2. Standard errors are clustered by fund. *t-statistics* are in parentheses. \*, \*\* and \*\*\* denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

#### Panel A. SFDR Article 6 funds

	Depende	nt variable: Avg. Portfolio E	missions
	Scope 1	Scope 2	Scope 3
Independent variables:	(1)	(2)	(3)
Article 8/9 * Post	-0.116***	-0.040**	-0.025
	(-4.30)	(-2.35)	(-1.58)
Fund Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
adj R–squared	0.877	0.903	0.921
Observations	13,664	13,664	13,664

#### Panel B. US PRI funds

	Depende	ent variable: Avg. Portfolio E	Emissions
Indonandant variables	Scope 1	Scope 2 $(2)$	Scope 3 $(2)$
Independent variables.	(1)	(2)	(3)
Article 8/9 * Post	-0.167*** (-6.66)	-0.059*** (-3.76)	-0.079*** (-5.69)
	( 0.00)	( 3.70)	( 5.05)
Fund Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
adj R–squared	0.893	0.917	0.940
Observations	14,128	14,128	14,128

# Panel C. Sustainable funds as designated by Morningstar

	Depender	nt variable: Avg. Portfolio E	Emissions
	Scope 1	Scope 2	Scope 3
Independent variables:	(1)	(2)	(3)
Article 8/9 * Post	-0.126***	-0.025	-0.047*
	(-3.09)	(-0.80)	(-1.64)
Fund Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
adj R–squared	0.879	0.901	0.921
Observations	9,536	9,536	9,536

# Panel D. Non-SFDR PRI funds matched based on pre-SFDR size and environmental performance

	Depende	ent variable: Avg. Portfolio H	Emissions
	Scope 1	Scope 2	Scope 3
Independent variables:	(1)	(2)	(3)
Article_8/9 * Post	-0.128***	-0.047***	-0.039***
	(-5.55)	(-3.28)	(-2.99)
Fund Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
adj R–squared	0.879	0.905	0.925
Observations	18,808	18,808	18,808

# Panel E. Funds in the same fund family

	Dependent variable: Avg. Portfolio Emissions			
	Scope 1	Scope 2	Scope 3	
Independent variables:	(1)	(2)	(3)	
Article 8/9 * Post	-0.105***	-0.043***	-0.058***	
	(-4.12)	(-2.66)	(-4.14)	
Article_8/9	0.067	0.155***	0.222***	
	(1.02)	(3.25)	(4.50)	
Fund Family Fixed Effects	Yes	Yes	Yes	
Year Fixed Effects	Yes	Yes	Yes	
adj R–squared	0.118	0.0838	0.0985	
Observations	14,368	14,368	14,368	

### Table 4. Sources of the Changes in Average Portfolio Emissions

This table repeats the analysis in Table 2 using changes in portfolio-level emissions and the decomposition of these changes proposed by Cheema-Fox et al. (2021). See Appendix D for additional details of the decomposition calculation. Panel A, B, and C show the results of decomposition of funds' changes in Scope 1, 2, 3 emissions, respectively.  $\Delta$  Avg. Portfolio Emissions is the annual change in Avg. Portfolio Emissions (as previously defined). Return, Flow, and Impact are the three components into which  $\Delta$  Avg. Portfolio Emissions is broken down. Return is the part of  $\Delta$  Avg. Portfolio Emissions attributed to changes in portfolio weights due to divergent returns. Flow is the part of  $\Delta$  Avg. Portfolio Emissions attributed to changes in funds' investment decisions. Impact is the part of  $\Delta$  Avg. Portfolio Emissions attributed to changes an portfolio Emissions attributed to changes in portfolio Emissions. Impact is the part of  $\Delta$  Avg. Portfolio Emissions attributed to changes in portfolio Emissions. Impact are as previously defined. Standard errors are clustered by fund. t-statistics are in parentheses. \*, \*\* and \*\*\* denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

