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Abstract

The popularity of sustainable investments is unbroken and attracts investors and researchers alike. Modelling the properties of such 'green' firms, Pástor, Stambaugh, and Taylor 2021 consider a hedge against climate risks in their theoretical model. Likewise, it could be assumed that companies with high social scores might offer a protection against related events. On February 24, 2022 with the Russian invasion on Ukraine one of the biggest events imaginable came to pass. Using standard event study methodology we analyse if and how Refinitiv's ESG-ratings, as well as the CO2 intensity, influence the cumulative abnormal returns during different event windows. We find that the abnormal returns of companies with high ecological scores are positively influenced in the pre and post-event window. However the effects are of no economical relevance. Therefore our results do not fully support the hypothesis of an 'ESG-hedge' against such an extreme event. If such an effect exists, it was superimposed by other properties accounting for stability and defensiveness.

JEL-Codes: G110, G140, M140.

Keywords: abnormal returns, war, Ukraine, ESG.

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1. Introduction

Investments considering environmental, social and governancial (ESG) aspects became increasingly popular in recent years. There is an ongoing debate within the literature about the return expectations and risk properties regarding 'green' stocks. Engelhardt, Ekkenga, and Posch 2021 find, that European firms with high Refinitiv ESG scores generated higher abnormal returns, when the pandemic hit the financial markets between February 3 and March 23, 2020. They observe that this effect was mainly driven by the social aspect of ESG. This is in line with the study of Albuquerque et al. 2020 who find in their US sample, that firms with higher Refinitiv E and S ratings performed better in the first quarter of 2020. The Russian invasion on Ukraine on February 24, 2022 is another kind of crisis which recently emerged. In this event study we provide new evidence to the discussion of a hedge effect of firms with high ESG-ratings in times of crisis, which is highly relevant for investors in sustainable stocks and for those who try to diversify (tail) risks.

In the general approach of Pedersen, Fitzgibbons, and Pomorski 2021, sustainable companies are expected to generate higher future profits. The expected returns of those firms ultimately depend on which investor type is dominant in the market. Investors being aware of ESG scores use this information to re-evaluate expectations regarding risk-return patterns.[1] To do so, a deeper understanding of the risk and return properties in dependence of those scores is needed. Engle et al. 2020 document in their US-sample, that mimicking portfolios based on environmental scores from MSCI and Sustainalytics can hedge bad climate news. In addition Choi, Gao, and Jiang 2020 show in their international sample, that firms with low carbon emissions perform better when temperatures are abnormally high. Furthermore Ilhan, Sautner, and Vilkov 2021 find that options of S&P 500 firms which provide a protection against downside risks are more expensive for carbon-intense companies due to uncertainties on future climate policies. The climate hedge property of 'green' firms is also considered as one important factor in the equilibrium model for sustainable investments of Pástor,

1. ESG motivated investors use this information as well by choosing the portfolio with the highest Sharpe ratio for their preferred ESG score. Unaware investors do not use ESG information.

Stambaugh, and Taylor 2021.

This leads to the assumption, that firms with better ESG properties could offer a downward risk protection in extreme events. While Pástor, Stambaugh, and Taylor 2021 explicitly speak of a hedge against climate related risks, recent studies examined if this hedge effect can also be observed during different kinds of crisis. Studies which have been executed during the COVID-19 pandemic and the great financial crisis from 2008 onwards provide differing results. Lins, Servaes, and Tamayo 2017 show, that companies with high ratings on corporate social responsibility[2] outperformed firms with lower ratings during the financial crisis from August 2008 to March 2009, supporting the findings of Engelhardt, Ekkenga, and Posch 2021 and Albuquerque et al. 2020. Contrary, Bae et al. 2021 find no evidence of a downside-risk protection for companies with high ESG-ratings from Refinitiv or MSCI during the stock market crash from February 18 to March 20, 2020 as triggered by the pandemic. Their findings are in line with Demers et al. 2021, documenting in their US sample that after controlling for industry affiliation and other accounting and market based stock characteristics, the downside risk protection during the COVID-19 pandemic vanishes.

In order to evaluate the expected effects, we use the market model in the event study design as proposed by MacKinlay 1997. The sample covers 1.452 firms of 15 European developed countries as used by MSCI in the index composition of the MSCI Europe-Index. As a measure of 'greenness' we use Refinitiv's ESG-ratings as well as the CO_2 intensity.

