Journal of Asset Management
https://doi.org/10.1057/s41260-024-00351-6

ORIGINAL ARTICLE

Do ESG fund managers pump and dump the stocks in their portfolios? European evidence

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Revised: 13 December 2023 / Accepted: 17 February 2024

Abstract
We investigate portfolio pumping around quarter-ends by ESG equity mutual funds domiciled in the largest European markets in sustainable investments, i.e., the UK, France and Germany, for the period from January 2010 to December 2022. We find strong evidence that the UK funds inflate quarter-end returns, with price spikes being stronger at year-ends; nevertheless, the magnitude of price inflation is less than that of their conventional counterparts. On the contrary, results indicate that German and French funds do not engage in portfolio pumping. The COVID-19 pandemic strengthened the propensity of fund managers to cause a profound artificial enhancement to the performance of the investment portfolio. Further analysis shows that portfolio pumping is more prominent among the worst-performing funds, funds that charge investors with lower fees and achieve a poor ESG rating. However, managers that pump fund returns do not attract significantly more flows. Our results have produced valuable insights for regulators and investors participating in ESG markets, highlighting the necessity for a rigorous surveillance of the UK ESG equity market.

Keywords ESG equity mutual funds · Portfolio pumping · Turn-of-quarter effect · ESG score · COVID-19

JEL Classification G11 · G12 · G23

Introduction

Climate change is an imminent and critical global issue with long-term implications for the sustainable development of all countries. Investors' demands for climate and other sustainable information have soared in recent years, showing that an increasing number of investors use these criteria in order to screen their potential investments. ESG criteria refer to environmental standards (adaptation of environmental-friendly practices), social ones (promotion of ethical and social conscious themes) and finally governance standards (usage of accurate and transparent accounting methods to ensure accountability) which a company must adhere to. ESG investing is a rapidly rising trend in finance (Koutsokostas and Papathanasiou 2017; Wong et al. 2021; De Jong and Rocco 2022), surpassing $40 trillion of assets under management globally in 2022, according to Global Sustainable Investment Association[1]. Europe is one of the leading regions in ESG concentration (Papathanasiou et al 2022; Samitas et al. 2022), with asset under management poised to reach €9 trillion by 2025[2]. In particular, ESG funds will constitute over 50% of total European mutual fund assets, up from 37% in end-2021, according to PwC Luxembourg research.

A common practice of fund managers is to artificially inflate the performance of the investment portfolio, a practice known as portfolio pumping or "painting the tape," which is considered by market regulators to be illegal. This is typically done by purchasing additional stocks the fund

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[1] More information can be found on: https://www.bloomberg.com/company/press/esg-may-surpass-41-trillion-assets-in-2022-but-not-without-challenges-finds-bloomberg-intelligence/

[2] Further details are available on: https://www.funds-europe.com/news/european-esg-assets-to-reach-9-trillion-by-2025

Published online: 20 March 2024

already holds, at an inflated price, during the last days of a quarter, in order to augment the value of the existing positions and report better fund performance. The improved fund return reported will attract more flows, increase assets under management and, eventually, compensate fund managers (Ouyang and Cao 2020).

The existing literature shows that fund managers do involve in such trading activities and that price spikes are higher at year-ends rather than quarter-ends (Carhart et al. 2002; Bernhardt and Davies 2005; Gallagher et al. 2009; Agarwal et al. 2011; Ben-David et al. 2013; Lee et al. 2014; Li and Wu 2019; Shackleton et al. 2020). As concerns the characteristics of funds that distort the performance of their managed portfolios, the results provided by the literature are not clear, as Ben-David et al. (2013), Lee et al. (2014) and Li and Wu (2019) suggest that marking up is induced by top performing funds, whereas Gallagher et al. (2009) and Shackleton et al. (2020) show that these practices are pervasive among the worst-performing funds. However, no similar investigation has been conducted for ESG mutual funds. Thus, we intend to fill this gap in the literature, by examining the portfolio pumping activities of ESG fund managers for the first time.

In this paper, we explore quarter-end spikes in returns of funds that conform to ESG criteria in the leading European countries in sustainable assets, i.e., the UK, France and Germany, for the period 1/1/2010–12/31/2022. We choose the aforementioned markets as they are among: a) the largest markets in sustainable investments[3]; b) the leading markets on ESG concentration[4] (higher proportion of ESG assets compared to non-ESG[5]) and c) the first to impose mandatory climate-related disclosures for listed companies[6]. We use Bernhardt and Davies (2005) measure as a proxy of portfolio pumping and detect its presence by conducting fixed effects panel regression, congruent with Li and Wu (2019), for each region and for each quarter. We also examine whether the trend for price inflation is more pronounced among ESG funds in relation to their conventional peers. The rationale behind this approach is to document whether significant differences exist, since conventional funds do not take ESG criteria into consideration when making investment decisions. Furthermore, as COVID-19 had a significant impact on asset price volatilities, we investigate if the manipulating trading strategies were affected during the coronavirus pandemic. For the robustness of our results, we execute a two-stage regression in the spirit of Carhart et al. (2002) to further decipher whether performance reverses are stronger around quarter-ends or year-ends. Finally, we perform panel regression to shed light on the characteristics of funds that are more prone to portfolio pumping activities, in order to inform investors about funds that purposefully inflate securities' prices.

Thus, our study aims to provide sufficient evidence to answer the following research questions:

RQ1: Do ESG equity fund managers pump and dump the stocks included in their portfolios? Is portfolio pumping more prevalent among ESG funds or non-ESG funds?

RQ2: Was portfolio pumping during the infectious disease strengthened or weakened?

RQ3: Is price manipulation stronger at quarter-ends or year-ends?

RQ4: What types of funds engage in gaming behavior?

The contribution of our study lies in the following aspects. To the best of our knowledge, this study is the first to examine portfolio pumping in the ESG mutual fund industry. As "G" in ESG refers to governance factors that include business ethics and fair dealings with stakeholders, it is of great interest to examine whether ESG fund managers adhere to fair and accurate disclosure of quarter-end portfolio values. Our initiative is motivated by the possibility that these types of ethical investing may engage in improper strategies that provide investors with misleading indications of their relative performance. Documenting evidence of portfolio pumping is imperative for policy makers and regulators to shape appropriate policies in order to reduce its magnitude. In addition, reporting unusual end-of-quarter NAV price jumps is crucial for investors as it assists them in having an accurate impression of their portfolio performance. Second, by investigating the determinants of portfolio pumping, we are providing ESG investors with explicit schemes in order to avoid funds that deliberately manipulate their portfolios.

The remainder of this paper is organized as follows. In Section "Literature review", a literature review on portfolio pumping is included. A description of the data and techniques used in this study is presented in Section "Data and methodology". The empirical findings and conclusions of our research are reported in Sections "Empirical results" and "Conclusions", respectively.

[3] For further information please see: https://www.statista.com/statistics/892951/european-sustainable-fund-net-assets-by-country/

[4] Find out more on: https://www.morningstar.co.uk/uk/news/211424/which-countries-lead-on-esg.aspx

[5] France had overtaken the second place in the rankings and the UK ranked 13th out of the 48 leading countries on ESG according to Morningstar Direct during the first quarter of 2021.

[6] France was the first European country to move toward a system of legally binding standards, notably with Law of July 12, 2010, on the national commitment to the environment, which requires large private and public entities to disclose at least every 3 years the amount of their greenhouse gas emissions, and to describe the actions planned to reduce them. Please see https://corpgov.law.harvard.edu/2022/11/01/esg-trends-what-the-boards-of-all-companies-should-know-about-esg-regulatory-trends-in-europe/

Literature review

The body of the literature regarding portfolio pumping is not extensive. The majority of the studies indicate that portfolio pumping is existent and more prominent around year-ends rather than quarter-ends. Carhart et al. (2002) were the first to provide proof that fund managers inflate portfolio prices at quarter's end by making last minute purchases of stocks they already hold. They document that price manipulation is significantly higher at the end of the year, ranging from 0.5% for large-cap funds to over 2% for small-cap funds annually, while no effect at month-ends that do not coincide with quarter-ends is found. Hillion and Suominen (2004) also report evidence of price manipulation in order for a better performance to be documented. Fund managers' incentives to manipulate asset prices at the end of the quarter are so strong that their transactions have a significant impact even on the aggregate market returns (Bernhardt and Davies 2005). Even after adjusting for risk in the time series and cross-section, Agarwal et al. (2011) find the returns during December to be significantly higher than returns during the rest of the year for funds with high incentives and more opportunities to inflate returns. Funds strategically steer their returns upward in order to charge larger fees, by underreporting returns earlier in the year. However, this excessive trading may erode long-term fund performance, as suggested by Bhattacharyya and Nanda (2013).

Another strand of the literature focuses on whether winner or loser funds exhibit stronger portfolio pumping patterns. Ben-David et al. (2013) highlight stock price manipulation by some hedge funds on crucial reporting dates. The final day of the quarter in their study witnessed abnormal returns of 0.30% for stocks in the top quartile of hedge fund holdings, followed the next day by a reversal of 0.25%. The final few minutes of trading are when a sizable portion of the return is achieved. They provide additional evidence in support of manipulation by the analysis of intraday volume and order imbalance. For funds with greater incentives to outperform their peers, these trends are more pronounced. Lee et al. (2014) also explore the existence of portfolio pumping in the Korean equity fund market and outline the elements that support this practice. Their empirical findings show that fund managers manipulate fund performance by pumping up their portfolios at year-ends, when their accomplishments are evaluated, and this manipulation is stronger for small funds and those with higher past returns. In addition, portfolio pumping is more frequent in the products of small or foreign asset management firms, and fund managers are tempted to manipulate prices of holdings characterized by low liquidity. In addition, Li and Wu (2019) examine portfolio pumping from a performance-based perspective by utilizing information from 60 Chinese mutual fund companies on compensation policies. They show that pumping is more widespread among funds that rank at the top performance distribution points and at crucial cutoffs that companies set to evaluate the bonus amounts for the managers. Their analysis indicates that the flow-performance relationship described in earlier studies is not the driving force behind portfolio pumping, but rather performance ranking.

