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* Views expressed are those of the authors and do not necessarily reflect official positions of De Nederlandsche Bank.

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Abstract

We investigate the extent to which investors exhibit carbon home bias: disproportionate investment in carbon-intensive firms from the home market. We utilize a comprehensive stock-level holdings dataset of European investors to understand the relationship between carbon home bias, divestment and disclosure. We show that investors exhibit significant carbon home bias, with about half of their carbon emissions stemming from their domestic portfolios. Over our sample period 2013-2022, European investors have decarbonized their portfolios, but predominantly through their foreign portfolios. Domestic carbon exposures have persisted. Differences-in-differences analyses show that a shock inducing institutional investors to decarbonize is associated with higher ownership of domestic carbon-intensive stocks. Consistent with engagement, higher domestic ownership of carbon-intensive stocks is associated with lower carbon emissions and a higher likelihood of carbon disclosure. Our results show that carbon home bias is not driven by differential home-foreign carbon risk premia, but instead suggest investors' successful engagement at home while divesting abroad.

JEL Classification: G11, G15, G23, H55, Q54, Q56.

Keywords: home bias, carbon footprint, divestment, engagement, securities holdings statistics.

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1 Introduction

Carbon risk management has become increasingly important for investors worldwide. The European Union has been implementing measures to decrease carbon dioxide emissions in accordance with the Paris Agreement ratified in December 2015. With the introduction of the European Green Deal in December 2019, intra-EU policies targeting climate change will be further strengthened, prompting investors to measure and manage their carbon exposures.

To reduce exposure to climate risks, investors could either divest from firms with high climate risk exposure or actively engage with firms to demand that they lower their carbon emissions. However, practical implementation of these decarbonization strategies is complicated by persistent investor biases towards certain industries and markets, most notably home bias. Our first objective is to document the disproportionate investment in carbon-intensive firms within domestic markets, resulting in what we refer to as "carbon home bias."

Our second objective is to better understand why we might observe carbon home bias. A first reason for having larger holdings in carbon-intensive domestic firms could be that it makes active engagement more effective.[1] Because engagement is costly, investors might restrict themselves to a limited set of domestic firms, consistent with investors being more likely to engage with domestic targets (Dimson et al., 2021) and firms in greater proximity to socially responsible investment funds displaying larger reductions in carbon emissions (Dasgupta et al., 2023). A second reason why we might observe carbon home bias is that investors invest in dirty domestic firms to earn a domestic carbon risk premium (Bolton and Kacperczyk, 2022). This domestic carbon premium may exceed

[1]The Dutch pension fund ABP, one of the biggest institutional investors in the world, actively engaged with oil firms for years, and most notably held large positions in Royal Dutch Shell with the argument that engaging with Shell would ultimately be better than divesting the stock. By 2022, after Shell PLC moved its headquarter from the Netherlands to the United Kingdom, ABP announced their engagement strategy was not successful and fully divested from Shell and fossil fuel firms by early 2023. By constrast, Azar et al. (2021) show that the largest three asset managers in the world - BlackRock, Vanguard, and State Street Global Advisors - pursue engagement with firms to lower their carbon emissions.

the carbon premium of foreign portfolios, possibly due to an informational advantage concerning dirty industries that is country- or industry-specific (Van Nieuwerburgh and Veldkamp, 2009; Choi et al., 2017; Jagannathan et al., 2017; Schumacher, 2017).

To accomplish our objectives, we use a confidential security-by-security holdings dataset prepared by the ECB, which covers worldwide investment positions in individual stocks held by different euro area investors. We first document the extent to which portfolio carbon emissions are concentrated in domestic stocks. We find evidence for substantial carbon home bias with on average, domestic stocks accounting for around 50% of investors' total portfolio carbon footprint. Regression analyses confirm that portfolio carbon footprint is significantly positively related to portfolio home bias. Over time, euro area investors appear to decarbonize their portfolios but mainly through their foreign stock holdings.

Concerning our second objective to better understand the drivers of carbon home bias, we test the hypothesis that for decarbonization a divestment strategy is more attractive for foreign stocks, whereas engagement is more appealing for domestic stocks. If so, we expect that investors willing to decarbonize their portfolio would divest from foreign carbon-intensive firms and either keep constant or increase their investments in domestic carbon-intensive firms to gain more influence. To test these assertions we require a plausibly exogenous shock to investors' propensity to decarbonize. We exploit the effects of the French carbon disclosure Article 173, which mandates French institutional investors to measure and publicly disclose the portfolio carbon footprint. Consistent with our hypothesis, we show that the enactment of Article 173 leads to significantly lower French institutional ownership of carbon-intensive foreign stocks, but higher institutional ownership of carbon-intensive domestic stocks.

Arguably, there could be multiple reasons for French institutional investors to increase their ownership of domestic carbon-intensive stocks after Article 173. To further test the active engagement channel, we test whether French firms, with ex ante high

French institutional ownership, more strongly reduce carbon emissions and enhance climate mitigation measures by carbon disclosure ex post. Our results suggest domestic active engagement is successful: French firms with ex ante high French institutional ownership subsequently reduce their carbon emissions faster than other firms abroad. They are also more likely to subsequently report carbon emissions, but only when ownership is sufficiently large. These results are unlikely due to selection effects, i.e. French institutional investors divesting from carbon-intensive domestic firms, because in our analyses with carbon (disclosure) as dependent variable we use pre-Article 173 French institutional holdings as independent variable, and our holdings analyses show that ex post French institutional holdings tilt towards more carbon-intensive domestic firms.

Finally, we test whether differences between foreign and domestic carbon premia might explain our results. We analyze whether carbon-intensive stocks in the euro area earn excess returns and we test whether European investors earn a carbon premium on their home and foreign stock portfolios, but we find no evidence of either. If anything, only foreign investments carry a small positive carbon premium. So combined, our evidence is consistent with an engagement interpretation: Institutional ownership increases the incentives for firms to report and reduce emissions. By divesting from foreign carbon-intensive firms, investors fail to capture part of the (significantly positive) foreign carbon premium, so our results are inconsistent with a return-based explanation.

Our study contributes to climate finance literature that shows investors are actively divesting from high-emission firms, but with considerable heterogeneity in the extent of portfolio decarbonization. Investors that decarbonize most are pension funds that are PRI signatories (Boermans and Galema, 2019), institutional investors that are CDP signatories (Atta-Darkua et al., 2023), and low-carbon mutual funds (Ceccarelli et al., 2023). Our results show evidence for heterogeneity of decarbonization with most carbon divestment taking place through foreign holdings and active ownership helping to decarbonize domestic holdings.

Our work also relates to the active engagement literature, which studies engagement by institutional investors (e.g. McCahery et al., 2016; Dyck et al., 2019; Krueger et al., 2020; Lewellen and Lewellen, 2022) and engagement and risk mitigation (e.g. Gillan et al., 2021; Hoepner et al., 2022). The type of shareholder appears to matter: Flammer et al. (2021) show that activism by long-term institutional investors is associated with greater disclosure of climate change risks. Ilhan et al. (2023) show climate-conscious institutional ownership to be associated with a higher likelihood of disclosure. We show that also the domestic-foreign dimension matters for decarbonization, with engagement being more likely (Dimson et al., 2021) and more successful (Dasgupta et al., 2023) when domestic institutional ownership is high.

Several papers have analyzed the impact of the French Article 173. Mésonnier and Nguyen (2021) show that French institutional investors subject to Article 173 reduced their financing of fossil energy companies. Ilhan et al. (2023) show that French Article 173 increased the disclosure rate of firms with relatively high French institutional ownership. Whereas Mésonnier and Nguyen (2021) focus on fossil energy companies, we consider investor's full portfolio holdings of all worldwide stocks including both green and brown firms. Whereas Ilhan et al. (2023) focus on the effect of Article 173 on disclosure, we are interested in the differential impact of Article 173 on ownership of domestic versus foreign carbon-intensive firms and the associated carbon footprints of investors.

Our paper is also related to the literature that studies the emergence of a carbon premium. Stocks with higher carbon emissions earn higher stocks returns both in the US (Bolton and Kacperczyk, 2021) and internationally (Bolton and Kacperczyk, 2022; Hsu et al., 2023), although the carbon premium in the divestment literature is still debated (see e.g. Andersson et al., 2016; Fernando et al., 2017; Trinks et al., 2018). Our evidence is consistent with a global carbon premium as in Bolton and Kacperczyk (2022), but we fail to find evidence of a carbon premium associated with the portfolios of euro area investors in our sample.

Finally, our paper is also relevant to the broader literature on home bias (Tesar and Werner, 1995; Cooper et al., 2013) which is strong among European investors (De Santis and Gérard, 2009; Coeurdacier and Rey, 2013), by showing that home bias combined with tilting carbon-intensive domestic stocks is associated with carbon home bias.

This paper proceeds as follows. Section 2 presents the data and the measurement of some of our main variables. Section 3 presents the results and finally Section 4 concludes.

2 Data and measurement

2.1 Data

We use a confidential security-by-security holdings dataset prepared by the ECB. It covers all investment positions in individual stocks worldwide across euro area investors. Positions are recorded on a quarterly basis at market value over the period 2013Q4-2021Q4. The portfolio holdings are aggregated at the investor sector, investor country level. The initial sample has 6,534,195 observations covering 48,295 unique stocks. By end-2021 total stock investments are 3.426 trillion euro.[2]

In our analysis we focus on the ten largest investor countries which ensures that the domestic stock markets present a large number of stocks available for investment and are sufficiently diversified, thus allowing for sufficient variation in firm-level carbon intensity in the home markets. The holder areas included are Austria, Belgium, Finland, France, Germany, Greece, Italy, the Netherlands, Portugal and Spain. We group the data by distinguishing the following investor sectors: banks, investment funds, insurance companies, pension funds, other financial intermediaries, governments, non-financial firms and households. For some analyses, including the differences-in-differences analyses, we fo-

[2]This unique dataset is referred to as the Securities Holdings Statistics Sectoral (SHS-S). National central banks from the euro area collect granular holdings data mostly from direct reports and based on harmonized reporting principles. The securities holdings statistics have been collected since the start of 2014 under a mandatory reporting framework: Regulation (EU) No 1011/2012 (ECB/2012/24). Boermans et al. (2022) shows that this dataset is widely used in economics and increasingly so in the field of sustainable finance.

cus on institutional investors defined as investment funds, insurance companies, pension funds and other financial intermediaries. Non-institutional investors include households, governments, non-financial firms and banks.

We match the stock holdings with firm-level data of 11,901 firms from Refinitiv when all relevant variables are available. Our main variable of interest relates to carbon emissions of firms. Refinitiv provides yearly carbon emission levels which are in line with Greenhouse Gas Protocol, Kyoto Protocol or EU Trading Scheme. This carbon data includes direct and indirect equivalents of emissions: Scope 1 and Scope 2.[3] We control for standard firm-level characteristics, similar to Bolton and Kacperczyk (2021) and Bolton and Kacperczyk (2022). We obtain two digit NACE industry classifications from the ECB Centralised Securities Database (CSDB) and distinguish between 15 different industry categories k. Appendix Table A.1 provides details on all variables used in this study. After merging this gives 3,776,406 investor-time observations in the final sample. The total holdings at the end of the sample period (2021-Q4) are 3.1 trillion euro which cover 90.4 percent of the holdings in the initial sample.[4]

2.2 Measurement

Carbon footprint. We measure the carbon footprint associated with the stock portfolio of each investor i, where an investor is the unique combination of a holder area and a holder sector. In our main analyses we divide the CO_2 emissions of the firm by sales to obtain the relative carbon intensity of a firm in terms of pollution in tonnes per unit

[3]We included both self-reported and estimated carbon emissions. In addition, we winsorized outliers at one percent on the upper tail and ipolated yearly data back and forward up to one year. See Bajic et al. (2021) and Markwat and Swinkels (2023) for challenges with carbon data. Ours were retrieved on 20 October 2022.

[4]The most restrictive factor matching the holdings data with our other variables is carbon data. In addition, we perform several cleaning steps to reach our final sample. We drop holdings in major financial centers and offshore destinations. We exclude penny stocks, positions in individual stocks of less than EUR 1000, direct investment positions where the investor holds more than ten percent of the firm, and investor sectors at country level with fewer than EUR 50 million invested in stocks at a given period. Except for households, we exclude third-party holdings reporting for holder sectors by custodians across countries because of possible custodian bias which would create double counting.

of output. We then calculate a portfolio value-weighted average of the output-adjusted CO_2 emissions to reflect the size of the stock positions of each investor. Specifically, the carbon footprint, $CFP_{i,t}$, of each investor i equals the portfolio-weighted average of the ratio of CO_2 emissions in tonnes to sales at time t. Summation over all the stocks held in the portfolio by investment positions gives the investor's carbon footprint, $CFP_{i,t}$, in line with Andersson et al. (2016) and Boermans and Galema (2019) as follows:

$$CFP_{i,t} = \sum_{j=1}^{n} w_{i,j,t} \times x_{j,t}$$

where $w_{i,j,t}$ indicates the quarterly adjusted portfolio weight of a value-weighted portfolio for n firms and $x_{j,t}$ is defined as carbon emissions divided by sales. So $CFP_{i,t}$ captures the weighted average of how many units of CO_2 are emitted per unit of sales for each euro invested in stocks by investor i at time t. In robustness checks we define x_{jt} as carbon emissions not scaled by sales in line with Bolton and Kacperczyk (2021) and Bolton and Kacperczyk (2022) and refer to this measure as $Carbon_{i,t}$.

