Aalto University
School of Business

Is the SFDR Effective in Directing Capital Towards Sustainable Targets and Improving Transparency?

Master's Thesis
Helmi Peräkylä
Aalto University School of Business
Department of Finance
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Abstract

This thesis investigates the effectiveness of European Union's Sustainable Finance Disclosure Regulation. The SFDR was introduced by the European Commission to mitigate greenwashing in the previously scarcely regulated field of sustainable investing. The regulation mandates financial institutions to disclose sustainability data in a unified format, and categorizes products into three classes based on their sustainability ambition. The impact of SFDR is studied through assessing its' success in achieving the two main regulatory objectives: directing capital towards sustainable targets and improving transparency and comparability.

The ability to direct capital is studied in two ways. First, the impact of SFDR on mutual funds' behavior is assessed by analyzing the development of portfolio carbon emissions. Secondly, the effect of SFDR on investors is investigated by analyzing the effect of SFDR labels on fund netflows. The effect of SFDR on transparency and comparability is analyzed by studying the proportion of funds labeled as sustainable by SFDR, that exhibit indicators of sustainability discrepancies. The study utilizes a data sample of 122,841 fund-month observations of European and US mutual funds from September 2019 to June 2023.

The results suggest that SFDR succeeds in directing capital towards sustainable investment targets. However, the analysis indicates that the SFDR labels should not be interpreted as measure for sustainability, as the ambiguity of sustainability definitions allows also unsustainable products to be classified as sustainable. The study provides new insights onto existing literature by using carbon emissions as the sustainability measure, including the time after SFDR level 2 implementation into the analysis and using a numerical approach to evaluate the accuracy of SFDR labels.

Tekijä Helmi Peräkylä	
Työn nimi Is the SFDR effective in directing capital towards sustainable investment targets and improving transparency?	
Tutkinto Kauppatieteiden maisteri	
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Tiivistelmä

Tämä maisterintutkielma tarkastelee Euroopan Unionin kestävän rahoituksen tiedonantoasetuksen (SFDR, Sustainable Finance Disclosure Regulation) tehokkuutta. Tiedonantoasetuksen myötä Euroopan komissio pyrki luomaan sääntelykehyksen, joka mahdollistaa viherpesuun puuttumisen rahoitusmarkkinoilla. Asetus velvoittaa rahoitusmarkkinatoimijoita julkaisemaan vastuullisuustietoa yhtenevässä muodossa, ja luokittelee tuotteet kolmeen vastuullisuusluokkaan perustuen näiden vastuullisuustavoitteisiin. Asetuksen tehokkuutta tutkitaan arvioimalla kuinka hyvin asetus on saavuttanut sen kaksi lainsäädännöllistä päätavoitetta: ohjata pääomaa kohti vastuullisia sijoituskohteita ja parantaa läpinäkyvyyttä ja vertailukelpoisuutta.

Tehokkuutta ohjata pääomaa vastuullisiin sijoituskohteisiin tutkitaan kahdella tapaa. Ensin, asetuksen vaikutusta sijoitusrahastojen käyttäytymiseen arvioidaan analysoimalla sijoitusrahastojen portfolioiden hiilidioksidipäästöjen kehitystä. Seuraavaksi tiedonantoasetuksen vaikutusta sijoittajiin arvioidaan analysoimalla asetuksen mukaisten tunnusten vaikutusta rahastojen nettorahavirtaan. Lopuksi arvioidaan asetuksen vaikutusta läpinäkyvyyteen ja vertailukelpoisuuteen analysoimalla kuinka suuri osa vastuullisuustunnuksen saaneista rahastoista vaikuttaa toimivan poiketen vastuullisuustunnukseen liitettävistä vaatimuksista. Sääntelyn tehokkuutta tutkitaan huomioimalla tiedonantoasetuksen ensimmäisen ja toisen tason voimaantulot maaliskuussa 2021 ja kesäkuussa 2023 erikseen. Tämä tutkimus hyödyntää 122,841 havainnon dataotosta Eurooppalaisista ja Yhdysvaltalaisista rahastoista syyskuusta 2019 kesäkuuhun 2023.

Tulokset osoittavat että tiedonantoasetus onnistuu ohjaamaan pääomaa kohti vastuullisia sijoituskohteita. Samalla tutkimus kuitenkin osoittaa, että asetuksen mukaisia vastuullisuustunnuksia ei tulisi tulkita mittarina vastuullisuudelle, sillä vastuullisuus-termin monitulkintaiset määritelmät mahdollistavat sen, että myös ei-vastuulliset rahastot voivat tämän lainsäädännön alla tulla luokitelluksi vastuullisiksi. Tutkimus täydentää olemassa olevaa kirjallisuutta käyttämällä portfolioiden hiilidioksidipäästöjä vastuullisuuden mittarina, sisällyttämällä dataotokseen myös tiedonantoasetuksen toisen tason voimaantulon jälkeinen ajanjakso sekä hyödyntämällä numeerista lähestymistapaa vastuullisuustunnusten paikkansapitävyyden arvioinnissa.

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1 Introduction

As a response to the increased demand of sustainable investment targets and the lack of related regulation, EU introduced the Sustainable Finance Disclosure Regulation (SFDR) in 2021. SFDR was initiated to address the concerns regarding greenwashing in financial markets and it contributes specifically to the third objective of the EU Sustainable Finance Action Plan, that is, increasing transparency. Through the implementation of SFDR, EU aims to provide investors with clear and comparable information on the non-financial aspects of an investment.

SFDR aims to improve comparability and increase transparency by setting unified disclosure requirements and implementing a classification system for sustainable investments. In order to be classified as Article 9 mutual fund (dark-green fund), all investments are required to contribute towards sustainability targets, whereas Article 8 funds (light-green funds) are obliged to promote environmental and/or social factors but do not focus entirely on sustainable investments. Funds that are not taking sustainability factors into account and do not make sustainability related claims are classified as Article 6.[1] The classifications, along with the disclosure requirements, seem to offer concrete and simple means for distinguishing sustainable investment targets. However, since it is up to the companies to declare the article classifications for their products accordingly, the possibility for greenwashing is still present. Furthermore, the ambiguity of the definition of sustainable investment is causing challenges regarding the interpretation of the classifications.

As recent studies indicate, funds labeled as sustainable attract higher flows than non-ESG funds with otherwise similar characteristics (Kaustia and Yu, 2021; Liang, Sun and Teo, 2021). Thereby labeling or relabeling investment products as sustainable can appear as tempting for companies, especially in hopes of attracting investors willing to pay a green premium. Despite SFDR's aim to improve transparency, concerns have been raised about the accuracy and reliability of the classification system. A joint research conducted by leading European newspapers analyzed 838 European funds classified as Dark Green (Article 9). The results reveal that nearly 50% of the funds still invested in fossil fuels and aviation, which are commonly interpreted as the most unsustainable industries (Follow the Money, 2022). This suggests that the classification system provided by SFDR may not be able to provide investors with the transparency it pursues.

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[1] 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. OJ L 317, 9.12.2019, p. 1-16

Prior literature on the effectiveness of SFDR is scarce, and yet to arrive at a consensus. Becker, Martin and Walter (2022) and Cremasco and Boni (2022) find contradicting results on whether SFDR was able to steer mutual funds towards more sustainable investments. Studying the effect on investor sentiment, Becker, Martin and Walter (2022) show that Article 8 and Article 9 funds have attracted additional capital after the implementation of level 1 regulation, whereas Yu (2022) demonstrates that no such effect was visible and Ferriani (2023) suggests that only the Article 9 label explains additional inflow. The papers evaluating SFDR from a regulatory viewpoint (Busch, 2023; Partiti, 2023; Stefaniak, 2023), however, all raise concerns about the adequacy of SFDR as a classification scheme.

The initial SFDR regulation implemented in March 2021 required reporting on broader, entity-level sustainability practices and performance, and the detailed sustainability reporting requirements for defined set of metrics were set in the Regulatory Technical Standards (RTS) of SFDR level 2. This study evaluates the effectiveness of SFDR level 1 and level 2 implementations separately, as publicly reporting product-level information in a pre-defined format on e.g. carbon emission and fossil fuel intensive products only became mandatory after SFDR level 2. Even though some companies begun to prepare for the level 2 implementation by voluntary reporting the information required in RTS drafts, majority of FMPs and FAs developed their reporting processes and methodologies to be compatible with the level 2 regulation during the transition time. Therefore, by analyzing the initial effect of SFDR level 2 implementation, the regulation's success in solving the alleged inefficiency associated with level 1 implementation can be evaluated. The graph below presents a timeline of the key regulatory events in relation to the sample period of this study.

Figure 1: Timeline of SFDR regulation
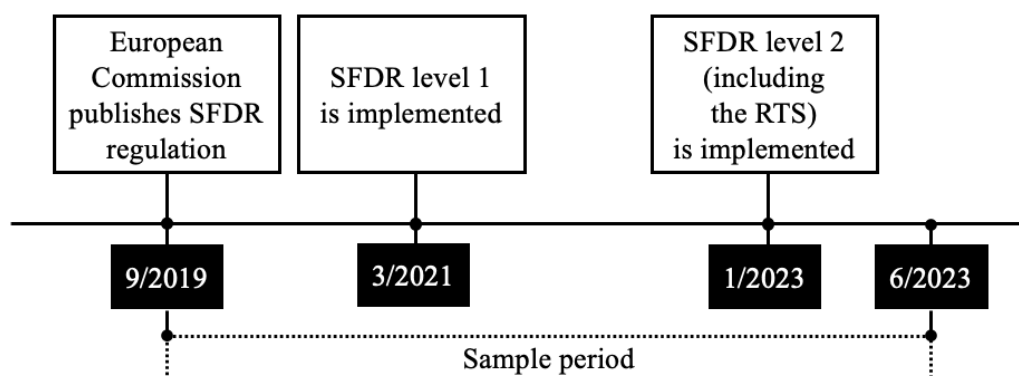
The aim of this thesis is to investigate the effectiveness of SFDR in shaping the behavior of funds and investors, as well as providing transparency. The effectiveness is evaluated through three research questions. Firstly, by examining the effect on fund sustainability (research question 1), secondly, by analyzing the effect on fund flows (research question 2), and finally, by assessing the discrepancies between sustainability disclosure and sustainability performance of funds classified as sustainable (research question 3). The approach of this paper is based on the two main objectives of SFDR: directing capital towards sustainable targets and improving transparency and comparability. Followingly, the first two research questions are defined to address the objective of directing capital: 1) Has the implementation of SFDR affected the carbon emission levels of European mutual funds? 2) Do funds with Article 8 and Article 9 labels attract additional fund flows? The third research question is set to evaluate the success of achieving the transparency and comparability objective: 3) Should SFDR label be interpreted as a measure of sustainability?

To assess the impact of SFDR on mutual funds' portfolios, I examine the change in funds' emission levels after the implementation of level 1 and level 2 SFDR requirements. Approaching the development of funds' sustainability actions from the perspective of carbon emissions is justified as emission decreases are one of the key components of assessing sustainability in the SFDR framework[2]. Prior literature has also utilized a similar approach (Wedari, Jubb and Moradi-Motlagh, 2021; In and Schumacher, 2021). Nonetheless, considering the findings of Weil et al. (2005), disclosure requirements alone may not be able to affect funds' behavior.

In addition to investing in more sustainable targets, mutual funds are affected by SFDR's aim to provide investors more sustainability information through the article classification scheme. Prior studies show that funds labeled as sustainable attract additional fund flows (Liang, Sun and Teo, 2021; Shapiro, 2023), while simultaneously creating opportunities for greenwashing behavior (Liang, Sun and Teo, 2021; Kaustia and Yu, 2021). Research question 2 evaluates whether this setting holds also for SFDR classifications.

However, directing additional funds towards Article 8 and Article 9 funds may not fulfill the objective of the implemented regulation, if the sustainability of these funds is not guaranteed. In light of recent public discussion (Follow the Money, 2022) and research (Partiti,

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[2] ESMA (2022) Annex I: Answers to questions on the interpretation of Regulation (EU) 2019/2088, submitted by the European Supervisory Authorities on 9 September 2022

2023) implying that the SFDR classification system leaves room for greenwashing, I am motivated to confirm whether the article classifications align with the actual environmental commitment of the mutual funds. The self-proclaimed product classifications and actual sustainability performance measured in emission levels and fossil fuel investments may contain inconsistencies.

I contribute to the existing literature on the effects of SFDR in three ways. Firstly, I evaluate if SFDR has been successful in steering funds' towards more sustainable behavior using carbon emission levels as the measure for sustainability. The effect of implementation is often studied from an outside-in perspective by analyzing fund performance metrics, such as fund inflow. I expand the analysis by conducting, to my knowledge, the first study on SFDR's effects with carbon emissions as the sustainability measure and am therefore able to offer new insights complementing the existing literature (Becker, Martin and Walter, 2022; Yu, 2022). Additionally, I conduct an analysis on the effect of SFDR implementation on the investor behavior by analyzing fund netflow. This way, I contribute to the existing research by including the first six months after level 2 implementation in the analysis. As the initial level 1 regulation was widely criticized as obscure by both the financial intermediaries and the regulatory bodies, the contents of level 2 regulation were accordingly adjusted, leading to stricter requirements. The comprehensive effect of current SFDR is therefore likely to be visible only after the level 2 adjustments. Finally, I perform a comparison study between the funds in different article classes to uncover possible discrepancies between sustainability disclosure and sustainability performance. Using carbon emission level and fossil fuel involvement as measures for sustainability, I study whether Article 8 and 9 funds that demonstrate worse sustainability performance than Article 6 funds exist. This analysis offers quantitative evidence on the accuracy of SFDR labels, and thereby broadens the findings of the qualitative studies by Busch (2023) and Partiti (2023).

The results show that SFDR has accelerated the decarbonization of mutual funds' portfolios in EU. A decrease of 8 tonnes (CO^2 per €1M invested) is observed after SFDR level 2 implementation, while the effect of level 1 implementation remains insignificant. This implies that the impact on fund sustainability was achieved through the tightened requirements implemented in January 2023. Additionally, the analysis on differences between the article groups shows that the emission decreases are currently mostly driven by Article 6 funds, that are improving their sustainability practices following Article 8 and 9 funds. As the absolute carbon emission level is 40 to 60 tonnes higher in Article 6 funds compared to Article 8 and 9

funds, these results suggest that the regulation is affecting the most unsustainable funds the most, as intended.

Thirdly, I find that Article 8 and 9 labels have attracted additional netflow after level 2 implementation, suggesting that the trust towards the regulatory sustainability labels has accumulated recently. The observed effect on inflows after January 2023 is most pronounced for Article 9 funds, with an increase of 1.5 percentage points in the single sample period analysis and 0.7 percentage points in the split sample period analysis. Also Article 8 funds have attracted higher inflows than Article 6 funds, with approximately 0.9 percentage points in the single sample period and 0.3 in the split sample period analysis. However, the impact of SFDR labels is only visible after level 2 implementation, as the effect of SFDR level 1 remains insignificant in all tests. My results showing insignificant effect of SFDR level 1 are in line with Yu (2022) and partly with Ferriani (2023), as she finds the Article 8 label insignificant, even though the relevance of the Article 9 label differs from the findings of this study. In contrast, the findings contradict the findings of Becker, Martin and Walter (2022), as they demonstrate a positive effect of SFDR labels on fund netflow following level 1 implementation. However, my findings regarding the effect of SFDR level 2 are aligned with Becker, Martin and Walter, showing an increasingly positive effect on netflow. Nevertheless, since previous literature has only examined SFDR level 1 implementation, comparing the results comprehensively is not yet possible.

Finally, I find evidence that SFDR labels do not guarantee sustainability, supporting the claims expressed by Busch (2023), Partiti (2023) and Stefaniak (2023). My results show that 10 – 15 % of Article 9 funds demonstrate worse sustainability performance than an average Article 6 fund, even after the clarifications on the definitions of article classifications provided along with the level 2 regulation. Sustainability performance is first measured with carbon emissions and then with fossil fuel involvement. The results suggest that although the differences in disclosure and performance have decreased slightly regarding carbon emissions, they have significantly increased concerning fossil fuel involvement. This confirms that under SFDR, funds labelled as sustainable are still allowed to engage in environmentally harmful activities, and that the opportunity for greenwashing persists even after level 2 implementation.

The rest of the paper is structured as follows: chapter 2 provides an overview of the sustainable finance regulatory environment and introduces the main concepts related to SFDR. Chapter 3 presents the highlights of related literature and hypothesis development, and chapter 4 introduces the data and methodology used in this study. Chapter 5 showcases the results of

the statistical tests and chapter 6 provides additional perspective on the results of chapter 5 using alternative methodology. Chapter 7 discusses the findings and limitations, and chapter 8 concludes the study.

2   Overview of the regulatory environment

In 2018, the European Commission (EC) published the Sustainable Finance Action Plan (SFAP). The plan consists of three main objectives aiming towards greener future, and is aligned with the goals of Paris Agreement and the Sustainable Development Goals of the United Nations 2030 Agenda. SFAP aims for 1) steering capital towards sustainable investment and away from environmentally harmful sectors 2) managing financial risks resulting from climate change and 3) fostering transparency and long-termism.[3]

The foundation for European Union's sustainable finance regulation was strengthened when the European Green Deal policy initiative package was introduced in 2019. The package aims for net climate neutral Europe in 2050 and sets additional target of Greenhouse Gas (GHG) reductions of 55% by 2030. (European Commission, 2020) The initiative package defines large public investment plans for contributing towards the sustainability objectives, but the public sector cannot execute the transition to greener future without the support of private sector. The role of financing sector and sustainable finance is emphasized in the Green Deal package, hence the extensive reformation of Sustainable Finance regulation.

Considering mutual funds, the most significant regulatory acts following SFAP are the Sustainable Finance Disclosures Regulation (SFDR), EU Taxonomy Regulation (TR) and Corporate Sustainability Reporting Directive (CSRD). Additionally, the sustainable finance framework includes also Markets in Financial Instruments Directive (MiFiD), Insurance Distribution Directive (IDD), Undertakings for Collective Investments in Transferable Securities (UCITS) and Alternative Investment Fund Managers Directive (AIFMD) regulations. The next sub chapters will first elaborate on the mutual relationship between SFDR, TR and CSRD and then focus on the main concepts of SFDR.

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[3] COM (2018) 097. Communication From The Commission to the European Parliament, The European Council, The Council, The European Central Bank, The European Economic and Social Committee and The Committee of the Regions. Action Plan: Financing Sustainable Growth.

2.1 Interrelations of SFDR, EU Taxonomy and CSRD

SFDR is a regulation implemented to support redirecting capital towards sustainable targets as well as improve transparency and prevent greenwashing. The regulation includes a broad set of reporting requirements for financial market participants (FMPs) and financial advisors (FAs) regarding their impact on environmental and social factors. Most importantly, SFDR is intended to provide public transparency on how the investment targets perform compared to the sustainability benchmarks. The information SFDR requires FMPs and FAs to report and assess is mainly based on the data published by complying to CSRD and the mentioned sustainability benchmarks are defined by EU Taxonomy (TR).

