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ESG ETF performance during crisis: An analysis of the Russia-Ukraine conflict

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PREFACE AND ACKNOWLEDGEMENTS

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The views stated in this thesis are those of the author and not necessarily those of the supervisor, second assessor, Erasmus School of Economics or Erasmus University Rotterdam.

ABSTRACT

This thesis assesses the risk-adjusted performance of ESG ETFs surrounding the invasion of Ukraine. Using the post-expense returns of these ETFs, several factor models were applied to analyze this performance. These models show that in the period leading up to the invasion, the negative returns of the ETFs were insignificant. During the period after the invasion, the higher-rated ETFs performed worse than their lower-rated counterparts and tended to underperform the market. In general, the ETFs failed to outperform the market and were not effective hedge, exhibiting significant losses during the market decline.

Keywords: Russia, Ukraine, War, ESG, ETF, Alpha

JEL Classification: G11, G12, G14, G15, G23, M14

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CHAPTER 1 Introduction

1.1 The Russo-Ukraine conflict

On February 24 2022, Russian forces entered Ukraine marking an escalation in the longstanding tensions between the two countries. What followed was a period where Europe rapidly had to ensure their independence of Russian oil and gas, while the US reexplored their conventional non-sustainable energy sources. Markets were characterized by an increased rate of inflation and new spending records in military budgets were reached. NATO mentioned that they saw a real increase of 11% in defence spending by Europe and Canada, which according to the Secretary General, was an increase not yet seen before. Global defence spending rose by 9% to record 2.2 trillion according to The International Institute of Strategic Studies. Overall, this conflict has had major environmental, social and governmental consequences (ESG). Suddenly, MSCI Downgraded Russia's ESG ratings. According to Bloomberg, the amount of ESG funds that held stocks with the MSCI classification aerospace & defence, rose with a historic 25 percent in the third quarter of 2023, compared to March 2022. While some fund owners seem hesitant to make this addition to their fund due to ethical concerns, prominent political figures around the world urge them to rethink their position. According to investment magazine, in 2023, the UK government promised to protect their defence industry against ESG investors 'trying to immorally defund British defence.' NATO Secretary General Jens Stoltenberg stated that certain investors had the incorrect notion that the defence industry is immoral, but that these concerns were invalid as aiding allies or Ukraine defend their country was to be deemed ethical. The European Defence Agency stated that the defence industry was actively being harmed by ESG funds that exclude it, as it made it harder for the industry to attract investors and employees, as well as diminishing its reputation. These frustrations are echoed by the Dutch minister of defence, Kasja Ollongren. In the face of refusals to provide loans to defence firms by banks over ESG concerns and European sustainability laws, she has proposed a new measure. In which, the ministry of defence would be the guarantor for loans for defence companies, making loans more accessible for these companies. The European commission has also made several pledges, with the newest proposal consisting of 1.5 billion euro's to boost the industry's production capacity.

1.2 Contributions and academic relevance

While it seems as though the performance of sustainable equities and funds during crises has been widely discussed in academic literature, relatively few seem to focus on the Russia-Ukraine conflict, with its unique implications for ESG ratings. Furthermore, even fewer seem to focus on the performance of ESG-ETFs during such crises. Although Pavlova and de Boyrie (2022) have studied this relationship recently in regards to the COVID-19 crisis, such a study seems yet to be performed

for the Russo-Ukraine conflict. The Russo-Ukraine conflict has presented several novelties, such as a rise in defence and aerospace stocks. ESG ETFs differ from traditional ESG stocks in their composition, for example their transparency and sometimes the inclusion of hedging stocks. They offer diversification, low managing costs and reduced tax costs as they sometimes reinvest dividends. This paper will focus on the following research question: *how do sustainable ETFs perform relative to the market during the Russia-Ukraine conflict?*

1.3 Main findings

The main findings of this study are that the sample of vetted ESG ETFs fail to outperform the market on a risk-adjusted abnormal returns basis across the entire 28 week period surrounding the invasion, as well as proving to be an ineffective hedge during the market downturn. They did outperform similar non-ESG ETFs during this downturn however. Moreover, after the invasion, the higher-rated ESG portfolios tend to have significantly worse performance than their lower-rated counterparts, with underperformance compared to the market. The lower-rated portfolios typically offered a performance equal to the market for the both periods, while the higher ratings only did so in the pre-invasion period. When paired with other ETFs on category, age, strategy and assets under management, the ESG ETFs offered similar performance, while even outperforming the matched ETFs when accounting for more risk-factors after the invasion. Dividing the sample in three strategies, index, social and clean, the clean technology oriented funds outperformed the other strategies across the entire observation period, offering risk-adjusted abnormal returns on par with the market. Finally, when comparing ETFs with the Morningstar low carbon designated ETFs to those missing this certification, I found that the low carbon group exhibited significant negative returns across the whole timeframe, whereas the normal group had returns equal to the market.

1.4 Construction paper

To answer the research question, I will be looking at existing literature in Chapter 2 and clarify the main concepts within this topic. Continuing, the dataset and construction of variables will be examined in the third chapter. The fourth chapter will contain the methodological approach of my analysis. The results will be presented in chapter 5, while the conclusions will be drawn and discussed in the final chapter, chapter 6. Some additional annotations can be found in the appendix.

CHAPTER 2 Literature Review

2.1 ESG and ETF

ESG refers to Environmental, Social and Governance, throughout this paper. ESG is a concept which measures the sustainability of financial assets. Based on these three pillars, the assets are given a score. There seems to be a lack of consensus and manner as to how to calculate these scores.

Therefore, often scores awarded by rating agencies are used, such as the Morningstar 'globes' rating. Exchange Traded Funds, also known as ETFs, are funds that function like individual stocks, as they can be bought and sold on exchanges. These ETFs essentially hold a basket of assets, like commodities or securities. In this way, they provide an easily accessible way to hold a variety of assets without having to purchase them individually. Additionally, they might contain assets that are not readily available to trade on the public markets. Sometimes, they also reinvest received dividends. These characteristics make it a cost and tax efficient instrument for investors, while also offering them diversification.

2.2 Previous findings

2.2.1 Previous findings from the Russo-Ukraine conflict

There have been several studies regarding stock performance based on ESG ratings or the sustainability of equities during this unique event. Deng et al. (2022) found mixed results in their study, as they found that stocks with high regulatory risk for the low-carbon transition outperformed in the US, while in Europe the opposite seemed true. High-transition risk equities suffered. Another study by Singh et al. (2022) suggests that the conflict increased investors' preference for Aerospace and defence stocks, as well as energy stocks due to the growing role of sustainable energy. They concluded that investor preference shifted from ESG equities to energy investments. Interestingly, this effect seems to be a reversal of their findings during the COVID-19 crisis. Here, they found that investor appetite shifted from energy to ESG investments. Abbassi et al. (2023) found that using a sample of the S&P Global 1200 index, stocks with a high environmental score were negatively affected by the crisis. A study by Ahmed et al. (2022), seems to corroborate this. They conclude that firms that had a high ESG score were not less likely to divest and retract from Russia, nor did they fare better from the following shock in the stock market. French et al. (2023) have similar findings. They found that after controlling for timeframes and firm choice, there were strongly negative returns associated with firms that undertook strong ESG actions against Russia. As stronger firm decisions against the military actions, as well as exiting Russia, led to stronger negative cumulative abnormal returns. While Kick and Rottmann (2022) suggested that there were slightly positive abnormal returns associated with high ESG stocks, they mention that these are too small to be of any economic

relevance. They acknowledge that these results contradict the theory that such ESG stocks provide a hedge against events such as the Russia-Ukraine war. Katsampoxakis et al. (2024) contradict this, as they deduce that both during the COVID-19 crisis and the conflict in Ukraine, ESG indices appear to be safe havens for investors during such times, as they appear to provide them with positive returns while negating risk.

While the aforementioned studies mainly mention equities during the conflict, relatively few are regarding funds and none mention ESG ETFs. One such study mentions that during the crisis, socially responsible funds seem to fail to outperform conventional funds in the long term. (Cosma et al., 2023) This is further supported by Chen et al. (2022), as they deduce that sustainable, uncontroversial US funds underperform their more unsustainable competitors. Environmentally friendly funds attracted fewer investors, while the mutual fund sector in the US, on the whole, saw an increase in carbon-polluting and defence-related holdings, reducing the number of sustainable funds in the US.

2.2.2 Previous findings from the COVID-19 crisis

Additionally, there has been a broad amount of similar studies performed on the other recent market downturn, regarding equities during the COVID-19 outbreak. Ding et al. (2021), Cardillo et al. (2022) Broadstock et al. (2021), Albuquerque et al. (2020), Singh (2020), find that ESG-related investment strategies concerning equities lead to higher performance during a crisis period. Demers et al. (2020) and Glossner et al. (2020) find conflicting results.

Studies regarding funds interestingly, found different effects of implicating an ESG-related investing strategy. When looking at US actively managed mutual funds, Pastor and Vorsatz (2020), derive that funds with a high sustainability rating offered better performance than their peers, as well as being favored by investors that reallocated their assets. Döttling and Kim (2022) have findings that seem to contrast this. Not only do they find a low interest by retail investors for ESG mutual funds by Morningstar rating, but they also find that higher ESG ratings lead to more capital being withdrawn from these funds.

Furthermore, this period also contains multiple studies based on the performance of ESG ETFs, which seem to be lacking in the Russo-Ukraine conflict. One such paper, used ANOVA and multivariate regression to analyze ETF performance and their Eco ratings as derived from Corporate Knights. They found that a higher rating did not lead to better performance during the COVID-19 market downturn. (Folger et al., 2020) The other paper, by Pavlova and de Boyrie (2022) seems to reaffirm this. Using ESG ETFs using Morningstar ratings, they similarly found that higher ESG ratings did not provide any resilience during a market downturn, as they boasted a similar performance to the market.

Kanuri (2020) has looked at ESG ETFs during the period before both crises, from their inception in 2015, until 2019. Their ESG portfolio, based on equal weighting and value share, underperformed across the entire period when compared to global proxy ETFs and US Proxy ETFs. A Russell 3000 ETF and SPDR Global Dow ETF, respectively.

2.2.3 Meta table

Below, in **Table 1** is a meta table comprised of the most relevant literature concerning this topic. The most important results connected to the research are highlighted. For relevance, the studies pertaining to equities during the COVID-19 crisis are omitted. It then becomes evident that the Fama-French model is most prevalent among the ETF studies, the goal of which is to estimate abnormal returns. Carhart and the CAPM also seem two popular choices for this role. There mostly seems to be a negative relation between high ESG funds and returns compared to the market.

Table 1 Meta table

Author(s) (Publication year)	Time period	Region	Method	Control variables	Results
Pavlova and de Boyrie (2022)	Nov. 2019-May 2020	Global	Event study Fama French, Carhart CAPM		No difference in alpha for all models during the crisis
Deng et al. (2022)	Jan. 24 – April 29 2022	Global	Event study BERT language model Fama-French regression	ESG Inflation Exposure, international war, sanctions	Outbreak = 1.79*ESG
Kick and Rottmann (2022)	Jan. 15 – Dec. 30 2021	Europe	Event study Market model	Industry Country Firm characteristics	CAR(-3,3) = -.03 CAR (4,10) = 0.01
Folger et al (2020)	Jan. 11 2019-March 3 2020	Global	Event study Anova Tukey test Regression		Financial returns covid = -1.52*Eco rating
Ahmed et al. (2022)	Jan. 24 – April 29 2022	Europe	Event study (Logistic) regression Portfolio analysis	Firm characteristics Risk Fama-French factors	Raw returns ESG score continuation = -0.673
Döttling and Kim (2022)	Jan 2019-April 2020	Global	Event study Fama-French Difference in differences	Fund characteristics	High ESG x covid x retail = -3.648 flow

Kanuri (2020)	Feb 2005- July 2019	Global	Event study CAPM Fama French Carhart		Alpha = -0.52% & -0.55%
Pastor and Vorsatz (2020)	Jan. 1 2017 – April 30 2020	US	Event study CAPM Fama-French Carhart Regressions	Industry Fund characteristics	4/5 sustainability globe Carhart alpha = 3.76
Chen et al. (2022)	Jan. 1 2021- May 27 2022	US	Market model, Panel regressions	Size, Rating, Turnover, Age, Expense ratio, Fund return	ESG fund annualized cumulative daily return = - 1.566 ESG Fund
Singh et al. (2022)	April 1 2019- May 6 2022	Global	Event study return spillovers		Net contribution ESG = -26%
Abbassi et al. (2023)	Jan. 26 2021- March 8 2022	Global	Event study Market model	Sector Firm characteristics	CAR(+1,+7) = -0.045
French et al. (2023)	Jan 25 - March 25 2022	US, Russia	Event study Market model		CAR(0,30) = -7.49%
Cosma et al. (2023)	20 Feb. 2020 –20 Feb. 2021 24 Feb. 2022- 24 Feb 2021	Europe	Anova Several post hoc tests		No significant difference between groups
Katsampoxakis et al. (2024)	Jan. 3 – 23 Aug. 2022	Global	Continuous Wavelet Transformations		Negative correlation VIX and several ESG ETFs

2.3 Hypotheses

Building upon current studies and the meta table, we formulate three hypotheses. The first being Hypothesis 1: ETFs with a lower ESG score outperform their peers with a higher ESG score during the Russo-Ukraine conflict. Hypothesis 2 asserts that ESG ETFs fail to outperform the market during this period. Finally, hypothesis 3 states: ESG ETFs fail to be an effective hedge for investors during this timeframe.

CHAPTER 3 Data

3.1 Sample

To arrive at the sample of sustainable ETFs, I utilized Morningstar's Quintessential List of Sustainable Funds (Liu, 2020). This list is comprised of funds that have been vetted by Morningstar's former head of sustainability research, Jon Hale. The list is comprised of funds that actively consider ESG in their investment strategy. For example, simply mentioning in the fund's prospectus that ESG is one consideration in their investment strategy, is not enough to be considered for the list. Funds that focus on social impact, and sustainable sectors and actively consider ESG in their investment process are considered. The latter most often feature exclusions for certain areas that are typically deemed as non-sustainable by index families, such as controversial weapons or oil and gas explorations.

This list contained 81 ETFs. Of these, eight were disbanded, leaving 73 active ETFs. In [Appendix C](#), like Winegarden (2019) and Pavlova & de Boyrie (2022), I classified these ETFs based on three categories. Index, Clean and Social. Funds classified as Index operate like any other broad indices. However, typically they also feature some exclusionary screenings, as previously mentioned. Moreover, the clean category pertains to waste management and clean, alternative technology. This means that these funds employ a strategy that chases an ESG goal, specifically environmental objectives. This is in stark contrast to the Index category, as they do not chase a specific ESG goal. The final category, social, refers to all the funds that employ strategies that chase specific ESG goals, not including environmental objectives and/or clean tech and waste management. For instance, the NAACP Minority Empowerment ETF seeks to invest in mid and large-cap companies that are "empowering to minorities".

3.2 Matched funds

To compare the returns of these ESG ETFs, I matched them to similar non-ESG ETFs, which can be found in [Appendix A](#). Similarly to Pavlov & de Boyrie (2022), I matched them by sector and assets under management (AUM). I did this by looking at their Morningstar category. Furthermore, when possible, I tried to match according to strategy & fund age, as closely as possible. I chose to match for strategy, as this would allow for a closer comparison between the matched and ESG funds. I felt the addition of fund age was necessary to overcome survivorship bias. This might be present, as my sample only contains funds that are not disbanded, which leads to only successful funds remaining in the sample, driving up returns. If the matched funds are about the same age as the ESG funds, this would hopefully lead to negating this issue. This was not possible in a few instances, as ESG funds are a relatively new phenomena and are often based on pre-existing indices that are much older. This leads to a few matched funds being much older despite being based on the same index as the ESG fund. For example, the Nuveen ESG Mid-Cap Value ETF and iShares Morningstar Mid-Cap Value ETF are both based on the MSCI USA Mid-Cap Value Index. However, the first ETF was launched in 2004,

and the latter from iShares was only launched in 2016. Although, I am still convinced that this age difference might not necessarily lead to survivorship bias. The newer ESG ETF is based on an index that has already proven to be successful in attracting funding in ETFs, leading to a high likelihood of success, somewhat negating this survivorship bias, as it is less likely to disband.

3.3 Sustainability ratings

To measure the sustainability of funds, I opted for multiple of the most popular ESG metrics. I opted not to use the Sustainable Finance Disclosure Regulation (SFDR) in the EU as Cremasco and Boni (2022), reported that these classification seemed to prove unreliable, especially with respect to the Morningstar category according to Ferriani (2023). For this reason, I opted for the Morningstar globes rating. Various studies concerning ESG equities also use the Refinitiv ESG rating such as Ding et al. (2021), Cardillo et al. (2022) and Albuquerque et al. (2020). Therefore I also included it in my research. Finally, I also used the MSCI ESG rating. For funds, the Refinitiv ratings were not readily available to me, therefore I attempted to approximate the Refinitiv rating for ESG funds.

Refinitiv refreshes their ratings on a weekly basis, while Morningstar updates them monthly and it appears MSCI reevaluates them on a yearly basis. To assess what time frame I needed to choose for these ratings, I looked to Pavlova & de Boyrie (2022) in order to replicate their research methodology. It appears as though they used ratings available on ETF.com and Morningstar.com. As these sites only provide the most recently available ratings, Pavlova & de Boyrie (2022), seemed to have utilized the most recent ratings available to them, as opposed to the historical ratings during the crisis period. This contrasts to other studies, as Albuquerque et al. (2020) use a cross section of Refinitiv ratings, while Cardillo et al. (2022) and Albuquerque et al. (2020) include Refinitiv ratings before or at the start of the COVID-19 crisis. This motivated me to also look at ratings just before the crisis period, as well as the most recently available. When comparing the Morningstar sustainability rating of February 2022 at the start of the invasion, to the most recently available (February 2024), it appears they have stayed almost exactly the same, with only a slight difference in availability of ratings. Unfortunately, I was unable to verify this for the MSCI and Refinitiv ratings, as the historic data of these ratings is not readily available to me. The historical MSCI data was not included in my access to the CRSP database, while approximating the historic Refinitiv rating in the same manner as the current was impossible due to the historical holdings of the funds not being readily accessible. However, comparing the current MSCI rating of the sample to those obtained by Pavlova & de Boyrie (2022), it becomes possible that the ratings have changed from when their research was conducted. While my sample contains firms from A until AAA, theirs also includes the ratings BBB and BB. Nevertheless, it cannot be ruled out that this difference simply comes from ETFs that have disbanded since the publication of their paper and are therefore not included in my sample.

MSCI, Refinitiv and Morningstar calculate the fund rating by taking the weighted average of their ESG ratings of companies in the funds. They then correct for the number of available ratings according to Morningstar (2019), MSCI (2023) and Refinitiv (2022). The company ESG ratings are typically based on the scores for the three pillars of ESG, based on many varying criteria per pillar. They are then assigned a rating according to their ESG-based performance relative to their peers within their sector or industry.

I attempted to replicate this method for fund rating by calculating the weighted average of the Refinitiv ESG rating of the 100 biggest holdings by fund share, if these were available. Due to Datastream constraints, this was the largest sample possible. They were then assigned a letter according into which score range from Refinitiv (2022), they fell, from D - to A +. For example, according to Refinitiv (2022), a score between 0.33 until 0.4166 falls is assigned the C rating. The weighted average was calculated using the following formula, with n being the number of holdings from which the ESG rating was available and the weight being the share of the holding in the fund. An overview of the calculations can be found in [Appendix B](#).

$$ESG\ score = \frac{ESG\ holding_1 * weight\ holding_1 + \dots + ESG\ holding_n * weight\ holding_n}{assets\ of\ n\ holdings\ percentage\ of\ total\ fund\ assets}$$

The holdings and Refinitiv ESG score were retrieved from Eikon. Furthermore, I retrieved the MSCI rating from MSCI.com and the Morningstar sustainability rating from its own website, Morningstar.com. Because of the low amount of observations of ESG funds with a 1 and 2 Morningstar globes sustainability rating, I combined them into one category. This was also the case for the Refinitiv C+ rating and A rating, which only had one observation each. I combined them with the B- and A- category respectively. Additionally, the low carbon rating, expense ratio and fund age were also retrieved from Morningstar.com. The low carbon rating variable was constructed as follows: funds received a 1 if they had a Morningstar low carbon designation, and 0 if they lacked this acknowledgement. To receive this certification, a fund must consist of less than 7% fossil fuel-involved assets on average for the trailing 12 months. The second requirement is that the average Morningstar fossil fuel risk score is below 10. (Morningstar, 2023) Based on these ratings the funds were split into groups. These groups form the basis for their respective equally weighted portfolios, as provided in [Appendix C](#).