Home bias. We calculate home bias as the differential between the home weight, the portfolio weight of an investor in its home country, and the home country market capitalization weight in the global market portfolio. The global market portfolio is calculated based on the stocks included in our sample. So home bias is defined as:

$$Home\ bias_{i,t} = \frac{TNA_{i,t}^{home}}{TNA_{i,t}} - \frac{MV_{i,t}^{home}}{MV_t}$$

where for investor i at time t, $TNA_{i,t}^{home}$ indicates the total portfolio value of stock investments in the home country and $TNA_{i,t}$ indicates total portfolio value, both in euros. For our universe of stocks, $MV_{i,t}^{home}$ indicates the total market value of home stocks, associated with the home country of investor i, and MV_t indicates the value of all stocks in the global market portfolio, both in euros. A positive (negative) home bias shows that an investor is overweighted (underweighted) in the home market portfolio compared to the global market portfolio.[5]

3 Results

In this results section we first present some descriptives in Section 3.1 on home bias of euro area investors and the carbon footprints of their portfolios. Next we more formally analyze the relationship between portfolio carbon footprint and home bias of investors at both the portfolio level (Section 3.2) and the stock level (Section 3.3). Using the French carbon disclosure Article 173 we test whether this shock has had a differential impact on the ownership of carbon-intensive assets from the home country in Section 3.4. In Section 3.5 we test whether institutional ownership in the home country affects carbon emissions and the likelihood of carbon reporting. Finally, we assess whether there are differences in carbon premia between euro area investors' domestic and foreign stock holdings in Section 3.6.

3.1 Descriptives

In Figure 1 we average over investors (i.e. holder areas and holder sectors) to present a bar graph with the average carbon footprint per quarter (left-hand y-axis) and two line graphs (right-hand y-axis) with average home bias and the average percentage of the portfolio carbon footprint coming from the home market. In the beginning of the sample period the average carbon footprint fluctuates between 250 and 300, but as of 2019 the average CFP declines towards 150. European investors display considerable carbon home bias with 45 to 50% of the portfolio carbon footprint emanating from home market stocks. This carbon home bias is also consistently higher than home bias and

[5] There is a wide range of home bias measures in the literature, see e.g. Cooper et al. (2013) for an overview. We argue that our measure is most suitable because we do not have extreme cases where the domestic market has a very large or very small share of the value of all stocks in the global market portfolio. In addition, in all countries considered, the fraction of the total portfolio value of stock investments in the home country dominates the share of the domestic stocks value in the global market portfolio.

correlated over time with both showing a declining trend.

[*Insert Figure 1—"Carbon footprint and (carbon) home bias"*]

Investors could actively reduce their carbon home bias by tilting their domestic portfolio towards cleaner firms and away from dirtier firms. To analyze the extent to which this occurs, we derive the 25% cleanest stocks and the 25% dirties stocks based on a quartile split of their carbon intensities, where we first average carbon intensities over time to isolate the tilting effect from firms changing their carbon emissions over time. Next we calculate aggregate weights of holder countries and holder sectors in four subportfolios: *Home clean*, *Home dirty*, *Foreign clean* and *Foreign dirty*. Finally, we take the average of these portfolio weights in each quarter to plot the graphs in Figure 2.

Figure 2 shows that European investors are decarbonizing both their foreign and their domestic portfolios, but for the foreign portfolio this is much more pronounced. There is a substantial rise in *Foreign clean* and a considerable decline in *Foreign dirty*. Also *Home clean* increases somewhat, but *Home dirty* stays fairly constant over time (around 10%) for a large part of the sample, suggesting that carbon home bias is fairly persistent over time. So European investors are mostly decarbonizing by shifting their portfolios away from dirty foreign firms and towards cleaner foreign (and to some extent) domestic firms, with their portfolio weight in dirty domestic firms only declining very marginally.

[*Insert Figure 2—"Carbon Footprint at home and abroad"*]

Next we present some summary statistics to gauge the variation in (carbon) home bias in the cross-section of holder countries. Table 1 presents descriptives split according to holder areas, based on the portfolio regression sample of which summary statistics can be found in Panel A of Table 2. Table 1 Panel A describes the extent of home bias in our regression sample, where we average each variable for holder countries over the different holder sectors and time periods. *% In world market* indicates the share the different holder areas' domestic stock market capitalizations contribute to the total world market. Because the investor countries in our sample are relatively small, apart from France (4%) and Germany (4%), these shares are quite small for most countries. The column 'ALL' shows the combined aggregation over the ten countries (instead of the average) and shows that they comprise about 11% of the global market portfolio. *% Invested at home* indicates the average percentage of the portfolio of investor sectors that is invested in the domestic stock market. On average, domestic stocks comprise 46% of the total investments in stocks in our sample, but this significantly varies across holder areas: Greece (GR) has the highest percentage invested at home (81%) and the Netherlands (NL) the lowest (20%). Note that these are averages, but the difference between *% Invested at home* and *% In world market* is representative of how our home bias measure is calculated each quarter at the holder sector by holder area level, and therefore illustrates considerable home bias in the euro area.

[*Insert Table 1—"Portfolio carbon footprint and home bias: Descriptives"*]

Panel B provides several summary statistics to ascertain the extent to which carbon home bias fluctuates across holder areas. *% Carbon in world* is calculated as carbon emissions associated with a holder country as a percentage of worldwide carbon emissions. Like with *% In world market* in Panel A, most countries stock market carbon emissions are only a small percentage of carbon emissions in world markets. Next, *% Carbon home* and *% CFP home* are computed as the portfolio-weighted averages of absolute carbon emissions and carbon emissions weighted by sales, respectively. In most countries these portfolio measures of carbon home bias are fairly close to each other and both show sizeable variation across holder countries. Comparing Panel B with Panel A shows that countries with relatively high (low) home bias also tend to have relatively high (low) carbon home bias.

Panel C presents the average total carbon footprint and displays different subcomponents that add up to *Portfolio CFP total*. Carbon footprint vary substantially across holder areas, ranging from 158 in Belgium to 735 in Greece. We split up total carbon footprint in a part that represents stocks from the domestic market (*Portfolio CFP home*) and a part that represents stocks from abroad (*Portfolio CFP foreign*).[6] Although on average (Column *ALL*) domestic carbon footprint is larger than foreign carbon footprint, there is quite some variation across countries: For countries with relatively large home bias (e.g. Greece, Finland and Portugal) total carbon footprint is mostly domestic carbon footprint, whereas in holder areas with less home bias (e.g. the Netherlands and Belgium) it is mostly foreign carbon footprint. Combined these summary statistics indicate a substantial carbon home bias, that appears to be related to home bias.

[*Insert Table 2—"Summary statistics"*]

3.2 Portfolio carbon footprint analyses

Next we provide additional evidence for carbon home bias by analyzing the relationship between home bias and investors' portfolio carbon footprints. Specifically, we relate the carbon footprint (CFP) of investor i's stock portfolio at time t, where investor i is defined as a unique holder sector by holder area combination, by estimating:

$$\log(CFP)_{i,t} = \beta_0 + \beta_1 Home\ bias_{i,t} + \beta_k' Controls_{i,t} + \epsilon_{i,t} \quad (1)$$

where *Home bias* indicates the fraction investor i invests at home compared to the market value of the home portfolio as a fraction of the world portfolio. We include investor (i.e. holder area × holder sector) fixed effects and time fixed effects in all specifications, as

[6] Note that in $\%CFPhome$ is not exactly *Portfolio CFP home* divided by *Portfolio CFP total*, because in Panel B we first compute this ratio, before we average across holder sectors and quarters.

well as several control variables indicated with $Controls_{i,t}$. Standard errors are clustered at the investor level throughout.

Possibly, home bias might capture some form of industry bias (both at home and abroad) because Schumacher (2017) finds evidence that investors specialize at home and abroad in similar industries. Also, because carbon emissions are largely driven by industry, we control for *Industry bias global*, which is calculated following Choi et al. (2017). We include *Active share* (Cremers and Petajisto, 2009) to control for the fact that investors in holder areas with more carbon-intensive stocks markets might choose to deviate from the market portfolio to hedge climate risks (Andersson et al., 2016). We include a set of standard firm controls (Bolton and Kacperczyk, 2021, 2022), including B/M, ROE, $Invest/A$, $Leverage$ and $Log(PPE)$ of which we take a value-weighted portfolio average. Except for the natural logarithm of PPE, all firm controls are winsorized at 2.5% before taking their portfolio-weighted average. We include the natural logarithm of total holdings in euros ($\log(Holdings)$) to control for investor size.

We include the natural logarithm of *CFP home benchmark* and *CFP world benchmark*, which are value-weighted benchmarks computed analogously to $\log(CFP)$. We expect their main effects to be largely subsumed by the included fixed effects, but we also interact these variables with home bias to test whether the effect of home bias on CFP is driven by home markets being either cleaner or dirtier than world markets. Definitions of all variables are provided in Appendix Table A.1

Table 3 presents the results. In Column (1) we include only home bias, which is significantly positively correlated with $\log(CFP)$: an increase in home bias of 10 percentage points is associated with a 6.7% increase in CFP. Because we include holder area $\times$ holder sector fixed effects, this is a within investor effect, across time. In Column (2) we further control for *Industry bias*, *Active share* and a set of firm controls. Industry bias is negatively related to portfolio CFP, which suggests that given home bias, if investors have a bias towards certain industries, it is towards less carbon-intensive ones. Active share is insignificant. Consistent with firm-level evidence (Bolton and Kacperczyk, 2022), from the positive signs on log(PPE) it is mostly portfolios that have more capital intensive firms that have higher CFP. Note that in both specifications in Columns (1) and (2) the main effect of home bias on CFP is positive and significant at 1%.

[*Insert Table 3—"Home bias and portfolio CFP"*]

Next, in Table 3 Columns (3) to (4) we test to what extent the main effect of home bias is driven by holder areas with relatively carbon-intensive stock markets. In principle, investors that are home-biased could still choose to divest from carbon-intensive firms even if their home stock market is relatively carbon intensive. Therefore, in Column (3) we include *log(CFP home benchmark)* and *log(CFP world benchmark)* which are the $CFPs$ calculated for the domestic market portfolios and global market portfolio, respectively. Controlling for these carbon intensity benchmarks does not change the positive association between home bias and CFP. In Column (4) we interact home bias with CFP of the home benchmark. This interaction is positive and significant, whereas the main effect of home bias becomes negative and insignificant. This confirms our findings from Table 1 that investors' CFP closely follows benchmark CFP, which implies that holder areas with higher home bias will have higher portfolio CFP conditional on the carbon intensity at home. In Column (5) we further control with the interaction between home bias and its interaction with CFP of the global market portfolio to control for the effect being driven by variation in (global) CFP over time. Results show that the interaction between home bias and log*(CFP home benchmark)* remains positive and significant and the main effect of home bias remains insignificant. This suggests that the effect of home bias is driven by variation in carbon intensity across domestic stock markets.

As a robustness check we take the portfolio-weighted average of $Carbon$ as a dependent variable (instead of $Carbon/Sales$). We control for size by including the natural logarithm of *Sales* as a control variable. Results are reported in Appendix Table B.1 and are qualitatively very similar to the results presented in Table 3. This suggests that both absolute carbon-emissions and carbon intensity are positively related to home bias.

3.3 Stock ownership analyses

The previous results suggest carbon-intensive stocks are held more by investors when they are from their home country. Next, we test this using the richness of the full sample by considering as dependent variable the (natural logarithm of) total investor's (euro) ownership in a stock over time. We construct a stock-investor panel data set, to test at the stock level to what extent stocks with similar carbon emission levels and observable characteristics have different ownership. Our standard specification is:

$$\begin{aligned}\log(Own)_{i,s,t} = \beta_0 &+ \beta_1 Home\ dummy_{s,t} + \beta_2 \log(Carbon/sales)_{s,t} \\ &+ \beta_3 Home\ dummy_{s,t} \times \log(Carbon/sales)_{s,t} \\ &+ \beta_k' Controls_{s,t} + \epsilon_{i,s,t}\end{aligned} \tag{2}$$

where the dependent variable $\log(Own)_{i,s,t}$ is defined as the aggregate euro ownership of investor i in stock s at time t and investor i is the combination of holder area and holder sector. *Home dummy* is an indicator variable equal to one when the country of investor i is equal to the statutory country associated with stock s and zero otherwise. Control variables are similar to those commonly used in ownership studies (Hong and Kacperczyk, 2009; Bolton and Kacperczyk, 2021, 2022) and include $\log(MV)$, *log(Firm size)*, *Inverse of price*, *Momentum*, B/M, *Beta*, $Volatility$ and $Volume$. All variables are described in Appendix Table A.1. All specifications include holder area fixed effects, holder sector fixed effects and industry-time fixed effects. Standard errors are clustered at the investor-stock level.

[*Insert Table 4—"Stock ownership and carbon home bias"*]

Table 4 presents the results. Column (1) only includes main effects, controls and fixed effects. As expected, the dummy indicating whether a stock's country equals the investor country (*Home dummy*) is positive and significant as well as large: home stocks have on average home ownership that is more than three times higher than stocks that are not from the home market. Interestingly, consistent with previous literature (Bolton and Kacperczyk, 2022), carbon intensity ($\log(Carbon/sales)$) is negatively associated with ownership. The effect size is small: a ten percent increase in ($\log(Carbon/sales)$) is only associated with a 0.5 percentage decrease in ownership.