The results show, that in the pre and post-event window higher ecological ratings led to positive abnormal returns. The observed magnitudes however are economically irrelevant, so that a relevant downward risk protection can not be assigned to stocks with high Refinitiv ESG-ratings. For the CO_2 intensity we observe protective effects in the post-event window, which we suppose are due to the special nature of the event with one of the largest fossil energies providers in Europe being the aggressor.

The remainder of this paper proceeds as follows. Section 2 describes the data and the asset pricing tests. Next, we present the results in Section 3. Section 4 concludes.

2. Based on the ESG-ratings from MSCI.

2. Data and Methodology

We use daily total return data as well as accounting and ESG data from Datastream and Worldscope in €. The data are retrieved for the 15 developed European countries the MSCI Europe-Index consists of.[3] It is common practice to use accounting data of t_{-1} from June onwards, in order to avoid a lookahead bias. Since the event of interest occurred in February, we use accounting data from t_{-2}. According to the datastream documentation (Thomson Reuters 2017), ESG data provisioning depends on companies fiscal year ends and the records are refreshed in a 2 weeks interval. However, even for companies with a fiscal year end in September, no ESG-data were yet provided by end of March 2022. Therefore we stay with the approach used for the accounting data and use t_{-2} ESG data.

We use several static filters as suggested by e.g. Schmidt et al. 2011 or Ince and Porter 2006 to clean our data. Furthermore, we control for illiquid companies and public holidays by setting zero returns to NA. Moreover, we exclude penny stocks.[4] All applied filters are summarised in tables B1 and B2 in Appendix B. In addition to those filters, firms have to be covered by Refinitiv's ESG-rating. The country composition of the sample is as of figure A1 in Appendix A.

The estimation window over 250 trading days spans from January 15 to December 30, 2021. The tension already grew since the annexation of the Krim in 2014, becoming more threatening in July 2021 when the article 'On the Historical Unity of Russians and Ukrainians' (Vladimir Putin 2021) was published. Despite even louder warnings by the end of the year, defining the year 2021 as 'normal' seems reasonable. By the beginning of January 2022 leading stock indices like the MSCI World, the Dow Jones Industrial Average or the German DAX reached new all time highs. This is an indication that investors did not expect the upcoming war, yet. As Event date t_0 the day of the invasion February 24, 2022 was chosen. As event window we define the event date and the three business days before and after the event, therefore also covering the recognitions of the People's Republics of Donetsk and Luhansk on February 21,

3. All countries and the corresponding country lists are presented in table A1 in Appendix A.
4. We define penny stocks as stocks with an unadjusted price below 1€ on December 31, 2021.

2022. Furthermore we define a pre-event window from t_{-10} to t_{-4} and a post-event window from t_{+4} to t_{+10}.[5]

For the calculation of abnormal returns during the event period, we start by regressing daily returns on the MSCI Europe-Index returns using equation (1):

$$R_{i,t} = \alpha_i + \beta_i MSEU_t + \epsilon_i, \tag{1}$$

where $R_{i,t}$ are the stock specific realized returns during the estimation period and $MSEU_t$ are the realized returns of the MSCI Europe-Index. We require each stock to have a coverage of cleaned returns data of at least 70%.

The expected returns during the event period are calculated as of equation (2):

$$E(R_{i,t}) = \alpha_i + \beta_i MSEU_t \tag{2}$$

Abnormal returns (AR) are defined as of equation (3):

$$AR_{i,t} = R_{i,t} - E(R_{i,t}) \tag{3}$$

We calculate cumulative abnormal returns (CAR) as of equation (4):

$$CAR_i = \sum_{t_0+d_1}^{t_0+d_2} (AR_{i,t}), \tag{4}$$

where d_1 and d_2 are the borders of the defined event windows in days and may be negative or positive.