3.4 Construction of variables

To evaluate performance, daily net asset value (NAV) was used from Eikon between 18 November 2021 and 2 June 2022, (14 weeks before and after the 24 February incursion of Russian forces into Ukraine). This NAV was then used to calculate post-expense daily returns, using the following formula, where t stands for the day, and $return_t$ is in percentage.

$$Return_t = \frac{NAV_t - NAV_{t-1}}{NAV_t} * 100$$

Cumulative return was calculated in percentage using the following formula. *Cumulative return_t* was set at 100% for $t = 1$, with t being days.

$$Cumulative Return_t = (return_t + 1) * cumulative return_{t-1}$$

To calculate the portfolio standard deviation the following formula was used:

$$\sigma_{portfolio} = \sqrt{w_i^2 \sigma_i^2 + 2w_i w_j \rho_{i,j} \sigma_i \sigma_j} \text{ for } i = 1, \dots, n \text{ and } j = 1, \dots, n \text{ with } i \neq j$$

Where σ is the standard deviation, ρ the correlation between assets i and j , n the number of holdings in the portfolio and w the weight of the security. It is therefore calculated using a covariance matrix and equal weighting ($1/n$) for all holdings in a portfolio. This covariance matrix contains the covariance between all possible pairings of securities in a fund. This matrix is then multiplied by the weights of the holdings. The square root of this variance gives the portfolio standard deviation. I performed this in Stata.

3.4 Sample factors of models

Fama and French (2015), propose a model with 5 factors that explains excess stock returns. They build on the inability of the CAPM model to explain variation in stock returns, by adding several factors that help explain this unexplained variation. They used the value-weighted return of all the NYSE, AMEX, and NASDAQ firms in the US that have a CRSP share code of 10 or 11, to calculate the market return (R_m). For the risk-free rate (R_f), they used the returns of the one-month US treasury bills. To construct the remaining four factors (based on 2x3 sorts), they used 6 value-weighted portfolios based on size and book-to-market ratio, 6 formed on size and operating profitability, and 6 formed on size and investment. For every one of these sorts, two breakpoints were used to assign stocks into three groups, the 30th and 70th NYSE percentiles, except for the size sort, which used the median of NYSE listed stocks, thus producing the 2x3 sorts.

The small minus big factor (SMB) reflects the difference in returns of small market cap stocks and big market cap stocks. It is notable that the composition of this factor differs slightly between the 3 factor Fama-French model and the 5 factor, as indicated in [Table 2](#). Moreover, the high minus low factor (HML) measures the difference in returns of stocks with a high book-to-market ratio and stocks with a low book-to-market ratio. Additionally, the robust minus weak factor (RMW), captures the difference between the returns of robust operating profitability stocks and weak profitability stocks. Finally, the conservative minus weak factor (CMA) does the same for the investment of firms. In addition to all these factors, a momentum factor is also incorporated, winners minus losers or WML, for the Carhart model and the 5 factor plus momentum. It is calculated using the same breakpoints as the other sorts and measures the difference in returns of up-trending stocks or ‘winners’ and down-trending stocks or ‘losers’.

Table 2 Construction of factors by Fama and French (2015)

Sort	Breakpoints	Factors and their components
Size (3-factor)	NYSE median	$SMB_{B/M} = \frac{SH + SN + SL}{3} - \frac{BH + BN + BL}{3}$
		$SMB_{B/M} = \frac{SH + SN + SL}{3} - \frac{BH + BN + BL}{3}$
Size (5-factor)	NYSE median	$SMB_{OP} = \frac{SR + SN + SW}{3} - \frac{BR + BN + BW}{3}$
		$SMB_{Inv} = \frac{SC + SN + SA}{3} - \frac{BC + BN + BA}{3}$
		$SMB = \frac{SMB_{B/M} + SMB_{OP} + SMB_{Inv}}{3}$
Value	30th and 70th NYSE percentiles	$HML = \frac{SH + BH}{2} - \frac{SL + BL}{2}$
Profitability	30th and 70th NYSE percentiles	$RMW = \frac{SR + BR}{2} - \frac{SW + BW}{2}$
Investment	30th and 70th NYSE percentiles	$CMA = \frac{SC + BC}{2} - \frac{SA + BA}{2}$
Momentum	30th and 70th NYSE percentiles	$Mom = \frac{SH + BH}{2} + \frac{SL + BL}{2}$

Note: The primary letter refers to the Size category, small (S) or big (B). The second letter indicates other groups. For example for the B/M group, high (H), neutral (N), or low (L). Or the OP group, robust (R), neutral (N), or weak (W). For the Inv group, conservative (C), neutral (N), or aggressive (A) are referred to. Finally, for the Mom group, the following categories exist, high (H) or low (L).

The data for the Fama-French factors I accessed from their Data Library on his page at the website of the University of Dartmouth. Specifically US markets factors, as this covers the same exchanges as where the funds are listed, as it contains NYSE, AMEX, and NASDAQ. (Fama & French, 2024) The Data Library is based on data from the Center for Research in Security Prices (CRSP) as well as Compustat and Moody's. (Fama & French, 2023)

3.5 Descriptive statistics

Table 3 contains some descriptive statistics from the sample. It is notable that the variation in total assets is very large amongst the funds. Additionally, by looking at the maximum and minimum the total assets contains some notable outliers.

Table 3 Descriptive statistics of sample

	<i>Average</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
Refintiv ESG score	69.755	8.264	41.227	85.048
Expense ratio	0.361	0.208	0.090	0.970
Age	8.758	4.535	4.315	19.346
Total Assets	1128.822	2129.965	7.700	12800.000
Low carbon	0.472	0.503	0.000	1.000

Note: These statistics are based on the sample from Morningstar, only including active ETFs as described in section 3.1. Age was calculated in years on 30/05/2024. Assets are concerning total assets in April 2024 in million US Dollars. The Refintiv ESG score is a sample-based estimation according to the method described in section 3.3, and does not reflect the actual lipper fund Refintiv ESG scores.

From **Table 4**, it becomes evident that the average net returns are much lower in all portfolios before the invasion, while the average returns after the invasion appear to move closer towards 0%. This could be because higher volatility might be present after the invasion, with very low, or even negative returns canceling out high returns centering the average returns around 0%. Interestingly, there seems to be a pattern of higher average returns for more sustainable funds before the invasion, a pattern which reverses after the invasion, as the less sustainable options offer better returns. The standard deviations seem to suggest that higher-rated funds seem to have lower volatility across the whole period, with exception of the low carbon funds. These seem to have a higher volatility, indicated by the higher standard deviation.

Table 4 Descriptive statistics of net returns by portfolio

Portfolio	SD	Before invasion			After invasion		
		Min.	Max.	Avg.	Min.	Max.	Avg.
Globes							
1 & 2	1.309	-6.041	9.229	-0.295	-9.634	8.688	0.088
3	1.353	-5.488	7.766	-0.196	-4.172	7.727	-0.015
4	1.042	-5.249	6.343	-0.178	-8.037	7.588	-0.156
5	1.753	-13.553	4.141	-0.254	-5.384	4.676	-0.007
MSCI							
A	1.251	-6.041	9.229	-0.221	-9.634	13.227	0.008
AA & AAA	1.099	-13.553	5.869	-0.201	-6.044	6.895	-0.025
Strategy							
Clean	1.063	-6.041	9.229	-0.450	-9.634	13.227	0.143
Index	1.200	-13.553	4.141	-0.162	-5.384	7.441	-0.044
Social	1.288	-3.188	2.918	-0.156	-4.234	3.995	-0.012
Certification							
Low carbon	1.256	-13.553	7.040	-0.225	-7.056	8.308	-0.024
carbon	1.124	-6.430	9.229	-0.203	-9.634	13.227	0.012
Refinitiv							
C & B-	2.032	-8.187	9.229	-0.419	-9.634	13.227	0.096
B	1.296	-13.553	5.716	-0.297	-6.936	7.588	0.061
B+	1.133	-6.947	5.869	-0.175	-6.044	7.441	-0.029
A- & A	0.988	-3.234	2.918	-0.138	-4.265	4.513	-0.047

Note: All above statistics provided above are percentages. SD refers to the portfolio standard deviation. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022.

Looking at [Table 5](#), there appears to be a correlation between the sustainability of funds and the share of low carbon certifications. Most portfolios seem to be centered around the same age, with the exception of the clean strategy funds. This makes sense, as the clean energy movement predates the ESG trend in corporate strategies. The more sustainable portfolios seem to have a higher number of average total assets. This is interesting as it might imply that more sustainable funds could be attracting more funding. This might also have some relation to the fact that the average expense ratio's seem to be lower.

Table 5 Funds and means by portfolio

Portfolio	n	Age (year)	Assets (\$Mn.)	Expense ratio	Low carbon
Globes					
1 & 2 Globes	9	10.54	312.87	0.59	0.22
3 Globes	24	8.30	921.55	0.33	0.46
4 Globes	25	8.44	1600.67	0.33	0.40
5 Globes	14	8.83	1166.10	0.32	0.79
MSCI					
A	44	7.90	738.34	0.37	0.45
AA & AAA	28	10.04	1742.43	0.34	0.50
Strategy					
Clean	13	13.43	511.25	0.60	0.15
Index	47	7.55	1374.12	0.29	0.55
Social	12	8.27	837.09	0.39	0.50
Certification					
Low carbon	34	8.96	1192.77	0.32	1.00
carbon	38	8.53	1071.61	0.40	0.00
Refinitiv					
C & B-	10	9.74	559.20	0.50	0.30
B	10	12.83	799.25	0.55	0.40
B+	28	8.53	641.81	0.38	0.46
A- & A	24	6.84	2071.67	0.20	0.58

Note: N reflects the number of funds. Age was calculated on 29/05/2024. Assets are concerning total assets in April 2024 in million US Dollar.

3.6 Descriptive figures

In figures 1-5, I graphed the cumulative returns of the portfolios according to their different groupings. It becomes clear from the figures that the cumulative returns ended significantly lower 14 weeks after the invasion than at the start of the observation period. In the weeks immediately following the invasion, the returns dropped significantly. They seemed to recover in March 2022, coinciding with the FED rate hikes, before continuing the downtrend the months after. In [Figure 1](#), the 1 & 2 globes portfolio seems to perform the poorest, while the 4 globes portfolio seems to offer the best returns. However, the portfolios seem to exhibit quite similar returns overall. [Figure 2](#) provides an interesting phenomenon. While the index and social-oriented funds seem to have closely correlated returns, the clean strategy seems to offer very poor returns, both pre-and post-invasion. [Figure 3](#) seems to illustrate similar returns for low carbon designated and funds lacking this designation, while [Figure 4](#) offers a different picture. The lowest sustainability ratings offer far worse performance compared to their higher-rated peers. This is reaffirmed in [Figure 5](#), as the group with slightly lower ratings offered slightly worse performance after the invasion period.

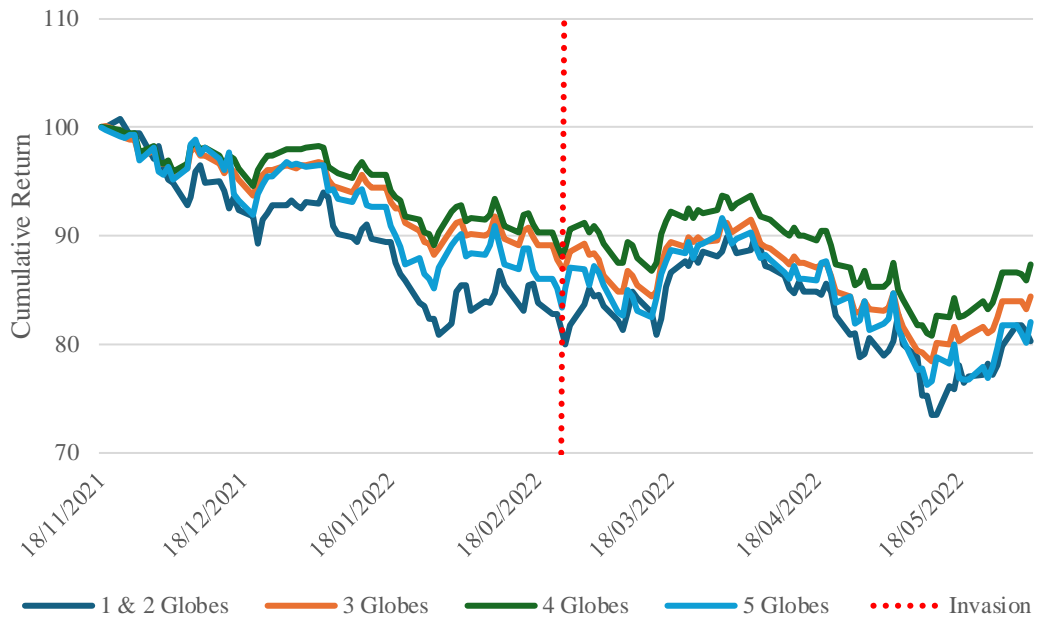


Figure 1 Cumulative Return by Morningstar Globes (in percentage)

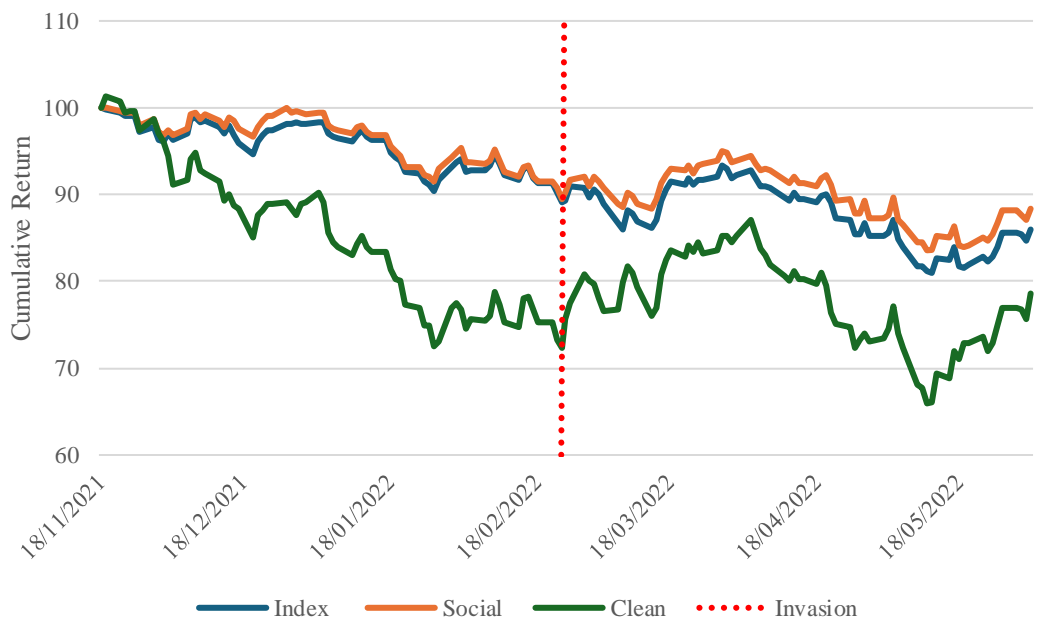


Figure 2 Cumulative Return by Strategy (in percentage)

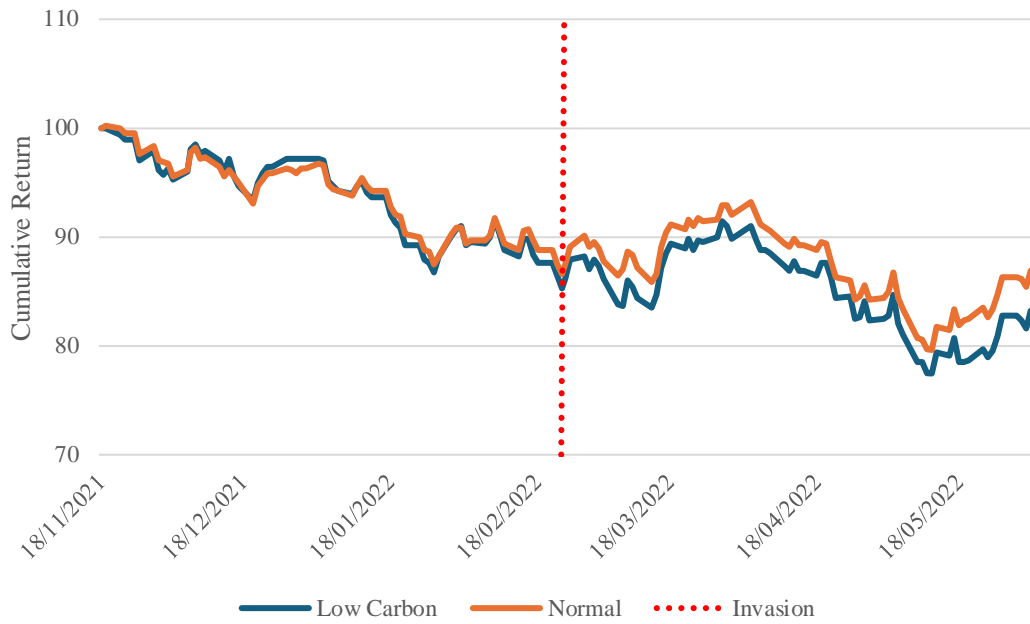


Figure 3 Cumulative Return by Morningstar carbon designation (in percentage)

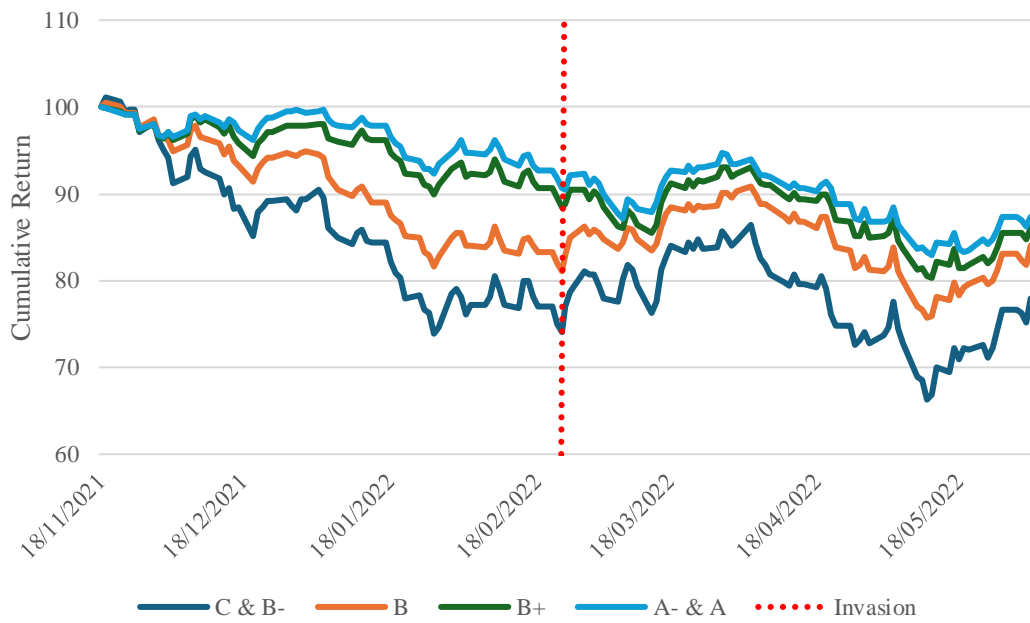


Figure 4 Cumulative Return by Refinitiv Grade (in percentage)

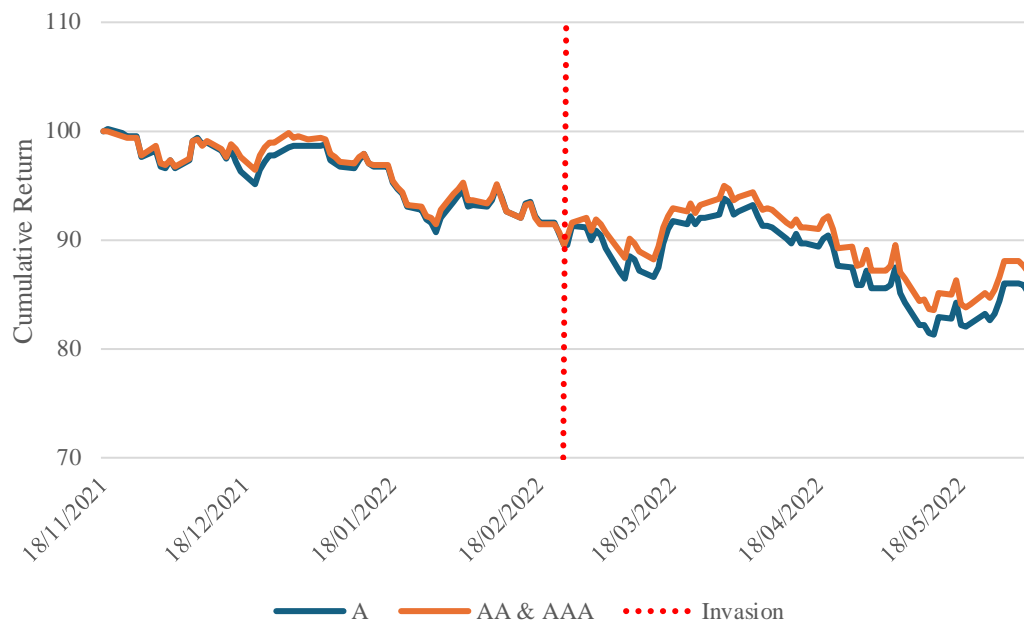


Figure 5 Cumulative Return by MSCI rating (in percentage)

Chapter 4 Method

4.1 Models

Similar methods will be employed to Pavlova & de Boyrie (2022), in order to attempt to replicate their findings. Following Pavlova & de Boyrie (2022), several multiple factors models will be used to calculate the risk-adjusted abnormal performance of equally weighted portfolios. To test our hypothesis that during the Russo-Ukraine conflict ESG ETFs fail to outperform the market, we will use these models and test whether their alpha is indeed insignificant. Secondly, we will investigate if any of the alpha in these models of the ESG funds is significantly positive. This will allow us to investigate the second hypothesis, that ESG ETFs fail to be an effective hedge for investors during periods of crisis. This ‘alpha’ is essentially the excess returns left unexplained by the models’ several risk factors, such as the covariance with the market, in the CAPM model, or the five factors of the Fama-French model. This alpha therefore gives us the risk-adjusted abnormal performance. As these factors are based on portfolios of the market, any significant alpha indicates a deviance from the risk-adjusted performance of the market measured by our models.