In Table 4 Column (2) we add the interaction of *Home dummy* and $\log(Carbon/sales)$. This interaction is positive and significant: when a stock is from the home market a ten percentage increase in $Carbon/sales$ is associated with a 0.4 percentage increase in ownership. The main effect of $\log(Carbon/sales)$ remains negative and statistically significant. For stocks not from the home market a ten percentage increase in $Carbon/sales$ is associated with a 0.5 percentage decrease in ownership. Possibly our effect could be partially driven by variation in firm revenue, so in Column (3) we add $\log(Carbon)$ instead of $Carbon/sales$ and control for $\log(Sales)$. Here we find that the effect of absolute carbon is also negative and similar in size to the effect of $Carbon/sales$. In Column (4) we add the interactions between $Home$ and $\log(Sales)$ and $Home$ and $log(Carbon)$, which are similar to the results reported in Column (2): carbon emissions are positively related to ownership of domestic stocks, while they are negatively related to ownership of foreign stocks.

As an alternative measure of carbon risk, we define a dummy variable equal to one when a stock belongs to one of the top-3 industries with the highest Scope 1 and 2 emissions and zero otherwise: Mining and Quarrying, Petrochemical manufacturing, and Electricity, gas, steam (see Mésonnier and Nguyen, 2021; Alessi and Battiston, 2022, for similar approaches). While such proxy does not allow for much firm-level variation, one major benefit of using NACE-2 classifications is that we can apply this measure to the full portfolio holdings data, doubling the number of observations and more than tripling the number of firms from around 10,000 to around 38,000.

In Table 4 Columns (5) and (6), instead of carbon intensity we introduce this variable, *Dirty industry dummy* and interact it with *Home stock dummy*. Note that the main effect of the *Dirty industry dummy* is subsumed by the Industry × time fixed effects. Consistent with our results on carbon and carbon intensity, the interaction effect is positive and significant at the 1% level: Stock ownership in dirty industries is about 40 percent higher for domestic stocks than for foreign stocks, both when applying a broader sample in Column (5) and a similar sample as for our carbon analysis in Column (6) that includes a full set of firm controls. So ownership bias towards dirty industries in the home market is substantial.

Finally, in Table 4 Columns (7) and (8) we consider a sample split of institutional owners (*IO*, Column 7) and all other investors (*non-IO*, Column 8). Arguably, institutional investors could be more sophisticated and therefore less prone to biases. On the other hand, institutional investors engage most in active ownership, which might be more attractive for domestic stocks. The coefficients on the interaction between *Home stock dummy* and *Carbon/sales* are both positive and very similar in size, but the coefficient is only statistically significant for the subsample of institutional investors.

3.4 French climate risk disclosure Article 173

So far we have shown that investors tend to be biased towards carbon-intensive stocks in the home market. To better understand what drives this effect, we test for a causal effect between carbon-intensive home stocks and ownership by analyzing the impact of a regulatory shock. Specifically, we use a French regulation on climate disclosures by institutional investors to estimate a differences-in-differences (DiD) model. The Energy Transition for Green Growth Act was passed by French parliament on 22 July 2015, which mandates French institutional investors, including investment funds, other financial intermediaries, insurance corporations, and pension funds, to disclose climate risk exposures. The primary objective of French lawmakers was to raise awareness among institutional investors regarding the carbon emissions associated with their investments and the related financial risks stemming from climate change. The regulation outlines reporting standards for voluntary decarbonization targets and their alignment with both national and international climate goals. Additionally, investors are expected to specify the measures necessary to attain these targets, such as adjustments to investment policies, divestment, and engagement activities.

The implementation Decree for Article 173 was published on 31 December 2015, and its provisions entered into force on 1 January 2016. French institutional investors are required to measure the carbon footprint of their investment portfolio and publicly disclose the associated carbon emissions. Additionally, investors must analyze their exposure to both physical and transition risks. The former refers to the possibility of suffering losses due to more frequent and severe natural disasters triggered by climate change, such as damage to 'non-financial firms' physical assets that have been invested in. The latter pertains to the risk of suffering losses due to stricter environmental policies aimed at mitigating climate change, such as the potential for stranded assets of invested firms operating in the fossil energy sector. Furthermore, investors are expected to evaluate their contribution towards combating climate change by disclosing information regarding whether their portfolio is in alignment with a 2-degree trajectory of global climate and calculating the proportion of their investments in low-carbon intensive versus high-carbon intensive firms or industries. The regulation functions on a "comply or explain" basis, requiring investors that do not provide the necessary numerical climate and carbon reporting to explain their reasons for non-compliance with the law. The first reporting by investors was required by 30 June 2017 over the reporting year 2016 on a comply or explain basis (see also Mésonnier and Nguyen, 2021; Ilhan et al., 2023).

The idea of using this shock is that, as a result of the new regulation, French institutional investors are motivated to reduce their carbon footprint. This can be done in at least two ways, either by divesting from carbon-intensive firms or refraining from divestment and pressuring firms to report and reduce their carbon emissions. We hypothesize that divestment is more likely for investors' foreign holdings whereas active ownership is more likely for domestic stocks. If so, we expect that the decarbonization shock will be associated with French institutional investors decreasing their ownership of foreign stocks and increasing their ownership of domestic stocks to increase their influence with these firms. To test these two conjectures, we estimate the following specification:

$$\begin{aligned}\log(Own)_{i,s,t} = \beta_0 &+ \beta_1 POST_t \times FRO_i \times High\ carbon_i \\ &+ \beta_2 POST_t \times FRO_i + \beta_3 POST_t \times High\ carbon_i \\ &+ \beta_4 High\ carbon_i + \beta_5 Home\ stock\ dummy_{s,t} \\ &+ \beta_k' Controls_s + \epsilon_{i,s,t}\end{aligned} \tag{3}$$

where the dependent variable $\log(Own)_{i,s,t}$ is defined as the aggregate euro ownership of institutional investor i in stock s at time t, and investor i is the combination of holder area and holder sector. Article 173 only applies to French institutional investors, which makes other euro area institutional investors a natural control group. $POST_t$ is defined as an indicator variable equal to one after 2015Q4 and zero otherwise. FRO is a dummy variable equal to one for French owners and zero otherwise. *High carbon* is a dummy variable equal to one when carbon emissions are higher than the sample median of carbon emissions based on the first measurement of carbon emissions before 2016Q1. We measure *High carbon* as a static variable before the regulation takes effect to prevent time-variation in carbon-emissions driving our results. We include holder area fixed effects, holder sector fixed effects and industry-time fixed effects in all specifications. All other (control) variables are the same as in Equation 2. Overall we expect β_1 to be negative: As result of the decarbonization shock, divestment dominates because the number of foreign stocks is much larger than the number of domestic stocks in the sample. For domestic stocks, we expect that the "active ownership" channel dominates the divestment channel. Therefore, we expect β_1 to be positive for the sample of only home stocks. Conversely, we expect β_1 to be negative for the sample of foreign stocks.

[*Insert Table 5—"Differences in Differences Institutional Ownership: Effects of French Article 173"*]

Table 5 presents the results. In Column (1) we estimate Equation 3 for the full sample. The coefficient of interest is $POST \times FRO \times High\ carbon$, which is negative and significant. This indicates that after the regulatory shock (Article 173), French institutional investors significantly reduced their ownership in high-carbon firms in comparison to the ownership of institutional owners from other euro area holder areas. This is consistent with French institutional investors being more motivated to reduce their carbon footprint as a result of the law and on aggregate they do so by divesting from high-carbon firms, which is in line with findings by Mésonnier and Nguyen (2021) who also use Article 173 for identification, but focus on only energy intensive stocks. The magnitude of our estimated effect is meaningful, with French institutional ownership of high carbon stocks after Article 173 being 16% lower compared to ownership by other European institutional investors.

Next in Table 5 Columns (2) and (3) we split the sample in institutional investors' holdings in home market stocks (Column 2) and their holdings in foreign stocks (Column 3). In terms of number of stocks, investors' portfolios contain fewer domestic than foreign stocks which considerably reduces the sample in Column 2. Most interestingly, we find a positive sign on $POST \times FRO \times High\ carbon$ in Column (2) and a negative sign in Column 3. This indicates that French institutional investors only significantly reduce their ownership in foreign, high-carbon firms, whereas they *increase* their ownership in domestic firms following the climate regulatory shock. Economically, the effect in the foreign sample in Column (3) is comparable to the overall effect in Column (1), with 17% lower French institutional ownership in high carbon stocks. The effect in the domestic sample in Column (2) is almost twice as high: after Article 173, French ownership of high-carbon French stocks is 32% higher than institutional ownership of high-carbon French stocks by other European institutional investors.

We interpret these results as being consistent with our conjecture that to decrease ones carbon footprint, divestment is more likely for foreign firms whereas French investors might hold on to domestic carbon-intensive firms for reasons of active ownership. Finally, in Table 5 Column (4) we again consider the entire sample but also interact the three-way interaction with $Home\ dummy$. The coefficient of interest here is $POST \times FRO \times High\ carbon \times Home\ dummy$, which is more difficult to interpret but is—consistent with the results from Columns (2) and (3)—positive and significant. Also the economic effect of the quadruple interaction is comparable in size to that of the triple interaction in Column (2).

To give a causal interpretation to the results presented in Table 5, before the Article 173 regulation came into effect we should not see an impact of treatment, i.e. the triple interaction $POST \times FRO \times Highcarbon$. To test for this common trend assumption we re-estimate Equation 3 for the sample of domestic stocks (comparable to Column (2) in Table 5) and include lead and lag indicators instead of $POST$ and interact them with $FRO \times High\ carbon$. Specifically, we include a set of indicators ($Treat_{t+i}$) each equal to one only in quarter $t+i$, where t indicates for the quarter before or after 2015Q4, and equal to zero otherwise. We consider five indicators corresponding to values for i equal to -4 to and including 0, where $t = 0$ is 2016Q1, the quarter in which Article 173 came into effect. Finally we add and interact with an indicator $Treat_{q \geq t+1}$ that is equal to one for all quarters greater or equal than $t+1$.

[*Insert Figure 3—"Dynamic effect of treatment estimates"*]

Figure 3 presents the results. Consistent with a common trend, it shows no significant triple interaction in the periods before Article 173 came into effect. The triple interaction is insignificant in the four quarters before 2016Q1 (i.e. $t-4$ to and including $t-1$). On 2016Q1 the triple interaction becomes positive and significant. Also in the post-period, for all quarters greater than 2016Q1 the effect is on average positive and significant although slightly smaller than the initial effect. These findings suggest we can give a causal interpretation to the result that post Article 173, compared to other euro area institutional investors, French institutional investors increased their holdings in French carbon-intensive stocks. These results corrobrate the presence of a carbon home bias.

3.5 Domestic institutional ownership and carbon emissions (disclosure)

We have found that investors have a bias towards carbon-intensive assets in the home market. The French Article 173 that mandates institutional investors to disclose their carbon footprint which in turn leads French institutional investors to reduce their carbon exposure, but only for foreign stocks and not for domestic stocks. One argument as to why they might do so is that they have the expectation that it is easier to convince carbon-intensive firms in the home market to reduce their emissions, i.e. engagement. Conversely, influencing foreign firms might be more difficult, which could make divesting from foreign stocks more attractive.

Before we test whether institutional investors are better at pressuring firms from their domestic market, we test whether EMU institutional ownership is related to carbon emissions (disclosure). Specifically, we take a stock-year panel and regress actual emissions and emissions disclosure on EMU institutional ownership. We estimate:

$$y_{s,t} = \beta_0 + \beta_1 IO_{s,t} + \beta_k' Controls_{s,t} + \epsilon_{s,t} \tag{4}$$

where $y_{s,t}$ of stock s in year t is either defined as actual reported carbon emissions $log(CO_2)$ or as *Disclosure*, which is a dummy variable equal to one when a stock discloses its carbon emissions and zero otherwise.[7] We regress $log(CO_2)$ and *Disclosure* on institutional ownership ($IO_{s,t}$) by European investors, where we include industry-time fixed effects and country fixed effects in all specifications. These baseline estimates should be interpreted as correlations, which potentially capture both our assertions that (i) institutional owners select stocks that have lower emissions and/or are more likely to report emissions and (ii) institutional owners pressure firms to report and lower their emissions.

Table 6 presents the results, where Columns (1) to (4) present results with $log(CO_2)$ as dependent variable and Columns (5) to (8) present results with *Disclosure* as dependent variable. In Column (1) we present estimations for the total sample of stocks, where we regress a stock's carbon emissions on euro area institutional ownership (IO). As expected we find that they are negatively related: a one percentage point higher IO is associated with 2.2% lower carbon emissions. In Columns (2) and (3) we split the sample into two subsamples of foreign and euro area stocks, respectively. For both we find a negative relationship between institutional ownership and carbon emissions. The effect size for IO for the foreign sample appears to be bigger, but this is likely due to a selection effect: We find in Table 4 Column (7) that carbon emissions are associated with lower foreign ownership and higher domestic ownership. In Column (4) we replace euro area institutional ownership with *IO home*, which is for each stock defined as the domestic institutional ownership of its respective country (i.e. one of the 10 holder countries in our sample). Arguably, this variable more directly measures the effect of domestic institutional ownership. The coefficient in Column (4) is negative and is exactly the same as in Column (5), but due to lower power in the smaller sample no longer statistically

[7] Note that we only code *Disclosure* equal to one when in the raw self-reported carbon data from Refinitiv a firm reports either Scope 1 or Scope 2 emissions, or both. Estimated carbon emissions are excluded from this.

significant.