We regress those CARs on ESG scores from Refinitiv as well as on the carbon dioxide intensity (C2R), being the total CO_2 and CO_2 equivalent emissions in tonnes, divided by total assets. We do so, since the CO_2 intensity can be considered another proxy for the E dimension which is independent from an artificial scoring mechanism. It is hard to find useful proxys for the environmental pillar of ESG which are available

5. The presented results are robust to different window lengths before and after the event.

for a broad range of companies. It is even harder to find useful variables for the social and governance pillars. Therefore, no results on characteristics related to those ESG dimension are reported.[6]

We use a variety of control variables. We follow Demers et al. 2021 and use the first two digits of the SIC codes as industry controls. To account for the special nature of the event, we use the Industry Classification Benchmark (ICB) subsectors to exclude companies of the defence industry.[7] We further control for country fixed effects. As outlined by Cakici and Zaremba 2021 it is especially important to control for size, since bigger companies tend to have better ESG scores.[8] As further variables we add the book-to-market ratio (BM)[9], profitability (PRO) as defined by Novy-Marx 2013 and investment (INV) being defined as $INV = \Delta Total\ assets_{t-2}/Total\ assets_{t-3}$, following Fama and French 2015. Additionally, we follow Bae et al. 2021 and control for the cash and the debt rate (CSR and TDR).[10]

Table 1 shows the descriptive statistics of our variables. Table 2 shows their cross-correlations. It may be noted, that the scores, as provided by Refinitiv, have high correlation-coefficients among each other. Furthermore they also have a remarkable correlation of 35% – 56% with firm size, confirming the mentioned observation of Cakici and Zaremba 2021 in our sample. C2R on the other side shows low correlations with any other variable.

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6. When using characteristics that are related to the social pillar of ESG such as the rate of employee-turnover or the injuries per million working hours, the sample size drops to 454, which is less than 1/3 of the available sample when using Refinitiv scores. Data availability in the governance pillar is even worse.

7. SIC does not provide a sector to identify companies of the defence sector. Our main results are robust to the direct usage of the ICB subsectors as industry control variables on the full sample. As expected, the control variable for the defence sector is highly significant with considerable magnitudes, especially in the [-3,3] window.

8. They even argue, that ESG premiums may be the 'small firm effect in disguise' (p. 4).

9. We define book value as the sum of common shareholders equity and deferred taxes. We use the book value as reported in t_{-2} and the corresponding market value at the t_{-2} ultimo. For BM calculations, we use domestic currencies.

10. All variables used, are summarized in table A2 in Appendix A.

Table 1. Descriptive statistics. This table shows descriptive statistics for our dependent and independent variables. The CARs are the cumulative abnormal returns during the indicated days before, during and after the event in %. TSC, ESC, SSC and GSC are the (total, environmental, social and governancial) ESG scores as provided by Refinitiv. C2R is the carbon dioxide intensity as calculated from the total CO_2 and CO_2 equivalent emissions in tonnes, divided by total assets. PRO is calculated as described in Novy-Marx 2013. For INV the approach of Fama and French 2015 is used. As a size proxy the natural logarithm of the market value on December 31, 2021 is used. BM is calculated in domestic currencies, dividing book value of t_{-2} by the market value of t_{-2} ultimo. CSR and TDR are the cash and debt rate.

	N	Mean	St. Dev.	Min.	Median	Max
CAR [-30,-4]	1,452	-4.11	12.52	-69.89	-3.39	47.96
CAR [-10,-4]	1,452	-1.84	6.28	-32.86	-1.44	28.28
CAR [-3,3]	1,452	-0.74	9.20	-77.38	-1.00	50.15
CAR [4,10]	1,452	-0.57	7.11	-36.00	-0.46	50.70
TSC	1,452	52.65	21.07	2.23	54.49	95.13
ESC	1,434	45.57	27.18	0.00	45.53	99.18
SSC	1,434	55.43	23.61	0.64	56.95	96.99
GSC	1,434	54.42	22.27	0.94	56.40	97.87
C2R	1,064	0.15	0.90	0.00	0.01	20.59
PRO	1,452	0.31	0.24	-0.21	0.26	2.05
INV	1,452	0.09	0.46	-0.79	0.01	6.54
ln(MV)	1,452	7.49	1.71	2.69	7.39	12.81
BM	1,452	-0.95	0.95	-6.63	-0.88	3.88
CSR	1,452	0.15	0.14	0.00	0.11	0.98
TDR	1,452	0.28	0.18	0.00	0.27	0.90

