Sustainability labels vs. reality: how climate-friendly are green and ESG funds?

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Abstract

This paper assesses the environmental performance of sustainability-related investment funds compared to conventional ones across three dimensions: financed activities, portfolio carbon footprint, and investment in firms with ambitious science-based targets. We identify ESG funds using Morningstar (MS) strategies, the Sustainable Finance Disclosure Regulation's Article 8/9 classification, and funds' self-naming. We find that the greenest funds invest more in low-carbon sectors, but their carbon footprints are comparable to conventional funds. Also, MS Low-Carbon and Art.8 funds tend to invest in the same sectors as conventional funds but target less polluting firms. Overall, results reveal inconsistencies between ESG labels and outcomes, highlighting the limited role these funds currently play in financing the transition to a net-zero economy.

JEL Codes: C58, G11, G23, Q50, Q56
Keywords: ESG funds; low-carbon transition; sustainable finance; climate change

Non-technical summary

The Assets under Management (AuM) of global sustainability-related investment funds accounted for USD 30.3 trillion at the end of 2022, about a quarter of the global market. In non-US markets, this sector increased by 20% since 2020, reflecting rising investor interest in supporting the transition to a low-carbon economy. However, vague definitions of "sustainable" funds, limited availability of truly sustainable assets, and inconsistent transparency about fund strategies have created a wide variety of ESG-labeled funds, many of which risk misleading investors and raise concerns about "greenwashing".

This paper identifies ESG funds using three classification methods. First, we categorize funds strategies into Fossil-Fuel Free, Green, Impact, general ESG, and other funds using Morningstar. Second, we apply the European Sustainable Finance Disclosure Regulation (SFDR) categories - Articles 6, 8, and 9 - to distinguish funds by their sustainability disclosure levels. Third, we analyse fund names for ESG or green-related keywords.

We construct a novel granular database combining fund-level sustainability attributes and SFDR classification from Morningstar, holdings data from Refinitiv Lipper, and firm-level emissions from Urgentem. We assess funds' environmental performance, focusing on financed activities (e.g., renewables vs. fossil fuels), carbon footprints (absolute emissions and intensity), and investments in firms with science-based climate targets.

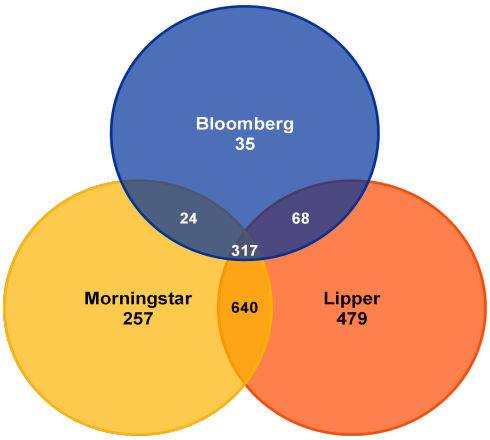
Our findings show that the "greenest" funds (Green Tech, SFDR Article 9, and self-marketed Green funds) invest more in renewables and less in fossil fuels compared to non-ESG funds. However, their carbon footprints are not significantly lower. Only Low Carbon and Article 8 funds show meaningful emission reductions over time. Also, no ESG fund category consistently favors firms with ambitious science-based climate targets.

These results show that most ESG funds have a limited role in financing the low-carbon transition and highlight the risk of greenwashing, especially among self-marketed Green funds. This underscores the need for stronger regulatory safeguards, like those proposed by the European Securities Market Authority to limit misleading sustainability claims in fund names. Clearer sustainability metrics and accountability standards are essential to help investors identify funds that genuinely support the climate transition.

1 Introduction

Sustainability-related investment funds account for over USD 30 trillion in Assets under Management (AuM), roughly a quarter of the global investment fund market (GSIA, 2023). In non-US markets, the AuM of this segment increased by 20% between 2020 and 2022, despite volatile financial conditions. This expansion reflects strong investor interest in supporting the transition to a low-carbon economy, as well as political and regulatory efforts to mobilize private finance towards climate goals. Sustainable investing has also become a marketing tool and a key area of product differentiation in the asset management industry. However, the definitions of sustainability and climate impact are broad and often vague. This ambiguity, combined with limited availability of genuinely green assets and inconsistent transparency about fund strategies, has led to a wide variety of funds labeled as ESG (Chen and Mussalli, 2020; Liang et al., 2022). Some of these funds risk misleading investors, raising increasing concerns about "greenwashing." Figure 1 illustrates well the lack of agreement on what constitutes an ESG fund. As of December 2021, Bloomberg, Lipper, and Morningstar unanimously classified only 24% of 1,820 ESG-labeled funds as such. Since then, SFDR Article 8/9 classifications have become market practice, and ESMA has issued guidelines on the use of ESG or sustainability-related terms in funds' names (ESMA, 2024a). Yet, ambiguity in definitions and metrics persists, and the actual contribution of ESG funds to sustainability objectives remains unproven.

Figure 1: ESG funds according to three data providers



Note: Data from Bloomberg, Lipper and Morningstar. The overlapping areas show that more than one data provider consider a fund being ESG. The ESG labels are as of December 2021.

The literature offers limited insight into their actual environmental performance of ESG funds. Most studies focus on fund-level sustainability scores, risk-return characteristics, or corporate ESG ratings (Pedersen et al., 2021; Pástor et al., 2021; Berg et al., 2022; Ceccarelli et al., 2024). By contrast, relatively little attention has been paid to the actual investments of these funds and their role in financing emission reductions. There is growing concern that ESG investing does not consistently align with environmental outcomes (Kölbel et al., 2020; Humphrey and Li, 2021; Kim and Yoon, 2022; Wang et al., 2023; Atta-Darkua et al., 2023). Understanding whether ESG-labeled funds truly support decarbonization is crucial for informing investors and guiding regulation.

This paper provides a detailed assessment of the environmental performance of sustainability-labeled investment funds. We define and compare ESG and non-ESG funds using three classification approaches. First, we rely on Morningstar's classification of fund strategies, which identifies categories such as Fossil Fuel Free, Green, Impact, general ESG, and others. Second, we apply the Sustainable EU Finance Disclosure Regulation, which requires funds to self-report under one of three disclosure levels: Article 6 (no sustainability objective), Article 8 (promoting environmental/social characteristics), or Article 9 (having a sustainability objective). Third, we analyze fund names for the presence of ESG- or climate-related keywords such as "sustainable," "green," or "climate," following the approach of Capotă et al. (2022).

Using these categories, we analyze the environmental performance of over 8,000 funds globally between 2016 and 2021. We construct a novel, granular database combining fund-level classification and sustainability attributes from Morningstar, portfolio holdings from Refinitiv Lipper, and firm-level emissions from Urgentem. This allows us to examine how different types of ESG-labeled funds compare to conventional funds across several dimensions: (i) the share of activities financed in renewable vs. fossil fuel sectors, (ii) the carbon footprint of portfolios in terms of absolute emissions and emissions intensity[1], and (iii) the share of investments in companies with ambitious science-based targets for decarbonization.

Our analysis provides several interesting findings. First, when comparing different sustainability taxonomies for ESG funds, we observe a strong alignment between Morningstar's (MS) sustain-

[1]We consider Scope 1 and 2 emissions in our baseline results, as they are currently more reliable than Scope 3 data.

ability strategies and the SFDR classification. Specifically, 91% of GreenTech and Low Carbon funds fall under SFDR Article 8 or 9. Conversely, among Article 9 funds, 60% are classified as GreenTech/Low Carbon and 22% as Impact funds. In contrast, self-marketed Green funds show much weaker alignment with these classifications: fewer than half qualify as Article 8 or 9 and follow a stringent sustainable strategy (such as GT/LC or Impact), while 28% are Article 6 funds with no sustainable strategy. The former may reflect green-hushing—understating sustainability to avoid scrutiny—whereas the latter points to greenwashing, with marketing claims unsupported by substantive actions.

Second, funds with the most explicit green objectives—such as Morningstar Green Tech, SFDR Article 9, and self-labeled Green funds—invest more in low-carbon sectors (e.g., Electric Components, Environmental Services, Industrials, Renewables and Utilities) and less in high emitting sectors (e.g., Fossil Fuels Energy, Communication, Financials and Health) compared to non-ESG funds. However, the carbon footprint of their portfolios, both in terms of absolute emissions and intensity, does not differ significantly from those of conventional funds.

Third, Morningstar Low-Carbon and Article 8 funds do not significantly shift their sectoral composition between 2016 and 2021, but tend to hold less carbon-intensive firms within sectors, leading to more substantial emission reductions over time. While Impact funds display lower absolute emissions in both 2016 and 2021, their emission changes across the period are not statistically different from those of conventional funds. Finally, ESG funds—whether classified by Morningstar or self-identified—show similar carbon footprints in both 2016 and 2021 compared to non-strategy funds. Finally, across all classifications, we find no ESG fund category that consistently allocates more capital to firms with ambitious science-based targets.

Overall, the paper highlights that most ESG funds currently play a limited role in financing decarbonization. The disconnect between ESG labels and actual environmental outcomes raises concerns about the credibility of sustainability claims and reinforces the case for regulatory action to address greenwashing (ESMA, 2024a). Our findings highlight the need for well-defined quantitative criteria for sustainability metrics, stronger regulatory standards, and better investor information to ensure that sustainable investing contributes meaningfully to environmental goals.

The remainder of the paper is structured as follows. Section 2 defines the metrics used to

assess funds' contributions to the low-carbon transition. Section 3 describes our novel database and data coverage. Section 4 presents the ESG funds taxonomy used in the empirical analysis. Section 5 provides stylised facts across funds' categories. Section 6 outlines the research questions and econometric framework. Section 7 discusses the main findings, and Section 8 concludes.

2 Metrics

To assess transition performance (we will use interchangeably terms sustainability, environmental, ESG performance) of investment funds and a potential mismatch between this transition performance and marketing as an ESG fund, we fist need to define such metrics. Financial institutions can contribute to provide funding to the low-carbon transition in several ways (Caldecott et al., 2022). First, providing or withdrawing capital to/from sustainable or polluting activities, respectively. Second, by reducing or increasing the cost of capital to sustainable or polluting activities, respectively. Third, by encouraging or enabling sustainable practices by companies they invest in.

In this section we introduce three sets of metrics along which we assess low-carbon transition of investment funds following guidelines of main net-zero initiatives (GFANZ, 2022; NZAOA, 2024; SBTi, 2023). First group of metrics focuses on assets financed by investment funds. We would particularly expect that sustainability-oriented funds redirect funding to climate solutions and reduce/withdraw funding from fossil fuels.

Second set of metrics looks at funds portfolio emissions, both absolute emissions and emission intensity, level and change. The level of emissions may be less clear to interpret as financial institutions may invest in highly carbon-intensive firms and actively engage investees in transition. Thus, emission level should be complemented by the change in emissions over time with the objective to reach zero portfolio emissions. Funds have different ways to reduce their portfolio emissions, for example, by selling off most carbon-intensive firms. Bolton et al. (2022) suggest how to reach net-zero portfolio with minimum tracking error. Divestment is an important instrument to encourage firms undertake the transition by increasing cost of capital and particularly for firms with activities in fossil fuel sector. However, majority of firms in transition need access to affordable funding to finance the transition (Carradori et al., 2023). In this case, divestment

helps achieve carbon-neutrality of an individual fund but doesn't help solve the problem.

The first two sets of metrics are backward-looking and do not take into account transition plans of firms or funds. Firms' net-zero alignment and/or investments in sustainable activities, like EU Taxonomy-aligned activities, should provide investors with information on firms' engagement in the transition. However, this information is not yet subject to mandatory reporting and thus not regularly available to investors. Currently, funds can have access to data from private sector initiatives like SBTi and PACTA that analyse firms' alignment with net-zero transition plans. Our third group of metrics uses a portfolio share held in companies with science-based targets (SBT) and ambitions of these targets. Given a previous study that finds that companies with more ambitious SBT have lower credit risk (Carbone et al., 2021), we assume that more environmentally-concerned investors privilege companies that have set up targets and potentially more ambitious targets. Future research could incorporate indicators of investor engagement and stewardship to better assess funds' contribution to emissions reduction. Busch et al. (2021) emphasize the need to distinguish investor influence from firm-level impact. Since investors cannot reduce emissions directly, evaluating their efforts to drive corporate action is crucial (Boyano et al., 2021). However, robust, quantitative measures of engagement practices and their effectiveness remain largely unavailable.

2.1 Financed activities

First, we look at what type of activities are financed by investment funds. Economic sectors are identified by codes of the Global Industry Classification Standard (GICS). The GICS is in some aspects more granular than often used Statistical Classification of Economic Activities in the European Community (NACE), in particular it allows identifying fossil fuels sector and renewables sector. Ideally, one should be able to use the European Taxonomy to identify sustainable activities. However, as shown by Alessi and Battiston (2022), the current nomenclature like NACE is a bad fit to assess financing of EU Taxonomy eligible and aligned activities. The authors partially solve the problem by providing a table of weights of the taxonomy eligible/aligned activities within each NACE sector. These weights are estimated by the authors based on the market information and the size of the sector in the market. This approach could be applied to

an aggregate financial sector, like French banking sector or French investment funds (Piquard et al., 2024), but less justifiable for the use at an entity level.

In this paper, we keep original GICS sectors (Communication, Discretionary goods, Staple goods, Fossil Fuel Energy, Financials, Health Care, Industrials, Information Technology, Materials, Real Estate, Renewables, Utilities) with two exceptions: we single out Environmental services[2] and Electrical components[3] from Industrials. Both categories are potential candidates for green tech investments as the former deals with waste and pollution and the latter includes firms producing batteries and thus supports the renewable energy sector.

The EU Taxonomy suggests that sustainable activities should significantly contribute to the transition and do not do any significant harm. While we cannot properly assess sustainability of firms' activities based on the available classification, we can apply this logic to make our judgement regarding where sustainability-related funds should or should not invest. First, we expect little to no investments in Fossil Fuel Energy sector. Second, we expect significantly higher investments in transition-related sectors. This can include renewables, Electrical components, Environmental services, Utilities, Industrials. Finally, we expect significantly less to no investments to sectors that do not contribute significantly to the transition such as Financials, Information technology, Health Care.

2.2 Portfolio carbon footprint

Following the EU Sustainable finance disclosure reporting (SFDR), private financial alliances (e.g., NZAOA (2024)) and the ECB climate-related indicators on carbon emissions (ECB, 2023), we use two main metrics: Financed Emissions (FE) and Weighted-Average Carbon Intensity (WACI). Financed emissions are absolute emissions of green house gases measured in tonnes of CO2 equivalent (CO2e). Carbon intensity is defined as firms' absolute emissions divided firms' revenues and measures efficiency of carbon emissions. The two measures are complementary. Absolute emissions depend on the size of a company or a fund and make comparison across

[2](According to the GICS definition, Environmental services refer to companies providing environmental and facilities maintenance services. This category includes waste management, facilities management and pollution control services, but it excludes large-scale water treatment systems that classified in the Water Utilities sub-industry.

[3](According to the GICS definition, Electrical components include companies that produce electric cables and wires, electrical components or equipment not classified in the Heavy Electrical Equipment sub-industry

entities and sectors less meaningful, on the other hand, absolute emissions allow assessing the progress made to reach net zero objective. Emission intensity makes comparison of the efficiency of activities between companies and funds possible but reduction in emission efficiency does not necessarily lead to reduction in absolute emissions.