On the other hand, Gallagher et al. (2009) and Shackleton et al. (2020) show that portfolio pumping is more profound among funds that underperform relatively to their peers. Gallagher et al. (2009) find significantly higher abnormal returns on the last day of quarter-ends, especially at financial year-ends. They suggest that gaming trades occur mostly among smaller and less liquid stocks which are easier to manipulate. They report that poor-performing managers are most likely to engage in gaming behavior in order to retain their jobs. Similarly, Shackleton et al. (2020) analyze price inflation practices by fund managers in China and highlight that equity funds artificially enhance portfolio performance at quarter-ends, particularly at year-ends. They further point out that the worst-performing managers experience more severe NAV inflation and stocks in which fund managers have greater shares show a more distinct pattern of price inflation around quarter- and year-ends than other stocks. Finally, Duong and Meschke (2020) investigate how regulatory scrutiny of portfolio pumping affected the way US mutual funds trade. They prove that the imposition of fines and the subsequent reputational harm has resulted in a decline in last minute price spikes around quarter-ends. These declines are largest in magnitude for small-cap and better-performing funds.

Data and methodology

Data

The dataset of our empirical study is obtained from LSEG's Lipper Database, including actively managed equity mutual funds that comply with the ESG criteria, since passive funds replicate a market index, investing in the constituents of the underlying index in the same proportion as they are present in the index. We select funds operating in the UK, France and Germany, because not only do these markets have the highest assets in sustainable funds in the continent, but also they were one of the first to require of listed corporations to disclose information relating to climate change. Our sample consists of funds that invest domestically and do not hold positions in foreign stocks to a great extent. Moreover, we take into account funds that have FTSE 100, CAC 40 and DAX 30 as a primary investment benchmark when they are

Table 1 Descriptive statistics of fund characteristics/ESG funds

	UK		France		Germany	
	Mean	Median	Mean	Median	Mean	Median
No. of funds	198		50		23	
Fund TNA	507.71	177.87	269.92	77.09	814.85	152.20
Fund age	289.56	246.12	266.64	232.80	429.72	399.60
Expense ratio (%)	1.23	1.31	2.10	1.83	1.50	1.47
Cash holdings (%)	1.48	1.08	1.55	0.88	1.59	0.80
Normalized fund flow (%)	0.94	− 0.66	0.27	− 0.58	0.30	− 0.25
Number of shares	67.08	48	51.24	42	48.84	44
ESG score	68.22	69.27	74.34	76.30	74.05	76.97

The table above provides the descriptive statistics of fund characteristics of the sampled ESG equity mutual funds. Fund characteristics include fund TNA, fund age, expense ratio, cash holdings, normalized fund flow, number of shares included in the portfolio and ESG score. *Fund TNA* is the average of the fund's total net assets throughout the sample period (in €million). *Fund age* is defined as the time (months) that spans from the fund's launch date until the end of the sample period. *Expense ratio* is the fund's operating cost relative to its assets. *Cash holdings* is the percentage of cash the fund manager holds in the portfolio. *Normalized fund flow* is defined as the monthly fund flow divided by the fund's TNA at the beginning of the month. *Number of shares* is the number of stocks contained in the portfolio. *ESG score* is the measurement of the fund's performance with respect to Environmental, Social and Governance issues. The table reports the mean and median of each variable time series. For the estimation of cash and stocks included in the portfolios, 3-month portfolio holdings were used throughout the sample period. All data are retrieved from LSEG. The sample period is from January 1, 2010, to December 31, 2022

domiciled in the UK, France and Germany, respectively. The rationale behind this approach is to secure the reliability of our results, as, when a fund tracks multiple benchmarks, it is difficult to detect if there is a spike in fund returns in relation to the benchmark's returns[7]. We remove funds that have less than 2 years of operation throughout the sample period, as it usually requires months for a manager to develop his/her investment plan. We also exclude funds that hold less than 10 stocks in their portfolios, to better capture the portfolio pumping behavior. Therefore, our final sample comprises 271 ESG equity mutual funds, 198 of which are concentrated in the UK, 50 in France and 23 in Germany. Timespan covers the period from January 2010 to December 2022. Thus, it is of great interest to investigate a time period after the dissemination of the study of Carhart et al. (2002) in order to confirm if this phenomenon has been eliminated, as denoted by Duong and Meschke (2020). Appendix 1 provides a full description of the sampled data (asset names with the corresponding identification codes).

In Table 1, the time series averages of cross-sectional mean and median of fund characteristics, including total net assets, fund age, expense ratio, cash holdings, normalized fund flow, number of shares contained in the portfolio and ESG score, are presented. For the estimation of cash and stocks included in the portfolios, 3-month portfolio holdings were used throughout the sample period.

As shown, funds operating in the UK include more stocks in their portfolios and attract more flows. French funds incorporate sustainable assets to a greater extent and have a higher expense ratio. Funds domiciled in Germany are larger in magnitude, older in age and hold more cash in their portfolios. Finally, in most cases, the means of the funds' characteristics are greater than the equivalent medians, indicating a high possibility of the distributions to be right skewed.

Methodology

We investigate portfolio pumping, focusing on ESG funds' NAV anomalies during quarter-ends. We estimate fund abnormal return as follows:

$$ARNAV_{i,t} = RNAV_{i,t} - RMkt_t, \tag{1}$$

where $ARNAV_{i,t}$ is the abnormal return of fund i on day t, $RNAV_{i,t}$ is the raw return of fund i on day t and $RMkt_t$ is the value-weighted market[8] return on day t. $RNAV_{i,t}$ is computed through the following formula:

$$RNAVi,t = \frac{NAV_{i,t} - NAV_{i,t-1}}{NAV_{i,t-1}}, \tag{2}$$

[7] We have faced this problem mostly in the case of UK ESG mutual funds. Some funds report over one investment benchmark (f.e. FTSE 250 TR, Numis Smaller Companies Extended and FTSE 100), making it difficult to ensure the comparability of the results.

[8] The return of FTSE 100, CAC 40 and DAX 30 for the UK, French and German markets, respectively.

where $NAV_{i,t}$ and $NAV_{i,t-1}$ are the net asset value per unit share of fund i on day t and $t-1$, respectively, adjusted by share split and dividend.

If fund managers engage in portfolio pumping, we should expect them to exhibit an abnormally high return at the end of the quarter due to placing a large volume of orders for a stock at an inflated bid price. Contrariwise, in the 1st days of the next quarter, the fund's NAV is anticipated to revert, as the manipulation is commonly short-term, and the fund managers will dump the stocks by selling their positions. We select a time span of 6 days around the turn of the quarter, 3 days before the end of the quarter and 3 days after the end of the quarter, and evaluate the pumping and reversal of the fund's abnormal return as a proxy for portfolio pumping.

We measure portfolio pumping as the difference between the quarter-end pumping and the following reversal divided by two, in accordance with Bernhardt and Davies (2005):

$$Blip_{i,T} = \frac{Pump_{i,T} - Reversal_{i,T+1}}{2}, \tag{3}$$

where $Blip_{i,T}$ symbolizes the proxy of portfolio pumping for fund i at the end of quarter T. $Pump_{i,T}$ is the fund i's average abnormal return in the last 3 days of quarter T, and $Reversal_{i,T+1}$ is the fund i's average abnormal return in the first 3 days of quarter $T+1$, which are calculated, respectively, through the following equations:

$$Pump_{i,T} = \frac{ARNAV_{i,T}^{3rdToLastDay} + ARNAV_{i,T}^{2ndToLastDay} + ARNAV_{i,T}^{LastDay}}{3} \tag{4}$$

$$Reversal_{i,T+1} = \frac{ARNAV_{i,T+1}^{1stDay} + ARNAV_{i,T+1}^{2ndDay} + ARNAV_{i,T+1}^{3rdDay}}{3}, \tag{5}$$

where $ARNAV_{i,T}^{3rdToLastDay}$, $ARNAV_{i,T}^{2ndToLastDay}$ and $ARNAV_{i,T}^{LastDay}$ are the fund i's abnormal return on the 3rd-to-last day, 2nd-to-last day and last day of quarter T, respectively. In the same manner, $ARNAV_{i,T+1}^{1stDay}$, $ARNAV_{i,T+1}^{2ndDay}$ and $ARNAV_{i,T+1}^{3rdDay}$ denote the fund i's abnormal return on the 1st, 2nd and 3rd day of quarter $T+1$, respectively.

To examine whether fund managers inflate the price of shares included in their portfolios at the end of the quarter, we execute the following panel regression, as in Li and Wu (2019):

$$\begin{aligned} ARNAV_{i,t} = {} & \alpha_0 + \alpha_1 Day_t^{3rdToLast} + \alpha_2 Day_t^{2ndToLast} + \alpha_3 Day_t^{Last} + \alpha_4 Day_t^{1st} + \alpha_5 Day_t^{2nd} \\ & + \alpha_6 Day_t^{3rd} + \alpha_7 LogFundTNA_{i,t} + \alpha_8 LogFundAge_{i,t} + f.e. + \varepsilon_{i,t}, \end{aligned} \tag{6}$$

where $ARNAV_{i,t}$ is defined as above, and $Day_t^{3rdToLast}$, $Day_t^{2ndToLast}$ and Day_t^{Last} are dummy variables that are equal to 1 if t is the 3rd-to-last, 2nd-to-last and last day of a quarter, respectively, and 0 otherwise. The dummy variables Day_t^{1st}, Day_t^{2nd} and Day_t^{3rd} are defined analogously, indicating the first 3 days of the next quarter. The control variables encompass fund size and fund age, which the existing literature proves to have a significant effect on fund performance (Chen et al 2004; Pollet and Wilson 2008; Cremers and Petajisto 2009; Massa and Patgiri 2009; Huang et al. 2011). $LogFundTNA_{i,t}$ is the logarithm of the fund i's monthly total net assets. $LogFundAge_{i,t}$ is defined as the logarithm of the total months that span from fund i's launch date until the end of the sample period. We also control for time and fund fixed effects.