The following models will be used: 1) CAPM, 2) Fama-French (1993) 3-factor model, 3) Carhart, 4) Fama-French (2015), 5-factor model, and 5) Fama-French 5-factor model plus momentum factor. The models are performed for two periods, once for the period before and once after the invasion.

- (1) $R_t - R_{ft} = \alpha + \beta_1 (R_{mt} - R_{ft}) + \varepsilon_t$
- (2) $R_t - R_{ft} = \alpha + \beta_1 (R_{mt} - R_{ft}) + \beta_2 (SMB_t) + \beta_3 (HML_t) + \varepsilon_t$
- (3) $R_t - R_{ft} = \alpha + \beta_1 (R_{mt} - R_{ft}) + \beta_2 (SMB_t) + \beta_3 (HML_t) + \beta_4 (RMW_t) + \varepsilon_t$
- (4) $R_t - R_{ft} = \alpha + \beta_1 (R_{mt} - R_{ft}) + \beta_2 (SMB_t) + \beta_3 (HML_t) + \beta_4 (RMW_t) + \beta_5 (CMA_t) + \varepsilon_t$
- (5) $R_t - R_{ft} = \alpha + \beta_1 (R_{mt} - R_{ft}) + \beta_2 (SMB_t) + \beta_3 (HML_t) + \beta_4 (RMW_t) + \beta_5 (CMA_t) + \beta_6 (WML_t) + \varepsilon_t$

Where:

R_t = equally weighted return for day t based on the groups that the ETFs were split into

R_{ft} = risk-free rate

$R_{mt} - R_{ft}$ = excess return on the market

SMB_t = returns of small cap stocks – returns of big cap stocks

HML_t = returns of high value characteristic stocks - returns of low value characteristics stocks

WML_t , =returns of up trending stocks or ‘winners’ – returns of down trending stocks or ‘losers’

RMWt = robust profitability stocks - weak profitability stocks

CMAt = returns stocks of low investment or 'conservative' stocks – returns of high investment stocks or 'aggressive'

4.2 Standard errors

Standard errors are estimated using the Newey-West Method. This is done in an effort to overcome autocorrelation, as the equities in funds might have daily returns that are correlated to the returns of the previous day, for example by momentum. This would mean that they exhibit autocorrelation. The maximum number of lags to be taken into account for autocorrelation will be two. This is done on the basis of suggestions by Greene (2011). He mentions that is common practice for the number of lags to correspond to the integer part of $T^{1/4}$, where T is the number of observations for time. Thus in this case, with the number of observations in time being 65 before and 69 after the invasion, the number of lags was set at 2. However, some gaps were present between these observations, as on weekends returns are non-present due to the stock exchanges being closed. In these cases, the lags are concerning the last two available periods. For example, for an observation on a Monday, the lags will refer to the last two available dates. So, in this case, Thursday and Friday from the week beforehand will be the last two observations. The Newey-West method also deals with the heteroskedasticity present in our model. This is present, as for example the CAPM does not take into account some factors in their model, leading to a large variance of the errors. For example, small stocks typically exhibit higher returns according to the Fama French model. Because the CAPM model does not account for factors such as this, it leads to a large heteroskedastic error term.

CHAPTER 5 Results

5.1 Results by hypothesis

Each table in the results section features the regressions from [Section 4.1](#). These regressions are then performed on each grouping in the tables for two periods. The first period, before the invasion refers to 18 November 2021 until 23 February 2022, while the second period, after the invasion spans from 24 February to 2 June 2022. The constants from the regressions in [Appendix D](#), also known as the ‘alpha’ are given in the tables of this chapter. Any significant alpha, shows that this coefficient is different from zero, indicating that the portfolio generates an abnormal performance after adjusting for the several risk factors employed, as well as the excess return on the market, $R_m - R_f$. The market in this case refers to all the firms listed on the AMEX, NASDAQ and NYSE. A significant negative alpha means that the portfolio underperforms the market, while a significant positive alpha illustrates an outperformance of the market. In order to determine which model prices best, the adjusted r-squared in [Appendix D](#) is used. The adjusted r-squared shows how much of the variance of the excess returns of a portfolio is explained by the factors and excess return on the market included in the models. In other words, a model with a high adjusted r-squared means that the model is a good fit for the portfolio. The adjusted r-squared is not comparable across different samples however, therefore we compare the adjusted r-squared only for the models of a particular portfolio and period. For instance, only the adjusted r-squared of the models before the invasion for the index portfolio would be compared to each other to determine the model which model fits this instance best. The model with the highest adjusted r-squared dictates which alpha to look at for that specific portfolio within that period.

In order to test hypothesis 1, that lower-rated ESG funds outperformed higher-rated ESG funds during the Russo-Ukraine war, I performed the time regressions mentioned in the methods on ETFs grouped by three rating methods, Morningstar sustainability globes, MSCI ESG rating and Refinitiv ESG rating in [Table 6](#), [Table 7](#), and [Table 8](#), respectively. According to their rating, they were assigned a portfolio. This will make it possible to see whether a negative trend persists across the alphas and the sustainability scores.

To evaluate hypothesis 2, that during the Russo-Ukraine conflict ESG ETFs fail to outperform the market, I perform the regressions on the entire sustainable ETF sample in [Table 11](#). I also cross-examine these returns across different sub-samples of this ESG ETF sample. In [Table 9](#) I divide this sample into portfolios according to the fund strategies clean, index and social, whilst in [Table 10](#) they are divided into two sub-samples, one with the Morningstar low-carbon designated funds and the other with those without this certification. Using this, it makes it possible to check whether the results regarding the hypothesis remain the same for different types of ESG ETFs. If no significant positive alphas are present in these results, we can confirm the second hypothesis.

Finally, I will investigate hypothesis 3, whether ESG ETFs were an ineffective hedge for investors during periods of crisis, I will compare the performance of the ESG ETFs sample to ETFs to their matched equivalent in [Table 11](#) as provided in [APPENDIX A](#) ESG Funds sample and matched funds. If the ESG funds have higher alphas than the matched group, they possibly provide a hedge in a market downturn, as this would show they provide a better performance in the market downturn than comparable non-ESG ETFs. Additionally, the ESG ETFs would have to provide better returns than the market, as a return equal to the down-turning market would still mean significant losses for investors.

5.1.1 Results of hypothesis 1

In [Table 6](#), the sample was divided by Morningstar globes sustainability rating with one globe being the lowest possible score and five globes the highest possible score. In [Appendix C](#), a detailed overview of these portfolios is provided. Portfolio 1 & 2 globes contains all the ETFs in the sample with a Morningstar globes sustainability rating of 1 and 2. All ETFs with a Morningstar globes rating of 3 are allocated to the 3 globes portfolio, while all ETFs with a 4 globes and 5 globes rating are allocated to the 4 globes portfolio and 5 globes portfolio, respectively. 5 globes being the highest possible rating, while 1 globe is the lowest.

In [Table 6](#) below, no portfolio provides significant risk-adjusted returns before the invasion, except for significantly negative returns in the CAPM model for the ETFs that have a rating of 3 Morningstar globes. However, based on [Table 31](#), we find that the Fama-French 5 factor model (FF5) provides a better fit for the subsample of the Morningstar 3 globes rating after the invasion, indicated by the higher adjusted r-squared. Therefore, looking at the FF5 regression, the 3 globes group does not provide significant returns before the invasion.

Furthermore, the ETFs with Morningstar globes sustainability rating of 1 until 4 have no significant returns after the invasion. Interestingly, for the highest sustainability group, with the maximum Morningstar sustainability rating of 5 globes, the alpha is significant across all models in [Table 6](#) after the invasion, signaling that there are negative returns after accounting for all the factors employed in the regressions highlighted in [Section 4.1](#).

It seems as though according to Morningstar globes, the highest sustainability group with a globes rating of 5, performed worse than the market after the invasion, looking at the negative alpha across all models employed in [Table 6](#), whilst the lower sustainable ratings 1-4 globes seemed to perform as well as the market as their alpha's in all models did not differ significantly from zero, indicated by their p-value.

Table 6 Abnormal return by Morningstar globes

Portfolio	Period	CAPM α	FF3 α	Carhart α	FF5 α	FF5+mom α
1 & 2 globes	Before invasion	-0.113 (0.077)	-0.080 (0.077)	-0.087 (0.075)	-0.061 (0.081)	-0.068 (0.080)
	After invasion	0.033 (0.107)	0.051 (0.087)	0.056 (0.086)	0.053 (0.062)	0.030 (0.061)
3 globes	Before invasion	-0.090* (0.053)	-0.086 (0.057)	-0.087 (0.058)	-0.091 (0.059)	-0.093 (0.060)
	After invasion	-0.100 (0.067)	-0.098 (0.065)	-0.096 (0.066)	-0.084 (0.063)	-0.086 (0.062)
4 globes	Before invasion	-0.052 (0.037)	-0.055 (0.041)	-0.055 (0.041)	-0.055 (0.042)	-0.057 (0.041)
	After invasion	-0.066 (0.047)	-0.067 (0.045)	-0.066 (0.047)	-0.059 (0.045)	-0.059 (0.044)
5 globes	Before invasion	-0.069 (0.044)	-0.046 (0.033)	-0.036 (0.028)	-0.063 (0.051)	-0.048 (0.040)
	After invasion	-0.064*** (0.024)	-0.063*** (0.022)	-0.062*** (0.022)	-0.052** (0.020)	-0.048** (0.020)

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All statistics provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. Portfolio 1 & 2 globes contains all the ETFs in the sample with a Morningstar globes rating of 1 and 2. Portfolio 3 globes contains those with a Morningstar globes rating of 3, while 4 globes and 5 contain those with a rating of 4 and 5 globes, respectively. The ratings were retrieved may 2024, and concern the most recently available.

To evaluate if these results in [Table 6](#) are determined by the Morningstar ESG rating methodology, we will also look at the alphas of portfolios by MSCI and Refinitiv ratings as these use differing methodologies. Therefore we once again divide the sample by rating, this time using the MSCI grading system. The A portfolio in [Table 7](#), contains all ETFs with a MSCI rating of A, while the AA & AAA portfolio includes all ETFs in the sample with an AA and AAA MSCI grade. The MSCI rating ranks from AAA until CCC, with CCC being the lowest. The constituents of each portfolio can be found in [Appendix C](#).

In [Table 7](#) we see similar trends to those seen in [Table 6](#). Before the invasion, the alphas across all models are non-significant, except for the FF5 model for the higher-rated group, AA & AAA. In [Table 35](#), before the invasion, the FF5 model has an adjusted r-squared equal to that of the Fama-French 5 factor plus momentum model (FF5+mom) for the AA & AAA portfolio. Thus, it is debatable whether the higher rated group provides negative returns compared to the market before the invasion, as the FF5 model and FF5+mom model have an equally good fit for the AA & AAA group, but have a non-significant and a negative significant coefficient respectively.

After the invasion, the higher-rated group in [Table 7](#), AA & AAA, has significant alphas across the CAPM, the FF3 and the Carhart model, with the addition of more factors in the Fama-French 5 factor model removing its significance. This time, [Table 35](#) indicates that the FF5 model has the highest adjusted r-squared. Therefore, dictated by the adjusted r-squared, it is concluded that the AA & AAA portfolio performs as well as the market after the invasion.

It seems as though there are only minor differences in returns for the Morningstar rating in [Table 6](#) and MSCI rating in [Table 7](#), when looking at the significant alphas across the models before and after the invasion, with the portfolios mostly providing a risk-adjusted performance about equal to the market, indicated by the non-significant alphas. However, when incorporating the adjusted r-squared, the results appear to differ. Looking at the model with the highest adjusted r-squared after the invasion for the higher-rated group, AA & AAA in [Table 7](#), it seems as though it does not perform significantly worse after the invasion than the lower-rated group A or the market, indicated by the insignificant alpha in the FF5 model, the model with the highest adjusted r-squared. This contrasts [Table 6](#), where after the invasion the highest-rated group of 5 globes performs worse than the lower-rated portfolios of 1-4 globes across all models, as they all provide significant negative alpha's compared to the insignificant alpha's of groups 1-4. However, meaningful comparisons across these two ratings are quite challenging due to only two groups being present in the MSCI classification.

Table 7 Abnormal return by MSCI rating

Portfolio	Period	CAPM α	FF3 α	Carhart α	FF5 α	FF5+mom α
A	Before invasion	-0.078 (0.047)	-0.064 (0.048)	-0.066 (0.048)	-0.060 (0.049)	-0.063 (0.048)
	After invasion	-0.051 (0.060)	-0.044 (0.051)	-0.042 (0.051)	-0.038 (0.042)	-0.048 (0.041)
AA & AAA	Before invasion	-0.072 (0.044)	-0.072 (0.046)	-0.066 (0.044)	-0.085* (0.047)	-0.078 (0.047)
	After invasion	-0.085* (0.046)	-0.089* (0.049)	-0.088* (0.049)	-0.074 (0.050)	-0.065 (0.049)

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All statistics provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. Portfolio A contains all the ETFs in the sample with a MSCI ESG rating of A, while the portfolio AA & AAA contains those with a rating of AA and AAA. The ratings were retrieved may 2024, and concern the most recently available.

[Table 8](#) offers a better comparison to the Morningstar ratings and seems to corroborate the findings of these ratings. This would also imply that the ESG grading system somewhat drives our results, as the results from the MSCI gradings deviate from those provided by the Refinitiv and Morningstar groupings. Once more, we divide our sample into portfolios according to their ESG rating in [Table 8](#).

The ETFs with a Refinitiv ESG rating of C and B- are grouped into the C & B- portfolio. Those with a Refinitiv ESG rating of B are attributed to the B portfolio, while those with a B+ rating are attributed to the B+ portfolio. Finally, those with a rating of A- and A are included in portfolio A- & A. The holdings of each portfolio can be found in [Appendix C](#). The Refinitiv score ranks from A+ until D-, with D- being the lowest.

The portfolios C & B-, B+, and A- & A in [Table 8](#), show insignificant alphas for all models before the invasion, with the exception of the B rating, which had negative alphas for all models. The results from C & B-, B+, and A- & A seem to indicate that before the invasion, the sustainable ETFs did not perform significantly different to the market, while the rating of B underperformed the market.

[Table 8](#) shows significant negative alphas across all models for the B+ and A- & A grades after the invasion, while the alphas of the lower-rated C & B-, and B portfolios were all insignificant for the same models. This falls in line with [Table 6](#), where the highest-rated group with a Morningstar sustainability rating of 5, had significant negative returns after the invasion, while the lower ratings of 1-4 had no significant returns after the invasion. This conflicts with the conclusions from [Table 7](#), where taking into account only the model with the highest adjusted r-squared for AA & AAA, the FF5 model, there are no significant returns for both groups after the invasion. This table does not compare very well to [Table 6](#) and [Table 8](#) however, as it only has two groups and the ratings across both groups are quite similar. As [Table 6](#) and [Table 8](#) seem more consistent compared to the groupings of [Table 7](#), their results are utilized to answer the hypothesis. By looking at these two tables, it becomes evident that funds with a higher sustainability rating offer worse risk-adjusted performance than their lower sustainable peers after the invasion.

It would seem as though this confirms our hypothesis that ESG ETFs with a higher sustainability rating perform worse during a market downturn, as higher ratings provide lower risk-adjusted returns than the market after the crisis period in [Table 6](#) and [Table 8](#), while lower ratings provide abnormal risk-adjusted returns equal to the market. This could be because of fossil fuel and defence companies being held by lower-rated funds while those with higher ratings exclude these from their holdings. It is possible that sectors were underpriced before the invasion, as after the invasion there was a large increase of investor attention on these sectors, leading to higher returns in the period after the invasion.

Table 8 Abnormal return by Refinitiv grade

Portfolio	Period	CAPM α	FF3 α	Carhart α	FF5 α	FF5+mom α
C & B-	Before invasion	-0.201 (0.132)	-0.107 (0.114)	-0.115 (0.112)	-0.072 (0.119)	-0.077 (0.116)
	After invasion	0.043 (0.170)	0.085 (0.121)	0.095 (0.115)	0.103 (0.088)	0.064 (0.081)
B	Before invasion	-0.160** (0.070)	-0.119* (0.065)	-0.117* (0.064)	-0.119* (0.065)	-0.117* (0.064)
	After invasion	0.003 (0.084)	0.011 (0.071)	0.010 (0.073)	0.010 (0.063)	0.010 (0.063)
B+	Before invasion	-0.043 (0.036)	-0.049 (0.039)	-0.047 (0.039)	-0.055 (0.040)	-0.052 (0.040)
	After invasion	-0.101** (0.046)	-0.103** (0.049)	-0.103** (0.050)	-0.080* (0.047)	-0.078* (0.045)
A- & A	Before invasion	-0.027 (0.029)	-0.050 (0.032)	-0.048 (0.032)	-0.064* (0.034)	-0.064* (0.035)
	After invasion	-0.109*** (0.039)	-0.116** (0.044)	-0.117** (0.045)	-0.110** (0.046)	-0.103** (0.046)

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All statistics provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. Portfolio C & B-contains all the ETFs in the sample with a Refinitiv ESG grade of C and B-. Portfolio B contains those with a grade of B, while B+ contains those with a grade of B+. The A- & A Portfolio contains those with a Refinitiv grade of A- and A. The ratings were retrieved on 23/05/2024, concern the most recently available and are an approximation.

5.1.2 Results of hypothesis 2

In [Table 9](#), the ESG ETF sample is divided into portfolios according to investment strategy. All ETFs in the sample that have an index-like investment strategy are attributed to the index portfolio. ETFs with a ‘social’ investment strategy are placed in the social portfolio, while those with a ‘clean’ investment strategy are placed in the clean portfolio. These classifications were established by the methodology of Winegarden (2019) and Pavlova & de Boyrie (2022), as outlined in [Section 3.1](#). The ETFs within each portfolio are located in [Appendix C](#).

Comparing the different categories of fund strategies before the invasion in [Table 9](#), it seems as though the clean funds do not provide any significant alphas across all models. The index and social strategy funds have significant negative alphas before the invasion in all models, with exception of the Carhart, FF5 and FF5 plus momentum models of the index portfolio. In this pre-invasion period the FF5 model has the highest adjusted r-squared for the index portfolio in [Table 40](#). Based on these models, the Index and social group offer significant negative returns before the invasion in [Table 9](#).