[*Insert Table 6—"Carbon emissions (disclosure) and euro area institutional ownership"*]

Next in Table 6 Columns (5) to (8) we consider the same specifications as in Columns (1) to (4), but we replace the dependent variable with *Disclosure*, which is an indicator variable that measures whether a firm reports carbon emissions suggesting the firm is take climate mitigation action. Column (5) shows that a one percentage point increase in *IO* is associated with the likelihood of a firm reporting carbon emissions increasing with 1.5%. Consistent with the carbon emissions estimates in Columns (2) and (3), we find that the size of the effect is larger for foreign stocks than for euro area stocks. Part of this difference is likely due to a selection effect: Euro area institutional investors could have a preference for foreign firms that report carbon emissions. In Column (8) we find that also domestic institutional investment is positively related to the likelihood of reporting emissions.

The results reported in Table 6 give an indication of the overall effect of EMU-wide institutional ownership in our sample but they do not separate selection effects from influence effects. Also more generally, they suffer from endogeneity. Therefore, we return to the differences-in-differences analyses outlined in Section 3.4 and we assess whether post Article 173, domestic firms with high French institutional investment subsequently reduce their carbon emissions more, and are more likely to disclose their carbon emissions. Arguably, Article 173 is an exogenous shock to the demand for emissions disclosure (Ilhan et al., 2023). The differences-in-differences specification based on a stock-year panel dataset we test is:

$$\begin{aligned} y_{s,t} = \beta_0 &+ \beta_1 POST_t \times FR_s \times High\ French\ IO_s \\ &+ \beta_2 POST_t \times FR_s + \beta_3 POST_t \times High\ French\ IO_s \\ &+ \beta_4 High\ French\ IO_s + \beta_k' Controls_{s,t} + \epsilon_{s,t} \end{aligned} \tag{5}$$

where for stock s in year t, $y_{s,t}$ is either $log(CO_2)$ or *Disclosure*. $log(CO_2)$ is the natural logarithm of (raw) self-reported Scope 1 and Scope 2 carbon emissions. *Disclosure* is a dummy variable equal to one when a firm discloses its carbon emissions and zero otherwise. $POST_t$ is defined as an indicator variable equal to one from 2016 onwards and zero otherwise. FR_s is a dummy variable equal to one when the statutory country associated with stock s is France and $High\ French\ IO_s$ is a dummy variable equal to one when French institutional investment is above the median in 2015 and zero otherwise. We measure *High French IO* as a static variable before Article 173 is enacted to prevent time variation in French institutional ownership and resulting selection effects from possibly driving our results. Firm controls include B/M, ROE, *Leverage*, *Momentum*, $Invest/A$ and $Log(PPE)$ as defined in Appendix Table A.1.[8] All specifications include industry-time fixed effects and statutory country fixed effects. The main effects of $POST$ and FR are subsumed by these fixed effects.

[*Insert Table 7—"Carbon emissions and French Article 173"*]

Table 7 reports the results of estimating Equation 5 with $log(CO_2)$ as dependent variable. Column (1) includes the main effect of *High French IO*, its interaction with $POST$ and Industry-time and country fixed effects, showing that French institutional

[8]Note that especially the differences-in-differences estimations that have carbon emissions as dependent variable might suffer from a "bad controls" problem (Angrist and Pischke, 2009). That is, ex post the treatment is likely to have an effect on some of the covariates. For instance, carbon reductions might require additional investments and additions (or reductions) in property plant and equipment. Therefore, when we take $log(CO_2)$ as dependent variable in the differences-in-differences estimations, we measure all controls statically in 2015Q4.

investment is associated with high carbon emissions of firms in general, before and after Article 173. The triple interaction added in Column (2), $POST \times FR \times High\ IO$, however, is negative and significant. This indicates that after the enactment of Article 173, French stocks with (ex ante) above median French institutional ownership (i.e. the treated) have significantly lower carbon emissions than stocks from other countries with below median French institutional ownership. The associated reduction is also sizeable, with reported carbon emissions in the treated group being about 45% lower.

Table 7 Columns (3) and (4) present estimations with a full set of control variables. The signs of significant controls are as expected, with larger firm with relatively more investments and more property, plant and equipment being associated with higher carbon emissions. Column (3) shows that High French institutional investment is now insignificantly related with carbon emissions. In Column (4) we add the triple interaction $POST \times FR \times High\ IO$ which is again negative and significant. This allows for a causal interpretation that reported carbon emissions are significantly lower for French stocks when ex ante French institutional ownership is above the median. The reported effect sizes are surprisingly large, although we have to keep in mind that firms self-report their carbon emissions. So with the caveat that all firms' carbon emissions are self-reported, we conclude that the positive shock to French investors' demand for carbon emission reduction is subsequently associated with lower reported carbon emissions.

[*Insert Table 8—"Reporting carbon emissions and French Article 173"*]

Table 8 reports the results of estimating Equation 5 with *Disclosure* as dependent variable. Column (1) includes the main effect of *High French IO*, its interaction with *POST* and Industry-time and country fixed effects. High French institutional investment is associated with a 21% higher likelihood of reporting carbon emissions, and this likelihood increases by about 3% post Article 173. The triple interaction we add in Column (2), $POST \times FR \times High\ IO$ is insignificant. In Column (3) we add firm controls which appear to capture a large part of the main effect of *High French IO*, which decreases from 21% in Columns (1) and (2) to about 7% in Columns (3) and (4). Post Article 173 we find an increase of 1.5% in the likelihood of reporting emissions, but similar to Column (2) we find that in Column (4) $POST \times FR \times High\ IO$ is insignificant. So we fail to find evidence that after the enactment of Article 173 French firms (as compared to foreign ones) are more likely to report their carbon emissions when their ex ante French institutional ownership is high.

Possibly, the effect of active ownership is stronger when institutional owners have a sizable position (Gloßner, 2019; Ilhan et al., 2023). Therefore in Table 8 Columns (5) and (6) we consider the subsample for which French institutional ownership is at least 0.5%. Column (5) shows that the coefficient of $POST \times High\ French\ IO$ indicates that with at least 0.5% ownership, French firms are about 5.3% more likely to report emissions in the post Article 173 period. When we add the interaction between $POST \times FR \times High\ French\ IO$ we find a positive and significant coefficient which is relatively large: When French institutional investors hold at least 0.5% of the shares, high French *IO* is associated with about 20% higher likelihood of reporting carbon emissions in the post Article 173 period. In Columns (7) and (8) we further restrict our sample to French *IO* of at least 3%, where we find that the effect size of the triple interaction is even a bit larger at 26%. Combined these results suggest that the positive shock to the demand for carbon emission disclosure has had a sizable effect on the likelihood of domestic firms reporting carbon emissions, but only when French institutional investors hold at least 0.5% of the shares.

3.6 Stock return analyses

The previous analyses suggest that institutional investors succeed in using home bias to influence domestic firms to improve their carbon performance. An alternative explanation, which would not necessarily be at odds with these findings, is that investors might prefer domestic carbon-intensive assets because of their carbon premium, especially if the domestic carbon premium would be larger than the foreign carbon premium. To investigate this, we first assess whether carbon-intensive euro area versus foreign stocks are associated with higher excess returns. Second, we test whether more carbon-intensive portfolios earn excess returns, where we again distinguish between foreign and domestic subportfolios.

For our stock excess return estimations we follow Choi et al. (2017) and collapse the ownership panel to the stock-quarter level and estimate the following equation:

$$R_{s,t} - RF_t = \beta_0 + \beta_1 \log(Carbon/sales)_{s,t} + \beta_k' Controls_{s,t} + \epsilon_{s,t} \qquad (6)$$

where $R_{s,t} - RF_t$ indicates excess returns and firm controls include B/M, $Leverage$, $Momentum$, $Invest/A$, $\log(PPE)$, $Beta$, $Volatility$ and ROE as defined in Appendix Table A.1. We also include $log(Sales)$ in specifications in which we include $\log(carbon)$ instead of $\log(Carbon/sales)$. We include industry fixed effects, statutory country fixed effects and time fixed effects in all specifications. Standard errors are clustered at the stock level.[9]

Table 9 presents the results. Columns (1) and (2) show the effect of $\log(Carbon/sales)$ and $\log(Carbon)$, respectively. Here we find that only $\log(Carbon)$ in Column (2) is significantly positively related to excess returns, whereas the effect of $\log(Carbon/sales)$ is insignificant. These results are consistent with those from Bolton and Kacperczyk (2022). In Columns (3) to (6) we consider sub-samples of stocks from the euro area countries and all stocks from foreign countries with euro area investments. Here we only find a positive significant relationship between carbon emissions and excess returns for

[9]Note that cross-sectional excess return regressions like these are commonly estimated with Fama-Macbeth regressions. However, the time dimension of our panel is relatively short, so we estimate the pooled panel and include time fixed effects instead. That is, following Petersen (2009) we adjust for a possible time effect in the standard errors parametrically and adjust for a possible firm effect by clustering on the dimension that is large (i.e. the number of firms).

the *Foreign* subsamples in Columns (3) and (5): In Column (5) the effect is significant at the 1% level for $\log(Carbon)$ and in Column (3) it is significant at the 10% level for $\log(Carbon/sales)$. For the *EMU* subsamples in Columns (4) and (6) the effect is insignificant. Combined, these results suggest that—if anything—a domestic carbon premium is unlikely to motivate investors to hold on to carbon-intensive assets from the home market.

[*Insert Table 9—"Cross-section of stock-level excess returns"*]

To further investigate whether differential carbon premia might be an explanation for carbon home bias, we analyze the relationship between portfolio performance and carbon emissions. For our portfolio analyses we estimate a standard four-factor model on the same panel we used in the carbon footprint analyses:

$$\begin{aligned} R_{i,t} - RF_t = \alpha_p + \beta_1 \log(CFP)_{i,t-1} + \beta_2 Home\ bias_{i,t-1} + \beta_3 log(Holdings)_{i,t-1} \\ + \beta_4(RM_t - RF_t) + \beta_5 SMB_t + \beta_6 HML_t + \beta_7 WML_t + \epsilon_{i,t} \end{aligned} \tag{7}$$

where $\mathrm{R}_{i,t} - \mathrm{RF}_t$ is the excess returns on the portfolio of investor i. Returns on portfolios of investor i at year-quarters t are stacked in a panel. The main variable of interest, $log(CFP)$ is the natural logarithm of CFP, lagged one quarter. All specifications include investor (i.e. holder area × holder sector fixed) fixed effects to isolate time variation in excess returns and CFP. We also control for the size of the portfolio at the start of the quarter $\log(Holdings)$ and Fama-French developed market factors.

We include the following controls: *Home bias* is the home bias of investor i at year-quarter $t-1$ and $\log(Holdings)$ controls for the size of the portfolio of investor i at time $t-1$. We include developed market factors from Fama-French: $\mathrm{RM}_t - \mathrm{RF}_t$ is the market risk premium, which is the return on a market portfolio in excess of the risk-free rate. SMB_t (Small minus Big) is the return on a portfolio long in small cap stocks and short in large cap stocks. The HML_t (High minus Low) factor measures the return differential between high and low book-to-market stocks. WML_t (Momentum factor) represents the return on a portfolio long in stocks with the highest returns and short in those with the worst returns in the previous 12 months. All returns of the factors and excess returns ($R_{i,t} - RF_t$) are measured in US dollars. All estimations include investor fixed effects, ϕ_i, to isolate within investor, over-time variation of excess returns. Table 2 provides summary statistics of the variables used in our analyses.

Table 10 presents the results. Column (1) regresses portfolio excess returns on total portfolio CFP. Excess returns are positively and significantly related to portfolio CFP. A doubling of CFP is associated with portfolio returns that are about 3.5 percentage points higher on an annual basis. We also control for *Home bias*, which is not statistically significant. The estimate on $\log(Holdings)$ shows that larger portfolios are associated with lower excess returns. The coefficient on the market factor $Mkt - RF$ is relatively close to one, so our average investor holds a portfolio close to the market portfolio. The factors show that high book-to-market and size exposure are associated with a return premium.

[*Insert Table 10—"Portfolio excess return regressions"*]

To assess this composition effect further, we examine several subportfolios. From Tables 1 and 3 we know that investors that are home-biased and those with relatively carbon-intensive domestic stock markets also have a higher carbon footprint. Table 9 shows that within the cross-section of stocks, carbon-intensive stocks from the euro area do not earn a carbon premium, whereas foreign stocks do. Next, we ask whether these results can also be found at the portfolio level. Table 10 Column (2) regresses the excess returns of investors' home portfolio on home portfolio carbon footprint.[10] The coefficient of log(*CFP home*) is insignificant. Next we consider a foreign subportfolio for which we separately calculate portfolio excess returns, CFP and $\log(Holdings)$. Column (3)

[10]Note that portfolios are reweighted such that weights sum up to one. We also separately calculate the excess returns, CFP and $\log(Holdings)$ of these subportfolios.

shows carbon-intensive foreign subportfolios are significantly positively associated with excess returns.