2.2.1 Financed emissions

Financed emissions are absolute emissions that measure for how much emissions a fund is responsible by holding a share in a firm. It is defined as follows:

$$AE_{i,t} = \frac{\sum_{j=1}^{H} AE_{j,t} \cdot \omega_{i,j,t}}{\sum_{j=1}^{H} \omega_{i,j,t}}$$

where $i = 1, \ldots, N$ is a given fund, $j = 1, \ldots, H$ a specific firm in the portfolio and $t = 1, \ldots, T$ is a given year. $AE_{j,t}$ is absolute emissions of firm j. $\omega_{i,j,t} = \frac{holding_{i,j,t}}{marketcap_{j,t}}$ represents a ratio of the market value of a fund holding of firm j to the total market capitalization of the firm.

2.2.2 Carbon intensity

Similarly to financed emissions, the weighted-average carbon intensity of a fund's portfolio is defined as:

$$CI_{i,t} = \frac{\sum_{j=1}^{H} CI_{j,t} \cdot \omega_{i,j,t}}{\sum_{j=1}^{H} \omega_{i,j,t}}$$

where $i = 1, \ldots, N$ is a given fund, $j = 1, \ldots, H$ a specific firm in the portfolio and $t = 1, \ldots, T$ is a given year. $CI_{j,t}$ is the carbon of firm j. $\omega_{i,j,t} = \frac{holding_{i,j,t}}{marketcap_{j,t}}$ represents a ratio of the market value of a fund holding of firm j to the total market capitalization of the firm.

2.2.3 Change in portfolio emissions

An important metric is the change in portfolio emissions in time, either change in financed emissions or in carbon intensity. This metric allows assessing portfolio decarbonisation rate. The EU Climate Benchmarks regulation (EC, 2019) sets up at least 7% of annual decarbonisation rate for financial portfolios. This is the rate that will allow reaching carbon neutrality by 2050.

2.2.4 Factor decomposition

Drivers of the change are no less important as reduction in portfolio emissions due to portfolio reshuffling is different from emission reduction in investee firms. To measure the drivers of the change in financed emissions and carbon intensity of a fund, we decompose these variables into three main components, i.e. changes in firms' absolute emissions (carbon intensity) holding portfolio shares fixed, changes in portfolio shares keeping absolute emissions (carbon intensity) fixed, and cross effects where both are allowed to change at the same time. The decomposition takes the following form:[4]

$$
\begin{aligned}
\Delta AE_{i,t} = AE_{i,t} - AE_{i,t-1} & \\
&= \frac{\sum_j \omega_{i,j,t} AE_{j,t}}{\sum_j \omega_{i,j,t}} - \frac{\sum_j \omega_{i,j,t-1} AE_{j,t-1}}{\sum_j \omega_{i,j,t-1}} \\
&= \left[\frac{\sum_j \omega_{i,j,t} AE_{j,t-1}}{\sum_j \omega_{i,j,t}} - \frac{\sum_j \omega_{i,j,t-1} AE_{j,t-1}}{\sum_j \omega_{i,j,t-1}} \right] \\
&\quad + \left[\frac{\sum_j \omega_{i,j,t-1} AE_{j,t}}{\sum_j \omega_{i,j,t-1}} - \frac{\sum_j \omega_{i,j,t-1} AE_{j,t-1}}{\sum_j \omega_{i,j,t-1}} \right] \\
&\quad + \left[\frac{\sum_j \omega_{i,j,t} AE_{j,t}}{\sum_j \omega_{i,j,t}} - \frac{\sum_j \omega_{i,j,t-1} AE_{j,t}}{\sum_j \omega_{i,j,t-1}} - \frac{\sum_j \omega_{i,j,t} AE_{j,t-1}}{\sum_j \omega_{i,j,t}} + \frac{\sum_j \omega_{i,j,t-1} AE_{j,t-1}}{\sum_j \omega_{i,j,t-1}} \right] \\
&= \Delta emiss_{i,t} + \Delta ptf_{i,t} + \Delta cross_{i,t} \quad (1)
\end{aligned}
$$

In Formula 1, the three components are highlighted in square parentheses.

The decomposition of the change in carbon intensity (not reported) follows a similar methodology with the difference that firm-level carbon footprint is defined in emission intensity. Thus, in the decomposition, we distinguish between portfolio rebalancing factor, emission intensity factor and cross-effect. Emission intensity in itself is driven by firm emissions and revenues. For example, firms' carbon intensity can drop by increasing firms' revenue without varying firms' emissions.

[4] Some indexes are omitted for readability.

2.3 Targets

Our final measures have an objective to introduce a forward-looking perspective. Indeed, financed activities and carbon footprint reflect the past or current state, however, they do not indicate how firms address the transition. We can imagine two firms from the same sector with the same level of emissions, with one firm set up a Paris-aligned objective, established a clear transition plan and investing heavily in new low-carbon technology while another firm continues business as usual and further invests in traditional technology. Previously used measures do not distinguish between these two firms.

Ideally, the best would be to use green capital expenditures, that is tangible investments made in low-carbon technologies. However, this information is currently unavailable for the majority of firms. For this reason, we rely on widely used Science-Based Targets supported by SBT initiative.[5]

We use two metrics. First, portfolio share invested in firms with set Science-based target. We assume that ESG funds should have investment preferences for firms that disclose their intention to reduce emissions. Second, we compute an indicator that reflects firms' target ambitions. We measure ambition with respect to the declared *level* of the reduction of carbon emissions, and to the intended *horizon* of decarbonization. A higher level of emission reductions and/or over a shorter period of time indicate a more ambitious target.

3 Data

Our novel database employs three different data sources. We collect fund level data on sustainable attributes and SFDR Art. 6/8/9 from Morningstar, holdings information on funds' portfolios from Refinitiv Lipper, and firm-level data on emissions from Urgentem.

First, we obtain fund-level data from the Morningstar (MS) database, which includes a total of 73,963 open-end funds, active and inactive, domiciled in the EU as of end of 2021. In our analysis we focus on equity funds (20,001 of the total) for two reasons: first, attribution of financed carbon emissions is straightforward since equity holders own a company, have voting rights with the possibility to influence company's decisions and thus directly responsible for company's

[5] More information available at https://sciencebasedtargets.org/

emissions, second, we focus on active equity funds where asset managers have mandate to choose companies they invest in. From this pool, we extract only funds that are alive in the period between November 2020 and December 2021 (9,775 of the equity funds) and for which TNA and ISIN information is available. After Our final MS database is composed of 9,095 active open-end equity funds.

Morningstar started to assign Sustainable Attributes in 2018 with no information being available before that date. Fund categories can change from one year to another mostly because of arrival of new information. For simplicity, we take the attributes as of 2021, assuming that a fund obtaining the label had the same characteristics in the three preceding years.

Second, we construct portfolio holdings using fund-level data from Refinitiv Lipper, which provides both static information (fund name, ISIN code, domicile,...) and time series data (total net assets, ISIN-by-ISIN portfolio holdings, number of shares held, market value of the holdings, percentage of the holdings in the fund's portfolio,...). We collect a total of 8,158 distinct open-end equity funds domiciled in the EU with data spanning a total of six years, from 2016 to 2021. We construct a balanced panel so that we can track changes in portfolio composition throughout the entire time span. Furthermore, we keep only funds for which equity holdings represent more than 75% of the portfolio to avoid funds with short positions, positive or negative cash holdings, and other specific cases.

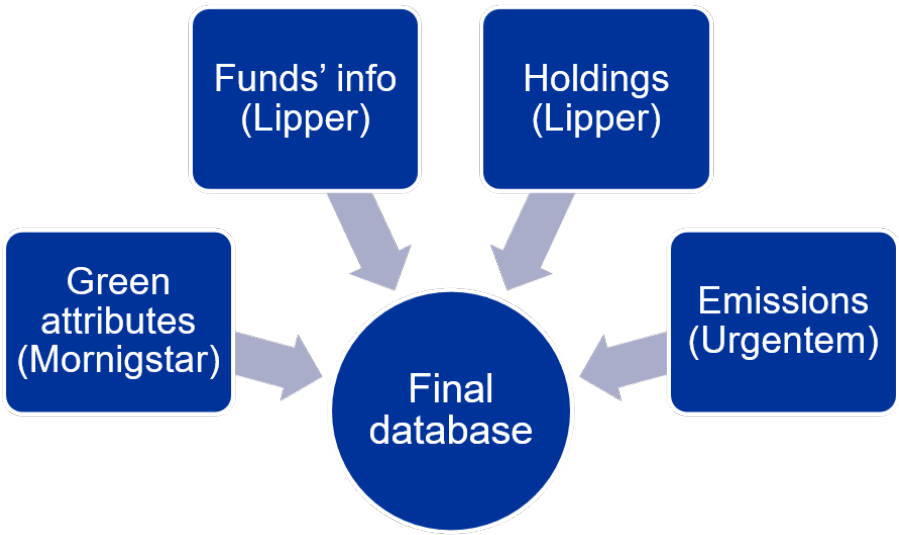
Third, we obtain emission data from Urgentem, which provides firm level data on a variety of carbon-related metrics. For our analysis, we focus on Absolute emissions (measured in tons of carbon dioxide equivalent, or tCO_2e) and Carbon intensity (measured in tons of carbon dioxide equivalent over million dollar revenue, or $tCO_2e/\$m$). In both cases, we have the breakdown of Scope 1, Scope 2 and Scope 3 emissions, where Scope 1 emissions refer to firms' direct emissions, Scope 2 refers to firms' indirect emissions related to energy consumption, and Scope 3 covers all the other upward and downward indirect emissions. The database includes information on the sector, sub-sector and industry of the covered firms, which is crucial for our analysis. We collect a total of 18,627 distinct firms throughout the years 2016 to 2021. Our panel is therefore fully balanced.

We complement the data with information on firm market capitalisation and exchange rates to

convert all data into US dollars from Bloomberg.

Lastly, we combine these three sources to obtain our final database. Figure 2 gives a visual summary of its components. We eliminate all funds for which we cannot track either their respective portfolio holdings with the corresponding firm emissions for the six years considered in the analysis, or the Sustainable attributes provided by Morningstar. In addition, we eliminate outliers in firms' carbon footprint following Bolton and Kacperczyk (2023). For each year, we take the distribution of the year-on-year growth in absolute emissions and we eliminate those firms which exhibit a growth of more than 350%. This number comes from an acceptable reduction of the excess kurtosis of the distribution based on the aforementioned work. On average across the years the kurtosis decreases to 10, down from values ranging from 4,000 to 20,000.

Figure 2: Summary of database sources



Note: Funds' information and funds' holdings are both from Lipper, but they come in two different datasets.

Table 1 provides an overview of the coverage of our database. The benchmark universe of funds is that of Morningstar, which to our knowledge is the most complete picture of open-end equity funds domiciled in the EU. In 2021, our sample covers a total of 1,838 funds, 778,480 distinct holdings, and 13,627 unique firms. While the number of funds we cover is approximately 20% of the total, the assets under management (AUM) represent about 28% of the universe.

Table 1: Database coverage

Data	Number of funds	Total AUM (bn euro)
Morningstar universe	9,095	3,680
Our Database	1,838	1,026
Coverage	20.21%	27.88%

Note: Data as of 2021.

For the econometric analysis, we remove very small and young funds, i.e. funds with a portfolio value less than 10 millions US dollars, and those whose inception date is after 2015. The first exclusion aims at stabilising the sample against fund whose portfolios (and carbon footprint) can change dramatically albeit being negligible to the overall picture, while the second takes into account the fact that very young funds might not have established a clearly defined green strategy yet.

4 Taxonomy of sustainability-related funds

In the absence of regulatory taxonomy for sustainable funds and lack of consensus among taxonomies provided by various data providers, we classify funds in our sample according to their climate-friendly characteristics ourselves. We use three approaches. First, we use Morningstar funds' sustainable attributes that we adapt for our needs. In this classification we focus on the concept of funds' *strategy*, as reported by Morningstar. Second approach uses SFDR Art. 6/8/9 attributes, which capture the concept of *disclosure*, as funds identify themselves as one of the three types and bear the cost of disclosing relevant information. Finally, the last approach is to use funds' *self-marketing* to investors.

4.1 Funds' sustainable strategies (Morningstar)

Literature identifies several strategies regarding sustainability strategies that funds aim to pursue, namely, exclusion or negative screening, positive screening, integration/incorporation, engagement and thematic investments (e.g., Boffo and Patalano (2020)). These strategies are

usually stated in funds' prospectuses and defer by the extent to which sustainability factors are integrated. Exclusion strategies are the least demanding as funds only commit not to invest in certain activities such as fossil fuels or weapons. Integration strategies request a fund to consider sustainability factors in its decision making process, although only to the extent that these factors affect the financial performance of the portfolio. Funds that use engagement strategies commit to engage with firms they invest in and to drive their sustainability performance. This strategy is also commonly referred to as an impact strategy, as funds seek to make an impact with their investments. Finally, fund that pursue thematic investment strategies invest in a specific set of assets, such as climate solutions. Normally, this strategy is not seeking to create impact because investee firms are already sustainable, with the exception when funds are provided to under-capitalised firms. It is important to stress that all these strategies are set by market practice and they are neither standardised nor supervised.

Morningstar collects information on funds' strategies from their prospectus and provides it in the Morningstar Sustainable Attributes package. All characteristics are classified in three levels, as reported in Table 2. Level 1 splits all funds in either Sustainable Investment funds or all other funds. Level 2 further distinguishes between ESG funds, Impact funds and Environmental funds. Finally, Level 3 splits these three categories even further. ESG funds can either incorporate or engage ESG criteria throughout the investment process. Impact funds are categorised by investment themes such as Gender Diversity, Low Carbon/Fossil-Fuel Free, Community Development, Environmental, Other Impact themes. Finally, environmental funds are funds whose strategies are focused on investing in environmentally oriented industries, such as renewable energy and water.

Table 2: Morningstar Sustainable Attributes.

MS Level 1	MS Level 2	MS Level 3	Our classification				
			No	ESG	IMP	GT	LC
No Sustainable Investment	None	None	*X*				
Sustainable Investment	ESG Fund	ESG Incorporation		*X*			
		ESG Engagement			*X*		
	Impact Fund	Gender Diversity		*X*			
		Low Carbon/Fossil-Fuel Free					*X*
		Community Development		*X*			
		Environmental				*X*	
		Other Impact Themes		*X*			
	Environmental Fund	Renewable Energy				*X*	
		Water-Focused				*X*	
		General Environmental Sector				*X*	

Building on these attributes, we construct our own groups, by aggregating attributes which are specifically "green" or environmental, from the ones that pertain to different ESG areas of focus. Table 2 reports the match between Morningstar and our classification. Our indicator divides funds into five categories. No strategy funds are funds that do not provide any intention to pursue sustainable strategies. ESG funds are funds that follow general "ESG" criteria such as ESG incorporation, or with a focus on topics other than environmental (e.g. social). Our Impact category differs from Morningstar as we focus on funds that explicitly aim to create an impact in companies they invest in via engagement (for example, by using their voting rights). The Green category includes funds that invest in environmental/climate solutions, for instance renewable energy. Finally, we use Morningstar category Low carbon funds to identify funds with strategies involving investment in low carbon/fossil-fuel free firms.

Our second classification focuses on the regulatory aspect. The European Sustainable Finance Disclosure Regulation (SFDR)[6] requires funds to disclose information depending on their level of integration of sustainability in investments. Article 6 refers to funds who pursue no sustainability objectives and thus bear minimum disclosure requirements. Article 8 concerns funds that aim to promote environmental or social characteristics together with other objectives. These funds

[6] Regulation (EU) 2019/2088 of the European Parliament and the Council (2019)

have to disclose more information. Finally, Article 9 focuses on funds who have sustainable objective as their primary investment objective. These funds bear the highest cost of information disclosure.