CSRD is gradually replacing the previous corporate reporting directive NFRD, and includes the same non-financial reporting requirements as the former. With CSRD implementation, the scope of companies required to report information on e.g. their environmental and social practices was significantly extended. Differing from NFRD, CSRD is now aligned the TR and requires additional reporting on the TR metrics.[4]

TR is an entity designed for defining which economic activities can be considered sustainable. The regulation sets out six objectives considering different aspects of climate change, the first two implemented being 1) climate change mitigation and 2) climate change adaptation. For an economic activity to be considered as sustainable, it must "substantially" contribute to at least one of the objectives, and additionally fulfill the Do No Significant Harm (DNSH) criteria and comply with minimum safeguards and the technical screening criteria. (European Commission, 2023).[5] However, discussion on the criteria definitions of TR has been active during the last year, as e.g. gas and nuclear power industries were recently included as sustainable economic activities. [6]

For now, TR only considers the environmental aspect of sustainable economic activities. EC was originally planning on developing a similarly built framework for assessing social sustainability, but it is on hold for the time being (Funds Europe, 2022). Current SFDR and

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[4] Directive (EU) 2022/2464 Of the European Parliament and of the Council of 14 December 2022 Amending Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC and Directive 2013/34/EU, as regards corporate sustainability reporting. OJ L 322, 16.12.2022, p. 15-80

[5] Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088. OJ L 198, 22.6.2020, p. 13-43

[6] Commission Delegated Regulation (EU) 2022/1214 of 9 March 2022 amending Delegated Regulation (EU) 2021/2139 as regards economic activities in certain energy sectors and Delegated Regulation (EU) 2021/2178 as regards specific public disclosures for those economic activities. OJ L 188, 15.7.2022, p. 1-45

CSRD reporting is therefore also built on the assumption of specifically environmental sustainability as no unified regulatory definitions on social sustainability are available, which is why this thesis also focuses on environmental sustainability.

2.2 Objectives and structure of SFDR

The main principle of SFDR is to create an even comparison system for different financial products by improving transparency. By setting unified standards on the form and magnitude of reported information, EC aims for stopping the intentional overestimation of financial products' sustainability and thereby reducing possibilities for greenwashing. FMPs and FAs are required to report on their operations' sustainability risks and undesired sustainability impacts (Principal Adverse Impact, PAI) according to a harmonized European standard and in a predefined format. SFDR requires disclosure both on entity level (information on the operations of the FMP/FA) and product level (information on the impact of the provided product). The intensity of the required information is based on the product classification. The initial implementation of SFDR was in March 2021, and the level 2 requirements came to force in January 2023 accompanied by the Regulatory Technical Standards (RTS).[7]

2.3 Key amendments of SFDR level 2

SFDR level 1 regulates the entity-wide sustainability disclosure, such as public policies regarding the Principal Adverse Impacts or sustainability related due diligence standards.[8] In other words, it requires companies to disclose company-level information on sustainability performance, forcing to raise discussions related to the matter inside the FMPs and FAs. SFDR level 2, on the other hand, requires more detailed disclosure by defining the unified standards and methodologies for reporting sustainability-related information. The Regulatory Technical Standards (RTS) of SFDR level 2 include standardized templates in a pre-described form for reporting the mandatory disclosures of products and require reporting certain standardized sustainability performance indicators and metrics regarding the PAIs. In practice, SFDR level 2 obligates companies to report data on e.g. greenhouse gas emissions in a unified format, aiming to increase the quantity, quality and comparability of sustainability-related data.

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[7] Regulation (EU) 2019/2088 (n1)
[8] Regulation (EU) 2019/2088 (n1)

The European legislative bodies have described the SFDR level 1 as the tip of the iceberg regarding sustainability-related disclosure.[9] The European Supervisory Authorities demanded clarifications and instructions on interpretation already before the level 1 implementation from the European Commission, and later suggested SFDR level 1 regulatory requirements to be interpreted as a draft preceding the delayed level 2 regulation[10]. Therefore, the level 1 regulation does lie out the guidelines for entity level sustainability disclosure, but the detailed reporting requirements only came into force along with SFDR level 2.

Consequently, the effects on carbon emission development are likely to be more visible after SFDR level 2, as the reported sustainability data coverage increases through the obligation and achieves a more comparable format. Additionally, SFDR level 2 provides clarifications regarding the product classification system to address criticism regarding the ambiguity of SFDR Article 8 and 9 definitions and to increase trust in the classification system. Therefore, this study focuses especially on the effects of the level 2 implementation.

2.4 Article based classification system

SFDR categorizes financial products into three categories based on the level of sustainability ambition of the product. The classification system is exhaustive, hence every European fund belongs to one of the three categories. The classification to either Article 9, Article 8 or Article 6 category is intended to help investors distinguish whether the sustainability ambition of the target is aligned with their preferences. As further discussed during the following sections, the accuracy of the system for this purpose has raised doubts.

Article 9 is the category for financial products with the highest level of sustainability focus. To be eligible for Article 9, the products are required to have sustainable investment as their core objective. That is, all the investments of an Article 9 fund must qualify as sustainable investments. Article 8 products promote environmental or social features among others, but not exclusively. Article 8 funds can, consequently, manage portfolios with both sustainable and non-sustainable investments. Finally, rest of the products not fulfilling sustainable investment criteria for Article 9 or 8 are considered as Article 6. The extent of sustainability reporting requirements increases together with the classification.[11]

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[9] Joint ESA Supervisory Statement on the Application of the Sustainable Finance Disclosure Regulation, JC 2021 06

[10] Joint ESA Supervisory Statement on the Application of the Sustainable Finance Disclosure Regulation, JC 2021 06

[11] Regulation (EU) 2019/2088 (n1)

Currently, SFDR legislation defines the term sustainable investment as "an economic activity contributing to an environmental or social objective" while simultaneously complying with the DNSH criteria and minimum safeguards.[12] It is, therefore, on the responsibility of each FMP and FA to develop and report the process according to which the sustainability of an investment is evaluated. Consequently, FMPs and FAs have great responsibility on defining the proclaimed category for each product.

2.5 SFDR reporting requirements

2.5.1 Entity level reporting

FMPs and FAs are required to disclose information related to sustainability practices and risks on the legal entity level. Main purpose of the entity reporting is to bring the companies' policies regarding decision-making and sustainability risks into daylight. FMPs and FAs are required to disclose information on adverse sustainability impacts (PAIs), consistency of remuneration policies with sustainability risks and policies on how they will integrate sustainability risks into the process of investment decision-making. [13]

SFDR also requires FMPs and FAs to disclose certain information on their website. Companies have to provide information on their policies to identify and prioritize Principal Adverse Impacts (PAIs) and a description of possible identified impacts and related actions. In practice, PAIs denote negative material effects on sustainability factors that are a direct result of the firms' investment choices or worsen depending on the investment choices, such as carbon footprint and greenhouse gas emissions. If investment firms are not considering certain PAIs, they are obligated to explain why these impacts are not taken into account. Also briefings of engagement policies related to managing and preventing possible conflicts of interests need to be disclosed. SFDR disclosure relies on the comply or explain principle, expected to incentivize entities towards taking all PAIs into consideration.[14]

2.5.2 Product level reporting

According to SFDR article 7, product level disclosure requirements consist of pre-contractual disclosures, periodic reporting and website product disclosures. In pre-contractual and website product disclosures, FMPs and FAs are expected to deliver information regarding

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[12] Regulation (EU) 2019/2088 (n1)
[13] Regulation (EU) 2019/2088 (n1)
[14] Regulation (EU) 2019/2088 (n1)

each product's characteristics and investment objectives as well as an explanation on how the objectives are assessed, measured and monitored. Similarly to entity level reporting, related risks, their effects on investment returns and practices on how they're taken into account during the investment process are to be disclosed for each product. Additionally, information on how the product considers PAIs is required.

Moreover, FMPs and FAs offering Article 8 and / or Article 9 products are required to report additional information regarding the sustainability objectives of the product in pre-contractual and website disclosure as well as in periodic reporting. Disclosure requirements cover declaration on how and to which extent the product promotes the objective(s) that define the product as sustainable. Additionally, a comparison to a designated index to assess the level of impact is required. [15]

2.6 Implementation issues and article class downgrades

The applicability and interpretation of SFDR faced criticism already before the level 1 implementation, and the tightened requirements of delayed level 2 implementation resulted in extensive confusion among FMPs and FAs as well as investors (FSUG, 2023) leading also to remarkable amount of product downgrades from Article 9 to Article 8 (Morningstar, 2023). Before the initial implementation in March 2021, the European Supervisory Authorities demanded clarification for the interpretation of SFDR from the European Commission, as the practical implications of the regulations were unclear also to the authorities supervising the lawfulness of the implementation executed by FMPs and FAs. The national FSAs, FMPs and FAs also called for clarifications after the initial implementation of SFDR, which resulted in the final 12-month delay of the level 2 requirements.[16]

Following the publication of the clarifications regarding the SFDR level 2 regulation and the interpretation of the RTS during the early months of 2022, funds received information regarding the stricter qualifications of Article 9 funds from January 2023 onwards. This resulted in a significant amount of products classified as Article 9 being reclassified as Article 8 during the fourth quarter of 2022. During Q4/2022, over 300 funds representing €175B in assets downgraded to Article 8 (Morningstar, 2023). This effect was, however, mainly limited

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[15] Regulation (EU) 2019/2088 (n1)
[16] ESAs (2021) Letter: Priority issues relating to SFDR application

to changes between Article 9 and 8, as only seven funds downgraded from Article 8 to Article 6 during the same period.

SFDR has been criticized for creating opportunities for greenwashing, to which also the European Commission has been forced to react.[17] Wide range of parties affected by the SFDR have raised concerns regarding the interpretation of SFDR, especially regarding the product classification system (FSUG, 2023; Busch, 2023; Partiti, 2023). Main concern regarding interpretation is stated to be the lack of unified definition of a sustainable investment, shifting the responsibility for definition to FMPs and FAs themselves. According to Busch (2023), the core problem arises from the interpretation of the regulation itself – SFDR was intended to be merely a disclosure framework, but is now broadly perceived as a classification system. However, as widely discussed, without a unified approach for defining sustainable investment, the accuracy and reliability of the classification system seems vague[18] (Partiti, 2023). At the time of writing this paper, the European Commission is gathering responses to the public consultation assessing usability and legal certainty of SFDR.[19]

3 Literature review

3.1 Key issues in the field of sustainable investing

Together with the increasing demand of sustainable investment products, also the demand for sustainability data has increased. The ESG scoring system was introduced for this purpose, but has later faced severe criticism from academics as well as industry professionals. Evaluating the ESG factors has become a monumental part of decision making, especially for institutional investors. As Cornell (2020) states, the ESG factors have been particularly emphasized as the initial corporate objective of maximizing shareholder value has been implied to be outdated. However, the vagueness regarding the true contents of sustainable investment products, such as ESG-labeled funds, and the rating systems used to evaluate these products have led to a major problem of comparability (Abhayawansa and Tyagi, 2021; Berg, Klöbel anad Rigobon, 2022; Cornell, 2020).

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[17] ESMA (2022) (n2)
[18] ESA (2023) Call for Evidence on Greenwashing, 4: EFAMA's Response to ESMA's Call For Evidence On Greenwashing
[19] ESA (2022) Annex II: Amendments to answers to questions on the interpretation of Regulation (EU) 2019/2088, submitted by the European Supervisory Authorities, adopted on 6 July 2021 and 13 May 2022

The ESG score system aims for clarity and comparability by offering a singular score ranging from 0 to 100, that describes the responsibility level of said product or company. The problem arises, as the ESG ratings by different rating agencies are poorly correlated. In line with Cornell (2020) and Abhayawansa and Tyagi (2021), Dimson, Marsh and Staunton (2020) prove that even the leading rating agencies' scorings are in great disagreement with each other. As ESG ratings were created to provide external input on the credibility of the target, following the footsteps of the credit rating system, the lack of correlation between agency providers' estimates implies issues with transparency. Previous literature (Gidwani, 2020; Dimson, Marsh and Staunton, 2020) indicates a consensus that using ESG ratings in investment processes is often misleading.

In addition to varying methodologies regarding ESG-ratings, also the interpretation of sustainability measures may cause significant differences. Ultimately, decisions regarding the assessment of ESG performance are inherently subjective, and highly dependent on the preferences and values of individual analysts. Recent literature (Christensen, Serafeim and Sikochi, 2022; Dimson, Marsh and Staunton, 2020; Abhayawansa and Tyagi, 2021) states that regardless of rating agencies attempts to achieve objectivity, subjectivity of decision making has an integral role in ESG metrics and its' effects cannot be disregarded. However, the rating providers' public efforts towards achieving objective – and complex – methodologies for measuring sustainability may lead investors to the false belief of entirely reliable and objective data, ignoring the significant effect of analysts' subjective input (Christensen, Serafeim and Sikochi, 2022; Tang, Yan and Yao, 2021; Berg, Klöbel and Rigobon, 2022).

Even though greenwashing first emerged in the retail and ecommerce industries, the similar means for achieving an environmental-friendly image are now being used in the financial sector (Abouarab, Mishra and Simon, 2022). Investment targets labeled as sustainable attract, on average, more investments than targets with otherwise similar characteristics (Liang, Sun and Teo, 2021; Kaustia and Yu, 2021). Therefore, the risk of companies labeling or repurposing an investment product as a sustainable without actually directing resources towards sustainability efforts is concrete. Migliorelli (2021) argues that as investors' awareness towards sustainability related factors has increased, labeling products, formally or informally, as "sustainable", "green" or "responsible" for marketing purposes correspondingly becomes more effective. Recent literature (Migliorelli, 2021; Kleffel and Muck, 2023) implies that the tendency to fall for greenwashing is related to investors' intrinsic motivation of "doing good". Thereby

disclosing vast amounts of ESG information to cover for poor ESG performance can effectively mislead investors, if regulation is not effective in distinguishing it.

3.2 Sustainability protocols and the behavior of mutual funds and their investors

Based on existing literature, it appears that investors do value sustainability and that sustainable funds attract higher capital inflows. However, results on whether the increased demand is achieved through actual sustainability performance or rather through sustainability labels are varying. Hartzmark and Sussman (2019) study the effect of Morningstar Sustainability Ratings on fund flow and suggest that highly ranked funds receive excess inflow whereass funds with low ranking experience net ouflow, indicating that investors do integrate the sustainability information into their decision-making. Also Ammann, et al. (2018) find evidence that high Morningstar Sustainability Ratings positively affect the inflows of mutual funds, even though the effect on institutional investors is weaker, and Ferriani (2023) argues that Morningstar Ratings are a relevant factor in explaining heterogenity in fund inflows. Followingly, Baker, Egan and Sarkar (2022) suggest that investors are willing to pay a premium for funds with high ESG ratings. These findings imply that the sustainability information provided in a simple format by rating agencies does affect investor behavior.

In addition to sustainability and ESG rating agencies, several organizations and governmental bodies assign labels for investment products based on a variety of sustainability attributes. Existing literature has shown that sustainability labels awarded by governmental and nonprofit organizations are associated with high additional inflow (Brito-Ramos, et al., 2024). On the other hand, also labels assigned by companies are recognized by investors, as funds with Morningstar Low Carbon designation label receive additional inflow (Ceccarelli, Ramelli and Wagner, 2022). Certain sustainability labels, however, differ from the above mentioned as they are self-assigned. Brito-Ramos, et al. (2024) suggest that the effect of self-proclaimed labels, such as ESG related fund name, remains insignificant, indicating that investors require certain level of objectivity from the assigning party.

Also the SFDR article classifications can be considered as part of this self-proclaimed category, although the labeling system relies on legislation. Consequently, the findings on the effectiveness of SFDR vary. Yu (2022) suggests that SFDR labels do not result in additional inflow, Becker, Martin and Walter (2022) argue that SFDR labels do attract excess capital and Ferriani (2023) only describes Article 9 classification as significant instead of both Article 8 and Article 9. Overall, the SFDR classification system has been criticized for leaving room for greenwashing.

Although the greenwashing concerns related to SFDR article classifications are a relatively new topic and therefore yet scarcely researched, previous literature clearly shows that greenwashing in mutual funds has been a prominent issue. Despite SFDR being introduced specifically to address this problem, the novel research on the effects of SFDR implementation on mutual funds confirm that the concern regarding greenwashing will likely remain relevant also in the future.

As well as recent news articles (Follow the Money, 2022), also recent academic articles indicate that funds practice greenwashing, either consciously or inadvertently. Li and Melvin (2023) find that significant share of mutual funds with "ESG" in their name do not invest accordingly, holding a portfolio which does not reflect the criteria. Even if the funds do not specifically claim to invest in an environmentally responsible manner, merely the label name is likely to mislead capital that is intended towards sustainable investments, and thereby contribute to greenwashing. Also Kaustia and Yu (2021) show that ESG-labeled mutual funds attract more inflow compared to non-labeled peers, even when external sustainability rating contradicts with the ESG-label, indicating greenwashing behavior. Furthermore, Dumitrescu, Gil-Bazo and Zhou (2022) suggest that in the US, 1 of 3 mutual funds do not invest according to their ESG practices defined in the fund prospectus and Abouarab, Mishra and Simon (2022) show that sustainably marketed funds fail to outperform in decreasing carbon emission levels.

Recent literature also implies that greenwashing appears evident when researching disclosure practices instead of labeling. Yu, Luu and Chen (2020) state that addressing the inconsistency between ESG disclosure and ESG performance would be necessary, as they find significant differences between the two and raise concerns regarding greenwashing behavior. On the other hand, Clement, Robinot and Trespeuch (2023) argue that the lack of comparability is a more significant issue than greenwashing. While Yu, Luu and Chen (2020) suggest that funds practicing greenwashing are likely to disclose large amounts of ESG data despite their poor ESG performance, Marquis, Toffel and Zhou (2016) suggest that funds associated with greenwashing would be the ones choosing not to disclose any selective sustainability information. As SFDR places the mandatory disclosure mandate for all financial institutions, the former definition is likely to be more accurate definition in the future discussions.

3.3 Disclosure requirements as a regulatory tool

Requiring companies to disclose certain information is not a novel concept in the European Union legislation regime. Traditionally, these mandatory disclosure requirements have been

used to mitigate agency problems between the inside and outside parties related to the company. These legislative actions have required public information on e.g. company leadership and state of the company financials. Rolo (2022) suggests that instead of purely preventing agency problems, the disclosure regulation has recently shifted towards acting as a tool for steering corporate governance. According to Rolo (2022), mandatory disclosures are changing corporate behavior by increasing the amount of information for shareholders and stakeholders. However, recent research fails to find consensus on whether this approach is effective.

Weil, et al. (2005) argue that disclosure requirements aiming for transparency are only effective in steering corporate behavior if the information provided is embedded into the decision-making processes of the users of the information. If the users do not consider the provided information as pivotal to their decision-making, the effect of additional disclosure will likely remain indifferent. Prior literature (Schneider and Ben-Shahar, 2015; Weil et al., 2005) suggests that one of the few examples of widely successful mandatory disclosure requirement has been nutrition labeling. Consumers and companies have integrated the additional information in their decision making processes by avoiding certain choices considered as unhealthy. However, previous studies (Doshi, Fowell and Toffel, 2013; Schneider and Ben-Shahar, 2015) suggest that mandatory disclosure requirements have often failed to improve corporate governance, as the additional information provided has not been properly understood and integrated into decision-making.