#### Panel A. Scope 1 emissions

Independent variables:	∆ Avg. Portfolio Emissions (1)	Return (2)	Flow (3)	Impact (4)
Article_8/9 * Post	-0.205*** (-4.24)	-0.073* (-1.86)	-0.107** (-2.06)	-0.024* (-1.91)
Article_8/9	0.024 (0.79)	-0.050 (-1.48)	0.108** (2.51)	-0.034*** (-3.30)
Fund Fixed Effects	No	No	No	No
Year Fixed Effects	Yes	Yes	Yes	Yes
adj R–squared	0.069	0.003	0.030	0.105
Observations	16,084	16,084	16,084	16,084

#### Panel B. Scope 2 emissions

Independent variables:	∆ Avg. Portfolio Emissions (1)	<i>Return</i> (2)	Flow (3)	Impact (4)
Article 8/9 * Post	-0.041*** (-4.26)	-0.035*** (-3.40)	0.010 (0.86)	-0.019*** (-4.19)
Article_8/9	0.032*** (5.31)	-0.021*** (-2.80)	0.039*** (4.40)	0.011*** (4.00)
Fund Fixed Effects	No	No	No	No
Year Fixed Effects	Yes	Yes	Yes	Yes
adj R–squared	0.062	0.027	0.032	0.086
Observations	16,084	16,084	16,084	16,084

#### Panel C. Scope 3 emissions

Independent variables:	∆ Avg. Portfolio Emissions (1)	Return (2)	Flow (3)	Impact (4)
Article_8/9 * Post	-0.071	-0.088*	-0.114**	0.128***
	(-1.51)	(-1.75)	(-2.06)	(6.19)
Article 8/9	0.013	-0.172***	0.276***	-0.086***
_	(0.41)	(-3.97)	(5.62)	(-8.38)
Fund Fixed Effects	No	No	No	No
Year Fixed Effects	Yes	Yes	Yes	Yes
adj R–squared	0.144	0.010	0.038	0.335
Observations	16,084	16,084	16,084	16,084

## **Table 5. Holding Constant Portfolio Composition**

This table repeats the analysis in Table 2 computing *Avg. Portfolio Emissions* based on the firms that remain in the portfolio of the fund over the whole sample period (i.e., from 2018 to 2021). That is, excluding from the computation of *Avg. Portfolio Emissions* the firms that enter and exit the portfolio of the fund at some point during the sample period. The rest of the variables and the specifications are as in Table 2. Standard errors are clustered by fund. *t-statistics* are in parentheses. \*, \*\* and \*\*\* denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

	Dependent variable: Avg. Portfolio Emissions			
	Scope 1	Scope 2	Scope 3	
Independent variables:	(1)	(2)	(3)	
Article_8/9 * Post	-0.051*** (-5.35)	-0.029*** (-3.80)	-0.039*** (-6.78)	
Fund Fixed Effects	Ves	Ves	Ves	
Year Fixed Effects	Yes	Yes	Yes	
adj R–squared	0.988	0.979	0.992	
Observations	15,992	15,992	15,992	

#### Table 6. Fund-Firm Level analysis of Changes in Shares Owned

This table presents regressions using Fund-Firm level data and *Log* (1+ *Shares*) as the dependent variable. *Log* (1+ *Shares*) is the logarithm of one plus the number of shares of a firm held by a fund. Column (1) and (2) estimate the model without firm controls, while columns (3) and (4) include the following additional firm control variables and their interactions with *Article\_8/9* and *Post: Revenues, Leverage, ROE, EPS growth, BM* and *Salesgrowth. Higher\_FirmEmissions* is an indicator variable that equals one if the total emissions of the firm in 2019 are in the top decile of the respective fund portfolio, and zero otherwise. Columns (1) and (3) use Fund-Firm and Year fixed effects. Columns (2) and (4) use Fund-Firm and Fund-Year fixed effects. Standard errors are clustered by fund. *t-statistics* are in parentheses. \*, \*\* and \*\*\* denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