Evaluating the after invasion period in [Table 9](#), the clean portfolio still does not boast any significant alphas for any of the models. Similarly, the social and index portfolios still have negative alphas, now across all models in both groups. However, the alpha of the index portfolio becomes quite more negative than the social category after the invasion.

Throughout the whole observation period in [Table 9](#), it seems as though clean technology category funds perform as well as the market, while the social and index seem to significantly underperform the market when accounting for adjusted r-squared. None of the categories outperform the market, providing returns equal to the market at best.

Table 9 Abnormal return by fund strategy

Portfolio	Period	CAPM α	FF3 α	Carhart α	FF5 α	FF5+mom α
Index	Before invasion	-0.041 (0.032)	-0.050 (0.034)	-0.047 (0.033)	-0.062* (0.036)	-0.059* (0.035)
	After invasion	-0.105*** (0.038)	-0.112** (0.043)	-0.111** (0.043)	-0.102** (0.044)	-0.098** (0.044)
Social	Before invasion	-0.037* (0.021)	-0.046** (0.023)	-0.043** (0.021)	-0.058** (0.023)	-0.056** (0.022)
	After invasion	-0.073*** (0.023)	-0.078*** (0.025)	-0.080*** (0.025)	-0.086*** (0.026)	-0.083*** (0.025)
Clean	Before invasion	-0.238 (0.156)	-0.147 (0.145)	-0.156 (0.143)	-0.108 (0.148)	-0.115 (0.145)
	After invasion	0.091 (0.203)	0.135 (0.154)	0.145 (0.152)	0.160 (0.113)	0.128 (0.110)

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All statistics provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. The index portfolio contains all ESG ETFs in the sample that have an index-like investment strategy. Social contains those that have a 'social' investment strategy, while clean contains those that have a 'clean' investment strategy. See [Section 3.1](#) as to how these classifications were established.

in [Table 10](#) the ESG ETFs are divided into two portfolios. The low carbon portfolio consists of all the funds that have a Morningstar low carbon designation, while those that lack this certification are allocated to the normal portfolio. The make-up of the portfolios is explained in [Appendix C](#).

Evaluating the alphas in [Table 10](#), it becomes evident that the Morningstar low carbon designation group offers far worse performance than their normal counterparts. Across both periods and all models, the alphas of the normal group are all negative and insignificant, while those with the low carbon designation are all negative and significant.

These certifications in [Table 10](#) are obviously different from the rating systems discussed in tables 6-8. However, they could be viewed as a metric of a specific pillar in the ESG framework, the

environmental pillar. In this light, it once again underscores our rejection of hypothesis 2 in [Section 5.1.2](#), as according to this metric, the higher-rated low carbon designated ETFs performed worse compared to their peers lacking this designation, as well as compared to the market. Nevertheless, it primarily shows that even after looking at particular groups of ESG ETFs, they still all fail to outperform the market.

Table 10 Abnormal return by Morningstar carbon designation

Portfolio	Period	CAPM α	FF3 α	Carhart α	FF5 α	FF5+mom α
Low						
Carbon	Before invasion	-0.076** (0.034)	-0.066* (0.034)	-0.063* (0.033)	-0.074** (0.035)	-0.069* (0.034)
	After invasion	-0.084** (0.037)	-0.080** (0.035)	-0.079** (0.036)	-0.069* (0.035)	-0.067* (0.035)
Normal	Before invasion	-0.076 (0.054)	-0.067 (0.057)	-0.069 (0.056)	-0.066 (0.059)	-0.069 (0.058)
	After invasion	-0.048 (0.064)	-0.045 (0.056)	-0.043 (0.057)	-0.037 (0.049)	-0.043 (0.048)

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All statistics provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. The low carbon portfolio contains all ETFs in the ESG ETF sample with a Morningstar low carbon designation. The normal group contains those without this certification. The classifications were determined May 2024.

In [Table 11](#) the sample of ESG ETFs is compared with their matched counterparts, as described in [Appendix A](#). The ESG Portfolio holds all the ETFs in the ESG ETF sample, while the matched portfolio includes their matched counterparts.

Evaluating the performance of the ESG group in [Table 11](#), it is evident that before the invasion, only the CAPM model has a significant alpha. However, from [Table 45](#), it becomes clear that this model provides the best fit for the pre-invasion period of the ESG group, as it has the highest adjusted r-squared compared to the other models performed on the ESG group before the invasion. This result differs from the post-invasion period for the ESG group in [Table 11](#), as no alphas are significant across all models. It is therefore concluded that the ESG sample performs as well as the market throughout the observation period.

The ESG portfolio in [Table 11](#) does not outperform the market, before or after the invasion as no significant positive alphas are present. Even after I control for different investment strategies in [Table 9](#) and similarly checking if these results persist after dividing by carbon emission in [Table 10](#), these findings remain. In none of these three tables a significant positive alpha is present across the whole observation period. The ESG ETFs seem to have a performance equal to the market at best. Because

of this lack of outperformance, Hypothesis 2 appears to be confirmed. ESG ETFs do not outperform the market during the crisis period.

Table 11 Abnormal return by sustainable ETFs sample and matches

Portfolio	Period	CAPM α	FF3 α	Carhart α	FF5 α	FF5+mom α
Matched	Before invasion	0.037 (0.041)	-0.005 (0.035)	-0.004 (0.035)	-0.038 (0.029)	-0.037 (0.029)
	After invasion	-0.030 (0.047)	-0.057 (0.045)	-0.062 (0.045)	-0.082** (0.036)	-0.077** (0.035)
ESG	Before invasion	-0.076* (0.042)	-0.067 (0.044)	-0.066 (0.044)	-0.069 (0.046)	-0.069 (0.045)
	After invasion	-0.065 (0.050)	-0.062 (0.045)	-0.060 (0.045)	-0.052 (0.042)	-0.055 (0.041)

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All statistics provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. The matched portfolio contains the ETFs individually matched to the ETFs in the ESG ETF sample, as provided in [Appendix A](#). The ESG Portfolio contains all the ETFs in the ESG ETF sample, also outlined in [Appendix A](#).

5.1.3 Results of hypothesis 3

The matched group in [Table 11](#) does not have any significant alphas in the pre-invasion period, whilst I established that the ESG portfolio during this same period did have a significant negative alpha, based on the CAPM model which had the highest adjusted r-squared. The matched group therefore outperformed the ESG sample in the pre-invasion period.

This finding reverses in the post-invasion period in [Table 11](#). While the ESG sample has no significant alphas across all models, the matched sample has negative alphas for the FF5 and FF5 + mom models. Investigating [Table 46](#), it becomes clear that the FF5 and FF5 + mom models have the highest adjusted r-squared for the matched group after the invasion. So, these models are used to determine which alpha to look at for the matched group. As the alpha of these models are both significantly negative, while the ESG alphas are all non-significant, it becomes clear that the ESG sample outperformed the matched sample in the post-invasion period.

The ESG group provided better risk-adjusted returns than their matched peers in the crisis period, which seems to suggest that the ESG ETFs provided a suitable hedge for investors looking to offset their position in similar assets. However, this is not the case, as the ESG ETFs performed as well as the market, indicated by the non-significant alphas after the invasion in [Table 11](#), implying that they

also suffered similar losses as the market during this timeframe. This means that although they might shield an investor from losses relative to similar non-ESG ETFs, they still lead to significant losses in the post invasion period. Using these conclusions I can confirm hypothesis 2, as the ESG ETFs do not provide a suitable hedge for investors.

5.2 Robustness checks

Several robustness checks were employed to ensure consistent results. Five different models were used to evaluate if model choice influenced the risk-adjusted performance of the portfolios. The CAPM model, the Fama-French 3 factor model, the Carhart, the Fama-French 5 factor model as well as the Fama-French 5 factor model with a momentum factor.

To see whether our ESG rating methodology influenced the performance of higher rated ESG ETFs compared to lower rated ETFs, three differing rating systems were used. The Refinitiv ESG grading, the Morningstar globes rating and the MSCI ESG grading.

Furthermore, to validate the consistency of results concerning the performance of ESG ETFs, they were split up according to several classifications, to see if classification influenced this performance. Firstly, they were grouped by Morningstar low carbon designation. One group consisted of those with the designation, while one was formed using those without the certification. Secondly, the sample was divided by investment strategy. These strategies were determined similarly to Winegarden (2019) and Pavlova & de Boyrie (2022), leading to three groups. The first features those with an index-like strategy, the second contains those with a 'social' investment strategy, while the third group contains those with a clean investment strategy.

CHAPTER 6 Conclusion

6.1 Hypotheses

With the intention of answering the following research question: how do sustainable ETFs perform relative to the market during the Russia-Ukraine conflict? I looked at three hypotheses. Firstly, my results show that during the Russo-Ukraine conflict ETFs with a lower ESG score outperform those with a ESG high score during the Russo-Ukraine conflict. Secondly, ESG ETFs fail to outperform the market. Thirdly, ESG ETFs fail to be an effective hedge for investors during this period.

These findings are similar to other studies in a similar period (Russo-Ukraine war) such as Chen et al. (2022) and Cosma et al. (2023). These findings are also reproduced by studies in a different period, particularly the COVID-19 crisis, such as Döttling and Kim (2022), Folger et al. (2020) and Pavlova and de Boyrie (2022). However, one study by Pastor and Vorsatz (2020), found differing results in this context. These differing results can be attributed to the fact that their research has a slightly different scope, as they focus on actively managed equity funds, which differ from my sample of solely sustainable ETFs. During the period from their inception until the COVID-19 crisis, Kanuri (2020) also found similar results to my conclusions.

6.2 Research question

From the conclusion in the previous sections, it is evident that sustainable ETFs did not perform better than the market. At best, they did not perform significantly different from the market, while portfolios with a higher sustainability rating performed worse than the market. The sustainable ETFs did not provide any downturn protection from the drop in the stock market following the invasion, making them an unsuitable hedge in the crisis period, though they were able to hedge the losses of similar non-ESG ETFs.

6.3 Implications

From the results of this study and other research, it becomes evident that during the last crisis periods investing solely in ESG ETFs was not a suitable strategy for investors looking for excess returns. It might be wiser for investors during such periods to avoid ESG ETFs. If one favors ESG ETFs for sustainability reasons, it might also be beneficial not to solely invest in ESG ETFs and at least diversify across non-ESG ETFs to remove some of this downward risk. However, it remains to be said that the Russo-Ukrainian war, as well as the COVID-19 period come with their own unique characteristics and challenges posed to investors and might very well be very different than future periods of market turmoil. Therefore, future crises might call for a reevaluation of this stance.

6.3 Limitations and recommendations

The current ESG-rating methodology comes with some fundamental limitations, especially due to approximating the Refinitiv ESG score. As these ratings are unavailable for some bonds and stocks, along with funds in the case of ETFs that are fund of funds. A majority of the ratings were also unavailable for the matched ETFs, which did not allow me to compare the sustainability of the matched group with the sustainable sample. Due to data constraints, I was only able to utilize the top 100 biggest holdings of a fund in approximating the Refinitiv ESG score. Potentially future research with access to actual Refinitiv fund ESG score (now LSEG Lipper) could use the actual ratings to gain more accurate ratings. Unfortunately, the historical data was not readily available for the MSCI and Refinitiv ratings. The historical MSCI data was not included in my access to the CRSP database and approximating the historic Refinitiv rating in the same manner as the current one was impossible due to the historical holdings of the funds not being readily accessible. It might be useful for future research to use historical ratings for a cross-sectional approach to the data, as well as compare the current ratings with the historical ones during the crisis period, as I was only able to do so for the Morningstar ratings. This would verify my findings to be consistent with the other ratings, as well as those of Pavlova and de Boyrie (2022).

The effect of the Russo-Ukraine crisis on the market might also be somewhat distorted by the aftermath of the COVID-19 crisis, making it difficult to isolate its impact on the sample. Nevertheless, as the previous research focuses on this period, this study at the very least builds on the existing research by including the aftermath of this period and a novel crisis. It stands to reason that future studies could reevaluate these findings by performing sort-like research in future crises, as it would perhaps be easier to isolate the impacts of crises when there is less overlap. Additionally, the universe of vetted sustainable ETFs would be larger, as the segment of sustainable ETFs continues to grow from its relatively short existence. During the same period, there have only been two major crises, providing a small timeframe to evaluate the performance of these ETFs. A larger number of observations would allow for a more reliable prediction of these funds during market downturns.

Finally, the lack of a clear standard in ESG ratings makes comparisons and reliable ESG scoring quite troubling. Potentially, future research could utilize the Sustainable Finance Disclosure Regulation (SFDR) as a widely accepted standard, when it has made more progress in adjusting and set clear boundaries in its legislation as it currently remains unreliable according to Cremasco and Boni (2022).

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APPENDIX A ESG Funds sample and matched funds

Table 12 Overview of the ESG ETFs and their matches

ETFs	Strategy	Age (year)	Assets (\$Mn.)	Sector	Match
Alpha Architect Freedom 100 Em Mkts ETF	Index	5.05	814.3	Diversified Emerging Mkts	JPMorgan ActiveBuilders EM Eq ETF
ALPS Clean Energy ETF	Clean	5.95	212.2	Miscellaneous Sector	First Trust Nasdaq Oil & Gas ETF
Amplify Advcd Btty Mtls and Matrls ETF	Clean	6.01	88.3	Natural Resources	VanEck Natural Resources ETF
Change Finance US LgCp FossilFuel Fr ETF	Index	6.66	121.9	Large Blend	Applied Finance Valuation LgCp ETF
ClearBridge Dividend Strategy ESG ETF	Index	7.04	46.5	Large Blend	Siren DIVCON Leaders Dividend ETF
ClearBridge Large Cap Growth ESG ETF	Index	7.04	225.0	Large Growth	Fidelity® Fundamental Large Cap Gr ETF
Columbia Sustainable Intl Eq Inc ETF	Index	7.98	7.7	Foreign Large Value	Virtus WMC International Dividend ETF
Columbia Sustainable US Equity Inc ETF	Index	7.98	57.2	Large Value	Columbia Research Enhanced Value ETF
Etho Climate Leadership US ETF	Social	8.55	181.6	Mid-Cap Blend	Invesco Zacks Mid-Cap ETF
First Trust EIP Carbon Impact ETF	Social	4.80	28.4	Utilities	Invesco Dorsey Wright Utilities Momt ETF
First Trust Global Wind Energy ETF	Clean	15.98	197.4	Miscellaneous Sector	VanEck Uranium & Nuclear ETF
First Trust NASDAQ® Cln Edge® GrnEngyETF	Clean	17.33	737.1	Miscellaneous Sector	First Trust Energy AlphaDEX® ETF

First Trust NASDAQ® Cln Edge®StGidIfsETF	Clean	14.56	1200.0	Miscellaneous Sector	Fidelity MSCI Utilities ETF
First Trust Water ETF	Index	17.08	1700.0	Natural Resources	SPDR® S&P Metals and Mining ETF
FlexShares STOXX Glbl ESG Impact ETF	Index	7.90	177.7	Global Large- Stock Blend	SPDR® Global Dow ETF
FlexShares STOXX US ESG Impact ETF	Index	7.90	199.4	Large Blend	FlexShares US Quality Large Cap ETF
Global X Conscious Companies ETF	Social	7.91	637.3	Large Blend	Goldman Sachs Equal Wght US Lg Cp Eq ETF
Goldman Sachs JUST US Large Cap Eq ETF	Index	6.00	340.0	Large Blend	ALPS Equal Sector Weight ETF
Impact Shares NAACP Minority Empwrmt ETF	Social	5.91	44.5	Large Blend	Invesco S&P 500® ex-Rate Snsv LowVol ETF
Impact Shares YWCA Women's Empwrmt ETF	Social	5.79	54.0	Large Blend	ProShares S&P 500® ex-Technology
Invesco Global Clean Energy ETF	Clean	16.99	121.5	Global Small/Mid Stock	Invesco Global Listed Private Equity ETF
Invesco Global Water ETF	Index	16.99	289.2	Natural Resources	Invesco S&P 500® Equal Weight Matrls ETF
Invesco S&P Global Water ETF	Index	17.07	1000.0	Natural Resources	iShares MSCI Global Mtls&Mng Prdcrs ETF
Invesco Solar ETF	Clean	16.15	1000.0	Miscellaneous Sector	iShares US Oil & Gas Explor & Prod ETF
Invesco Water Resources ETF	Index	18.50	2200.0	Natural Resources	Global X Copper Miners ETF

Invesco WilderHill Clean Energy ETF	Clean	19.26	322.4	Small Growth	iShares Morningstar Small-Cap Growth ETF
IQ Candriam International Equity ETF	Social	4.47	188.6	Foreign Large Blend	Davis Select International ETF
IQ Candriam U.S. Large Cap Equity ETF	Social	4.47	380.9	Large Blend	Gotham Enhanced 500 ETF
iShares ESG 1-5 Year USD Corp Bd ETF	Index	6.91	856.2	Short-Term Bond	PIMCO Enhanced Low Duration Active ETF
iShares ESG MSCI EAFE ETF	Index	7.94	8240.0	Foreign Large Blend	iShares MSCI Intl Quality Factor ETF
iShares ESG MSCI EM ETF	Index	7.94	4200.0	Diversified Emerging Mkts	Schwab Fundamental Emerg Mkts Lg Co ETF
iShares ESG MSCI USA ETF	Index	7.52	12800.0	Large Blend	iShares Russell 3000 ETF
iShares ESG MSCI USA Leaders ETF	Index	5.09	970.4	Large Blend	Fidelity Low Volatility Factor ETF
iShares ESG MSCI USA Small-Cap ETF	Index	6.16	1600.0	Small Blend	iShares Russell 2500 ETF
iShares ESG U.S. Aggregate Bond ETF	Index	5.64	3600.0	Intermediate Core Bond	VictoryShares Core Intermediate Bond ETF
iShares ESG USD Corporate Bond ETF	Index	6.91	1100.0	Corporate Bond	Vanguard Total Corporate Bond ETF
iShares Global Clean Energy ETF	Clean	15.95	2300.0	Miscellaneous Sector	VanEck Oil Services ETF
iShares Global Green Bond ETF	Social	5.57	348.3	Global Bond-USD Hedged	Vanguard Total World Bond ETF
iShares MSCI ACWI Low Carbon Target ETF	Index	9.50	923.4	Global Large-Stock Blend	SPDR® Portfolio MSCI Global Stk Mkt ETF
iShares MSCI Global Sust Dev Goals ETF	Social	8.13	289.1	Global Large-Stock Blend	iShares MSCI Kokusai ETF

iShares MSCI KLD 400 Social ETF	Social	17.56	4400.0	Large Blend	Invesco S&P 500 GARP ETF
iShares MSCI USA ESG Select ETF	Social	19.37	3400.0	Large Blend	Vanguard Russell 3000 ETF
iShares® ESG MSCI EM Leaders ETF	Index	4.34	34.4	Diversified Emerging Mkts	SPDR® MSCI Emerging Mkts StratFacts ETF
KraneShares MSCI China Environment ETF	Clean	6.65	60.1	China Region	Franklin Emerging Mkt Core Div TltIdxETF
Nuveen ESG Emerging Markets Equity ETF	Index	7.00	266.3	Diversified Emerging Mkts	JPMorgan Diversified Return EMkts Eq ETF
Nuveen ESG High Yield Corporate Bd ETF	Index	4.70	83.5	High Yield Bond	Xtrackers Short Duration High Yld Bd ETF
Nuveen ESG Intl Dev Mkts Eq ETF	Index	7.00	425.7	Foreign Large Blend	First Trust Dev Mkts Ex-US AlphaDEX® ETF
Nuveen ESG Large-Cap ETF	Index	5.01	29.7	Large Blend	Natixis Vaughan Nelson Select ETF
Nuveen ESG Large-Cap Growth ETF	Index	7.48	1300.0	Large Growth	American Century US Quality Growth ETF
Nuveen ESG Large-Cap Value ETF	Index	7.48	1600.0	Large Value	Invesco S&P 500® Pure Value ETF
Nuveen ESG Mid-Cap Growth ETF	Index	7.48	389.8	Mid-Cap Growth	First Trust Mid Cap Growth AlphaDEX® ETF
Nuveen ESG Mid-Cap Value ETF	Index	7.48	339.8	Mid-Cap Value	iShares Morningstar Mid-Cap Value ETF
Nuveen ESG Small-Cap ETF	Index	7.48	1200.0	Small Blend	iShares U.S. Small-Cap Eq Fac ETF
Nuveen ESG US Aggregate Bond ETF	Index	6.69	347.2	Intermediate Core Bond	iShares Government/Credit Bond ETF

