



Staff memo

# **Fifty shades of green: the colour of Swedish equity funds.**

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## Staff Memo

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# Summary<sup>1</sup>

Using proprietary quarterly portfolio data and emissions data, I study the carbon footprint and trading activity of actively managed home-biased Swedish equity funds over the period 2019-2021. In particular, I focus on funds belonging to investment management companies that have joined the *Net Zero Asset Managers Initiative* (i.e. initiative funds) and compare their characteristics and investment portfolios with those funds whose investment management companies have not openly joined the initiative (i.e. non-initiative funds). To better identify a fund's potential alignment with the net zero target, I also include information about whether or not the fund has received a "Low Carbon Designation" label from Morningstar. I document that, on average, initiative funds have been decarbonizing their portfolios more actively than non-initiative funds. However, by and large, I find only limited evidence that initiative funds (even those with a low carbon designation) have been substantially reducing their exposure to the most polluting stocks in their portfolios. This is the case even when firms belong to very high-emitting industries. This suggests two main possibilities: a) funds hold on to the most polluting stocks in their portfolios because they consider the firms issuing them to be working sufficiently on their green transitions; b) funds are still not greening their portfolios rapidly or effectively enough. This second option is clearly more troublesome both for the climate transition and the financial system. The only way to be able to fully distinguish between these two alternatives would be to obtain more structured, transparent and verifiable information that would allow for proper monitoring.

**Keywords:** Equity mutual funds, climate-related risks, greenhouse gases (GHG) emissions, carbon footprint, financial stability.

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## Sammanfattning på svenska

I denna studie använder jag kvartalsvis data på svenska aktiefonders<sup>2</sup> investeringsportfölj och koldioxidutsläpp för att undersöka fondernas koldioxidavtryck och börsandel under perioden 2019-2021. Jag fokuserar särskilt på fonder som tillhör fondförvaltare som har anslutit sig till initiativet *Net Zero Asset Managers Initiative* och jämför deras egenskaper och investeringsportföljer med fonder vars fondförvaltare inte anslutit sig till något klimatinitiativ. För att lättare kunna avgöra i vilken utsträckning en fond har anpassat sig till målet om nollutsläpp, inkluderar jag även information om huruvida en fond har fått Morningstars beteckning *Low Carbon Designation*. Det visar sig att fonder som har anslutit sig till initiativet i genomsnitt har minskat koldioxidutsläppen i sina portföljer mer aktivt än de som inte har anslutit sig. Däremot hittar jag få bevis för att de anslutna fonderna (även de med beteckningen *Low Carbon Designation*) avsevärt skulle ha minskat sina exponeringar mot de mest förorenande företagen i sina portföljer, inte ens när dessa företag tillhör branscher med mycket höga utsläpp. Det kan finnas två huvudsakliga förklaringar till detta: a) att fonderna behåller de mest förorenande aktierna i sina portföljer eftersom de anser att företagen som ger ut dem arbetar tillräckligt bra med sin gröna omställning; b) att fonderna inte miljöanpassar sina portföljer tillräckligt snabbt och effektivt. Den senare förklaringen är betydligt mer besvärande, både för klimatomställningen och för det finansiella systemet. Det är dock svårt att bedöma vilken förklaring som är mest relevant, eftersom det kräver mer strukturerad, transparent och verifierbar information som möjliggör bättre övervakning.

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<sup>2</sup> Dessa aktiefonder har en så kallad "home-bias", dvs. de handlar mest med svenska aktier.

# 1 Introduction

The consequences of climate change are creating new forms of financial risks that both asset managers and investors in general need to consider when choosing how to prudently allocate their capital.<sup>3</sup> Yet, even though the industry, by and large, has committed to more disclosure and transparency,<sup>4</sup> we still know little about how investment funds are working to align themselves to the net zero target.<sup>5</sup> This is important because there are still no clear rules that apply to all funds when it comes to how to conduct their sustainability work<sup>6</sup> and information disclosure by firms and institutional investors is still limited, mostly voluntary and often not verifiable.<sup>7</sup>

In Sweden, all of the major Swedish investment management companies have joined the *Net Zero Asset Managers Initiative*<sup>8</sup> which gathers together an international group of asset managers committed to supporting the goal of net zero greenhouse gas (henceforth, GHG)<sup>9</sup> emissions by 2050 or sooner. Yet, since the Swedish government has actively committed to net zero, not only by signing the Paris Agreement in 2015 but also by developing an ambitious plan (see Appendix B), regardless of whether or not a fund has any specific climate goals at all, eventually *all funds* will need to align their investment portfolios to the net zero target to avoid the potential realization of transition risks. Of course, by the same token, *all firms*, and especially those that contribute the most to the overall level of GHG in Sweden, also need to invest to reduce their emissions in line with net zero. Funds could therefore just wait and let firms do their work for them.

Unfortunately, since the targets are fast approaching and information about most firms' transition plans and stranded assets is still scarce, at best, passively waiting may constitute a risk in itself. In fact, unless funds are confident that, to a large extent, the firms in their portfolios are working sufficiently to align themselves with net zero, the more they wait to start adjusting their portfolios, the faster the pace at which they

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<sup>3</sup> A recent study found that 215 of the world's largest companies are exposed to almost \$1 trillion in climate-related risk (CDP, 2019).

<sup>4</sup> See for example Larry Fink (2020) letter to BlackRock's CEOs.

<sup>5</sup> Net zero refers to an overall balance between emissions produced and emissions taken out of the atmosphere (Burke, 2019).

<sup>6</sup> For example, in Sweden, how to approach sustainability work is entirely left to the discretion of each fund (Fondbolagens Förening, 2021).

<sup>7</sup> In a recent blog, staff members at the IMF clearly argue that there is a need for high-quality, reliable, and comparable data that would help banks, pension funds, and other investment firms to assess climate-related risks (Gardes-Landolfini and Natalucci, 2022). A similar argument has been also made recently in the Sveriges Riksbank' financial stability report (Sveriges Riksbank FSR 2022:1, p.11-12).

<sup>8</sup> The Net Zero Asset Managers Initiative, launched in December 2020 had, in May 2022, 273 signatories with a total of \$ 61.3 trillion in assets under management (Netzeroassetmanagers, 2022). In a nutshell, the signatory's commitment to this initiative implies that "asset managers will have to work with their clients and are expected to ratchet up the proportion of assets managed in line with net zero goals." Information about what signatories commit to can be found on the Net Zero Asset Managers Initiative's website.

<sup>9</sup> The carbon-dioxide (CO<sub>2</sub>) equivalent is the unit of measure that expresses the climate impact from emissions of different greenhouse gases by converting amounts of other gases into the equivalent amount of carbon dioxide with the same global warming potential. Emissions are converted into CO<sub>2</sub> emissions using a methodology provided by the UN climate panel, the IPCC. In the text, I use the words CO<sub>2</sub> equivalents (CO<sub>2</sub>e) and greenhouse gases (GHG) interchangeably. This is because carbon-dioxide equivalents (CO<sub>2</sub>e) describe different greenhouse gases in a common unit. For any quantity and type of greenhouse gas, CO<sub>2</sub>e signifies the amount of CO<sub>2</sub> which would have the equivalent global warming impact (Brander and Davis 2012).

will need to do it in the future will be (Bolton, Kacperczyk and Samama, 2022). So to ensure an effective and orderly transition, both funds and firms should work together toward the goal of greening the financial system, and the economy.

Unfortunately, I do not have information about firms' transition plans, but keeping firms' emissions constant at their 2019 level, I employ proprietary quarterly portfolio data available at Sveriges Riksbank to investigate the carbon footprint and trading activity of actively managed home-biased Swedish equity funds over the period 2019-2021.

In particular, I focus on funds that belong to investment management companies and have joined the *Net Zero Asset Managers Initiative* (i.e. initiative funds) and compare their characteristics and investment portfolios with those of funds whose investment management companies have not openly joined the initiative (i.e. non-initiative funds). Moreover, to better identify whether a fund may be more or less aligned with net zero, despite the fact that the investment company owning it has or has not joined the *Net Zero Asset Managers Initiative*, I also collect information about whether or not a fund has obtained the "Low Carbon Designation" (i.e. LDC label) assigned by Morningstar since 2018.

I document that, on average over the period 2019-2021, initiative funds have been decarbonizing their portfolios more actively than non-initiative funds. However, by and large, I find only limited evidence that initiative funds (even those with a low carbon designation) have been substantially reducing their exposure to the most polluting stocks in their portfolios. This is the case even when firms belong to very high-emitting industries. Overall, results suggest two main possibilities: a) funds hold on to the most polluting stocks in their portfolios because they consider the firms issuing them to be working sufficiently on their green transitions; b) funds are not greening their portfolios rapidly or effectively enough and therefore need to invest substantially more resources in this process.

The second option described above is clearly the most troublesome because it implies that funds may not be collecting (costly) information about the transition plans of the firms they have invested in but instead are simply waiting for them to reduce their emissions. However, if these firms fail to meet the net zero target, funds may find themselves in a rush to readjust their portfolios with potentially significant consequences for their clients and, in the worst case scenario, for financial stability.