Cremasco and Boni (2022) and Ferriani (2023) suggest that disclosure requirements set by SFDR would not be effective in shaping funds' or investors' investment behavior. On the other hand, Becker, Martin and Walter (2022) show that the implementation of SFDR was successful in steering funds' investment behavior leading to higher sustainability ratings. Clearly, more research is to be conducted to arrive at a consensus.

3.4   The relationship between environmental disclosure and environmental performance

The functioning logic of SFDR relies on the impact of corporate disclosure, as companies are required to publicly state if they consider certain ESG factors or adverse sustainability impacts (PAIs) and explain why, if they do not.[20] Previous literature has studied the effect of

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[20] Regulation (EU) 2019/2088 (n1)

sustainability disclosure regarding carbon emissions and found conflicting results regarding the alignment between company disclosure and actual performance.

Bui, Houqe and Zaman, (2020) show that in companies with active climate governance, accurate alignment between corporate sustainability disclosure and sustainability performance was observed, indicating that no room was left for greenwashing. Similarly, Luo and Tang (2014) state that companies' voluntary disclosure on carbon emission is indicative of their carbon performance.

However, previous research mostly finds evidence on companies practicing intentional overstatement in companies' environmental disclosures, known as greenwashing. Wedari, Jubb and Moradi-Motlagh (2021) demonstrate a negative correlation between climate-related disclosure and 1-year lagged environmental performance among companies with consistently increasing carbon emissions. Similar effect is not visible among companies with consistently decreasing emissions, indicating intentional actions to influence negative perceptions by the companies with poor environmental performance. Also In and Schumacher (2021) report misalignment between corporate disclosures on carbon performance and records of actual carbon performance.

The existing literature extensively states the gaps on disclosure regulation and fluctuation in reporting practices as the main reasons for the found misalignment (Wedari, Jubb and Moradi-Motlagh, 2021; In and Schumacher, 2021). Considering the main objectives of SFDR, the regulation has explicitly been established to address the misalignment between disclosure and performance by improving transparency and thereby preventing greenwashing. It is therefore expected that after implementing the unified reporting practices of SFDR, sustainability disclosure of companies should more accurately reflect the underlying sustainability performance. However, as Wedari, Jubb and Moradi-Motlagh (2021) and In and Schumacher (2021) both state, the disclosure practices focused more on the future oriented targets rather than observed effects on sustainability. As also the article classification system of SFDR is based on the level of sustainability ambition instead of current performance[21], the stated problem is likely to persist.

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[21] Regulation (EU) 2019/2088 (n1)

3.5   Hypothesis development

With my first hypothesis, I aim to verify the concerns regarding SFDR's lack of concrete effects. As Partiti (2021) and Stefaniak (2023) conclude, the ambiguity and complexity of the SFDR framework has led to a partially biased interpretation of the regulation by financial market participants. Instead of adapting to the common policy of transparent reporting and hence being incentivized to let go of emission intensive investments, the market has realized the benefits of the self-proclaimed labeling process. Whereas the regulation relies on the penalizing effect of having to disclose potentially undesirable non-financial information with the same accuracy as financial information, the unclear and ambiguous definitions of the article classification requirements leave room for label misuse.

As the European Union specifically addresses the objective of steering capital towards less carbon-intensive targets and achieving climate neutrality during the following decades[22], aiming for reduced carbon emissions is also an integrated part of the SFDR framework. Hence, it is reasonable to expect that the implementation of such regulation would result in a visible decrease in the emission levels of the funds, presuming that the regulatory package was effective. However, considering the several shortcomings of the regulatory environment addressed by e.g. Busch (2023), Partiti (2021) and Stefaniak (2023), I expect that the regulation has not been successful in achieving it's low-carbon objectives. Naturally, studying these assumptions further requires excluding dedicated impact funds from the study due to the different nature of operations regarding emissions. This leads me to the first hypotheses of the thesis:

Hypothesis 1: The implementation of SFDR has not affected European mutual funds'
portfolio carbon emissions

Regardless of the measurable effects on fund-level sustainability, previous literature shows that sustainability-related labels are associated with excess fund flows (Liang, Sun and Teo, 2021; Becker, Martin and Walter, 2022; Shapiro, 2023; Ceccarelli, Ramellim and Wagner, 2024). Although this effect is desirable when assessing the ability to affect movements of capital and increased appetite for sustainable investment targets, it may also falsely incentivize seeking the benefits of a sustainable label without addressing the related requirements. Considering also the observations of Busch (2023) and Stefaniak (2023) regarding the

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[22] COM (2018) 097 (n3)

interpretation of SFDR classification scheme, it is reasonable to expect that SFDR article classifications are not an exception in fulfilling the investor demand for responsible investment targets.

Even though especially ESG related claims and effects of ESG labels have been increasingly studied in the universe of mutual funds, the literature on SFDR and it's effects is still scarce due to the novelty of the regulatory package. Becker, Martin and Walter (2022) were able to show that after the implementation of SFDR level 1 requirements in March 2021, funds classified as Article 8 or Article 9 received additional fund flows compared to Article 6 funds. On the other hand, Yu (2022) suggests that SFDR labels did not attract additional capital after controlling for other sustainability labels after the implementation of SFDR level 1, contrary to the findings of Becker, Martin and Walter (2022). As the level 2 requirements were implemented at the beginning of 2023, the tightening demands especially for Article 9 classifications resulted in article downgrades worth of \$175B fund holdings (Reuters, 2023). Assuming that the clarifications provided together with the level 2 implementation were sufficient and the investor demand for sustainable investment targets persists, Article 8 and Article 9 funds should have attracted additional inflow similarly to the findings of Becker, Martin and Walter (2022). Thereby the second hypothesis of the thesis is:

Hypothesis 2: Funds classified as Article 8 and Article 9 attract additional fund flows compared to Article 6 funds

As the scarce financial literature indicates, quantitatively measuring the effects of sustainable finance regulation is mostly restricted to analyzing financial performance and fund flows. However, improving comparability and transparency and thereby limiting greenwashing is one of the key objectives of SFDR[23], and analyzing the effects of SFDR without considering the transparency aspect would be inadequate. The findings of Busch (2023) and Partiti (2023) are in line with the findings of The Great Green Investment Investigation (Follow the Money, 2022) and suggest that a remarkable share of investment funds stating sustainability as their objective are simultaneously engaged in environmentally harmful activities, such as fossil fuel and carbon-intensive industries.

The current regulation classifies funds based on their sustainability ambitions and the related requirements are set corresponding to the article class.[24] This serves the purpose of improving

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[23] Regulation (EU) 2019/2088 (n1)
[24] Regulation (EU) 2019/2088 (n1)

transparency by requiring more detailed reporting from the highest article classes, but does not obligate any exclusions from environmentally harmful activities. As the supervision of complying with SFDR criteria is not unified across Europe, the leniency of national supervisory bodies varies. In other words, funds taking advantage of this feature are not necessarily acting against the law, and the transparency objective of the regulation is therefore not fully realized.

Based on the responses to the Call for Evidende (CfE) released by the European Supervisory Authorities, several Article 9 funds were found to violate the UNGC principles as well as derive majority of their revenues from fossil fuels[25],[26],[27]. Additionally, the CfE responses highlight the problematic un-unified nature of SFDR implementation regarding e.g. sector exclusion and GHG cutoffs.[28] It is therefore reasonable to expect that Article 8 and 9 funds with fossil fuel involvement and carbon emission level contradicting with their sustainability objectives are present also in the studied sample, even after the implementation of the clarified level 2 reporting requirements. Hence, the third hypotheses of the thesis are:

3a: Share of Article 8 and Article 9 funds with higher carbon emissions than Article 6 funds has not decreased after SFDR level 2 implementation

3b: Share of Article 8 and Article 9 funds with higher fossil fuel involvement than Article 6 funds has not decreased after SFDR level 2 implementation

4   Data and methodology

4.1   Sources of data

I construct the sample utilizing mutual fund data from Morningstar Direct. The database allows for categorizing fund data based on their SFDR classifications, enabling comparison between the "unclassified" Article 6 funds and sustainably motivated Article 8 and Article 9 funds. Therefore I use Morningstar Direct as the source for both the sustainability data and the financial data. For the SFDR Article classifications, only the most recent classification is

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[25] ESA (2023) Call for Evidence on Greenwashing, 1: Article 9 Funds: Uncovering Data Inconsistencies in EET Disclosures.
[26] ESA (2023) Call for Evidence on Greenwashing, 2: Position Paper: Dutch Pension Funds' Views on Greenwashing
[27] ESA (2023) Call for Evidence on Greenwashing, 4: EFAMA's Response to ESMA's Call For Evidence On Greenwashing
[28] ESA (2023) Call for Evidence on Greenwashing, 3: Annex: ESA CALL FOR EVIDENCE

available. Consequently, the sample is frozen and the potential effect of movement between article categories is not considered.

4.2   Sample selection

To analyze the overall carbon performance development of European funds, as well as the differences between different classifications of European funds, I construct two different data samples: one including only European funds and the other including both European and US funds. As later discussed, the availability of carbon emission data on US funds is limited, and the control group does not therefore fully represent an average US fund. However, the opportunity to compare the pace of portfolio decarbonization between highly regulated (EU) and lowly regulated (US) areas helps to contextualize the extent to which portfolio decarbonization is due to the global trend of sustainability, as opposed to regulatory intervention.

The sample of European funds is constructed using the Morningstar Direct database, starting from the universe of Global Open-End Funds. The initial sample is narrowed down to open-end funds domiciled in Europe, as funds outside Europe are not subject to the EU SFDR regulation and thereby irrelevant for testing. Following Abate and Ferrari (2021), the sample is limited to equity funds and to be included, the funds are required to be denominated in Euro. To ensure continuity, the sample is further narrowed down by only including the oldest share class of each fund, also following Abate and Ferrari (2021).

I construct the sample using monthly mutual fund data starting from September 2019 and ending in June 2023. The start date of the sample aligns with the approval timeline of the SFDR. This marks the point at which the financial market participants first received information about the upcoming mandatory disclosure, even though the SFDR level 1 requirements did not come into force until March 2021. The end date is set to cover the first six months of funds' operations after the enforcement of SFDR level 2 in January 2023. I exclude all observations with missing variables from the sample. Ultimately, I arrive at a comprehensive dataset of 78,148 fund-month observations from 4,489 unique funds.

Additionally, I gather data on US based mutual funds to construct a control group sample. I follow the limitations set for the European sample, with the corresponding exceptions of domiciled in the US and denominated in US Dollar. As I exclude all observations with missing variables, the final sample size of control group decreases significantly due to missing emission

data. Thereby I arrive at a dataset of 44,663 fund-month observations from 2,481 unique funds. The features of the sample and possible selection effects are further discussed in section 4.2.1.

To be able to reasonably measure sustainability performance using carbon emissions, I exclude dedicated impact funds from the sample. This is due to the different nature of such funds' sustainability actions, that are commonly executed by investing in high emission intensity targets and then reshaping the operations over the long-term ownership period. First, I exclude all funds categorized by Morningstar as "practicing impact investing"[29], removing 23 funds from the sample. Afterwards, I check for funds with name containing the word "impact", and remove additional 2 funds. Finally, I manually review the prospectuses of the 30 highest-emitting funds to determine if any needed to be removed, but find no impact investing objectives.

Finally, all variables are winsorized at 1% and 99% level, following Becker, Martin and Walter. For studying the separate effects of SFDR level 1 and SFDR level 2 implementations, I further divide the European and the combined samples into two sub samples: level 1 sub sample covering observations from September 2019 to December 2022 and level 2 sample covering observations from June 2021 to June 2023. This results in level 1 sub sample with 56,335 observations and level 2 sub sample with 67,974 observations for the European sample and level 1 sub sample with 28,618 observations and level 2 sub sample with 32,073 observations for the US sample.

4.2.1   Composition of US control group

The considerable amount of US funds with missing data is due to the fact that financial institutions are not regulated on a federal level with regards to carbon emission reporting. It is important to note that this control group is not able to build a perfectly representative picture of an average US fund, as carbon emission disclosure is currently only regulated in the states of Washington[30] and California[31], and to some extent in Oregon[32], and the regulations have been applied only recently. As a result, these states are therefore overrepresented in the control sample. As carbon disclosure is not federally mandated, is is probable that the funds with

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[29] Morningstar Direct, Data on November 2023
[30] 173-441 WAC Washington Climate Commitment Act
[31] SB 253 Climate Corporate Data Accountability Act & SB 261 Climate Related Financial Risk Act
[32] Oregon Greenhouse Gas Reporting Program

available carbon emission data and hence included in the control sample are, on average, less emitting than an average US fund.

To offer further insights into the characteristics of the control group, Table 1 presents the geographical distribution of the funds. As Morningstar does not provide information on the home states of funds, the distribution is further analysed by manually gathering information on 10% (248) of the control group funds. The 10% sample is selected at random. The random sample test indicates that funds legally registered to California cover for 21% of the control group sample, while funds in Washington for 8% of the sample. The overrepresentation was expected due to the existing reporting regulation. In contrast, Oregon has no funds in this sample, despite the presence of regulations. Other states account for approximately 70% of the sample, with Delaware (31%) and Massachusetts (20%) appearing most frequently. Although these states do not currently have a specific carbon disclosure regulation in place, the state of Delaware has introduced an ambitious carbon reduction strategy (Delaware Climate Action Plan) and the state of Massachusetts is currently developing the Massachusetts Priority Climate Action Plan. This may explain the overrepresentation of these states in the sample. However, it is important to note that especially Delaware offers an attractive taxation scheme for funds registered in the state, which may also contribute to the overrepresentation, as the state is also overall overrepresented as fund legal registration location.

In order to gain a deeper understanding of the composition of the control group, Table 2 presents the key observables of two groups: the US control group funds and the US funds that were excluded from the control group. The sample of funds excluded from control group was selected by forming a random sample of the same size as the control group. This comparison demonstrates that the control group funds are relatively similar to other funds in terms of return, with an average monthly return of 0.89% for control group funds and 0.85% for other funds. The average monthly netflow is negative for both groups, but lower for control group (-0.38%) than for other funds (-0.25%). The most significant distinction between these two groups is in size. The average control group fund is over four times smaller in terms of total net assets, with an average fund size of €395M, than a fund excluded from control group, which has an an average fund size of €1,789M. Comparing the fund age and share of institutional funds reveals that the funds in control group are on average five years older, and have a significantly higher proportion of institutional funds (0.44 for the control group, 0.13 for the others). This indicates that the funds in the control group are significantly smaller than the an average US fund, while they are also more often institutional. As according to Kaustia and Yu (2021) and Dyck et al.

(2019), higher level of institutional ownership is associated with better sustainability performance, this supports the assumption that the control group funds likely exhibit better sustainability performance than an average US fund. Furthermore, the share of funds with a sustainability focus[33] is higher among the control group funds (7%) than among the others (4%), although the difference is relatively modest.

In addition to being subject to state-level regulation or purely voluntarily choosing to report, the portfolio-level emission data may be available if the fund has only invested in companies that are required to report by the federal GHGRP, the fund is preparing for SEC climate disclosure regulation compliance or the fund is also operating in Europe and preparing for CSDDD compliance. Nevertheless, especially the latter two factors indicate voluntary engagement in sustainability protocols to some extent, and also these funds are therefore more likely to exhibit better-than-average sustainability performance than the average fund.

Therefore, before the federally mandating SEC climate disclosure regulation and the CSDDD gradually come into force from 2024 onwards, the data on US funds' carbon emissions will likely portray a significantly more positive picture than a country-wide sample would. Nevertheless, as this study focuses on the relative development of carbon emissions instead of absolute values, using US funds as a control group still provides insights on the impact and effectiveness of EU regulation.

4.3 Variables of interest

4.3.1 Carbon emission data

I retrieve data on each funds' portfolio carbon emissions from Morningstar Direct. The measure for carbon emissions (CE) used in this study is *carbon emissions (CO_2) in tonnes per €1M invested*, which allows relative comparison between funds of different sizes.

The variable is calculated followingly. The absolute amount of carbon emissions equals the sum of portfolio company's reported Scope 1 and Scope 2 emissions. The absolute amount of a company's emissions is then multiplied by the share of the fund's holding in said company, to define the proportion of company's emissions attributable to the owner. This process is

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[33] Morningstar Datapoint Definition: Describes full dedication on sustainability [..] or considering ESG factors in its prospectus or regulatory filings.

repeated for all portfolio companies and the attributable carbon emissions are summed together. Finally, the total CE is divided by the total sum invested (€M).[34]

The final monthly *carbon emissions (CO²) in tonnes per €1M invested* for each fund comprises of the emissions of the portfolio companies with available data for the month in question. In other words, if there is no data on portfolio company's emissions on a certain month, it is excluded from the fund's portfolio emissions calculation of the certain month. Therefore it should be acknowledged that the portfolio emission data is not necessarily a comprehensive picture of all funds due to this possible absence of some portfolio companies' data. However, it represents the most comprehensive data currently available and is expected to improve along with the implementation of current and further regulatory measures, as CE is one of the mandatory PAIs to report under SFDR and CSDDD.

Scope 3 emissions are out the breadth of this study, as the reporting requirement was just extended outside Scope 1 and Scope 2 during 2024, meaning that data coverage is not yet sufficient. Additionally, the coverage of carbon emission data is weaker among the US based funds, as there are no federal GHG reporting requirements in force yet. This might result in a reporting bias regarding the control group sample, which must be considered when analyzing the differences between these two groups.

4.3.2 Netflow data

Data on fund flows is also gathered from Morningstar Direct. I define monthly net inflow following Becker, Martin and Walter, i.e., calculate the monthly netflow for each fund as a percentage of total net assets as follows:

$$TNA_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1}\,(1 + R_{i,t})}{TNA_{i,t-1}}$$

where $TNA_{i,t}$ denotes the total net assets of fund i at the end of month t, $TNA_{i,t-1}$ denotes the total net assets of fund i at the end of the previous month and $R_{i,t}$ denotes the return of fund i on month t.

4.3.3 Fossil Fuel Involvement data

As an alternative measure for sustainability, section 5.3 utilizes data on fossil fuel involvement of Article 8 and Article 9 funds. Morningstar Direct defines the variable as the

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[34] Morningstar Direct, Datapoint Definition & Datapoint Methodology

asset-weighted percentage of fund's holdings in the following sub-industries: Thermal coal extraction, thermal coal power generation, oil and gas production, oil and gas power generation & oil and gas products and services.

4.4 Control variables

For the most parts, this paper follows the approach of Becker, Martin and Walter (2022) and Alda (2020) in choosing control variables. In addition to fund netflow, monthly data on fund size, return and fund age is obtained from Morningstar Direct. Fund size is defined as the logarithm of total net assets and fund age as months since inception date.

Differing from Becker, Martin and Walter (2022), I also retrieve data on the fund ownership. Previous literature (Kaustia and Yu, 2021; Dyck, et al., 2019) shows that higher level of institutional ownership is associated with higher firm-level ESG scores. It is therefore reasonable to expect that high level of institutional ownership in a fund also affects its' sustainability performance, and therefore needs to be controlled to capture only the regulations' effects on fund sustainability. Followingly, I retrieve also the institutional indicator for each unique fund, that shows whether the fund is institutional based on three alternative definitions: has the word "institutional" in its name, has a minimum initial investment of $100 000 or more or states in its prospectus that it is designed for institutional investors.