In the absence of any regulatory sustainability labels, market participants started using the SFDR regulation with the sole scope of promoting their sustainability engagement. An interesting element is that by self-selecting being Article 8 or 9, funds impose higher reporting costs. This should suggest that Art. 8/9 funds should potentially differ from no strategy funds. SFDR was not intended to be a labelling regime and does not include the type of requirements usually attached to voluntary labels For this reason, from end-2022 until end-2023, ESMA documented a wave of "downgrades" of Art.9 to Art.8 (ESMA, 2023b,c, 2024b). According to Morningstar data, the largest wave took place in the fourth quarter of 2022 with some 40% of funds being shifted by asset managers from Art. 9 to Art. 8 (Gard, 2023).

4.2 Name-based self-marketing taxonomy

Our last classification focuses purely on information how funds advertise themselves to investors via their names. Analysis by ESMA (2021, 2025) shows that becoming an ESG fund either by setting up a new fund or by conversion of an old non-ESG fund to an ESG fund attracts higher inflows as well as investors who more tolerant to past negative returns (Capotă et al., 2022). Furthermore, ESG-named funds managed to obtain higher fees, particularly from less financially-literate investors (Black and Kölbel, 2024). Matching self-marketing with ESG strategies and SFDR disclosure could also be a good proxy to reveal possible miss-selling and – potentially – the extent of green-washing. In the spirit of Capotă et al. (2022), we conduct a text-based analysis on the funds' names to search for key words that hint to a green-related marketing strategy. We include multiple definitions of funds' names: the common name, the standard name, the legal name, and the name of the oldest share class to maximise the probability of capturing keywords that hint to a green marketing strategy. As a result, we group the funds into three categories. ESG marketed funds refer to a general ESG focus, not necessarily geared towards environmental issues. It can use such words as "sustainable", "ESG", "Ethical", "Social", "SRI". Green marketed have names that recall a specific focus on environment-friendly investment using

words like "Climate", "Energy transition", "Environment".[7] The last category refers to funds that do not employ neither ESG nor green-related words in their names.

5 Stylised facts

In this section we present some stylised facts that emerge from our database. First, we show the distribution of fund types, then we look at how portfolio composition differs by fund type, and finally we look at heterogeneity in carbon emissions.

5.1 Morningstar Sustainable strategies

About half of the funds in the sample have a sustainable investment strategy identified by Morningstar, and manage almost two thirds of all assets in the sample (Table 3). The largest group is Impact funds, which make up almost one third of funds in the sample. The next biggest category is low-carbon/fossil-fuel free funds with 10% of funds and 18% of assets under management. Green tech and General ESG funds are the smallest categories contributing 2% and 7% respectively to the whole sample. Interestingly, No strategy funds and General ESG funds have – on average – a smaller portfolio than the others. This may hint to fund class size specific characteristics, as well as to slight selection bias.

Table 3: Morningstar Sustainable strategies

Strategy	Number of funds	(%)	AUM (bn euro)	(%)
Low carbon	187	10%	188	18%
Green tech	45	2%	45	4%
Impact	525	29%	365	36%
ESG	124	7%	36	4%
No strategy	957	52%	393	38%
Total	1,838	100%	1,026	100%

Note: Data as of 2021.

5.2 SFDR taxonomy

Table 4 shows the sample breakdown in terms of SFDR intentions. Funds that declare compliance to either Article 8 or 9 are about 42% of the sample, while they constitute 53% in terms

[7] A complete list of the keywords is available in Table 12 in the Appendix

of AUM. In this case, there is no much discrepancy in average size of the portfolio across fund types.

Table 4: SFDR taxonomy

SFDR	Number of funds	(%)	AUM (bn euro)	(%)
Art. 9	64	3%	59	6%
Art. 8	714	39%	488	48%
Art. 6	1,060	58%	479	47%
Total	1,838	100%	1,026	100%

Note: Data as of 2021.

5.3 Text-based self-marketing

In Table 5, we report the sample breakdown by type of fund using self-marketing strategy. ESG and Green funds total about 10% of the sample both in number of funds and in terms of assets under management (AUM), so that once again there is no discrepancy in average size of the portfolio across fund types.

Table 5: Text-based self-marketing

Marketing	Number of funds	(%)	AUM (bn €)	(%)
Green marketed	114	6%	68	7%
ESG marketed	77	4%	44	4%
Not marketed	1,647	90%	914	89%
Total	1,838	100%	1,026	100%

Note: Data as of 2021.

5.4 Cross-comparison

In Tables 6, 7 and 8, we compare different categorisations of fund types. Table 6 focuses on Green Tech and Low-Carbon funds and compares these to all other categories of SFDR and self-marketing. We notice that the majority (90%) of Green Tech and Low-Carbon funds are either Art. 8 (72%) or Art.9 (17%) funds. Most of Art. 8 funds do not market themselves as such (59%), while some market themselves as ESG funds (13%). Among Art. 9 funds we see self-marketing strategies quite equally split across all categories.

In Table 7, we focus on Article 9 funds and compare them to other categories. We observe that

Table 6: Cross-comparison between Morningstar Green tech/Low carbon strategies and SFDR & ESG self-marketing taxonomies

GT/LC	Green marketed	ESG marketed	Not marketed	Total
Art. 6	1.49%	0.50%	6,44%	8.42%
Art. 8	1.98%	13.37%	58.91%	72.26%
Art. 9	6.44%	5.94%	4.95%	17.33%
Total	9.90%	19.80%	70.30%	100.00%

Note: Green tech and Low carbon have been merged into a single category. Data as of 2021.

Table 7: Cross-comparison between SFDR Art. 9 funds and Morningstar & ESG self-marketing taxonomies

Art. 9	No strategy	ESG	Impact	GT/LC	Total
Green marketed	0.00%	1.72%	1.72%	22.41%	25.86%
ESG marketed	1.72%	5.17%	13.79%	20.69%	41.38%
Not marketed	1.72%	6.90%	6.90%	17.24%	32.76%
Total	3.45%	13.79%	22.41%	60.34%	100.00%

Note: Green tech and Low carbon have been merged into a single category. Data as of 2021.

two thirds of these funds are self-marketed with majority being ESG-marketed (41%). Most of Art.9 funds pursue Green Tech - Low-Carbon investment strategies (60%). The two other strategies include Impact (22%) and General ESG (14%).

Finally, in Table 8 we compare Green-marketed funds with the two other classifications. Interestingly, we see that almost half of the green-marketed funds are Art.6 funds (47%) and have no investment strategy (29%). At the same time, around 40% of Green-marketed funds are Art.9 that further pursue Green Tech - Low-Carbon strategy (34%).

As a whole, we see the following picture. The majority of GT/LC funds are Art. 8 and do not market themselves. Most of Art. 9 funds are GT/LC funds and equally choose among the three marketing strategies. Many Art. 9 funds are also Impact funds, and in this case they prefer

Table 8: Cross-comparison between Green-marketed funds and MS & SFDR taxonomies

Green marketed	No strategy	ESG	Impact	GT/LC	Total
Art. 6	28.95%	0.00%	10.53%	7.89%	47.37%
Art. 8	0.00%	2.63%	0.00%	10.53%	13.16%
Art. 9	0.00%	2.63%	2.63%	34.21%	39.47%
Total	28.95%	5.26%	13.16%	52.63%	100.00%

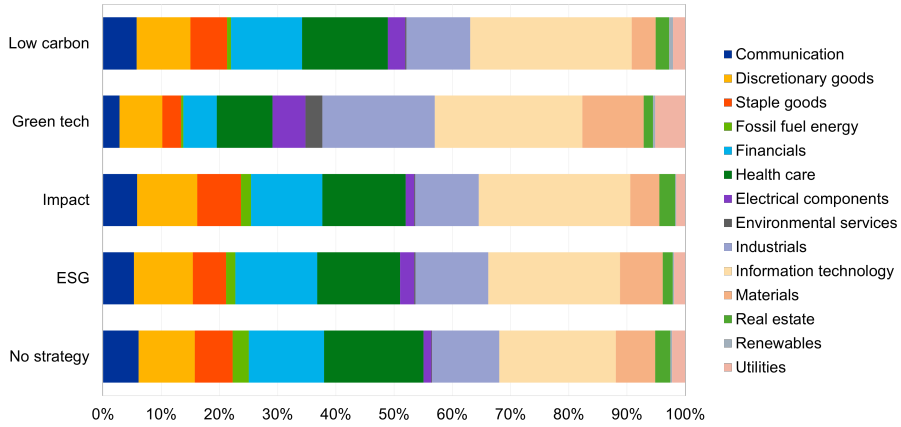
Note: Green tech and Low carbon have been merged into a single category. Data as of 2021.

to market themselves as ESG funds. Finally, less than half of the Green-marketed funds report as Art. 8/9 or have a more focused investment strategy as Impact or GT/LC. Green-marketed funds can somewhat equally be either Art. 6 or Art. 9. This observation surprises and raises some questions. Further attention is drawn to the fact that a large share of Green-marketed funds are both Art. 6 and do not have any sustainable investment strategy, which can be interpreted as a warning of potential greenwashing.

5.5 Financed activities by fund type

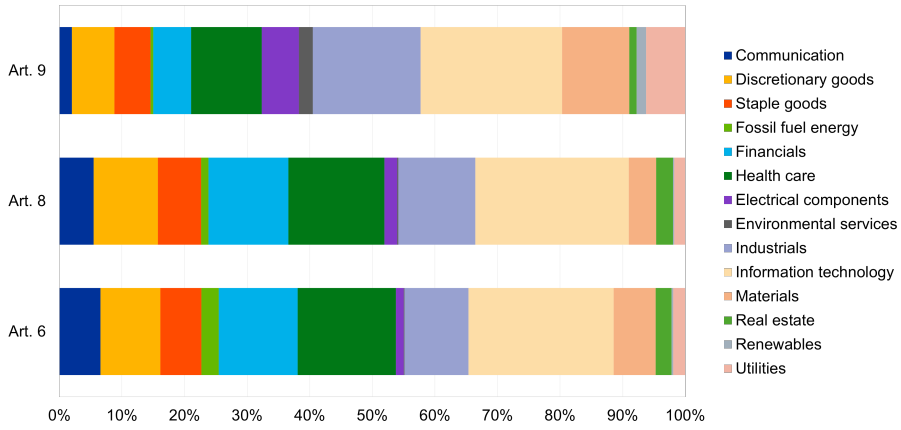
Looking at the sector level, a clear difference emerges across fund types. In Figures 3 to 5 we show the portfolio composition (weighted by funds' size) of MS strategy, SFDR disclosure and name-based self-marketing funds respectively for 2021.

Figure 3: Financed Activities of Funds by MS Sustainable Strategy



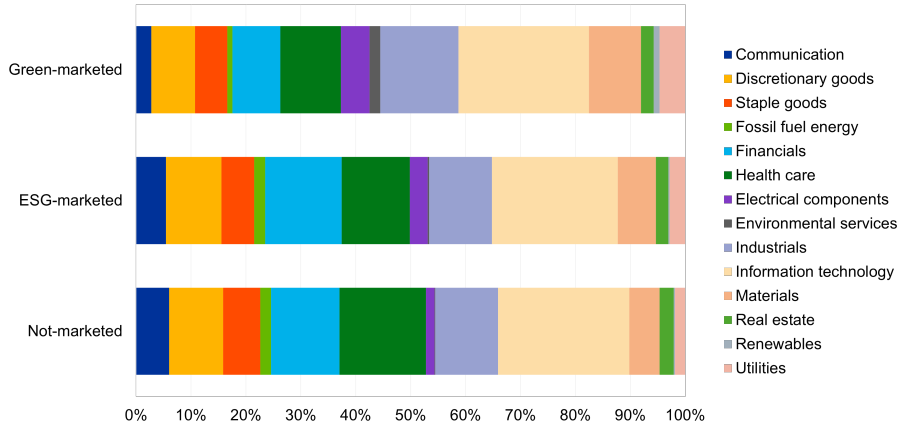
Note: Values in percentage of the portfolio. Data as of 2021.

Figure 4: Financed Activities of Funds by SFDR Disclosure Type



Note: Values in percentage of the portfolio. Data as of 2021.

Figure 5: Financed Activities of Funds by Self-marketed strategy



Note: Values in percentage of the portfolio. Data as of 2021.

A few patterns are noticeable. Interestingly, findings are very similar across all fund sustainability taxonomies. First, only the greenest categories (Green Tech in MS, Art.9 in SFDR, Green self-marketed funds) seem to have a significantly different allocation of funds. In particular, we observe little to no exposure to Fossil Fuel Sector, larger holdings of Renewables, halved amount of Financials and Health Care, while doubled exposure to Industrials and multiple times larger holdings in Electrical components, Environmental services and materials. Second, all other categories seem to show little difference in their portfolio allocation compared to the No-strategy funds. Finally, we can also notice that sustainability-strategy funds have an overall lower ex-

posure to the Fossil Fuel Sector, and somewhat higher exposure to Electrical components and Renewables, while the rest of the portfolio seem to be identical with no-strategy funds.

6 Econometric analysis

In this section, we investigate how sustainability-related funds perform on five sustainability metrics in an econometric setup. In all regressions we test sustainability-related funds (funds with sustainability strategies defined by Morningstar, funds self-declared as Art. 8/9 or self-marketed ESG/Green funds) against conventional funds (funds that have no strategy according to the Morningstar, declare themselves as Art. 6 or do not market themselves as sustainable). The five metrics cover there dimensions: first, financed activities (Section 2.1); second, portfolio carbon footprint in level and change for financed absolute emissions and emission intensity of Scopes 1 and 2 (Section 2.2); and third, firm-level targets (Section 2.3). In addition, we show the drivers of carbon footprint change based on the decomposition introduced in Section 2
We test the following hypothesis.

Financed activities. We test if the econometric analysis confirms observations in the previous section. Investment funds with sustainable attributes are expected to invest more in renewable energy, environmental services and electrical components but less in fossil fuel sectors. The greenest funds should have lower exposure to sectors such financials, health care, information an communication technologies. The latter sectors have low carbon footprint but also contribute little to the transition, and they have been highlighted as the prevalent destination of ESG funds (e.g., FT (2022)). The econometric setup is as follows:

$$sector_{i;t} = \beta_0 + \beta_1 \delta_i^{fclass} + \sum_{k=1}^{K} \beta_k ctrls_{k;i;t} + \varepsilon_i$$

where $sector_{i;t}$ represents the percent of the portfolio of fund i invested in a given sector, δ_i^{fclass} is the fund's classification under any of the three taxonomies, and $ctrls_{k;i;t}$ are a set of qualitative control variables.[8] t represents the year of measurement, which for this regression setup is 2021

[8]Throughout the entire econometric setup, the controls are the following: (1) Geographical focus (are of the globe, country-specific, mixed, etc.); (2) Capitalisation focus (small-medium cap, large cap, flexible cap, none); (3) Style focus (growth, value, blend, none).

only, since it is as static analysis.

***Level* of portfolio carbon emissions.** Carbon footprint of funds with sustainable attributes may vary by fund type. Funds oriented towards financing green technology and low-carbon activities may be expected to have significantly lower carbon footprint both in financed emissions and emission intensity. On the other hand, impact funds oriented towards financing the transition may have relatively high portfolio emissions conditionally that they engage with the investee companies to drive their emission reductions. For such funds, high level of emissions should be coupled with large emission reduction effect. General ESG funds may have large carbon footprint and no change in the level over time. The econometric setup is as follows:

$$CF_{i;t} = \beta_0 + \beta_1 \delta_i^{fclass} + \sum_{k=1}^{K} \beta_k ctrls_{k,i,t} + \varepsilon_i$$

where $CF_{i;t}$ is the level of carbon footprint (either absolute emissions or carbon intensity) of fund i in year t (where t is either 2016 or 2021), and all the other terms are the same as above.