We further investigate the existence of portfolio pumping by switching abnormal return data with *Blip* data around the end of the quarter. We replace the *ARNAV* data on the last day of quarter T with *Blip* data, and we delete the *ARNAV* observations for the remaining days around the turn of the quarter (the 3rd- and 2nd-to-last days of the quarter and the 1st, 2nd and 3rd days of the following quarter). Subsequently, we execute the following regression for each country and for each quarter:

$$\begin{aligned} ARNAV_{i,t} = {} & \alpha_0 + \alpha_1 LastDay_t + \alpha_2 LogFundTNA_{i,t} \\ & + \alpha_3 LogFundAge_{i,t} + f.e. + \varepsilon_{i,t}, \end{aligned} \tag{7}$$

where $ARNAV_{i,t}$, $LogFundTNA_{i,t}$ and $LogFundAge_{i,t}$ are defined as above, and $LastDay_t$ is an indicator variable that takes the value of 1 if t is the last day of the quarter and 0 otherwise.

While proceeding with our empirical results, we also explore whether the positive return at the end of the quarter is associated with the negative return at the beginning of the next quarter, by implementing a two-stage regression in the spirit of Carhart et al. (2002). In the first stage, we regress *Pump* values on *Reversal* values for every month of our sample period:

$$Pump_{i,t} = \alpha_{0,t} + \alpha_{1,t} Reversal_{i,t+1} + \varepsilon_{i,t}, \tag{8}$$

In the second-stage regression, we test whether the slope coefficients α_1 obtained from Eq. (8) are significantly lower when t is the last day of a quarter or a year, as follows:

$$\alpha_{1,t} = \beta_0 + \beta_1 QuarterEnd_t + \beta_2 YearEnd_t + \varepsilon_t, \tag{9}$$

where $QuarterEnd_t$ is a dummy variable that is equal to 1 if t is the last day of March, June or September and 0 otherwise. Analogously, $YearEnd_t$ takes the value of 1 if t is the last day of December and 0 otherwise.

Table 2 Summary statistics of portfolio pumping measures/ESG funds

Variable	Mean	Median	Std	Min	Max
Panel A: UK (198 funds)					
RNAV (bp)	2.378	7.490	100.2	− 1232.3	671.4
RMkt (bp)	1.517	5.268	103.1	− 1087.4	905.3
ARNAV (bp)	0.947	2.289	91.8	− 919.2	741.7
Pump (bp)	3.040	2.763	38.7	− 133.9	115.5
Reversal (bp)	− 9.215	− 8.024	35.7	− 112.1	70.5
Blip (bp)	6.127	6.690	28.8	− 79.5	78.9
Panel B: France (50 funds)					
RNAV (bp)	2.728	3.372	118.6	− 1214.6	849.5
RMkt (bp)	2.357	5.650	129.2	− 1227.7	965.9
ARNAV (bp)	0.243	0.536	49.2	− 589.3	574.1
Pump (bp)	1.316	1.290	19.3	− 50.9	59.2
Reversal (bp)	1.148	0.701	21.9	− 63.3	58.4
Blip (bp)	0.084	0.746	14.9	− 37.2	46.3
Panel C: Germany (23 funds)					
RNAV (bp)	2.662	7.086	127.1	− 1228.9	924.7
RMkt (bp)	3.437	7.615	128.1	− 1223.9	1097.6
ARNAV (bp)	− 0.646	1.169	97.1	− 882.9	881.9
Pump (bp)	0.158	2.226	33.4	− 85.4	102.3
Reversal (bp)	− 0.392	− 1.109	34.4	− 98.4	83.7
Blip (bp)	0.275	2.172	28.1	− 74.2	74.6

The table above presents the summary statistics of portfolio pumping measures for the European equity mutual funds for the period from January 2010 to December 2022. The sample consists of funds that adhere to the ESG criteria, domiciled in the UK (Panel A), France (Panel B) and Germany (Panel C), which have a domestic geographical investment focus. *RNAV* is the daily mutual fund raw return, adjusted by dividend and split. *RMkt* is the daily value-weighted market return; the return of FTSE 100, CAC 40 and DAX 30 in Panels A, B and C, respectively. *ARNAV* is the daily fund abnormal return. *Pump* and *Reversal* denote the average abnormal return before and after the turn of a quarter, respectively. *Blip* is the proxy variable for portfolio pumping, estimated as half of the difference between *Pump* and *Reversal*

Finally, we apply the following panel regression to investigate the relation between portfolio pumping and several fund characteristics:

$$Blip_{i,T} = c + \delta_k X_{i,k,T-1} + \varepsilon_{i,t}, \tag{10}$$

where $Blip_{i,T}$ is defined as above (Eq. 3), and $X_{i,k,T-1}$ denotes the fund i's characteristics, which include fund return, fund TNA, age, expense ratio, cash holdings, normalized fund flow, number of shares contained in the portfolio and ESG score. All explanatory variables are lagged by 3 months[9].

Empirical results

ESG portfolio pumping

In Table 2, the summary statistics on the main variables of our study (*RNAV*, *RMkt*, *ARNAV*, *Pump*, *Reversal* and *Blip*) are reported.

As shown, ESG funds based in France and the UK[10] outperform the market's return. The average of funds' NAV per share (*RNAV*) is 2.728 basis points (bp) and 2.378 bp for French and British funds, higher than the value-weighted market return (*RMkt*), which stands at 2.357 bp and 1.517 bp, respectively. On the other hand, ESG funds in Germany underperform, on average, the market. The above findings translate into a positive average abnormal return (*ARNAV*) for funds operating in France ($ARNAV = 0.243$ bp) and the UK ($ARNAV = 0.947$ bp), and a negative one for German funds ($ARNAV = -0.646$ bp). Furthermore, we observe a significant pumping-reversal pattern of portfolio pumping for the UK funds. The average *Pump* value at quarter-end is 3.040 bp, while the average *Reversal* at the beginning of the quarter is −9.215 bp, which results in a *Blip* value of 6.127 bp on average. On the contrary, we do not receive indications of portfolio pumping for French funds, as the *Blip* value is extremely low (0.084 bp), while the *Reversal*

[9] Except ESG score which is lagged by 12 months.

[10] In agreement with Rompotis (2022).

Table 3 Regression results for abnormal returns around quarter-ends/ESG funds

Variable	UK	France	Germany
$Day_t^{3rdToLast}$	3.6144***	1.8409	− 0.8363
	(3.18)	(1.52)	(− 0.66)
$Day_t^{2ndToLast}$	2.4425***	0.9616	0.7581
	(2.03)	(0.77)	(0.59)
Day_t^{Last}	3.0769***	1.1443	0.6179
	(2.71)	(0.91)	(0.49)
Day_t^{1st}	− 7.4753***	1.6508	− 0.1077
	(− 6.58)	(1.34)	(− 0.08)
Day_t^{2nd}	− 7.0925***	− 0.1783	1.2910
	(− 6.24)	(− 0.13)	(1.09)
Day_t^{3rd}	− 13.0219***	1.8339	− 2.3469
	(− 11.45)	(1.51)	(− 1.83)
Log Fund $TNA_{i.t}$	0.1062	0.3513***	0.2318
	(1.17)	(2.13)	(0.64)
Log Fund $Age_{i.t}$	− 0.8553***	− 0.0172	− 0.0035
	(− 3.64)	(− 0.05)	(− 0.02)
Observations	592,103	156,725	67,954
Adj. R^2	0.0036	0.0077	0.0107

The table above presents the results of the panel regression of ESG equity mutual funds' daily abnormal returns on dummy variables demoting 6 days around the turn of the quarter. We execute regression separately for funds domiciled in the UK, France and Germany. The dependent variable is $ARNAV_{i,t}$ which is the fund's i abnormal return on day t. $Day_t^{3rdToLast}$, $Day_t^{2ndToLast}$, Day_t^{Last}, Day_t^{1st}, Day_t^{2nd} and Day_t^{3rd} are all indicator variables representing the 6 days around the turn of the quarter. *Log Fund* $TNA_{i,t}$ is the logarithm of the fund i's total net assets at the end of the prior month. *Log Fund* $Age_{i,t}$ is defined as the logarithm of the total months that span from fund i's launch date until the end of the sample period. We also control for time and fund fixed effects, but results are omitted for brevity purposes; so is the intercept term. T-statistics are given in parentheses

***Statistical significance at 5% level. The sample period is from January 1, 2010, to December 31, 2022

at the beginning of the quarter is positive (1.148 bp). Finally, weak evidence of the occurrence of portfolio pumping is reported for German funds at quarter-ends; however, it is possible that fund managers may inflate the stocks in their portfolios only in year-ends.

Table 3 presents the results of the panel regression described in Eq. 6 which shows the level of abnormal returns around the quarter-end.

In the case of the UK ESG mutual funds, we observe significantly positive abnormal returns in the final 3 days of the quarter, followed by negative abnormal returns in the first 3 days of the next quarter, corroborating evidence of strong portfolio pumping. The coefficients $Day_t^{3rdToLast}$, $Day_t^{2ndToLast}$ and Day_t^{Last} are positive and statistically significant at 5% level, showing that the UK fund managers inflate portfolio prices by approximately 9 bp in the last 3 days of the quarter, with $Day_t^{3rdToLast}$ being the day when the stronger price inflation occurs ($Day_t^{3rdToLast} = 3.6144$). On the other hand, the estimations on Day_t^{1st}, Day_t^{2nd} and Day_t^{3rd} are negative and statistically significant at 5% level, suggesting that fund abnormal returns reverse nearly 28 bp in the 3 following days after the turn of the quarter. Day_t^{3rd} is the day that experiences the highest reversal ($Day_t^{3rd} = -13.0219$). On the contrary, no evidence that managers pump and dump the stocks included in their portfolios are documented for French and German ESG funds, as all the coefficients are statistically insignificant and do not follow a similar pattern. Furthermore, we find that size has a significant positive impact on fund abnormal returns in the case of French funds, whereas age negatively affects the performance of the UK funds.

ESG funds vs conventional funds

We examine the propensity for portfolio pumping among non-ESG funds to assess whether investment strategies differ for ESG funds. Given the large number of conventional funds in circulation during the sample period, we include in the sample through the screening process 300 funds that meet the characteristics of ESG funds to the extent feasible, in particular in terms of total assets under management and the number of securities encompassed in their portfolios. Descriptive statistics of the characteristics of conventional funds and the main variables of the sample are presented in Tables 4 and 5, respectively.