4.5 Descriptive statistics

4.5.1 Summary statistics

The summary statistics for the variables used in this study are presented in Tables 3 – 5. Tables 3A to 5A report summary statistics on fund-level, and Tables 3B to 5B on observation-level. An important remark regarding the differences between Europe and US, both on fund-level and observation-level, is that the mean and median for carbon emission is lower in US based funds than in European funds in the studied sample. This might be explained by the above-mentioned features of the control sample. The lack of obligating federal emission reporting regulation in the US results in a selective reporting bias regarding the emissions, as it is reasonable to assume that the companies valuing sustainability high are more likely to report voluntarily. This does not, however, preclude using the group of US funds as the control group, as the study focuses on the magnitude of observed change, not absolute values.

4.5.2 Correlation matrix

Table 6 reports the correlation matrix between the variables of interest and control variables. The correlations between each variable are low, mostly ranging from -0.04 to 0.06, suggesting that all control variables are independently valuable for the regression study. Correlations between Return and Netflow and Return and Age receive highest values, 0.15 and 0.12 respectively, but can still be considered relatively low and hence do not limit the use of these controls.

4.6 Methodology

4.6.1 The effect of SFDR regulation on fund sustainability behavior

The mandatory disclosure regulation aims to direct money flows towards more sustainable targets. In the case of mutual funds, this means decreasing portfolio emissions, among other sustainability measures. I test the effectiveness of the pursued steering by analyzing the development of funds' portfolio carbon emissions before and after the implementation of SFDR. Carbon emissions are used as the measure for actual environmental performance following Wedari, Jubb and Moradi-Motlagh (2022).

The dataset consists of the treatment group of European mutual funds and the control group of US mutual funds. To avoid flawed comparison, the dataset is matched using 1:1 nearest neighbor matching, following Becker, Martin and Walter (2022) and Bilbao-Terol, et al. (2017). The control observations are allowed to be matched more than once to improve the matching accuracy, and the unmatched observations are removed from the sample.

I use two separate data samples, sample 1 for capturing the effect of level 1 implementation and sample 2 for level 2 implementation. Sample period 1 spans from September 2019 to December 2022, and Sample period 2 from June 2021 to June 2023. I test the effect of the regulation on portfolio carbon emissions by running two separate regressions using the following model:

$$(1)\ CE = \beta_0 * \text{Treated} + \beta_1 * \text{Post}_t + \beta_2 * \text{Treated}_i * \text{Post}_t + \beta_3 * \text{Size}_{i,t-1} + \beta_4 *$$
$$\text{Age}_{i,t-1} + \beta_5 * \text{Return}_{i,t-1} + \beta_6 * \text{Flow}_{i,t-1} + \text{Institutional}_i + \varepsilon_i,$$

Where *CE* describes the Carbon Emissions of a fund i. *Treated* is a dummy variable equaling 1 for all fund subject to SFDR regulation (treatment group of European funds) and 0 for others (control group of US funds). *Post* is a dummy variable equaling 1 for all observations after the time of implementation, and 0 for others. *Treated*Post* is the interaction variable capturing the

combined effect of the two. I control for fund size, age, return and netflow. Additionally, I use the dummy *Institutional* as a control for institutional ownership.

First, I run the regressions using the combined sample of European and US funds to assess the overall development of carbon emissions in Europe. Secondly, I run the regression using the European sample divided by article class to assess the differences in carbon emission development between article classes.

4.6.2   *The effect of SFDR on Article 8 and 9 fund flows*

As the European Securities and Markets Authority (ESMA) states in their risk analysis published in October 2023, strong demand for sustainable investment products incentivizes greenwashing. Also Kaustia and Yu (2021) and Liang, Sun and Teo (2021) suggest that sustainable funds are seen as more attractive than "regular", non-sustainable, funds from the investor perspective. To verify whether this is apparent for funds classified as Article 8 and Article 9, I test the effect of SFDR classifications on mutual fund flows. I expect the funds classified as Article 8 and Article 9 to gather higher fund netflows than the Article 6 funds.

Using solely the Article 8 and 9 labels as a definition for sustainable funds, however, does not build a comprehensive picture of the factors affecting investors' decisions. In May 2022, ESMA published the principles-based guidance covering the practices of naming funds as "sustainable", "ESG" or "Green". Following the guidance, only funds classified as Article 8 or Article 9 have the right to use such descriptive terms in their name. Therefore, along with the article-based classifications, also these general sustainability labels may affect fund flows. Differing from the methodology of Becker, Martin and Walter (2022), I control for these labels in addition to article classifications using dummy variables. The comprehensive list of sustainability indicator words is gathered by ESMA and includes both general ESG references and more specific E and S descriptions.[35] As the list published by ESMA is extremely comprehensive, comprising over 1,000 sustainability words, I limit the controlled words to the 25 most frequent terms, including for example "Sustainable", "ESG", "Green", "Net Zero" and "Environmental". The dummy variable equals 1 if then name of the fund contains one or more of the chosen sustainability terms and 0 otherwise. Consequently, it can be used as a control variable for the netflow regressions. However, the fund names are evaluated based on the

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[35] ESMA (2023) ESMA Report on Trends, Risks and Vulnerabilities Risk Analysis - ESG Names and Claims in the EU Fund Industry, amending regulation (EU) 2010/1095 of European Parliament and of the Council of 24

current fund name in the data retrieved from Morningstar in January 2024. Therefore, the possible effect of name changes is not captured by this control variable.

The test is conducted using a sample of European funds classified in three sections. The first sample studies Article 8 funds and includes Article 6 funds as control group, the second studies Article 9 funds and includes Article 6 funds as control group, and the third includes both Article 8 and 9 funds and Article 6 funds as control group. The samples are matched using 1:1 nearest neighbor matching method to improve the comparison quality of statistical models, following Becker, Martin and Walter (2022) and Bilbao-Terol, et al. (2017). I allow the control observations to be used more than once, and remove the unmatched observations from the sample.

I test the hypothesis with the following model:

$$(2)\ Netflow_{i,t} = \beta_0 * Treated_i + \beta_1 * Post_t + \beta_2 * (Treated_i * Post_t) + \beta_3 * Label_i$$
$$+ \beta_4 * Size_{i,t-1} + \beta_5 * Age_{i.t-1} + \beta_6 * Return_{i.t-1} + \varepsilon_i,$$

Where *Netflow* is the net of fund flows of fund i in month t calculated according to the methodology in section 4.3.2. Here, *Treated* is a dummy variable equaling 1 for all observations classified as Article 8 and/or Article 9 corresponding to the regression in question and 0 for the control group. *Post* is a dummy variable equaling 1 for all observations after the time of implementation, and 0 for others. *Treated*Post* is the interaction term capturing the difference-in-difference effect. The dummy variable *Label* equals 1 if the funds' name contains one or more of the sustainability-related terms, such as "ESG", "Green", "Sustainable", "Environmental" or "Responsible"[36]. I control for fund size, age and return.

4.6.3 *The accuracy of SFDR Article labeling*

In addition to the analysis on the development of carbon emissions and additional fund flows associated with SFDR labels, this study aims to shed light on the reliability of the labeling system. The widely discussed problem regarding the labeling system is that the regulatory framework provides a sustainability label that is interpreted as a self-explanatory sustainability guarantee among the market participants, even though it is not (Busch, 2023; Bodellini, 2023). The definitions of the sustainable Article 8 and Article 9 classification requirements are based

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[36] ESMA (2023) (n35)

on the self-proclaimed level of sustainability ambition[37] and therefore offer space for both unintentional misunderstanding and intentional misleading.

Even though the topic of SFDR labeling is widely discussed in recent literature, literature studying the possible controversies between the labels and labeled funds' concrete sustainability performance is scarce. I study the sustainability controversies of Article 8 and Article 9 funds by conducting a simple comparative analysis following Liang, Sun and Teo (2021) and van Sambeek (2024). As the measures for concrete sustainability performance, I use fund portfolio carbon emissions and portfolio fossil fuel involvement. The measures follow the six sustainability objectives set by EU Taxonomy[38], and these two specific data points are chosen based on the applicability to objectives 1 (*climate change mitigation*) and 2 (*climate change adaptation*) and the level of data coverage.

Carbon emission data is gathered similarly to the main data sample of the study, meaning the reported amount of Scope 1 and 2 carbon emissions in tonnes per €1M of revenue. Data on fossil fuel involvement describes the share of each funds' investment portfolio that is involved in the fossil fuel industry, i.e., in thermal coal extraction, thermal coal power generation, oil and gas production, oil and gas power generation or oil and gas products & services.[39]

I construct a dataset including a pair of observations of carbon emissions and fossil fuel involvement for each of the unique funds. The first observation of the pair is dated after level 1 implementation (6/2021) and the second after level 2 implementation (6/2023). Followingly, I calculate the summary statistics for each Article group for both sustainability measures.

Finally, I define the indicators for sustainability controversies. As exactly this kind of study has not been conducted before regarding SFDR labels, there are no distinguished definitions for such factors. Following the methodologies of Liang, Sun and Teo (2021) and van Sambeek (2024), I choose relative cutoff measures for the controversy indicators. I conduct the analysis using the following definitions:

$$(3) \ Possible \ controversy_{i,t} = SM_{fund \ i \ in \ class \ n,t} > \mu(SM_{class \ n-1})_t$$

$$(4) \ Clear \ controversy_{i,t} = SM_{fund \ i \ in \ class \ n,t} > \mu(SM_{class \ n-2})_t$$

Where SM denotes the used sustainability measures CE (CO^2 tonnes per €1M invested) and Fossil Fuel involvement (% of funds' investment portfolio that is involved in thermal coal

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[37] Regulation (EU) 2019/2088 (n1)
[38] Regulation (EU) 2020/852 (n5)
[39] Morningstar Direct, Datapoint Definition

extraction, thermal coal power generation, oil and gas production, oil and gas power generation or oil and gas products and services). $Class_n$ denotes the proclaimed Article class of a fund, either Article 6, 8 or 9, with Article 9 being the higher. $Class_{n-1}$ denotes the previous class. For Article 9 funds, $Class_{n-1}$ is Article 8 and for Article 8 funds $Class_{n-1}$ is Article 6. $Class_{n-2}$ denotes the class two steps lower, i.e., $Class_{n-2}$, for Article 9 funds is Article 6. Finally, μ denotes the mean.

That is, fund *i* indicates *Possible controversy* during time *t* if its sustainability measure value is higher than the mean of the same measure among the funds in the previous class during time *t*. Additionally, fund *i* indicates *Clear controversy* if its sustainability measure value is higher than the mean of the same measure among the funds in the class two steps lower during time *t*. Therefore, only Article 9 funds can indicate *Clear controversy* according to these definitions.

Utilizing these classifications, I examine the sustainability performance of Article 8 and 9 funds in comparison to the funds with less or no sustainability ambitions. As the article-based classifications are commonly interpreted as a measure for fund's sustainability, Article 9 or 8 funds with worse sustainability performance than Article 6 funds should raise greenwashing concerns. Identifying a significant proportion of funds showing signs of controversy between disclosure and actual performance would suggest that the SFDR sustainability label does not accurately describe the actual sustainability of a fund. Conducting this test with the pair observations dated 6/21 and 6/23 also enables evaluating whether the level 2 regulation has succeeded in its objective of reducing greenwashing.

5 Empirical results

5.1 The Effect of SFDR on portfolio carbon emissions

5.1.1 All European funds

To evaluate the effect of SFDR on funds' sustainability, I test the development of funds' portfolio carbon emissions before and after the implementation of said regulation. To capture the steering effect of SFDR in European funds, I run two difference-in-differences regressions with Carbon emissions as the dependent variable following equation 1. The effect is tested against a control group of US based funds unaffected by the European regulation regime. Regression (Level 1) captures the effect of SFDR after the level 1 implementation and regression (Level 2) after the level 2 implementation. Table 7 reports the regression results for (Level 1) covering the sample period from September 2019 to December 2022 and for (Level

2) covering the sample period from June 2021 to June 2023. The models use fund clustered standard errors.

The coefficients of main interest, *Treated*, *Post* and *Treated x Post*, are not statistically significant in (Level 1) suggesting that no visible effect of the regulation can be confirmed following the level 1 implementation. Only the control variables *Size* and *Age* achieve statistical significance at 1% level, indicating a moderate and minor decrease in the carbon emission levels, respectively. Additionally, control variable *Return* achieves significance at 5% level and implies that carbon emissions are slightly higher in funds with higher return. These results are consistent with the hypothesis that SFDR is not an effective tool for steering funs towards decreasing carbon emissions.

In (Level 2), the interaction term *Treated x Post* is statistically significant at the 1% level and suggests that the funds affected by the regulation have indeed experienced a decrease in their carbon emissions after the level 2 implementation of SFDR. Here, the observed decrease after level 2 implementation indicates that in European funds, the average amount of funds' carbon emissions has decreased approximately 8 tonnes more than the emissions of the control group funds. The fund-level decrease is reported per €1M invested to ensure comparability between differently sized funds, meaning that the larger portfolio the fund has, the larger the absolute decrease would be. Also the coefficient *Post* is statistically significant and implies that the emission levels have decreased overall among the studied sample after the implementation of the regulation. The coefficient *Treated*, however, is also significant at 1% and indicates that European funds, on average, have approximately 17 tonnes higher carbon emissions per €1M of revenue than funds in the US. This is contrary to the underlying expectation that European funds would, on average, be more cautious regarding emissions than US based funds, but it likely to be due to the before mentioned features of the control group and the differences in emission reporting practices. Additionally, the coefficient for institutional ownership is statistically significant and indicates that the share of institutional investors affects funds' sustainability, in line with Dyck et al. (2019) and Kaustia and Yu (2021). Overall, the results of (level 2) are contradictory to the hypothesis that disclosure regulation would not be effective in decreasing carbon emissions, as a significant decrease in emission levels after the level 2 implementation can be confirmed.

Next, I move on to separate analyses on the European funds classified according to SFDR. This is to assess whether the carbon emission decrease of European funds is driven by a significant change in a certain fund class or rather by a geography-wide phenomena. I test the effect of SFDR implementation on carbon emission levels for Article 8 and Article 9 separately and finally for these two classes combined, using Article 6 funds as a control group in all the following tests.

First, I assess the effect of SFDR level 1 implementation. I run three difference-in-differences regressions with carbon emissions as the dependent variable following Equation 1. In the regressions, the variable *Treated* equals one for the corresponding article class, and the variable Post for observations after the level 1 implementation in the beginning of March 2021. Table 8 reports the results for each regression covering the sample period from September 2019 to December 2022. The models use fund clustered standard errors.

Secondly, I repeat the test, now assessing the SFDR level 2 implementation. Again, I run three difference-in-differences regressions with carbon emissions as the dependent variable following Equation 1. In the regressions, the variable *Treated* equals one for the corresponding article class, and the variable Post for observations after the level 2 implementation in January 2023. Table 9 reports the results for each regression covering the sample period from June 2021 to June 2023. The models use fund clustered standard errors.

The *Treated* coefficient is statistically significant at 1% level for the both sample periods and indicates, as expected, that the carbon emissions per €1M of revenue are remarkably lower in Article 8 and Article 9 funds than in Article 6 funds. Also the *Post* coefficient is statistically significant for all the regressions, and the values imply that the carbon emission levels have decreased after overall after the implementation of the regulation, but especially after the level 1 in March 2021. The decrease is stronger for Article 8 funds than Article 9 funds. However, the interaction term *Treated x Post* is positive in all the regressions for both of the sample periods, suggesting that the emission of Article 8 and 9 have in fact decreased less than the emissions of Article 6 funds. This could indicate that the observed decrease of section 5.1.1 is actually driven by the improvements made by Article 6 funds, as the overall level of emissions is already significantly lower in Article 8 and 9 funds. Differing from the results in section 5.1.1, the coefficient for institutional ownership is also positive.

In order to provide further context for the observed results, I plot the average carbon emissions (CO^2 per €1M invested) of two fund groups, Article 6 and Article 8&9, during the

sample period. As Figure 2 illustrates, there has been a downward trend in both groups following the implementation of SFDR in March 2021. However, the decrease of Article 6 funds (40 tonnes) has been significantly larger than of Article 8&9 funds (15 tonnes). Moreover, following the implementation of SFDR level 2, the emissions of Article 6 funds have continued to decrease, while those of Article 8&9 have remained at the same level or even increased. Furthermore, Figure 2 shows that before the implementation of SFDR level 1, the difference in emissions of Article 6 and Article 8&9 funds would have been significantly smaller, or even non-existent. This, however, is likely due to the characteristics of the available data. Prior to the implementation of SFDR level 1, reporting carbon emissions was not mandatory, and the voluntarily reporting Article 6 companies most likely performed better than an average Article 6 fund. This assumption is further supported by the significant increase in Article 6 emissions observed in the graph during the last few months before the level 1 implementation date. Overall, the carbon emission development illustrated in Figure 2 appears to align with the conclusion that the emission decrease observed in European funds in section 5.1.1 was largely due to significant improvements in Article 6 funds' sustainability practices.

As the tables 8 and 9 show, the *Treated x Post* coefficients for Article 9 funds remains insignificant. To be able to further analyze whether the observed effect of funds in lower Article class improving their performance following the higher class funds is also present between Article 8 and 9 funds, I run an additional regression test for Article 9 funds with Article 8 funds as a control group. I run two difference-in-differences regressions following Equation 1, first with sample period Post1 and then with Post2. In the regressions, the variable *Treated* equals one for Article 9 funds and zero for Article 8. The variable Post equals 1 for all observations after March 2023 in regression Level 1, and 1 for all observations after January 2023 in regression level 2. Table 10 reports the results for both regressions. The models use fund clustered standard errors.

The results of Table 10 are consistent with those of Tables 8 and 9, as *Treated x Post* remains insignificant in both regressions, Level 1 and Level 2. The significant coefficient of *Treated* in Level 2 regression suggests that the overall emission level in Article 9 funds is lower than in Article 8 funds, as expected. Also the coefficient *Post* only receives statistical significance in Level 2 regression, suggesting that the overall emission level of the sample has decreased after the implementation of SFDR level 2. However, compared to the results of tables 8 and 9 with Article 6 funds as a control group, the decrease is significantly smaller. Furthermore, as the *Treated x Post* remains insignificant even after level 2 implementation, the results do not

provide clear evidence on whether the observed decrease would be driven by Article 8 or Article 9 improvements. Consequently, a similar pattern of sustainability performance improvement as for Article 6 funds cannot be shown for Article 8 funds. Finally, the level 2 regression results might be affected by the frozen sample as the article reclassifications cannot be considered. As the amount of Article 8 funds reclassifying as Article 9 was again increasing during Q1 and Q2 of 2023 (Morningstar 2023), the sample of Article 9 funds inevitably includes funds that have only upgraded from Article 8 very recently, and thereby dilute the differences between Article 8 and Article 9 funds.

5.2   The effect of SFDR on Article 8 and Article 9 fund flows

To assess whether SFDR has been successful in directing capital towards more sustainable targets, I test the effect of SFDR implementation on fund netflows. As previous literature shows, sustainability labels have been proved to attract additional capital (Liang, Sun and Teo, 2021; Shapiro, 2023). However, potential positive results from this section do not yet prove that the regulation would have been successful. These tests do not determine if the funds are sustainable but focus on the effect of sustainability labels, and therefore the possibility for greenwashing persists. The section 5.3 attempts to further study the actual level of sustainability of the funds classified as sustainable.