***Change* in portfolio carbon emissions.** As discussed in the previous item, funds investing in green technologies may have already low carbon footprint and in this case may reduce their emissions by relatively little or not at all. Impact funds are expected to reduce carbon emissions significantly over time. General ESG funds may not have any specific mandate regarding carbon emissions and for this reason may not do it.

$$\Delta CF_{i,t,t-h} = \beta_0 + \beta_1 \delta_i^{fclass} + \sum_{k=1}^{K} \beta_k ctrls_k + \varepsilon_i$$

where $\Delta CF_{i,t}$ is the change of carbon footprint (either absolute emissions or carbon intensity) of fund i in year t (where t is either 2016 or 2021), and all the other terms are the same as above.

Share of firms with science-based targets in fund portfolio. We expect funds with sustainable attributes to invest more in firms with science-based targets as setting up an SBT signalling firm's commitment and forward-looking orientation to reduce emissions.

$$target_{i;t} = \beta_0 + \beta_1 \delta_i^{fclass} + \sum_{k=1}^{K} \beta_k ctrls_k + \varepsilon_i$$

where $target_{i;t}$ is the percentage of firms that have science-based targets in the portfolio of fund i in year t (where t is either 2016 or 2021), and all the other terms are the same as above.

Additionally, we control for a wide range fund-specific characteristics, such as the total net assets under management, the change in total net assets over the time-span of analysis, and a set of investment focus specifics. The latter include investment geographical focus, preference for certain market capitalisation (small, mid, large), and the investment style (growth, value, blend). Some funds have a combination of these investment characteristics, while some have none.

Tables 13 to 24 in the Appendix present a statistical summary of the variables used in the econometric analysis for both 2016 and 2021, divided by fund type across the three taxonomies[9]

7 Results

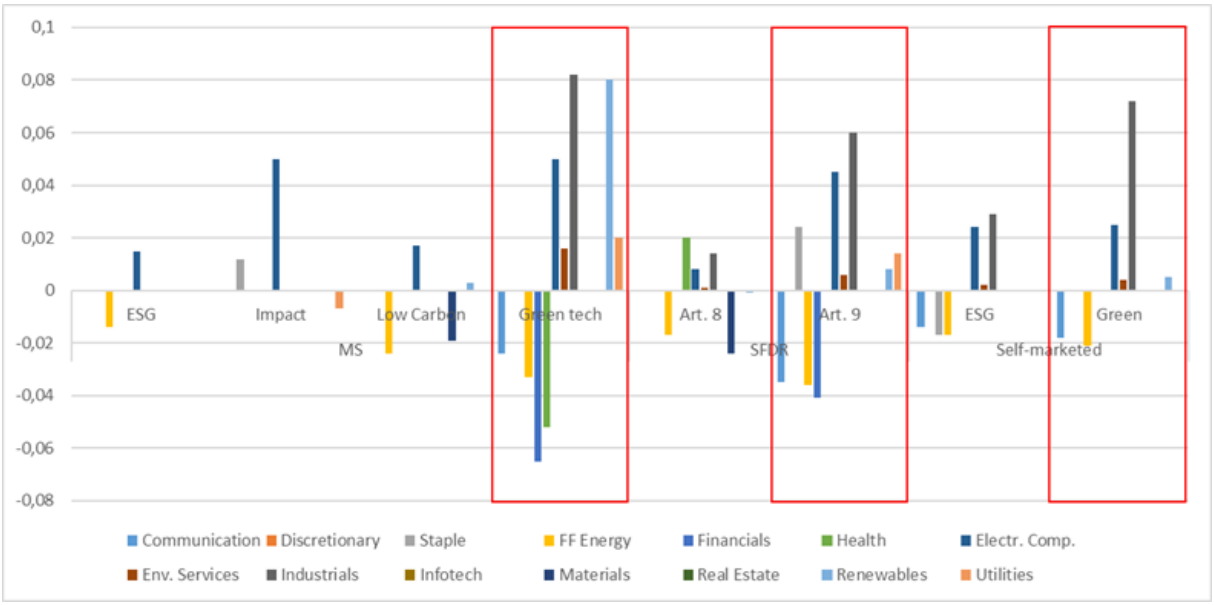
This section is dedicated to the results obtained by running four econometric specifications outlined in Section 6 and by decomposing change in portfolio carbon footprint by factor described in Section 2.

7.1 Financed activities

In this Subsection we discuss results of the econometric analysis on financed activities by various types of sustainable investment funds. We compare how investment allocations by sector in funds with MS sustainable strategies, SFDR Art.8/9 or ESG/Green self-marketing differ from conventional funds with no sustainability attributes in 2021. The results are presented in Figure 6 that provides a summary of all coefficients significant at 10% level and allows comparing the results across different sustainable funds classifications. The detailed regression results are presented respectively in Tables 25, 26, 27 in the Appendix.

[9] Qualitative control variables are excluded.

Figure 6: Summary of all statistically significant coefficients of financed activities by sustainability-related funds as reported in Tables 25 - 27



Note: Regression data as of 2021.

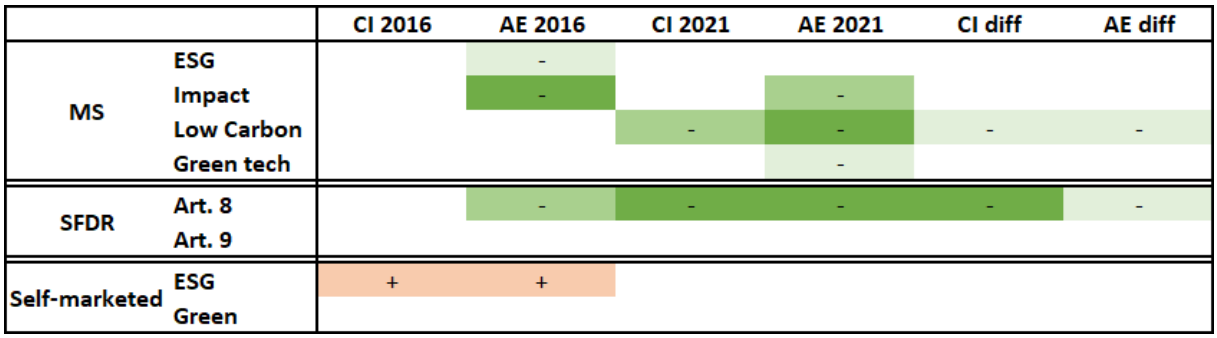
The econometric analysis largely confirms the previously observed patterns. Portfolios of the greenest categories of funds in all taxonomies differ the most from no strategy funds. In particular, they hold more of assets in sectors such as Electric Components, Environmental Services, Industrials, Renewables and Utilities, as well as less of assets in Communication, Fossil Fuel Energy, Financials, and Health. Green tech funds of the Morningstar classification show the largest difference both in number of sectors and in the size of coefficients, while Green self-marketed funds demonstrate the least difference among the three taxonomies with fewer sectors and smaller coefficients. For example, Green self-marketed funds do not differ in their investments in Financials and Health sectors relatively to no-marketed funds.

All other categories of sustainability-related funds show much less consistent patterns. The only two sectors stand out for all fund types are Fossil Fuel Energy and Electric Components. The former attracts significantly less investments except from Impact Funds, while the latter brings in more investments. Overall, the three MS categories are the closest to no-strategy funds.

7.2 Carbon footprint level and change

In this section, we look at how portfolios of investment funds with sustainability attributes differ from conventional funds in terms of the level and change in carbon footprint measured as Scope 1&2 absolute emissions and carbon intensity .

Figure 7: Summary of all statistically significant coefficients of level and change in carbon footprint for sustainability-related funds as reported in Tables 28 to 30



Note: Data as of end-2021. "-" and "+" correspond to signs of the coefficients while colours reflect statistical significance. Empty cells refer to statistically insignificant coefficients, light colours correspond to 10% significance while the darkest colours reflect 1% significance. Positive coefficients are significant at 10%. Values in percentage of the portfolio.

Figure 7 presents a summary of results regarding the difference in carbon footprint between sustainability-related and conventional investment funds. The details of regressions are shown in Tables 28, 29 and 30 for MS, SFDR and Self-marketed classifications respectively in the Appendix.

Most coefficients in Tables 28 - 30 are negative but only some of them are statistically significant. Figure 7 shows signs of statistically significant coefficients and their significance. We observe several patterns. First, carbon footprint of portfolios of the greenest categories of funds such as Green tech, Art.9 and Green self-marketed is essentially the same as the one of no-strategy funds in terms of absolute emissions and emission intensity in both 2016 and 2021. The same is true regarding the change in carbon footprint. This result is somewhat surprising if one expects greener sectors being less carbon intensive; however, this is the case only when Scope 3 emissions are taken into account. The production of transition-oriented technologies (Scope 1&2) can be even more polluting, for example, batteries, solar panels or electric vehicles.

Second, Low Carbon and Art.8 funds exhibit lower carbon footprint in 2021 as well as a reduction relatively to 2016 both in absolute emissions and emission intensity at statistically significant levels. According to this metrics, Low Carbon funds justify their label at least in 2021; however, change in carbon footprint between 2021 and 2016 is barely different from the no strategy funds standing at 10% significance level.

Third, Impact funds have lower absolute emissions both in 2016 and 2021; however, the change between the two periods is no different from conventional funds.

Finally, ESG funds, identified by MS or self-marketed, exhibit the same level of carbon footprint in 2016 and 2021 as no-strategy funds. The latter even show a 10% significance increase in their emissions relatively to conventional funds.

7.3 Drivers of carbon footprint

Decomposition of portfolio financed emissions

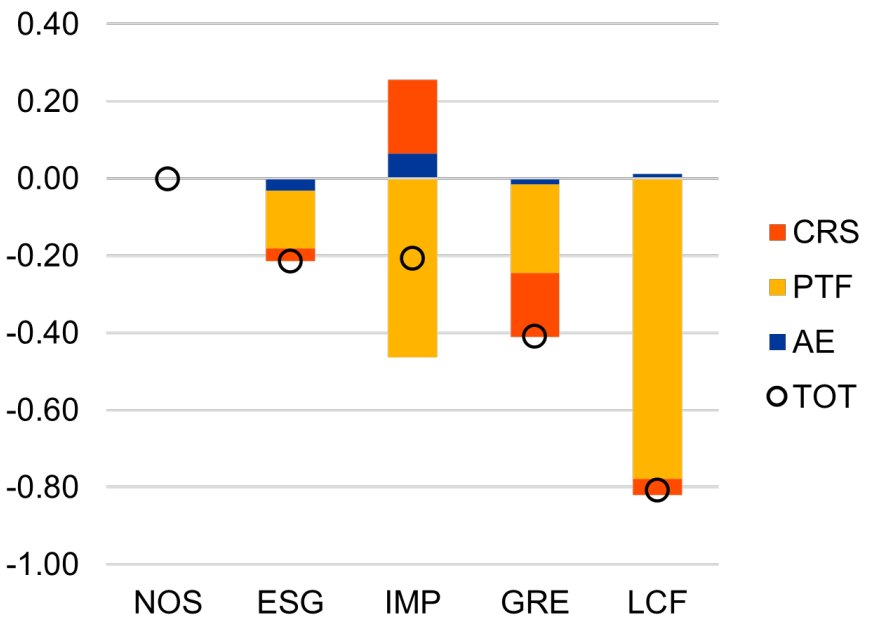
After investigating if funds with sustainable attributes have reduced their carbon footprint between 2016 and 2021, we analyse drivers behind these changes. More specifically, we decompose change in portfolio carbon footprint, as outlined in Formula 1, into two main factors - reduction in emissions of firms in portfolio and portfolio rebalancing. Each factor is expressed in percentage change of carbon footprint of an average fund within each category. As such, the numbers are directly comparable with the regressions results outlined above in terms of unit of measure.[10] Figures 8 to 10 report the decomposition of the percentage change in absolute emissions of an average fund for each category. First of all, we observe that on average all fund categories except Low-Carbon funds increased their absolute emissions. Among Morningstar categories (Fig. 8), all strategies increased their emissions by less than funds with no strategy. These results are comparable with those of Column 6 of Table 28. Low-carbon funds reduced their overall emissions between 2016 and 2021, and this is in line with the regressions results showing that solely reduction in emissions of Low carbon funds was statistically significantly lower relatively to the no-strategy funds. Interestingly, all other categories of funds increased their emissions primarily via rebalancing their portfolios towards more carbon intensive firms,

[10] Clearly, whereas the first analysis comes from a regression of sustainability-related funds relatively to no-strategy funds as a benchmark, here we do an algebraic decomposition for each category separately.

while reduction in firms' emissions played little role. Counter-intuitively firms held by Impact funds did not change their emissions, while one would expect the opposite, that is, Impact funds invest in carbon intensive firms to drive their their emissions down. Cross effects capture the case when both portfolios weights and firms' emissions change at the same time. They are more difficult to interpret, but they largely pushed towards a reduction of emissions for all fund categories except Impact funds.

Descriptive statistics add colour on the heterogeneity of results among individual funds. They show that 50% of funds in each category did reduce their absolute emissions with a median fund reducing by 12% and 44% for no strategy and low-carbon funds respectively. The increase in emissions also vary across categories with greener categories exhibiting relatively smaller maximum upsurge (Tables 14 - 18).

Figure 8: Decomposition of the average percent change in funds' absolute emissions (Scope 1&2) between 2016 and 2021, by Morningstar strategy

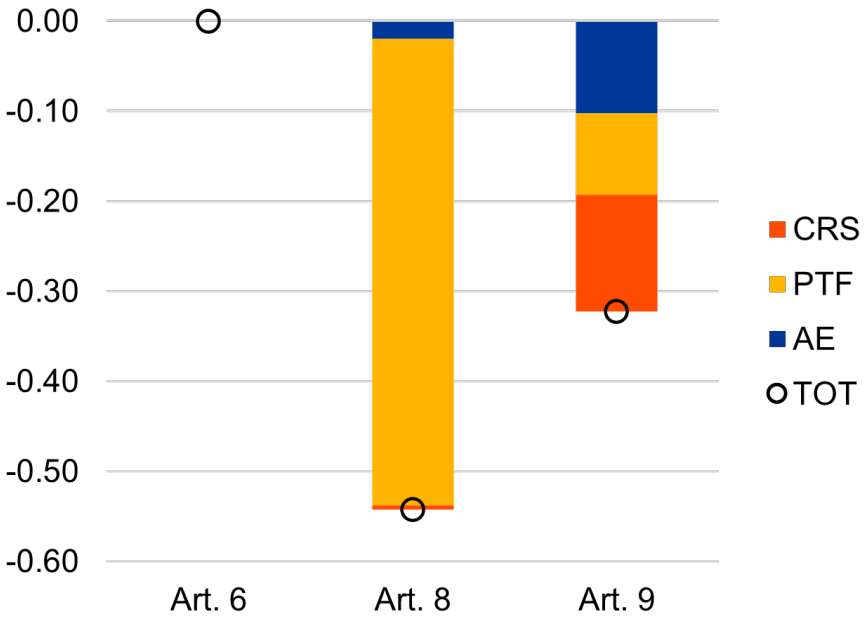


Note: AE refers to change in portfolio emissions driven by the change in investee firms' absolute emissions; PTF refers to change in portfolio emissions driven by portfolio rebalancing; CRS refers to the cross-effect when portfolio weights and firms' emissions change at the same time; TOT refers to the overall change in portfolio emissions. The numbers are expressed in percentage change of portfolio emissions.

Figure 9 reports factors behind the change in portfolio emissions along the SFDR categories.

All the fund categories increased their emissions from 2016 to 2021, however, increase of Art. 8 and 9 funds was almost four and 2 times less than that of Art 6. funds. This confirms the consistency with the regression results (Table 29) since the overall change (increase) in emissions of Art.8/9 funds has been relatively lower than the benchmark Art. 6 funds. The increase was primarily driven by portfolio reallocation. Art.9 funds additionally saw their carbon footprint reduced via reduction in emissions of the investee firms and cross-effect in a quite important way. Descriptive statistics (Tables 19 - 21) confirm these observations in the distribution.