Conventional funds based in France and the UK[11] also perform better than the market index, while the performance of German funds lags the return of DAX 30. This results in an average positive abnormal return of 0.329 bp and 1.038 bp for French and British funds, respectively, and a negative abnormal return for German funds ($ARNAV = -0.697$ bp). German funds do not pump equity prices ($Pump = -0.450$ bp), while French funds' returns do not revert in the 1st days of the next quarter ($Reversal = 1.208$ bp). In contrast, both price inflation ($Pump = 6.415$ bp) and price deflation ($Reversal = -13.583$ bp) are of larger magnitude for the UK conventional funds compared to ESG funds.

The outcomes of the panel regression showing the level of abnormal returns around quarter-ends for the conventional mutual funds in the sample are displayed in Table 6.

Strong portfolio pumping is supported by the highly positive abnormal returns we observe in the last 3 days of the quarter for the UK conventional funds, followed by negative abnormal returns in the first 3 days of the following quarter. The results show that portfolio returns strengthen by around 19 bp at the end of the quarter, double the amount observed in the case of ESG UK funds

[11] In accordance with Bredin et al. (2014).

Table 4 Descriptive statistics of fund characteristics/ conventional funds

	UK		France		Germany	
	Mean	Median	Mean	Median	Mean	Median
No. of funds	200		50		50	
Fund TNA	504.41	164.07	251.49	68.79	816.15	123.38
Fund age	283.58	240.63	260.59	234.50	423.76	393.60
Expense ratio (%)	1.36	1.44	2.19	1.92	1.61	1.58
Cash holdings (%)	1.66	1.26	1.64	0.98	1.72	0.92
Normalized fund flow (%)	0.82	− 0.70	0.38	− 0.49	0.63	− 0.39
Number of shares	69.80	50	53.80	43	46.82	42

The table above provides the descriptive statistics of fund characteristics of the conventional equity mutual funds. Fund characteristics include fund TNA, fund age, expense ratio, cash holdings, normalized fund flow and number of shares included in the portfolio. *Fund TNA* is the average of the fund's total net assets throughout the sample period (in €million). *Fund age* is defined as the time (months) that spans from the fund's launch date until the end of the sample period. *Expense ratio* is the fund's operating cost relative to its assets. *Cash holdings* is the percentage of cash the fund manager holds in the portfolio. *Normalized fund flow* is defined as the monthly fund flow divided by the fund's TNA at the beginning of the month. *Number of shares* is the number of stocks contained in the portfolio. The table reports the mean and median of each variable time series. For the estimation of cash and stocks included in the portfolios, 3-month portfolio holdings were used throughout the sample period. All data are retrieved from LSEG. The sample period is from January 1, 2010, to December 31, 2022

Table 5 Summary statistics of portfolio pumping measures/ conventional funds

Variable	Mean	Median	Std	Min	Max
Panel A: UK (200 funds)					
RNAV (bp)	2.467	7.556	100.6	− 1230.9	672.7
RMkt (bp)	1.517	5.268	103.1	− 1087.4	905.3
ARNAV (bp)	1.038	2.367	91.8	− 917.7	741.5
Pump (bp)	6.415	5.954	20.9	− 25.1	46.3
Reversal (bp)	− 13.583	− 7.987	40.4	− 99.7	41.8
Blip (bp)	9.998	8.765	25.9	− 24.2	61.7
Panel B: France (50 funds)					
RNAV (bp)	2.813	3.443	118.9	− 1210.9	851.5
RMkt (bp)	2.357	5.650	129.2	− 1227.7	965.9
ARNAV (bp)	0.329	0.563	48.2	− 587.4	575.6
Pump (bp)	1.438	1.441	19.5	− 51.5	59.9
Reversal (bp)	1.208	0.865	22.1	− 63.79	58.9
Blip (bp)	0.115	0.841	15.1	− 37.7	46.5
Panel C: Germany (50 funds)					
RNAV (bp)	2.563	6.788	124.9	− 1222.3	914.9
RMkt (bp)	3.437	7.615	128.1	− 1223.9	1097.6
ARNAV (bp)	− 0.697	0.939	98.1	− 865.5	856.9
Pump (bp)	− 0.450	1.324	34.8	− 88.7	107.9
Reversal (bp)	− 0.673	− 1.945	35.6	− 104.4	86.7
Blip (bp)	0.111	1.972	29.1	− 77.1	81.4

The table above presents the summary statistics of portfolio pumping measures for the conventional European equity mutual funds for the period from January 2010 to December 2022. The sample consists of funds domiciled in the UK (Panel A), France (Panel B) and Germany (Panel C), which have a domestic geographical investment focus. *RNAV* is the daily mutual fund raw return, adjusted by dividend and split. *RMkt* is the daily value-weighted market return; the return of FTSE 100, CAC 40 and DAX 30 in Panels A, B and C, respectively. *ARNAV* is the daily fund abnormal return. *Pump* and *Reversal* denote the average abnormal return before and after the turn of a quarter, respectively. *Blip* is the proxy variable for portfolio pumping, estimated as half of the difference between *Pump* and *Reversal*

Table 6 Regression results for abnormal returns around quarter-ends/conventional funds

Variable	UK	France	Germany
$Day_t^{3rdToLast}$	5.7892***	1.7062	− 0.9713
	(4.98)	(1.42)	(− 0.78)
$Day_t^{2ndToLast}$	6.2174***	0.9908	− 0.8857
	(5.46)	(0.80)	(− 0.71)
Day_t^{Last}	7.1935***	1.6162	0.5536
	(6.32)	(1.34)	(0.44)
Day_t^{1st}	− 13.0814***	1.7782	0.8912
	(− 11.51)	(1.52)	(0.72)
Day_t^{2nd}	− 15.4457***	1.9381	− 1.2410
	(− 13.59)	(1.70)	(− 1.05)
Day_t^{3rd}	− 11.0542***	− 0.1053	− 1.6883
	(− 9.73)	(− 0.06)	(− 1.40)
Log Fund $TNA_{i.t}$	0.1352	0.3816***	0.2911
	(1.47)	(2.31)	(0.80)
Log Fund $Age_{i.t}$	− 0.7617***	− 0.0142	− 0.0102
	(− 3.24)	(− 0.04)	(− 0.03)
Observations	598,084	155,189	147,726
Adj. R^2	0.0064	0.0083	0.0177

The table above presents the results of the panel regression of conventional equity mutual funds' daily abnormal returns on dummy variables demoting 6 days around the turn of the quarter. We execute regression separately for funds domiciled in the UK, France and Germany. The dependent variable is $ARNAV_{i,t}$ which is the fund's i abnormal return on day t. $Day_t^{3rdToLast}$, $Day_t^{2ndToLast}$, Day_t^{Last}, Day_t^{1st}, Day_t^{2nd} and Day_t^{3rd} are all indicator variables representing the 6 days around the turn of the quarter. *Log Fund* $TNA_{i,t}$ is the logarithm of the fund i's total net assets at the end of the prior month. *Log Fund* $Age_{i,t}$ is defined as the logarithm of the total months that span from fund i's launch date until the end of the sample period. We also control for time and fund fixed effects, but results are omitted for brevity purposes; so is the intercept term. T-statistics are given in parentheses

***Statistical significance at 5% level. The sample period is from January 1, 2010, to December 31, 2022

and, at the beginning of the following quarter, fund prices fall even further, by about 39 bp. Thus, funds that do not adhere to ESG criteria participate in more severe portfolio pumping. Documented differences may be due to the fact that ESG funds probably follow different standards for stock screening. Different standards impose different constraints on stock selection, which, in turn, impose different constraints on pumping stock prices. Moreover, as in the case of German and French ESG funds, no evidence is reported that non-ESG fund managers are involved in pumping activities, since all the coefficients are not statistically significant and exhibit a random motivation.

ESG portfolio pumping during COVID-19

As the majority of stock markets across the globe crashed after the emergence of COVID-19 pandemic, we are intrigued to probe whether manipulating trading strategies of ESG fund managers have changed after the spread of the disease. The summary data for the portfolio pumping measures during COVID-19 are provided in Table 7.

As observed, the performance of ESG funds during the COVID-19 is slightly inferior compared to the markets' in any case, since we find the raw return equal to 0.609 bp, 2.102 bp and 0.733 bp for the UK, French and German funds, while the value-weighted market return reaches 0.739 bp, 2.286 bp and 2.038 bp, respectively. Thus, ESG funds perform worse, on average, than the market, delivering a negative abnormal return in the UK (*ARNAV* = −0.222 bp), in France (*ARNAV* = −0.445 bp) and in Germany (*ARNAV* = −1.452 bp). Moreover, high *Pump* values are documented in each group of funds, especially in the case of the UK. The average *Pump* value at quarter-end is 14.373 bp, while the average *Reversal* at the beginning of the quarter is −13.939 bp, which results in a *Blip* value of 14.156 bp on average. Contrariwise, returns remain positive in the 1st days of the next quarter for German funds (*Reversal* = 2.254 bp), or they are marginally negative for French funds (*Reversal* = −0.228 bp). Therefore, results provide evidence in support of extreme price manipulation for the UK ESG funds, while no such proof is reported for the remaining fund categories.

Table 8 presents the panel regression results for the ESG mutual funds in the sample, indicating the level of abnormal returns at quarter-ends during COVID-19.

The empirical findings connote that the UK managers have steered fund returns upwards after the surge of COVID-19 to a greater extent compared to the overall sample period, as fund prices are inflated by around 43 bp at the end of the quarter. At the beginning of the following quarter, portfolio returns decline by about the same amount (42 bp), substantiating evidence of excessive portfolio pumping. We also find the coefficients of $Day_t^{3rdToLast}$, $Day_t^{2ndToLast}$ and Day_t^{Last} positive and statistically significant at 5% level in the case of French and German funds; however, none of the coefficients of Day_t^{1st}, Day_t^{2nd} and Day_t^{3rd} are negative and statistically significant at 5% level. Thus, we infer that pumping activities are non-significant in French and German ESG market.

ESG portfolio pumping at quarter-ends and year-ends

We proceed with our empirical findings concerning ESG pumping by providing in Table 9; the results of the regression described in Eq. 7, after substituting *ARNAV* data with *Blip* data in the last day of the quarter and deleting the *ARNAV* data for the remaining days around the turn of the quarter.