PIMCO Enhanced Short Maturity Actv ESG ETF	Index	4.49	166.4	Ultrashort Bond	ClearShares Ultra-Short Maturity ETF
PIMCO RAFI ESG US ETF	Index	4.47	49.8	Large Value	Principal Value ETF
SPDR® Kensho Clean Power ETF	Clean	5.63	195.1	Equity Energy	Invesco S&P SmallCap Energy ETF
SPDR® MSCI ACWI Low Carbon Target ETF	Index	9.53	111.5	Global Large-Stock Blend	iShares Global Equity Factor ETF
SPDR® MSCI EAFE Fossil Fuel Free ETF	Index	7.62	282.0	Foreign Large Blend	PIMCO RAFI Dyn Multi-Factor Intl Eq ETF
SPDR® MSCI Em Mkts Fossil Fuel Free ETF	Index	7.62	83.9	Diversified Emerging Mkts	Fidelity Emerging Markets Mltfct ETF
SPDR® S&P 500 Fossil Fuel Rsrv Free ETF	Index	8.52	1700.0	Large Blend	iShares Russell Top 200 ETF
SPDR® SSGA Gender Diversity ETF	Index	8.25	235.8	Large Blend	FCF US Quality ETF
US Vegan Climate ETF	Index	4.74	92.2	Large Growth	First Trust NASDAQ-100 ex-Tech Sect ETF
VanEck Vectors Environmental Svcs ETF	Clean	17.66	72.1	Industrials	Invesco S&P SmallCap Industrials ETF
VanEck Vectors Green Bond ETF	Social	7.26	92.4	Global Bond	Invesco International Corporate Bond ETF
VanEck Vectors Low Carbon Energy ETF	Clean	17.10	140.1	Miscellaneous Sector	Invesco Oil & Gas Services ETF
Vanguard ESG International Stock ETF	Index	5.72	3800.0	Foreign Large Blend	Goldman Sachs ActiveBeta® Intl Eq ETF
Vanguard ESG US Stock ETF	Index	5.72	8300.0	Large Blend	SPDR® Port S&P 1500 Comps Stk Mkt ETF

Xtrackers MSCI EAFE ESG Leaders Eq ETF	Index	5.75	50.2	Foreign Large Blend	WisdomTree International Mltfctr
Xtrackers MSCI EMs ESG Leaders Eq ETF	Index	5.51	26.7	Diversified Emerging Mkts	WisdomTree Emerging Markets Mltfctr
Xtrackers MSCI USA ESG Leaders Eq ETF	Index	5.26	1100.0	Large Blend	Franklin US Equity Index ETF
Xtrackers S&P 500 ESG ETF	Index	4.95	1100.0	Large Blend	First Trust Large Cap Core AlphaDEX® ETF

Note: Age was calculated on 11/06/2024. Assets are concerning total assets in April 2024 in million US Dollar. The strategy was determined May 2024, following Winegarden (2019) and Pavlova & de Boyrie. The index strategy means that the ETFs follow an index like strategy, while social refers to an investment strategy chasing social goals. The clean strategy chases environmental goals, investing in clean technology. The sector stands for the Morningstar sector. The ETFs were matched by Morningstar category, strategy, age and assets.

APPENDIX B Refinitiv ESG score calculations

Table 13 Calculations of the Refinitiv ESG rating of the ESG ETFs

ETFs	Weighted ESG Score	Percentage Fund Assets	ESG score	Grade
Alpha Architect Freedom 100 Em Mkts ETF	68.785	97.001	70.912	B+
ALPS Clean Energy ETF	52.370	95.260	54.976	B-
Amplify Advcd Btty Mtls and Matrls ETF	57.130	87.644	65.184	B
Change Finance US LgCp FossilFuel Fr ETF	68.422	99.498	68.767	B+
ClearBridge Dividend Strategy ESG ETF	68.957	94.400	73.047	B+
ClearBridge Large Cap Growth ESG ETF	68.358	95.605	71.500	B+
Columbia Sustainable Intl Eq Inc ETF	75.129	98.269	76.452	A-
Columbia Sustainable US Equity Inc ETF	72.356	99.001	73.087	B+
Etho Climate Leadership US ETF	21.023	37.197	56.516	B-
First Trust EIP Carbon Impact ETF	57.165	93.572	61.092	B
First Trust Global Wind Energy ETF	63.014	93.161	67.641	B+
First Trust NASDAQ® Cln Edge® GrnEngyETF	54.477	97.703	55.758	B-
First Trust NASDAQ® Cln Edge®StGidIfsETF	71.127	97.655	72.835	B+
First Trust Water ETF	61.771	95.898	64.414	B
FlexShares STOXX Gbl ESG Impact ETF	50.759	66.874	75.903	A-
FlexShares STOXX US ESG Impact ETF	61.537	83.799	73.434	B+
Global X Conscious Companies ETF	52.740	71.207	74.065	B+
Goldman Sachs JUST US Large Cap Eq ETF	57.284	75.085	76.292	A-
Impact Shares NAACP Minority Empwrmt ETF	69.145	91.150	75.858	A-
Impact Shares YWCA Women's Empwrmt ETF	65.062	88.291	73.690	B+
Invesco Global Clean Energy ETF	44.627	74.059	60.259	B
Invesco Global Water ETF	60.225	86.554	69.580	B+
Invesco S&P Global Water ETF	59.070	91.708	64.411	B
Invesco Solar ETF	49.136	89.848	54.688	B-
Invesco Water Resources ETF	61.348	96.028	63.886	B
Invesco WilderHill Clean Energy ETF	34.768	84.333	41.227	C
IQ Candriam International Equity ETF	51.161	64.180	79.715	A-

IQ Candriam U.S. Large Cap Equity ETF	58.945	78.248	75.331	A-
iShares ESG 1-5 Year USD Corp Bd ETF	25.762	33.563	76.757	A-
iShares ESG MSCI EAFE ETF	46.827	58.647	79.845	A-
iShares ESG MSCI EM ETF	50.704	68.926	73.563	B+
iShares ESG MSCI USA ETF	54.292	72.346	75.045	A-
iShares ESG MSCI USA Leaders ETF	62.443	82.613	75.585	A-
iShares ESG MSCI USA Small-Cap ETF	15.802	28.063	56.309	B-
iShares ESG U.S. Aggregate Bond ETF	0.371	0.454	81.676	A-
iShares ESG USD Corporate Bond ETF	13.829	18.216	75.915	A-
iShares Global Clean Energy ETF	57.402	94.237	60.913	B
iShares Global Green Bond ETF	14.947	22.385	66.771	B+
iShares MSCI ACWI Low Carbon Target ETF	37.627	49.782	75.584	A-
iShares MSCI Global Sust Dev Goals ETF	69.535	96.204	72.279	B+
iShares MSCI KLD 400 Social ETF	60.061	79.543	75.507	A-
iShares MSCI USA ESG Select ETF	64.133	85.767	74.775	B+
iShares® ESG MSCI EM Leaders ETF	48.161	67.872	70.959	B+
KraneShares MSCI China Environment ETF	51.825	96.293	53.820	B-
Nuveen ESG Emerging Markets Equity ETF	58.549	84.025	69.680	B+
Nuveen ESG High Yield Corporate Bd ETF	25.725	46.310	55.550	B-
Nuveen ESG Intl Dev Mkts Eq ETF	70.435	90.908	77.479	A-
Nuveen ESG Large-Cap ETF	71.202	98.009	72.648	B+
Nuveen ESG Large-Cap Growth ETF	67.446	98.900	68.196	B+
Nuveen ESG Large-Cap Value ETF	72.603	99.595	72.898	B+
Nuveen ESG Mid-Cap Growth ETF	54.022	92.412	58.458	B
Nuveen ESG Mid-Cap Value ETF	66.467	98.235	67.662	B+
Nuveen ESG Small-Cap ETF	28.275	49.927	56.633	B-
Nuveen ESG US Aggregate Bond ETF	0.225	0.265	85.048	A
PIMCO Enhanced Short Mtrty Actv ESG ETF	24.741	35.065	70.558	B+
PIMCO RAFI ESG US ETF	66.142	86.188	76.742	A-
SPDR® Kensho Clean Power ETF	55.593	98.921	56.200	B-
SPDR® MSCI ACWI Low Carbon Target ETF	41.836	55.803	74.970	B+

SPDR® MSCI EAFE Fossil Fuel Free ETF	43.489	54.404	79.936	A-
SPDR® MSCI Em Mkts Fossil Fuel Free ETF	42.639	59.435	71.741	B+
SPDR® S&P 500 Fossil Fuel Rsrv Free ETF	53.074	71.392	74.342	B+
SPDR® SSGA Gender Diversity ETF	67.059	89.364	75.040	A-
US Vegan Climate ETF	60.197	84.420	71.307	B+
VanEck Vectors Environmental Svcs ETF	62.328	95.010	65.602	B
VanEck Vectors Green Bond ETF	14.728	22.976	64.102	B
VanEck Vectors Low Carbon Energy ETF	66.335	99.272	66.822	B+
Vanguard ESG International Stock ETF	29.516	38.268	77.131	A-
Vanguard ESG US Stock ETF	51.707	68.570	75.407	A-
Xtrackers MSCI EAFE ESG Leaders Eq ETF	54.607	70.526	77.428	A-
Xtrackers MSCI EMs ESG Leaders Eq ETF	52.550	71.891	73.097	B+
Xtrackers MSCI USA ESG Leaders Eq ETF	62.078	82.157	75.560	A-
Xtrackers S&P 500 ESG ETF	62.487	81.905	76.293	A-
<p>Note: The Refinitiv score was retrieved on 23/05/2024. The weighted ESG score is the sum of all the available individual weighted holding scores in the top 100 holdings by percentage of the fund. The weighted individual holding is calculated by multiplying the ESG score of the holding with the percentage of the holding in the total assets of a fund. The percentage of fund refers to the percentage of the available funds in the top 100 holdings from the total assets of the fund. The ESG score of the fund is then calculated by dividing the weighted ESG score by percentage of total funds. The grades are then assigned accordingly with Refinitiv (2022), in Table 14.</p>				

Table 14 Refinitiv ESG score range and associated grade

Refinitiv ESG score range	Refinitiv ESG grade
0 - 0.08333	D-
0.0833 - 0.1666	D
0.1666 - 0.2500	D+
0.2500 - 0.3333	C-
0.3333 - 0.4166	C
0.4166 - 0.5000	C+
0.5000 - 0.5833	B-
0.5833 - 0.6666	B
0.6666 - 0.7500	B+
0.7500 - 0.8330	A-
0.8333 - 0.9166	A
0.9166 - 1.000	A+

Note: This method of grade assignment was retrieved form Refinitiv (2022). Please note that the top end of each range grade is included in the grade, while the bottom is excluded. For example, for the C grade, the bottom end of the range is excluded, 0.3333, while the top end, 0.4166 is included. The grade A+ highest, while D- is the lowest.

APPENDIX C Portfolio construction

Table 15 Portfolio consisting of ETFs with Morningstar globes rating 1 & 2

ETFs	Ticker	ISIN	Globes
Columbia Sustainable Intl Eq Inc ETF	ESGN	US19761L2016	1
Invesco WilderHill Clean Energy ETF	PBW	US46137V1347	1
First Trust EIP Carbon Impact ETF	ECLN	US33738D7057	2
First Trust NASDAQ® Cln Edge® GrnEngyETF	QCLN	US33733E5006	2
FlexShares STOXX Gbl ESG Impact ETF	ESGG	US33939L6882	2
FlexShares STOXX US ESG Impact ETF	ESG	US33939L6965	2
Impact Shares YWCA Women's Empwrmt ETF	WOMN	US45259A1007	2
Invesco Solar ETF	TAN	US46138G7060	2
iShares MSCI Global Sust Dev Goals ETF	SDG	US46435G5320	2

Note: the Morningstar Sustainability Rating is the most recently available on May 2024, concerning February 2024. Due to only two ETFs with a globes rating of 1 being in the sample, they were added to the 2 globes portfolio. Morningstar ranks from 5 until 1 globes, with 1 being the lowest.

Table 16 Portfolio consisting of ETFs with Morningstar globes rating 3

ETFs	Ticker	ISIN
ALPS Clean Energy ETF	ACES	US00162Q4608
Amplify Advcd Btty Mtls and Matrils ETF	BATT	US0321088058
Goldman Sachs JUST US Large Cap Eq ETF	JUST	US3814303968
Impact Shares NAACP Minority Empwrmt ETF	NACP	US45259A2096
Invesco Global Clean Energy ETF	PBD	US46138G8472
Invesco S&P Global Water ETF	CGW	US46138E2634
Invesco Water Resources ETF	PHO	US46137V1420
IQ Candriam International Equity ETF	IQSI	US45409B4538
iShares ESG MSCI EAFE ETF	ESGD	US46435G5163
iShares ESG USD Corporate Bond ETF	SUSC	US46435G1931
iShares Global Green Bond ETF	BGRN	US46435U4408
iShares MSCI ACWI Low Carbon Target ETF	CRBN	US46434V4648
iShares® ESG MSCI EM Leaders ETF	LDEM	US46436E6014
Nuveen ESG Emerging Markets Equity ETF	NUEM	US67092P8885
Nuveen ESG High Yield Corporate Bd ETF	NUHY	US67092P8547
Nuveen ESG Intl Dev Mkts Eq ETF	NUDM	US67092P8059
PIMCO Enhanced Short Mtrty Actv ESG ETF	EMNT	US72201R6430
SPDR® MSCI EAFE Fossil Fuel Free ETF	EFAX	US78470E1064
SPDR® MSCI Em Mkts Fossil Fuel Free ETF	EEMX	US78470E2054
SPDR® S&P 500 Fossil Fuel Rsrv Free ETF	SPYX	US78468R7961
SPDR® SSGA Gender Diversity ETF	SHE	US78468R7474
VanEck Vectors Green Bond ETF	GRNB	US92189F1710
VanEck Vectors Low Carbon Energy ETF	SMOG	US92189F5026
Vanguard ESG International Stock ETF	VSGX	US9219107250

Note: the Morningstar Sustainability Rating is the most recently available May 2024, concerning February 2024. Morningstar ranks from 5 until 1 globes, with 1 being the lowest.

Table 17 Portfolio consisting of ETFs with Morningstar globes rating 4

ETFs	Ticker	ISIN
Alpha Architect Freedom 100 Em Mkts ETF	FRDM	US02072L6074
ClearBridge Dividend Strategy ESG ETF	YLDE	US5246823091
ClearBridge Large Cap Growth ESG ETF	LRGE	US5246822002
Columbia Sustainable US Equity Inc ETF	ESGS	US19761L3006
First Trust Global Wind Energy ETF	FAN	US33736G1067
First Trust Water ETF	FIW	US33733B1008
Global X Conscious Companies ETF	KRMA	US37954Y7316
Invesco Global Water ETF	PIO	US46138E6510
IQ Candriam U.S. Large Cap Equity ETF	IQSU	US45409B4611
iShares ESG 1-5 Year USD Corp Bd ETF	SUSB	US46435G2434
iShares ESG MSCI EM ETF	ESGE	US46434G8630
iShares ESG MSCI USA ETF	ESGU	US46435G4257
iShares ESG MSCI USA Small-Cap ETF	ESML	US46435U6635
iShares ESG U.S. Aggregate Bond ETF	EAGG	US46435U5496
iShares Global Clean Energy ETF	ICLN	US4642882249
KraneShares MSCI China Environment ETF	KGRN	US5007678502
Nuveen ESG US Aggregate Bond ETF	NUBD	US67092P8703
PIMCO RAFI ESG US ETF	RAFE	US72201T3427
SPDR® Kensho Clean Power ETF	CNRG	US78468R6559
SPDR® MSCI ACWI Low Carbon Target ETF	NZAC	US78463X1946
VanEck Vectors Environmental Svcs ETF	EVX	US92189F3047
Vanguard ESG US Stock ETF	ESGV	US9219107334
Xtrackers MSCI EAFE ESG Leaders Eq ETF	EASG	US2330512185
Xtrackers MSCI EMs ESG Leaders Eq ETF	EMSG	US2330512268
Xtrackers S&P 500 ESG ETF	SNPE	US2330511435
Note: the Morningstar Sustainability Rating is the most recently available May 2024, concerning February 2024. Morningstar ranks from 5 until 1 globes, with 1 being the lowest.		

Table 18 Portfolio consisting of ETFs with Morningstar globes rating 5

ETFs	Ticker	ISIN
Change Finance US LgCp FossilFuel Fr ETF	CHGX	US26922A5609
Etho Climate Leadership US ETF	ETHO	US26924G8886
First Trust NASDAQ® Cln Edge®StGidIfsETF	GRID	US33737A1088
iShares ESG MSCI USA Leaders ETF	SUSL	US46435U2188
iShares MSCI KLD 400 Social ETF	DSI	US4642885705
iShares MSCI USA ESG Select ETF	SUSA	US4642888022
Nuveen ESG Large-Cap ETF	NULC	US67092P8620
Nuveen ESG Large-Cap Growth ETF	NULG	US67092P2011
Nuveen ESG Large-Cap Value ETF	NULV	US67092P3001
Nuveen ESG Mid-Cap Growth ETF	NUMG	US67092P4090
Nuveen ESG Mid-Cap Value ETF	NUMV	US67092P5089
Nuveen ESG Small-Cap ETF	NUSC	US67092P6079
US Vegan Climate ETF	VEGN	US26922A2978
Xtrackers MSCI USA ESG Leaders Eq ETF	USSG	US2330511500

Note: the Morningstar Sustainability Rating is the most recently available on May 2024, concerning February 2024. Morningstar ranks from 5 until 1 globes, with 1 being the lowest. Morningstar ranks from 5 until 1 globes, with 1 being the lowest.

Table 19 Portfolio consisting of ETFs with MSCI rating A

ETFs	Ticker	ISIN
Invesco WilderHill Clean Energy ETF	PBW	US46137V1347
First Trust EIP Carbon Impact ETF	ECLN	US33738D7057
First Trust NASDAQ® Cln Edge® GrnEngyETF	QCLN	US33733E5006
FlexShares STOXX Gbl ESG Impact ETF	ESGG	US33939L6882
FlexShares STOXX US ESG Impact ETF	ESG	US33939L6965
Impact Shares YWCA Women's Empwrmt ETF	WOMN	US45259A1007
Invesco Solar ETF	TAN	US46138G7060
ALPS Clean Energy ETF	ACES	US00162Q4608
Amplify Advcd Btty Mtls and Matrils ETF	BATT	US0321088058
Goldman Sachs JUST US Large Cap Eq ETF	JUST	US3814303968
Impact Shares NAACP Minority Empwrmt ETF	NACP	US45259A2096
Invesco Global Clean Energy ETF	PBD	US46138G8472
iShares Global Green Bond ETF	BGRN	US46435U4408
iShares MSCI ACWI Low Carbon Target ETF	CRBN	US46434V4648
iShares® ESG MSCI EM Leaders ETF	LDEM	US46436E6014
Nuveen ESG Emerging Markets Equity ETF	NUEM	US67092P8885
Nuveen ESG High Yield Corporate Bd ETF	NUHY	US67092P8547
PIMCO Enhanced Short Mtrty Actv ESG ETF	EMNT	US72201R6430
SPDR® MSCI Em Mkts Fossil Fuel Free ETF	EEMX	US78470E2054
SPDR® S&P 500 Fossil Fuel Rsrv Free ETF	SPYX	US78468R7961
SPDR® SSGA Gender Diversity ETF	SHE	US78468R7474
VanEck Vectors Green Bond ETF	GRNB	US92189F1710
Vanguard ESG International Stock ETF	VSGX	US9219107250
Alpha Architect Freedom 100 Em Mkts ETF	FRDM	US02072L6074
ClearBridge Dividend Strategy ESG ETF	YLDE	US5246823091
ClearBridge Large Cap Growth ESG ETF	LRGE	US5246822002
Columbia Sustainable US Equity Inc ETF	ESGS	US19761L3006
Global X Conscious Companies ETF	KRMA	US37954Y7316
IQ Candriam U.S. Large Cap Equity ETF	IQSU	US45409B4611
iShares ESG MSCI USA Small-Cap ETF	ESML	US46435U6635
iShares ESG U.S. Aggregate Bond ETF	EAGG	US46435U5496
iShares Global Clean Energy ETF	ICLN	US4642882249
KraneShares MSCI China Environment ETF	KGRN	US5007678502
Nuveen ESG US Aggregate Bond ETF	NUBD	US67092P8703
PIMCO RAFI ESG US ETF	RAFE	US72201T3427
SPDR® Kensho Clean Power ETF	CNRG	US78468R6559
SPDR® MSCI ACWI Low Carbon Target ETF	NZAC	US78463X1946
VanEck Vectors Environmental Svcs ETF	EVX	US92189F3047
Vanguard ESG US Stock ETF	ESGV	US9219107334
Xtrackers MSCI EMs ESG Leaders Eq ETF	EMSG	US2330512268

Xtrackers S&P 500 ESG ETF	SNPE	US2330511435
Change Finance US LgCp FossilFuel Fr ETF	CHGX	US26922A5609
Etho Climate Leadership US ETF	ETHO	US26924G8886
Nuveen ESG Small-Cap ETF	NUSC	US67092P6079
Note: the MSCI ESG rating was retrieved May 2024. MSCI rating ranks from, AAA until CCC, with CCC being the lowest.		