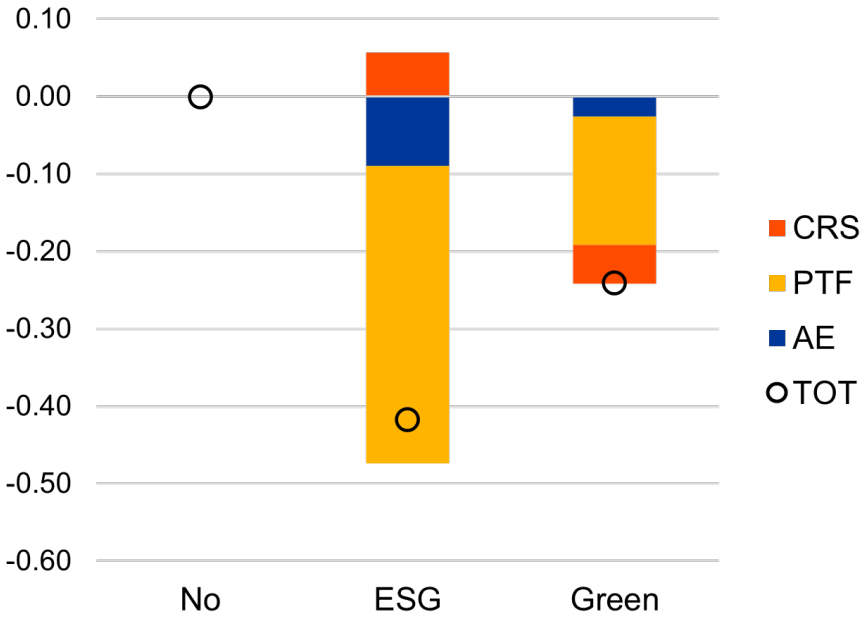
Figure 9: Decomposition of the average percent change in funds' absolute emissions (Scope 1&2) between 2016 and 2021, by SFDR category



Note: AE refers to change in portfolio emissions driven by the change in investee firms' absolute emissions; PTF refers to change in portfolio emissions driven by portfolio rebalancing; CRS refers to the cross-effect when portfolio weights and firms' emissions change at the same time; TOT refers to the overall change in portfolio emissions. The numbers are expressed in percentage change of portfolio emissions.

Finally, Figure 10 confirms the overall regression results of Column 6 in Table 30: both ESG-marketed and Green-marketed funds increased their emissions less than conventional funds by around three and 2 times respectively. Once again, all variation is primarily driven by portfolio rebalancing. Interestingly, ESG-marketed funds saw their carbon footprint reduced thanks to the investee firms decarbonisation efforts.

Figure 10: Decomposition of the average percent change in funds' absolute emissions (Scope 1&2) between 2016 and 2021, by text-based self-marketing



Note: AE refers to change in portfolio emissions driven by the change in investee firms' absolute emissions; PTF refers to change in portfolio emissions driven by portfolio rebalancing; CRS refers to the cross-effect when portfolio weights and firms' emissions change at the same time; TOT refers to the overall change in portfolio emissions. The numbers are expressed in percentage change of portfolio emissions.

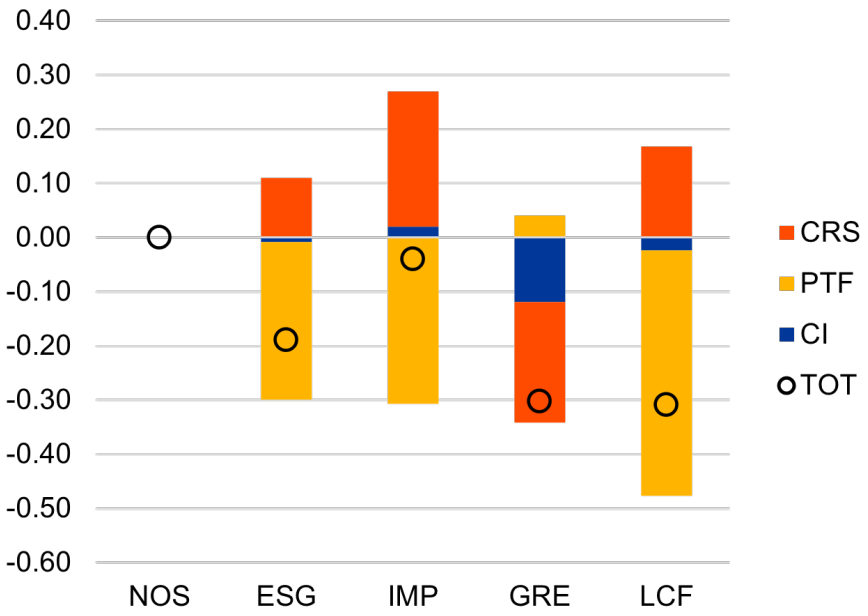
Decomposition of portfolio carbon intensity

Figures 11 to 13 report the decomposition of the percentage change in carbon intensity of an average fund for each category. The results are significantly different from absolute emissions. All fund categories either decreased or did not change carbon intensity of their portfolios. The reduction was driven by decline in firms' emission intensity and cross-effect while portfolio rebalancing led to an increase. As carbon intensity consists of absolute emissions divided by revenues, the decrease in emission intensity is potentially primarily driven by increase in revenues and inflation following economic conditions in 2021, aftermath of the Covid-19 slowdown. This is consistent with findings of Guegan and Salakhova (2025) for French equity funds.

Figure 11 reports the decomposition of each Morningstar category. Out of all categories, ESG, Green Tech and Low carbon/Fossil fuel free funds have reduced intensity more than other categories, mainly thanks to a combination of a reduction of emissions of the firms in their

portfolios and cross-factors.

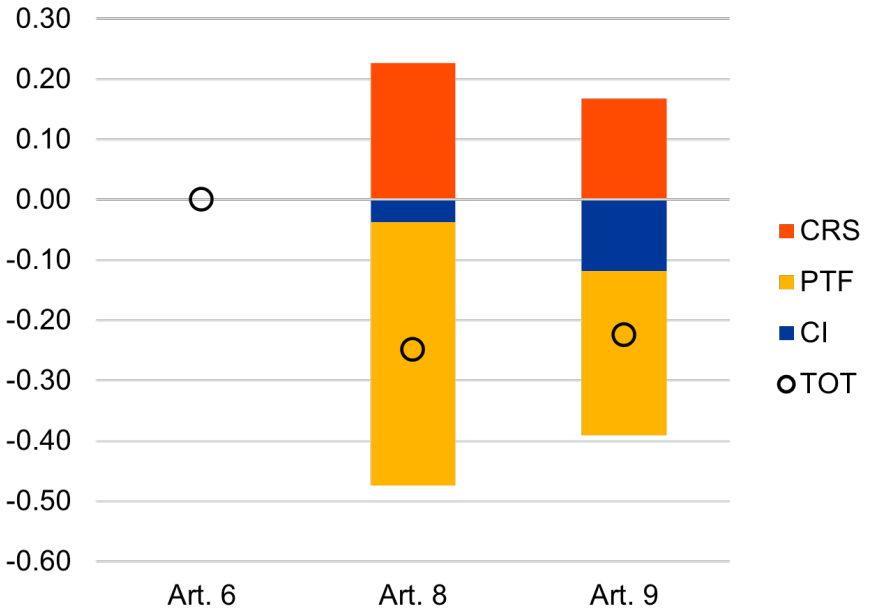
Figure 11: Decomposition of the average percent change in funds' carbon intensity (Scope 1&2) between 2016 and 2021, by Morningstar strategy



Note: CI refers to change in portfolio intensity driven by the change in investee firms' carbon intensity; PTF refers to change in portfolio intensity driven by portfolio rebalancing; CRS refers to the cross-effect when portfolio weights and firms' intensity change at the same time; TOT refers to the overall change in portfolio intensity. The numbers are expressed in percentage change of portfolio intensity.

Results of SFDR taxonomy depicted in Figure 12 show a better overall performance of Art. 8/9 funds. Descriptive statistics (Tables 20 and 21) further support these results as 75% of funds in the two categories reduce their emission intensity with a median reduction of 14% and 18% for Art. 8 and 9 funds respectively. Maximum increase in Art. 9 funds is three times smaller. The statistically insignificant results for Art. 9 funds regarding reduction in emissions intensity (Table 4) is potentially explained by lack of statistical power.

Figure 12: Decomposition of the average percent change in funds' carbon intensity (Scope 1&2) between 2016 and 2021, by SFDR disclosure

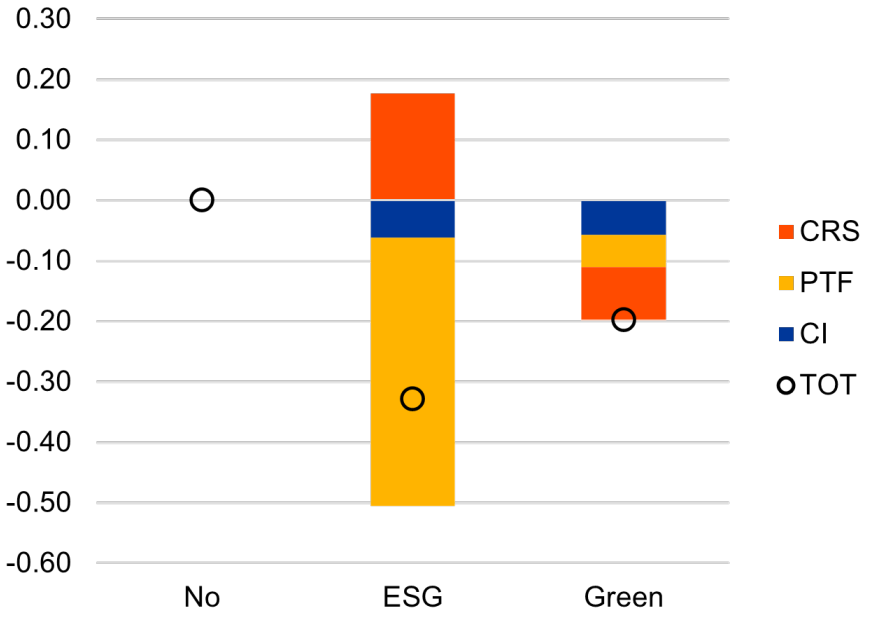


Note: CI refers to change in portfolio intensity driven by the change in investee firms' carbon intensity; PTF refers to change in portfolio intensity driven by portfolio rebalancing; CRS refers to the cross-effect when portfolio weights and firms' intensity change at the same time; TOT refers to the overall change in portfolio intensity. The numbers are expressed in percentage change of portfolio intensity.

Finally, Figure 13 show that ESG and green marketed funds on average reduced their carbon intensity by more that conventional funds. Interestingly, contribution of reduction in firms emissions is comparable across all categories. ESG-marketed funds kept their portfolios relatively stable regards carbon intensity of the investee firms, while no strategy and green-marketed funds rebalanced their portfolios towards more polluting firms. Cross-effects significantly contributed to mitigate increase in carbon footprint due to pure portfolio reallocation.

Descriptive statistics (Tables 22 - 24 again show that 75% of ESG and Green marketed funds reduced their emissions, while the maximum increase among funds in these categories was multiple times smaller than that of conventional funds.

Figure 13: Decomposition of the average percent change in funds' carbon intensity (Scope 1&2) between 2016 and 2021, by text-based text-marketing



Note: CI refers to change in portfolio intensity driven by the change in investee firms' carbon intensity; PTF refers to change in portfolio intensity driven by portfolio rebalancing; CRS refers to the cross-effect when portfolio weights and firms' intensity change at the same time; TOT refers to the overall change in portfolio intensity. The numbers are expressed in percentage change of portfolio intensity.

7.4 Targets

In this section, we look whether funds with sustainability attributes hold a larger share of firms with Science-based targets. Information on the targets is also provided by Urgentem, and includes different dimensions, such as primary metrics of the target (e.g. reduction in scopes 1 and 2 absolute emissions, ceiling for carbon intensity etc.) and declared horizon for the their achievement. For simplicity, given the high degree of heterogeneity in the definition of targets, we construct a variables that indicates solely the share of firms with a target in a fund's portfolio, regardless of what it may be.[11] Tables 9 to 11 present the regression results for each taxonomy, which show that funds, regardless of the sustainability classifications, behave in a similar manner

[11]The sample of firms with targets provided by Urgentem is smaller than that of emissions, and we have no way to determine whether firms are not reported because they do not have targets, or because of data availability. As an approximation, we consider all firms in our emissions database that are not in the target database as having no target.

as conventional funds when considering their financing of firms with science-based targets. If any, signs hint to the fact that self-marketed funds are somewhat correlated with a higher share of firms with targets, but this correlation is by no means significant. These results hint to the fact that the presence of a clearly defined carbon footprint target does not constitute a preferential investment choice for green funds.

Table 9: Firms with science-based targets in funds, by MS strategy

	(1)	(2)
	Tg ptf (2016)	Tg ptf (2021)
	b/se	b/se
No strategy	0.000	0.000
	(.)	(.)
ESG	-3.085	-4.449
	(3.813)	(3.622)
Impact	-4.192*	-3.816
	(2.114)	(2.058)
Green tech	6.470	8.151
	(5.794)	(5.641)
Low carbon	-1.893	-2.012
	(3.143)	(3.014)
Constant	44.365***	49.205***
	(4.431)	(4.560)
TNA (2016)	Yes	No
TNA (2021)	No	Yes
Geo	Yes	Yes
Cap	Yes	Yes
Style	Yes	Yes
R-squared	0.222	0.229
Adj. R-squared	0.214	0.220
F(2, N)	25.42	27.18
N	1619	1670

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 10: Firms with science-based targets in funds, by SFDR disclosure classification

	(1)	(2)
	Tg ptf (2016)	Tg ptf (2021)
	b/se	b/se
Art. 6	0.000	0.000
	(.)	(.)
Art. 8	-0.277	0.606
	(1.876)	(1.847)
Art. 9	-1.657	-0.485
	(5.250)	(4.870)
Constant	45.131***	49.894***
	(4.414)	(4.525)
TNA (2016)	Yes	No
TNA (2021)	No	Yes
Geo	Yes	Yes
Cap	Yes	Yes
Style	Yes	Yes
R-squared	0.219	0.225
Adj. R-squared	0.212	0.218
F(2, N)	28.15	30.04
N	1619	1670

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 11: Firms with science-based targets in funds, by self-marketing

	(1)	(2)
	Tg ptf (2016)	Tg ptf (2021)
	b/se	b/se
Not marketed	0.000	0.000
	(.)	(.)
ESG marketed	3.451	3.625
	(4.426)	(4.255)
Green marketed	5.969	3.971
	(3.877)	(3.610)
Constant	43.473***	48.920***
	(4.416)	(4.547)
TNA (2016)	Yes	No
TNA (2021)	No	Yes
Geo	Yes	Yes
Cap	Yes	Yes
Style	Yes	Yes
R-squared	0.221	0.226
Adj. R-squared	0.213	0.219
F(2, N)	28.37	30.17
N	1619	1670

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

8 Conclusions

ESG investment funds have grown rapidly in recent years, driven by rising demand for sustainable finance products and higher expectations for the financial sector to contribute to the climate transition. This momentum has led to a surge in the supply of ESG-labeled financial products. However, the definitions of sustainability and climate impact are often vague, raising increasing concerns about "greenwashing."

This paper provides a comprehensive assessment of the environmental performance of sustainability-labeled investment funds. First, we construct a novel, granular dataset and propose a fund-level classification based on Morningstar investment strategies, SFDR Articles 6, 8, and 9, and self-reported fund names. Then, we evaluate funds across three key dimensions: (i) the carbon intensity of the activities they finance, (ii) the carbon footprint of their portfolios, and (iii) their

investment in firms with ambitious science-based targets (SBTs).