As observed, the coefficient on $LastDay_{i,t}$ is statistically significant (t = 4.52) for the UK ESG funds at 5% level, verifying that managers distort the performance of

Table 7 Summary statistics of portfolio pumping measures during COVID-19/ESG funds

Variable	Mean	Median	Std	Min	Max
Panel A: UK (198 funds)					
RNAV (bp)	0.609	6.043	128.1	− 1232.1	667.6
RMkt (bp)	0.739	6.646	130.8	− 1087.4	905.3
ARNAV (bp)	− 0.222	− 0.394	109.2	− 908.4	631.9
Pump (bp)	14.373	13.181	44.1	− 53.1	107.8
Reversal (bp)	− 13.939	− 12.930	46.0	− 103.9	64.6
Blip (bp)	14.156	15.223	32.8	− 47.3	71.6
Panel B: France (50 funds)					
RNAV (bp)	2.102	5.277	139.1	− 1209.8	795.9
RMkt (bp)	2.286	8.609	151.7	− 1227.7	838.9
ARNAV (bp)	− 0.445	0.078	42.7	− 322.3	301.6
Pump (bp)	3.667	3.294	16.5	− 22.2	34.9
Reversal (bp)	− 0.228	− 2.069	21.4	− 34.5	41.6
Blip (bp)	1.948	2.520	11.7	− 18.6	21.6
Panel C: Germany (23 funds)					
RNAV (bp)	0.733	5.441	151.1	− 1223.2	929.9
RMkt (bp)	2.038	5.723	155.9	− 1223.9	1097.6
ARNAV (bp)	− 1.452	0.050	99.8	− 687.8	561.3
Pump (bp)	3.963	2.723	31.7	− 42.3	73.2
Reversal (bp)	2.254	1.866	34.9	− 50.1	65.9
Blip (bp)	0.855	1.621	26.1	− 46.1	42.8

The table above presents the summary statistics of portfolio pumping measures for the European equity mutual funds for the period from January 2020 to December 2022. The sample consists of funds that adhere to the ESG criteria, domiciled in the UK (Panel A), France (Panel B) and Germany (Panel C), which have a domestic geographical investment focus. *RNAV* is the daily mutual fund raw return, adjusted by dividend and split. *RMkt* is the daily value-weighted market return; the return of FTSE 100, CAC 40 and DAX 30 in Panels A, B and C, respectively. *ARNAV* is the daily fund abnormal return. *Pump* and *Reversal* denote the average abnormal return before and after the turn of a quarter, respectively. *Blip* is the proxy variable for portfolio pumping, estimated as half of the difference between *Pump* and *Reversal*

their portfolios. On the other hand, for funds operating in the German and French market, a statistically insignificant coefficient is reported ($t = 0.22$ and $t = 0.11$, respectively). The empirical results in Table 9 support the findings from the previous section that the UK ESG funds managers engage in portfolio pumping activities, whereas German and French funds do not exhibit any irregular returns during quarter-ends.

Table 10 reports the results of aforementioned regression (Eq. 7) for each quarter of the sample period.

Results provide further evidence that ESG fund managers in the UK inflate quarter-end NAV prices, as the coefficient on $LastDay_{i,t}$ is statistically significant at 5% level for each quarter of the sample period (with the exception of the third quarter) and markedly higher at year-ends. These findings are consistent with the majority of the literature (Carhart et al. 2002; Gallagher et al. 2009; Agarwal et al. 2011; Ben-David et al. 2013; Lee et al. 2014; Li and Wu 2019; Shackleton et al. 2020) highlighting that fund managers manipulate stock prices at quarter-ends, particularly at year-ends. As fund managers' evaluation is usually based on their yearly performance, it is reasonable to assume that they have a greater incentive to conduct portfolio pumping at year-ends. Contrariwise, our findings confirm the absence of gaming behavior in the German and French ESG market, as all the estimations on $LastDay_{i,t}$ are not statistically significant. These results are in line with Duong and Meschke (2020), who suggest that portfolio pumping was reduced due to increased regulatory scrutiny after the study of Carhart et al. (2002). Therefore, our empirical findings denote cross-country differences in the level of portfolio pumping. These diverging results could lie in regulatory differences among these countries or perhaps the lack of efficient supervision in the UK market. Another reason for the occurrence of portfolio pumping among the UK funds could be the different incentive schemes managers face that motivate them to perform such activities.

Table 8 Regression results for abnormal returns around quarter-ends during COVID-19/ESG funds

Variable	UK	France	Germany
$Day_t^{3rdToLast}$	15.1862***	4.2816***	2.8247***
	(13.36)	(3.73)	(2.35)
$Day_t^{2ndToLast}$	13.5389***	3.7061***	3.9113***
	(11.90)	(3.24)	(3.44)
Day_t^{Last}	14.4471***	2.9978***	5.1536***
	(12.69)	(2.65)	(4.53)
Day_t^{1st}	− 13.4822***	0.0162	2.2184
	(− 11.85)	(0.02)	(1.81)
Day_t^{2nd}	− 12.5383***	− 1.7164	2.4851***
	(− 11.02)	(− 1.45)	(2.07)
Day_t^{3rd}	− 15.7025***	1.0308	2.0192
	(− 13.84)	(0.82)	(1.64)
Log Fund $TNA_{i,t}$	0.1290	0.3980***	0.3174
	(1.42)	(2.41)	(0.88)
Log Fund $Age_{i,t}$	− 0.8274***	− 0.0221	− 0.0119
	(− 3.49)	(− 0.09)	(− 0.06)
Observations	145,270	36,813	17,002
Adj. R^2	0.0378	0.0416	0.0235

The table above presents the results of the panel regression of ESG equity mutual funds' daily abnormal returns on dummy variables demoting 6 days around the turn of the quarter. We execute regression separately for funds domiciled in the UK, France and Germany. The dependent variable is $ARNAV_{i,t}$ which is the fund's i abnormal return on day t. $Day_t^{3rdToLast}$, $Day_t^{2ndToLast}$, Day_t^{Last}, Day_t^{1st}, Day_t^{2nd} and Day_t^{3rd} are all indicator variables representing the 6 days around the turn of the quarter. *Log Fund* $TNA_{i,t}$ is the logarithm of the fund i's total net assets at the end of the prior month. *Log Fund* $Age_{i,t}$ is defined as the logarithm of the total months that span from fund i's launch date until the end of the sample period. We also control for time and fund fixed effects, but results are omitted for brevity purposes; so is the intercept term. T-statistics are given in parentheses

***Statistical significance at 5% level. The COVID-19 period is from January 1, 2020, to December 31, 2022

Robustness considerations

As a robustness test, we carry out a two-stage regression as in Carhart et al. (2002), in order to determine whether performance reverses are more prevalent around quarter-ends or year-ends. In Table 11, the results of the second-stage regressions described in Eq. 9 are illustrated.

The coefficient on $YearEnd_t$ is statistically significant at 5% level in the case of ESG funds domiciled in the UK, confirming that the positive return at the end of the year is associated with the negative return at the beginning of the next year. On the other hand, the coefficient on $QuarterEnd_t$ is also negative but statistically insignificant for the UK funds. These findings confirm previous evidence that the UK portfolio pumping is larger in magnitude at year-ends rather than quarter-ends.

Table 9 Regression results for the occurrence of ESG portfolio pumping for each country

Dependent variable: $ARNAV_{i,t}$	UK	France	Germany
$LastDay_{i,t}$	5.7917***	0.0892	0.2719
	(4.52)	(0.11)	(0.22)
Log Fund $TNA_{i,t}$	0.1381	0.3337***	0.2016
	(1.52)	(2.02)	(0.56)
Log Fund $Age_{i,t}$	− 0.8039***	− 0.0163	− 0.0031
	(3.53)	(− 0.03)	(− 0.01)
Observations	545,168	144,455	62,594
Adj. R^2	0.0014	0.0035	0.0113

The table above presents the results of the panel regression of the ESG funds' daily abnormal return on the dummy variable indicating the last day of a quarter and control variables. The dependent variable is the funds' daily abnormal return ($ARNAV_{i,t}$). $LastDay_{i,t}$ is an indicator variable that takes the value of 1 if t is the last day of a quarter and 0 otherwise. *Log Fund* $TNA_{i,t}$ is the logarithm of the fund i's total net assets at the end of the prior month. *Log Fund* $Age_{i,t}$ is defined as the logarithm of the total months that span from fund i's launch date until the end of the sample period. We also control for time and fund fixed effects, but results are omitted for brevity purposes; so is the intercept term. T-statistics are given in parentheses

***Statistical significance at 5% level. The sample period is from January 1, 2010, to December 31, 2022

What types of ESG funds exhibit stronger pumping practices?

Table 12 shows the results of the panel regression (Eq. 10) in order to detect the type of funds that have a stronger tendency to inflate the performance of their portfolios at quarter-ends.