I assess the influence of SFDR classification labels by running three difference-in-differences regressions with fund netflow as the dependent variable following Equation 2. The first regression compares netflow between Article 8 and Article 6 funds, the second between Article 9 and Article 6 funds and the third between the combined sample of the previous and Article 6 funds.

First, I assess the influence of the level 1 implementation, and conduct the regressions using a sample from September 2019 to December 2022. In the regressions, the variable *Treated* equals one for the corresponding article class and zero for the others, and the variable Post for all observations after the beginning of March 2021. The models use fund-clustered standard errors. Table 11 presents the results.

Secondly, I repeat the tests to evaluate the impact of level 2 implementation in January 2023. I use a sample period from June 2021 to June 2023, with the variable *Post* equaling 1 for all observations after the implementation in the beginning of January 2023. The variable *Treated* takes the value of 1 for the corresponding article class and zero for the others. The models use fund-clustered standard errors. Table 12 presents the results.

As table 11 presents, the coefficients for *Treated* are negative, and weakly significant only for Article 9 and Article 8 & 9 regressions, suggesting that on average, Article 8 and Article 9 funds receive lower netflow than Article 6 funds. The coefficient *Post* is significant at the 1% level for all the regressions and indicates that overall fund netflows have decreased after March 2021. The interaction term *Treated x Post* is significant at the 10% level for Article 8 & 9 combined, suggesting that these funds have received approximately 0.5 percentage points higher netflows after March 2021 than Article 6 funds. Coefficients for *Label* remain insignificant, showing no effect of sustainability-related fund names on the netflow. The coefficients of control variables *Size*, *Return* and *Age* are all statistically significant and negative, suggesting a netflow decrease of 0.15 percentage points at maximum.

Regarding the results of Table 12, the values for the *Treated* coefficient are negative, and significant on 5% level for Article 8 and Article 8&9 regressions. This indicates that the netflow in Article 8 and Article 9 funds has been lower than in Article 6 funds, similarly as after level 1 implementation. However, differing from the results after level 1 implementation, the coefficient *Post* suggests that the netflow to funds has overall increased by over 4 percentage points after the level 2 implementation. The interaction coefficient *Treated x Post* is significant at 1% level and suggests that the netflow has increased after the level 2 implementation. According to the results, Article 8 funds have received approximately 0.33 percentage points higher and Article 9 funds 0.77 percentage points higher netflows than Article 6 funds after January 2023. To provide perspective on the magnitude of the changes, an average European fund's netflow has a standard deviation of 0.55 percentage points (Table 3A). A netflow increase of 0.33 percentage points would then account for 60% of the standard deviation. Thereby, for an average fund with the median netflow of -0.33 % (Table 3A), already the increase of 0.33 percentage points would affect significantly by increasing the monthly netflow to zero. Consequently, even the relatively small netflow increases of less than one percentage points will have a significant effect on fund flows, as also the monthly fluctuation expressed by standard deviation is merely 0.5 percentage points. The *Label* coefficient is significant on 1% level in regression (Art. 9) and suggests that funds with sustainability labels in their name received approximately 0.26 percentage points higher netflows. Again, the coefficients for control variables *size*, *return* and *age* are slightly negative.

To be able to further analyze whether the positive coefficient observed for *Treated x Post* after level 2 implementation was driven by the strongly positive coefficient for *Post*, I plot the time series of monthly netflow (cumulative and as a percentage of total assets) covering the

entire sample period from September 2019 to June 2023. The figures 3 and 4 present the netflows to Article 6 funds and Article 8&9 funds separately. As illustrated in the figures, the average netflow for European funds is significantly negative during the Post 1 sample period (9/2019 to 12/2022) and turns to a more positive note after the implementation of level 2 regulation in January 2023. This partially explains the shift from negative to positive coefficient for *Post* and *Treated x Post* in tables 8 and 9. As expected, the Post 1 sample period was particularly affected by unusual economic events, such as the COVID-19 pandemic and the Russian invasion of Ukraine. These events have significantly affected the global economy and, consequently, on fund flows. However, the figure also indicates that following the level 2 implementation in January 2023, the average netflow percentages of Article 8 and 9 funds were slightly higher than those of Article 6 funds, supporting the initial results of this section. Additionally, as the figure 2 shows, the disparity between Article 8&9 and Article 6 funds is more significant when measured in terms of cumulative netflow (€1M). This suggests that the absolute netflow increase (in €M) has been significantly higher than in Article 6 funds, given the larger average size of Article 8 and 9 funds.

It is noteworthy that the implementation of the regulation seems to be followed by a surge in fund netflow during the implementation month. After level 1, the increase in percentages is very similar between the two groups, suggesting that the overall increase is not driven by demand for sustainable funds. However, the cumulative netflow in Figure 2 suggests a significantly higher increase during March 2021 for Article 8 & 9 funds, even though also the decreases during the following months are larger. Also following the implementation of level 2, the netflow percentages continue to exhibit a unified trend with a slight lead for Article 8&9 funds, but the higher increase of Article 8&9 funds is especially visible when measured with cumulative netflow (€M). Therefore, it seems that even though the positive effect observed on Article 8 & 9 netflows after level 2 implementation is driven by overall positive netflow development, the sustainable funds have attracted some additional inflow.

5.3   The accuracy of SFDR Article labeling

Finally, I study the accuracy of SFDR labels regarding the environmental performance of the funds. Tables 13 and 14 present the summary statistics for the carbon emission and fossil fuel involvement measures for each article class separately.

The figures show that on a high level, the article class is aligned with the environmental sustainability of the fund, as the means and medians of Carbon Emissions and Fossil Fuel

Involvement decrease while the article class increases. However, as the percentile and range values show, the fluctuation inside a certain class is relatively high. The outlier values may indicate sustainability controversies, and are therefore further studied. As already the summary statistics show, it seems that the SFDR Article classifications are not able to offer a guarantee of environmentally sustainable investment operations. Tables 15 and 16 present the results of the comparison analysis.

The results suggest that the share of Article 9 funds indicating a controversy regarding carbon emissions has decreased after the SFDR level 2 requirements came into force. The share of *possible controversy* among Article 9 funds has decreased over 7 percentage points, whereas the share of *clear controversy* has decreased approximately 1.3 percentage points. However, the share of funds classified as *possible controversy* is significantly higher among Article 9 funds, suggesting that nearly a third of Article 9 funds had higher carbon emissions than an average article 8 fund before level 2 implementation, and 25% of Article 9 funds after level 2 implementation. The effect of implementation seems to have been minor among Article 8 funds. The results contradict with the hypothesis 3a, as the level 2 implementation seems to have decreased the proportion of funds with relatively high emissions.

Contrary to the development of carbon emissions, Article 8 and Article 9 funds' involvement in fossil fuel industries increased after the implementation of level 2 requirements. Even tough 1.5 percentage points less Article 9 funds were categorized as *possible controversy*, the share of funds in the *clear controversy* category grew nearly 3.5 percentage points. This suggests that after level 2 implementation, over 16% of Article 9 funds had higher level of fossil fuel involvement than an average Article 6 fund. Also nearly 3.5 percentage points more Article 8 funds fell into the *possible controversy* category after SFDR level 2. This suggests that the hypothesis 3b holds, as no clear decrease is visible after level 2 implementation.

6 Robustness tests: Alternative single sample period

To ensure that the results presented in section 5 are robust, additional analyses using a single sample period instead of two separate sample periods are conducted. The baseline analysis separates the two regulatory events, level 1 implementation and level 2 implementation, to separate sample periods. This is to capture first the initial effect of the regulation and followingly the effect of the tighter standards coming into force during level 2 implementation. However, using two separate sample periods reduces the amount of independent observations

and hence decreases the explaining power of the regression models. Therefore, I repeat the tests using a single sample period.

6.1 The Effect of SFDR on fund carbon emissions

I repeat the tests of section 5.1.1 and 5.1.2 and study the effect of SFDR implementation on fund-level carbon emission, but now with a single regression model using the following equation 4:

$$(5)\ CE_{i,t} = \beta_0 * \text{Treated}_i + \beta_1 * \text{Post1}_t + \beta_2 * \text{Post2}_t + \beta_3 * (\text{Treated}_i * \text{Post1}_t) + \beta_4 \\ * (\text{Treated}_i * \text{Post2}_t) + \beta_5 * \text{Institutional} + \beta_6 * \text{Size}_{i,t-1} + \beta_7 * \text{Age}_{i,t-1} + \beta_8 \\ * \text{Return}_{i,t-1} + \varepsilon_i,$$

6.1.1 All European funds

Following equation 4, I run the regression with Carbon Emissions as the dependent variable, and use US-based funds as the control group. The regression captures both the effects of level 1 and level 2 implementation, as the dummy variable *Post1* equals 1 for all observations after level 1 implementation in March 2021 until December 2022, and *Post2* for all observations after level 2 implementation in January 2023. *Treated* equals 1 for all European funds, as previously, and the interaction terms *Treated x Post1* and *Treated x Post2* capture the combined effect. The control variables remain unchanged. Table 17 presents the results.

In line with the results of section 5.1.1, the coefficients of *Treated x Post1* and *Treated x Post2* suggest that the carbon emissions of EU funds have decreased after the implementation of SFDR. The single sample period analysis indicates a stronger impact on the European funds than the split sample period analysis, suggesting a decrease of 20 tonnes per €1M of revenue after the level 2 implementation. The coefficients *Post1* and *Post2* show that also the overall level of carbon emissions has decreased throughout the sample period, and achieve the 5% and 1% level of statistical significance respectively, differing from the results in 5.1.1. Similarly to the previous analysis, the *Treated* coefficient still receives a positive and statistically significant value. As stated before, this could partly be due to the differences in reporting regulation and practices between Europe and the US as well as the features of the control group. Also the effect of Institutional ownership is left insignificant, contrary to the results in 5.1.1 and previous literature (Dyck et al., 2019; Kaustia and Yu, 2021).

6.1.2 Article 8 and 9 funds

Next, I test whether the emission decrease of European funds addressed in 5.1.1 and 6.1.1 is driven by a certain fund class. Similarly to the section 6.1.1, I run a difference-in-differences regression following equation 4 with carbon emissions as the dependent variable, now using the Article 6 funds as a control group. The coefficient *Treated* equals 1 for the corresponding article class, and *Post1* and *Post2* mark the implementation dates for level 1 and level 2 implementation. The interaction terms follow the logic of previous sections and control variables remain unchanged. The results for are presented in Table 18.

Similarly to the section 5.1.2, the results suggest that the carbon emission level of Article 8 and 9 funds is significantly lower than Article 6 funds, and that the difference is strongest between Article 9 and 6. Differing from the previous analysis, the variables *Post1* and *Post2* are statistically significant at 1% level in all of the three models, suggesting that the overall level of carbon emissions has decreased since the initial implementation of the regulation. All the models show a strengthening effect in the overall emission level decrease between level 1 and level 2 implementations

The interaction terms *Treated x Post1* and *Treated x Post2* with statistical significance of 1% are in line with the results of section 5.1.2, suggesting that the carbon emission level of Article 8 and 9 funds has in fact increased after the implementation. The positive and significant values support the initial interpretation from section 5.2, that as the overall level of emissions is significantly lower among Article 8 and 9 funds, the decrease observed in sections 5.1.1 and 6.1.1 is currently driven by Article 6 improving their sustainability performance following the already-better-performing Article 8 and 9 funds.

6.2 The Effect of SFDR labels on fund netflows

I also test the influence of SFDR on fund flows using a single sample period. I run three difference-in-differences regressions with Netflow as the dependent variable and Article 6 funds as the control group, following equation 5:

$$(6) \; \text{Netflow}_{i,t} = \beta_0 * \text{Treated}_i + \beta_1 * \text{Post1}_t + \beta_2 * \text{Post2}_t + \beta_3 * (\text{Treated}_i * \text{Post1}_t) + \beta_4 \\ * (\text{Treated}_i * \text{Post2}_t) + \beta_5 * \text{Size}_{i,t-1} + \beta_6 * \text{Age}_{i.t-1} + \beta_7 * \text{Return}_{i.t-1} + \varepsilon_i,$$

The variable *Treated* equals one for corresponding article class, and variables *Post1* and *Post2* mark the timing of the level 1 and level 2 implementations. The interaction terms *Treated x Post1* and *Treated x Post2* are used to capture the effect of each implementation on the Article

8 and 9 funds. The control variables remain unchanged from section 5.2. Table 19 presents the results.

In line with the results of Section 5.2, the above regressions indicate that on average throughout the sample period, Article 8 and 9 funds have received slightly lower inflows than Article 6 funds, as the coefficients of Treated are statistically significant and negative in all three models. However, differing from section 5.2, the results suggest that the positive effect on fund netflow was visible for Article 9 funds already after level 1 implementation. All three models show a strengthening positive effect from level 1 implementation to level 2 implementation. This analysis suggests that Article 8 funds would have attracted approximately 1.3 percentage points higher netflow than Article 6 funds, and Article 9 funds even over 3 percentage points higher netflow than Article 6. This is in line with the hypothesis 2 of the thesis and with previous literature (Becker, Martin and Walter, 2022), but it is important to note that the observed results are significantly stronger than in the split sample period analysis. The difference could be explained by the fact that as the single sample period includes larger number of independent observations, the results are likely to be less prone to the effect of economic turmoil than the shorter split sample periods.

7 Discussion

7.1 The Effect of SFDR on fund carbon emissions

The sections 5.1 and 6.1 show that SFDR has achieved its' desired objective of directing funds towards more sustainable investment targets, as the carbon emissions of European funds' portfolios have significantly decreased after level 2 implementation. The results indicate that after January 2023, the portfolio carbon emissions of European funds have decreased approximately 10 – 20 tonnes (per €1M invested) more, compared to US funds. Further studying the carbon emissions of European funds indicates that the observed decrease is currently larger among the Article 6 funds instead of Article 8 and Article 9 funds. This could suggest that the regulation is achieving it's desired result of complicating the market for unsustainable investments through transparency.

Naturally, portfolio carbon emissions are not a comprehensive measure for fund sustainability. However, as the coefficients *Treated* show in sections 5.1.2 and 6.1.2, the difference on the base level of portfolio emissions seems to follow the classification logic with Article 9 funds being the most sustainable, and Article 6 the least. The results of section 6.1.2 indicate that Article 9 funds have, on average, nearly 60 tonnes (per €1M invested) lower

carbon emissions than Article 6 funds, and Article 8 funds nearly 40 tonnes (per €1M invested). When comparing European funds to US funds, the results of 5.1.1 and 6.1.1 demonstrate that, contrary to the assumption of the thesis, European funds have higher carbon emissions than US based funds. This can, nevertheless, be due to selective reporting bias. As there are no federal GHG reporting mandates similar to SFDR in the US, it is likely that only the funds prioritizing sustainability factors choose to report, and therefore the overall base level of US funds' emissions appears lower than it actually is. However, comparisons can still be performed as this study focuses on the relative change incurred by SFDR instead of absolute numbers. If the US data is subject to selective reporting bias as assumed and the average carbon performance is worse than among the funds currently reporting, the actual effect of SFDR on carbon emission decreases could be stronger than observed in sections 5.1.1 and 6.1.1.

As the coefficients *Post1* and *Post2* suggest, the decreasing trend on carbon emissions is visible throughout the sample. Sections 5.1.1 and 6.1.1 show that along with the European funds affected by SFDR, also the emissions of US based funds' portfolios have decreased, albeit less. It is evident that in addition to the regulatory changes in Europe, also the global operating environment has shifted towards prioritizing sustainability higher. Nevertheless, the results of this study show that the regulation has accelerated the development in European funds. Yet, the results of sections 5.1.2 and 6.1.2 suggest the most evident change in carbon emissions has been among Article 6 funds, as the results in fact show a carbon emission increase of approximately 6 tonnes (per €1M invested) for Article 8 funds after level 2 implementation. Additionally, the difference in overall carbon emissions between Article 6 and Article 8&9 funds has decreased significantly after level 2 implementation, suggesting that Article 6 funds are no longer lagging so far behind. The portfolio decarbonization of Article 6 funds could indicate that a future Article 8 classification would now, after the tightened requirements, be a strong enough incentive for improving portfolio sustainability. This effect could, to some extent, be strengthened by the possible downgrades of Article 8 or 9 funds into the Article 6 category, and thereby improving the performance of the group. However, as the major downgrade waves happened from Article 9 into Article 8 and similar large scale behavior is not reported for Article 6 funds, the observed emission decreases are expected to be due to Article 6 funds actually improving their sustainability practices.

The coefficients studying the effect of level 1 implementation remained either insignificant or weak, supporting the assumption that SFDR level 1 had been ineffective. Sections 5.1.1 and 6.1.1 suggest that only after the implementation of tightened level 2 standards, concrete

changes in the level of carbon emissions were visible. The observed changes should be specifically associated with the implementation of level 2 regulation, as the Post1 sample period spans until the end of December 2022 and should therefore capture also the potential non-immediate effects after the level 1 implementation. These findings are in line with the stands of numerous regulatory authorities of European countries criticizing the ambiguity and incompleteness of the level 1 regulation.[40] However, contrary to the hypothesis 1 of this paper, the results demonstrate a significant decreasing effect on fund portfolio carbon emissions after the implementation of SFDR level 2. Considering the doubts expressed by e.g. Busch (2023), Partiti (2021) and Stefaniak (2023) about the functioning logic of the regulatory framework, showing the decreasing effect on carbon emissions does not alone prove the overall success of SFDR. It does, however, indicate that SFDR has successfully affected the environmental performance of mutual funds.

7.2   The Effect of SFDR labels on fund netflows

The analysis on the SFDR classifications' effect on netflows indicates that in the end, funds with Article 8 or Article 9 label have attracted 0.3 to even 1.5 percentage points additional capital after the implementation of SFDR, even though the results are partly contradictory depending on the sample period. The positive effect seems to be related specifically to the SFDR labels, as the *Treated x Post* coefficients are significant while simultaneously controlling for other general sustainability labels mentioned in the names of the funds. This could indicate that investors have recently internalized the public criticism towards the ambiguity of sustainable investment products and ESG ratings, and therefore value the regulation-based label higher – regardless of its' accuracy.

The variable *Treated* receives highest level of statistical significance in the single sample period analysis in section 6.2, and suggests that on average, Article 8 and Article 9 funds receive 0.15 percentage points lower netflow than Article 6 funds. Also the analysis in section 5.2 suggests an overall higher netflow for Article 6 funds instead of Article 8 and 9.

The results by both methodologies, in sections 5.2 and 6.2, prove that the overall fund netflows have decreased remarkably after the SFDR level 1 implementation, and increased significantly after the level 2 implementation. These results seem to describe the overall economic turbulence present throughout the sample period. After the level 1 implementation,

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[40] ESAs (2021) (n14)

no positive effect on the netflow of Article 8 and 9 funds was visible in the single sample period analysis. This contradicts with the hypothesis that SFDR labeled funds would attract more inflow, and could indicate investor distrust towards the regulatory classifications during that time period. The incompleteness of SFDR was apparent to investors during 2021 at the latest, as the implementation of level 2 regulation was postponed twice due to the complexity of the technical standards and obscurity of interpretation for financial supervisory authorities.[41] This led to doubts and confusion about the accuracy of effective level 1 regulation, as clarifications and adjustments were needed but the delivery of those was delayed. The results of sections 5.2 and 6.2 suggest that after considering the effect of level 2 implementation, the influence of SFDR labels appears strongly positive. As also the overall netflow to funds was strongly positive after level 2 but significantly negative before, the results might be partly explained by this effect. However, the results could also demonstrate a growing trust in the reliability of SFDR classifications after the corrected and stricter standards came into force. According to the theories presented by Doshi, Dowell and Toffel (2013) and Schneider and Ben-Shahar (2015), this would indicate that investors have integrated the additional information provided by SFDR disclosure into their decision-making – or at least the information provided merely by the SFDR label.