Table 2. Correlation matrix in %; This table shows cross-correlations for our dependent and independent variables. The CARs are the cumulative abnormal returns during the indicated days before, during and after the event. TSC, ESC, SSC and GSC are the (total, environmental, social and governancial) ESG scores as provided by Refinitiv. C2R is the carbon dioxide intensity as calculated from the total CO_2 and CO_2 equivalent emissions in tonnes, divided by total assets. PRO is calculated as described in Novy-Marx 2013. For INV the approach of Fama and French 2015 is used. As a size proxy the natural logarithm of the market value on December 31, 2021 is used. BM is calculated in domestic currencies, dividing book value of t_{-2} by the market value of t_{-2} ultimo. CSR and TDR are the cash and debt rate.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) CAR [-30,-4]	100%														
(2) CAR [-10,-4]	64%	100%													
(3) CAR [-3,3]	-8%	1%	100%												
(4) CAR [4,10]	11%	6%	8%	100%											
(5) TSC	24%	28%	-8%	0%	100%										
(6) ESC	22%	31%	-6%	3%	83%	100%									
(7) SSC	19%	25%	-5%	-1%	89%	68%	100%								
(8) GSC	15%	10%	-8%	0%	65%	30%	37%	100%							
(9) C2R	5%	8%	-7%	2%	-7%	-3%	-7%	-4%	100%						
(10) PRO	-18%	-17%	3%	-26%	-3%	-5%	-1%	0%	0%	100%					
(11) INV	-13%	-15%	9%	-8%	-10%	-7%	-6%	-12%	-4%	13%	100%				
(12) ln(MV)	3%	11%	5%	-4%	56%	47%	52%	35%	-8%	-9%	4%	100%			
(13) BM	28%	21%	-20%	15%	5%	11%	0%	2%	8%	-42%	-20%	-22%	100%		
(14) CSR	-7%	-8%	4%	-8%	-9%	-6%	-10%	-6%	1%	33%	19%	-10%	-30%	100%	
(15) TDR	14%	15%	-6%	-2%	10%	17%	10%	-3%	6%	-10%	-3%	-3%	6%	-18%	100%

3. Results & Discussion

Table 3 reports the results of the cross-sectional regressions of CARs on Refinitiv's ESG scores.[11] Models 1 – 3 show the results for the total score (TSC). In the [-10,-4] window abnormal returns are positively influenced by this variable with a t-value of 3.9325 and

11. We use unwinsorized CARs. Further analysis, using winsorized CARs, are available upon request. The reported results are robust to winsorizing the CARs at the 1% and 99% level.

a magnitude of 0.04%. This is mainly driven by the environmental and governancial part of TSC as indicated by the significant coefficients of the respective scores (ESC and GSC) in model 4 with a positive regression coefficient of 0.02% each and t-values of 2.5156 (ESC) or 1.9846 (GSC). The social score (SSC) however stays insignificant. In contrast to TSC and GSC, ESC is also significant in the [4,10] window with a t-value of 2.8335 and a magnitude of 0.03%. The observed regression coefficients on Refinitiv's ESG scores can all be considered to be economically irrelevant. In terms of a downward-risk protection, stocks with higher Refinitiv ESC scores offered only a small protection of 0.02% – 0.03% per score point in the pre and post 7-days event windows. During the event itself, there is no significant effect at all. It seems that investors focused on other factors when confronted with the recognition of the People's Republics and the invasion itself. In the models 7 – 9 we use C2R as a proxy for the 'greenness' of companies. In the post-event window we observe an abnormal underperformance for companies with a high CO_2-intensity. This could have been expected, since Russia is one of the largest providers of fossil energies in Europe and the war raised scepticism on the security of energy supplies.

The reasons why the downward risk protection effect of firms with high ESG-ratings is negligible can be manifold. First of all, the Russian invasion is no typical ecological event. Investors might therefore not consider ESG-ratings in a way that develop strong effects in the light of such an event. Second, the construction of Refinitiv's ESG-ratings might differ from the market's definition of sustainability. Using firm characteristics directly could help reducing such a 'rating-construction bias'. However, as noted before, there is an issue with data availability on ESG-relevant data, especially in the social and governancial dimensions. Lastly the defined event windows may not be suitable, since uncertainty regarding the upcoming conflict impacted the markets already before the event. Therefore we performed additional tests with a longer pre-event window as shown in table C1 in Appendix C, which support our results.