Results show that portfolio pumping is more prominent among the worst-performing funds, as the coefficient on $RNAV_{i,T-1}$ is negative and statistically significant at 5% level ($t = -8.28$). These results contradict Carhart et al. (2002), Ben-David et al. (2013), Lee et al. (2014) and Li and Wu (2019) who argue that portfolio pumping is mainly driven by managers pursuing bonuses linked with performance-based compensation contracts. On the contrary, our empirical findings are in accordance with Gallagher et al. (2009) and Shackleton et al. (2020) who suggest that underperforming funds tend to inflate portfolio prices in relation to their peers. ESG poor-performing managers display greater evidence of portfolio pumping. This gaming behavior could be attributed to the fact that loser funds do not want to lag behind other funds or managers wanting to avoid potential penalties imposed by fund companies due to bad performance. Furthermore, we find that ESG rating is negatively correlated with portfolio pumping, as the coefficient on $ESG\ Score_{i,T-1}$ is significantly negative ($t = -2.72$) . This means that low-rated ESG funds show stronger evidence of marking up activity. Given the fact that the abidance to the ESG

Table 10 Regression results for the occurrence of ESG portfolio pumping for each quarter

Dependent variable: $ARNAV_{i,t}$	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Panel A: UK				
$LastDay_{i,t}$	7.2918***	4.9983***	2.0358	10.5297***
	(3.38)	(2.92)	(1.35)	(5.82)
$Log\ Fund\ TNA_{i,t}$	0.1168	0.1047	0.1065	0.1046
	(1.34)	(1.24)	(1.25)	(1.17)
$Log\ Fund\ Age_{i,t}$	− 0.6842***	− 0.7677***	− 1.2583***	− 0.9445***
	(− 2.97)	(− 3.48)	(− 5.37)	(− 3.98)
Observations	134,943	135,573	137,046	137,606
Adj. R^2	0.0122	0.0171	0.0165	0.0703
Panel B: France				
$LastDay_{i,t}$	− 0.0542	− 0.3298	0.4598	0.2343
	(− 0.04)	(− 0.21)	(0.28)	(0.13)
$Log\ Fund\ TNA_{i,t}$	0.3514***	0.3639***	0.3489***	0.2892
	(2.11)	(2.20)	(2.07)	(1.69)
$Log\ Fund\ Age_{i,t}$	0.0129	0.1378	− 0.0198	− 0.0033
	(0.03)	(0.32)	(− 0.05)	(− 0.01)
Observations	35,101	35,551	36,451	37,351
Adj. R^2	0.0357	0.0589	0.0339	0.0708
Panel C: Germany				
$LastDay_{i,t}$	− 0.3129	− 0.5257	0.9036	1.4105
	(− 0.12)	(− 0.21)	(0.36)	(0.57)
$Log\ Fund\ TNA_{i,t}$	0.0647	− 0.1151	0.1881	0.2017
	(0.07)	(− 0.15)	(0.29)	(0.32)
$Log\ Fund\ Age_{i,t}$	− 0.0083	− 0.0022	− 0.0041	− 0.0021
	(− 0.15)	(− 0.04)	(− 0.08)	(− 0.03)
Observations	15,338	16,215	15,360	15,681
Adj. R^2	0.0015	0.0017	0.0014	0.0025

The table above presents the results of the panel regression of the ESG funds' daily abnormal return on the dummy variable indicating the last day of a quarter and control variables. The dependent variable is the funds' daily abnormal return ($ARNAV_{i,t}$). $LastDay_{i,t}$ is an indicator variable that takes the value of 1 if t is the last day of a quarter and 0 otherwise. $Log\ Fund\ TNA_{i,t}$ is the logarithm of the fund i's total net assets at the end of the prior month. $Log\ Fund\ Age_{i,t}$ is defined as the logarithm of the total months that span from fund i's launch date until the end of the sample period. We also control for time and fund fixed effects, but results are omitted for brevity purposes; so is the intercept term. T-statistics are given in parentheses

***Statistical significance at 5% level. The sample period is from January 1, 2010, to December 31, 2022

criteria implies the implementation of accurate accounting methods and accountability to shareholders, this outcome is expected to some extent, as stronger commitment to these criteria could lead to the elimination of unethical practices. Surprisingly, funds that charge investors with lower expenses appear to conduct more pumping, as we find the estimation on $Expense\ Ratio_{i,T-1}$ negative and statistically significant ($t = -3.24$). These results are in contrast with the results of Agarwal et al. (2011) who argue that funds strategically manipulate their returns in order to impose larger fees. The low-cost strategy can be an effective marketing tool used by fund companies to attract new clients, especially for new entrant funds. However, this is not the case in our analysis, as we find a negligible positive coefficient for $Fund\ Flow_{i,T-1}$. Therefore, funds that engage in portfolio pumping do not ultimately succeed in increasing fund inflows. The cost of conducting portfolio pumping outweighs the marginal benefits the funds receive.

The empirical results in Table 12 also show that pumping is primarily the focus of younger rather than older funds. Perhaps, it is a tactic used by funds when entering an overcrowded market. We further find that pumping is stronger in less-diversified portfolios; this finding is unsurprising, as the smaller the number of stocks included in the portfolio, the easier their manipulation becomes. On the other hand, pumping is positively associated with cash holdings and fund size. This indicates that managers who hold more cash in their portfolios can more easily purchase additional stocks, they already hold at an inflated price. In addition, our findings suggest that larger funds tend to inflate asset prices

Table 11 Pumping-reversal pattern of ESG portfolio pumping

Dependent variable: $\alpha_{1.t}$	UK	France	Germany
$QuarterEnd_t$	− 0.0607	0.0044	0.0403
	(− 0.46)	(0.08)	(0.29)
$YearEnd_t$	− 0.3011***	0.1219	− 0.0543
	(− 3.55)	(1.44)	(− 0.63)
Observations	28,161	7,362	4,288
Adj. R^2	0.0192	0.0073	0.0020

The table above presents the results of the regression which investigates whether the positive return of ESG funds at the end of a quarter is associated with the negative return at the beginning of the next quarter. The dependent variable is $\alpha_{1,t}$, which is the slope coefficient in the regression of *Pump* on *Reversal* from the model in Eq. 8. Consequently, we execute a second-stage regression of the time series on two indicator variables: $QuarterEnd_t$ which takes the value of 1 if t is the last trading day of March, June or September and 0 otherwise, and $YearEnd_t$, which takes the value of 1 if t is the last trading day of December and 0 otherwise. The intercept term is not included in the table for brevity purposes. T-statistics are given in parentheses

***Statistical significance at 5% level. The sample period is from January 1, 2010, to December 31, 2022

to a greater extent than smaller funds, probably because they have more incentives to do so, due to the higher value of assets being managed. However, the estimated coefficients for fund age, number of shares, cash holdings and fund size are all statistically insignificant at 5% level.

Conclusions

In this paper, we investigate quarter-end spikes in returns of funds that apply ESG factors in the major European markets of the UK, France and Germany, for the period 1/1/2010–12/31/2022. We utilize Bernhardt and Davies (2005) proxy for portfolio pumping, and we analyze its occurrence by carrying out fixed effects panel regression (Li and Wu 2019) for each region and for each quarter. Results show that the UK fund NAV prices experience extremely abnormal increases at quarter-ends, especially at year-ends. However, compared to their traditional counterparts, the UK ESG managers tend to inflate fund returns less. Contrariwise, no evidence of portfolio pumping is found for ESG funds in Germany and France. The COVID-19 pandemic significantly increased fund managers' inclination to artificially boost the performance of the investment portfolios. Our findings are robust when applying the Carhart et al. (2002) two-stage regression model in order to ascertain the magnitude of turn-of-quarter/year effect. We also find that loser funds engage in stronger portfolio pumping and that price manipulation is negatively related to expense ratio and ESG rating.

Table 12 Key drivers of ESG portfolio pumping

Dependent variable: $Blip_{i,T}$	All funds
$RNAV_{i,T-1}$	− 2.7835***
	(− 8.28)
$Log\ Fund\ TNA_{i,T-1}$	0.5722
	(1.26)
$Log\ Fund\ Age_{i,T-1}$	− 1.0808
	(− 0.92)
$Expense\ Ratio_{i,T-1}(\%)$	− 1.9147***
	(− 3.24)
$Cash\ Holdings_{i,T-1}(\%)$	0.3069
	(1.53)
$Fund\ Flow_{i,T-1}(\%)$	0.0009
	(0.02)
$No.\ of\ Shares_{i,T-1}$	− 0.0040
	(− 0.66)
$ESG\ Score_{i,T-1}$	− 0.1138***
	(− 2.72)
R^2	0.64

The table above presents the results of panel regressions of portfolio pumping on various ESG fund characteristics. The dependent variable is $Blip_{i,T}$, which is the proxy for fund i's portfolio pumping at the end of quarter T. $RNAV_{i,T-1}$ is mutual fund raw return during quarter $T-1$. $Log\ Fund\ TNA_{i,T-1}$ is the logarithm of the fund i's total net assets at quarter $T-1$. $Log\ Fund\ Age_{i,T-1}$ is defined as the logarithm of the total months that span from quarter $T-1$ until the end of the sample period. $Expense\ Ratio_{i,T-1}$ is the fund's operating cost relative to its assets during quarter $T-1$. $Cash\ Holdings_{i,T-1}$ is the average percentage of cash the fund manager holds in the portfolio during quarter $T-1$. $Fund\ Flow_{i,T-1}$ is defined as the quarterly fund flow divided by the fund's TNA at the beginning of the quarter $T-1$. $Number\ of\ Shares_{i,T-1}$ is the average amount of stocks contained in the portfolio during quarter $T-1$. $ESG\ Score_{i,T-1}$ is the measurement of the fund's performance with respect to Environmental, Social and Governance issues during year *T-1*, taken from LSEG. For the estimation of cash and stocks included in the portfolios, 3-month portfolio holdings were used throughout the sample period The intercept term is omitted for brevity purposes. All explanatory variables are lagged by 3 months, except ESG score which is lagged by 12 months. We include time fixed effects in all regressions and use robust, clustered standard errors

***Statistical significance at 5% level. The sample period is from January 1, 2010, to December 31, 2022

Our study adds to the body of literature in two ways. First, to the best of the authors' knowledge, this study is the first to explore portfolio pumping across ESG equity mutual funds. Examining if ESG fund managers provide accurate disclosure of portfolio values in financial statements is an extremely relevant issue, as "G" accounts for governance considerations which include business ethics and fair interactions with stakeholders. The motivation behind our initiative lies in the fact that these types of ethical investments might employ unethical tactics that misguide investors about their relative portfolio performance. It is essential for

policymakers and regulators to be aware of the occurrence of portfolio pumping in order to develop policy frameworks that would lessen its impact. Investors must also disclose any exceptional end-of-quarter NAV price increases since it helps them to accurately assess the performance of their portfolios. Second, by examining the factors that drive portfolio pumping, we are giving ESG investors clear guidelines for avoiding funds that purposefully manipulate their portfolios.