Our findings reveal a persistent disconnect between ESG labels and actual environmental outcomes. While the greenest funds—such as Green Tech, Low Carbon, and SFDR Article 9—invest more in low-carbon sectors and less in fossil fuels, their overall carbon footprints are not significantly lower than those of conventional funds. Some funds do demonstrate better performance: Morningstar Low Carbon and SFDR Article 8 funds, for instance, tend to invest in less carbon-intensive firms within the same sectors and show more substantial emission reductions over time. However, we find no consistent evidence that ESG funds allocate more capital to firms with ambitious SBTs.

These results suggest that many sustainability-labeled funds may not deliver meaningful environmental impact. Particularly concerning is the inconsistency of self-labeled green funds, many of which neither disclose sustainability objectives nor follow verifiable low-carbon strategies—raising the risk of greenwashing. In contrast, a subset of funds appears to engage in "green-hushing," avoiding sustainability labels despite demonstrably greener portfolios.

Together, these insights support the need for stronger regulatory standards, including clearer definitions and stricter use of ESG-related terms, as proposed by ESMA (ESMA, 2023a). Ultimately, for ESG investment to play a credible role in the climate transition, it must be anchored in transparent, measurable, and verifiable sustainability criteria.

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Appendix

Text-based analysis

Table 12 reports the keywords used to search for sustainability-related labels in funds' names. To capture as many characteristics as possible, the allows for abbreviations, since funds are often identified with their short names in the markets. Most keywords are in English, but there are few cases of other languages.

Table 12: Keywords of the text-based analysis

PA/Green funds	ESG funds
alternative energy	esg
carb	eth
clim	etisk
clm	free
ecol	imp
energy trans	resp
env	rsp
green benefit	social
green tigers	sri
natu	sus
renew	trans
solar	-
transition energy	-

Summary statistics

Tables 13 to 24 report the summary statistics (mean, standard deviation, minimum, maximum and relevant percentiles) for all the variables employed in the econometric analysis (with the exception of some of the controls, which are qualitative), by type of fund under the three classifications. The figures read as follows: sectors express the percentage of the portfolio that is allocated to that particular economic activity, total net assets (TNA) are in million euro,

change in TNA is in percentage over the years 2016-2021, absolute emissions are in tonnes of CO2 equivalent, change in absolute emissions is in percentage over the years 2016-2021, carbon intensity is in tonnes of CO2 equivalent over million dollar revenues, change in carbon intensity is in percentage over the years 2016-2021, targets express the percentage of firms in the portfolio with carbon footprint targets of any kind.

Table 13: Total funds' sample

Variable	Mean	SD	Min	p5	p25	p50	p75	p95	Max
Communication	5.08	5.64	0.00	0.00	0.48	4.13	7.37	14.33	90.06
Discretionary goods	10.31	7.62	0.00	0.00	5.47	9.75	13.93	22.07	76.40
Staple goods	7.52	7.26	0.00	0.00	2.15	6.28	10.79	20.58	86.47
Fossil fuel energy	2.82	6.65	0.00	0.00	0.00	0.51	3.75	9.56	98.71
Financials	14.36	12.97	0.00	0.00	5.50	13.49	19.52	32.49	100.00
Health care	11.79	13.48	0.00	0.00	2.93	10.49	16.25	27.42	100.00
Electrical components	1.92	3.21	0.00	0.00	0.00	0.31	2.97	7.75	42.94
Environmental services	0.22	0.92	0.00	0.00	0.00	0.00	0.00	1.39	10.55
Industrials	12.95	10.47	0.00	0.00	5.62	10.97	17.90	33.81	77.47
Information technology	17.75	15.07	0.00	0.00	6.21	14.50	27.07	43.16	98.33
Materials	6.98	10.00	0.00	0.00	1.70	5.11	8.77	19.32	100.00
Real estate	4.27	15.55	0.00	0.00	0.00	0.00	2.77	10.65	100.00
Renewables	0.46	1.46	0.00	0.00	0.00	0.00	0.00	2.95	23.19
Utilities	2.60	5.51	0.00	0.00	0.00	0.00	3.27	9.78	77.94
TNA (2016)	297.99	549.18	0.09	5.08	31.50	104.03	305.45	1,329.27	6,492.12
TNA (2021)	558.36	1,242.62	0.95	9.23	49.69	178.76	522.61	2,312.55	24,091.96
TNA change	616.73	5,028.45	-98.98	-68.65	-17.70	46.28	197.00	1,457.41	138,392.05
AE (2016)	1,786,406	2,419,346	1,190	35,753	255,248	854,462	2,485,524	6,152,419	24,199,240
AE (2021)	1,648,187	2,738,103	1,459	24,074	193,709	752,377	2,109,536	6,127,000	60,042,392
AE change	0.55	3.27	-1.00	-0.86	-0.56	-0.17	0.52	3.77	90.02
CI (2016)	203	215	3	28	72	141	258	587	2,710
CI (2021)	134	200	1	14	41	85	161	388	3,844
CI change	-0.07	1.34	-1.00	-0.87	-0.65	-0.38	0.02	1.62	18.86
Target (2016)	53.17	40.80	0.00	0.00	0.00	71.90	90.32	97.67	100.00
Target (2021)	51.91	40.10	0.00	0.00	0.00	68.74	87.92	97.59	100.00

Table 14: Morningstar No strategy funds

Variable	Mean	SD	Min	p5	p25	p50	p75	p95	Max
Communication	5.22	6.14	0.00	0.00	1.15	4.10	7.40	14.69	90.06
Discretionary goods	10.44	7.96	0.00	0.00	5.28	10.05	13.97	22.39	72.75
Staple goods	7.42	7.61	0.00	0.00	1.61	6.17	10.68	20.18	86.47
Fossil fuel energy	3.41	7.41	0.00	0.00	0.00	1.69	4.40	10.58	98.71
Financials	15.15	14.32	0.00	0.00	6.26	13.88	19.84	34.69	100.00
Health care	11.60	14.21	0.00	0.00	2.77	9.59	15.56	27.53	100.00
Electrical components	1.43	2.24	0.00	0.00	0.00	0.00	2.30	5.89	19.81
Environmental services	0.15	0.64	0.00	0.00	0.00	0.00	0.00	0.89	6.98
Industrials	12.41	9.93	0.00	0.00	5.39	10.77	17.50	31.13	77.47
Information technology	16.70	15.16	0.00	0.00	5.46	12.73	25.65	42.51	98.33
Materials	7.63	11.91	0.00	0.00	1.62	5.19	9.35	22.12	100.00
Real estate	4.18	15.77	0.00	0.00	0.00	0.00	2.38	10.85	100.00
Renewables	0.43	1.25	0.00	0.00	0.00	0.00	0.00	2.80	12.56
Utilities	2.97	6.17	0.00	0.00	0.00	0.66	3.73	12.82	77.94
TNA (2016)	259.90	545.44	0.09	4.39	25.43	84.58	251.13	1,142.93	6,492.12
TNA (2021)	410.35	1,009.98	1.26	7.25	36.40	127.62	373.82	1,509.31	11,208.53
TNA change	285.11	1,783.12	-95.68	-69.85	-21.11	33.63	150.21	899.00	47,200.65
AE (2016)	2,085,070	2,749,422	1,190	30,470	288,523	1,070,011	2,965,759	7,665,458	24,199,240
AE (2021)	2,005,418	3,284,950	1,459	21,392	229,926	1,002,644	2,576,916	7,398,783	60,042,392
AE change	0.72	4.08	-0.99	-0.84	-0.53	-0.12	0.59	4.33	90.02
CI (2016)	206	218	3	27	74	154	258	581	2,710
CI (2021)	146	177	1	13	46	98	174	428	1,545
CI change	-0.01	1.36	-0.99	-0.87	-0.61	-0.34	0.10	1.68	18.86
Target (2016)	55.36	40.63	0.00	0.00	0.00	73.90	91.63	98.47	100.00
Target (2021)	54.03	39.88	0.00	0.00	0.00	72.17	89.01	98.04	100.00

Table 15: Morningstar ESG funds

Variable	Mean	SD	Min	p5	p25	p50	p75	p95	Max
Communication	4.62	4.21	0.00	0.00	1.81	3.70	7.21	12.02	22.54
Discretionary goods	10.82	7.19	0.00	0.14	6.15	10.15	14.25	23.32	38.85
Staple goods	7.05	5.84	0.00	0.00	2.79	6.68	9.48	14.93	38.78
Fossil fuel energy	2.19	2.88	0.00	0.00	0.00	0.67	3.44	7.91	15.18
Financials	14.16	11.56	0.00	0.00	7.53	14.00	18.48	33.07	98.92
Health care	13.52	13.39	0.00	0.00	6.86	11.82	17.04	25.53	100.00
Electrical components	3.04	4.78	0.00	0.00	0.00	1.70	4.42	9.41	38.06
Environmental services	0.35	1.45	0.00	0.00	0.00	0.00	0.00	1.57	10.55
Industrials	15.16	10.81	0.00	0.00	7.94	13.31	19.31	38.56	48.95
Information technology	17.03	12.65	0.00	0.00	7.74	14.46	24.40	38.76	66.17
Materials	6.70	5.57	0.00	0.00	2.69	5.58	8.92	17.79	26.39
Real estate	1.69	2.56	0.00	0.00	0.00	0.00	2.82	6.68	15.98
Renewables	0.49	1.47	0.00	0.00	0.00	0.00	0.01	2.80	10.41
Utilities	2.48	3.01	0.00	0.00	0.00	1.61	4.57	7.97	16.36
TNA (2016)	182.06	396.79	0.75	3.23	21.17	56.23	148.99	955.67	2,398.71
TNA (2021)	289.62	682.00	0.95	6.71	27.78	86.35	249.92	1,329.77	4,909.69
Delta TNA	809.65	4,602.61	-94.33	-72.24	-21.33	34.53	110.75	3,261.75	48,358.62
AE (2016)	1,799,224	2,040,596	4,482	25,223	266,827	934,590	3,079,852	5,644,818	10,005,404
AE (2021)	1,532,499	1,916,288	6,224	20,262	225,150	717,631	2,244,899	5,325,021	10,810,050
AE change	0.51	2.30	-0.97	-0.83	-0.58	-0.19	0.46	3.66	13.38
CI (2016)	164	113	5	25	77	138	238	342	670
CI (2021)	103	99	5	14	38	71	141	291	704
CI change	-0.19	0.79	-0.96	-0.86	-0.69	-0.38	-0.12	1.45	4.47
Target (2016)	52.59	43.51	0.00	0.00	0.00	77.73	93.54	99.81	100.00
Target (2021)	51.32	42.32	0.00	0.00	0.00	69.32	92.17	98.30	100.00

Table 16: Morningstar Impact funds

Variable	Mean	SD	Min	p5	p25	p50	p75	p95	Max
Communication	4.94	5.34	0.00	0.00	0.00	4.06	7.05	14.63	37.69
Discretionary goods	10.47	7.76	0.00	0.00	5.48	9.81	14.08	22.57	76.40
Staple goods	7.87	6.72	0.00	0.00	2.87	6.51	11.00	20.66	45.20
Fossil fuel energy	2.69	7.01	0.00	0.00	0.00	0.00	3.37	9.24	92.95
Financials	14.24	11.34	0.00	0.00	5.88	13.66	20.38	31.48	84.40
Health care	11.29	12.76	0.00	0.00	2.55	10.06	16.38	26.34	100.00
Electrical components	1.83	2.94	0.00	0.00	0.00	0.00	2.85	8.04	21.65
Environmental services	0.19	0.81	0.00	0.00	0.00	0.00	0.00	1.35	8.74
Industrials	12.96	10.98	0.00	0.00	5.19	10.40	18.10	35.02	59.57
Information technology	18.64	15.70	0.00	0.00	6.43	15.50	27.38	45.45	89.49
Materials	6.31	7.84	0.00	0.00	1.24	5.04	8.36	16.60	97.69
Real estate	5.16	17.30	0.00	0.00	0.00	0.00	3.37	13.59	100.00
Renewables	0.37	1.49	0.00	0.00	0.00	0.00	0.00	2.53	23.19
Utilities	1.80	4.29	0.00	0.00	0.00	0.00	2.44	7.27	60.67
TNA (2016)	368.33	584.38	0.54	9.22	60.07	146.91	404.51	1,489.04	4,814.20
TNA (2021)	694.53	1,197.70	1.78	20.09	95.68	286.41	749.23	2,816.37	11,164.37
Delta TNA	951.53	7,991.93	-98.98	-68.37	-22.49	44.33	265.76	1,871.91	138,392.05
AE (2016)	1,285,762	1,795,821	7,279	44,755	200,714	616,907	1,632,023	4,473,220	17,943,076
AE (2021)	1,298,126	2,054,357	6,196	30,624	145,918	543,510	1,584,077	4,519,357	22,577,346
AE change	0.51	2.23	-0.98	-0.85	-0.54	-0.13	0.55	3.83	18.00
CI (2016)	198	226	7	31	69	119	244	604	2,257
CI (2021)	135	276	5	15	37	75	139	374	3,844
CI change	-0.04	1.56	-0.98	-0.88	-0.67	-0.40	0.00	1.61	15.12
Target (2016)	48.32	40.68	0.00	0.00	0.00	63.79	87.50	96.90	100.00
Target (2021)	46.92	40.13	0.00	0.00	0.00	61.41	85.88	96.63	100.00

Table 17: Morningstar Green tech funds

Variable	Mean	SD	Min	p5	p25	p50	p75	p95	Max
Communication	3.19	4.16	0.00	0.00	0.00	1.16	5.77	10.67	16.99
Discretionary goods	7.37	5.02	0.00	0.00	4.39	6.32	8.98	17.10	22.52
Staple goods	4.83	5.13	0.00	0.00	0.61	3.67	6.70	17.52	19.12
Fossil fuel energy	1.26	1.64	0.00	0.00	0.00	0.00	2.25	4.47	4.92
Financials	5.50	6.60	0.00	0.00	0.00	2.29	9.34	17.01	25.87
Health care	10.97	8.95	0.00	0.00	2.76	11.36	16.54	25.04	33.52
Electrical components	6.46	7.53	0.00	0.00	1.72	4.98	7.58	19.12	42.94
Environmental services	1.72	2.86	0.00	0.00	0.00	0.00	2.17	8.18	10.51
Industrials	19.18	11.25	5.73	5.94	11.32	15.66	24.04	44.61	49.87
Information technology	20.64	11.62	2.41	4.24	12.05	19.07	28.02	39.92	55.15
Materials	10.63	11.51	0.00	0.00	3.82	7.08	15.08	27.05	65.92
Real estate	1.16	1.88	0.00	0.00	0.00	0.00	2.49	4.95	7.09
Renewables	1.29	2.48	0.00	0.00	0.00	0.00	1.31	7.23	10.25
Utilities	5.34	7.47	0.00	0.00	0.00	2.85	6.01	19.99	31.25
TNA (2016)	267.63	552.36	4.64	10.00	22.99	50.31	311.08	1,503.92	2,722.16
TNA (2021)	1,002.09	1,701.38	4.30	15.55	71.50	282.29	732.48	4,002.75	8,369.38
Delta TNA	597.94	1,130.65	-74.03	-14.38	69.58	183.00	891.55	1,840.43	7,058.64
AE (2016)	1,714,286	3,230,624	11,478	55,144	228,511	628,861	1,616,505	5,238,367	19,329,304
AE (2021)	1,087,003	1,347,524	16,919	34,835	208,842	582,791	1,526,353	3,941,995	6,458,241
AE change	0.31	1.34	-0.93	-0.91	-0.61	-0.17	1.00	2.79	5.73
CI (2016)	273	318	17	33	76	163	318	1,047	1,496
CI (2021)	110	90	10	15	48	95	151	322	385
CI change	-0.31	0.62	-0.97	-0.85	-0.67	-0.53	-0.12	0.79	2.40
Target (2016)	61.78	37.80	0.00	0.00	45.15	81.55	92.14	96.63	97.01
Target (2021)	61.49	37.56	0.00	0.00	41.67	77.32	89.16	98.14	100.00