Looking at the control variables in models 1 – 6, companies with higher profitability perform significantly worse in the [-3,3] and [4,10] event windows.[12] Following the

12. Due to the drop in observation of $\sim 25\%$ in models 7 – 9, the comparability might be limited.

invasion and the sanctions imposed by western oriented governments, the impact on established business models was not assessable. This uncertainty might have caused investors to sell stocks with well established business models. This is also reflected by the significant negative regression coefficients on BM in the [-3,3] window, indicating a preference for growth over value stocks. In the [4,10] window the significance vanishes, but the sign stays negative. Investors might contemplate value stocks to be more stable in case of growing uncertainty before the event.[13] During the event this preference changed, since growth stocks might have been considered to be more flexible in their business model. For INV and ln(MV) we observe significant positive values within the [-3,3] window with a considerable magnitude. That means, that investors might have been more reluctant to sell growing big companies, assigning them the property to better compensate the impact of the crisis. However, in the pre and post-event window we observe no significance regarding firm size. Interestingly, the coefficient on INV was significantly negative with (absolute) t-values between 3.0712 and 3.2119 and an economically relevant magnitude between -1.41% and -2.45% before the event and becomes strongly negative again in the post-event window. Investors in companies with an aggressive investment style supposedly disliked the uncertainty as in the days before the war. The positive sign during the [-3,3] window might therefore be explained with the materialization of the risk, expecting victory of the Russian Federation within a few days. When it became clearer, that the conflict lasts longer, uncertainty on existing and expanding business models returned to the markets.

13. As reflected by the significant positive regression coefficients on BM in the [-10,-4] window.

Table 3. Cross sectional regressions of cumulative abnormal returns on Refinitiv ESG scores in %. This table reports the results of cross sectional regressions. The event date t_0 is February 24, 2022. The reported windows are located before, during and after this event. TSC, ESC, SSC and GSC are Refinitiv's (total, environmental, social and governancial) ESG scores. For C2R the total carbon dioxide and CO_2 equivalent emissions in tonnes, divided by total assets are used. PRO is calculated as described in Novy-Marx 2013. For INV the approach of Fama and French 2015 is used. As a size proxy the natural logarithm of the market value on December 31, 2021 is used. For the calculation of BM the 2020 book values and the MV on the 2020 ultimo are used. We report t-values in parenthesis, based on robust standard errors (White 1980). We control for firm and industry fixed effects. ***, ** and * indicate a significance level of 1%, 5% and 10%.

	(1) [-10,-4]	(2) [-3,3]	(3) [4,10]	(4) [-10,-4]	(5) [-3,3]	(6) [4,10]	(7) [-10,-4]	(8) [-3,3]	(9) [4,10]
Intercept	5.61***	-4.47	8.69***	6.56***	-3.64	9.25***	5.22***	2.55	11.60***
	(3.7278)	(0.7898)	(2.6742)	(4.3664)	(0.6464)	(2.7686)	(3.4126)	(0.3887)	(3.2243)
TSC	0.04***	-0.02	0.01						
	(3.9325)	(1.0944)	(0.9657)						
ESC				0.02**	0.01	0.03***			
				(2.5156)	(0.9007)	(2.8335)			
SSC				0.00	-0.01	-0.01			
				(0.2184)	(0.8407)	(0.7362)			
GSC				0.02**	-0.02	-0.01			
				(1.9846)	(1.3251)	(1.198)			
C2R							0.30*	-0.61	-0.55**
							(1.8107)	(0.8461)	(2.5714)
PRO	0.26	-2.20*	-3.75***	0.07	-2.50*	-4.02***	-1.54	-2.84*	-4.46***
	(0.2745)	(1.6974)	(4.0127)	(0.0688)	(1.9028)	(4.2454)	(1.2971)	(1.9179)	(3.7469)
INV	-1.41***	1.71***	-1.31**	-1.44***	1.76***	-1.32**	-2.45***	2.32**	-1.13
	(3.1538)	(3.5787)	(2.4114)	(3.2119)	(3.6521)	(2.407)	(3.0712)	(2.018)	(1.2265)
ln(MV)	-0.11	0.45**	-0.07	-0.20	0.38*	-0.11	0.14	-0.02	-0.01
	(0.8008)	(2.3685)	(0.4885)	(1.428)	(1.9313)	(0.7206)	(1.3198)	(0.104)	(0.0659)
BM	0.62***	-1.38***	-0.06	0.54**	-1.49***	-0.13	0.23	-1.54***	0.10
	(2.6421)	(3.9821)	(0.2275)	(2.2612)	(4.2484)	(0.4614)	(0.9322)	(4.0421)	(0.3313)
CSR	-2.26	0.58	2.06	-2.31	0.32	1.99	1.62	2.37	-0.10
	(1.395)	(0.2675)	(1.1921)	(1.4428)	(0.1442)	(1.1514)	(0.7251)	(0.9034)	(0.0399)
TDR	0.02	-2.52	-0.22	-0.10	-2.61	-0.31	1.70*	-4.63**	-0.30
	(0.0188)	(1.4299)	(0.1678)	(0.1046)	(1.4673)	(0.2348)	(1.6534)	(2.24)	(0.1993)
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
R^2	0.258	0.176	0.186	0.2655	0.1778	0.1909	0.2523	0.2306	0.2229
Adj. R^2	0.2113	0.1241	0.1348	0.2174	0.124	0.1379	0.1864	0.1629	0.1545
N	1452	1452	1452	1434	1434	1434	1064	1064	1064