	Dependent variable: <i>Log(1+Shares)</i>				
Independent variables:	(1)	(2)	(3)	(4)	
Article 8/9 * Post * Higher FirmEmissions	-0.218***	-0 249***	-0 280***	-0 285***	
In the _0, > 1 ost Ingher_1 that issues	(-3.64)	(-4.43)	(-3.10)	(-4.91)	
Post * Higher FirmEmissions	0.128***	0.124***	-0.110**	-0.185***	
0 _	(3.20)	(3.17)	(-2.25)	(-4.56)	
Article 8/9 * Post	-0.049		-0.148		
_	(-0.50)		(-1.15)		
Article_8/9 * Post * Revenue			0.000	-0.000	
			(0.89)	(-0.11)	
Article_8/9 * Post * Leverage			-0.115	-0.092	
			(-0.59)	(-0.74)	
Article_8/9 * Post * ROE			0.439***	0.425***	
			(4.99)	(6.32)	
Article_8/9 * Post * EPS growth			0.034***	0.022***	
			(4.08)	(2.87)	
Article_8/9 * Post * BM			0.001	-0.002	
			(0.23)	(-1.08)	
Article_8/9 * Post * Salesgrowth			-0.058	-0.121	
			(-0.38)	(-1.25)	
	N	17	N		
Controls & Interactions	No	Yes	No	Yes	
Fund-Firm Fixed Effects	Yes	Yes	Yes	Yes	
Year Fixed Effects	Yes	No	Yes	No	
Fund-Year Fixed Effects	No	Yes	No	Yes	
adj R–squared	0.275	0.340	0.280	0.347	
Observations	1,816,126	1,816,126	1,816,126	1,816,126	

# Table 7. Cross-sectional Variation in Funds' Disclosure Costs

This table repeats the analysis in Table 2, analyzing variation in fund decarbonization across three different settings where funds' disclosure costs are expected to vary. In Panel A, we examine variation based on *Prior Disclosure Rule*, an indicator variable that equals one if the fund is domiciled in a country with an investor sustainability disclosure requirement prior to the introduction of the SFDR. In Panel B, we examine variation based on the relative average emissions of a fund before SFDR. *Higher Emissions* is an indicator variable that equals one if *Avg. Portfolio Emissions* in 2019 (i.e., right before the entry into force of the regulation) is above the median of treated funds. In Panel C, we examine variation based on the levels of fund sensitivity to sustainability. *Higher Sensitivity* is an indicator variable that equals one if *Sustainability\_Sensitivity* is above the median of treated funds. *Sustainability\_Sensitivity* is the 2019 country-year EPI (Environmental Performance Index) score from the domicile country of the investment fund. The rest of the variables and the specifications are as in Table 2. Standard errors are clustered by fund. *T-statistics* are in parentheses. \*, \*\* and \*\*\* denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

	Dependent variable: Avg. Portfolio Emissions			
	Scope 1	Scope 2	Scope 3	
Independent variables:	(1)	(2)	(3)	
Article_8/9*Post*Prior Disclosure Rule	0.224*	0.207	0.249**	
	(1.91)	(1.59)	(2.22)	
Article_8/9 * Post	-0.139***	-0.057***	-0.066***	
	(-5.70)	(-3.71)	(-4.94)	
Post* Prior Disclosure Rule	-0.246**	-0.283**	-0.329***	
	(-2.42)	(-2.27)	(-3.10)	
Fund and Year Fixed Effects	Yes	Yes	Yes	
adj R–squared	0.892	0.916	0.939	
Observations	16,084	16,084	16,084	

#### Panel A. Prior disclosure rule in the country

#### **Panel B. Prior Portfolio Emissions**

	Dependent variable: Avg. Portfolio Emissions				
	Scope 1	Scope 2	Scope 3		
Independent variables:	(1)	(2)	(3)		
Article 8/9*Post*Higher Emissions	-0.175***	-0.010	-0.128***		
	(-3.74)	(-0.33)	(-4.98)		
Article 8/9 * Post	-0.050	-0.054**	-0.003		
	(-1.36)	(-2.32)	(-0.18)		
Post*Higher Emissions	-0.149***	-0.045**	-0.097***		
	(-4.66)	(-2.20)	(-5.44)		
Fund and Year Fixed Effects	Yes	Yes	Yes		
adj R–squared	0.894	0.916	0.941		
Observations	16,084	16,084	16,084		