In Table 10 Column (4) we reestimate Column (1) but replace $\log(CFP)$ with a $\log(CFP)$ variable for which we hold $Carbon/sales$ of each firm constant over the sample period.[11] Possibly, without investors changing their portfolios, costly operational improvements that reduce carbon intensity might be associated with (temporarily) lower stock returns. To gauge whether within-firm variation in carbon intensity (over time) is driving the effect, we take the average of firms' $Carbon/sales$ over time as input to our portfolio carbon footprint calculation. Column (4) presents the results, which are qualitatively similar to the ones in Column (1). This suggest that our results do not appear to be driven by firm-level variability of carbon intensity. Finally, in Columns (5) to (7) we repeat the estimations from Columns (1) to (3) but instead of the portfolio carbon footprint, which is based on $Carbon/sales$, we include the portfolio-weighted average of carbon emissions. In Column (5), total portfolio carbon is not significantly related to excess returns and in Column (6) we also find no significant results for the home subportfolio. We do find in Column (7) that the foreign subportfolio's excess returns are positively and significantly related to portfolio carbon emissions.

Because these portfolio analyses only concern correlations between returns and carbon, we further analyze whether investors on average earn a carbon premium. That is, we sort portfolio's each quarter in four carbon footprint quartiles and calculate their monthly return over the next quarter. We do this for a home and foreign subportfolio and for the total portfolio. Next we regress monthly excess returns on the Fama-French developed market factors from Equation 6. All returns are in US dollars. Appendix Table B.2 shows the results which confirm that we only find weak evidence for a positive carbon premium on the foreign subportfolio and no evidence for a carbon premium on the home and total portfolios.

[11] Specifically, we use the mean of CO_2 emissions over sales over the sample period to isolate valuation and portfolio allocation effects from changes in firms' carbon intensity.

Combined these results suggest that a domestic carbon premium is unlikely to drive carbon home bias. If anything, by divesting mostly from their carbon-intensive assets in their foreign portfolio investors fail to earn part of the foreign carbon premium.

4 Conclusion

This paper analyzes the carbon exposure and home bias of stock portfolios across a range of different investors from the euro area. We find that investors' home bias has important consequences for the carbon exposure of their global portfolios, with on average half of the carbon exposure coming from domestic investments. Our results suggest investors are actively decarbonizing their portfolios via two channels.

Specifically, we find that after the enactment of Article 173 French institutional investors increase their holdings in French carbon-intensive stocks whereas they reduce their holdings in foreign stocks. In two additional differences-in-differences analyses we show that the demand for lower carbon emissions and better reporting has a sizable effect on both carbon emissions and the likelihood of domestic French firms reporting carbon emissions.

In general, the sizable carbon home bias we find appears not to be due to the carbon measure we use, because we also find that stock ownership in dirty industries is 40 percent higher for domestic stocks than for foreign stocks. We also investigate an alternative return-based explanation for the observed carbon home bias. Specifically, we test for differential home-foreign carbon return premia. If anything, from a euro area perspective, the foreign carbon premium is higher than the domestic carbon premium, so we conclude that carbon premium differentials are unlikely to drive the observed carbon home bias.

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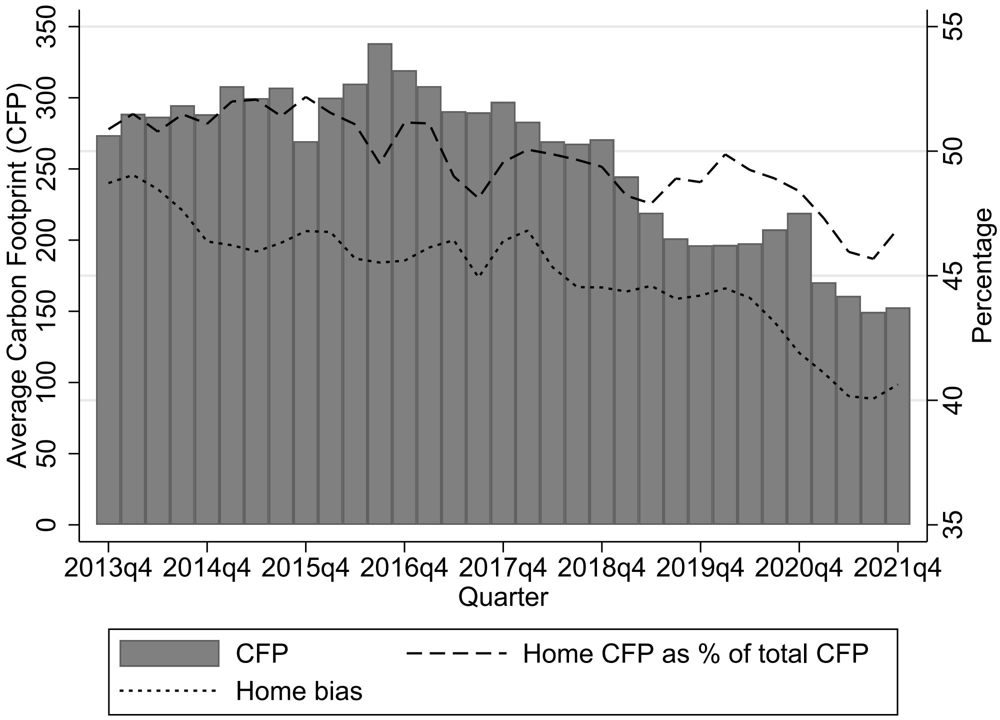
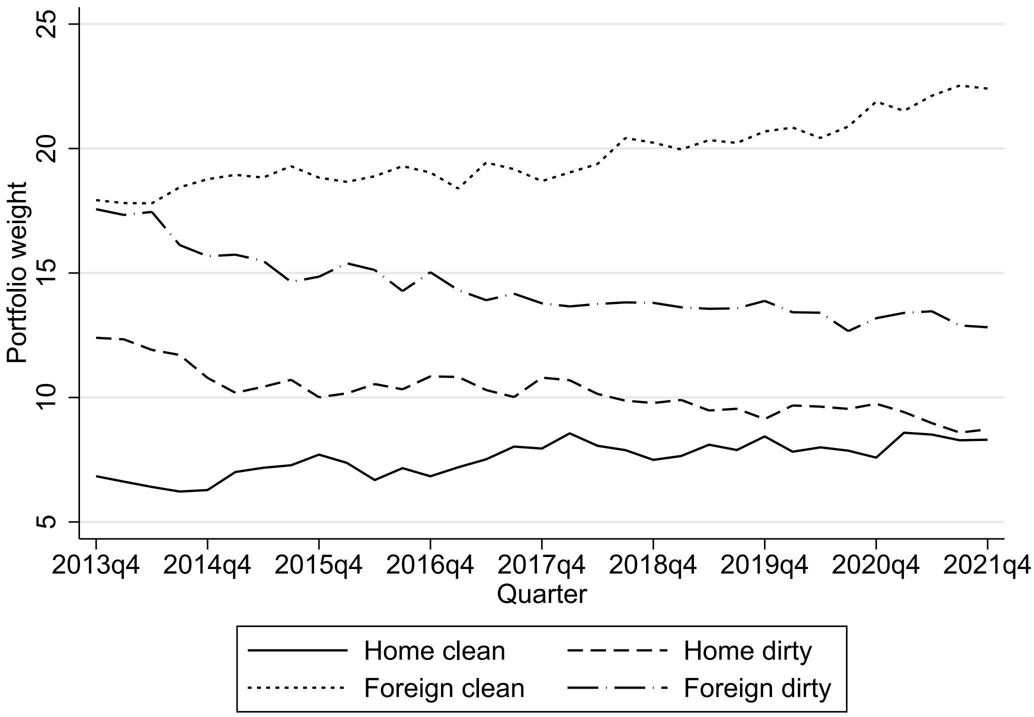
Figures

Figure 1: Carbon footprint and (carbon) home bias



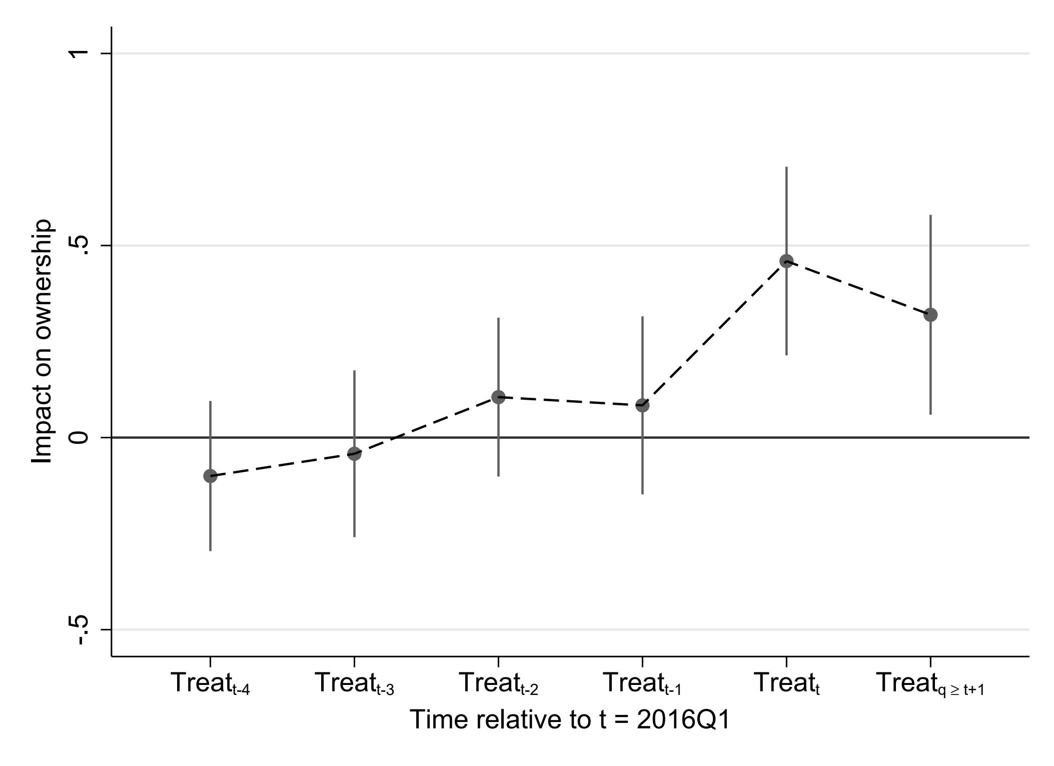
This figure presents several graphs based on the holder-country-holder-sector panel data. First, CFP is the portfolio-weighted average of carbon emissions divided by sales averaged each quarter. The bar graph with the corresponding left-hand y-axis present the average of CFP each quarter. Second. the figure shows two line graphs with the corresponding righ-hand y-axis: *Home CFP as percentage of total CFP* indicates the percentage of the total CFP that is due to domestic stocks. This percentage is calculated for each holder-area-holder-sector-quarter portfolio and subsequently averaged each quarter. *Home bias* is the portfolio home bias which is also averaged each quarter.

Figure 2: Carbon footprint adjustments through portfolio tilting



This figure presents four portfolios based on the holder-country-holder-sector-stock-quarter panel data. For each holder country, holder area and stock we calculate the average over time of carbon divided by sales. Then for each holder area and holder sector we split their holdings in four quartiles ranging from cleanest to most dirty holdings based on average carbon divided by sales. Next we calculate the aggregate weight for each holder sector, holder area and quarter in the 25% cleanest and 25% dirtiest domestic stocks and the 25% cleanest and 25% dirtiest foreign stocks. These aggregate weights are *Home clean*, *Home dirty*, *Foreign clean* and *Foreign dirty*, which we average each quarter to plot the corresponding graphs.

Figure 3: Dynamic effect of treatment estimates



This figure presents estimations of Equation 3 for the sample of domestic stocks in which we include lead and lag indicators instead of $POST$ and interact them with $FRO \times High\ carbon$. Specifically, we include a set of indicators ($Treat_{t+i}$) each equal to one only in quarter $t+i$, where t indicates for the quarter before or after 2016Q4, and equal to zero otherwise. We consider five indicators corresponding to values for i equal to -4 to and including 0, where $t = 0$ is 2016Q1, the quarter in which Article 173 comes into effect. We add an and interact with an indicator $Treat_{q \geq t+1}$ that is equal to one for all quarters greater or equal than $t+1$. The dots indicate the coefficient of each triple interaction together with a 90% confidence interval.

Tables

Table 1: Portfolio carbon footprint and home bias: Descriptives

	AT	BE	DE	ES	FI	FR	GR	IT	NL	PT	ALL
Panel A: Home bias											
% In world market	0%	1%	4%	1%	0%	4%	0%	1%	2%	0%	11%
% Invested at home	47%	30%	51%	43%	48%	52%	81%	39%	20%	52%	46%
Panel B: Carbon home bias											
% Carbon in world	0%	0%	5%	1%	0%	3%	0%	2%	0%	0%	11%
% Carbon home	29%	12%	51%	35%	41%	55%	72%	47%	5%	50%	40%
% CFP home	46%	26%	53%	45%	57%	50%	96%	46%	9%	66%	50%
Panel C: CFP decomposition											
Portfolio CFP total	240	158	227	216	185	192	735	217	178	295	257
Portfolio CFP home	152	45	143	105	120	94	715	99	11	233	166
Portfolio CFP foreign	88	113	84	110	64	98	20	118	167	62	91

This table reports averages for each holder area and the total sample of selected variables for the regression sample used in Table 3. Columns indicate the holder area's: Austria (AT), Belgium (BE), Germany (DE), Spain (ES), Finland, (FI), France (FR), Greece (GR), Italy (IT), The Netherlands (NL) and Portugal (PT). The final column (ALL) indicates the total mean for the ten investor countries. Panel A shows *% In world market*, which is the market value of stocks in our sample from a particular holder area as a percentage of the total market value of world stocks in our sample. *% Invested at home* indicates the market value of holdings from a particular holder area as a share of market value of all stocks from a particular holder area. Panel B shows *% Carbon in world*, which is the total carbon emissions (Scope 1+2) in our sample from a particular holder area as a percentage of the total carbon emissions of world stocks in our sample. *% Carbon home* indicates carbon emissions from investments in the home country as a percentage of total portfolio carbon emissions, averaged per holder area. *% Carbon home* indicates carbon footprint (CFP) from investments in the home country as a percentage of total carbon footprint, averaged per holder area. Carbon footprint is the portfolio weighted average of tonnes of CO_2 per millions euros of sales. Panel C provides a decomposition of the total portfolio carbon footprint in terms of home and foreign.