4. Conclusion

In this paper, we analyse abnormal returns of European stocks in different event windows around February 24, 2022 – the day when Russian forces invaded Ukraine. Following standard event study methodology, we scrutinize the effects of Refinitiv ESG-ratings and the carbon dioxide intensity on those abnormal returns in order to contribute to the ongoing discussion, whether sustainable stocks offer a downward risk protection on ESG related events.

We find that the ecological dimension of Refinitiv's ESG-rating has a significant effect on cumulative abnormal stock returns in the pre and post-event window. However, the magnitude is of economical irrelevance. It seems that the downward risk protec-

tion theory related to climate change events can not be expanded to such an event as the Russian war on Ukraine. While we observe some small effects, those are superimposed by other characteristics which account for stability and generally defensive investments. For investors seeking protection against any unexpected event, relying on ESG scores is from our point of view not suitable. Nevertheless, this could still be true for other catastrophes. It is therefore important to further investigate the behaviour of ESG investments during different types of crisis to understand if and how investors value ESG properties in terms of a potential downward risk protection.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Appendix A. Data items

Table A1. Countries and Datastream lists per country. The correct mapping of companies per country is ensured by the data screens, as described in Appendix section B.

Country	Country code	Lists
Austria	AT	WSCOPEOE, ALLAS, FOST
Belgium	BE	WSCOPEBG, FBEL
Denmark	DK	WSCOPEDK, DKALL
Finland	FI	WSCOPEFN, FFIN
France	FR	WSCOPEFR, FFRA
Germany	DE	WSCOPEBD, FGERDOM, FGERIBIS, FGER1, FGER2, FDEALLP1, FDEALLP2
Ireland	IE	WSCOPEIR, FIRL
Italy	IT	WSCOPEIT, FITA
Netherlands	NL	WSCOPENL, FHOL
Norway	NO	WSCOPENW
Portugal	PT	WSCOPEPT, FPOR
Spain	ES	WSCOPEES, FSPDOM, FSPN, FSPNQ
Sweden	SE	WSCOPESD, SDALL
Switzerland	SW	WSCOPESW, FSWA, FSWS
United Kingdom	UK	WSCOPEUK, FBRIT

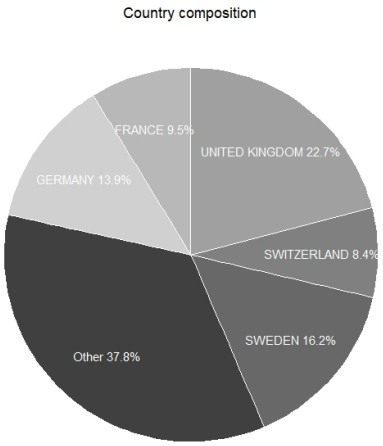

Figure A1. Country composition of the sample.

Table A2. Datastream and Worldscope items used. This table shows the Datastream and Worldscope items and their usage in our analysis. The periodicity indicates how the data were retrieved.