The conclusions that are drawn from this research are the following. First, ESG funds based in Germany and France maintain compliance with regulations regarding portfolio pumping, as no evidence of spikes in fund portfolio values at quarter-ends is found. Thus, investors can derive utility from socially responsible funds domiciled in these markets through non-performance attributes, as these funds develop ethical business practices, including financial transparency and business integrity. Second, as the UK ESG funds engage in frequent and strong portfolio pumping, it is evident that the Financial Conduct Authority (FCA) should strengthen its supervision to ensure lucidity in the domestic financial market. Third, depending on the timing of their entry into and withdrawal from the funds, certain investors may benefit at the expense of others if the reported NAVs of some ESG funds differ from their true NAVs. Future research should deal with the investigation of the cross-country differences found in our study regarding the level of portfolio pumping between the UK and the remaining markets.

Appendix 1. ESG mutual fund sample and the corresponding Reuters Instrument Codes (RIC)

UK ESG funds									
Lipper RIC	Asset Name	Lipper RIC	Asset Name	Lipper RIC	Asset Name	Lipper RIC	Asset Name	Lipper RIC	Asset Name
LP60011258	Aegon UK Eq.	LP68200151	BNY Mellon Eq. Inc.	LP65140581	Janus Hend. Inst H. Alp. UK Eq.	LP60009090	Merian UK Eq. Inc.	LP60009051	Schroder UK Opp.
LP68013762	Aegon UK Eq. Inc.	LP60064338	BNY Mellon Sust. UK Opp.	LP65000124	Janus Hend. Inst Main. UK Eq Trust	LP68473670	MGTS AFH DA UK Alp.	LP60011308	Scot. Widows Environ. Inv.
LP65070219	Aegon UK Opp.	LP60010681	BNY Mellon UK Eq. GBP	LP60009998	Janus Hend. UK Eq. Inc. & Grow.	LP65059306	MI Charles Stanley Eq.	LP60008606	Scot. Widows Eth.
LP60009444	Allianz UK List. Eq. Inc.	LP60010680	BNY Mellon UK Inc. GBP	LP60010749	Janus Hend. UK Resp. Inc.	LP68513051	MI Sel. Manag. UK Eq. Inc.	LP60011330	Scot. Widows UK Eq. Inc.
LP60008733	Artemis Inc.	LP65019684	Castlefield B.E.S.T Sust. Inc.	LP68027822	JOHCM UK Dyn.	LP60010192	Ninety One UK Alp.	LP60011373	Scot. Widows UK Grow.
LP65000844	Artemis Inst. Eq. Inc.	LP68162495	CFP Castlefield B.E.S.T UK Opp.	LP60098485	JOHCM UK Eq. Inc.	LP68301617	Ninety One UK Eq. Inc.	LP60073853	Scot. Widows UK Sel. Grow.
LP65000834	Artemis Inst. UK Sp. Sit.	LP65052850	Dimensional Un. King. Core Eq.	LP65012999	JOHCM UK Opp.	LP60010190	Ninety One UK Sp. Sit.	LP68130869	Slater Income
LP60008678	Artemis SmartGARP UK Eq.	LP60090716	Dimensional Un. King. Value	LP60036809	JPM UK Dyn.	LP68526921	Ninety One UK Sust. Eq.	LP60011403	S&W UK Eq. Grow.
LP60008735	Artemis UK Select	LP60008710	EdenTree - Resp. and Sust.	LP65140778	JPM UK Eq. Grow.	LP68516996	Omnis UK All Comp.	LP60097091	SPW Multi-Manag. UK Eq.
LP60008732	Artemis UK Sp. Sit.	LP65073328	ES River and Mercantile UK Dyn. Eq.	LP68340772	JPM UK Eq. Inc.	LP60009347	Premier Miton Inc.	LP60097095	SPW Multi-Manag. UK Eq. Inc.
LP60011531	ASI Stand. Life UK Eq.	LP65150399	ES River and Mercantile UK Eq.	LP60009673	JPM UK Eq. Value	LP60010920	Premier Miton Op. Inc.	LP68495924	SUTL Cazenove Char. Eq. Inc.
LP60008669	ASI UK Eq.	LP60009538	Family Asset Trust	LP60010214	Jupiter Grow. & Inc.	LP68115317	Premier Miton Resp. UK Eq.	LP68495914	SUTL Cazenove Char. Eq. Val.
LP68522814	ASI UK Eq. Enh. Ind.	LP60009541	Family Charities Eth. Trust	LP60010216	Jupiter Inc. Trust	LP60071459	Premier Miton UK Grow.	LP60077208	SVM UK Growth
LP68025538	ASI UK Eq. Ind. Manag.	LP65140498	Fidelity Enh. Inc.	LP60010206	Jupiter Resp.	LP68131612	Premier Miton UK Mult Cap	LP60077210	SVM UK Opp.
LP60011533	ASI UK Grow. Eq. Ret.	LP60009567	Fidelity Inst. UK	LP68483458	Jupiter UK Alp.	LP60011294	PUTM UK Eq. List. Unit Trust	LP60045042	SVS Church House UK Eq. Grow.
LP60011513	ASI UK H. Alp. Eq. Ret.	LP60009556	Fidelity MoneyBuilder Div.	LP60010221	Jupiter UK Grow.	LP60078649	Quilter Inv. Eq. 2 Fund 2	LP68441178	TB Evenlode Inc.
LP60011536	ASI UK H. Inc. Eq. Ret.	LP68245313	Fidelity UK Opp.	LP60010224	Jupiter UK Sp. Sit.	LP68209370	Quilter Inv. UK Eq. Grow.	LP60011930	TB Saracen UK Alp.
LP65028165	ASI UK Inc. Eq.	LP60009584	Fidelity UK Select Fund	LP60077161	Lazard Managed Eq.	LP68483487	Quilter Inv. UK Eq. Inc.	LP68320495	TB Saracen UK Inc.
LP65066669	ASI UK Inc. Unc. Eq. Ret.	LP68036281	FP Russell Invest. UK Grow. Ass.	LP60010292	Lazard MultiCap UK Inc.	LP68209368	Quilter Inv. UK Eq. Large-Cap Inc.	LP60069637	The Holly Inc
LP65029873	ASI UK Resp. Eq.	LP68154995	FTF Franklin UK Eq. Inc.	LP60100871	Lazard UK Omega	LP68208453	Quilter Inv. UK Eq. Large-Cap Val.	LP60011648	Thesis KES Grow.
LP60010719	Av Invrs UK List. Eq. Unc.	LP68362199	FTF Franklin UK Manag. Focus .	LP68090572	L&G UK Eq. Inc.	LP68208454	Quilter Inv. UK Eq. Opp.	LP65055356	Threadneedle UK Eq. Alp. Inc Ret
LP60062286	Aviva Inv. UK List. Eq. H. Alp.	LP68155001	FTF Franklin UK Opp. Fund	LP60010633	L&G UK Select Eq.	LP68483486	Quilter Investors UK Eq. U2 GBP	LP60011700	Threadneedle UK Eq. Inc.
LP68124399	Aviva Inv. UK List. Eq. Inc.	LP68154991	FTF Franklin UK Ris. Div.	LP65140728	L&G UK Sp. Sit.	LP60009198	Royal London Sust. Leaders	LP68235111	Threadneedle UK Eq. Opp.
LP60045250	Aviva Inv. UK List. S&MCap	LP68513244	GAM UK Eq. Inc.	LP68225560	LF Canlife UK Eq.	LP60011043	Royal London UK Div. Grow.	LP60095810	Threadneedle UK Ext. Alp.
LP65147566	AXA Framl. B. Chip Eq. Inc.	LP60076213	Halifax Sp. Sit.	LP68115510	LF IM UK Grow.	LP60011742	Royal London UK Eq. Inc.	LP60011704	Threadneedle UK Grow. & Inc.
LP60009708	AXA Framl. UK Sel. Opp.	LP60076124	Halifax UK Eq. Inc.	LP65022060	LF Lindsell Train UK Eq.	LP68076053	Royal London UK Eq.	LP60073766	Threadneedle UK Inst. Ret.
LP60009749	AXA Framl. UK Sust. Eq.	LP60075894	Halifax UK Grow. Acc.	LP68168807	LF Majedie UK Eq.	LP60009200	Royal London UK Grow. Trust	LP60011708	Threadneedle UK Monthly Inc.
LP60008804	Baillie Gifford UK Eq. Alp.	LP60077166	HL Multi-Manager Inc. & Grow. Trust	LP68168810	LF Majedie UK Focus	LP68180278	Royal London UK Opp.	LP60026066	Threadneedle UK Ret. Inc.
LP68472084	Baillie Gifford UK Eq. Core	LP68284213	HL Multi-Manager UK Grow.	LP68168812	LF Majedie UK Inc.	LP68227936	S&W Revera UK Dyn. Corp.	LP68346567	Threadneedle UK Sust. Eq.
LP68436890	Baillie Gifford UK Eq. Focus	LP68387777	HL Select UK Grow. Shares	LP60079870	Liontrust Inc.	LP68047784	Santander Enh. Inc. Port.	LP60011393	TM CRUX UK Core Fund
LP60008911	Barclays UK Alpha	LP68404438	HL Select UK Inc. Shares	LP65012951	Liontrust Sp. Sit.	LP60008625	Santander Eq. Inc. Ret.	LP68510929	TM Crux UK Sp. Sit.
LP60008928	Barclays UK Eq. Inc.	LP60010110	HSBC UK Grow. & Inc.	LP60052213	Liontrust Sust. Future	LP60046163	Santander PF UK Eq.	LP68356573	Trojan Eth. Inc.
LP60010451	BlackRock UK	LP68107643	IFSL Marlborough Mult. Cap Inc.	LP60010382	M&G Div.	LP60008632	Santander UK Grow. Ret.	LP60097085	Trojan Inc.
LP60010560	BlackRock UK Eq.	LP60010469	IFSL Marlborough Mult. Cap Grow.	LP60010377	M&G Eq. Invest.	LP60011120	Schroder Inc.	LP68163730	UBS UK Eq. Inc.
LP60010540	BlackRock UK Inc.	LP60009136	IFSL RC Brown UK Primary Opp.	LP60010438	M&G Recovery	LP65012872	Schroder Inc. Max.	LP65097212	Unicorn British Comp.
LP60010558	BlackRock UK Sp. Sit.	LP60010134	Invesco Inc. & Grow.	LP60010397	M&G UK Inc. Dist.	LP60011165	Schroder Recovery	LP68322707	VT Castlebay UK Eq.
LP60009783	BMO Resp. UK Eq.	LP60010144	Invesco UK Comp.	LP60010446	M&G UK Select	LP60078737	Schroder Sust. UK Eq.	LP68261756	VT Vanneck Eq.
LP60010976	BMO Select UK Eq.	LP60010877	Invesco UK Eq. H. Inc.	LP60011426	Man GLG Inc. Ret.	LP65000481	Schroder UK Alp. Inc.	LP68379838	Wesleyan UK Grow.
LP60009763	BMO UK Eq. Inc.	LP60010879	Invesco UK Eq. Inc.	LP68239014	Man GLG Underval. Ass.	LP60071826	Schroder UK Alp. Plus		
LP68200132	BNY Mellon Eq. Inc. Boost.	LP60010895	Invesco UK Opp.	LP60010463	Marks & Spencer UK Sel. Port.	LP60011175	Schroder UK Eq.		
FRANCE ESG funds									
Lipper RIC	**Asset Name**	**Lipper RIC**	**Asset Name**	**Lipper RIC**	**Asset Name**	**Lipper RIC**	**Asset Name**	**Lipper RIC**	**Asset Name**
LP68376699	ACA Fra.	LP60039090	BNP Paribas Valeurs	LP68051205	FCP Mon PEA	LP60076451	Indice Valor	LP68133687	OFI RS Fra. Eq.
LP65099696	Actions 21	LP60039200	CD Fra.Expertise	LP68062023	FDE Midcaps	LP60039671	Inter Actions	LP68459478	Pluvalca Allcaps
LP60043020	AIS Mandarine Opp.	LP60077518	Centifolia	LP68498313	Federis ISR Fra.	LP68478409	Investir PEA Palatine	LP60089985	R-Co Conviction Fra.
LP60057612	Allianz Actions Aeq.	LP60064419	Chaussier Fra.	LP65035053	Fox Fra.	LP60038212	LBPAM ISR Actions Focus Fra.	LP60039112	R-Co Midcap Fra.
LP60041818	Allianz Actions Fra.	LP68205967	CPR Actions Fra.	LP60041123	Fructi Actions Fra.	LP60056349	LBPAM ISR Actions Fra.	LP65027719	SG Actions Fra. Largecap
LP68399780	ALM Actions Fra.	LP60038878	CPR Middle-Cap Fra.	LP60039931	Groupama Fra. Stock	LP60038251	Livret Bourse Invest.	LP65071072	SG Actions Fra. Selection
LP68041039	Amundi Actions Fra.	LP65000905	Dorval Manageurs	LP60039382	GSD Fra.	LP65132374	Mandarine Opp.	LP60043209	Strategie Fra.
LP60038633	Amundi Fra. Engag.	LP60038250	Ecureuil Invest.	LP65119994	GTA Fra.	LP60040234	Martin Maurel Top Manag.	LP60065558	Sycomore Francecap
LP60038172	Amundi Strateg. Actions Fra.	LP68536971	EdR SICAV Tricolore Rend.	LP60097137	HSBC Actions	LP65026165	Moneta Multi Caps	LP60084448	Tocqueville Fra.
LP60039533	AXA Fra. Opp.	LP68214568	Etoile Multi Gestion Fra.	LP68022899	Impulsion Fra.	LP60040406	OFI Actions Fra.	LP60041806	Uni-Hoche
GERMANY ESG funds									
Lipper RIC	**Asset Name**	**Lipper RIC**	**Asset Name**	**Lipper RIC**	**Asset Name**	**Lipper RIC**	**Asset Name**	**Lipper RIC**	**Asset Name**
LP60032746	AL Trust Aktien Deutsch.	LP60032859	Deka-Deutsch. Aktien Strateg.	LP60034044	Frankfurter-Sparinvest	LP68631472	LI Data Intelligence	LP60032930	SEB Aktienfonds
LP60033660	Allianz Verm. Deutsch.	LP60033482	DekaFonds	LP60034236	HANSAsecur	LP60034272	MEAG ProInvest	LP60035879	UBS (D) Aktienfonds Sp. Deutsch.
LP60035578	Basler-Aktienfonds DWS	LP60033771	DWS Aktien Strateg. Deutsch.	LP60036076	HSBC German Equity	LP60034827	Metzler German Smaller Comp.	LP68407069	Velten Strateg. Deutsch.
LP60033245	Concentra	LP60033778	DWS Deutsch.	LP60032972	LBBW Aktien Deutsch.	LP60034075	ODDO BHF Frankfurt-Effekten		
LP68415643	CSR Aktien Deutsch.	LP60034021	Fondak	LP60034634	LBBW Schwellenlaender	LP68243261	S4A Pure Eq. Germany		

