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Bachelor's Programme in Finance

The performance of Green and Brown stocks: Evidence from the Nordic stock market

The realized returns of Green and Brown stocks, and climate sentiment as their predictor

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Abstract

This thesis examines the performance of Green and Brown stocks in the Nordic stock market. Using the Pastor et al. (2022) methodology, I ranked the stocks based on their greenness utilizing the MSCI environmental data. The time period used in this study dates from October 2013 to November 2023. My results indicate a notable divergence between the US and Nordic stock markets, with an inverse relationship in the cumulative realized returns of Green and Brown portfolios. However, regressing the returns of Nordic Green and Brown portfolios against the Fama & French (1993, 2015) five-factors, revealed the loss of statistically significant alpha of the portfolio returns. Additionally, I investigated the finding of Pastor et al. (2022) about climate concerns as a predictive factor of Green-minus-Brown portfolio returns. I used a comprehensive climate sentiment score dataset derived from opinions expressed on Twitter (Effrosynidis, 2022) as the climate concern factor. The result indicated no relationship between the Green and Brown portfolios, and the climate sentiments.

Keywords Sustainable investing, Asset pricing, ESG, climate change

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1 Introduction

"The financial world cannot operate without a thriving nature." Jennifer Wu, Global Head of Sustainable Investing at JP Morgan, made this announcement in November 2023 at the Finnish Finance Nature Summit. The effects of climate change continue to be more and more discussed in academic communities as it remains a major worldwide concern. With the effects of the global crisis on businesses and markets still evolving, environmental risks and opportunities are more significant than ever for the financial sector.

Although environmental investing has been around for nearly 50 years (Hu, 2022), attention to it has increased dramatically in the last two decades. After the ESG ratings of companies gained popularity, it has been considerably easier to conduct correlation-cause studies involving environmental and sustainable profile of a company. There is a substantial amount of academic literature on the topic, but the conclusions vary widely.

My thesis is based on a recent academic paper titled *Dissecting green returns* by Pastor et al. (2022), which compares the stock returns of green and brown companies. Their analysis provides an extensive insight to the US green and brown stocks' performance. They discovered that historically, green stocks had outperformed brown stocks, which they were able to explain by unexpected climate change concerns in the media.

Building on their research, my objective is to replicate their environmental stock ranking process and examine the past performance of the Nordic stock market's Green and Brown portfolios. I will investigate if the Nordic stock market has a green premium, similar to what Pastor et al. found in the US market. Continuing from that I will analyse the characteristics of the Nordic stock returns along with regressing them against the three- and five-factors of Fama & French (1993, 2015) and climate sentiment factors. The full sample consists of monthly stock returns of stocks with non-missing

environmental score data, covering the period from October 2013 to November 2023.

The rest of the paper is organized as follows. Section 2 gives an overview to the existing literature about environmental finance and green assets. In Section 3, I present the hypothesis, the data and the methods used to study the hypothesis. Section 4 introduces a discussion of the results. Section 5 concludes.

2 Literature review

Environmental finance has existed as a keyword in the scientific literature for half a century already (Hu et al, 2022). But the topic stayed under the radar until 2004, the year that the UN whitepaper "Who Cares Wins" introduced the term ESG, or environmental, social, and governance. The number of yearly publications about environmental finance began to rise rapidly shortly after the release of ESG, more precisely in 2007 (Hu et al, 2022). The global climate crisis is undoubtedly having an impact on the rise in interest in environmental finance along with its risks and opportunities for companies. The environmental profile and actions have been found to impact market valuation (In et al, 2017, Nagy et al, 2015, Pastor et al, 2022) and company performance (Harvey et al, 2018), which directly incentivizes investors to learn more about the topic and piques the interest of the finance community.

Numerous studies have examined the connection between environmental profile and company performance, with differing conclusions. As an illustration, In et al. (2017) discovered a substantial impact of company carbon efficiency on the returns of stocks. According to their findings, a portfolio made up of carbon-efficient stocks performed better than one made up of carbon-inefficient stocks. A supporting conclusion was made by Nagy et al. (2015) in a study where they created Tilt-and Momentum strategy test portfolios that were proportional to the ESG scores. Both portfolios enhanced their ESG profile and outperformed the MSCI World Index. A more recent study by Pastor et al. (2022) found similar historical performance of green stocks.

Although many studies have found outperforming green stocks, the current literature includes examples of differing conclusions. For example, the study by Larcker & Watts (2020) stated that the US “investors are entirely unwilling to sacrifice returns to invest in green securities.” Also, the study by Bolton & Kacperczyk (2021) builds on this with their finding that the amount of carbon emissions and the company returns have a positive relationship.