Importantly, by waiting, funds may also miss an opportunity to further help the transition. As suggested by Bolton et al. (2022), if firms do not sufficiently work to green their investments, fund's trading could actually incentivize them to put their transition plans into action more quickly.

Interestingly, I also document that, on average, the funds in the sample are quite long-term oriented. This suggests that for these funds full exit may not be the only available option to make a difference. In fact, if they are not already doing that, these funds could incentivize the firms in their portfolios to decrease (or further decrease) their emissions by engaging in direct monitoring. This monitoring could ensure that

resources are invested in firms that not only *have a transition plan* in place but also *execute this plan* in a timely fashion.

In conclusion, the only way to distinguish between the two alternatives above would be to obtain more structured and transparent information from the funds themselves (only so much can be inferred from their actual trading) and to further incentivize firms to be transparent about their transition plans. Yet, unless information is substantiated with appropriate data and verifiable, it will still be hard to engage in proper monitoring.

## 2 Data and empirical strategy

### 2.1 Fund characteristics: main variables and data

In this study, I explore the main hypothesis that funds that belong to investment management companies and have joined the *Net Zero Asset Managers Initiative* (i.e. initiative funds) may work more aggressively to green their portfolios than funds whose investment management companies have not openly joined the initiative (i.e. non-initiative funds).

This hypothesis is in line with the results documented by Gibson, Krueger, Matos, and Steffen (2020) who study funds that have joined the Principles for Responsible Investing (PRI). Although they document large heterogeneity, Gibson and her co-authors suggest that European funds that have joined the PRI have better ESG score footprints (a value weighted average of the ESG scores in the fund's portfolio). Besides, studying initiative funds is also important since it is documented that responsible investors attract more investor flow: Humphrey and Li (2021) document this result for PRI signatories, Hartzmark and Sussman (2019) for funds with high sustainability ratings, and Ceccarelli, Ramelli and Wagner (2021) for funds that have received a "Low Carbon Designation" (i.e. LDC label) from Morningstar. The latter results corroborate the idea that a fund joining a climate initiative conveys a valuable signal to its investors about the type of strategy it intends to employ.

Nevertheless, the fact that an investment management company joins a climate initiative may not necessarily mean that all funds in that investment management company are actually aligned with the net zero target, although one would expect that. Moreover, although many institutional investors have supported the Paris Agreement from the very beginning, the Net Zero Asset Managers Initiative was only launched in December 2020. Therefore, before 2021 even the funds joining the initiative may not have adjusted their portfolios in line with the net zero target. Consequently, to further exploit the variation in the cross-section of mutual funds and fine-tune the results, on top of considering whether a fund is an initiative fund or not, I also employ

the information content of the “Low Carbon Designation” (i.e. LDC label) assigned by Morningstar since 2018.<sup>10</sup>

Morningstar introduced this eco-label for mutual funds to help clients to easily identify funds with portfolios aligned with the transition to a low-carbon economy. Ceccarelli, Ramelli and Wagner (2021) show that low-carbon funds (funds that have received a LCD label) are likely to have lower exposure to future potential climate change risks and display higher idiosyncratic volatility relative to the current market portfolio, mostly because they usually under-weight carbon-intensive sectors. Therefore, adding this information to the information about whether or not a fund is an initiative fund should help better identify funds that are aligned with the net zero target.

A priori, it is not clear that funds with a LCD label are more likely to decarbonize their portfolios. This is because these funds should be more likely to select, to begin with, firms that are more aligned with reaching net zero. Therefore, including this variable should help the interpretation of the results and shed new light on the trading behaviour of these funds.

Fund characteristics are collected as follows. The information about whether a fund’s investment management company has joined the Net Zero Asset Managers Initiative is obtained from the “Race to Zero” website. The information of whether a fund in any given quarter over the sample period 2019-2021 has obtained a low carbon designations (i.e. a LCD label) is collected from Morningstar. From Morningstar, I also collect information about whether a fund is actively managed or not, fund flow, and fund age. For illustrative purposes, I also collect information on the fund’s Morningstar Rating, often called the star rating,<sup>11</sup> as well as on management fees and management tenure.

## 2.2 Fund portfolio data

The main source of fund portfolio data is VINN. VINN is a proprietary database that contains quarterly information on the securities holdings of all institutional investors registered in Sweden.<sup>12</sup> In VINN, funds report a very rich set of information, however I focus on a few key variables: (a) each fund’s main identifier (riad code), (b) each

<sup>10</sup> While the aim of this study is not to comment on the quality of this label, it is important to consider that investors have limited information about funds’ climate strategy and therefore the information conveyed by such a label becomes an important communication tool.

<sup>11</sup> The Morningstar Rating for funds, often called the star rating, is a purely quantitative, backward-looking measure of a fund’s past performance, measured from one to five stars.

<sup>12</sup> VINN collects information from Pension Funds, Insurance Corporations, Mutual Funds, Central banks, Monetary Financial Institutions, Money Market Funds, Social Security funds and Foreign Branches. A definition of these institutions can be found in the Handbook on Securities Statistics (IMF, 2015). Institutional investors need to be registered in Sweden to be covered in VINN. If an institutional investor operates on Swedish markets but is registered elsewhere, in Luxemburg for example, it is not covered in VINN. This is also the case for individual funds registered abroad but that belong to an investment management company registered in Sweden. VINN has a high coverage but does not cover 100% of the institutional investors registered in Sweden. Data is collected directly from the institutional investors and then custodian data is employed to fill in additional information for smaller holdings and sectors for which information cannot be collected directly. For mutual funds, special funds and synthetic mutual funds the coverage is in principle 100%. The data is originally collected each quarter by the Swedish Financial Authority (Finansinspektionen) and then used by Statistics Sweden (SCB) to create VINN on behalf of the Riksbank.



stock's main identifier (isin and organization number), (c) each stock's market value, (d) the total number of shares owned, and (e) the country of the issuer.

To begin with, I concentrate on all the equity funds' reporting to VINN. In December 2021, these funds (a total of 238) reported a total exposure to *Swedish listed firms* of about SEK 1,097,362 million, which represents 87% of the total market value reported by all equity and non-equity funds in VINN (a total of 372) in Swedish listed firms. Nevertheless, investment in Swedish listed firms is not the major part of the portfolios for all the equity funds reporting to VINN. Therefore, I further close in on funds with a conspicuous home bias which I define as funds with at least 60% of their total market value (i.e. Fund Size) invested in Swedish non-financial firms (about 110 funds).

Next, I use each stock identifier to match the investment portfolios with emissions data (Emissions Coverage). Total scope 1 and scope 2 emissions<sup>13</sup> and emissions intensities (scope 1 plus scope 2 emissions normalized by the firm's market capitalization) data for 2019 are available from Sustainalytics (which is also part of the Morningstar family). From Sustainalytics I also obtain each firm's industrial sector.

There are 279 firms in the funds' portfolios for which emissions data is available and I focus only on funds for which at least 60% of the total market value is represented by shares with non-missing scope 1 and scope 2 emissions (about 106 funds). Moreover, since I am interested in how funds have actively been managing their portfolios to reduce their carbon footprint, using the Index Fund identifier provided by Morningstar, I further identify actively managed funds<sup>14</sup> with at least 10 stocks with non-missing emissions data<sup>15</sup> in their portfolios (a total of 73 funds).<sup>16</sup> In December 2021, these funds reported a total exposure to Swedish listed firms of about SEK 684,764 million, which represents 62% of the total market value reported by all equity funds.

Finally, I match each fund with manually collected data on investment management companies joining the Net Zero Asset Managers Initiative<sup>17</sup> and identify 26 initiative funds and 47 non-initiative funds. In December 2021, initiative funds reported a total exposure to Swedish listed firms of about SEK 399,672 million, while non-initiative funds reported a total exposure to Swedish listed firms of about SEK 285,092 million.

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<sup>13</sup> Scope 1 are direct emissions from the activities of an organization from sources it controls. These would include company vehicles and fuel combustion on site, like gas boilers. Scope 2 are indirect emissions from the generation of electricity and heat used by an organization.

<sup>14</sup> Morningstar defines a fund as actively managed if "a fund's manager deliberately chooses specific investments for the fund's portfolio that he or she believes will perform better or be less risky than other investments."

<sup>15</sup> For excluded funds I had only a total of 4 or 5 stocks for which emissions data was available. Including these funds in the analysis does not change the results.

<sup>16</sup> Although, the number of funds (73) is smaller with respect to the original set of equity funds (309), these funds have a large home bias and therefore have large stakes in Swedish listed firms. In fact, in December 2021, these funds reported a total market value in Swedish listed firms of SEK 684,764 million which is almost 63% of the total reported by all equity funds in these securities (SEK 1,097,362 million).