Table 2: Summary statistics

	Mean	SD	p10	p90	N
Panel A: Portfolio variables					
CFP	256.83	247.08	103.48	454.80	2,376
log(CFP)	5.29	0.69	4.64	6.12	2,376
Home bias	0.45	0.27	0.10	0.82	2,376
Industry bias global	0.27	0.15	0.10	0.49	2,376
Active share	0.51	0.08	0.40	0.62	2,376
log(CFP home benchmark)	5.36	0.70	4.35	6.33	2,376
log(CFP world benchmark)	5.50	0.18	5.16	5.67	2,376
Total holdings (bln)	31.37	69.80	0.33	80.90	2,376
log(Holdings)	22.51	2.05	19.61	25.12	2,376
B/M	0.63	0.25	0.42	0.92	2,376
ROE	10.63	4.37	5.22	15.81	2,376
Leverage	0.23	0.05	0.17	0.29	2,376
Invest/A	0.03	0.01	0.02	0.04	2,376
Log(PPE)	13.24	1.73	11.00	15.06	2,376
Excess returns	1.87	8.16	-7.15	11.29	2,376
log(CFP constant Carbon/sales)	5.33	0.68	4.72	6.21	2,376
log(CFP home)	5.23	1.03	4.00	6.48	2,375
log(CFP foreign)	4.98	0.55	4.40	5.57	2,372
log(Carbon)	15.30	0.69	14.38	16.02	2,376
log(Carbon home)	14.76	1.33	13.20	16.26	2,376
log(Carbon foreign)	15.33	0.68	14.58	16.01	2,372
Panel B: Ownership analyses					
log(Hold)	12.93	2.92	9.02	16.80	3,776,406
Ownership (mln EUR)	17.16	140.31	0.01	19.77	3,776,406
log(Carbon/sales)	3.63	2.05	1.27	6.50	3,776,406
Home stock dummy	0.03	0.17	0.00	0.00	3,776,406
log(Carbon)	11.55	2.83	7.94	15.34	3,776,406
log(Sales)	7.92	1.91	5.51	10.34	3,776,406
Dirty industry dummy	0.11	0.31	0.00	1.00	3,776,406
log(MV)	22.16	1.69	19.96	24.33	3,776,406
log(Firm size)	15.66	2.01	13.14	18.24	3,776,406
Inverse of price	0.26	1.09	0.01	0.48	3,776,406
Momentum	0.01	0.03	-0.02	0.05	3,776,406
B/M	0.71	0.74	0.12	1.44	3,776,406
Beta	0.86	0.72	0.02	1.76	3,776,406
Volatility	0.09	0.06	0.05	0.16	3,776,406
Volume	0.04	0.06	0.00	0.16	3,776,406
Panel C: Ownership: French IO Differences in Differences					
log(Hold)	13.99	2.74	10.27	17.47	1,670,193
Ownership (mln EUR)	25.23	161.39	0.03	38.65	1,670,193
POST	0.78	0.41	0.00	1.00	1,670,193
FRO	0.16	0.36	0.00	1.00	1,670,193
High carbon	0.52	0.50	0.00	1.00	1,670,193
Home dummy	0.03	0.17	0.00	0.00	1,670,193

Summary statistics (continued)

	Mean	SD	p10	p90	N
Panel D: Carbon (disclosure) and French Article 173					
Log(CO_2)	12.22	2.63	8.99	15.76	29,034
Disclosure	0.43	0.49	0.00	1.00	50,602
High French IO dummy	0.69	0.46	0.00	1.00	29,034
POST	0.69	0.46	0.00	1.00	29,034
FR	0.03	0.18	0.00	0.00	29,034
log(Firm size)	15.77	1.74	13.74	18.07	29,034
B/M	0.80	0.79	0.18	1.61	29,034
ROE	10.77	17.25	-3.04	26.35	29,034
Leverage	0.26	0.17	0.03	0.49	29,034
Invest/A	0.05	0.04	0.00	0.10	29,034
Log(PPE)	13.91	1.95	11.39	16.31	29,034
Panel E: Stock return analyses					
Excess returns	3.34	23.17	-19.40	26.16	224,164
log(Carbon)	10.96	2.85	7.33	14.77	224,164
log(Sales)	7.22	1.91	4.81	9.63	224,164
log(Firm size)	14.98	1.97	12.52	17.52	224,164
B/M	0.78	0.79	0.15	1.58	224,164
Leverage	0.25	0.18	0.01	0.50	224,164
Momentum	0.01	0.03	-0.02	0.05	224,164
Invest/A	0.04	0.04	0.00	0.09	224,164
Log(PPE)	12.92	2.35	9.83	15.80	224,164
Beta	0.77	0.76	-0.10	1.73	224,164
Volatility	0.12	4.84	0.05	0.17	224,164
ROE	8.16	21.52	-9.43	27.25	224,164

This table reports summary statistics. Appendix Table A.1 provides variable definitions.

Table 3: Home bias and portfolio carbon footprint

	(1)	(2)	(3)	(4)	(5)
Home bias	0.668***	1.241***	1.267***	−1.347	−0.763
	[0.246]	[0.224]	[0.212]	[0.856]	[1.630]
Industry bias global		−2.083***	−2.146***	−2.130***	−2.126***
		[0.382]	[0.377]	[0.381]	[0.382]
Active share		−0.942	−0.867	−0.579	−0.584
		[0.594]	[0.604]	[0.537]	[0.536]
log(CFP home benchmark)			0.215***	−0.003	−0.015
			[0.058]	[0.077]	[0.075]
log(CFP world benchmark)			0.918***	0.866***	0.924***
			[0.167]	[0.168]	[0.206]
Home bias ×				0.470***	0.500***
log(CFP home benchmark)				[0.157]	[0.158]
Home bias ×					−0.135
log(CFP benchmark)					[0.292]
log(Holdings)		0.021	0.028	0.016	0.015
		[0.063]	[0.060]	[0.056]	[0.056]
B/M		0.251	0.204	0.178	0.173
		[0.173]	[0.170]	[0.181]	[0.181]
ROE		0.008	0.006	0.004	0.004
		[0.010]	[0.010]	[0.010]	[0.010]
Leverage		−1.185	−1.203	−1.114	−1.137
		[0.786]	[0.788]	[0.844]	[0.857]
Invest/A		3.806	4.073	5.115	5.020
		[3.737]	[3.558]	[3.504]	[3.605]
Log(PPE)		0.091***	0.089***	0.081***	0.081***
		[0.028]	[0.027]	[0.029]	[0.029]
Constant	5.116***	4.236***	−2.130	−0.474	−0.704
	[0.127]	[1.426]	[1.652]	[1.719]	[1.887]
Observations	2,376	2,376	2,376	2,376	2,376
Adjusted R^2	0.270	0.448	0.468	0.483	0.483
Time FE	Yes	Yes	Yes	Yes	Yes
Holder area × Sector FE	Yes	Yes	Yes	Yes	Yes

This table reports the results of estimating Equation 1 where the dependent variable is the natural logarithm of portfolio carbon footprint (CFP). All estimations include holder area × holder sector fixed effects. Appendix Table A.1 provides variable definitions. Standard errors are clustered at the holder area × holder sector (i.e. investor) level and are reported in parentheses and ***, **, * correspond to the 1%, 5%, and 10% level of significance.

Table 4: Stock ownership and carbon home bias

	(1)	(2)	(3)	(4)	(5)	(6)	(7) IO	(8) non-IO
Home stock dummy	3.710***	3.573***	3.709***	3.928***	3.179***	3.659***	3.232***	3.993***
	[0.037]	[0.069]	[0.037]	[0.158]	[0.023]	[0.037]	[0.082]	[0.116]
log(Carbon/sales)	−0.046***	−0.047***					−0.053***	−0.044***
	[0.003]	[0.003]					[0.004]	[0.004]
Home stock dummy × log(Carbon/sales)		0.040**					0.048**	0.049
		[0.018]					[0.021]	[0.030]
log(Carbon)			−0.045***	−0.046***				
			[0.003]	[0.003]				
log(Sales)			0.086***	0.088***				
			[0.006]	[0.006]				
Home stock dummy × log(Carbon)				0.041**				
				[0.018]				
Home stock dummy × log(Sales)				−0.087***				
				[0.026]				
Home stock dummy × Dirty industry dum.					0.402***	0.388***		
					[0.115]	[0.141]		
log(MV)	0.727***	0.727***	0.723***	0.724***	0.675***	0.723***	0.849***	0.645***
	[0.006]	[0.006]	[0.006]	[0.006]	[0.002]	[0.006]	[0.009]	[0.009]
log(Firm size)	0.088***	0.089***	0.054***	0.054***		0.080***	0.073***	0.102***
	[0.005]	[0.005]	[0.007]	[0.007]		[0.005]	[0.007]	[0.007]
Inverse of price	−0.048***	−0.048***	−0.048***	−0.047***		−0.052***	−0.072***	−0.030***
	[0.004]	[0.004]	[0.004]	[0.004]		[0.004]	[0.006]	[0.006]
Momentum	0.071	0.069	0.083	0.079		0.188**	1.167***	−0.854***
	[0.078]	[0.078]	[0.078]	[0.078]		[0.077]	[0.109]	[0.105]
B/M	−0.022***	−0.022***	−0.019**	−0.019**		−0.023***	0.009	−0.040***
	[0.008]	[0.008]	[0.008]	[0.008]		[0.008]	[0.012]	[0.012]
Beta	0.073***	0.073***	0.072***	0.073***		0.076***	0.144***	0.040***
	[0.004]	[0.004]	[0.004]	[0.004]		[0.004]	[0.006]	[0.006]
Volatility	0.223***	0.226***	0.284***	0.300***		0.027	−2.887***	2.018***
	[0.072]	[0.072]	[0.072]	[0.072]		[0.072]	[0.101]	[0.093]
Volume	0.422***	0.420***	0.430***	0.402***		0.550***	−1.849***	2.641***
	[0.107]	[0.107]	[0.106]	[0.106]		[0.106]	[0.134]	[0.163]
Constant	−5.608***	−5.604***	−5.337***	−5.367***	−3.432***	−5.818***	−8.332***	−4.087***
	[0.115]	[0.115]	[0.120]	[0.120]	[0.050]	[0.108]	[0.159]	[0.158]
Observations	3,776,406	3,776,406	3,776,406	3,776,406	6,245,873	3,863,641	1,851,685	1,924,721
Adjusted R^2	0.468	0.468	0.469	0.469	0.468	0.466	0.484	0.370
Holder area FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Holder sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table reports the results of estimating Equation 2 where the dependent variable is the natural logarithm of euro ownership of stocks. Columns (1) to (6) report results for the full sample, Columns (7) and (8) report results for the samples of institutional and non-institutional investors, respectively. *Home stock dummy* is an indicator variable equal to one when a stock is from the holder country's home country and zero otherwise. Appendix Table A.1 provides variable definitions. All estimations include holder area, holder sector and industry × time fixed effects. Standard errors are clustered at the holder area × holder sector × stock level and are reported in parentheses and ***, **, * correspond to the 1%, 5%, and 10% level of significance.

Table 5: Differences in Differences Institutional Ownership: Effects of French Article 173

	(1)	(2) Home stocks	(3) Foreign stocks	(4)
POST × FRO × High carbon	-0.158^{***}	0.320^{**}	-0.171^{***}	-0.170^{***}
	[0.037]	[0.134]	[0.038]	[0.038]
POST × FRO	-0.052^{*}	-0.154	-0.050^{*}	-0.051^{*}
	[0.027]	[0.101]	[0.027]	[0.027]
POST × High carbon	-0.047^{***}	-0.352^{***}	-0.040^{***}	-0.042^{***}
	[0.015]	[0.081]	[0.015]	[0.015]
FRO × High carbon	0.405^{***}	0.466^{***}	0.382^{***}	0.394^{***}
	[0.048]	[0.169]	[0.050]	[0.050]
Home dummy	3.362^{***}			3.324^{***}
	[0.050]			[0.090]
High carbon	-0.081^{***}	0.021	-0.094^{***}	-0.073^{***}
	[0.020]	[0.111]	[0.020]	[0.020]
POST × FRO × High carbon × Home dummy				0.376^{**}
				[0.149]
POST × FRO × Home dummy				0.128
				[0.111]
POST × High carbon Home dummy				-0.229^{***}
				[0.088]
POST × Home dummy				0.065
				[0.064]
FRO × Home dummy				0.521^{***}
				[0.136]
High carbon × Home dummy				-0.226^{*}
				[0.131]
Observations	1,670,193	51,908	1,618,285	1,670,193
Adjusted R^2	0.494	0.535	0.492	0.495
Holder area FE	Yes	Yes	Yes	Yes
Holder sector FE	Yes	Yes	Yes	Yes
Industry-time FE	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes

This table reports the results of estimating Equation 3 where the dependent variable is the natural logarithm of ownership of institutional investors. Columns (1) and (4) present results for the full sample, Column (2) presents results for all holdings of domestic (i.e. French) stocks and Column (3) presents results for all holdings of foreign (i.e. non-French) stocks. *POST* is defined as an indicator variable equal to one from 2016Q1 onwards and zero otherwise. *FRO* is a dummy variable equal to one for French (institutional) owners and zero otherwise. *High carbon* is a dummy variable equal to one when carbon emissions are higher than the sample median of carbon emissions based on the first measurement of carbon emissions before 2016Q1. *Home dummy* is an indicator variable equal to one when the holder area equals a stock's statutory country and zero otherwise. Appendix Table A.1 provides variable definitions. All estimations include holder area, holder sector and industry × time fixed effects. Standard errors are clustered at the holder area × holder sector × stock level and are reported in parentheses and ***, **, * correspond to the 1%, 5%, and 10% level of significance.