Table 18: Morningstar Low carbon funds

Variable	Mean	SD	Min	p5	p25	p50	p75	p95	Max
Communication	5.47	4.81	0.00	0.00	1.31	5.03	7.71	14.18	26.94
Discretionary goods	9.57	5.89	0.00	0.00	6.09	9.32	12.40	20.47	23.76
Staple goods	8.06	8.00	0.00	0.00	2.36	6.42	11.57	23.94	48.36
Fossil fuel energy	0.94	1.98	0.00	0.00	0.00	0.00	1.25	5.21	12.03
Financials	12.97	11.08	0.00	0.00	4.29	13.13	18.30	27.70	86.99
Health care	13.19	12.50	0.00	0.00	3.62	13.31	17.24	29.62	100.00
Electrical components	2.87	3.92	0.00	0.00	0.00	1.62	4.05	11.39	22.73
Environmental services	0.26	0.74	0.00	0.00	0.00	0.00	0.00	2.02	4.43
Industrials	12.76	10.67	0.00	0.00	5.90	10.06	15.89	36.70	48.37
Information technology	20.43	14.58	0.00	0.00	8.88	20.43	29.94	42.31	95.32
Materials	4.87	4.66	0.00	0.00	1.23	4.37	7.19	14.09	25.62
Real estate	4.69	15.85	0.00	0.00	0.00	1.47	3.55	9.02	100.00
Renewables	0.61	1.91	0.00	0.00	0.00	0.00	0.11	3.77	15.94
Utilities	2.38	5.33	0.00	0.00	0.00	0.12	2.88	9.27	47.32
TNA (2016)	379.57	523.36	0.69	5.10	42.08	189.57	516.27	1,505.89	3,300.50
TNA (2021)	1,004.90	2,124.25	3.80	18.08	92.38	401.88	1,250.86	3,150.62	24,091.96
Delta TNA	1,250.51	6,150.14	-96.26	-67.98	15.09	106.19	309.69	2,955.68	61,273.84
AE (2016)	1,672,353	1,861,833	2,518	39,328	322,021	881,893	2,700,486	5,116,039	11,190,867
AE (2021)	1,016,471	1,537,575	2,585	28,691	165,471	582,675	1,295,398	3,246,685	12,302,800
AE change	-0.09	1.30	-1.00	-0.92	-0.69	-0.44	0.10	1.33	11.23
CI (2016)	206	186	19	28	77	143	281	651	965
CI (2021)	95	95	3	13	35	64	120	315	539
CI change	-0.32	0.85	-1.00	-0.91	-0.73	-0.52	-0.26	0.67	5.79
Target (2016)	53.84	39.95	0.00	0.00	0.00	74.43	89.18	96.85	100.00
Target (2021)	53.12	39.24	0.00	0.00	0.00	69.16	86.88	97.13	100.00

Table 19: SFDR Art. 6 funds

Variable	Mean	SD	Min	p5	p25	p50	p75	p95	Max
Communication	5.30	6.17	0.00	0.00	0.92	4.14	7.47	14.89	90.06
Discretionary goods	10.26	7.71	0.00	0.00	5.34	9.84	13.63	22.47	71.09
Staple goods	7.46	7.32	0.00	0.00	2.10	6.16	10.63	20.43	86.47
Fossil fuel energy	3.70	8.23	0.00	0.00	0.00	1.86	4.48	12.12	98.71
Financials	15.07	14.14	0.00	0.00	6.03	13.79	19.87	34.86	100.00
Health care	10.81	13.04	0.00	0.00	2.35	9.08	15.20	24.53	100.00
Electrical components	1.43	2.32	0.00	0.00	0.00	0.00	2.25	6.16	19.78
Environmental services	0.16	0.71	0.00	0.00	0.00	0.00	0.00	1.01	8.18
Industrials	11.93	9.37	0.00	0.00	5.02	10.45	17.13	28.77	77.47
Information technology	17.16	15.38	0.00	0.00	5.77	13.27	25.78	44.87	98.33
Materials	8.02	12.20	0.00	0.00	1.90	5.44	9.73	22.40	100.00
Real estate	4.39	16.42	0.00	0.00	0.00	0.00	2.50	11.21	100.00
Renewables	0.50	1.52	0.00	0.00	0.00	0.00	0.00	3.21	23.19
Utilities	2.79	5.82	0.00	0.00	0.00	0.52	3.58	11.11	77.94
TNA (2016)	287.13	606.26	0.09	4.37	25.04	81.71	258.38	1,333.14	6,492.12
TNA (2021)	451.89	1,160.64	1.26	7.17	36.16	117.83	356.46	1,873.75	11,208.53
Delta TNA	415.62	4,590.08	-98.98	-71.10	-27.26	26.82	151.70	948.97	138,392.05
AE (2016)	1,963,183	2,571,227	1,190	38,551	299,829	1,041,727	2,709,543	6,858,322	24,199,240
AE (2021)	2,040,232	3,280,988	1,459	26,891	250,235	1,051,866	2,614,020	7,660,447	60,042,392
AE change	0.78	3.83	-0.99	-0.85	-0.49	-0.09	0.74	4.49	90.02
CI (2016)	211	216	3	27	75	150	269	611	2,257
CI (2021)	159	236	1	13	49	104	185	468	3,844
CI change	0.04	1.41	-0.98	-0.86	-0.60	-0.33	0.16	1.81	15.12
Target (2016)	53.92	40.78	0.00	0.00	0.00	72.02	90.92	98.02	100.00
Target (2021)	52.27	39.87	0.00	0.00	0.00	68.20	87.73	97.38	100.00

Table 20: SFDR Art. 8 funds

Variable	Mean	SD	Min	p5	p25	p50	p75	p95	Max
Communication	4.99	4.87	0.00	0.00	1.09	4.27	7.24	13.52	37.69
Discretionary goods	10.58	7.54	0.00	0.00	5.92	9.93	14.57	22.01	76.40
Staple goods	7.48	6.89	0.00	0.00	2.15	6.36	10.82	20.21	54.73
Fossil fuel energy	1.69	3.21	0.00	0.00	0.00	0.00	2.56	7.19	39.28
Financials	13.83	11.14	0.00	0.00	6.29	13.53	19.34	29.63	94.69
Health care	13.10	14.00	0.00	0.00	4.01	12.10	16.97	32.56	100.00
Electrical components	2.29	3.53	0.00	0.00	0.00	0.94	3.45	9.03	38.06
Environmental services	0.26	1.02	0.00	0.00	0.00	0.00	0.00	1.64	10.55
Industrials	14.09	11.72	0.00	0.00	5.94	11.36	18.51	39.53	59.57
Information technology	18.68	14.83	0.00	0.00	6.70	17.14	28.16	42.96	95.32
Materials	5.24	5.02	0.00	0.00	1.26	4.39	7.59	14.54	31.90
Real estate	4.35	14.88	0.00	0.00	0.00	0.32	3.26	10.75	100.00
Renewables	0.33	1.09	0.00	0.00	0.00	0.00	0.00	2.43	10.25
Utilities	2.17	4.98	0.00	0.00	0.00	0.00	2.73	7.85	60.67
TNA (2016)	326.60	473.78	0.69	6.83	52.08	136.34	362.60	1,379.24	2,935.63
TNA (2021)	683.13	1,324.06	0.95	16.14	90.26	294.26	739.76	2,736.59	24,091.96
Delta TNA	749.43	5,410.26	-96.26	-66.13	-4.17	66.98	213.86	1,912.37	112,727.73
AE (2016)	1,544,472	2,200,664	2,518	29,852	186,282	688,521	1,921,046	5,437,640	19,329,304
AE (2021)	1,128,443	1,638,512	2,090	19,593	120,612	514,634	1,422,474	4,217,079	12,302,800
AE change	0.23	2.27	-1.00	-0.88	-0.60	-0.29	0.24	2.41	36.99
CI (2016)	188	209	3	28	67	128	241	518	2,710
CI (2021)	100	134	2	13	33	66	120	278	1,522
CI change	-0.21	1.23	-1.00	-0.88	-0.71	-0.47	-0.14	1.01	18.86
Target (2016)	51.55	40.73	0.00	0.00	0.00	69.97	89.50	97.32	100.00
Target (2021)	50.80	40.39	0.00	0.00	0.00	68.28	87.94	97.73	100.00

Table 21: SFDR Art. 9 funds

Variable	Mean	SD	Min	p5	p25	p50	p75	p95	Max
Communication	2.47	3.56	0.00	0.00	0.00	0.00	4.64	10.04	13.82
Discretionary goods	8.15	6.71	0.00	0.00	4.46	7.56	10.22	17.60	36.52
Staple goods	9.17	9.72	0.00	0.00	3.45	7.35	12.30	29.17	48.36
Fossil fuel energy	0.93	1.73	0.00	0.00	0.00	0.00	1.22	4.23	8.99
Financials	8.66	9.61	0.00	0.00	0.00	4.17	16.44	25.66	32.94
Health care	13.23	13.63	0.00	0.00	4.27	12.80	17.13	25.53	100.00
Electrical components	6.05	6.83	0.00	0.00	1.46	4.84	8.48	15.86	42.94
Environmental services	0.76	2.05	0.00	0.00	0.00	0.00	0.05	5.07	10.51
Industrials	17.18	10.62	0.00	5.52	10.77	14.27	20.95	35.56	52.65
Information technology	17.14	11.88	0.00	0.00	6.76	15.39	26.85	34.74	54.77
Materials	9.28	8.24	0.00	0.00	3.76	7.20	11.00	25.62	37.19
Real estate	1.23	2.36	0.00	0.00	0.00	0.00	2.07	5.55	10.52
Renewables	1.23	3.00	0.00	0.00	0.00	0.00	0.94	8.31	15.94
Utilities	4.26	5.37	0.00	0.00	0.00	2.04	6.16	17.47	19.17
TNA (2016)	158.60	210.73	0.75	4.98	21.38	75.31	192.22	551.99	1,104.80
TNA (2021)	929.54	1,425.53	24.21	42.87	93.50	315.04	1,377.67	3,419.93	8,369.38
Delta TNA	2,467.09	6,891.98	-93.24	-57.21	73.61	350.13	1,163.29	11,232.72	48,358.62
AE (2016)	1,557,606	1,868,070	16,648	78,885	295,188	719,494	2,319,878	4,662,639	9,738,737
AE (2021)	959,466	1,094,188	29,385	66,795	329,900	591,709	1,211,828	2,749,865	6,009,734
AE change	0.45	2.37	-0.90	-0.84	-0.61	-0.32	0.48	3.44	12.23
CI (2016)	232	249	5	29	73	153	273	786	1,211
CI (2021)	99	87	12	24	44	69	117	326	381
CI change	-0.20	1.09	-0.91	-0.84	-0.72	-0.55	-0.18	1.62	5.36
Target (2016)	58.76	41.74	0.00	0.00	0.00	81.66	92.92	98.65	100.00
Target (2021)	58.28	40.78	0.00	0.00	0.00	78.22	90.20	98.09	100.00

Table 22: Text-based Not marketed funds

Variable	Mean	SD	Min	p5	p25	p50	p75	p95	Max
Communication	5.22	5.79	0.00	0.00	0.77	4.20	7.44	14.69	90.06
Discretionary goods	10.44	7.79	0.00	0.00	5.48	9.90	13.97	22.52	76.40
Staple goods	7.52	7.36	0.00	0.00	2.00	6.18	10.80	20.61	86.47
Fossil fuel energy	2.97	6.98	0.00	0.00	0.00	0.64	3.81	9.91	98.71
Financials	14.57	13.18	0.00	0.00	5.88	13.58	19.60	33.07	100.00
Health care	11.75	13.81	0.00	0.00	2.83	10.15	16.11	27.55	100.00
Electrical components	1.65	2.67	0.00	0.00	0.00	0.00	2.53	6.90	21.65
Environmental services	0.19	0.82	0.00	0.00	0.00	0.00	0.00	1.25	10.55
Industrials	12.90	10.59	0.00	0.00	5.48	10.81	18.03	34.13	77.47
Information technology	17.65	15.37	0.00	0.00	5.91	14.18	26.97	44.78	98.33
Materials	6.92	9.98	0.00	0.00	1.54	5.06	8.76	19.18	100.00
Real estate	4.24	15.34	0.00	0.00	0.00	0.00	2.79	11.03	100.00
Renewables	0.44	1.39	0.00	0.00	0.00	0.00	0.00	2.85	23.19
Utilities	2.54	5.60	0.00	0.00	0.00	0.00	3.21	9.73	77.94
TNA (2016)	308.23	564.60	0.09	5.29	32.83	110.25	310.81	1,352.98	6,492.12
TNA (2021)	555.21	1,253.23	1.26	9.04	47.59	177.63	527.81	2,264.34	24,091.96
Delta TNA	514.87	4,876.59	-98.98	-69.09	-20.03	41.53	181.59	1,141.76	138,392.05
AE (2016)	1,742,215	2,370,160	1,190	34,045	235,883	828,040	2,397,681	6,065,266	24,199,240
AE (2021)	1,653,876	2,460,966	1,459	23,425	183,895	751,320	2,155,769	6,426,983	28,765,570
AE change	0.59	3.38	-1.00	-0.86	-0.55	-0.15	0.53	3.92	90.02
CI (2016)	201	215	3	27	71	139	257	576	2,710
CI (2021)	137	207	1	13	40	87	164	403	3,844
CI change	-0.04	1.40	-1.00	-0.87	-0.64	-0.37	0.03	1.67	18.86
Target (2016)	51.97	40.85	0.00	0.00	0.00	69.16	89.81	97.67	100.00
Target (2021)	50.68	40.11	0.00	0.00	0.00	66.71	87.20	97.33	100.00

Table 23: Text-based ESG marketed funds

Variable	Mean	SD	Min	p5	p25	p50	p75	p95	Max
Communication	4.05	3.22	0.00	0.00	1.08	4.06	6.06	9.07	12.36
Discretionary goods	9.61	5.49	0.00	0.00	6.23	10.10	13.61	19.81	23.32
Staple goods	7.00	5.05	0.00	0.00	3.64	6.80	9.06	15.36	24.95
Fossil fuel energy	1.74	2.26	0.00	0.00	0.00	0.00	3.05	5.94	8.96
Financials	14.84	12.97	0.00	0.00	8.88	14.65	20.16	30.08	98.92
Health care	11.43	7.38	0.00	0.00	6.57	11.62	15.55	24.15	31.39
Electrical components	4.25	6.15	0.00	0.00	0.59	3.30	5.29	15.35	42.94
Environmental services	0.37	1.42	0.00	0.00	0.00	0.00	0.00	2.02	9.02
Industrials	12.97	9.36	0.00	0.00	7.26	10.96	16.19	30.02	48.95
Information technology	17.60	12.05	0.00	0.00	8.55	16.58	26.21	36.35	58.85
Materials	7.93	12.32	0.00	0.00	2.90	5.90	8.82	26.39	99.81
Real estate	3.92	15.85	0.00	0.00	0.00	0.02	2.59	6.32	100.00
Renewables	0.26	0.76	0.00	0.00	0.00	0.00	0.07	1.58	5.57
Utilities	3.40	4.39	0.00	0.00	0.00	2.08	5.86	17.75	19.99
TNA (2016)	274.64	480.18	0.75	4.98	30.99	96.41	218.76	1,453.24	2,398.71
TNA (2021)	575.59	1,188.74	0.95	12.02	71.50	237.33	443.79	3,443.38	7,747.49
Delta TNA	882.00	5,516.98	-76.09	-63.33	-2.91	62.88	281.02	1,336.10	48,358.62
AE (2016)	2,741,329	2,979,077	16,648	60,483	561,062	1,814,423	3,812,134	9,738,737	17,161,788
AE (2021)	1,699,585	1,674,023	6,877	41,497	308,430	1,224,169	2,737,028	5,422,493	6,458,241
AE change	0.17	2.15	-0.97	-0.92	-0.61	-0.36	0.06	3.02	12.52
CI (2016)	257	250	5	28	99	197	294	714	1,496
CI (2021)	106	85	5	17	51	85	132	316	402
CI change	-0.37	0.66	-0.96	-0.91	-0.69	-0.42	-0.26	0.27	4.47
Target (2016)	66.00	38.50	0.00	0.00	45.94	87.64	93.52	97.35	100.00
Target (2021)	64.46	38.43	0.00	0.00	46.50	83.95	94.46	100.00	100.00