<sup>17</sup> The Net Zero Asset Managers Initiative was launched in December 2020, but some of the Swedish investment management companies that I can identify did not join immediately and entrance was staggered. However, I assume that all of the families I could identify from the Race to Zero website (UNFCCC, Race to Zero) had already joined in 2019 even though most of them had joined after December 2020. In the analyses, I use the period before and after December 2020 to study whether funds have changed the way they managed their portfolios after families had joined the Net Zero Initiative.

In the next sub-section, I report more detailed descriptive statistics for all of the funds in the study and the main variables of interest.

## 2.3 Descriptive statistics

Descriptive statistics are reported in Table 1.

**Table 1. Funds' Descriptive statistics**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All Funds			Initiative Funds			Non-initiative Funds		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Fund Size	880	7,930	0,122	312	13,310*	11,739	568	4,975	7,653
Net Flow	756	-0.93	228	253	0.16	247	503	-1.48	219
Churn Ratio	805	0.18	0.20	286	0.13	0.11	519	0.21*	0.23
Ownership Stake	25,848	0.82%	1.35%	9,880	1.19%*	1.47%	15,968	0.59%	1.21%
Portfolio Weight	1,064	2.36%	2.02%	11,997	2.12%	1.81%	19,067	2.51%*	2.13%
<b>Fund Characteristics in Dec 2021</b>									
Home Bias	73	87.02%	9.27%	26	84.67%	10.84%	47	88.33%	8.11%
Emissions Coverage	73	83.10%	7.96%	26	81.19%	8.11%	47	84.16%	7.76%
LCD designation	73	61.64%	48.96%	26	69.23%	47.07%	47	57.45%	49.98%
Morningstar Rating	70	3.01	1.17	26	2.92	1.23	44	3.07	1.15
Management Fees	55	1.16	0.49	22	1.15	0.47	33	1.17	0.51
Fund Age	73	18.36	7.98	26	21.88	7.07	47	16.40	7.84
Management Tenure	73	6.72	6.21	26	7.73	7.95	47	6.16	5.02

Note: Table 1 shows descriptive statistics for the main variables of interest. The table starts by reporting statistics for all of the funds in the sample (columns 1-3), then these funds are split into 2 groups: Initiative funds (columns 4-6) and non-initiative funds (columns 7-9). Variables in the first five rows are calculated using quarterly data for 2019-2021, while the rest of the variables are calculated at the end of December 2021. \* indicates the statistical significance of a test on the mean between initiative and non-initiative funds.

Sources: VINN and Morningstar.

Table 1 shows that in December 2021, the funds in the study had, on average, around 87% of their market capitalization invested in Swedish stocks and that emissions data covered, on average, 83% of the total fund's market cap. Table 1 also shows that over the quarters under consideration (Q12019-Q42021), initiative funds had a statistically larger portfolio size than non-initiative funds. On average, initiative funds also own statistically larger stakes in the firms in their portfolios.<sup>18</sup> Yet, the portfolio weight of the average stock is statistically smaller than the weight of the average stock in the portfolio of non-initiative funds. This suggests that the former are slightly more diversified. Interestingly, although the mean appears to be very different, once controlling

<sup>18</sup> Firms' shares outstanding and market cap together with splits and dividends adjustment factors come from Bloomberg.

for standard deviation, there is no statistically significant difference in the net flow<sup>19</sup> between the two types of fund.

Although the funds in this study are all actively managed, this does not mean that they necessarily keep their holdings in a stock for a short period of time. Therefore, to be able to better identify whether a fund is more likely to trade or not to reduce its carbon footprint, I add information about the fund's investment horizon using its churn ratio.

The churn ratio, calculated as in Gaspar, Massa and Matos (2005) and Cella, Ellul and Giannetti (2013), captures how much of their portfolios funds turn over every quarter (see Cella, Ellul and Giannetti (2013) p. 1612 for the full discussion). By construction, the churn ratio moves in the interval between zero and two. If a fund had a churn ratio of zero, this would suggest that the fund does not turnover any of its holdings in a quarter. Conversely, a churn ratio of two means that the fund churns all of its portfolio holdings over the quarter.

Over the period 2019-2021, the average fund in the sample had a churn ratio of 0.18 which suggests that, although active, the average fund only turned over about 9% of its holdings in a quarter. Initiative funds show on average an even smaller turnover with a quarterly churn ratio of just 0.13 which is statistically different from that of the average non-initiative fund which is about 0.21. Interestingly, the standard deviation shows that there is quite considerable variation in the churn ratio of funds.

More in detail, if we look at the 5<sup>th</sup> percentile of the distribution, not reported in Table 1 because of limited space, the average fund's churn ratio is about 0.04 which suggests that these funds are turning over almost none of their holdings and are behaving rather like buy-and-hold funds. Just for comparison, the index funds that I have excluded show an average churn ratio of 0.08. The funds in the 95<sup>th</sup> percentile of the distribution, also not reported in Table 1, have had over the period under consideration an average churn ratio of about 0.46. This suggests that most of the trading may come from a small sample of funds and may occur in a small sample of firms since many funds, even if active, are quite long-term oriented and keep their holdings quite stable over time.<sup>20</sup>

Table 1 also shows that in December 2021 about 61% of the funds had obtained a LCD label and that these were more common among initiative funds. On the other hand, non-initiative funds were assigned slightly better star ratings (Morningstar Rating) which do not convey any information on the funds' climate alignment, but suggest that these funds have been performing better in the past. Moreover, the average fund in both sub-samples appears quite similar in terms of management fees, but initiative funds are older and with longer tenured managers. Unfortunately, although it

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<sup>19</sup> Fund flow is a proxy for the measure of the net movement of cash into and out of the fund. Outflows reflect share redemptions, or when investors take their money out of a fund, while inflows reflect share purchases.

<sup>20</sup> I also find that funds with a LCD label have lower churn ratios (on average) than those that do not obtain the label (0.16 with respect to 0.20, respectively). This latter statistic then suggests that these funds also tend to be more long-term oriented and trade their portfolio holdings less.

would be important to control for these latter characteristics, star ratings, management fees and management tenure information are only available for the month of December 2021. However, I control for (one quarter) lagged churn ratio, net flow, the fund's age and size. The main results are reported in the next section.

## 3 Main results

### 3.1 Funds' carbon footprint

To study funds' portfolios carbon footprint and decarbonization, I calculate the "weighted average carbon intensity" (i.e. WACI)<sup>21</sup> as recommended by the Task Force on Climate-Related Financial Disclosures (TCFD) to compare equity portfolios (TCFD 2017 and 2020).

For each fund  $j$  in each quarter,  $t$ , using each stock  $i$ 's weight in the fund's portfolio and the stock carbon intensity (CI) in 2019, I calculate the fund carbon footprint (WACI) as the following weighted average:

$$\text{Eq.1} \quad WACI_{j,t} = \sum_{i=1}^n \frac{\text{Market Value}_{i,j,t}}{\text{Total Portfolio Value}_{j,t}} * CI_{i,2019}$$

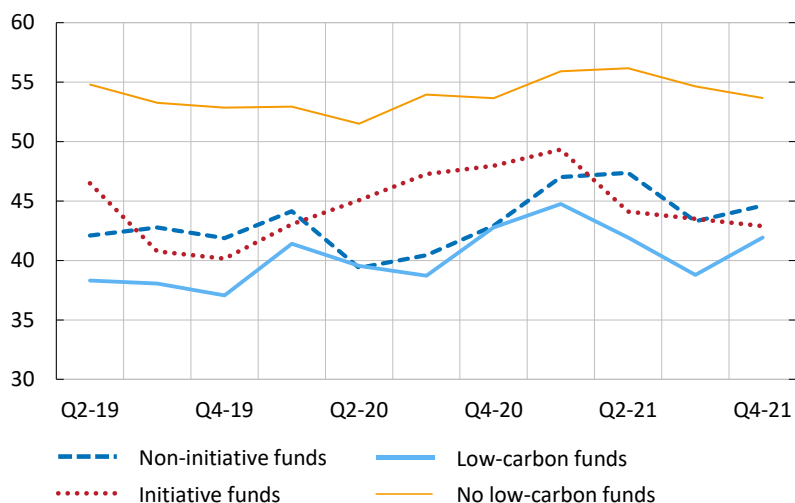
Over the period 2019-2021, the average WACI in the sample is about 44, which means that the average stock in the average fund emitted 44 tonnes of carbon dioxide (henceforth, CO<sub>2</sub>eq) per US\$1 million of company revenues in 2019. Figure 1 below illustrates how the average fund's WACI has evolved over the period 2019-2021 for different sub-sets of funds.

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<sup>21</sup> I want to note that, as suggested by Bolton et al. (2022), the net-zero goals are in levels and not in relative terms. Therefore, while funds, for comparability reasons and because of the easiness of the measure, report WACI, one has to acknowledge that this synthetic measure may inform us very little on the ability of any fund to help in the transition to net zero. Moreover, a fund's WACI is based on backward-looking information (i.e. past emissions) while the net zero target relies on the ability of firms to innovate and/or compensate for their emissions.