#### Panel C. Country Sensitivity towards Sustainability

	Dependent variable: Avg. Portfolio Emissions			
	Scope 1	Scope 2	Scope 3	
Independent variables:	(1)	(2)	(3)	
Article 8/9*Post*Higher Sensitivity	-0.073**	-0.053**	-0.014	
	(-2.05)	(-2.35)	(-0.70)	
Article_8/9*Post	-0.095***	-0.020	-0.055***	
	(-2.96)	(-0.98)	(-3.14)	
Post*Higher Sensitivity	0.038	-0.141**	-0.106**	
	(0.46)	(-2.49)	(-2.00)	
Fund and Year Fixed Effects	Yes	Yes	Yes	
adj R–squared	0.893	0.916	0.939	
Observations	16,008	16,008	16,008	

#### **Table 8. Alternative Measures of Decarbonization**

This table repeats the analysis in Table 2 using 4 alternative definitions of the dependent variable. In Panel A the dependent variable Avg. Emission Intensity is the value weighted average of the carbon emission intensity of the firms in the fund's portfolio (expressed in tons of CO<sub>2</sub> equivalents per dollar). Carbon emission intensity is calculated as emission amounts scaled by sales expressed in millions of US dollars. In Panel B the dependent variable Aggregated Portfolio Emissions is the logarithm of the sum of the carbon emissions of the firms in the fund's portfolio (in tons of CO<sub>2</sub> equivalents). In Panel C the dependent variable Avg. Portfolio Emissions (EW) is the logarithm of the equally weighted average of the carbon emissions of the firms in the fund's portfolio (in tons of CO<sub>2</sub> equivalents). In Panel D the dependent variable Avg. Portfolio Emissions in column (1) and Scope 1,2 and 3 carbon emissions in column (2) (in tons of CO2 equivalents). The rest of the variables and the specification are as in Table 2. Standard errors are clustered by fund. t-statistics are in parentheses. \*, \*\* and \*\*\* denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

#### Panel A. Emission Intensity

	Dependent variable: Avg. Emission Intensity			
	Scope 1	Scope 2	Scope 3	
Independent variables:	(1)	(2)	(3)	
Article_8/9 * Post	-0.070** (-2.56)	-0.001 (-0.19)	-0.022*** (-2.78)	
Fund Fixed Effects	Yes	Yes	Yes	
Year Fixed Effects	Yes	Yes	Yes	
adj R–squared	0.787	0.739	0.837	
Observations	16,084	16,084	16,084	

#### Panel B. Aggregate Emissions

	Dependent variable: Aggregated Portfolio Emissions			
	Scope 1	Scope 2	Scope 3	
Independent variables:	(1)	(2)	(3)	
Article 8/9 * Post	-0.108***	-0.027*	-0.025*	
	(-4.26)	(-1.66)	(-1.74)	
Fund Fixed Effects	Yes	Yes	Yes	
Year Fixed Effects	Yes	Yes	Yes	
adj R–squared	0.903	0.925	0.943	
Observations	16,084	16, 084	16, 084	

#### Panel C. Equal Weighted Emissions

	Dependent variable: Avg. Portfolio Emissions (EW)			
	Scope 1	Scope 2	Scope 3	
Independent variables:	(1)	(2)	(3)	
Article_8/9 * Post	-0.113*** (-4.95)	-0.031** (-2.31)	-0.027** (-2.37)	
Fund Fixed Effects	Yes	Yes	Yes	
Year Fixed Effects	Yes	Yes	Yes	
adj R–squared	0.885	0.913	0.941	
Observations	16,084	16, 084	16, 084	

# Panel D. Firm Total Emissions

	Dep. var.: Avg. Portfolio Emissions		
	$\Sigma(Scope 1, 2)$	Σ(Scope 1,2,3)	
Indep. variables:	(1)	(2)	
Article 8/9 * Post	-0.122***	-0.066*	
	(-6.35)	(-1.85)	
Fund Fixed Effects	Yes	Yes	
Year Fixed Effects	Yes	Yes	
adj R–squared	0.906	0.812	
Observations	16,084	16,084	