# Mnemonic	Usage	Periodicity
WC02999	ASSETS (TOTAL): - Calculate carbon dioxide intensity - Calculate cash rate - Calculate debt rate - Calculate investment factor - Calculate profitability	y
WC02003	CASH HOLDINGS: - Calculate cash rate	y
WC03501	COMMON SHAREHOLDERS EQUITY: - Calculate book value	y
WC01051	COST OF GOODS SOLD: - Calculate profitability	y
GEOGN	COUNTRY OF COMPANY: - Data screens	static
GEOLN	COUNTRY OF SECURITY: - Data screens	static
PCUR	CURRENCY SHORTCUT: - Data screens	static
ENERDP023	CO_2 AND CO_2 EQUIVALENT EMISSIONS (TOTAL): - Calculate carbon dioxide intensity	y
WC03255	DEBT (TOTAL): - Calculate debt rate	y
WC03263	DEFERRED TAXES: - Calculate book value	y
ENSCORE	ENVIRONMENTAL SCORE (ESG): - Independent regression variable	y
ECNAME	EXPANDED COMAPY NAME: - Data screens	static
ENAME	EXPANDED NAME: - Data screens	static
NAME	EXTENDED NAME: - Data screens	static
CGSCORE	GOVERNANCEL SCORE (ESG): - Independent regression variable	y
WC07015	INACTIVE DATE: - Data cleaning	static
ISINID	ISIN CODE - PRIMARY/SECONDARY FLAG: - Data screens	static
GGISN	ISIN ISSUER COUNTRY: - Data screens	static
MAJOR	MAJOR FLAG: - data screens	static
MV	MARKET VALUE: - Size control variable	d
WC01001	SALES: - Calculate profitability	y
WC07021	SIC1: - 2-digit SIC as industry control variable	static
SOSCORE	SOCIAL SCORE (ESG): - Independent regression variable	y
TYPE	STOCK TYPE: - Data screens	static
RI	TOTAL RETURN INDEX: - Calculate daily stock returns	d
TRESGS	TOTAL SCORE ESG: - Independent regression variable	y
UP	UNADJUSTED PRICE: - Exclude penny stocks	d

Appendix B. Applied data screens

Table B1. Static screens. This table shows the applied filters based on equities' static data, as obtained via Datastream.

#	Items involved	Description	Reference
1	Major = Y	We require the Major Flag being 'Y,' excluding therefore all securities not listed as major shares.	e.g., Schmidt et al. (2011), Hanauer and Huber (2018)
2	Stock Type = EQ	We require the Stock Type flag being 'EQ,' excluding all non-equities.	e.g., Ince and Porter (2006)
3	ISINID = P	We require the ISINID flag being 'P,' only considering primary listings.	e.g., Hanauer and Huber (2018)
4	NAME, ENAME, ECNAME	We filter for 'illegal symbols' in the names specifications of the stocks to exclude duplicates, warrants, ETFs, unit trusts, etc. A complete list of 'illegal symbols' can be found in Table B3.	e.g., Ince and Porter (2006), Griffin, Kelly, and Nardari (2010), Annaert, Ceuster, and Verstegen (2013)
5	GEOGN, GEOLN, ISINCC, GGISN	Stocks with a county indication different from the country composition to be analysed are removed.	e.g., Ince and Porter (2006), Griffin, Kelly, and Nardari (2010), Annaert, Ceuster, and Verstegen (2013)
6	PCUR	Stocks with a currency indication different from those of the sample countries are removed.	e.g., Griffin, Kelly, and Nardari (2010), Hanauer and Huber (2018)

Table B2. Dynamic screens. This table shows the applied filters based on individual stocks to eliminate abnormal data structures, which could potentially influence our analysis, as provided by Datastream and Worldscope.

#	Items	Description	Reference
1	RI	We delete zero returns to prevent illiquid stocks and public holidays from distorting our results.	
2	UP	We exclude so-called penny stocks in our analyses. We define penny stocks as stocks with an unadjusted price below 1€ on December 31, 2021.	Ince and Porter (2006)
3	RI	We follow Ince and Porter (2006) and set abnormal returns to NA when R_3 or $T_{t-1} > 300\%$ and $(1 + R_t)(1 + R_{t-1}) < 50\%$.	e.g., Ince and Porter (2006)
4	RI	We returns to NA when $R_t > 990\%$.	e.g., Schmidt et al. (2011)

Table B3. Illegal symbols. This table lists the illegal symbols used to exclude stocks with unwanted properties globally or per country. The list is mainly taken from Hanauer and Huber (2018).