**Figure 1. Funds' average WACI**

Tonnes of carbon dioxide



Note. Figure 1 illustrates the funds' average WACI calculated using Scope 1 and 2 Emissions Intensity as de-scribed in Section 3.1. The blue rectangular-dotted line represents results for the sub-sample of funds that do not belong to an investment management company that has openly joined a climate initiative (Non-initiative funds). The red dotted line shows results for the sub-sample of funds that belong to an investment management company that has openly joined a climate initiative (Initiative funds). The solid light blue line reports results for funds that have received a LCD label from Morningstar (Low-carbon funds) in quarter t-1 and the solid yellow line represent funds that have not receive a LCD label from Morningstar (NO Low-carbon funds).

Sources: VINN and Sustainalytics.

Figure 1 clearly shows that, on average, the WACI of initiative and non-initiative funds and that of funds that have received a LCD label have been very similar over the period 2019-2021, while that on funds without a LCD label has been larger. Yet, Table 1.A (in Appendix A) shows that, after controlling for trend and funds' characteristics, there is statistically no difference between all the lines plotted in Figure 1. The only exception would be, at best, the difference between the average WACI of low-carbon and no low-carbon funds, but results are quite weak (p-value 0.116).

Nevertheless, the WACI in itself tells us very little about whether funds have actively been trading to reduce their carbon footprint. To study this, I calculate the Active WACI Change measure introduced by Rohleder, Wilkens, and Zink (2022). This measure (calculated as described in equation 2 below) keeps the level of emissions constant to 2019, and calculates how the fund  $j$ 's trading in quarter  $t$  has contributed to an increase or decrease in its carbon footprint.

$$\text{Eq.2} \quad \text{Active WACI Change}_{j,t-1} = \frac{\sum_{i=1}^n ((\Delta \text{Portfolio Weight}_{i,t,t-1}) * CI_{i,2019})}{WACI_{j,t-1}}$$

The variable Active WACI Change had, over the period 2019-2021, an average of -.001 (with a median of -0.02 and a standard deviation of 0.19) suggesting that, consistent with the patterns in Figure 1, funds' trading has, on average, contributed only marginally to decarbonizing their portfolios. Yet, some funds have been more actively adjusting their portfolios in a way that could reduce their carbon footprint. I study this further in a multivariate setting.

I employ the Active WACI Change in each quarter to create a dummy variable (Active Decarbonization Dummy) that is equal to one if the Active WACI Change is negative and zero otherwise. I use the Active Decarbonization Dummy as a dependent variable to study whether initiative funds (and funds with a low carbon designation) have been more likely to trade in a way that reduces their carbon footprint over the period 2019-2021.

In particular, I regress the Active Decarbonization Dummy at time  $t$  on the following independent variables:

1. A dummy variable equal to one if a fund is an initiative fund and zero if not (*Initiative*).
2. A dummy variable equal to one if the fund has received a low carbon designation in quarter  $t-1$  and zero if it has not (*Low-carbon*).
3. An interaction of the two variables above (*Initiative\*Low-carbon*) to study directly initiative funds ( $Initiative=1$ ) with a low-carbon label ( $Low-carbon=1$ ).

The results generated by a panel OLS regression are reported in Table 2.<sup>22</sup> In Table 2, all regressions include quarter-year fixed effects to control for trend and, in some columns, I also control for the fund's age and (one quarter) lagged churn ratio, net flow, and size. Standard errors are robust and clustered at the fund level.

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<sup>22</sup> Results are similar if regressions are run as Probit regressions.

**Table 2. WACI and Active Decarbonization**

	Active Decarbonization Dummy						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Initiative	0.08*** (0.004)	0.06* (0.074)	0.09*** (0.002)	0.07* (0.058)	0.16*** (0.001)	0.10** (0.037)	0.10 (0.188)
Low-carbon			-0.04 (0.181)	-0.05 (0.148)	-0.01 (0.830)	-0.03 (0.492)	-0.01 (0.907)
Initiative#Low-carbon					-0.11* (0.090)	-0.06 (0.332)	-0.18* (0.065)
Year 2021							-0.28*** (0.008)
Initiative#Year 2021							0.01 (0.958)
Low-carbon#Year 2021							-0.04 (0.637)
Initiative#Low-carbon#Year 2021							0.28 (0.103)
Churn Ratio		-0.33*** (0.000)		-0.34*** (0.000)		-0.34*** (0.000)	-0.34*** (0.000)
Fund Flow		0.00* (0.084)		0.00 (0.100)		0.00 (0.136)	0.00 (0.119)
Fund Size		0.00 (0.750)		0.00 (0.822)		0.00 (0.960)	0.00 (0.949)
Fund Age		-0.04 (0.196)		-0.03 (0.334)		-0.03 (0.369)	-0.03 (0.416)
Observations	881	677	806	677	806	677	677
Adjusted R <sup>2</sup>	0.147	0.062	0.051	0.063	0.052	0.063	0.070

Note: Panel regressions with quarter-year fixed effects. Standard errors are robust and clustered at the fund level. Robust p-values are reported in the parentheses underneath the coefficients and should be interpreted as follows \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Sources: VINN and Morningstar.

By and large, results in Table 2 show that, under the period of this study, on average, initiative funds were more likely to trade in a way that decreased their carbon footprint, in line with the findings of Rohleder et al. (2022) and Gibson et al. (2020).<sup>23</sup> On the other hand, the coefficient of the dummy low-carbon is negative but never statistically significant, while the interaction between the two dummy variables has a negative sign but is highly insignificant after controlling for fund characteristics (in column (6)). These results suggest that while initiative funds are on average more likely to decarbonize their portfolios, those funds in this category that have a low carbon designation are not.

This latter result is however not in contrast with the fact that a fund receives a LCD label. In fact, as discussed above, these funds should select stocks based on the firms' plans to meet the net zero target and therefore they may be less likely to trade to actively decrease their carbon footprint based on current or past emissions. However, in

<sup>23</sup> Gibson et al., however, documents results of "ESG score footprints."

the long-run, as firms' emissions eventually decrease, the funds' carbon footprint should also decrease.<sup>24</sup>

Importantly, from Figure 1 it appears that the average fund's WACI has been increasing during the year 2020 but has been decreasing slightly in 2021, especially for the average initiative fund. In Table 2 column (7), I then study whether initiative funds may have started decarbonizing more after their investment management company joined the *Net Zero Asset Managers Initiative*. Since the majority of the investment companies in the sample joined in early 2021, in column (7) I include a dummy variable that is equal to one in 2021 and zero in 2020 and 2019 (Year 2021), and interact this variable with both the initiative dummy and the low-carbon dummy. Results suggest that, although in the overall sample funds were less likely to decrease their carbon footprint in 2021 with respect to 2020 and 2019 (the year 2021 dummy alone is negative and highly statistically significant), initiative funds with a low carbon designation were more likely to actively trade to decrease their carbon footprint in 2021 with respect to 2020 and 2019. However, this result has a p-value slightly above 10% and therefore is weak, at best.

Interestingly, Table 2 also documents that the larger a fund's churn ratio in quarter  $t-1$  (i.e. the more the fund turns over its portfolio holdings in quarter  $t-1$ ), the less likely it is that the fund actively decarbonizes its portfolio in quarter  $t$ . This result is highly statistically significant and suggests that a fund's trading per se may not be sufficient to encourage firms to put transition plans into action more quickly, as suggested by Bolton et al. (2022). Yet, at this stage, one cannot exclude that funds may not trade to actively reduce their carbon footprint because they have better (private) information about firms and their alignment with the net zero target. If so, they should be confident that in the future (total) emissions will substantially decrease. Yet, if they have not collected the relevant information, and are simply waiting for the firms to align themselves as they must do, this could have significant consequences for both the climate and the financial system.

Next, to better understand whether and how funds manage their portfolios' carbon footprints, I identify the stocks that mostly contribute to the funds' carbon footprints and study whether the funds have been decreasing their exposure to these stocks.

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<sup>24</sup> In general, firms can employ different strategies to align themselves with the net zero target and not all these strategies will necessarily affect their emissions in the short run. Firms could make investments to directly green their operation and reduce their emissions in a trajectory consistent with net zero. However, firms can also pay carbon taxes and/or trade emissions rights in line with the EU Emissions Trading System (EU ETS). Sweden is part of the EU Emissions Trading System (European Commission, 2021a) and introduced a carbon tax already in 1991. A carbon tax is effectively an energy tax levied on fossil fuels used in combustion engines (so called mobile sources of emissions) or for heating (so called stationary sources of emissions). For more information about the Swedish carbon tax and its effectiveness over time, see Martinsson et al. (2020). For a discussion about the pricing level of emissions and its importance for a smooth transition, see Almenberg et al. (2021).



### 3.2 Funds' potential decarbonization and trading

In this section, keeping emissions constant to their 2019 level, I identify the top polluting stocks in each fund's portfolio and study how funds have been trading in these stocks.