#### **Table 9. Excluding Portfolio Holdings in EU Firms**

This table repeats the analysis in Table 2 excluding holdings in EU firms from investors' portfolios. Panel A compares the periods before and after the entry into force of the regulation. Panel B shows the results by year taking 2018 as the reference year. *Avg. Portfolio Emissions\_NonEU* is the logarithm of the weighted average of the carbon emissions of non-EU firms in the fund's portfolio (expressed in tons of CO<sub>2</sub> equivalents). Weights are based on the fund's reported value of non-EU portfolio firm holdings. The variable is computed separately for Scope 1, 2, and 3. *Article\_8/9* is an indicator variable that equals one if the fund is labeled as an Article 8 or 9 fund, and zero otherwise. *Post* is an indicator variable that equals one for observations after 2019 (i.e., the year when the SFDR was ratified), and zero otherwise. *Year 2019, Year 2020, Year 2021* are indicator variables for years 2019, 2020, and 2021, respectively. Standard errors are clustered by fund. *t-statistics* are in parentheses. \*, \*\* and \*\*\* denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

#### Panel A. Pre-Post

	Dependent variable: Avg. Portfolio Emissions NonEU		
	Scope 1	Scope 2	Scope 3
Independent variables:	(1)	(2)	(3)
Article 8/9 * Post	-0.141***	-0.067***	-0.068***
	(-4.98)	(-3.62)	(-3.98)
Fund Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
adj R–squared	0.879	0.904	0.924
Observations	14,121	14,121	14,121

#### Panel B. Analysis by year

	Dependent variable: Avg. Portfolio Emissions_NonEU			
	Scope 1	Scope 2	Scope 3	
Independent variables:	(1)	(2)	(3)	
<i>Article 8/9 * Year 2019</i>	0.021	0.001	-0.037***	
	(1.04)	(0.10)	(-3.03)	
Article 8/9 * Year 2020	-0.077**	-0.057***	-0.093***	
	(-2.51)	(-2.66)	(-4.92)	
Article 8/9 * Year 2021	-0.183***	-0.076***	-0.079***	
_	(-4.89)	(-3.19)	(-3.60)	
Fund Fixed Effects	Yes	Yes	Yes	
Year Fixed Effects	Yes	Yes	Yes	
adj R–squared	0.879	0.904	0.924	
Observations	14,121	14,121	14,121	

### Table 10. Sources of the Changes in Average Portfolio Emissions Excluding EU Firms

This table repeats the analysis in Table 4 limiting the sample to fund's non-EU portfolio holdings. See Appendix D for additional details of the decomposition calculation. Panel A, B, and C show the results of decomposition of funds' changes in Scope 1, 2, 3 emissions, respectively.  $\Delta$  Avg. Portfolio Emissions is the annual change in Avg. Portfolio Emissions (as previously defined). Return, Flow, and Impact are the three components into which  $\Delta$  Avg. Portfolio Emissions attributed to changes in portfolio weights due to divergent returns. Flow is the part of  $\Delta$  Avg. Portfolio Emissions attributed to changes in funds' investment decisions. Impact is the part of  $\Delta$  Avg. Portfolio Emissions attributed to changes in portfolio firms' environmental performance. Article\_8/9 and Post are as previously defined. Standard errors are clustered by fund. t-statistics are in parentheses. \*, \*\* and \*\*\* denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

Independent variables:	Emissions (1)	Return (2)	Flow (3)	Impact (4)
Article_8/9 * Post	-0.314*** (-5.06)	-0.135** (-2.15)	-0.151*** (-3.08)	-0.034** (-2.36)
Article_8/9	0.074* (1.89)	0.108** (2.04)	-0.032 (-0.79)	0.012 (1.22)
Fund Fixed Effects	No	No	No	No
Year Fixed Effects	Yes	Yes	Yes	Yes
adj R–squared	0.0500	0.0222	0.00381	0.0680
Observations	14,121	14,121	14,121	14,121

#### Panel A. Scope 1 emissions sources of change

#### Panel B. Scope 2 emissions sources of change

Independent variables:	∆ Avg. Portfolio Emissions (1)	Return (2)	Flow (3)	Impact (4)
Article_8/9 * Post	-0.052*** (-4.07)	0.010	-0.048*** (-3.52)	-0.016*** (-2 73)
Article_8/9	0.031*** (3.85)	0.044*** (3.84)	-0.023** (-2.38)	(-2.73) 0.008** (2.40)
Fund Fixed Effects	No	No	No	No
Year Fixed Effects	Yes	Yes	Yes	Yes
adj R–squared	0.0574	0.0305	0.0228	0.107
Observations	14,121	14,121	14,121	14,121