Table 6: Carbon emissions (disclosure) and euro area institutional ownership

	log(CO_2)				*Disclosure*			
	(1) Total	(2) Foreign	(3) EMU	(4) EMU	(5) Total	(6) Foreign	(7) EMU	(8) EMU
IO	-0.022^{**}	-0.027^{**}	-0.015^{*}		0.015^{***}	0.025^{***}	0.009^{***}	
	[0.007]	[0.012]	[0.008]		[0.001]	[0.002]	[0.001]	
IO home				-0.015				0.007^{***}
				[0.013]				[0.002]
log(Firm size)	0.183^{***}	0.169^{***}	0.255^{***}	0.228^{***}	0.098^{***}	0.095^{***}	0.104^{***}	0.107^{***}
	[0.034]	[0.037]	[0.083]	[0.083]	[0.003]	[0.003]	[0.008]	[0.008]
B/M	0.019	0.019	0.076	0.089	-0.033^{***}	-0.029^{***}	-0.052^{***}	-0.057^{***}
	[0.033]	[0.037]	[0.064]	[0.065]	[0.004]	[0.005]	[0.010]	[0.011]
ROE	-0.003^{***}	-0.003^{***}	-0.005^{*}	-0.005^{*}	0.000	0.000	0.000	0.001^{**}
	[0.001]	[0.001]	[0.003]	[0.003]	[0.000]	[0.000]	[0.000]	[0.000]
Leverage	0.034	0.148	-0.746^{*}	-0.897^{**}	-0.105^{***}	-0.093^{***}	-0.181^{***}	-0.174^{***}
	[0.152]	[0.162]	[0.445]	[0.439]	[0.017]	[0.018]	[0.053]	[0.055]
Invest/A	2.528^{***}	1.975^{***}	7.170^{***}	6.750^{***}	0.011	-0.002	0.248	0.227
	[0.678]	[0.691]	[2.353]	[2.472]	[0.075]	[0.078]	[0.249]	[0.258]
Log(PPE)	0.766^{***}	0.775^{***}	0.718^{***}	0.744^{***}	0.028^{***}	0.027^{***}	0.034^{***}	0.035^{***}
	[0.033]	[0.036]	[0.083]	[0.082]	[0.003]	[0.003]	[0.007]	[0.007]
Constant	-1.561^{***}	-1.445^{***}	-2.170^{***}	-2.132^{***}	-1.407^{***}	-1.366^{***}	-1.483^{***}	-1.500^{***}
	[0.224]	[0.250]	[0.537]	[0.555]	[0.025]	[0.027]	[0.060]	[0.062]
Observations	39,583	33,390	6,193	5,866	68,460	60,202	8,258	7,874
Adjusted R^2	0.674	0.675	0.670	0.662	0.389	0.382	0.427	0.410
Industry-time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Statutory country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table reports the results of estimating Equation 4 where the dependent variable is $log(CO_2)$ in Columns (1) to (4) and *Disclosure* in Columns (5) to (8). *Disclosure* is a variable equal to one when a firm publishes carbon emissions and zero otherwise. *IO* is a variable that measures the percentage of institutional ownership by euro area investors. *IO home* is a variable that measures the percentage of institutional ownership by euro area investors in their home country. All estimations include industry × time and statutory country fixed effects. Appendix Table A.1 provides variable definitions. Standard errors are clustered at the stock level and are reported in parentheses and ***, **, * correspond to the 1%, 5%, and 10% level of significance.

Table 7: Carbon emissions and French Article 173

	(1)	(2)	(3)	(4)
High French IO dummy	0.440***	0.447***	−0.082	−0.072
	[0.088]	[0.088]	[0.064]	[0.064]
POST × High French IO dummy	−0.018	−0.014	−0.025	−0.024
	[0.031]	[0.032]	[0.024]	[0.025]
POST × FR × High French IO dummy		−0.448***		−0.759***
		[0.110]		[0.187]
FR × High French IO dummy		−3.358***		−2.993*
		[0.856]		[1.583]
log(Firm size)			0.196***	0.197***
			[0.045]	[0.045]
B/M			0.017	0.016
			[0.051]	[0.051]
ROE			−0.005***	−0.005***
			[0.002]	[0.002]
Leverage			0.377**	0.376**
			[0.186]	[0.186]
Invest/A			3.068***	3.092***
			[0.982]	[0.982]
Log(PPE)			0.705***	0.705***
			[0.043]	[0.043]
Constant	12.005***	12.112***	−0.826***	−0.734**
	[0.056]	[0.060]	[0.310]	[0.314]
Observations	30,760	30,760	29,034	29,034
Adjusted R^2	0.354	0.355	0.666	0.667
Industry-time FE	Yes	Yes	Yes	Yes
Statutory country FE	Yes	Yes	Yes	Yes

This table reports the results of estimating Equation 5 where the dependent variable is $log(CO_2)$. *POST* is defined as an indicator variable equal to one from 2016 onwards and zero otherwise. *FR* is a dummy variable equal to one when the statutory country associated with a stock is France and *High French IO* is a dummy variable equal to one when French institutional investment is above the median in 2015 and zero otherwise. All estimations include industry × time and statutory country fixed effects. Appendix Table A.1 provides variable definitions. Standard errors are clustered at the investor level and are reported in parentheses and ***, **, * correspond to the 1%, 5%, and 10% level of significance.

Table 8: Reporting carbon emissions and French Article 173

	(1)	(2)	(3)	(4)	(5) Fr.IO >0.5%	(6) Fr.IO >0.5%	(7) Fr.IO >3%	(8) Fr.IO >3%
High French IO	0.213***	0.211***	0.069***	0.069***	0.044**	0.041**	0.004	−0.009
	[0.009]	[0.009]	[0.010]	[0.010]	[0.017]	[0.017]	[0.023]	[0.023]
POST × High French IO	0.029***	0.035***	0.015*	0.015*	0.053***	0.057***	0.052***	0.067***
	[0.006]	[0.006]	[0.008]	[0.008]	[0.015]	[0.016]	[0.019]	[0.021]
POST × FR × High French IO		−0.002		0.041		0.207**		0.265***
		[0.018]		[0.057]		[0.081]		[0.080]
FR × High French IO		−0.072***		0.069*		0.010		0.068
		[0.019]		[0.038]		[0.047]		[0.058]
POST × FR		−0.055***		−0.031		−0.244***		−0.327***
		[0.015]		[0.050]		[0.076]		[0.072]
log(Firm size)			0.094***	0.094***	0.102***	0.102***	0.101***	0.101***
			[0.004]	[0.004]	[0.006]	[0.006]	[0.006]	[0.006]
B/M			−0.038***	−0.038***	−0.067***	−0.067***	−0.071***	−0.071***
			[0.005]	[0.005]	[0.008]	[0.008]	[0.010]	[0.010]
ROE			0.000	0.000	−0.000	−0.000	−0.000	−0.000
			[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Leverage			−0.096***	−0.096***	−0.140***	−0.140***	−0.118***	−0.119***
			[0.021]	[0.021]	[0.032]	[0.032]	[0.033]	[0.033]
Invest/A			−0.031	−0.030	0.018	0.021	0.174	0.184
			[0.095]	[0.095]	[0.155]	[0.155]	[0.153]	[0.152]
Log(PPE)			0.030***	0.030***	0.030***	0.030***	0.020***	0.019***
			[0.003]	[0.003]	[0.005]	[0.005]	[0.005]	[0.005]
Constant	0.161***	0.166***	−1.385***	−1.387***	−1.420***	−1.417***	−1.328***	−1.328***
	[0.005]	[0.004]	[0.032]	[0.032]	[0.045]	[0.045]	[0.055]	[0.053]
Observations	82,170	82,170	50,602	50,602	12,855	12,855	6,768	6,768
Adjusted R^2	0.190	0.190	0.394	0.394	0.492	0.492	0.545	0.546
Industry-time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Statutory country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table reports the results of estimating Equation 5. Columns (1) to (4) present results for the full sample, Columns (5) and (6) report results for a sample with French institutional ownership larger than 0.5% and Columns (7) and (8) present results for a sample with French institutional ownership larger than 3%. The dependent variable is *Disclosure*, an indicator variable equal to one when a firm discloses its carbon emissions and zero otherwise. *POST* is defined as an indicator variable equal to one from 2016 onwards and zero otherwise. *FR* is a dummy variable equal to one when the statutory country associated with a stock is France and *High French IO* is a dummy variable equal to one when French institutional investment is above the median in 2015 and zero otherwise. All estimations include industry × time and statutory country fixed effects. Appendix Table A.1 provides variable definitions. Standard errors are clustered at the investor level and are reported in parentheses and ***, **, * correspond to the 1%, 5%, and 10% level of significance.

Table 9: Cross-section of stock-level excess returns

	(1) Full	(2) Full	(3) Foreign	(4) EMU	(5) Foreign	(6) EMU
log(Carbon/sales)	0.039		0.059*	−0.075		
	[0.032]		[0.035]	[0.084]		
log(Carbon)		0.077**			0.104***	−0.068
		[0.033]			[0.035]	[0.085]
log(Sales)		0.358***			0.362***	0.280
		[0.072]			[0.077]	[0.183]
log(Firm size)	−0.418***	−0.720***	−0.417***	−0.345**	−0.737***	−0.496***
	[0.052]	[0.072]	[0.056]	[0.136]	[0.076]	[0.188]
B/M	1.662***	1.706***	1.706***	1.292***	1.750***	1.318***
	[0.097]	[0.099]	[0.106]	[0.197]	[0.108]	[0.203]
Leverage	−2.082***	−2.010***	−2.022***	−1.918**	−1.986***	−1.699**
	[0.287]	[0.289]	[0.304]	[0.834]	[0.305]	[0.832]
Momentum	7.777***	8.042***	7.579***	13.884**	7.842***	14.119**
	[2.276]	[2.280]	[2.434]	[6.217]	[2.438]	[6.203]
Invest/A	−3.445**	−2.984*	−3.936**	2.754	−3.423**	2.932
	[1.615]	[1.622]	[1.695]	[5.222]	[1.704]	[5.235]
Log(PPE)	−0.063	−0.154***	−0.053	−0.150	−0.152***	−0.195
	[0.048]	[0.050]	[0.052]	[0.141]	[0.054]	[0.144]
Beta	0.166*	0.151*	0.130	0.196	0.113	0.196
	[0.088]	[0.089]	[0.096]	[0.227]	[0.096]	[0.227]
Volatility	−0.002	−0.002	−0.002	8.466*	−0.002	8.449*
	[0.004]	[0.004]	[0.004]	[4.856]	[0.004]	[4.859]
ROE	−0.006*	−0.010***	−0.010**	0.036***	−0.014***	0.034***
	[0.004]	[0.004]	[0.004]	[0.010]	[0.004]	[0.010]
Constant	11.095***	13.839***	10.305***	11.949***	13.217***	12.988***
	[0.576]	[0.704]	[0.614]	[2.102]	[0.745]	[2.279]
Observations	224,164	224,164	199,954	24,210	199,954	24,210
Adjusted R^2	0.205	0.205	0.198	0.315	0.198	0.315
Year-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Statutory country FE	Yes	Yes	Yes	Yes	Yes	Yes
N countries	73	73	63	10	63	10
N stocks	9864	9864	8777	1089	8777	1089

This table reports the results of estimating Equation 6 where the dependent variable is stock excess returns. Columns (1) and (2) show results for the full sample of stocks. Columns (3) and (5) show results for non-euro area stocks and Columns (4) and (6) show results for euro area stocks. Appendix Table A.1 provides variable definitions. All estimations include year-quarter fixed effects, industry fixed effects and country fixed effects. *N stocks* indicates the number of stocks in the sample. Standard errors are clustered at the stock level and are reported in parentheses and ***, **, * correspond to the 1%, 5%, and 10% level of significance.