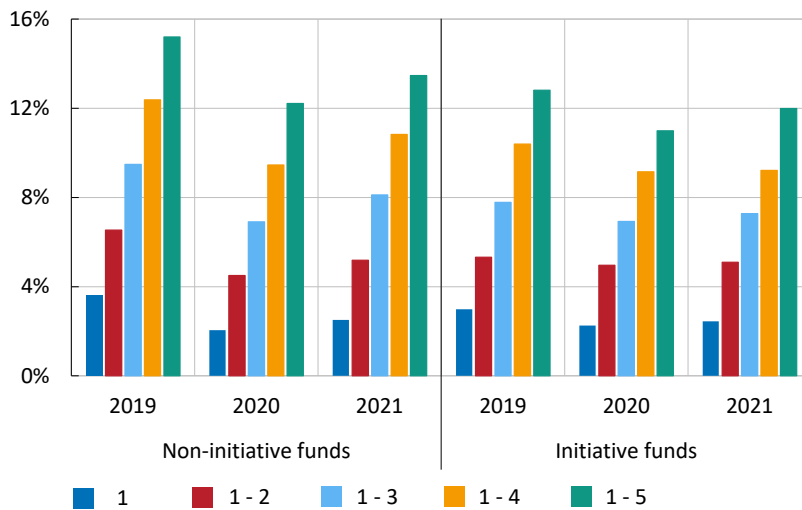
To identify the most polluting stocks in a fund's portfolio and illustrate their contribution to the fund's WACI, I follow Rohleder et al. (2022). In equation 3, for each fund  $j$  in each quarter  $t$ , I identify how much each stock contributes to the fund's WACI and sort all shares from the least to the most contributing ones.

$$\text{Eq.3} \quad \text{WACI Contribution}_{j,i,t} = \frac{\text{Portfolio Weight}_{i,t} * \text{CI}_{i,2019}}{\text{WACI}_{j,t}}$$

Naturally, keeping the portfolio weight of a stock constant, the lower the carbon intensity (CI) of the stock, the lower its contribution to the fund's carbon footprint. Conversely, keeping the CI constant, the larger the portfolio weight of the stock, the larger its contribution is. Figure 2 shows the (average) cumulated portfolio weight of the top five most contributing stocks to a fund's WACI in the initiative and non-initiative fund sub-sets.

**Figure 2. Top five stocks by contribution to WACI**

Cumulated average portfolio weight



Note. Figure 2 shows the cumulated portfolios of the five stocks (1-5) that contribute the most to the average fund's carbon footprint at the end of 2019, 2020 and 2021. Funds are divided between non-initiative funds (on the left of the black line) and initiative funds (on the right of the black line).

Sources: VINN and Sustainalytics.

Figure 2 shows that although the five stocks illustrated weigh heavily on the carbon footprint of the average fund (between 60-70% of a fund's WACI comes from these stocks), their cumulated portfolio weight is quite small with the top polluting one (represented by the blue bars) having, on average, the largest portfolio weight. These five stocks, in 2019, represented collectively about 13% (15%) of the value of the average initiative (non-initiative) fund's portfolio, and, although their weight has slightly

decreased in both sub-samples, in 2021 they still represented, on average, 12% (13%) of the portfolio value.

Focusing on December 2021 (since the portfolio weights on these stocks have not changed much over time), a total of 20 stocks can be classified as top WACI contributors in the 73 funds' portfolios (so few stocks appear to be top WACI contributors in several funds). In December 2019, these stocks emitted on average about 682 tonnes of CO<sub>2</sub>eq per US\$1 million of company revenues, while the average carbon intensity in the sample (a total of 242 stocks in December 2021) was 90 tonnes of CO<sub>2</sub>eq per US\$1 million of company revenues.

In December 2021, the most represented sectors were the industrial sector (which usually includes companies involved with aerospace and defence, industrial machinery, tools, lumber production, construction, waste management, manufactured housing, cement and metal fabrication), the material sector (i.e. commodity-related manufacturing industries) and the real estate sector. More in general, given that the funds all have a large home bias, often the same stock appears to be one of the top five contributors to a fund's WACI in several funds.

To better understand the ability of the fund to potentially influence a firm's investment decision by trading, I look at the total amount of shares (as a percent of share outstanding) that the funds collectively own in the top five WACI contributors (a total of about 72 stocks). In December 2021, the funds in this study owned an average cumulated stake of about 4.5% of the top five WACI contributors' share outstanding (calculated in each firm as the total amount of shares owned by the funds divided by the total number of the firm's shares outstanding).<sup>25</sup>

Since total ownership is quite limited, one may be tempted to assume that even if all of the funds in this study suddenly engaged in a full sell-off of the top polluting stocks in their portfolios this may not have direct repercussions either for the firms themselves or for financial stability. However, as shown in Table 1, the average fund in the sample is quite long-term oriented, therefore, the decision to completely disinvest in a given stock because the firm is not working enough to align itself with the net zero target, could send a powerful signal. Especially considering that the funds above are not the only ones to have a stake in those stocks.

If we take a broader approach and look at the stakes that all of the funds in this study have in each one of the abovementioned top polluters (whether or not the stock is a top five contributor to their own WACI), they own a total of about 10% of the average firm share outstanding in December 2021. Hence, in an environment with limited public information about firms' transition plans, if some funds start to sell, indiscriminately and suddenly, all of the shares they own in very polluting stocks to speed-up the pace of their own transition, this could create a fire-sale like scenario. Such a scenario, in the worst case, could have repercussions for the firms, and even for financial stability since the funds in this study are not the only one that own shares in those firms. These repercussions would be most dramatic if they affected firms and funds

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<sup>25</sup> The number of shares outstanding is available for 69 of the 72 stocks identified as top 5 contributors in Dec 2021.

that are already seriously working on their transition plans. Therefore, again, transparent and verifiable information is the key ingredient for an orderly transition.

To complete the analysis of funds' portfolios, I also look at the stocks that least contribute to the average fund's WACI. Interestingly, a large portion of these appear to be stocks in the financial sector. However, for firms in the financial sector it is particularly difficult to estimate the emissions and this poses a challenge when it comes to analysing their alignment to the net zero target. Therefore, it may be possible that their inclusion in a fund's portfolio does not necessarily contribute to making the fund more aligned with the net zero target. Even in this case then, more data would benefit both investors and policy makers.

To summarize the results so far, Figure 2 clearly shows that funds on average have not decreased their exposures to the most polluting stocks in their portfolios by much. Yet, Table 2 suggests that initiative funds have been more likely to decarbonize their portfolios with respect to non-initiative funds. Therefore, in the next sub-section, I study funds' trading more broadly and try to shed more light on what type of shares funds have been trading and whether this trading is consistent with potentially reducing exposure to highly polluting firms and increasing exposure to less polluting firms.

### 3.3 Funds' trading in polluting stocks

In this section, keeping emissions constant at their 2019 level, I study how funds have been trading stocks over the period 2019-2021 and whether this trading is consistent with actively reducing their exposure to polluting firms. To do so, I assume that funds may not only consider how polluting a stock is in the cross-section of all stocks available to trade (consistent with the idea that investors may rebalance their portfolios away from the most polluting stocks and towards less polluting ones), but they may also consider how much the emissions of the firm issuing the stock contribute to the fund's specific carbon footprint.

To develop this analysis, the dependent variable of interest is based on the total amount of shares owned by a fund in a given stock (as a percent of the total number of shares owned by a fund in all of the shares in its portfolio) because I want to identify changes driven by trading rather than by price changes. Moreover, I also want to isolate trading simply driven by funds passively rebalancing their portfolios from active trading.

Funds could simply passively<sup>26</sup> re-adjust their position in each stock in their portfolios by reinvesting the returns generated by the stock in the stock itself. I identify passive trading, for each fund  $f$  and each stock  $j$  in its portfolio, using the "theoretical" weight

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<sup>26</sup> Funds also buy and sell securities to keep the weight of each stock in the portfolio at the level established by the fund's investment strategy. In order to control for this issue, one should have information on the fund's original investment strategy, and unfortunately, this information is not available to me.

of the stock at time  $t$  assuming that the fund mechanically reinvests the realized returns between  $t-1$  and  $t$  ( $r_{j,t}$ )<sup>27</sup> in the stock itself.

$$\text{Eq.4} \quad w_{f,j,t}^* = w_{f,j,t-1}^*(1+r_{f,j,t})$$

Then, similar to the definition of active change employed by Calvet, Campbell and Sodini (2009), I define Active Trading as the difference between the reported weight of the stock in the fund portfolio at time  $t$  and its theoretical weight calculated using eq.4

$$\text{Eq.5} \quad \text{Active Trading}_{f,j,t}^* = w_{f,j,t} - w_{f,j,t}^*$$

The active trading measure should then capture active changes that do not result mechanically from reinvesting realized returns and thus reflects actual active trading.