My results partly support the findings of Becker, Martin and Walter (2022), that also show a positive effect of SFDR labels on fund netflow. However, they only study the effect of level 1 implementation on netflow, which I found to be negative. This difference could, however, be related to the shorter sample period used by Becker, Martin and Walter (2022) or to the fact that they do not control for other sustainability labels in their study. On the other hand, my results are also partly in line with findings of (Yu, 2022) where she shows that after considering other ESG factors, SFDR labels do not attract additional capital. She studies the effect of level 1 implementation, and my results support the findings regarding that time period, even though I find a positive effect on netflow later, after the level 2 implementation.

It is also important to note that, considering the timing of the regulation implementation and thereby timing of the sample of this study, the results might not reflect the effects of the regulation objectively. For the studied European funds, unexpected events such as the COVID pandemic and the Russian invasion to Ukraine have largely affected the overall economic

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[41] European Commission (2021) Letter: Information Regarding Regulatory Technical Standards under the Sustainable Finance Disclosure Regulation 2019/2088

situation and might also partly explain the observed significant changes in fund flows to all Article 6, 8 and 9 funds.

7.3   The Accuracy of SFDR labels

The results of section 5.3. confirm that the SFDR labels should not be interpreted as a sustainability guarantee, even though they are commonly seen as such. Table 12 shows that after the initial implementation of SFDR, nearly 32 % of Article 9 funds fell into the *possible controversy* category, indicating that their carbon emissions are higher than the emissions of average article 8 fund. Also, nearly 25% of Article 9 funds had higher fossil fuel involvement than an average Article 8 fund. Additionally, over 10% of Article 9 funds had higher carbon emissions and 13% had higher fossil fuel involvement than an average Article 6 fund. Improving transparency following the ambiguity of the article classification definitions was the main ambition of SFDR level 2 implementation, and the results show partial success.

As seen in the table 12 of section 5.3, the share of Article 9 funds showing possible or clear carbon emission controversies decreased after level 2 implementation. This suggests that the tightened standards were successful in increasing transparency, as less Article 9 funds claimed to promote environmental actions without corresponding performance. Similar effect is not visible among Article 8 funds. However, even after the decreases following level 2 requirements, one fourth of Article 9 funds still have higher emissions than an average Article 8 fund. This supports the findings of e.g. Busch (2023) and Partiti (2023), suggesting that the SFDR labels do not offer a guarantee of comprehensively sustainable investment.

On the other hand, measuring sustainability through fossil fuel involvement does not distinguish the effect of SFDR level 2 implementation. Table 13 in section 5.3 shows that in fact, the share of Article 9 funds with fossil fuel involvement higher than an average article 6 fund has increased. It is possible that decreasing carbon emission levels and thereby aligning the sustainability performance with the disclosed ambitions of the chosen SFDR level is easier regarding carbon emissions than fossil fuel involvement. Alternatively, the difference could be due to differences in reporting practices, as sustainably committed Article 9 funds may have more advanced processes for measuring and assessing also indirect usage of fossil fuels, which may result in higher level of reported values. It is also important to note that as stated previously, measuring sustainability accurately is challenging and before achieving an established and comprehensive practice for reporting, a great amount of information may be hidden. Occasionally, this may lead to situations where responsible companies with advanced

measuring and reporting practices are penalized compared to competitors with simple practices leaving certain parts out of scope.

As Busch (2023) and Partiti (2023) state, the unsustainable practices of Article 8 and Article 9 funds do not, by definition, mean that they are not law-abiding. Even though the market commonly expects sustainable results from the light-green and dark-green funds, the regulation does not currently define any quantifiable sustainability requirements. The reporting requirements tightened significantly following the level 2 implementation, but regardless of periodic mandatory disclosure, no numerical sustainability performance measures are set. Additionally, as explained in section 2, FMPs and FAs can also proclaim products as Article 8 or Article 9 based on the social sustainability aspect, even though there is no social taxonomy in place yet to concretely assess the level of sustainability. Consequently, at worst, the pool of Article 8 and 9 funds may include funds with non-existent environmental performance, as long as they have expressed a social objective, as no further assessment of social responsibility is possible in the current regulatory framework. In practice, this means that well informed and conscious investors may draw their own conclusions on the concrete sustainability of the investment targets based on the reported disclosure, but the regulatory label does not necessarily reveal it. That is, the regulation has been successful in increasing transparency through the disclosed information but the article classification system does not offer transparent comparability.

7.4   Limitations of the study and suggestions for future research

The results of this study are subject to certain limitations, as the studied effects are still developing due to the novelty of the regulation in question. The key limitations are associated with data availability and reporting bias.

Considering the data on US funds, reporting bias is inevitably affecting the results due to the lack of mandating country-wide carbon disclosure regulation in two ways. First, considering the demanding nature of carbon accounting and disclosure, companies with ambitious sustainability aims are more likely to have established a comprehensive assessment system for monitoring the carbon effects and thereby more likely to report. (Bui, Houqe and Zaman, 2020) Secondly, without an obligatory reporting regulation, publishing unfavorable information is not federally incentivized, leading to voluntary disclosure mostly by companies performing better than the average. Consequently, the effect of reporting bias may have diluted the accuracy of the results.

The US Securities and Exchange Commission (SEC) is currently preparing a final proposal of a climate change disclosure rulemaking[42], and the project has experienced several delays starting from January 2022. If the Climate Change Disclosure Rule (CCDR) is adopted during 2024 according to the current plan, the broadening coverage of carbon data offers new avenues for research during the upcoming years and enables more adequate comparison with strictly regulated areas such as the EU.

Regarding the analysis on European funds, the data on carbon emissions is limited to Scope 1 and Scope 2 reporting, as 2024 marks the first reporting year including Scope 3 emissions into the reporting regime.[43] Scope 1 and Scope 2 account for the emissions originating from the operations at the companies' physical facilities and from the energy usage. Scope 3 emissions represent a major share of companies GHG emissions, ranging from 40% to 90% of total emissions, depending on the industry, as they cover the emissions of the supply and distribution chain. Hence, gathering, monitoring and allocating Scope 3 data is challenging even with advanced emission protocol and is therefore yet to be regulated. The results of this study do not therefore account for the complete set of emissions but evaluate observed changes in Scope 1 and Scope 2. Including Scope 3 into the reporting requirements from the reporting year 2024 onwards could facilitate a more comprehensive analysis on the observed decarbonization of funds' portfolios.

Additionally, the results of this study might not completely represent the real emission impact. The reliability of carbon reporting has faced doubts and criticism – the reported data can be analyzed but the data might not fully reflect reality. (Borghei, 2021) Altogether, carbon accounting is a developing practice and the extensive disclosure requirements set by SFDR are not able to completely guarantee the accuracy and comparability of reported information. The internal processes of auditing and allocating emission data and using estimates might vary largely, and in some industries also the dependency on third-party reporting brings challenges on the accuracy of reported information. This challenge of carbon emission studies is only expected to inflate after the reporting requirements are broadened into Scope 3.

As the data on SFDR classifications is limited to the current state and no time-series is available, this study lacks considering the effects of article class upgrades and downgrades.

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[42] SEC (2023) Fact Sheet: Enhancement and Standardization of Climate-Related Disclosures
[43] Delegated Regulation (EU) 2023/2772 of 31 July 2023 supplementing Directive 2013/34/EU of the European Parliament and of the Council as regards sustainability reporting standards, OJ L, 2023/2772, 22.12.2023

Should the time-series data be published in the future, it would enable studying also the possible incentivizing effect of SFDR classification system in more detail.

Finally, as stated earlier, this study focuses on analyzing SFDR's effects on environmental sustainability performance and the factors of social sustainability are out of the scope of this paper. If the development of the EU social taxonomy is continued in the future, its' implementation would open new avenues for measuring sustainability more comprehensively, and hence offer possibilities for quantitative research also regarding social sustainability.

8   Conclusion

This paper studies the impact of Sustainable Finance Disclosure Regulation on mutual funds' sustainability performance and on the investor sentiment. The study builds on previous research by Becker, Martin and Walter (2022) and Yu, Luu and Chen (2020) by conducting the first SFDR study using carbon emissions as a measure for sustainability performance following In and Schumacher (2021) and Wedari, Jubb and Moradi-Motlagh (2021). Additionally, the existing literature on the impact of SFDR on fund netflows is extended by including the first six months after level 2 implementation in the analysis to capture the effect of tightened reporting requirements. Furthermore, this thesis aims to provide statistical evidence on the impact of SFDR on mutual funds' environmentally harmful activities such as high carbon emissions and fossil fuel involvement. The research is motivated by the recent discussion raised by news outlets (Follow the Money, 2022), academic literature (Busch, 2023; Partiti, 2023) and European regulatory bodies[44].

The study is conducted utilizing a sample of European and US mutual funds from September 2019 to June 2023, using a data set of 122,841 fund-month observations retrieved from Morningstar Direct. The sample is further divided to sub-samples based on the article classifications to analyze differences among European funds. The paper first studies the effect of SFDR on fund carbon emissions, as well as the effect of SFDR labels on fund netflow. Finally, it analyzes the proportion of Article 8 and 9 funds that exhibit indicators of sustainability controversies, i.e., discrepancies between sustainability disclosure and sustainability performance. The study is executed using difference-in-difference regressions and comparison analysis.

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[44] ESAs (2021) (n14)

Altogether, this paper presents four key findings that contribute to the existing literature. First, my findings suggest that SFDR has accelerated the decarbonization of fund portfolios in Europe. The regressions show a clear and statistically significant effect of SFDR level 2 implementation, suggesting a carbon emission decrease of 8 to 20 tonnes (CO^2 per €1M invested) in EU funds, depending on methodology. The impact of level 1 implementation remains insignificant with both methodologies, split sample period and single sample period, supporting the initial assumption of SFDR's lack of effectiveness. The findings, however, imply that the tightened reporting requirements and regulatory clarifications provided along the level 2 implementation process were successful in steering corporate behavior. Whether the change in portfolio emission levels originates from investment and divestment behavior of mutual funds or improved sustainability practices on the portfolio company level, the regulation has successfully directed companies towards more sustainable actions.

When analyzing the article classification groups separately, the results reveal that the emissions of Article 8 and 9 funds have actually increased after level 2 implementation, compared to Article 6 funds. This suggests that the observed decrease of 8 tonnes is mostly driven by emission decreases of Article 6 funds. Considering that the absolute emission levels are already 40 to 60 tonnes (CO^2 per €1M invested) lower in Article 8 and 9 funds, this indicates that the regulation is currently affecting the emissions of the most unsustainable funds the strongest, as desired. The improvements made by Article 6 funds imply that either a sincerely proclaimed Article 8 label incentivizes for enhancing sustainability performance, or having to frequently publish undesired information is considered damaging.

Thirdly, my findings show that after level 2 implementation, SFDR labels have attracted additional capital similarly to other sustainability labels. Funds labeled as Article 8 or Article 9 received 0.3 to 0.7 percentage higher netflows than Article 6 funds in split sample period analysis, and even 0.8 to 3.3 percentage points higher in single sample period analysis. The model controls for other sustainability labels in the fund name following the sustainability label list published by ESMA, but the effect remains mostly insignificant. This could imply that the investors value the regulatory labels over other ESG labels, or that they have internalized the information regarding the article classification into their decision-making process. However, as the effect of SFDR labels remained insignificant after the level 1 implementation, the trust towards the labels has accumulated only recently.

Finally, this study provides evidence that a significant proportion of Article 8 and Article 9 funds are still engaged in carbon and fossil fuel intensive investments, contrary to the objectives

of environmental sustainability. As the comparison analysis is conducted excluding dedicated impact funds from the sample, especially the funds exhibiting clear controversy (Art. 9 fund with higher carbon emissions or fossil fuel involvement than the mean of Art. 6 funds) raise concerns for greenwashing. These results support the statements by previous literature criticizing SFDR's reliability as a classification scheme. As the regulation allows funds to be classified as sustainable without proof of actual sustainability, the SFDR sustainability labels are not always able to provide an accurate assessment of sustainability and should not therefore be interpreted as such.

This study expands the limited literature on SFDR's effects by using carbon emissions as a new approach for measuring sustainability and extending the studied period to include also the time after the level 2 implementation. Additionally, this thesis uses a numerical approach for analyzing the SFDR labeling system, providing new evidence supporting the doubts presented by existing literature. This paper cannot offer a comprehensive overview of the sustainability development following SFDR due to the regulation's novelty and limited data availability. However, it does provide initial evidence on the effects of SFDR level 2 implementation on fund sustainability and could serve as a basis for future research conducted with more extensive data coverage.

In response to the thesis question, the results of this study suggest that SFDR has been effective in directing capital towards more sustainable targets both from the perspective of mutual funds and investors. However, the objective of improving transparency has not been fully met, as the ambiguity of Article 8 and Article 9 definitions still allows for environmentally unsustainable investments to be classified as sustainable.

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Figures

Figure 2: Carbon emissions of European funds (per €1M invested)

Figure 2 presents the monthly average of CO_2 tonnes (per €1M invested) for European funds during the sample period from 9/2019 to 6/2023. Y-axis represents the the amount of CO_2 emissions in tonnes, x-axis represents the point of time (year-month). The grey line represents the average carbon emission of Article 6 funds, the green line the average carbon emissions of Article 8&9 funds. The labels SFDR level 1 and SFDR level 2 denote the times of regulation implementation, respectively.
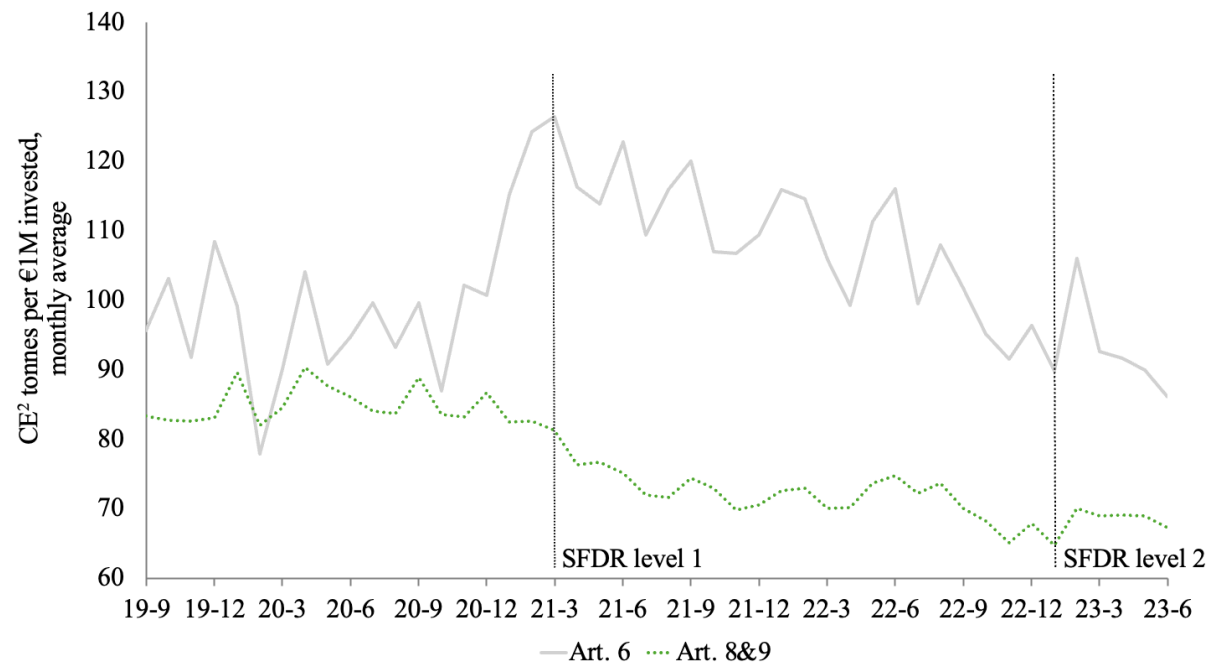
Figure 3: Monthly netflows (in €M) of European funds

Figure 3 presents the monthly netflow (in €M) to European funds during the sample period from 9/2019 to 6/2023. Y-axis represents the amount of Netflow in million euros, x-axis represents the point of time (year-month). Monthly netflow is presented as the average netflow among Article 6 funds (first column) and as the average among Article 8&9 funds (second column). The labels SFDR level 1 and SFDR level 2 denote the time of regulation implementation, respectively.
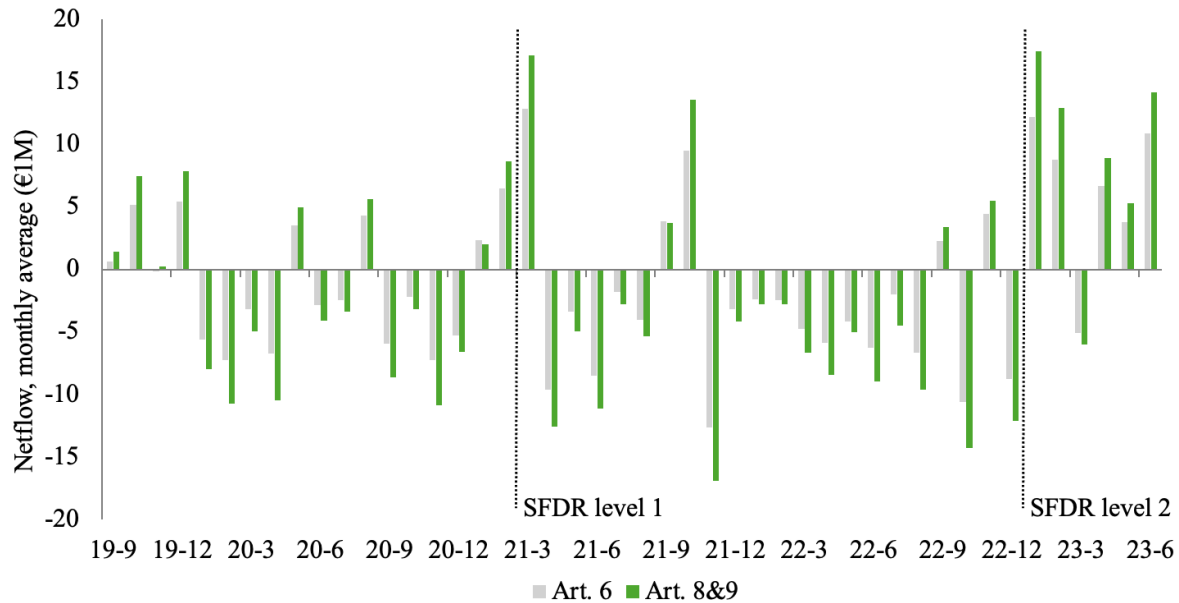
Figure 4: Monthly netflows (as a % of total assets) of European funds

Figure 4 presents the monthly netflow (as a % of total assets) to European funds during the sample period from 9/2019 to 6/2023. Y-axis represents the Netflow percentage, x-axis represents the point of time (year-month). Monthly netflow is presented as the average netflow among Article 6 funds (first column) and as the average among Article 8&9 funds (second column). The labels SFDR level 1 and SFDR level 2 denote the time of regulation implementation, respectively.