County	Items involved
All	1000DUPL, DULP, DUP, DUPE, DUPL, DUPLI, DUPLICATE, XSQ, XETa, ADR, GDR, PF, PF, PFD, PREF, PREFERRED, PRF, WARR, WARRANT, WARRANTS, WARRT, WT, WTS, WTS2, %, DB, DCB, DEB, DEBENTURE, DEBENTURES, DEBT, .IT, .ITb, INV, INV TST, INVESTMENT TRUST, RLST IT, TRUST, TRUST UNIT, TRUST UNITS, TST, TST UNIT, TST UNITS, UNIT, UNIT TRUST, UNITS, UNT, UNT TST, UT, AMUNDI, ETF, INAV, ISHARES, JUNGE, LYXOR, X-TR,EXPD, EXPIRED, EXPIRY, EXPY, ADS, BOND, CAP.SHS, CONV, CV, CVT, DEFER, DEP, DEPY, ELKS, FD, FUND, GW.FD, HI.YIELD, HIGH INCOME, IDX, INC.&GROWTH, INC.&GW, INDEX, LP, MIPS, MITS, MITT, MPS, NIKKEI, NOTE, OPCVM, ORTF, PARTNER, PERQS, PFC, PFCL, PINES, PRTF, PTNS, PTSHP, QUIBS, QUIDS, RATE, RCPTS, REAL EST, RECEIPTS, REIT, RESPT, RETUR, RIGHTS, RST, RTN.INC, RTS, SBVTG, SCORE, SPDR, STRYPES, TOPRS, UTS, VCT, VTG.SAS, XXXXX, YIELD, YLD
AT	PC, PARTICIPATION CERTIFICATE, GENUSSSCHEINE, GENUSSCHEINE
BE	VVPR, CONVERSION, STRIP
FI	USE
FR	ADP, CI, SICAV, ““)SICAV““), SICAV-
DE	GENUSSCHEINE
IT	RNC, RP, PRIVILEGES
NL	CERTIFICATE, CERTIFICATES, CERTIFICATES““), CERT, CERTS, STK““.
UK	PAID, CONVERSION TO, NON-VOTING, CONVERSION A
CH	CONVERTED INTO, CONVERSION, CONVERSION SEE

Appendix C. Additional results

Table C1. Cross sectional regressions of cumulative abnormal returns on Refinitiv ESG scores. This table reports the results of cross sectional regressions. The event date t_0 is February 24, 2022. The reported windows are located before this event. TSC, ESC, SSC and GSC are Refinitiv's (total, environmental, social and governancel) ESG scores. For C2R the total carbon dioxide and CO_2 equivalent emissions divided by total assets are used. PRO is calculated as described in Novy-Marx 2013. For INV the approach of Fama and French 2015 is used. As a size proxy the natural logarithm of the market value on December 31, 2021 is used. For the calculation of BM the 2020 book values and the MV on the 2020 ultimo are used. We report t-values in parenthesis, based on robust standard errors (White 1980). We control for firm and industry fixed effects. ***, ** and * indicate a significance level of 1%, 5% and 10%.

	(1) [-30,-4]	(2) [-30,-4]	(3) [-30,-4]
Intercept	14.79***	15.48***	16.21***
	(3.0832)	(3.1743)	(3.409)
TSC	0.10***		
	(4.5656)		
ESC		0.03	
		(1.6168)	
SSC		0.04*	
		(1.729)	
GSC		0.04**	
		(2.0627)	
C2R			0.43***
			(2.7105)
PRO	-0.39	-0.53	-2.99
	(0.2002)	(0.269)	(1.5307)
INV	-1.35*	-1.51*	-4.26**
	(1.6783)	(1.8688)	(2.5796)
ln(MV)	-0.79***	-0.87***	0.03
	(2.7594)	(2.9617)	(0.1132)
BM	1.99***	1.83***	1.91***
	(4.2279)	(3.8689)	(3.7743)
CSR	-3.99	-4.02	-0.23
	(1.1514)	(1.1609)	(0.0579)
TDR	0.12	-0.14	4.81**
	(0.0558)	(0.0675)	(2.1477)
Industry FE	yes	yes	yes
Country FE	yes	yes	yes
R^2	0.223	0.2259	0.2461
Adj. R^2	0.1348	0.1753	0.1797
N	1452	1434	1064