The Active Trading variable has an average of -0.18% (median -0.10% and sd 1.20%) over the period 2019-2021. This means that the actual average weight of a stock has been lower than the weight that stock should have had if the fund simply reinvested all the returns from the stock in the stock itself.

To study active trading in stocks with different carbon intensities, I employ the Active Trading variable calculated using equation 5 as the dependent variable in Table 3. In Table 3, I split the sample of stocks based on their emissions intensity ranking.

To identify the quintiles of emissions intensity, I sort all Swedish stocks for which emissions intensity is available in 2019 (a total of 399 stocks for which CI is available) from the least emitting one to the most emitting one (per million US dollars of revenues). The average CI in the first 3 quintiles is about 14 tonnes of CO<sub>2</sub>eq emitted per US\$1 million of company revenues in 2019. The average CI in the first 4 (5) quintiles is about 57 (437) tonnes of CO<sub>2</sub>eq emitted per US\$1 million of company revenues in 2019.

Using the information described above, I define the sub-sets of stocks as follows:

1. *Very High Emitters*: all stocks in the 5<sup>th</sup> quintile of emissions intensity.
2. *High Emitters*: all stocks in the 4<sup>th</sup> quintile of emissions intensity;
3. *Medium Emitters*: all stocks in the 3<sup>th</sup> quintile of emissions intensity;
4. *Lower Emitters*: all stocks in the 2<sup>nd</sup> and 1<sup>st</sup> quintiles of emissions intensity;

In each of the sub-samples above, I then regress the percent of actively traded shares by each fund at time  $t$  (Active Trade) on the following independent variables:

1. A dummy variable that captures whether a fund is an initiative fund or not (*Initiative*).
2. A dummy variable capturing whether the fund has received a low carbon designation or not (Low-carbon).
3. The stock contribution to a fund's WACI in quarter  $t-1$  (*WACIcon*).

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<sup>27</sup> Returns on each stock are actual returns calculated using the price data reported from the funds themselves.

4. And the following interaction variables:
  - a) *Initiative\* WAClcon* to study whether and how, with respect to non-initiative funds, initiative funds factor in the contribution of each stock to their carbon footprint when adjusting the exposure to a stock.
  - b) *Low-carbon\* WAClcon* to study whether and how, with respect to funds that have not received a low carbon designation, funds with a low carbon designation consider the contribution of each stock to their carbon footprint when adjusting the exposure to a stock.
  - c) *Initiative\*Low-carbon* to study the trading of initiative funds (*Initiative ==1*) with a low-carbon label (*Low-carbon==1*).
  - d) *Initiative\*Low-carbon\* WAClcon* to study whether and how initiative funds (*Initiative ==1*) with a low-carbon label (*Low-carbon==1*) factor in the contribution of each stock to their carbon footprint.

I also control for all of the stock characteristics I have variables for: stock size and realized stock return (contemporaneous and in the previous quarter).<sup>28</sup> Regressions also include sector-fixed effects to control for stocks' time-invariant characteristics since firms rarely change industry and quarter-year fixed effects to control for trend. To further address potential valuation effects, I also include sector-quarter-year fixed effects. Finally, I also include controls for some fund characteristics: fund age, (contemporaneous and lagged) net flow and (one quarter) lagged churn ratio and size. All standard errors are robust and clustered at the fund level.

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<sup>28</sup> In unreported analyses I also include a firm's bid-ask spread, Tobin'Q and 180 volatility. However, these variables are mostly not statistically significant and including them does not change the overall results. However, since including these variables reduces the sample size substantially, I exclude them from the main analyses.

**Table 3. Table 3 Funds' Active Trading**

Initiative funds with a low carbon designation

	(1)	(2)	(3)	(4)
	Very High Emitters	High Emitters	Medium Emitters	Lower Emitters
Initiative	0.16** (0.035)	0.22*** (0.000)	0.19** (0.016)	0.10** (0.027)
Low-carbon	0.13** (0.035)	0.21*** (0.000)	0.12 (0.270)	0.11** (0.021)
Initiative#Low-carbon	-0.24** (0.019)	-0.29*** (0.000)	-0.22* (0.052)	-0.17*** (0.007)
WAClcon	-0.00 (0.608)	-0.00 (0.147)	-0.03 (0.263)	-0.06*** (0.003)
Initiative# WAClcon	-0.01** (0.042)	-0.07*** (0.000)	-0.11** (0.024)	-0.32*** (0.000)
Low-carbon# WAClcon	-0.01*** (0.001)	-0.06*** (0.000)	-0.13** (0.011)	-0.32*** (0.000)
Initiative#Low-carbon# WAClcon	0.02** (0.013)	0.09*** (0.000)	0.15** (0.013)	0.45*** (0.000)
Stock Market Cap	-0.01 (0.514)	0.03* (0.074)	0.09*** (0.001)	0.02* (0.067)
Stock Return t	-0.00 (0.144)	0.00 (0.127)	0.00 (0.109)	0.00 (0.495)
Stock Return t-1	-0.02*** (0.001)	-0.02*** (0.000)	-0.02*** (0.000)	-0.02*** (0.000)
Churn Ratio	0.24** (0.035)	0.21*** (0.006)	0.26*** (0.007)	0.15 (0.217)
Fund Flow	-0.00 (0.372)	-0.00 (0.550)	-0.00 (0.164)	-0.00 (0.783)
Fund Flow Lag	0.00 (0.397)	0.00 (0.592)	0.00 (0.768)	0.00 (0.632)
Fund Size Lag	-0.01 (0.424)	-0.02 (0.382)	0.03* (0.066)	0.01 (0.741)
Fund Age Lag	0.05 (0.325)	0.07* (0.060)	-0.01 (0.712)	0.04 (0.366)
Observations	2123	2848	4341	7372
Adjusted R2	0.357	0.336	0.265	0.195

Note: Panel regressions with quarter-year, sector and sector-quarter-year fixed effects. Standard errors are robust and clustered at the fund level. Robust p-values are reported in the parentheses underneath the coefficients and should be interpreted as follows \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Sources: VINN, Bloomberg and Morningstar.

After controlling for stock and fund characteristics, trend and potential valuation effects, Table 3 shows that, over the period 2019-2021, with respect to non-initiative funds, initiative funds have been increasing their holdings of stocks in all categories. The results apply in particular to high emitters. Results are similar for funds with a low carbon designation, even though in this case the coefficient on the dummy variable in column 3 (medium emitters) is not statistically significant. Importantly, while the individual variables have positive and statistically significant coefficients, the interaction

between the initiative dummy and the low-carbon dummy has a negative and statistically significant coefficient. Therefore, initiative funds with a low carbon designation have instead been trading to reduce their exposures across all type of emitters.

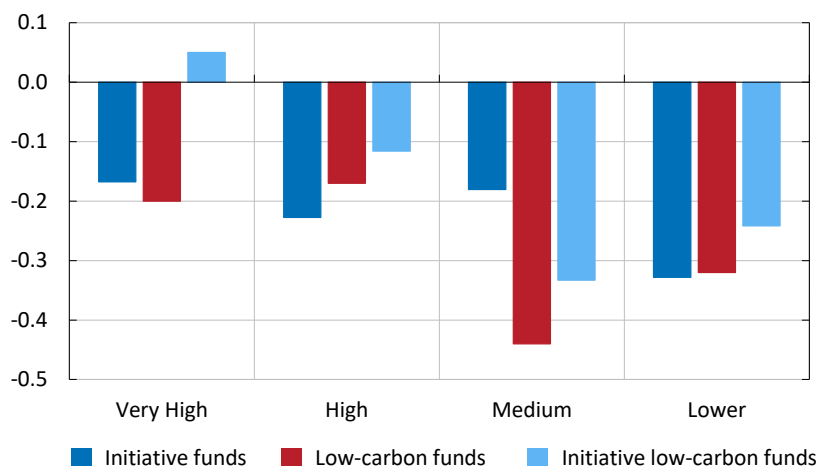
Next, the coefficients of the variable WACI contribution (*WACIcon*) clearly suggest that, with the exception of trading in lower-emitting stocks, how a stock contributes to a fund's WACI in the previous quarter is not associated with its active trading in the subsequent quarter. On the other hand, if we look at the interaction between the initiative (low-carbon) dummy and the *WACIcon* variable, the coefficients are all negative and statistically significant. Hence, on average, the more a stock contributes to its WACI, the less the average initiative (low-carbon) fund increases its holdings of such stock with respect to the average non-initiative (no low-carbon) fund.

Finally, if we look at the triple interaction between the initiative dummy, the low-carbon dummy and the *WACIcon* variable, the coefficient of this variable is positive and statistically significant in all columns and the magnitude of the coefficients increases as we move from very high-emitting stocks to lower-emitting stocks. This suggests that for initiative funds with a low carbon designation in quarter  $t-1$ , how a stock contributes to its carbon footprint matters but in a counter-intuitive way: in quarter  $t$  they buy *more* of the stocks that contributed the most to their carbon footprint in quarter  $t-1$ . This is the case across all types of emitters but especially among the medium and lower ones.