Table 20 Portfolio consisting of ETFs with MSCI rating AA & AAA

ETFs	Ticker	ISIN	MSCI rating
Columbia Sustainable Intl Eq Inc ETF	ESGN	US19761L2016	AA
iShares MSCI Global Sust Dev Goals ETF	SDG	US46435G5320	AA
Invesco S&P Global Water ETF	CGW	US46138E2634	AA
Invesco Water Resources ETF	PHO	US46137V1420	AA
IQ Candriam International Equity ETF	IQSI	US45409B4538	AA
iShares ESG MSCI EAFE ETF	ESGD	US46435G5163	AA
iShares ESG USD Corporate Bond ETF	SUSC	US46435G1931	AA
SPDR® MSCI EAFE Fossil Fuel Free ETF	EFAX	US78470E1064	AA
VanEck Vectors Low Carbon Energy ETF	SMOG	US92189F5026	AA
First Trust Global Wind Energy ETF	FAN	US33736G1067	AA
First Trust Water ETF	FIW	US33733B1008	AA
Invesco Global Water ETF	PIO	US46138E6510	AA
iShares ESG 1-5 Year USD Corp Bd ETF	SUSB	US46435G2434	AA
iShares ESG MSCI EM ETF	ESGE	US46434G8630	AA
iShares ESG MSCI USA ETF	ESGU	US46435G4257	AA
Xtrackers MSCI EAFE ESG Leaders Eq ETF	EASG	US2330512185	AA
First Trust NASDAQ® Cln Edge®StGidIfsETF	GRID	US33737A1088	AA
iShares ESG MSCI USA Leaders ETF	SUSL	US46435U2188	AA
iShares MSCI KLD 400 Social ETF	DSI	US4642885705	AA
iShares MSCI USA ESG Select ETF	SUSA	US4642888022	AA
Nuveen ESG Large-Cap ETF	NULC	US67092P8620	AA
Nuveen ESG Large-Cap Growth ETF	NULG	US67092P2011	AA
Nuveen ESG Large-Cap Value ETF	NULV	US67092P3001	AA
Nuveen ESG Mid-Cap Growth ETF	NUMG	US67092P4090	AA
Nuveen ESG Mid-Cap Value ETF	NUMV	US67092P5089	AA
US Vegan Climate ETF	VEGN	US26922A2978	AA
Xtrackers MSCI USA ESG Leaders Eq ETF	USSG	US2330511500	AA
Nuveen ESG Intl Dev Mkts Eq ETF	NUDM	US67092P8059	AAA
Note: the MSCI ESG rating was retrieved May 2024. Due to only one ETF with a MSCI ESG rating of AAA being in the sample, they were added to the AA MSCI rating portfolio. MSCI rating ranks from, AAA until CCC, with CCC being the lowest.			

Table 21 Portfolio consisting of ETFs with Refinitiv rating C & B-

ETFs	Ticker	ISIN	Refinitiv rating
Invesco WilderHill Clean Energy ETF	PBW	US46137V1347	C
First Trust NASDAQ® Cln Edge® GrnEngyETF	QCLN	US33733E5006	B-
Invesco Solar ETF	TAN	US46138G7060	B-
ALPS Clean Energy ETF	ACES	US00162Q4608	B-
KraneShares MSCI China Environment ETF	KGRN	US5007678502	B-
SPDR® Kensho Clean Power ETF	CNRG	US78468R6559	B-
Nuveen ESG High Yield Corporate Bd ETF	NUHY	US67092P8547	B-
iShares ESG MSCI USA Small-Cap ETF	ESML	US46435U6635	B-
Nuveen ESG Small-Cap ETF	NUSC	US67092P6079	B-
Etho Climate Leadership US ETF	ETHO	US26924G8886	B-

Note: the Refinitiv ESG rating was retrieved 23/05/2024 and is an approximation, by the calculations in [Appendix B](#). Due to only one ETF with a Refinitiv ESG rating of C being in the sample, they were added to the B- Refinitiv rating portfolio. Refinitiv ranks from A+ until D-, with D- being the lowest.

Table 22 Portfolio consisting of ETFs with Refinitiv rating B

ETFs	Ticker	ISIN
Amplify Advcd Btty Mtls and MatrIs ETF	BATT	US0321088058
Invesco Global Clean Energy ETF	PBD	US46138G8472
iShares Global Clean Energy ETF	ICLN	US4642882249
VanEck Vectors Environmental Svcs ETF	EVX	US92189F3047
Invesco S&P Global Water ETF	CGW	US46138E2634
Invesco Water Resources ETF	PHO	US46137V1420
First Trust Water ETF	FIW	US33733B1008
Nuveen ESG Mid-Cap Growth ETF	NUMG	US67092P4090
First Trust EIP Carbon Impact ETF	ECLN	US33738D7057
VanEck Vectors Green Bond ETF	GRNB	US92189F1710

Note: the Refinitiv ESG rating was retrieved 23/05/2024 and is an approximation, by the calculations in [Appendix B](#). Refinitiv ranks from A+ until D-, with D- being the lowest.

Table 23 Portfolio consisting of ETFs with Refinitiv rating B+

ETFs	Ticker	ISIN
VanEck Vectors Low Carbon Energy ETF	SMOG	US92189F5026
First Trust Global Wind Energy ETF	FAN	US33736G1067
First Trust NASDAQ® Cln Edge®StGidIfsETF	GRID	US33737A1088
FlexShares STOXX US ESG Impact ETF	ESG	US33939L6965
iShares® ESG MSCI EM Leaders ETF	LDEM	US46436E6014
Nuveen ESG Emerging Markets Equity ETF	NUEM	US67092P8885
PIMCO Enhanced Short Mtrty Actv ESG ETF	EMNT	US72201R6430
SPDR® MSCI Em Mkts Fossil Fuel Free ETF	EEMX	US78470E2054
SPDR® S&P 500 Fossil Fuel Rsrv Free ETF	SPYX	US78468R7961
Alpha Architect Freedom 100 Em Mkts ETF	FRDM	US02072L6074
ClearBridge Dividend Strategy ESG ETF	YLDE	US5246823091
ClearBridge Large Cap Growth ESG ETF	LRGE	US5246822002

Columbia Sustainable US Equity Inc ETF	ESGS	US19761L3006
SPDR® MSCI ACWI Low Carbon Target ETF	NZAC	US78463X1946
Xtrackers MSCI EMs ESG Leaders Eq ETF	EMSG	US2330512268
Change Finance US LgCp FossilFuel Fr ETF	CHGX	US26922A5609
Invesco Global Water ETF	PIO	US46138E6510
iShares ESG MSCI EM ETF	ESGE	US46434G8630
Nuveen ESG Large-Cap ETF	NULC	US67092P8620
Nuveen ESG Large-Cap Growth ETF	NULG	US67092P2011
Nuveen ESG Large-Cap Value ETF	NULV	US67092P3001
Nuveen ESG Mid-Cap Value ETF	NUMV	US67092P5089
US Vegan Climate ETF	VEGN	US26922A2978
Impact Shares YWCA Women's Empwrmt ETF	WOMN	US45259A1007
iShares Global Green Bond ETF	BGRN	US46435U4408
Global X Conscious Companies ETF	KRMA	US37954Y7316
iShares MSCI Global Sust Dev Goals ETF	SDG	US46435G5320
iShares MSCI USA ESG Select ETF	SUSA	US4642888022
Note: the Refinitiv ESG rating was retrieved 23/05/2024 and is an approximation, by the calculations in Appendix B . Refinitiv ranks from A+ until D-, with D- being the lowest.		

Table 24 Portfolio consisting of ETFs with Refinitiv rating A- & A

ETFs	Ticker	ISIN	Refinitiv rating
FlexShares STOXX Gbl ESG Impact ETF	ESGG	US33939L6882	A-
Goldman Sachs JUST US Large Cap Eq ETF	JUST	US3814303968	A-
iShares MSCI ACWI Low Carbon Target ETF	CRBN	US46434V4648	A-
SPDR® SSGA Gender Diversity ETF	SHE	US78468R7474	A-
Vanguard ESG International Stock ETF	VSGX	US9219107250	A-
iShares ESG U.S. Aggregate Bond ETF	EAGG	US46435U5496	A-
PIMCO RAFI ESG US ETF	RAFE	US72201T3427	A-
Vanguard ESG US Stock ETF	ESGV	US9219107334	A-
Xtrackers S&P 500 ESG ETF	SNPE	US2330511435	A-
Columbia Sustainable Intl Eq Inc ETF	ESGN	US19761L2016	A-
iShares ESG MSCI EAFE ETF	ESGD	US46435G5163	A-
iShares ESG USD Corporate Bond ETF	SUSC	US46435G1931	A-
SPDR® MSCI EAFE Fossil Fuel Free ETF	EFAX	US78470E1064	A-
iShares ESG 1-5 Year USD Corp Bd ETF	SUSB	US46435G2434	A-
iShares ESG MSCI USA ETF	ESGU	US46435G4257	A-
Xtrackers MSCI EAFE ESG Leaders Eq ETF	EASG	US2330512185	A-
iShares ESG MSCI USA Leaders ETF	SUSL	US46435U2188	A-
Xtrackers MSCI USA ESG Leaders Eq ETF	USSG	US2330511500	A-
Nuveen ESG Intl Dev Mkts Eq ETF	NUDM	US67092P8059	A-
Impact Shares NAACP Minority Empwrmt ETF	NACP	US45259A2096	A-
IQ Candriam U.S. Large Cap Equity ETF	IQSU	US45409B4611	A-
IQ Candriam International Equity ETF	IQSI	US45409B4538	A-
iShares MSCI KLD 400 Social ETF	DSI	US4642885705	A-
Nuveen ESG US Aggregate Bond ETF	NUBD	US67092P8703	A

Note: the Refinitiv ESG rating was retrieved 23/05/2024 and is an approximation, by the calculations in [Appendix B](#). Refinitiv ranks from A+ until D-, with D- being the lowest.

Table 25 Portfolio consisting of ETFs with the clean investment strategy

ETFs	Ticker	ISIN
Invesco WilderHill Clean Energy ETF	PBW	US46137V1347
First Trust NASDAQ® Cln Edge® GrnEngyETF	QCLN	US33733E5006
Invesco Solar ETF	TAN	US46138G7060
ALPS Clean Energy ETF	ACES	US00162Q4608
Amplify Advcd Btty Mtls and Matrils ETF	BATT	US0321088058
Invesco Global Clean Energy ETF	PBD	US46138G8472
iShares Global Clean Energy ETF	ICLN	US4642882249
KraneShares MSCI China Environment ETF	KGRN	US5007678502
SPDR® Kensho Clean Power ETF	CNRG	US78468R6559
VanEck Vectors Environmental Svcs ETF	EVX	US92189F3047
VanEck Vectors Low Carbon Energy ETF	SMOG	US92189F5026
First Trust Global Wind Energy ETF	FAN	US33736G1067
First Trust NASDAQ® Cln Edge®StGidIfsETF	GRID	US33737A1088
Note: the strategy was determined May 2024, following Winegarden (2019) and Pavlova & de Boyrie. The clean strategy chases environmental goals, investing in clean technology.		

Table 26 Portfolio consisting of ETFs with the index investment strategy

ETFs	Ticker	ISIN
FlexShares STOXX Gbl ESG Impact ETF	ESGG	US33939L6882
FlexShares STOXX US ESG Impact ETF	ESG	US33939L6965
Goldman Sachs JUST US Large Cap Eq ETF	JUST	US3814303968
iShares MSCI ACWI Low Carbon Target ETF	CRBN	US46434V4648
iShares® ESG MSCI EM Leaders ETF	LDEM	US46436E6014
Nuveen ESG Emerging Markets Equity ETF	NUEM	US67092P8885
Nuveen ESG High Yield Corporate Bd ETF	NUHY	US67092P8547
PIMCO Enhanced Short Mtrty Actv ESG ETF	EMNT	US72201R6430
SPDR® MSCI Em Mkts Fossil Fuel Free ETF	EEMX	US78470E2054
SPDR® S&P 500 Fossil Fuel Rsrv Free ETF	SPYX	US78468R7961
SPDR® SSGA Gender Diversity ETF	SHE	US78468R7474
Vanguard ESG International Stock ETF	VSGX	US9219107250
Alpha Architect Freedom 100 Em Mkts ETF	FRDM	US02072L6074
ClearBridge Dividend Strategy ESG ETF	YLDE	US5246823091
ClearBridge Large Cap Growth ESG ETF	LRGE	US5246822002
Columbia Sustainable US Equity Inc ETF	ESGS	US19761L3006
iShares ESG MSCI USA Small-Cap ETF	ESML	US46435U6635
iShares ESG U.S. Aggregate Bond ETF	EAGG	US46435U5496
Nuveen ESG US Aggregate Bond ETF	NUBD	US67092P8703
PIMCO RAFI ESG US ETF	RAFE	US72201T3427
SPDR® MSCI ACWI Low Carbon Target ETF	NZAC	US78463X1946
Vanguard ESG US Stock ETF	ESGV	US9219107334

Xtrackers MSCI EMs ESG Leaders Eq ETF	EMSG	US2330512268
Xtrackers S&P 500 ESG ETF	SNPE	US2330511435
Change Finance US LgCp FossilFuel Fr ETF	CHGX	US26922A5609
Nuveen ESG Small-Cap ETF	NUSC	US67092P6079
Columbia Sustainable Intl Eq Inc ETF	ESGN	US19761L2016
Invesco S&P Global Water ETF	CGW	US46138E2634
Invesco Water Resources ETF	PHO	US46137V1420
iShares ESG MSCI EAFE ETF	ESGD	US46435G5163
iShares ESG USD Corporate Bond ETF	SUSC	US46435G1931
SPDR® MSCI EAFE Fossil Fuel Free ETF	EFAX	US78470E1064
First Trust Water ETF	FIW	US33733B1008
Invesco Global Water ETF	PIO	US46138E6510
iShares ESG 1-5 Year USD Corp Bd ETF	SUSB	US46435G2434
iShares ESG MSCI EM ETF	ESGE	US46434G8630
iShares ESG MSCI USA ETF	ESGU	US46435G4257
Xtrackers MSCI EAFE ESG Leaders Eq ETF	EASG	US2330512185
iShares ESG MSCI USA Leaders ETF	SUSL	US46435U2188
Nuveen ESG Large-Cap ETF	NULC	US67092P8620
Nuveen ESG Large-Cap Growth ETF	NULG	US67092P2011
Nuveen ESG Large-Cap Value ETF	NULV	US67092P3001
Nuveen ESG Mid-Cap Growth ETF	NUMG	US67092P4090
Nuveen ESG Mid-Cap Value ETF	NUMV	US67092P5089
US Vegan Climate ETF	VEGN	US26922A2978
Xtrackers MSCI USA ESG Leaders Eq ETF	USSG	US2330511500
Nuveen ESG Intl Dev Mkts Eq ETF	NUDM	US67092P8059
Note: the strategy was determined May 2024, following Winegarden (2019) and Pavlova & de Boyrie. The index strategy means that the ETFs follow an index like strategy.		

Table 27 Portfolio consisting of ETFs with social investment strategy

ETFs	Ticker	ISIN
First Trust EIP Carbon Impact ETF	ECLN	US33738D7057
Impact Shares YWCA Women's Empwrmt ETF	WOMN	US45259A1007
Impact Shares NAACP Minority Empwrmt ETF	NACP	US45259A2096
iShares Global Green Bond ETF	BGRN	US46435U4408
VanEck Vectors Green Bond ETF	GRNB	US92189F1710
Global X Conscious Companies ETF	KRMA	US37954Y7316
IQ Candriam U.S. Large Cap Equity ETF	IQSU	US45409B4611
Etho Climate Leadership US ETF	ETHO	US26924G8886
iShares MSCI Global Sust Dev Goals ETF	SDG	US46435G5320
IQ Candriam International Equity ETF	IQSI	US45409B4538
iShares MSCI KLD 400 Social ETF	DSI	US4642885705
iShares MSCI USA ESG Select ETF	SUSA	US4642888022
Note: the strategy was determined May 2024, following Winegarden (2019) and Pavlova & de Boyrie. The social strategy means that the ETFs follow an investment strategy chasing social goals.		

Table 28 Portfolio consisting of ETFs lacking the Morningstar low carbon designation

ETFs	Ticker	ISIN
Invesco WilderHill Clean Energy ETF	PBW	US46137V1347
VanEck Vectors Low Carbon Energy ETF	SMOG	US92189F5026
First Trust Global Wind Energy ETF	FAN	US33736G1067
First Trust NASDAQ® Cln Edge®StGidIfsETF	GRID	US33737A1088
FlexShares STOXX US ESG Impact ETF	ESG	US33939L6965
iShares® ESG MSCI EM Leaders ETF	LDEM	US46436E6014
PIMCO Enhanced Short Mtrty Actv ESG ETF	EMNT	US72201R6430
Alpha Architect Freedom 100 Em Mkts ETF	FRDM	US02072L6074
ClearBridge Dividend Strategy ESG ETF	YLDE	US5246823091
Columbia Sustainable US Equity Inc ETF	ESGS	US19761L3006
Xtrackers MSCI EMs ESG Leaders Eq ETF	EMSG	US2330512268
iShares ESG MSCI EM ETF	ESGE	US46434G8630
Nuveen ESG Large-Cap Value ETF	NULV	US67092P3001
Nuveen ESG Mid-Cap Value ETF	NUMV	US67092P5089
Impact Shares YWCA Women's Empwrmt ETF	WOMN	US45259A1007
iShares Global Green Bond ETF	BGRN	US46435U4408
First Trust NASDAQ® Cln Edge® GrnEngyETF	QCLN	US33733E5006
ALPS Clean Energy ETF	ACES	US00162Q4608
KraneShares MSCI China Environment ETF	KGRN	US5007678502
SPDR® Kensho Clean Power ETF	CNRG	US78468R6559
Nuveen ESG High Yield Corporate Bd ETF	NUHY	US67092P8547
iShares ESG MSCI USA Small-Cap ETF	ESML	US46435U6635
Amplify Advcd Btty Mtls and Matrils ETF	BATT	US0321088058
iShares Global Clean Energy ETF	ICLN	US4642882249
VanEck Vectors Environmental Svcs ETF	EVX	US92189F3047
First Trust Water ETF	FIW	US33733B1008
First Trust EIP Carbon Impact ETF	ECLN	US33738D7057
VanEck Vectors Green Bond ETF	GRNB	US92189F1710
FlexShares STOXX Gbl ESG Impact ETF	ESGG	US33939L6882
Goldman Sachs JUST US Large Cap Eq ETF	JUST	US3814303968
Columbia Sustainable Intl Eq Inc ETF	ESGN	US19761L2016
iShares ESG MSCI EAFE ETF	ESGD	US46435G5163
iShares ESG USD Corporate Bond ETF	SUSC	US46435G1931
iShares ESG 1-5 Year USD Corp Bd ETF	SUSB	US46435G2434
iShares ESG MSCI USA ETF	ESGU	US46435G4257
Xtrackers MSCI EAFE ESG Leaders Eq ETF	EASG	US2330512185
Impact Shares NAACP Minority Empwrmt ETF	NACP	US45259A2096
IQ Candriam International Equity ETF	IQSI	US45409B4538
Note: the MSCI low carbon designation was accessed May 2024.		