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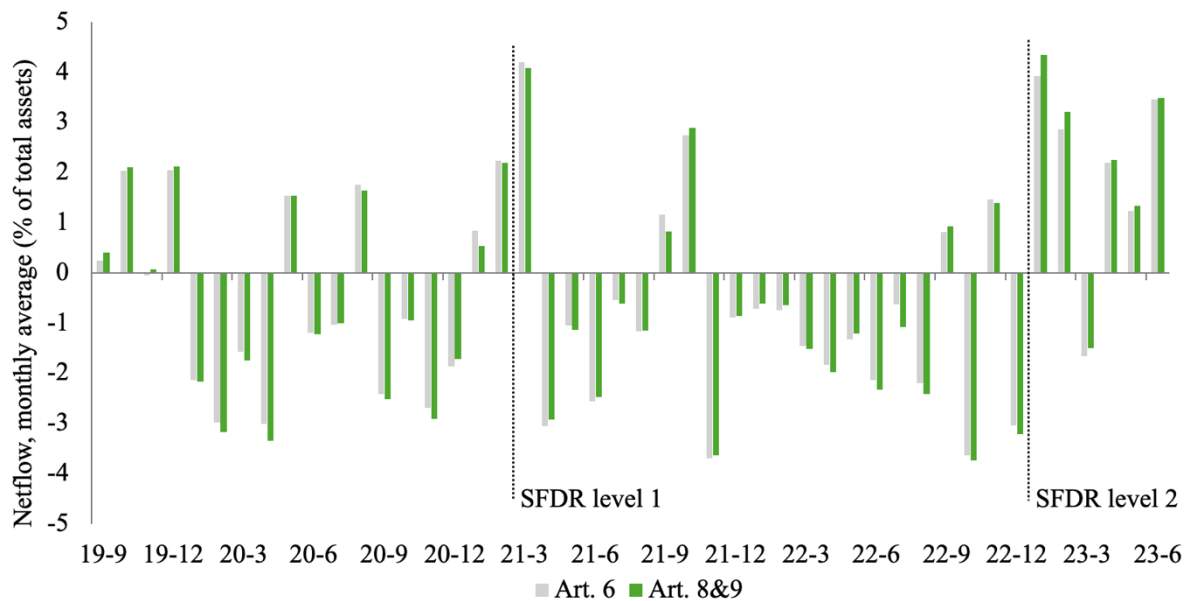
Tables

Table 1: Geographical distribution of US fund control group

Table 1 presents the geographical distribution to states of US funds in the control group, divided into four categories: three states that do regulate carbon disclosure to some extent, and the others. The home states are defined manually using random sample covering 10% of the whole control group of 2481 funds.

	Legal registration location of funds, US states			
	California	Washington	Oregon	Others
% of funds in control group	21%	8%	0%	71 %

Table 2: Summary statistics on US funds, control group VS excluded from control group

Table 2 presents the means of the key variables used in this paper for two groups: the US control group ("CG"), and a random sample of US funds excluded from control group ("Not CG"). *CE* accounts for the amount of carbon emissions (in tonnes per €1M invested), *Size* is the total value of assets in €M, *Return* is the monthly return in percentages, *Netflow* the monthly inflow as a percentage of total net assets, *Age* is months since inception date and *Institutional* is a dummy variable equaling 1 for funds fulfilling at least one of the following objectives: 1) has the word "institutional" in its name, 2) has a minimum initial investment of $100,000 or more or 3) states in its prospectus that it is designed for institutional investors, and 0 for others. *Sustainability focus* is a label awarded by Morningstar for funds that "describe full dedication on sustainability [..] or considering ESG factors in its prospectus or regulatory filings". Observations reports the number of observations in the sample.

	Control group		Excluded from Control group	
	Nbr of funds	Mean	Nbr of funds	Mean
Size (€M)	2,481	395	2,481	1,789
Return (%)	2,481	0.89	2,481	0.85
Netflow (%)	2,481	-0.38	2,481	-0.25
Age (months)	2,481	289	2,481	228
Institutional	2,481	0.44	2,481	0.13
Funds with a Sustainability focus (%)	2,481	7.32	2,481	4.12

Table 3A: Summary statistics on European funds

Table 3A presents the standard deviation (SD), mean, median, minimum and maximum of the main variables used in this paper. *CE* accounts for the amount of carbon emissions (in tonnes per €1M invested), *Size* is the total value of assets in €M, *Return* is the monthly return in percentages, *Netflow* the monthly inflow as a percentage of total net assets, *Age* is months since inception date and *Institutional* is a dummy variable equaling 1 for funds fulfilling at least one of the following objectives: 1) has the word "institutional" in its name, 2) has a minimum initial investment of $100,000 or more or 3) states in its prospectus that it is designed for institutional investors, and 0 for others. Observations reports the number of observations in the sample.

	Nbr of funds	SD	Mean	Median	Min	Max
CE	4,489	120	86	58	0.32	5,118
Size (€M)	4,489	803	311	91	0.10	18,937
Return (%)	4,489	0.50	0.58	0.63	-4.82	4.32
Netflow (%)	4,489	0.55	-0.27	-0.33	-3.30	7.42
Age (months)	4,489	136	241	243	47	654
Institutional	4,489	0.34	0.13	0.00	0.00	1.00

Table 3B: Summary statistics on observations of European funds

Table 3B presents the standard deviation (SD), mean, median, minimum and maximum of the main variables used in this paper. *CE* accounts for the amount of carbon emissions (in tonnes per €1M invested), *Size* is the total value of assets in €M, *Return* is the monthly return in percentages, *Netflow* the monthly inflow as a percentage of total net assets, *Age* is months since inception date and *Institutional* is a dummy variable equaling 1 for funds fulfilling at least one of the following objectives: 1) has the word "institutional" in its name, 2) has a minimum initial investment of $100,000 or more or 3) states in its prospectus that it is designed for institutional investors, and 0 for others. Observations reports the number of observations in the sample.

	Observations	SD	Mean	Median	Min	Max
CE	78,148	175	85	59	0.14	16,414
Size (€M)	78,148	115	401	113	0.10	20,663
Return (%)	78,148	4.94	-0.03	0.09	-56.76	39.66
Netflow (%)	78,148	4.81	-0.33	-0.59	-42.74	47.27
Age (months)	78,148	133	254	239	4.00	654
Institutional	78,148	0.35	0.15	0.00	0.00	1.00

Table 4A: Summary statistics on US funds

Table 4A presents the standard deviation (SD), mean, median, minimum and maximum of the main variables used in this paper. *CE* accounts for the amount of carbon emissions (in tonnes per €1M invested), *Size* is total value of assets in €M, *Return* is the monthly return in percentages, *Netflow* the monthly inflow as a percentage of total net assets, *Age* is months since inception date and *Institutional* is a dummy variable equaling 1 for funds fulfilling at least one of the following objectives: 1) has the word "institutional" in its name, 2) has a minimum initial investment of $100,000 or more or 3) states in its prospectus that it is designed for institutional investors, and 0 for others. Observations reports the number of observations in the sample.

	Nbr of funds	SD	Mean	Median	Min	Max
CE	2,481	105	72	49	0.26	3,878
Size (€M)	2,481	278	395	254	1.3	1,114,200
Return (%)	2,481	0.37	0.89	0.90	-1.26	4.81
Netflow (%)	2,481	1.24	-0.38	-0.77	-4.02	6.09
Age (months)	2,481	89	289	312	57	873
Institutional	2,481	0.50	0.44	0.00	0.00	1.00

Table 4B: Summary statistics on observations of US funds

Table 4B presents the standard deviation (SD), mean, median, minimum and maximum of the main variables used in this paper. *CE* accounts for the amount of carbon emissions (in tonnes per €1M invested), *Size* is total value of assets in €M, *Return* is the monthly return in percentages, *Netflow* the monthly inflow as a percentage of total net assets, *Age* is months since inception date and *Institutional* is a dummy variable equaling 1 for funds fulfilling at least one of the following objectives: 1) has the word "institutional" in its name, 2) has a minimum initial investment of $100,000 or more or 3) states in its prospectus that it is designed for institutional investors, and 0 for others. Observations reports the number of observations in the sample.

	Observations	SD	Mean	Median	Min	Max
CE	44,663	81	72	46	0.13	8,864
Size (€M)	44,663	349	454	158	0.12	1,373,300
Return (%)	44,663	6.21	-0.39	-0.59	-57.05	38.40
Netflow (%)	44,663	10.12	-0.65	-0.44	-73.23	61.79
Age (months)	44,663	176	264	306	11	873
Institutional	44,663	0.41	0.16	0.00	0.00	1.00

Table 5A: Summary statistics on European funds, categorized by article classification

Table 5A presents the standard deviation (SD), mean, median, minimum and maximum of the main variables used in this paper. *CE* accounts for the amount of carbon emissions (in tonnes per €1M invested), *Size* is the total value of assets in €M, *Return* is the monthly return in percentages, *Netflow* the monthly inflow as a percentage of total net assets, *Age* is months since inception date and *Institutional* is a dummy variable equaling 1 for funds fulfilling at least one of the following objectives: 1) has the word "institutional" in its name, 2) has a minimum initial investment of $100,000 or more or 3) states in its prospectus that it is designed for institutional investors, and 0 for others. Observations reports the number of observations in the sample.

Article 9	Nbr of funds	SD	Mean	Median	Min	Max
CE	274	46	54	43	1.7	389
Size (€M)	274	834	362	91	0.2	7,448
Return (%)	274	0.51	0.61	0.66	-1.25	2.65
Netflow (%)	274	0.63	-0.25	-0.38	-2.14	2.55
Age (months)	274	130	261	231	51	654
Institutional	274	0.35	0.14	0.00	0.00	1.00

Article 8	Nbr of funds	SD	Mean	Median	Min	Max
CE	2,552	122	73	55	0.32	5,118
Size (€M)	2,552	842	372	126	0.1	18,937
Return (%)	2,552	0.46	0.60	0.65	-2.02	4.32
Netflow (%)	2,552	0.54	-0.29	-0.34	-3.30	7.42
Age (months)	2,552	141	277	251	47	653
Institutional	2,552	0.34	0.14	0.00	0.00	1.00

Article 6	Nbr of funds	SD	Mean	Median	Min	Max
CE	1,772	157	93	66	0.32	5,119
Size (€M)	1,772	63	282	90	0.4	11,014
Return (%)	1,772	0.51	0.57	0.64	-4.82	3.60
Netflow (%)	1,772	0.54	-0.29	-0.34	-2.69	7.42
Age (months)	1,772	130	273	257	71	650
Institutional	1,772	0.34	0.13	0.00	0.00	1.00

Table 5B: Summary statistics on observations of European funds, categorized by article classification

Table 5B presents the standard deviation (SD), mean, median, minimum and maximum of the main variables used in this paper. *CE* accounts for the amount of carbon emissions (in tonnes per €1M invested), *Size* is the total value of assets in €M, *Return* is the monthly return in percentages, *Netflow* the monthly inflow as a percentage of total net assets, *Age* is months since inception date and *Institutional* is a dummy variable equaling 1 for funds fulfilling at least one of the following objectives: 1) has the word "institutional" in its name, 2) has a minimum initial investment of $100,000 or more or 3) states in its prospectus that it is designed for institutional investors, and 0 for others. Observations reports the number of observations in the sample.

Article 9	Observations	SD	Mean	Median	Min	Max
CE	4,805	54	53	42	1.4	770
Size (€M)	4,805	1,216	556	156	0.1	10,424
Return (%)	4,805	5.19	-0.06	0.12	-19.1	21.1
Netflow (%)	4,805	5.44	-0.22	-0.33	-30.76	47.27
Age (months)	4,805	133	254	239	4	654
Institutional	4,805	0.37	0.16	0.00	0.00	1.00

Article 8	Observations	SD	Mean	Median	Min	Max
CE	46,973	80	73	52	0.30	9,929
Size (€M)	46,973	1 060	473	162	0.1	20,663
Return (%)	46,973	4.93	-0.01	0.16	-27.58	34.13
Netflow (%)	46,973	4.83	-0.32	-0.62	-30.88	30.65
Age (months)	46,973	137	255	239	4	654
Institutional	46,973	0.37	0.17	0.00	0.00	1.00

Article 6	Observations	SD	Mean	Median	Min	Max
CE	26,369	167	110	78	0.14	16,414
Size (€M)	26,369	860	243	54	0.3	17,104
Return (%)	26,369	4.92	-0.11	-0.01	-56.76	39.66
Netflow (%)	26,369	4.94	-0.35	-0.57	-42.74	46.59
Age (months)	26,369	130	258	248	7	650
Institutional	26,369	0.29	0.10	0.00	0.00	1.00

Table 6: Correlation matrix

Table 6 presents the correlation coefficients of the independent variables used in the regression analyses of sections 5 and 6. *CE* accounts for the amount of carbon emissions (in tonnes per €1M invested), *Size* is the total value of assets in €M, *Return* is the monthly return in percentages, *Netflow* the monthly inflow as a percentage of total net assets, *Age* is months since inception date and *Institutional* is a dummy variable equaling 1 for funds fulfilling at least one of the following objectives: 1) has the word "institutional" in its name, 2) has a minimum initial investment of $100,000 or more or 3) states in its prospectus that it is designed for institutional investors, and 0 for others. Observations reports the number of observations in the sample. Label is a dummy variable equaling 1 if funds' name contains claims regarding sustainability (e.g. "green", "sustainable", "environmental", full list of terms published by ESMA[45].

	CE	Size	Return	Netflow	Age	Institutional	Label
CE	1						
Size	-0.0403	1					
Return	-0.0026	0.0208	1				
Netflow	-0.0194	-0.0235	0.1475	1			
Age	0.0263	0.1152	0.1197	-0.0227	1		
Institutional	-0.0084	0.0586	0.0098	-0.0021	-0.1637	1	
Label	-0.0011	0.0016	-0.0086	-0.0038	-0.0038	0.0025	1

[45] ESMA (2023) ESMA Report on Trends, Risks and Vulnerabilities Risk Analysis - ESG Names and Claims in the EU Fund Industry, amending regulation (EU) 2010/1095 of European Parliament and of the Council of 24

Table 7: Influence of SFDR implementation on portfolio carbon emissions in European funds

Table 7 presents the results of difference-in-differences regressions of European and US funds' Carbon Emissions on dummy variables *Treated*, *Post*, *Treated x Post* and control variables. Sample period spans from September 2019 to December 2022 for regression Level 1 and from June 2021 to June 2023 for regression Level 2. The variable *Treated* equals 1 for all European funds affected by the SFDR regulation, and 0 for US funds. Control group observations are matched to treatment observations using 1:1 nearest neighbor matching method. The variable *Post* equals 1 for all observations after level 1 implementation in March 2021 for regression Level 1 and for all observations after level 2 implementation in January 2023 for regression Level 2. The interaction term *Treated x Post* captures the combined effect of Treated and Post. The control variables include dummy variable *Institutional* equaling 1 for funds fulfilling at least one of the following objectives: 1) has the word "institutional" in its name, 2) has a minimum initial investment of $100,000 or more or 3) states in its prospectus that it is designed for institutional investors, and 0 for others, *Size* (logarithm of Assets under Management), *Return* (monthly return in percentages), *Netflow* (monthly inflow as a percentage of total net assets) and *Age* (months since inception date). All control variables are lagged by one month. The table reports fund-clustered t-statistics in parentheses and ***, ** and * indicate statistical significance at 1%, 5% and 10% levels.

	Dependent variable	
	Carbon emissions	
	(Level 1)	(Level 2)
Treated	-3.85	17.33 ***
	(-0.13)	(24.35)
Post	-33.10	-4.46 ***
	(-1.09)	(-4.93)
Treated x Post	20.29	-8.07 ***
	(0.67)	(-6.39)
Institutional	1.14	-1.38 ***
	(0.81)	(-0.48)
Size	-2.13 ***	-1.70 ***
	(-10.59)	(-10.25)
Return	0.59 **	0.19 ***
	(10.10)	(3.65)
Netflow	0.000	0.68
	(0.39)	(0.26)
Age	-0.02 ***	-0.02 ***
	(-6.11)	(-7.69)
Adjusted R^2	0.012	0.018
No. of observations	84,927	100,041

Table 8: Influence of SFDR level 1 implementation on portfolio carbon emissions in Article 8 and 9 funds

Table 8 presents the results of difference-in-differences regressions of Article 8 and 9 funds' Carbon Emissions on dummy variables *Treated*, *Post*, *Treated x Post* and control variables. Sample period spans from September 2019 to December 2022. The variable *Treated* equals 1 for Article 8 funds in the corresponding regression, 1 for Article 9 funds in the corresponding regression and 1 for Article 8 and 9 funds in the corresponding regression. Control group observations of Article 6 funds are matched to treatment observations using 1:1 nearest neighbor matching method. The variable *Post* equals 1 for all observations after level 1 implementation in March 2021. The interaction term *Treated x Post* captures the combined effect of *Treated* and *Post*. The control variables include dummy variable *Institutional* equaling 1 for funds fulfilling at least one of the following objectives: 1) has the word "institutional" in its name, 2) has a minimum initial investment of $100,000 or more or 3) states in its prospectus that it is designed for institutional investors, and 0 for others, *Size* (logarithm of Assets under Management), *Return* (monthly return in percentages), *Netflow* (monthly inflow as a percentage of total net assets) and *Age* (months since inception date). All control variables are lagged by one month. The table reports fund-clustered t-statistics in parentheses and ***, ** and * indicate statistical significance at 1%, 5% and 10% levels.

	Dependent variable		
	Carbon emissions		
	(Article 8)	(Article 9)	(Articles 8&9)
Treated	-60.42 ***	-71.39***	-60.09 ***
	(-12.33)	(-4.77)	(-12.97)
Post	-34.37 ***	-25.99*	-32.67 ***
	(-9.09)	(-2.13)	(-9.09)
Treated x Post	2.38 ***	20.84	2.41 ***
	(4.79)	(1.38)	(4.78)
Institutional	8.57 ***	5.05	8.75 ***
	(7.75)	(1.67)	(8.41)
Size	-4.10 ***	-1.11***	-3.86 ***
	(-15.92)	(-1.73)	(-15.95)
Return	0.74 ***	0.82 ***	0.70 ***
	(9.91)	(4.06)	(10.11)
Netflow	-0.00	-0.02	-0.00
	(-0.74)	(-0.62)	(-0.72)
Age	0.03 ***	0.03 **	0.03 ***
	(9.50)	(3.15)	(9.66)
Adjusted R^2	0.041	0.080	0.044
No. of observations	52,956	6,748	56,335

Table 9: Influence of SFDR level 2 implementation on portfolio carbon emissions in Article 8 and 9 funds

Table 9 presents the results of difference-in-differences regressions of Article 8 and 9 funds' Carbon Emissions on dummy variables *Treated*, *Post*, *Treated x Post* and control variables. Sample period spans from June 2021 to June 2023. The variable *Treated* equals 1 for Article 8 funds in the corresponding regression, 1 for Article 9 funds in the corresponding regression and 1 for Article 8 and 9 funds in the corresponding regression. Control group observations of Article 6 funds are matched to treatment observations using 1:1 nearest neighbor matching method. The variable *Post* equals 1 for all observations after Level 2 implementation in January 2023. The interaction term *Treated x Post* captures the combined effect of *Treated* and *Post*. The control variables include dummy variable *Institutional* equaling 1 for funds fulfilling at least one of the following objectives: 1) has the word "institutional" in its name, 2) has a minimum initial investment of $100,000 or more or 3) states in its prospectus that it is designed for institutional investors, and 0 for others, *Size* (logarithm of Assets under Management), *Return* (monthly return in percentages), *Netflow* (monthly inflow as a percentage of total net assets) and *Age* (months since inception date). All control variables are lagged by one month. The table reports fund-clustered t-statistics in parentheses and ***, ** and * indicate statistical significance at 1%, 5% and 10% levels.