In Figure 3, using the mean and the standard deviation of the variable *WACIcon* in each sub-set of carbon emitters, I report back-of-the-envelope calculations to assess the economic significance of the results in Table 3.

**Figure 3. Economic significance of results in Table 3**

Percentage points



Note. Figure 3 shows the percentage point change in the total amount of shares actively traded by a fund in a stock with a WACI contribution one standard deviation above the average contribution. Figure 3 is built using results in Table 3 for the sub-sets of 1) initiative funds (blue bars), 2) funds with and LCD designation (red bars) and 3) initiative funds with a LCD designation (light blue bars). Stocks are split into sub-samples based on their emissions intensity ranking. Very High Emitters are all stocks that belong to the 5th quintile of emissions intensity. High Emitters are all stocks that belong to the 4th quintile of emissions intensity; Medium Emitters are all stocks that belong to the 3th quintile of emissions intensity; Lower Emitters are all stocks that belong to the 2nd and 1st quintiles of emissions intensity.

Sources: VINN, Bloomberg and Sustanalytics.

Figure 3 shows the percentage point change in the total amount of shares actively traded by a fund in a stock with a WACI contribution one standard deviation above the average contribution. Results are reported for the sub-sets of: initiative funds (blue bars); funds with an LCD designation (red bars); and initiative funds with a LCD designation (light blue bars).

As also shown in Table 3, effects are stronger in the sub-sets of medium and lower emitters. In particular, if we focus on initiative funds with a low carbon designation (the solid bars), these funds consider how the stocks affect their carbon footprint, but especially when they trade in stocks that do not belong to the sub-sample of high emitters. This does not appear to be the case if we look at the average initiative fund or the average low-carbon fund in isolation.

In all other sub-sets, a one standard deviation increase in the average WACI contribution of a stock in quarter  $t-1$  is always associated with the fund further decreasing its exposure to the stock in quarter  $t$ . This result is particularly relevant for trading in the sub-sets of medium- and lower-emitting stocks. For example, if we focus on initiative funds with a low carbon designation, in the sub-set of lower emitters, a one standard deviation increase in the  $WACI_{con}$  (from the average 0.49 to 1.13) is associated with the fund further decreasing its exposure to the stock by 0.16pp (from -0.08 to -0.24, see Figure 3.A in Appendix A for more results). Results are similar for the sub-set of medium emitters.

These results suggest that there is large heterogeneity in the way funds factor in how stocks may contribute to their carbon footprint, and more interestingly, funds tend to



adjust their exposure to stocks issued by firms that are not the most polluting ones to a greater extent. This is consistent with the more general results in Figure 2, which suggest that funds hold on to the most polluting stocks in their portfolios. This may be the case because the funds have information about these firms' transition plans or expect the firms issuing these stocks to work more intensively on their transition plans as these firms are under particular pressure to green their operation. It could also simply be that these stocks are more difficult to replace in a way consistent with the overall funds' investment strategy, which also needs to be integrated in the funds' transition plan.

If we focus on initiative funds with a low-carbon label and look more closely at the firms that belong to the sub-set of very high emitters, those that contributed the most to the funds' WACI in December 2021 are firms that have transition plans in place and firms that work to make their existing production processes or products less polluting and more energy-efficient. However, biotech firms, real estate firms and investment firms are also common and for them is much harder to find public information about potential transition plans.

Overall, it is clear that it is quite difficult to understand whether funds have a strategy in place to align themselves with the net zero target by simply looking at their holdings without collecting more information about the firms themselves. In particular, while I document that initiative funds seem to have started adjusting their portfolios in a way that is consistent with potential decarbonization, it is also clear that they may not engage in straightforward rebalancing away from the most polluting stocks. However, decreasing exposure or completely disinvesting in stocks issued by very emitting firms may not be necessary in order to align the portfolio with net zero. As a matter of fact, on average, the funds in this study are more long-term oriented and tend to hold on to the stocks in their portfolios, including the most polluting ones. Hopefully, when it comes to these latter stocks, the funds hold them not just because of their buy-and-hold type of strategy but because they have better information about the firms issuing them and expect them to be more aligned with the net zero target.

## 4 Discussion

Funds' sustainability reports often suggest their intention to decrease exposure to fossil fuel industries as a way to reduce their carbon footprint. However, if we focus on Swedish mutual funds, entirely excluding certain industries may be meaningful for those that invest internationally, but for those that mostly invest in Swedish stocks, this may be a less than effective strategy.

In fact, only a few firms listed in Sweden produce, transform and sell products derived from coal, crude oil and natural gas (Cella 2021 and internal analyses), although they contribute considerably to the total emissions of scope 1 and scope 2 greenhouse gases (GHG) in Sweden. Moreover, some of the leading firms in these industries, especially those partially owned by the government or municipalities, tend to invest the most to reduce emissions, and this could have important spill-over effects on all of

their competitors too, even the international ones.<sup>29</sup> Therefore, although it may have directly measurable effects, simply excluding entire sectors from an investment strategy may be considered short-sighted for both the funds' clients and the climate. Unfortunately though, when information is scarce, costly and of poor quality, short-term solutions may be appealing.

This is the case because, although firms are more actively working to calculate and report their carbon emissions (ECB, Financial Stability Review, 2022),<sup>30</sup> currently, public disclosure of relevant data (for example, green gas emissions<sup>31</sup> and, more importantly, the value of potentially stranded assets and investment plans to reach emission neutrality) is very limited and often of poor quality.<sup>32</sup> Moreover, this information is not only costly to collect but it is also difficult to communicate to investors, who can only partially verify it or not verify it at all. Finally, since transition plans take time to be executed, returns may take time to be realized. All in all, then, it may be necessary for funds to have a more long-term oriented strategy that focuses less on short-term gains and more on long-term goals.

Importantly, given that the time-line to reach carbon neutrality is set, funds need to promptly scrutinize their investments to be concretely aligning themselves with net zero. This is important because investing in line with the green transition is a risk management tool that allows funds to protect themselves from potential transition risks. Therefore, monitoring whether funds are working in line with their sustainability targets or, in general, are simply preparing for the changes needed given the net zero policies in place, is also important for consumer protection. In this regard, considerable work is being done by the Swedish Financial Authority (FSA) with respect to the problem of "greenwashing", which is the practice of "presenting organizations and products as more sustainable than they are in reality."<sup>33</sup>

This paper is not directly about greenwashing since not all initiative funds market themselves directly as "sustainable or green" by including in their names terms such as "ESG", "sustainable", or "low-carbon". However, some such funds do exist in the sample (about 5% of the funds) and belong to both investment companies that have or have not joined a climate initiative. However, to insure that funds are not recognizable, I do not directly report results for these funds. Nevertheless, understanding how, in general, funds are working to decarbonize their portfolios should help the work currently being done to investigate the phenomenon of greenwashing. This work should also inform the discussion about what type of disclosure should be expected by all funds and funds that market themselves directly as "sustainable or green", in line with the ongoing work at the Swedish FSA.<sup>34</sup>

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<sup>29</sup> See The Economist (2022).

<sup>30</sup> See Emambakhsh et al. (2022).

<sup>31</sup> In 2024 carbon emission will be mandatory for large (listed or non-listed) firms and possibly for listed SME (European Commission, 2021b).

<sup>32</sup> See Jessop et al. (2022), Bolstad et al. (2020), and Fletcher and Oliver (2022).

<sup>33</sup> See Finansinspektionen (2022a).

<sup>34</sup> See Finansinspektionen (2022b).

Finally, in March 2021 the EU's Sustainable Finance Disclosure Regulation (SFDR)<sup>35</sup> was introduced. In a nutshell, under this regulation, funds must be classified according to the sustainability work they carry out. The SFDR has set definition criteria so that funds can be classified in three categories:

1. Products with sustainable investment as their specific objective. Sustainable investments are defined in the SFDR and must follow the principle of "do no significant harm." In addition, investee companies must follow good governance practices. (Article 9).
2. Products that promote environmental and/or social characteristics and only invest in companies that follow good governance practices. (Article 8).
3. Out-of-scope products that do not fall into either of the above categories and are labelled as non-sustainable (Article 6).

In May 2021, the Swedish Investment Funds Association (Fondbolagens förening), which currently represents about 90 per cent of the Swedish market's net fund assets, employing data collected directly from their members, found<sup>36</sup> that 2% of its member funds fell under Article 9 (so called 'dark green' funds), 77% could be classified under Article 8 (these funds are also commonly referred to as 'light green' funds) and 15% fell under Article 6.

The results above suggest that the majority of the Swedish funds that are member of the Swedish Investment Funds Association promote sustainable practices, even though these do not only refer to alignment to the net zero target. Although, this result is not at odds with the results documented in this paper, it is clear that a large number of funds may be doing work that is not easily inferred from their trading activity. Therefore, obtaining more detailed and verifiable information on funds' approach to reaching net zero would certainly be valuable for both the funds' clients and the regulator.