Table 24: Text-based Green marketed funds

Variable	Mean	SD	Min	p5	p25	p50	p75	p95	Max
Communication	3.77	4.51	0.00	0.00	0.00	2.74	5.98	10.67	32.29
Discretionary goods	8.86	6.01	0.00	0.00	4.70	8.47	12.67	20.30	25.41
Staple goods	7.91	7.04	0.00	0.00	3.39	6.68	11.01	20.09	46.70
Fossil fuel energy	1.34	1.96	0.00	0.00	0.00	0.00	2.29	5.55	8.99
Financials	11.11	8.87	0.00	0.00	0.00	12.68	17.88	23.66	32.94
Health care	12.60	11.78	0.00	0.00	4.80	12.01	17.06	25.55	100.00
Electrical components	4.28	5.33	0.00	0.00	0.32	3.24	5.40	15.35	38.06
Environmental services	0.61	1.60	0.00	0.00	0.00	0.00	0.00	4.28	10.51
Industrials	13.77	9.35	0.00	1.48	7.26	12.45	18.54	32.74	48.37
Information technology	19.29	12.29	0.00	0.00	9.11	18.90	28.66	39.41	54.77
Materials	7.31	8.41	0.00	0.00	2.50	5.87	9.44	19.08	65.92
Real estate	4.92	18.20	0.00	0.00	0.00	0.00	2.79	8.13	100.00
Renewables	0.92	2.37	0.00	0.00	0.00	0.00	0.00	6.41	15.94
Utilities	2.84	4.69	0.00	0.00	0.00	1.24	3.62	12.55	31.25
TNA (2016)	165.82	291.59	1.03	3.05	22.26	66.55	156.28	622.61	2,142.45
TNA (2021)	592.16	1,127.99	6.24	15.55	61.80	167.18	531.64	3,134.89	8,369.38
Delta TNA	1,909.15	6,503.33	-86.20	-57.78	11.47	122.16	654.62	10,334.47	61,273.84
AE (2016)	1,779,855	2,589,629	3,447	53,980	379,800	946,326	1,900,365	6,709,523	19,329,304
AE (2021)	1,531,338	5,634,425	3,521	56,684	260,599	644,996	1,415,681	4,032,467	60,042,392
AE change	0.34	2.14	-0.98	-0.91	-0.61	-0.28	0.61	2.79	15.30
CI (2016)	194	182	18	33	74	142	242	624	1,047
CI (2021)	105	153	11	16	43	66	125	252	1,519
CI change	-0.25	0.69	-0.97	-0.86	-0.73	-0.48	-0.06	1.13	2.40
Target (2016)	61.78	39.41	0.00	0.00	0.00	83.22	92.95	98.49	100.00
Target (2021)	61.20	38.74	0.00	0.00	0.00	82.53	90.24	98.09	100.00

Regression results

Financed activities

Tables 25 to 27 report the regression results of the financed activities by category of funds, for the year 2021. The coefficients signal a higher (+) or lower (-) exposure to a sector for a given fund category relative to the baseline (No strategy/Art. 6/Not marketed). Controls are omitted for readability.

Table 25: Financed activities - Morningstar investment strategy (2021)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Communication	Discretionary	Staple	Energy	Financials	Health	Electr. comp.	Env. services	Industrials	Infotech	Materials	Real estate	Renewables	Utilities
	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p
No strategy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
ESG	-0.002	0.002	-0.009	-0.014*	-0.007	0.019	0.015***	0.002	0.015	0.012	-0.007	-0.018	-0.001	-0.005
	(0.686)	(0.770)	(0.188)	(0.038)	(0.569)	(0.153)	(0.000)	(0.054)	(0.088)	(0.365)	(0.417)	(0.201)	(0.716)	(0.321)
Impact	-0.005	-0.001	0.012**	-0.002	-0.006	-0.004	0.005**	0.000	0.001	-0.009	-0.003	0.014	0.000	-0.007*
	(0.154)	(0.904)	(0.002)	(0.617)	(0.387)	(0.622)	(0.007)	(0.720)	(0.803)	(0.239)	(0.623)	(0.076)	(0.845)	(0.013)
Green tech	-0.024**	-0.014	-0.007	-0.033**	-0.065***	-0.052*	0.050***	0.016***	0.082***	0.009	0.020	-0.008	0.008***	0.020*
	(0.006)	(0.239)	(0.491)	(0.002)	(0.001)	(0.012)	(0.000)	(0.000)	(0.000)	(0.673)	(0.155)	(0.721)	(0.001)	(0.013)
Low carbon	-0.004	-0.006	0.011	-0.024***	-0.011	0.001	0.017***	0.001	0.011	0.003	-0.019*	0.023	0.003*	-0.006
	(0.404)	(0.304)	(0.064)	(0.000)	(0.269)	(0.922)	(0.000)	(0.160)	(0.126)	(0.768)	(0.011)	(0.051)	(0.024)	(0.158)
Constant	0.047***	0.070***	0.061***	0.089***	0.130***	0.148***	0.018***	0.003**	0.067***	0.141***	0.128***	0.026	0.012***	0.053***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.008)	(0.000)	(0.000)	(0.000)	(0.149)	(0.000)	(0.000)
TNA (2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geo	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Style	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.094	0.114	0.125	0.072	0.145	0.143	0.144	0.111	0.361	0.270	0.082	0.193	0.048	0.080
Adj. R-squared	0.085	0.104	0.115	0.062	0.136	0.134	0.135	0.101	0.354	0.262	0.072	0.185	0.038	0.070
F(2, N)	9.57	11.77	13.09	7.14	15.57	15.33	15.48	11.40	51.91	33.88	8.19	21.99	4.67	7.96
N	1670	1670	1670	1670	1670	1670	1670	1670	1670	1670	1670	1670	1670	1670

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 26: Financed activities - SFDR disclosure (2021)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Communication	Discretionary	Staple	Energy	Financials	Health	Electr. comp.	Env services	Industrials	Infotech	Materials	Real estate	Renewables	Utilities
	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p
Art. 6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
Art. 8	-0.002	0.004	0.004	-0.017***	-0.007	0.020**	0.008***	0.001*	0.014**	0.007	-0.024***	-0.001	-0.001*	-0.004
	(0.564)	(0.285)	(0.237)	(0.000)	(0.272)	(0.003)	(0.000)	(0.013)	(0.001)	(0.306)	(0.000)	(0.871)	(0.042)	(0.091)
Art. 9	-0.035***	-0.006	0.024**	-0.036***	-0.041*	-0.020	0.045***	0.006***	0.060***	-0.014	0.009	-0.008	0.008***	0.014*
	(0.000)	(0.576)	(0.010)	(0.000)	(0.012)	(0.255)	(0.000)	(0.000)	(0.000)	(0.446)	(0.481)	(0.658)	(0.000)	(0.039)
Constant	0.048***	0.070***	0.057***	0.085***	0.126***	0.150***	0.022***	0.004***	0.074***	0.146***	0.126***	0.021	0.012***	0.054***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.227)	(0.000)	(0.000)
TNA (2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geo	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Style	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.102	0.113	0.120	0.076	0.142	0.145	0.132	0.052	0.358	0.269	0.093	0.189	0.052	0.076
Adj. R-squared	0.093	0.105	0.112	0.067	0.134	0.136	0.124	0.042	0.352	0.262	0.084	0.181	0.043	0.067
F(2, N)	11.67	13.20	14.14	8.51	17.11	17.45	15.76	5.62	57.67	38.05	10.61	24.10	5.72	8.49
N	1670	1670	1670	1670	1670	1670	1670	1670	1670	1670	1670	1670	1670	1670

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 27: Financed activities - Self-marketing (2021)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Communication	Discretionary	Staple	Energy	Financials	Health	Electr. comp.	Env services	Industrials	Infotech	Materials	Real estate	Renewables	Utilities
	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p	b/p
Not marketed	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
ESG marketed	-0.014*	-0.005	-0.017*	-0.017*	0.004	-0.018	0.024***	0.002*	0.014	0.006	0.010	0.007	-0.001	0.006
	(0.028)	(0.534)	(0.039)	(0.041)	(0.776)	(0.244)	(0.000)	(0.030)	(0.159)	(0.723)	(0.355)	(0.666)	(0.493)	(0.346)
Green marketed	-0.018**	-0.007	0.003	-0.021**	-0.022	-0.020	0.025***	0.004***	0.029***	0.012	0.005	0.007	0.005***	0.001
	(0.001)	(0.353)	(0.674)	(0.002)	(0.067)	(0.132)	(0.000)	(0.000)	(0.001)	(0.371)	(0.587)	(0.615)	(0.000)	(0.821)
Constant	0.048***	0.070***	0.058***	0.089***	0.127***	0.150***	0.019***	0.004***	0.072***	0.142***	0.129***	0.019	0.012***	0.055***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.279)	(0.000)	(0.000)
TNA (2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geo	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Style	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.098	0.113	0.119	0.064	0.140	0.140	0.120	0.049	0.351	0.269	0.077	0.189	0.047	0.072
Adj. R-squared	0.089	0.104	0.110	0.055	0.132	0.132	0.111	0.040	0.344	0.262	0.068	0.181	0.037	0.063
F(2, N)	11.17	13.16	13.95	7.07	16.87	16.84	14.05	5.30	55.77	37.97	8.64	24.11	5.06	7.99
N	1670	1670	1670	1670	1670	1670	1670	1670	1670	1670	1670	1670	1670	1670

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Carbon footprint level and change

Tables 28 to 30 report the regression results of the carbon footprint by category of funds, for the years 2016 and 2021, and for the change between 2016 and 2021. The coefficients signal a higher (+) or lower (-) carbon footprint (or an increase (+) or decrease (-) of the carbon footprint) for a given fund category relative to the baseline (No strategy/Art. 6/Not marketed). Controls are omitted for readability.

Table 28: Portfolio carbon footprint: funds with MS sustainability strategy

	(1)	(2)	(3)	(4)	(5)	(6)
	CI 2016	AE 2016	CI 2021	AE 2021	CI change	AE change
	b/t	b/t	b/t	b/t	b/t	b/t
No strategy	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)
ESG	-35.925	-6.35e+05*	-13.701	-5.29e+04	-0.101	-0.431
	(-1.225)	(-2.169)	(-0.473)	(-0.163)	(-0.555)	(-0.921)
Impact	-4.808	-5.15e+05***	-5.309	-4.46e+05**	-0.005	-0.165
	(-0.376)	(-4.031)	(-0.422)	(-3.155)	(-0.066)	(-0.804)
Green tech	-28.378	-8.89e+05	-63.419	-1.10e+06*	-0.417	-0.451
	(-0.601)	(-1.886)	(-1.361)	(-2.093)	(-1.417)	(-0.597)
Low carbon	-2.474	-2.50e+05	-57.475**	-8.75e+05***	-0.328*	-0.824*
	(-0.119)	(-1.207)	(-2.807)	(-3.798)	(-2.539)	(-2.488)
CI level (2016)					-0.001***	
					(-7.903)	
AE level (2016)						-0.000***
						(-5.231)
Constant	243.491***	1.60e+06***	163.916***	1.92e+06***	0.116	1.811***
	(8.434)	(5.547)	(5.736)	(5.960)	(0.629)	(3.891)
TNA (2016)	Yes	Yes	No	No	Yes	Yes
TNA (2021)	No	No	Yes	Yes	No	No
TNA change	Yes	Yes	Yes	Yes	Yes	Yes
Geo	Yes	Yes	Yes	Yes	Yes	Yes
Cap	Yes	Yes	Yes	Yes	Yes	Yes
Style	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.059	0.245	0.091	0.151	0.084	0.051
Adj. R-squared	0.047	0.235	0.079	0.140	0.071	0.037
F(2, N)	4.75	24.45	7.58	13.39	6.53	3.83
N	1452	1452	1452	1452	1452	1452

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 29: Portfolio carbon footprint: SFDR disclosure classification

	(1)	(2)	(3)	(4)	(5)	(6)
	CI 2016	AE 2016	CI 2021	AE 2021	CI change	AE change
	b/t	b/t	b/t	b/t	b/t	b/t
Art. 6	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)
Art. 8	-15.527	-3.04e+05**	-60.959***	-8.28e+05***	-0.241***	-0.477*
	(-1.340)	(-2.613)	(-5.309)	(-6.414)	(-3.340)	(-2.572)
Art. 9	64.381	-6.99e+04	-49.523	-1.02e+06	-0.415	-0.746
	(1.217)	(-0.132)	(-0.956)	(-1.752)	(-1.261)	(-0.883)
CI level (2016)					-0.001***	
					(-7.963)	
AE level (2016)						-0.000***
						(-5.290)
Constant	237.723***	1.55e+06***	158.280***	1.88e+06***	0.124	1.833***
	(8.279)	(5.393)	(5.596)	(5.899)	(0.677)	(3.959)
TNA (2016)	Yes	Yes	No	No	Yes	Yes
TNA (2021)	No	No	Yes	Yes	No	No
TNA change	Yes	Yes	Yes	Yes	Yes	Yes
Geo	Yes	Yes	Yes	Yes	Yes	Yes
Cap	Yes	Yes	Yes	Yes	Yes	Yes
Style	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.060	0.237	0.103	0.162	0.086	0.051
Adj. R-squared	0.049	0.228	0.093	0.152	0.074	0.039
F(2, N)	5.43	26.27	9.70	16.34	7.47	4.26
N	1452	1452	1452	1452	1452	1452

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 30: Portfolio carbon footprint: ESG self-marketed funds

	(1)	(2)	(3)	(4)	(5)	(6)
	CI 2016	AE 2016	CI 2021	AE 2021	CI change	AE change
	b/t	b/t	b/t	b/t	b/t	b/t
Not marketed	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)
ESG marketed	54.487*	5.98e+05*	-32.119	-2.70e+05	-0.252	-0.256
	(2.141)	(2.262)	(-1.314)	(-0.819)	(-1.647)	(-0.646)
Green marketed	-0.766	-2.44e+04	-14.849	31935.371	-0.141	-0.146
	(-0.034)	(-0.104)	(-0.683)	(0.109)	(-1.036)	(-0.415)
CI level (2016)					-0.001***	
					(-8.515)	
AE level (2016)						-0.000***
						(-5.413)
Constant	250.933***	1.48e+06***	162.038***	1.74e+06***	0.184	1.724***
	(9.522)	(5.396)	(6.245)	(4.968)	(1.128)	(4.170)
TNA (2016)	Yes	Yes	No	No	Yes	Yes
TNA (2021)	No	No	Yes	Yes	No	No
TNA change	Yes	Yes	Yes	Yes	Yes	Yes
Geo	Yes	Yes	Yes	Yes	Yes	Yes
Cap	Yes	Yes	Yes	Yes	Yes	Yes
Style	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.058	0.222	0.081	0.093	0.081	0.046
Adj. R-squared	0.048	0.214	0.072	0.084	0.070	0.035
F(2, N)	5.78	26.87	8.35	9.68	7.80	4.28
N	1619	1619	1619	1619	1619	1619

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$