#### Panel C. Scope 3 emissions sources of change

	∆ Avg. Portfolio			
	Emissions	Return	Flow	Impact
Independent variables:	(1)	(2)	(3)	(4)
Article 8/9 * Post	-0.297***	-0.125	-0.216***	0.096***
_	(-3.79)	(-1.51)	(-2.93)	(3.86)
Article 8/9	0.038	0.249***	-0.144**	-0.078***
—	(0.79)	(3.45)	(-2.44)	(-5.54)
Fund Fixed Effects	No	No	No	No
Year Fixed Effects	Yes	Yes	Yes	Yes
adj R–squared	0.0744	0.0245	0.00745	0.214
Observations	14,121	14,121	14,121	14,121

# **Table 11. US Domiciled Funds**

This table repeats the analysis in Table 2 restricting both the treatment and control groups to the subsample of funds that are domiciled in the United States. The variables and the specifications are as in Table 2. Standard errors are clustered by fund. *t-statistics* are in parentheses. \*, \*\* and \*\*\* denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

	Dependent variable: Avg. Portfolio Emissions		
	Scope 1	Scope 2	Scope 3
Independent variables:	(1)	(2)	(3)
Article 8/9 * Post	-0.127***	-0.028	-0.070***
_	(-3.83)	(-1.33)	(-3.85)
Fund Family Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
adj R–squared	0.900	0.918	0.949
Observations	9,108	9,108	9,108

## **Table 12. PRI Signatories**

This table repeats the analysis in Table 2 restricting the treatment group to the subsample of *Article 8/9* funds that are PRI signatories prior to the start of the sample period. The control group, variables and other specifications are as in Table 2. Standard errors are clustered by fund. *t-statistics* are in parentheses. \*, \*\* and \*\*\* denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

	Depender	Dependent variable: Avg. Portfolio Emissions		
	Scope 1	Scope 2	Scope 3	
Independent variables:	(1)	(2)	(3)	
Article_8/9 * Post	-0.125***	-0.069***	-0.063***	
	(-4.68)	(-4.07)	(-4.20)	
Fund Family Fixed Effects	Yes	Yes	Yes	
Year Fixed Effects	Yes	Yes	Yes	
adj R–squared	0.896	0.919	0.943	
Observations	12,716	12,716	12,716	

# **Table 13. Additional Control Variables**

This table repeats the analysis in Table 2 including the following additional control variables: *Log(revenues)*, *Log(fund AUM)*, *Log(number of stocks)*, *Pct. Industry concentration*, *Avg. Leverage*, *Avg. ROE*, *Avg. EPS growth*, and *Avg. BM*. The rest of the variables and the specification are as in Table 2. Standard errors are clustered by fund. *t-statistics* are in parentheses. \*, \*\* and \*\*\* denote significance at the 10%, 5%, and 1% level (two-tail) respectively.

	Depende	nt variable: Avg. Portfolio E	Emissions
Independent variables:	Scope 1	Scope 2	Scope 3
4 1. 0/0 * D	(1)	(2)	
Article 8/9 * Post	-0.109***	-0.021*	-0.026***
	(-5.10)	(-1.75)	(-3.36)
Log(fund AUM)	0.077***	-0.006	0.026***
	(4.88)	(-0.73)	(4.61)
Log(number of stocks)	0.312***	0.103***	0.048***
	(8.29)	(5.55)	(3.78)
Industry concentration	-0.165	-0.022	-0.069
2	(-1.52)	(-0.19)	(-1.30)
Log(Avg. revenues)	0.918***	0.823***	0.984***
	(24.14)	(46.60)	(68.86)
Avg. Leverage	1.863***	0.800***	-0.329***
	(5.95)	(4.64)	(-2.86)
Avg. ROE	-0.187***	0.070***	0.000
	(-3.88)	(2.79)	(0.02)
Avg. EPS growth	-0.005	0.020***	0.006
	(-0.39)	(2.73)	(1.18)
Avg. BM	0.032***	0.031***	0.009***
	(5.26)	(9.87)	(4.54)
Fund Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
adj R–squared	0.913	0.946	0.978
Observations	16,084	16,084	16,084

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