Table 29 consisting of ETFs with the Morningstar low carbon designation

ETFs	Ticker	ISIN
Nuveen ESG Emerging Markets Equity ETF	NUEM	US67092P8885
SPDR® MSCI Em Mkts Fossil Fuel Free ETF	EEMX	US78470E2054
SPDR® S&P 500 Fossil Fuel Rsrv Free ETF	SPYX	US78468R7961
ClearBridge Large Cap Growth ESG ETF	LRGE	US5246822002
SPDR® MSCI ACWI Low Carbon Target ETF	NZAC	US78463X1946
Change Finance US LgCp FossilFuel Fr ETF	CHGX	US26922A5609
Invesco Global Water ETF	PIO	US46138E6510
Nuveen ESG Large-Cap ETF	NULC	US67092P8620
Nuveen ESG Large-Cap Growth ETF	NULG	US67092P2011
US Vegan Climate ETF	VEGN	US26922A2978
Global X Conscious Companies ETF	KRMA	US37954Y7316
iShares MSCI Global Sust Dev Goals ETF	SDG	US46435G5320
iShares MSCI USA ESG Select ETF	SUSA	US4642888022
Invesco Solar ETF	TAN	US46138G7060
Nuveen ESG Small-Cap ETF	NUSC	US67092P6079
Etho Climate Leadership US ETF	ETHO	US26924G8886
Invesco Global Clean Energy ETF	PBD	US46138G8472
Invesco S&P Global Water ETF	CGW	US46138E2634
Invesco Water Resources ETF	PHO	US46137V1420
Nuveen ESG Mid-Cap Growth ETF	NUMG	US67092P4090
iShares MSCI ACWI Low Carbon Target ETF	CRBN	US46434V4648
SPDR® SSGA Gender Diversity ETF	SHE	US78468R7474
Vanguard ESG International Stock ETF	VSGX	US9219107250
iShares ESG U.S. Aggregate Bond ETF	EAGG	US46435U5496
PIMCO RAFI ESG US ETF	RAFE	US72201T3427
Vanguard ESG US Stock ETF	ESGV	US9219107334
Xtrackers S&P 500 ESG ETF	SNPE	US2330511435
SPDR® MSCI EAFE Fossil Fuel Free ETF	EFAX	US78470E1064
iShares ESG MSCI USA Leaders ETF	SUSL	US46435U2188
Xtrackers MSCI USA ESG Leaders Eq ETF	USSG	US2330511500
Nuveen ESG Intl Dev Mkts Eq ETF	NUDM	US67092P8059
IQ Candriam U.S. Large Cap Equity ETF	IQSU	US45409B4611
iShares MSCI KLD 400 Social ETF	DSI	US4642885705
Nuveen ESG US Aggregate Bond ETF	NUBD	US67092P8703
Note: the MSCI low carbon designation was accessed May 2024.		

APPENDIX D Regressions including coefficients and r-squared

Table 30 Regressions for equally weighted portfolio of ETFs with Morningstar globes rating of 1 & 2

Variables	CAPM	FF3	Carhart	FF5	FF5+mom
Before invasion					
MktRF	1.005*** (0.065)	0.925*** (0.067)	0.937*** (0.072)	0.888*** (0.068)	0.899*** (0.075)
SMB		0.090 (0.114)	0.068 (0.112)	0.013 (0.109)	0.011 (0.109)
HML		-0.105 (0.069)	-0.087 (0.069)	-0.040 (0.103)	-0.041 (0.105)
RMW				-0.160* (0.088)	-0.143 (0.089)
CMA				-0.152 (0.203)	-0.125 (0.220)
Mom			-0.109 (0.068)		-0.056 (0.070)
Constant	-0.113 (0.077)	-0.080 (0.077)	-0.087 (0.075)	-0.061 (0.081)	-0.068 (0.080)
Adjusted R-squared	0.835	0.842	0.844	0.848	0.846
F-Stat	324	114.9	87.66	72.18	59.59
Prob > F	0	0	0	0	0
After Invasion					
MktRF	0.891*** (0.068)	0.795*** (0.076)	0.789*** (0.078)	0.735*** (0.057)	0.743*** (0.051)
SMB		0.583*** (0.213)	0.473** (0.221)	0.171 (0.149)	0.029 (0.133)
HML		-0.035 (0.106)	0.051 (0.110)	0.059 (0.099)	0.120 (0.099)
RMW				-0.641*** (0.103)	-0.571*** (0.094)
CMA				-0.137 (0.143)	0.189 (0.183)
Mom			-0.176 (0.132)		-0.369*** (0.130)
Constant	0.033 (0.107)	0.051 (0.087)	0.056 (0.086)	0.053 (0.062)	0.030 (0.061)
Adjusted R-squared	0.798	0.851	0.853	0.906	0.915
F-Stat	270.1	130.7	99.56	132.4	123.1
Prob > F	0	0	0	0	0

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All coefficients provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. MktRF is the excess return on the market, SMB is the small minus big factor, HML is the high minus low factor, WML is the winners minus losers factor, RMW is the robust minus weak factor, CMA is the conservative minus aggressive factor and Mom is the momentum factor. These factors are constructed with the portfolios mentioned in [section 3.4](#).

Table 31 Regressions for equally weighted portfolio of ETFs with Morningstar globes rating of 3

Variables	CAPM	FF3	Carhart	FF5	FF5+mom
Before invasion					
MktRF	0.591*** (0.045)	0.579*** (0.051)	0.582*** (0.053)	0.574*** (0.053)	0.577*** (0.056)
SMB		-0.055 (0.095)	-0.059 (0.097)	-0.055 (0.099)	-0.055 (0.100)
HML		-0.045 (0.048)	-0.042 (0.046)	-0.042 (0.080)	-0.042 (0.082)
RMW				-0.036 (0.078)	-0.032 (0.082)
CMA				0.039 (0.165)	0.047 (0.178)
Mom			-0.019 (0.050)		-0.016 (0.059)
Constant	-0.090* (0.053)	-0.086 (0.057)	-0.087 (0.058)	-0.091 (0.059)	-0.093 (0.060)
Adjusted R-squared	0.764	0.761	0.757	0.753	0.749
F-Stat	208.7	68.88	50.91	40.01	32.81
Prob > F	0	0	0	0	0
After invasion					
MktRF	0.597*** (0.040)	0.581*** (0.050)	0.579*** (0.052)	0.541*** (0.040)	0.542*** (0.039)
SMB		0.208* (0.115)	0.159 (0.125)	-0.012 (0.119)	-0.023 (0.129)
HML		0.024 (0.082)	0.062 (0.087)	0.157 (0.110)	0.162 (0.108)
RMW				-0.336*** (0.080)	-0.330*** (0.082)
CMA				-0.210 (0.145)	-0.184 (0.175)
Mom			-0.077 (0.114)		-0.029 (0.126)
Constant	-0.100 (0.067)	-0.098 (0.065)	-0.096 (0.066)	-0.084 (0.063)	-0.086 (0.062)
Adjusted R-squared	0.795	0.801	0.800	0.830	0.827
F-Stat	265.3	92.24	68.84	67.36	55.30
Prob > F	0	0	0	0	0

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All coefficients provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. MktRF is the excess return on the market, SMB is the small minus big factor, HML is the high minus low factor, WML is the winners minus losers factor, RMW is the robust minus weak factor, CMA is the conservative minus aggressive factor and Mom is the momentum factor. These factors are constructed with the portfolios mentioned in [section 3.4](#).

Table 32 Regressions for equally weighted portfolio of ETFs with Morningstar globes rating of 4

Variables	CAPM	FF3	Carhart	FF5	FF5+mom
Before invasion					
MktRF	0.686*** (0.034)	0.693*** (0.041)	0.694*** (0.042)	0.699*** (0.039)	0.703*** (0.042)
SMB		-0.038 (0.065)	-0.039 (0.068)	0.007 (0.072)	0.006 (0.073)
HML		-0.004 (0.039)	-0.004 (0.039)	-0.010 (0.068)	-0.011 (0.069)
RMW				0.051 (0.060)	0.057 (0.061)
CMA				0.011 (0.125)	0.021 (0.129)
Mom			-0.006 (0.043)		-0.021 (0.046)
Constant	-0.052 (0.037)	-0.055 (0.041)	-0.055 (0.041)	-0.055 (0.042)	-0.057 (0.041)
Adjusted R-squared	0.880	0.877	0.875	0.874	0.872
F-Stat	469.3	152.6	112.6	89.44	73.48
Prob > F	0	0	0	0	0
After invasion					
MktRF	0.690*** (0.027)	0.687*** (0.035)	0.686*** (0.036)	0.662*** (0.030)	0.662*** (0.029)
SMB		0.174* (0.091)	0.156 (0.096)	0.036 (0.085)	0.039 (0.093)
HML		0.041 (0.055)	0.056 (0.062)	0.115 (0.077)	0.114 (0.076)
RMW				-0.226*** (0.065)	-0.227*** (0.067)
CMA				-0.120 (0.110)	-0.126 (0.128)
Mom			-0.030 (0.081)		0.006 (0.089)
Constant	-0.066 (0.047)	-0.067 (0.045)	-0.066 (0.047)	-0.059 (0.045)	-0.059 (0.044)
Adjusted R-squared	0.911	0.914	0.913	0.926	0.925
F-Stat	696.7	243.2	180.1	170.6	140
Prob > F	0	0	0	0	0

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All coefficients provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. MktRF is the excess return on the market, SMB is the small minus big factor, HML is the high minus low factor, WML is the winners minus losers factor, RMW is the robust minus weak factor, CMA is the conservative minus aggressive factor and Mom is the momentum factor. These factors are constructed with the portfolios mentioned in [section 3.4](#).

Table 33 Regressions for equally weighted portfolio of ETFs with Morningstar globes rating of 5

Variables	CAPM	FF3	Carhart	FF5	FF5+mom
Before invasion					
MktRF	1.004*** (0.040)	0.948*** (0.033)	0.928*** (0.036)	0.993*** (0.032)	0.967*** (0.030)
SMB		0.093 (0.073)	0.126 (0.085)	0.196*** (0.070)	0.202*** (0.069)
HML		-0.061 (0.043)	-0.090* (0.053)	-0.164 (0.108)	-0.162 (0.101)
RMW				0.193*** (0.067)	0.154* (0.079)
CMA				0.148 (0.168)	0.087 (0.130)
Mom			0.174* (0.089)		0.128 (0.081)
Constant	-0.069 (0.044)	-0.046 (0.033)	-0.036 (0.028)	-0.063 (0.051)	-0.048 (0.040)
Adjusted R-squared	0.907	0.911	0.922	0.922	0.927
F-Stat	623.4	219.3	189.9	153.4	136.7
Prob > F	0	0	0	0	0
After invasion					
MktRF	1.000*** (0.012)	0.992*** (0.013)	0.991*** (0.013)	0.995*** (0.013)	0.994*** (0.012)
SMB		0.121*** (0.040)	0.108* (0.059)	0.152*** (0.045)	0.179*** (0.048)
HML		0.017 (0.022)	0.027 (0.021)	0.024 (0.025)	0.013 (0.027)
RMW				0.046 (0.038)	0.033 (0.036)
CMA				-0.083 (0.050)	-0.143*** (0.052)
Mom			-0.021 (0.040)		0.068* (0.035)
Constant	-0.064*** (0.024)	-0.063*** (0.022)	-0.062*** (0.022)	-0.052** (0.020)	-0.048** (0.020)
Adjusted R-squared	0.989	0.990	0.990	0.992	0.992
F-Stat	6001	2284	1696	1651	1413
Prob > F	0	0	0	0	0

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All coefficients provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. MktRF is the excess return on the market, SMB is the small minus big factor, HML is the high minus low factor, WML is the winners minus losers factor, RMW is the robust minus weak factor, CMA is the conservative minus aggressive factor and Mom is the momentum factor. These factors are constructed with the portfolios mentioned in [section 3.4](#).

Table 34 Regressions for equally weighted portfolio of ETFs with MSCI rating A

Variables	CAPM	FF3	Carhart	FF5	FF5+mom
Before invasion					
MktRF	0.787*** (0.042)	0.752*** (0.047)	0.756*** (0.049)	0.742*** (0.047)	0.748*** (0.050)
SMB		0.045 (0.075)	0.037 (0.074)	0.032 (0.073)	0.031 (0.073)
HML		-0.044 (0.045)	-0.037 (0.045)	-0.034 (0.068)	-0.035 (0.069)
RMW				-0.044 (0.066)	-0.035 (0.068)
CMA				-0.028 (0.125)	-0.014 (0.136)
Mom			-0.041 (0.042)		-0.028 (0.047)
Constant	-0.078 (0.047)	-0.064 (0.048)	-0.066 (0.048)	-0.060 (0.049)	-0.063 (0.048)
Adjusted R-squared	0.883	0.883	0.882	0.881	0.879
F-Stat	482.3	162.2	120.9	95.51	78.57
Prob > F	0	0	0	0	0
After invasion					
MktRF	0.762*** (0.036)	0.721*** (0.041)	0.718*** (0.042)	0.685*** (0.031)	0.689*** (0.029)
SMB		0.312*** (0.115)	0.252** (0.117)	0.081 (0.086)	0.022 (0.086)
HML		0.003 (0.064)	0.051 (0.069)	0.083 (0.072)	0.108 (0.073)
RMW				-0.359*** (0.066)	-0.330*** (0.064)
CMA				-0.127 (0.105)	0.009 (0.125)
Mom			-0.097 (0.086)		-0.153* (0.091)
Constant	-0.051 (0.060)	-0.044 (0.051)	-0.042 (0.051)	-0.038 (0.042)	-0.048 (0.041)
Adjusted R-squared	0.894	0.913	0.914	0.938	0.940
F-Stat	573.2	238.9	180.6	206.5	177.5
Prob > F	0	0	0	0	0

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All coefficients provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. MktRF is the excess return on the market, SMB is the small minus big factor, HML is the high minus low factor, WML is the winners minus losers factor, RMW is the robust minus weak factor, CMA is the conservative minus aggressive factor and Mom is the momentum factor. These factors are constructed with the portfolios mentioned in [section 3.4](#).

Table 35 Regressions for equally weighted portfolio of ETFs with MSCI rating of AA & AAA

Variables	CAPM	FF3	Carhart	FF5	FF5+mom
Before invasion					
MktRF	0.708*** (0.036)	0.706*** (0.038)	0.695*** (0.036)	0.731*** (0.041)	0.720*** (0.041)
SMB		-0.077 (0.065)	-0.058 (0.071)	0.011 (0.074)	0.013 (0.076)
HML		-0.038 (0.033)	-0.054* (0.032)	-0.086 (0.060)	-0.085 (0.059)
RMW				0.128* (0.072)	0.110 (0.078)
CMA				0.113 (0.139)	0.085 (0.140)
Mom			0.094* (0.050)		0.058 (0.053)
Constant	-0.072 (0.044)	-0.072 (0.046)	-0.066 (0.044)	-0.085* (0.047)	-0.078 (0.047)
Adjusted R-squared	0.869	0.869	0.873	0.876	0.876
F-Stat	426.1	142	111.4	91.51	76.57
Prob > F	0	0	0	0	0
After invasion					
MktRF	0.718*** (0.028)	0.730*** (0.035)	0.729*** (0.036)	0.713*** (0.032)	0.709*** (0.031)
SMB		0.090 (0.078)	0.086 (0.101)	0.027 (0.108)	0.079 (0.116)
HML		0.049 (0.053)	0.053 (0.060)	0.139 (0.084)	0.116 (0.084)
RMW				-0.109 (0.074)	-0.135* (0.069)
CMA				-0.173 (0.128)	-0.295** (0.138)
Mom			-0.008 (0.091)		0.137 (0.095)
Constant	-0.085* (0.046)	-0.089* (0.049)	-0.088* (0.049)	-0.074 (0.050)	-0.065 (0.049)
Adjusted R-squared	0.917	0.916	0.915	0.919	0.920
F-Stat	750.3	248.1	183.3	154.8	131.2
Prob > F	0	0	0	0	0

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All coefficients provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. MktRF is the excess return on the market, SMB is the small minus big factor, HML is the high minus low factor, WML is the winners minus losers factor, RMW is the robust minus weak factor, CMA is the conservative minus aggressive factor and Mom is the momentum factor. These factors are constructed with the portfolios mentioned in [section 3.4](#).

Table 36 Regressions for equally weighted portfolio of ETFs with Refinitiv rating of C & B-

Variables	CAPM	FF3	Carhart	FF5	FF5+mom
Before invasion					
MktRF	1.224*** (0.109)	0.996*** (0.112)	1.012*** (0.118)	0.947*** (0.113)	0.956*** (0.121)
SMB		0.493*** (0.164)	0.465*** (0.157)	0.356** (0.147)	0.354** (0.147)
HML		-0.191* (0.110)	-0.167 (0.113)	-0.146 (0.149)	-0.147 (0.151)
RMW				-0.250* (0.127)	-0.236* (0.129)
CMA				-0.258 (0.266)	-0.237 (0.284)
Mom			-0.142 (0.107)		-0.044 (0.101)
Constant	-0.201 (0.132)	-0.107 (0.114)	-0.115 (0.112)	-0.072 (0.119)	-0.077 (0.116)
Adjusted R-squared	0.724	0.785	0.786	0.793	0.790
F-Stat	168.7	78.90	59.74	49.95	41.01
Prob > F	0	0	0	0	0
After invasion					
MktRF	1.062*** (0.105)	0.843*** (0.101)	0.831*** (0.102)	0.752*** (0.081)	0.766*** (0.070)
SMB		1.143*** (0.303)	0.905*** (0.301)	0.506** (0.217)	0.260 (0.173)
HML		-0.131 (0.146)	0.055 (0.159)	0.017 (0.141)	0.121 (0.141)
RMW				-0.950*** (0.165)	-0.829*** (0.144)
CMA				-0.338 (0.217)	0.228 (0.257)
Mom			-0.381** (0.189)		-0.638*** (0.181)
Constant	0.043 (0.170)	0.085 (0.121)	0.095 (0.115)	0.103 (0.088)	0.064 (0.081)
Adjusted R-squared	0.671	0.812	0.820	0.875	0.892
F-Stat	139.8	98.92	78.57	96.61	94.50
Prob > F	0	0	0	0	0

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All coefficients provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. MktRF is the excess return on the market, SMB is the small minus big factor, HML is the high minus low factor, WML is the winners minus losers factor, RMW is the robust minus weak factor, CMA is the conservative minus aggressive factor and Mom is the momentum factor. These factors are constructed with the portfolios mentioned in [section 3.4](#).

Table 37 Regressions for equally weighted portfolio of ETFs with Refinitiv rating of B

Variables	CAPM	FF3	Carhart	FF5	FF5+mom
Before invasion					
MktRF	0.782*** (0.060)	0.681*** (0.061)	0.676*** (0.062)	0.702*** (0.062)	0.697*** (0.065)
SMB		0.042 (0.093)	0.052 (0.097)	0.134 (0.093)	0.135 (0.095)
HML		-0.162*** (0.056)	-0.170*** (0.054)	-0.202** (0.089)	-0.201** (0.090)
RMW				0.128 (0.091)	0.122 (0.093)
CMA				0.028 (0.184)	0.018 (0.192)
Mom			0.049 (0.060)		0.021 (0.064)
Constant	-0.160** (0.070)	-0.119* (0.065)	-0.117* (0.064)	-0.119* (0.065)	-0.117* (0.064)
Adjusted R-squared	0.775	0.801	0.799	0.803	0.800
F-Stat	222	86.99	64.73	53.21	43.66
Prob > F	0	0	0	0	0
After invasion					
MktRF	0.760*** (0.048)	0.714*** (0.057)	0.715*** (0.059)	0.680*** (0.047)	0.680*** (0.047)
SMB		0.450*** (0.142)	0.460*** (0.150)	0.219* (0.117)	0.219* (0.122)
HML		0.032 (0.075)	0.024 (0.083)	0.071 (0.096)	0.072 (0.099)
RMW				-0.406*** (0.083)	-0.405*** (0.087)
CMA				-0.067 (0.161)	-0.065 (0.189)
Mom			0.016 (0.107)		-0.002 (0.120)
Constant	0.003 (0.084)	0.011 (0.071)	0.010 (0.073)	0.010 (0.063)	0.010 (0.063)
Adjusted R-squared	0.826	0.860	0.858	0.893	0.891
F-Stat	324.5	140.2	103.6	114.5	93.92
Prob > F	0	0	0	0	0

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All coefficients provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. MktRF is the excess return on the market, SMB is the small minus big factor, HML is the high minus low factor, WML is the winners minus losers factor, RMW is the robust minus weak factor, CMA is the conservative minus aggressive factor and Mom is the momentum factor. These factors are constructed with the portfolios mentioned in [section 3.4](#).