Author contributions All authors have participated in (a) conception and design, or analysis and interpretation of the data; (b) drafting the article or revising it critically for important intellectual content; and (c) approval of the final version.

Funding Open access funding provided by HEAL-Link Greece.

References

Agarwal, V., N.D. Daniel, and N.Y. Naik. 2011. Do hedge funds manage their reported returns?. *The Review of Financial Studies* 24: 3281–3320. https://doi.org/10.1093/rfs/hhr058.

Ben-David, I., F. Franzoni, A. Landier, and R. Moussawi. 2013. Do hedge funds manipulate stock prices?. *Journal of Finance* 68: 2383–2434. https://doi.org/10.1111/jofi.12062.

Bernhardt, D., and R.J. Davies. 2005. Painting the tape: Aggregate evidence. *Economic Letters* 89: 306–311. https://doi.org/10.1016/j.econlet.2005.06.015.

Bhattacharyya, S., and V. Nanda. 2013. Portfolio pumping, trading activity and fund performance. *Review of Finance* 17: 885–919. https://doi.org/10.1093/rof/rfs017.

Bredin, D., K. Cuthbertson, D. Nitzsche, and D.C. Thomas. 2014. Performance and performance persistence of UK closed-end equity funds. *International Review of Financial Analysis* 34: 189–199. https://doi.org/10.1016/j.irfa.2014.05.011.

Carhart, M.M., R. Kaniel, D.K. Musto, and A.V. Reed. 2002. Leaning for the tape: Evidence of gaming behavior in equity mutual funds. *Journal of Finance* 57: 661–693. https://doi.org/10.1111/1540-6261.00438.

Chen, J., H. Hong, M. Huang, and J.D. Kubik. 2004. Does fund size erode mutual fund performance? The role of liquidity and organization. *The American Economic Review* 94: 1276–1302.

Cremers, K.J.M., and A. Petajisto. 2009. How active is your fund manager? A new measure that predicts performance. *The Review of Financial Studies* 22: 3329–3365.

De Jong, M., and S. Rocco. 2022. ESG and impact investing. *Journal of Asset Management* 23: 547–549. https://doi.org/10.1057/s41260-022-00297-7.

Duong, T.X., and F. Meschke. 2020. The rise and fall of portfolio pumping among US mutual funds. *The Journal of Corporate Finance* 60: 101530. https://doi.org/10.1016/j.jcorpfin.2019.101530.

Gallagher, D.R., P. Gardner, and P.L. Swan. 2009. Portfolio pumping: An examination of investment manager quarter-end trading and impact on performance. *Pacific-Basin Finance Journal* 17: 1–27. https://doi.org/10.1016/j.pacfin.2007.12.001.

Hillion, P., and M. Suominen. 2004. The manipulation of closing prices. *The Journal of Financial Markets* 7: 351–375. https://doi.org/10.1016/j.finmar.2004.04.002.

Huang, J., C. Sialm, and H. Zhang. 2011. Risk shifting and mutual fund performance. *The Review of Financial Studies* 24: 2575–2616. https://doi.org/10.1093/rfs/hhr001.

Koutsokostas, D., and S. Papathanasiou. 2017. Mutual funds in Greece: Case study of domestic equity mutual funds during a financial crisis. *Managerial Finance* 43: 812–827. https://doi.org/10.1108/MF-10-2016-0293.

Lee, J., K. Baek, and Y.S. Park. 2014. What drives portfolio pumping in the Korean equity fund market?. *Asia-Pacific Journal of Financial Studies* 43: 297–315. https://doi.org/10.1111/ajfs.12048.

Li, X., and W. Wu. 2019. Portfolio pumping and fund performance ranking: A performance-based compensation contract perspective. *Journal of Banking & Finance* 105: 94–106. https://doi.org/10.1016/j.jbankfin.2019.05.020.

Massa, M., and R. Patgiri. 2009. Incentives and mutual fund performance: Higher performance or just higher risk taking?. *The Review of Financial Studies* 22: 1777–1815.

Ouyang, L., and B. Cao. 2020. Selective pump-and-dump: The manipulation of their top holdings by Chinese mutual funds around quarter-ends. *Emerging Markets Review* 44: 100697. https://doi.org/10.1016/j.ememar.2020.100697.

Papathanasiou, S., I. Dokas, and D. Koutsokostas. 2022. Value investing versus other investment strategies: A volatility spillover approach and portfolio hedging strategies for investors. *The North-American Journal of Economics and Finance* 62: 101764. https://doi.org/10.1016/j.najef.2022.101764.

Pollet, J.M., and M. Wilson. 2008. How does size affect mutual fund behavior?. *Journal of Finance* 63: 2941–2969.

Rompotis, G. 2022. The ESG ETFs in the UK. *Journal of Asset Management* 23: 114–129. https://doi.org/10.1057/s41260-021-00251-z.

Samitas, A., S. Papathanasiou, D. Koutsokostas, and E. Kampouris. 2022. Are timber and water investments safe-havens? A volatility spillover approach and portfolio hedging strategies for investors. *Finance Research Letters* 47: 102657. https://doi.org/10.1016/j.frl.2021.102657.

Shackleton, M., J. Yan, and Y. Yao. 2020. NAV inflation and impact on performance in China. *European Financial Management* 26: 118–142. https://doi.org/10.1111/eufm.12207.

Wong, W.C., J.A. Batten, A.H. Ahmad, S.B. Mohamed-Arshad, S. Nordin, and A.A. Adzis. 2021. Does ESG certification add firm value?. *Finance Research Letters* 39: 101593. https://doi.org/10.1016/j.frl.2020.101593.

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