## 5 Conclusions

Despite data constraints and lack of information on firms' (and funds) transition plans, this staff memo is a first attempt to study whether Swedish home-biased active equity funds have been trading in order to reduce their carbon footprint.

By and large, the results in this staff memo suggest that, over the period 2019-2021, Swedish funds belonging to investment management companies that have joined the *Net Zero Asset Managers Initiative* (i.e. initiative funds) have started, at least partially, to green their portfolios by trading in a way that is more likely to reduce their carbon footprint. However, I do not find any clear evidence of asset managers reducing their exposure to the most polluting stocks in their portfolios or rebalancing away from very emitting firms and towards firms that emit less (Bolton and Kacperczyk 2021 and Jondeau, Mojon, and Da Silva 2021).

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<sup>35</sup> See European Union (2019).

<sup>36</sup> See Fondbolagens Förening (2021).

I also document that, on average, the funds in the sample are quite long-term oriented and, individually, have usually small ownership stakes in the most polluting stocks in their portfolios; yet this does mean that they cannot incentivize these firms to speed up their transition. In fact, even if they choose not to exit their investments in these firms, long-term investors can collaborate and directly monitor the firms in their portfolios to encourage them to decrease (or further decrease) their emissions or, more broadly, to make sure that they have a transition plan in place and that they execute it in a timely fashion.

Surely, firms need to become better at measuring their emissions and assessing how transition risks affects their operations. However, the more information becomes accurate and verifiable, the less costly monitoring will become.

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# APPENDIX A. Additional tables and figures

**Table 1.A Funds' WACI**

Multivariate analysis

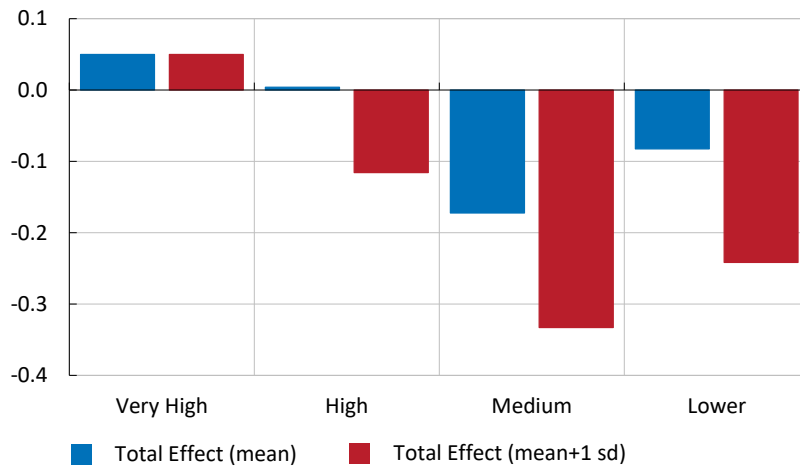
	WACI				
	(1)	(2)	(3)	(4)	(5)
Initiative	-0.13 (0.984)		2.83 (0.619)	8.83 (0.471)	7.20 (0.541)
Low-carbon		-8.42 (0.116)	-8.05 (0.154)	-3.90 (0.513)	-5.16 (0.415)
Initiative#Low-carbon				-13.70 (0.264)	-7.78 (0.509)
Year 2021					2.31 (0.510)
Initiative#Year 2021					4.90 (0.569)
Low-carbon#Year 2021					2.54 (0.659)
Initiative#Low-carbon#Year 2021					-14.48 (0.168)
Fund Flow	0.02* (0.092)	0.02 (0.107)		0.01 (0.159)	0.01 (0.156)
Fund Flow Lag	0.01 (0.156)	0.01 (0.180)		0.01 (0.232)	0.01 (0.230)
Fund Size Lag	0.50 (0.764)	0.39 (0.818)		0.05 (0.974)	-0.03 (0.984)
Fund Age	-1.36 (0.833)	0.33 (0.959)		0.66 (0.911)	0.50 (0.933)
Observations	676	676	806	676	676
Adjusted R <sup>2</sup>	0.017	0.043	0.013	0.063	0.065

Note: Panel regressions with quarter-year fixed effects. Standard errors are robust and clustered at the fund level. Robust p-values are reported in the parentheses underneath the coefficients and should be interpreted as follows \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Sources: VINN and Morningstar.

**Figure 3.A Initiative funds with a low-carbon label only**

Percentage points



Note. Figure 3.A shows the percentage point change in the total amount of shares actively traded by a fund in a stock with an average WACI contribution and a WACI contribution one standard deviation above the average contribution for the sub-set of initiative funds with a LCD designation. The blue bars represent the effect calculated for a stock with an average WACI contribution, while the red bars represent the effect for a stock with an average WACI contribution plus one standard deviation. Stocks are split into sub-samples based on their emissions intensity ranking. Very High Emitters are all stocks that belong to the 5th quintile of emissions intensity. High Emitters are all stocks that belong to the 4th quintile of emissions intensity; Medium Emitters are all stocks that belong to the 3rd quintile of emissions intensity; Lower Emitters are all stocks that belong to the 2nd and 1st quintiles of emissions intensity.

Sources: VINN, Bloomberg and Sustainalytics.

## APPENDIX B. The Swedish net zero strategy

Global warming of more than 2°C above pre-industrial levels will have considerable consequences for ecosystems, economies and financial systems (e.g. Giglio et al. 2020 and BIS 2021).<sup>37</sup> According to the IPCC's report in 2018, warming is already been in the range between 0.8°C and 1.2°C above pre-industrial levels and, at the current rate, warming of 1.5°C will be reached between 2030 and 2052 (IPCC 2018).

Although there has been considerable academic and policy focus on the issue, the problem of climate change is particularly difficult to tackle since addressing it requires effective, timely and globally coordinated policies aimed at limiting carbon dioxide (CO<sub>2</sub>) equivalent (in total levels) emissions. In 2015, by signing the Paris Agreement and the United Nations 2030 Agenda for Sustainable Development, many countries joined forces to prevent temperatures from rising more than 2°C above pre-industrial levels and move towards a fully decarbonized economy. Although slowing down climate change requires concrete policies implemented in a timely fashion, such policies are, unfortunately, still in short supply despite the fact that many countries have committed themselves to net zero.<sup>38 39</sup> Worryingly, the latest IPCC report from April 2022 assessed that limiting warming to around 1.5°C requires global greenhouse gas emissions to be reduced by a staggering 43% by 2030 (IPCC 2022).

Policy makers in Sweden have been very aware of the damage climate change can cause. As early as 1991, Sweden introduced a carbon tax<sup>40</sup> and has been very determined to reduce greenhouse gas emissions.

With respect to emissions in 1990, Sweden expects to reach climate neutrality and at least a 85% reduction in total domestic greenhouse gas (GHG) emissions by 2045. To offset the remaining 15%, Sweden plans supplementary measures such as increased carbon sequestration in forest and land, carbon capture and storage technologies (CCS) and emission reduction efforts outside of Sweden. By 2030, the government expects emissions from domestic transport (excluding domestic aviation) to be, at least, 70% lower compared to the sectors' emissions in 2010. By 2040, emissions in Sweden in sectors covered by the EU Effort Sharing Regulation (road transport, heating of buildings, agriculture, small industrial installations and waste management)<sup>41</sup> should be at least 75% lower than in 1990.<sup>42</sup>

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<sup>37</sup> Giglio et al. 2020 provides a review of the literature on the interactions between climate change and financial markets. The report from BIS (BIS 2021) reviews the effects of climate-related risk drivers on banks and the banking system.

<sup>38</sup> See Worland (2021)

<sup>39</sup> See Climate Action Tracker (2021)

<sup>40</sup> A carbon tax is effectively an energy tax levied on fossil fuels used in combustion engines (so called mobile sources of emissions) or for heating (so called stationary sources of emissions). See Martinsson et al. (2020) for more details.

<sup>41</sup> European Commission (2021c)

<sup>42</sup> For more details, see UNFCCC (2020) and Naturvårdsverket (2020).

Sweden's climate goals are ambitious but they are achievable.<sup>43</sup> To help the transition, large investments in green technologies have been deployed.<sup>44</sup> The issuance of financial instruments to invest specifically in projects to help the transition to a green economy (so-called 'green bonds') is steadily picking up (Ferlin and Sternbeck Fryxell 2020), and both institutional investors and retail investors have become more engaged in climate-risk-related questions.<sup>45</sup> The Swedish Financial Supervisory Authority (Finansinspektionen) is also working to ensure that the financial system contributes to sustainable development.<sup>46</sup>

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<sup>43</sup> See Government Offices of Sweden (2021) and European Parliament (2021)

<sup>44</sup> For example, some of the largest Swedish firms are investing in producing fossil-free steel. See Reuters (2021) and Carpenter (2020).

<sup>45</sup> For example, Alecta (2020), one of the largest Swedish pension funds, in the spring 2020 published its first climate report in accordance with the principles of the Task Force on Climate-related Financial Disclosure (TCFD).

<sup>46</sup> See Finansinspektionen (n.d.)



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