Table 38 Regressions for equally weighted portfolio of ETFs with Refinitiv rating of B+

Variables	CAPM	FF3	Carhart	FF5	FF5+mom
Before invasion					
MktRF	0.715*** (0.028)	0.727*** (0.033)	0.723*** (0.032)	0.737*** (0.035)	0.732*** (0.036)
SMB		-0.057 (0.055)	-0.050 (0.058)	-0.020 (0.063)	-0.019 (0.064)
HML		-0.003 (0.030)	-0.009 (0.028)	-0.020 (0.047)	-0.019 (0.047)
RMW				0.048 (0.061)	0.041 (0.066)
CMA				0.054 (0.105)	0.044 (0.111)
Mom			0.037 (0.035)		0.022 (0.042)
Constant	-0.043 (0.036)	-0.049 (0.039)	-0.047 (0.039)	-0.055 (0.040)	-0.052 (0.040)
Adjusted R-squared	0.912	0.911	0.910	0.909	0.908
F-Stat	662.3	218.5	163.4	129.2	106.3
Prob > F	0	0	0	0	0
After invasion					
MktRF	0.722*** (0.025)	0.735*** (0.032)	0.734*** (0.032)	0.711*** (0.026)	0.711*** (0.026)
SMB		0.065 (0.083)	0.033 (0.092)	-0.047 (0.087)	-0.037 (0.096)
HML		0.044 (0.053)	0.069 (0.063)	0.148* (0.079)	0.144* (0.080)
RMW				-0.169** (0.065)	-0.174** (0.067)
CMA				-0.169 (0.110)	-0.193 (0.119)
Mom			-0.051 (0.083)		0.027 (0.087)
Constant	-0.090** (0.042)	-0.093** (0.045)	-0.092* (0.046)	-0.080* (0.047)	-0.078* (0.045)
Adjusted R-squared	0.925	0.924	0.923	0.929	0.928
F-Stat	837.1	275.1	204.8	178.9	147
Prob > F	0	0	0	0	0

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All coefficients provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. MktRF is the excess return on the market, SMB is the small minus big factor, HML is the high minus low factor, WML is the winners minus losers factor, RMW is the robust minus weak factor, CMA is the conservative minus aggressive factor and Mom is the momentum factor. These factors are constructed with the portfolios mentioned in [section 3.4](#).

Table 39 Regressions for equally weighted portfolio of ETFs with Refinitiv rating of A & A-

Variables	CAPM	FF3	Carhart	FF5	FF5+mom
Before invasion					
MktRF	0.599*** (0.025)	0.654*** (0.031)	0.650*** (0.030)	0.668*** (0.029)	0.667*** (0.029)
SMB		-0.163*** (0.052)	-0.157*** (0.055)	-0.109* (0.061)	-0.109* (0.062)
HML		0.026 (0.026)	0.020 (0.026)	0.005 (0.045)	0.005 (0.046)
RMW				0.064 (0.053)	0.064 (0.058)
CMA				0.113 (0.098)	0.113 (0.105)
Mom			0.031 (0.036)		0.001 (0.042)
Constant	-0.027 (0.029)	-0.050 (0.032)	-0.048 (0.032)	-0.064* (0.034)	-0.064* (0.035)
Adjusted R-squared	0.883	0.905	0.905	0.906	0.904
F-Stat	482.4	205	153.1	124.1	101.7
Prob > F	0	0	0	0	0
After invasion					
MktRF	0.632*** (0.026)	0.667*** (0.030)	0.668*** (0.031)	0.661*** (0.030)	0.658*** (0.029)
SMB		-0.062 (0.071)	-0.046 (0.085)	-0.068 (0.100)	-0.024 (0.104)
HML		0.054 (0.051)	0.042 (0.056)	0.104 (0.075)	0.085 (0.074)
RMW				-0.022 (0.066)	-0.044 (0.062)
CMA				-0.070 (0.108)	-0.171 (0.131)
Mom			0.025 (0.074)		0.114 (0.095)
Constant	-0.109*** (0.039)	-0.116** (0.044)	-0.117** (0.045)	-0.110** (0.046)	-0.103** (0.046)
Adjusted R-squared	0.909	0.912	0.911	0.910	0.910
F-Stat	676.9	236.5	175	137.9	116.2
Prob > F	0	0	0	0	0

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All coefficients provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. MktRF is the excess return on the market, SMB is the small minus big factor, HML is the high minus low factor, WML is the winners minus losers factor, RMW is the robust minus weak factor, CMA is the conservative minus aggressive factor and Mom is the momentum factor. These factors are constructed with the portfolios mentioned in [section 3.4](#).

Table 40 Regressions for equally weighted portfolio of ETFs with an index investment strategy

Variables	CAPM	FF3	Carhart	FF5	FF5+mom
Before invasion					
MktRF	0.660*** (0.024)	0.682*** (0.028)	0.676*** (0.026)	0.701*** (0.028)	0.697*** (0.028)
SMB		-0.038 (0.046)	-0.028 (0.049)	0.023 (0.054)	0.024 (0.055)
HML		0.023 (0.025)	0.015 (0.024)	-0.020 (0.036)	-0.019 (0.035)
RMW				0.085 (0.055)	0.079 (0.060)
CMA				0.099 (0.085)	0.089 (0.087)
Mom			0.050 (0.037)		0.021 (0.039)
Constant	-0.041 (0.032)	-0.050 (0.034)	-0.047 (0.033)	-0.062* (0.036)	-0.059* (0.035)
Adjusted R-squared	0.915	0.915	0.916	0.920	0.919
F-Stat	694.1	231.5	176.1	148.2	122.1
Prob > F	0	0	0	0	0
After invasion					
MktRF	0.680*** (0.025)	0.707*** (0.032)	0.707*** (0.032)	0.697*** (0.028)	0.695*** (0.027)
SMB		0.037 (0.071)	0.026 (0.085)	0.004 (0.088)	0.031 (0.095)
HML		0.066 (0.052)	0.075 (0.058)	0.127 (0.080)	0.116 (0.079)
RMW				-0.063 (0.064)	-0.076 (0.063)
CMA				-0.112 (0.106)	-0.174 (0.123)
Mom			-0.018 (0.072)		0.070 (0.085)
Constant	-0.105*** (0.038)	-0.112** (0.043)	-0.111** (0.043)	-0.102** (0.044)	-0.098** (0.044)
Adjusted R-squared	0.925	0.925	0.924	0.925	0.925
F-Stat	834.9	280.9	207.7	168.8	139.9
Prob > F	0	0	0	0	0

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All coefficients provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. MktRF is the excess return on the market, SMB is the small minus big factor, HML is the high minus low factor, WML is the winners minus losers factor, RMW is the robust minus weak factor, CMA is the conservative minus aggressive factor and Mom is the momentum factor. These factors are constructed with the portfolios mentioned in [section 3.4](#).

Table 41 Regressions for equally weighted portfolio of ETFs with a social investment strategy

Variables	CAPM	FF3	Carhart	FF5	FF5+mom
Before invasion					
MktRF	0.650*** (0.022)	0.672*** (0.024)	0.666*** (0.024)	0.696*** (0.022)	0.693*** (0.023)
SMB		-0.121*** (0.034)	-0.110*** (0.038)	-0.037 (0.035)	-0.037 (0.035)
HML		-0.013 (0.020)	-0.022 (0.021)	-0.048 (0.037)	-0.048 (0.037)
RMW				0.126*** (0.046)	0.123** (0.049)
CMA				0.099 (0.076)	0.093 (0.076)
Mom			0.054 (0.033)		0.012 (0.030)
Constant	-0.037* (0.021)	-0.046** (0.023)	-0.043** (0.021)	-0.057** (0.023)	-0.056** (0.022)
Adjusted R-squared	0.933	0.940	0.942	0.951	0.951
F-Stat	889.7	336.4	261.5	251.4	206.5
Prob > F	0	0	0	0	0
After invasion					
MktRF	0.670*** (0.011)	0.692*** (0.011)	0.694*** (0.012)	0.699*** (0.013)	0.698*** (0.013)
SMB		-0.001 (0.038)	0.038 (0.052)	0.034 (0.053)	0.053 (0.059)
HML		0.044** (0.021)	0.013 (0.022)	0.004 (0.036)	-0.005 (0.037)
RMW				0.017 (0.034)	0.007 (0.033)
CMA				0.085 (0.062)	0.041 (0.065)
Mom			0.063 (0.042)		0.050 (0.046)
Constant	-0.073*** (0.023)	-0.078*** (0.025)	-0.080*** (0.025)	-0.086*** (0.026)	-0.083*** (0.025)
Adjusted R-squared	0.973	0.974	0.975	0.974	0.974
F-Stat	2470	856.8	661	520	433.4
Prob > F	0	0	0	0	0

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All coefficients provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. MktRF is the excess return on the market, SMB is the small minus big factor, HML is the high minus low factor, WML is the winners minus losers factor, RMW is the robust minus weak factor, CMA is the conservative minus aggressive factor and Mom is the momentum factor. These factors are constructed with the portfolios mentioned in [section 3.4](#).

Table 42 Regressions for equally weighted portfolio of ETFs with a clean investment strategy

Variables	CAPM	FF3	Carhart	FF5	FF5+mom
Before invasion					
MktRF	1.203*** (0.134)	0.977*** (0.139)	0.996*** (0.149)	0.910*** (0.141)	0.921*** (0.154)
SMB		0.234 (0.223)	0.202 (0.218)	0.082 (0.208)	0.080 (0.209)
HML		-0.301** (0.137)	-0.273* (0.140)	-0.186 (0.211)	-0.187 (0.213)
RMW				-0.297* (0.160)	-0.279* (0.162)
CMA				-0.300 (0.386)	-0.272 (0.415)
Mom			-0.165 (0.138)		-0.057 (0.135)
Constant	-0.238 (0.156)	-0.147 (0.145)	-0.156 (0.143)	-0.108 (0.148)	-0.115 (0.145)
Adjusted R-squared	0.640	0.683	0.683	0.692	0.687
F-Stat	114.6	46.88	35.46	29.75	24.43
Prob > F	0	0	0	0	0
After invasion					
MktRF	1.048*** (0.120)	0.817*** (0.124)	0.806*** (0.128)	0.690*** (0.096)	0.702*** (0.089)
SMB		1.119*** (0.394)	0.908** (0.393)	0.287 (0.266)	0.085 (0.232)
HML		-0.162 (0.175)	0.003 (0.193)	0.116 (0.157)	0.202 (0.162)
RMW				-1.235*** (0.189)	-1.136*** (0.176)
CMA				-0.477* (0.259)	-0.012 (0.315)
Mom			-0.337 (0.254)		-0.524** (0.226)
Constant	0.091 (0.203)	0.135 (0.154)	0.145 (0.152)	0.160 (0.113)	0.128 (0.110)
Adjusted R-squared	0.596	0.724	0.728	0.827	0.836
F-Stat	101.3	60.59	46.53	66.14	58.71
Prob > F	0	0	0	0	0

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All coefficients provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. MktRF is the excess return on the market, SMB is the small minus big factor, HML is the high minus low factor, WML is the winners minus losers factor, RMW is the robust minus weak factor, CMA is the conservative minus aggressive factor and Mom is the momentum factor. These factors are constructed with the portfolios mentioned in section 3.4.

Table 43 Regressions for equally weighted portfolio of ETFs with a Morningstar low carbon designation

Variables	CAPM	FF3	Carhart	FF5	FF5+mom
Before invasion					
MktRF	0.820*** (0.029)	0.796*** (0.030)	0.789*** (0.029)	0.812*** (0.031)	0.804*** (0.030)
SMB		-0.038 (0.046)	-0.026 (0.049)	0.017 (0.051)	0.019 (0.052)
HML		-0.061** (0.026)	-0.071*** (0.025)	-0.091** (0.043)	-0.090** (0.042)
RMW				0.081 (0.056)	0.069 (0.061)
CMA				0.065 (0.092)	0.046 (0.092)
Mom			0.061* (0.036)		0.040 (0.040)
Constant	-0.076** (0.034)	-0.066* (0.034)	-0.063* (0.033)	-0.074** (0.035)	-0.069* (0.034)
Adjusted R-squared	0.938	0.940	0.942	0.942	0.942
F-Stat	974	337	259.4	209.1	174
Prob > F	0	0	0	0	0
After invasion					
MktRF	0.814*** (0.022)	0.797*** (0.026)	0.795*** (0.027)	0.779*** (0.022)	0.779*** (0.022)
SMB		0.104* (0.061)	0.077 (0.074)	0.021 (0.073)	0.032 (0.081)
HML		-0.007 (0.041)	0.014 (0.045)	0.067 (0.060)	0.063 (0.060)
RMW				-0.127*** (0.047)	-0.132*** (0.047)
CMA				-0.141 (0.090)	-0.166 (0.103)
Mom			-0.044 (0.066)		0.028 (0.072)
Constant	-0.084** (0.037)	-0.080** (0.035)	-0.079** (0.036)	-0.069* (0.035)	-0.067* (0.035)
Adjusted R-squared	0.960	0.962	0.962	0.965	0.964
F-Stat	1646	572.4	426.7	371.5	305.4
Prob > F	0	0	0	0	0

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All coefficients provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. MktRF is the excess return on the market, SMB is the small minus big factor, HML is the high minus low factor, WML is the winners minus losers factor, RMW is the robust minus weak factor, CMA is the conservative minus aggressive factor and Mom is the momentum factor. These factors are constructed with the portfolios mentioned in [section 3.4](#).

Table 44 Regressions for equally weighted portfolio of ETFs with no Morningstar low carbon designation

Variables	CAPM	FF3	Carhart	FF5	FF5+mom
Before invasion					
MktRF	0.699*** (0.049)	0.678*** (0.054)	0.682*** (0.057)	0.672*** (0.055)	0.677*** (0.059)
SMB		0.029 (0.091)	0.023 (0.092)	0.030 (0.091)	0.029 (0.092)
HML		-0.024 (0.052)	-0.019 (0.051)	-0.022 (0.083)	-0.022 (0.084)
RMW				-0.029 (0.077)	-0.021 (0.080)
CMA				-0.007 (0.162)	0.005 (0.175)
Mom			-0.032 (0.049)		-0.025 (0.057)
Constant	-0.076 (0.054)	-0.067 (0.057)	-0.069 (0.056)	-0.066 (0.059)	-0.069 (0.058)
Adjusted R-squared	0.817	0.812	0.810	0.807	0.804
F-Stat	286	93.38	69.24	54.55	44.80
Prob > F	0	0	0	0	0
After invasion					
MktRF	0.682*** (0.039)	0.660*** (0.047)	0.657*** (0.048)	0.621*** (0.035)	0.623*** (0.035)
SMB		0.335*** (0.120)	0.286** (0.125)	0.094 (0.094)	0.055 (0.099)
HML		0.047 (0.069)	0.085 (0.074)	0.138* (0.082)	0.154* (0.082)
RMW				-0.382*** (0.064)	-0.363*** (0.064)
CMA				-0.149 (0.118)	-0.059 (0.141)
Mom			-0.079 (0.098)		-0.101 (0.100)
Constant	-0.048 (0.064)	-0.045 (0.056)	-0.043 (0.057)	-0.037 (0.049)	-0.043 (0.048)
Adjusted R-squared	0.856	0.876	0.876	0.910	0.910
F-Stat	404.6	161.3	120.7	138.8	115.8
Prob > F	0	0	0	0	0

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All coefficients provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. MktRF is the excess return on the market, SMB is the small minus big factor, HML is the high minus low factor, WML is the winners minus losers factor, RMW is the robust minus weak factor, CMA is the conservative minus aggressive factor and Mom is the momentum factor. These factors are constructed with the portfolios mentioned in [section 3.4](#).

Table 45 Regressions for equally weighted portfolio of ETFs matched with the ESG ETFs

Variables	CAPM	FF3	Carhart	FF5	FF5+mom
Before invasion					
MktRF	0.633*** (0.036)	0.739*** (0.034)	0.736*** (0.033)	0.748*** (0.032)	0.745*** (0.032)
SMB		0.034 (0.049)	0.038 (0.051)	0.029 (0.041)	0.030 (0.041)
HML		0.204*** (0.030)	0.201*** (0.029)	0.127*** (0.044)	0.127*** (0.045)
RMW				-0.066 (0.054)	-0.070 (0.061)
CMA				0.236** (0.092)	0.230** (0.097)
Mom			0.019 (0.036)		0.013 (0.042)
Constant	0.037 (0.041)	-0.005 (0.035)	-0.004 (0.035)	-0.038 (0.029)	-0.037 (0.029)
Adjusted R-squared	0.841	0.909	0.908	0.919	0.917
F-Stat	339.9	213.8	158.4	145.7	119.6
Prob > F	0	0	0	0	0
After invasion					
MktRF	0.645*** (0.027)	0.759*** (0.035)	0.764*** (0.034)	0.751*** (0.023)	0.749*** (0.022)
SMB		0.173** (0.069)	0.282*** (0.083)	0.082 (0.057)	0.111* (0.065)
HML		0.280*** (0.051)	0.195*** (0.055)	0.211*** (0.071)	0.199*** (0.068)
RMW				-0.234*** (0.049)	-0.248*** (0.052)
CMA				0.203*** (0.076)	0.135 (0.101)
Mom			0.174*** (0.057)		0.076 (0.065)
Constant	-0.030 (0.047)	-0.057 (0.045)	-0.062 (0.045)	-0.082** (0.036)	-0.077** (0.035)
Adjusted R-squared	0.869	0.916	0.923	0.952	0.952
F-Stat	452.7	248.6	204.6	271.4	227
Prob > F	0	0	0	0	0

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All coefficients provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. MktRF is the excess return on the market, SMB is the small minus big factor, HML is the high minus low factor, WML is the winners minus losers factor, RMW is the robust minus weak factor, CMA is the conservative minus aggressive factor and Mom is the momentum factor. These factors are constructed with the portfolios mentioned in [section 3.4](#).

Table 46 Regressions for equally weighted portfolio of ETFs in the ESG ETF sample

Variables	CAPM	FF3	Carhart	FF5	FF5+mom
Before invasion					
MktRF	0.756*** (0.038)	0.734*** (0.042)	0.732*** (0.042)	0.738*** (0.042)	0.737*** (0.044)
SMB		-0.002 (0.068)	-0.000 (0.070)	0.024 (0.070)	0.024 (0.072)
HML		-0.041 (0.038)	-0.043 (0.037)	-0.054 (0.061)	-0.054 (0.061)
RMW				0.023 (0.066)	0.021 (0.070)
CMA				0.027 (0.124)	0.024 (0.133)
Mom			0.012 (0.038)		0.005 (0.045)
Constant	-0.076* (0.042)	-0.067 (0.044)	-0.066 (0.044)	-0.069 (0.046)	-0.069 (0.045)
Adjusted R-squared	0.894	0.893	0.891	0.889	0.888
F-Stat	539.2	178.2	131.6	103.9	85.16
Prob > F	0	0	0	0	0
After invasion					
MktRF	0.745*** (0.030)	0.725*** (0.036)	0.723*** (0.037)	0.696*** (0.028)	0.697*** (0.028)
SMB		0.226** (0.089)	0.187* (0.095)	0.060 (0.080)	0.044 (0.089)
HML		0.021 (0.055)	0.052 (0.058)	0.105 (0.070)	0.111 (0.070)
RMW				-0.261*** (0.052)	-0.254*** (0.053)
CMA				-0.145 (0.102)	-0.109 (0.120)
Mom			-0.062 (0.080)		-0.040 (0.085)
Constant	-0.065 (0.050)	-0.062 (0.045)	-0.060 (0.045)	-0.052 (0.042)	-0.055 (0.041)
Adjusted R-squared	0.921	0.930	0.929	0.943	0.943
F-Stat	794.3	300.1	224.4	227	186.9
Prob > F	0	0	0	0	0

Note: standard errors are in brackets, and concern the Newey-West standard errors. *, **, *** signify p-values of $p < 0.1$, $p < 0.05$, $p < 0.01$ respectively. All coefficients provided above are in percentage. Before invasion pertains to the period 18 November 2021 until 23 February 2022, while after invasion contains the period 24 February until 2 June 2022. MktRF is the excess return on the market, SMB is the small minus big factor, HML is the high minus low factor, WML is the winners minus losers factor, RMW is the robust minus weak factor, CMA is the conservative minus aggressive factor and Mom is the momentum factor. These factors are constructed with the portfolios mentioned in [section 3.4](#).