Table 10: Portfolio excess return regressions

	(1) Full	(2) Home	(3) Foreign	(4) Full	(5) Full	(6) Home	(7) Foreign
log(CFP)	0.862**						
	[0.347]						
log(CFP home)		0.286					
		[0.274]					
log(CFP foreign)			0.535**				
			[0.249]				
log(CFP constant Carbon/sales)				1.052**			
				[0.449]			
log(Carbon)					0.424		
					[0.278]		
log(Carbon home)						0.030	
						[0.165]	
log(Carbon foreign)							0.447*
							[0.226]
Home bias	−1.031			−1.001	−0.258		
	[1.058]			[1.091]	[1.137]		
log(Holdings)	−0.317*			−0.320*	−0.361**		
	[0.178]			[0.175]	[0.174]		
log(Holdings home)		−0.569**				−0.523**	
		[0.237]				[0.242]	
log(Holdings foreign)			−0.030				−0.070
			[0.188]				[0.184]
Mkt - RF	0.911***	0.830***	0.915***	0.907***	0.908***	0.828***	0.916***
	[0.014]	[0.024]	[0.015]	[0.013]	[0.013]	[0.023]	[0.015]
SMB	0.251***	0.464***	0.102***	0.264***	0.263***	0.472***	0.104***
	[0.030]	[0.036]	[0.027]	[0.030]	[0.031]	[0.036]	[0.028]
HML	0.100***	0.128***	0.014	0.095***	0.098***	0.127***	0.014
	[0.026]	[0.036]	[0.017]	[0.026]	[0.026]	[0.036]	[0.016]
WML	−0.035	−0.048	−0.057**	−0.041*	−0.040*	−0.051	−0.058**
	[0.024]	[0.035]	[0.027]	[0.024]	[0.023]	[0.035]	[0.027]
Constant	2.522	10.365**	−2.570	1.542	1.261	10.429*	−5.877
	[5.046]	[5.025]	[4.535]	[5.151]	[6.491]	[5.521]	[5.661]
Observations	2,376	2,375	2,372	2,376	2,376	2,376	2,372
Adjusted R^2	0.758	0.615	0.813	0.758	0.757	0.615	0.812
Holder area × Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table reports the results of estimating Equation 7. All explanatory variables except the Market factor and Fama-French factors are lagged by one period. Columns (1), (4) and (5) provide estimations for the total portfolio, Columns (2) and (6) provide estimations for the home subportfolio and Columns (3) and (7) present estimates for the foreign subportfolio. Column (4) provides estimations for the total portfolio where the mean of carbon/sales over time is taken for each firm in the calculation of CFP. The control variable *log(Holdings)* indicates the size of each (sub)portfolio. Appendix Table A.1 provides variable definitions. All estimations include investor fixed effects, where investor is a holder-country-holder-sector combination. Standard errors are clustered at the investor level and are reported in parentheses and ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively.

Appendix A Variable definitions

Table A.1: Variable definitions

Variable	Definition
Panel A: Portfolio analyses	
Carbon footprint (*CFP*)	CFP is defined in Equation 1 and measured in terms of tonnes of CO_2 per millions euros of sales.
Carbon	Portfolio-weighted Scope 1 and Scope 2 carbon emissions, measured in tonnes
Home bias	The fraction of the portfolio defined in home stocks minus the fraction of the world portfolio that is composed of home stocks.
Industry bias global	Following Choi et al. (2017), the absolute difference between actual industry weights and global market-value industry weights of investor i at time t, divided by two to scale from zero to one.
Active share	Defined at the stock-level as the sum of absolute difference between the portfolio weight in a stocks and its weight in the world portfolio.
CFP home benchmark	Value-weighted average of holder area $Carbon/sales$ based on market values of the respective stocks from a certain holder area. Portfolio weights are adjusted quarterly.
CFP world benchmark	Value-weighted average of $Carbon/sales$ of all world-wide stocks in the sample. Portfolio weights are adjusted quarterly.
Total holdings (bln)	Defined as the total size of portfolio of investor i at time t, measured in billions of euro's.
B/M	The portfolio-weighted book-to-market ratio winsorized at 2.5%.
ROE	The portfolio-weighted return on equity measured as a percentage and winsorized at 2.5%.
Leverage	Portfolio-weighted leverage ratio, measured as the ratio of book value of total debt to book value total assets, winsorized at 2.5%.
Invest/A	Portfolio-weighted CAPEX divided by the book value of assets and winsorized at 2.5%.
log(PPE)	Portfolio-weighted natural logarithm of property, plant and equipment.
Excess returns	The portfolio's value-weighted returns minus the risk-free rate as defined by Fama-French.
log(CFP constant Carbon/sales)	The portfolio-weighted sum of Carbon/sales, where Carbon/sales is held constant by taken its mean over the sample period.

Table A.1: Variable definitions (continued)

Variable	**Definition**
log(CFP home)	Natural logarithm of CFP of the home subportfolio, reweighted such that weights sum to one.
log(CFP foreign)	Natural logarithm of CFP of the foreign subportfolio, reweighted such that weights sum to one.
Mkt − RF	The Fama-French quarterly return on the value-weighted stock portfolio of developed markets minus the risk-free rate.
SMB	The quarterly return on the portfolio long small-cap stocks and short large cap stocks.
HML	The quarterly return on the portfolio long value stocks and short growth stocks.
WML	The monthly return on the portfolio long 12-month stock winners and short 12-month past losers.
NACE industries	We include the following industry categories based on NACE two digit categories: B. Mining and quarrying; C1. Petrochemical manufacturing; C2. Pharmaceutical manufacturing; C3. Other manufacturing; D. Electricity, gas, steam; E. Water supply; sewerage, waste management; F. Construction; G. Wholesale and retail trade; H. Transportation and storage; I. Accommodation and food service activities; J. Information and communication; K. Financial and insurance activities; L. Real estate activities; M. Professional, scientific and technical activities; Z. Other. Industry Z. 'Other' is created and consists of the following industries with limited stock market presence: A. 'Agriculture, forestry and fishing', N. Administrative and support service activities, O. 'Public administration and defence; compulsory social security', P. 'Education', Q. 'Human health and social work activities', R. Arts, entertainment and recreation and S. 'Other service activities'.
Panel B: Ownership analyses	
log(Hold)	The natural logarithm of ownership.
Ownership	The euro value of a stock held by a holder-area-holder-sector (investor) at time t.
POST	An indicator variable equal to one from 2016Q1 onwards and zero otherwise.
FRO	An indicator variable equal to one for French owners and zero otherwise.

Table A.1: Variable definitions (continued)

Variable	**Definition**
log(Carbon/sales)	The natural logarithm in terms of tonnes of CO_2 per millions euros of sales.
Home stock dummy	An indicator variable equal to one if the holder country is equal to the statutory country associated with the stock, and zero otherwise.
Log(Carbon)	The natural logarithm of carbon emissions in terms of tonnes of CO_2
log(Sales)	The natural logarithm of total sales in euros
Dirty industry dummy	Indicator variable equal to one when a stock belongs to one of the NACE two industries and zero otherwise: B. Mining and Quarrying, C1. Petrochemical manufactoring and D. Electricity, gas and steam.
log(MV)	The natural logarithm of stock total market value in euros
log(Firm size)	The natural logarithm of firms' total assets.
Inverse of price	The inverse of a firm's share price measured at the end of year-quarter t.
Momentum	The rolling average of twelve month stock returns, measured at the end of each year-quarter t and winsorized at 0.5%.
B/M	The stock book-to-market ratio winsorized at 2.5%.
Beta	The CAPM beta of a firm in year-quarter t, calculated using daily return data and winsorized at 0.5%.
Volatility	The rolling standard deviation of monthly stock returns, measured at the end of each year-quarter t and winsorized at 0.5%.
Volume	Daily trading volume in billions of euros over each year-quarter t.
Panel C: Stock-level variables	
log(CO_2)	the natural logarithm of Scope 1 and Scope 2 carbon emissions, taking into account only the (raw) emissions as reported by firms themselves
Disclosure	Dummy variable equal to one when firms report Scope 1 and Scope 2 carbon emissions and zero otherwise
IO	The percentage of institutional ownership by euro area investors
IO home	The percentage of institutional ownership by euro area investors in their home country
High French IO dummy	Dummy variable equal to one when French institutional investment is above the median in 2015 and zero otherwise
POST	Indicator variable equal to one from 2016 onwards and zero otherwise
FR	An indicator variable equal to one when the statutory country associated with a stock is France and zero otherwise

Table A.1: Variable definitions (continued)

Variable	**Definition**
Excess returns	The portfolio's value-weighted returns minus the risk-free rate as defined by Fama-French.
Home stock dummy	Indicator variable equal to one when the statutory country is one of the 10 euro area holding areas in our sample and zero otherwise.
log(Carbon/sales)	The natural logarithm in terms of tonnes of CO_2 per millions euros of sales.
log(Carbon)	The natural logarithm of carbon emissions in terms of tonnes of CO_2
log(Sales)	The natural logarithm of total sales in euros
Momentum	The rolling average of twelve month stock returns, measured at the end of each year-quarter t and winsorized at 0.5%.
log(Firm size)	The natural logarithm of total assets measured in euros.
B/M	Book-to-market ratio: the ratio of book value of equity to market value of equity, winsorized at 2.5%.
ROE	Return on equity measured as net income as a percentage of total equity
Leverage	The ratio of book value of total debt to book value total assets, winsorized at 2.5%.
Invest/A	CAPEX divided by the book value of assets, winsorized at 2.5%.
log(PPE)	Natural logarithm of property, plant and equipment.
Beta	The CAPM beta of a firm in year-quarter t, calculated using daily return data and winsorized at 0.5%.
Volatility	The rolling standard deviation of monthly stock returns, measured at the end of each year-quarter t and winsorized at 0.5%.

This table provides a definition for the variables used in the regression analyses.

Appendix B Additional analyses and robustness checks

Table B.1: Home bias and portfolio carbon emissions

	(1)	(2)	(3)	(4)	(5)
Home bias	0.616**	0.747**	0.734**	−3.564**	1.857
	[0.283]	[0.304]	[0.304]	[1.593]	[4.561]
log(Sales)	0.627***	0.469***	0.459***	0.422***	0.421***
	[0.117]	[0.128]	[0.126]	[0.125]	[0.127]
Industry bias global		−1.654***	−1.665***	−1.723***	−1.708***
		[0.416]	[0.415]	[0.408]	[0.405]
Active share		0.316	0.329	0.268	0.196
		[0.665]	[0.665]	[0.656]	[0.639]
log(Carbon home benchmark)			0.070	−0.045	−0.059
			[0.048]	[0.047]	[0.046]
log(Carbon world benchmark)			1.083***	1.044***	1.237***
			[0.125]	[0.124]	[0.178]
Home bias × log(Carbon home benchmark)				0.283***	0.323***
				[0.098]	[0.105]
Home bias × log(Carbon benchmark)					−0.386
					[0.316]
log(Holdings)		−0.009	−0.006	0.004	0.008
		[0.067]	[0.068]	[0.068]	[0.069]
B/M		−0.104	−0.113	−0.124	−0.148
		[0.195]	[0.192]	[0.191]	[0.182]
ROE		−0.008	−0.008	−0.010	−0.009
		[0.010]	[0.010]	[0.010]	[0.010]
Leverage		−1.996**	−1.961**	−1.879**	−1.899**
		[0.786]	[0.792]	[0.814]	[0.823]
Invest/A		3.466	3.419	3.954	3.185
		[3.884]	[3.826]	[3.663]	[4.001]
Log(PPE)		0.094***	0.090***	0.088***	0.091***
		[0.032]	[0.032]	[0.032]	[0.032]
Constant	9.060***	10.387***	−7.790***	−5.218**	−8.066**
	[1.221]	[1.494]	[2.381]	[2.443]	[3.104]
Observations	2,376	2,376	2,376	2,376	2,376
Adjusted R^2	0.437	0.514	0.517	0.523	0.525
Time FE	Yes	Yes	Yes	Yes	Yes
Country × Sector FE	Yes	Yes	Yes	Yes	Yes

This table reports the results of estimating Equation 1 where the dependent variable is the natural logarithm of portfolio carbon emissions, which is the portfolio-weighted average of firm's Scope 1 and Scope 2 carbon emissions. All estimations include holder country × holder sector (i.e. investor) fixed effects. Appendix Table A.1 provides variable definitions. Standard errors are clustered at the investor level and are reported in parentheses and ***, **, * correspond to the 1%, 5%, and 10% level of significance.

Table B.2: Jensen's alpha's CFP- and Carbon-sorted portfolios

	(1) Home	(2) Foreign	(3) Total
Panel A: CFP quartiles			
Low	−0.054	−0.131	−0.049
	[0.224]	[0.166]	[0.166]
2	−0.225	0.058	−0.074
	[0.229]	[0.127]	[0.145]
3	−0.004	0.035	0.023
	[0.252]	[0.109]	[0.162]
High	−0.232	0.074	−0.148
	[0.346]	[0.122]	[0.285]
High–Low	−0.177	0.206*	−0.099
	[0.240]	[0.106]	[0.193]
Panel B: Carbon quartiles			
Low	−0.020	−0.157	−0.179
	[0.228]	[0.158]	[0.241]
2	−0.188	0.159	−0.030
	[0.279]	[0.118]	[0.169]
3	−0.194	0.054	0.091
	[0.255]	[0.118]	[0.153]
High	−0.111	−0.024	−0.129
	[0.278]	[0.134]	[0.192]
High–Low	−0.091	0.133	0.051
	[0.174]	[0.108]	[0.171]

This table reports Jensen's alphas from home, foreign and total subportfolios sorted on portfolio carbon footprint quartiles (panel A) and portfolio carbon emission quartiles. Each quarter we sort value-weighted portfolios of all holder areas and holder sectors into four quartiles, ranging from the lowest carbon (footprint) (1) to highest carbon (footprint) (4). Subsequently we hold these portfolios for 3 months and compute average returns within each quartile bucket. We rebalance portfolios each quarter based on carbon (footprint). To compute Jensen's alpha's we regress excess returns of each quartile portfolio on a constant, a market factor and the Fama-French developed market factors in Equation 7. All returns are measured in US dollars, consistent withe the Fama-French factors. Standard errors are reported in parentheses and ***, **, * and correspond to the 1%, 5%, and 10% level of significance.

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