	Dependent variable		
	Carbon emissions		
	(Article 8)	(Article 9)	(Articles 8&9)
Treated	-35.55 ***	-50.49 ***	-36.20 ***
	(-48.42)	(-24.01)	(-52.59)
Post	-14.50 ***	-8.93 **	-14.99 ***
	(-15.00)	(-3.29)	(-16.54)
Treated x Post	6.25 ***	1.36	6.64 ***
	(4.59)	(0.36)	(5.22)
Institutional	6.39 ***	3.99	6.43 ***
	(7.41)	(1.62)	(7.59)
Size	-3.39 ***	-0.34	-2.97 ***
	(-16.43)	(-0.66)	(-15.43)
Return	0.43 ***	0.46 **	0.37 ***
	(6.74)	(2.67)	(6.23)
Netflow	-0.00	-0.04	-0.0001
	(-0.81)	(-1.07)	(-0.80)
Age	0.03 ***	0.04 ***	0.03***
	(10.93)	(4.96)	(12.34)
Adjusted R^2	0.040	0.087	0.043
No. of observations	63,430	9,079	67,974

Table 10: Influence of SFDR implementation on portfolio carbon emissions in Article 9 funds

Table 10 presents the results of difference-in-differences regressions of European and US funds' Carbon Emissions on dummy variables *Treated*, *Post*, *Treated x Post* and control variables. Sample period spans from September 2019 to December 2022 for regression Level 1 and from June 2021 to June 2023 for regression Level 2. The variable *Treated* equals 1 for all European funds affected by the SFDR regulation, and 0 for US funds. Control group observations of Article 8 funds are matched to treatment observations using 1:1 nearest neighbor matching method. The variable *Post* equals 1 for all observations after level 1 implementation in March 2021 for regression Level 1 and for all observations after level 2 implementation in January 2023 for regression Level 2. The interaction term *Treated x Post* captures the combined effect of Treated and Post. The control variables include dummy variable *Institutional* equaling 1 for funds fulfilling at least one of the following objectives: 1) has the word "institutional" in its name, 2) has a minimum initial investment of $100,000 or more or 3) states in its prospectus that it is designed for institutional investors, and 0 for others, *Size* (logarithm of Assets under Management), *Return* (monthly return in percentages), *Netflow* (monthly inflow as a percentage of total net assets) and *Age* (months since inception date). All control variables are lagged by one month. The table reports fund-clustered t-statistics in parentheses and ***, ** and * indicate statistical significance at 1%, 5% and 10% levels.

	Dependent variable	
	Carbon emissions	
	(Level 1)	(Level 2)
Treated	-13.949	-14.674 ***
	(-1.443)	(-9.055)
Post	-2.925	-7.46 ***
	(-0.415)	(-3.557)
Treated x Post	-1.75	-0.625
	(-0.281)	(-0.213)
Institutional	4.21 *	8.01 ***
	(1.989)	(4.48)
Size	-1.947 ***	-2.078 ***
	(-3.874)	(-5.183)
Return	0.467 **	0.032
	(3.114)	(0.247)
Netflow	-0.003	-0.028
	(-0.219)	(-1.017)
Age	0.049 ***	0.04 ***
	(6.317)	(5.998)
Adjusted R^2	0.023	0.021
No. of observations	6,747	9,081

Table 11: Influence of SFDR labels after level 1 implementation on netflow

Table 11 presents the results of difference-in-differences regressions of Article 8 and 9 funds' Netflow on dummy variables *Treated*, *Post*, *Treated x Post* and control variables. Netflow is presented in percentage points of total assets. Sample period spans from September 2019 to December 2022. The variable *Treated* equals 1 for Article 8 funds in the corresponding regression, 1 for Article 9 funds in the corresponding regression and 1 for Article 8 and 9 funds in the corresponding regression. Control group observations of Article 6 funds are matched to treatment observations using 1:1 nearest neighbor matching method. The variable *Post* equals 1 for all observations after Level 1 implementation in March 2021. The interaction term *Treated x Post* captures the combined effect of Treated and Post. The control variables include *Size* (logarithm of Assets under Management), *Return* (monthly return in percentages) and *Age* (months since inception date). All control variables are lagged by one month. The table reports fund-clustered t-statistics in parentheses and ***, ** and * indicate statistical significance at 1%, 5% and 10% levels.

	Dependent variable		
	Netflow		
	(Art. 8)	(Art. 9)	(Art. 8&9)
Treated	-0.346	-0.299 *	-0.513 *
	(-1.536)	(-0.403)	(--2.467)
Post	-6.007 ***	-5.041 ***	-6.048 ***
	(-33.731)	(-8.245)	(-37.546)
Treated x Post	0.390	0.138	0.495 *
	(1.714)	(0.184)	(2.350)
Label	0.038	0.090	0.041
	(0.509)	(0.478)	(0.575)
Size	-0.120 ***	-0.148 ***	-0.138 ***
	(-4.164)	(-4.791)	(12.775)
Return	-0.013 ***	-0.046 ***	-0.017 ***
	(-4.164)	(-4.793)	(-5.421)
Age	-0.0003 **	-0.0005	-0.0003 **
	(-2.891)	(-1.077)	(-2.648)
Adjusted R^2	0.039	0.033	0.041
No. of observations	52,956	6,758	56,335

Table 12: Influence of SFDR labels after level 2 implementation on netflow

Table 12 presents the results of difference-in-differences regressions of Article 8 and 9 funds' Netflow on dummy variables *Treated*, *Post*, *Treated x Post* and control variables. Netflow is presented in percentage points of total assets. Sample period spans from June 2021 to June 2023. The variable *Treated* equals 1 for Article 8 funds in the corresponding regression, 1 for Article 9 funds in the corresponding regression and 1 for Article 8 and 9 funds in the corresponding regression. Control group observations of Article 6 funds are matched to treatment observations using 1:1 nearest neighbor matching method. The variable *Post* equals 1 for all observations after Level 2 implementation in January 2023. The interaction term *Treated x Post* captures the combined effect of Treated and Post. The control variables include *Size* (logarithm of Assets under Management), *Return* (monthly return in percentages) and *Age* (months since inception date). All control variables are lagged by one month. The table reports fund-clustered t-statistics in parentheses and ***, ** and * indicate statistical significance at 1%, 5% and 10% levels.

	Dependent variable		
	Netflow		
	(Art. 8)	(Art. 9)	(Art. 8&9)
Treated	-0.034	-0.289 **	-0.009 **
	(-1.098)	(-2.970)	(-3.227)
Post	4.370 ***	4.279 ***	4.402 ***
	(106.783)	(33.941)	(113.801)
Treated x Post	0.333 ***	0.772 ***	0.331 ***
	(5.767)	(4.369)	(6.067)
Label	-0.013	0.265 ***	-0.0001
	(-0.225)	(0.164)	(-0.031)
Size	-0.096 ***	-0.091 ***	-0.107 ***
	(-11.012)	(-3.869)	(-13.097)
Return	-0.027 ***	-0.066 ***	-0.031 ***
	(-10.322)	(-8.191)	(-12.199)
Age	-0.0001	0.0006	-0.0001
	(-1.320)	(-0.164)	(1.101)
Adjusted R^2	0.219	0.241	0.225
No. of observations	63,430	9,079	67,974

Table 13: Summary statistics of carbon emissions

Table 13 presents the summary statistics of portfolio carbon emissions at the end of June 2023 covering mean, minimum, 25th percentile, median, 75th percentile, maximum and range, categorized by article classification. Carbon emissions is presented as tonnes per €1M invested. Obs. presents the number of observations.

	Mean	Min	P25	Median	P75	Max	Range	Obs.
Article 9	48.50	1.61	17.06	39.75	64.41	754	753	278
Article 8	65.50	0.27	22.61	45.91	80.46	1,531	1,531	2,566
Article 6	99.29	0.29	33.96	65.96	119.00	4,910	4,910	1,657

Table 14: Summary statistics of fossil fuel involvement

Table 14 presents the mean, minimum, 25th percentile, median, 75th percentile, maximum and range of fossil fuel involvement, categorized by article classification. Fossil fuel involvement is the percentage of funds' investment portfolio that is involved in thermal coal extraction, thermal coal power generation, oil and gas production, oil and gas power generation or oil and gas products & services. The observations present the values at the end of June 2023. Obs. presents the number of observations.

	Mean	Min	P25	Median	P75	Max	Range	Obs.
Article 9	4.48	0.00	0.00	2.93	6.73	66.95	66.95	278
Article 8	6.64	0.00	1.66	5.35	9.53	92.56	92.56	2,566
Article 6	8.35	0.00	2.88	7.03	11.05	98.33	98.33	1,657

Table 15: Percentage (%) of funds indicating a sustainability controversy, carbon emissions

Table 15 present the results of a comparison analysis conducted between Article 9, Article 8 and Article 6 funds. The dataset consists of 4501 unique funds. Studied measure is Portfolio Carbon emissions (tonnes per €1M invested). Fund is categorized to *Possible controversy* if its' portfolio carbon emissions are higher than the mean of emissions in previous article class, i.e., Article 9 funds indicate controversy if their carbon emissions are higher than the mean of Article 8 funds, and Article 8 funds if their carbon emissions are higher than the mean of Article 6 funds. Article 9 funds indicate *Clear controversy*, if their carbon emissions are higher than the mean of Article 6 funds.

	Possible controversy		Clear controversy	
	After level 1 implementation	After level 2 implementation	After level 1 implementation	After level 2 implementation
Article 9	31.79 %	24.46 %	10.26 %	8.99 %
Article 8	17.52 %	17.73 %		

Table 16: Percentage (%) of funds indicating a sustainability controversy, fossil fuel involvement

Table 16 present the results of a comparison analysis conducted between Article 9, Article 8 and Article 6 funds. The dataset consists of 4501 unique funds. Studied measure is Fossil fuel involvement (% of funds' investment portfolio that is involved in thermal coal extraction, thermal coal power generation, oil and gas production, oil and gas power generation or oil and gas products & services). Fund is categorized to *Possible controversy* if its' portfolio fossil fuel involvement is higher than the mean of fossil fuel involvement in previous article class, i.e., Article 9 funds indicate controversy if their fossil fuel involvement is higher than the mean of Article 8 funds, and Article 8 funds if their fossil fuel involvement is higher than the mean of Article 6 funds. Article 9 funds indicate *Clear controversy*, if their fossil fuel involvement is higher than the mean of Article 6 funds.

	Possible controversy		Clear controversy	
	After level 1 implementation	After level 2 implementation	After level 1 implementation	After level 2 implementation
Article 9	24.62 %	23.02 %	12.82 %	16.19 %
Article 8	28.84 %	31.57 %		

Table 17: Influence of SFDR implementation on portfolio carbon emissions in European funds, single sample period

Table 17 presents the results of difference-in-differences regressions of European and US funds' Carbon Emissions on dummy variables *Treated*, *Post1, Post2*, their interaction terms *Treated x Post1*, *Treated x Post2* and control variables. The sample period spans from September 2019 to June 2023. The variable *Treated* equals 1 for all European funds affected by the SFDR regulation, and 0 for US funds. Control group observations are matched to treatment observations using 1:1 nearest neighbor matching method. The variable *Post1* equals 1 for all observations after level 1 implementation in March 2021 until December 2022 and *Post2* for all observations after level 2 implementation in January 2023. The interaction terms *Treated x Post1* and *Treated x Post2* capture the combined effects of Treated and Post. The control variables include dummy variable *Institutional* equaling 1 for funds fulfilling at least one of the following objectives: 1) has the word "institutional" in its name, 2) has a minimum initial investment of $100,000 or more or 3) states in its prospectus that it is designed for institutional investors, and 0 for others, *Size* (logarithm of Assets under Management), *Return* (monthly return in percentages), *Netflow* (monthly inflow as a percentage of total net assets) and *Age* (months since inception date). All control variables are lagged by one month. The table reports fund-clustered t-statistics in parentheses and ***, ** and * indicate statistical significance at 1%, 5% and 10% levels.

	Dependent variable
	Carbon emissions
Treated	29.35 ***
	(11.49)
Post1	-3.15 **
	(-2.99)
Post2	-6.28 ***
	(-6.40)
Treated x Post1	-1.18
	(-0.371)
Treated x Post2	-20.14 ***
	(-7.28)
Institutional	0.68
	(0.58)
Size	-1.91 ***
	(11.64)
Return	0.30 ***
	(5.65)
Netflow	0.001
	(0.48)
Age	-0.02 ***
	(-7.99)
Adjusted R^2	0.012
No. of observations	122,811

Table 18: Influence of SFDR implementation on portfolio carbon emissions in Article 8 and 9 funds, single sample period

Table 18 presents the results of difference-in-differences regressions of European funds on dummy variables *Treated*, *Post1, Post2*, their interaction terms *Treated x Post1*, *Treated x Post2* and control variables. The sample period spans from September 2019 to June 2023. The variable *Treated* equals 1 for Article 8 funds in the corresponding regression, 1 for Article 9 funds in the corresponding regression and 1 for Article 8 and 9 funds in the corresponding regression. Control group observations are matched to treatment observations separately for each regression using 1:1 nearest neighbor matching method. The variable *Post1* equals 1 for all observations after level 1 implementation in March 2021 until December 2022 and *Post2* for all observations after level 2 implementation in January 2023. The interaction terms *Treated x Post1* and *Treated x Post2* capture the combined effects of Treated and Post. The control variables include dummy variable *Institutional* equaling 1 for funds fulfilling at least one of the following objectives: 1) has the word "institutional" in its name, 2) has a minimum initial investment of $100,000 or more or 3) states in its prospectus that it is designed for institutional investors, and 0 for others, *Size* (logarithm of Assets under Management), *Return* (monthly return in percentages), *Netflow* (monthly inflow as a percentage of total net assets) and *Age* (months since inception date). All control variables are lagged by one month. The table reports fund-clustered t-statistics in parentheses and ***, ** and * indicate statistical significance at 1%, 5% and 10% levels.

	Dependent variable		
	Carbon emissions		
	(Article 8)	(Article 9)	(Articles 8&9)
Treated	-65.42 ***	-85.87 ***	-64.60 ***
	(-17.85)	(-8.34)	(-18.38)
Post1	-39.61 ***	-34.98 ***	-37.50 ***
	(-14.01)	(-4.52)	(-13.72)
Post2	-55.25 ***	-51.57 ***	-52.81 ***
	(-19.05)	(3.06)	(-18.85)
Treated x Post1	2.90 ***	3.23 ***	2.78 ***
	(0.78)	(3.06)	(0.77)
Treated x Post2	3.62 ***	4.13 ***	3.45 ***
	(0.94)	(0.38)	(0.94)
Institutional	8.92 ***	1.86	8.26 ***
	(9.63)	(0.75)	(9.71)
Size	-3.65 ***	-0.70	-3.04 ***
	(-17.64)	(-1.32)	(-15.33)
Return	0.48 ***	0.41 **	0.53 ***
	(7.54)	(2.30)	(8.84)
Netflow	-0.00	-0.04 *	-0.00
	(-0.79)	(-1.03)	(-0.75)
Age	0.03 ***	0.05 ***	0.03***
	(11.28)	(5.83)	(12.31)
Adjusted R^2	0.044	0.092	0.045
No. of observations	73,342	9,598	78,147

Table 19: Influence of SFDR labels on netflow in Article 8 and 9 funds, single sample period

Table 19 presents the results of difference-in-differences regressions of Article 8 and 9 funds' Netflow on dummy variables *Treated*, *Post1*, *Post2*, their interaction terms *Treated x Post1, Treated x Post2, Treated x Post1 x Post2* and control variables. Netflow is presented as the monthly inflow as a percentage of total net assets. Sample period spans from September 2019 to June 2023. The variable *Treated* equals 1 for Article 8 funds in the corresponding regression, 1 for Article 9 funds in the corresponding regression and 1 for Article 8 and 9 funds in the corresponding regression. Control group observations of Article 6 funds are matched to treatment observations using 1:1 nearest neighbor matching method. The variable *Post*1 equals 1 for all observations after Level 1 implementation in March 2021 until December 2022 and Post2 for all observations after Level 2 implementation in January 2023. The interaction terms *Treated x Post1, Treated x Post2* and *Treated x Post1 x Post2* capture the combined effect of Treated and Post. The control variables include *Size* (logarithm of Assets under Management), *Return* (monthly return in percentages) and *Age* (months since inception date). All control variables are lagged by one month. The table reports fund-clustered t-statistics in parentheses and ***, ** and * indicate statistical significance at 1%, 5% and 10% levels.

	Dependent variable		
	Netflow		
	(Art. 8)	(Art. 9)	(Art. 8&9)
Treated	-0.094 ***	-0.283 ***	-0.146 ***
	(-5.634)	(-5.868)	(-6.871)
Post1	-1.070 ***	-1.141 ***	-1.066 ***
	(-8.675)	(-3.938)	(-9.556)
Post2	6.232 ***	6.983 ***	6.140 ***
	(46.010)	(18.785)	(50.767)
Treated x Post1	-0.811 **	0.251*	-0.292 ***
	(-5.192)	(0.511)	(-0.596)
Treated x Post2	1.268 ***	3.279 ***	1.285 ***
	(7.277)	(6.487)	(8.058)
Label	-0.090	-0.008	-0.015
	(-0.151)	(-0.050)	(-0.279)
Size	-0.124 ***	-0.109 ***	-0.132 ***
	(13.932)	(-4.519)	(-15.636)
Return	-0.041 ***	-0.086 ***	-0.047 ***
	(-2.338)	(-10.373)	(-18.099)
Age	-0.0001	-0.0004	-0.0001
	(-1.737)	(-1.206)	(-1.032)
Adjusted R^2	0.275	0.299	0.282
No. of observations	73,342	9,507	78,147

Appendix: Glossary

List of Abbreviations

Abbreviation	Definition
SFDR	Sustainable Finance Disclosure Regulation (EU) 2019/2088
SFAP	Sustainable Finance Action Plan (COM) 2018/097
ESG	Environmental, Sustainable and Governance
EC	European Commission
GHG	Greenhouse Gas
TR	Taxonomy Regulation (EU) 2020/852
CSRD	Corporate Sustainability Reporting Directive (EU) 2022/2464
FMP	Financial Market Participant
FA	Financial Advisor
NFRD	Non-Financial Reporting Directive (EU) 2014/95
DNSH	Do No Significant Harm criteria
PAI	Principal Adverse Impact
RTS	Regulatory Technical Standards
ESAs	European Supervisory Authorities
CfE	Call for Evidence
CE	Carbon Emissions
ESMA	European Securities and Markets Authority