Bolton & Kacperczyk further continue from this in their most recent study (2023) with an impressive sample of 14,400 companies in 77 countries. Their result further confirms the carbon premium from their earlier study, stating that the association between high stock returns and high carbon emissions is found in all sectors and most countries.

With confidence it can be stated that the academic literature is torn. Some studies support the existence of carbon premium while others have found the green premium. Academically, the carbon premium can be explained by asset pricing theory and behavioural finance. For example, Sudheer Chava concluded in his paper *Environmental Externalities and Cost of Capital* that companies with environmental concerns (heavy-polluting, toxic-waste exc.) experience significantly higher cost of equity and debt capital imposed by investors and lenders. Also, in the already mentioned study by Bolton and Kacperczyk (2021) it was argued that "investors are already demanding compensation for their exposure to carbon emission risk". These studies are excellent at explaining the carbon premium but what about the green premium?

The driving force of the green premium seems to be more complex compared to the Carbon premium. It is argued that the greenium could result from something else than objective financial evaluation of the asset. For example, both Seltzer et al. (2022) and Huynh et al (2020) found that green bond pricing is connected to the climate concerns of investors. This investors' tastes' effect on asset prices has been acknowledged for many years. For example, by Fama & French (2007) through their framework on how disagreement and tastes for assets could affect asset prices. Further supported by Hong et al. (2009) finding that companies producing socially frowned upon products like alcohol and tobacco, have higher expected returns as an effect of possible systematic neglection of the stock.

Pastor et al. were among the first to implement the theory of climate concerns' connection to pricing of stocks. As done with the bonds, Pastor et al predicted the stock returns with the climate concerns in the media. This result was an important step forward in studying environmental investing. However, the MCCC (Media Climate Change Concerns) Index (Ardia et al. 2020), that was used by Pastor et al. to predict the Green minus Brown portfolio, only accounts for the US. The fact that their study only concentrates on the US stock market leaves an open research gap for the rest of the world.

3 Research material and methods

3.1 Main hypotheses

The main objective of this thesis is to examine whether there exists a green premium in the Nordic stock market. The studies about the expected returns and cost of capital for brown firms suggests that Brown companies should have higher returns (Chava 2011, El Ghoul et al 2011). The existence of green premium would thus indicate that the investors are willing to pay a premium for investing in green stocks. The presence of other than objectively financial preferences on stocks has been acknowledged by the academic literature (e.g. Fama & French 2007, Hong et al. 2009).

Recent academic literature suggests that when looking at the returns of stocks (Pastor et al 2022, Ardia et al 2022) and bonds (Seltzer et al. 2022, Huynh et al 2020), the green premium can be predicted by measurable climate concern. Motivated by these results, I study the relationship of the Green and Brown stock returns compared to the climate sentiments in the Nordics.

3.2 Description of data

I used MSCI ESG Ratings data as my source in order to construct the environmental scores of the stocks for my sample. A multitude of providers offer their ESG Ratings data currently but there exists a fair-share of evidence that MSCI is the most suitable provider for this use. According to Berg et al. (2019), the MSCI sample of companies is larger than the samples from Sustainalytics, S&P Global, Moody's ESG, KLD, and Refinitiv, among other ESG raters. Furthermore, MSCI is deemed to be "the world's biggest ESG rating agency" by Eccles & Stroehle (2018). ESG ratings of MSCI are also the least noisy among other ESG rating agencies, according to Berg et al. (2021).

For stock data, I used Datastream, which has a comprehensive sample of non-US market data. Oftentimes CRSP is the preferred source for US market data, but I downloaded the US market data from Datastream in order to avoid any methodology differences between data providers. Consequently, making the Nordic and US data more comparable. More precisely, I downloaded a time series of variables RI and MV, which represent the Return Index of the stock and Market Capitalization of the firm. The full Nordic sample includes all public company stocks from Finnish, Swedish, Norwegian and Danish stock exchanges. Likewise, the full US sample consists of NASDAQ, NYSE and NYSE American (Formerly known as AMEX).

The MCCC (Media Climate Change Concern) Index used in the study of Pastor et al (2022) and Ardia et al (2022) only accounts for the US. My research of a dataset about climate concerns of the Nordics resulted in the dataset created by Dimitrios Effrosynidis (2022). Effrosynidis describes his data as "The most comprehensive dataset to date regarding climate change and human opinions via Twitter". It has a time-period spanning 13 years and over 15 million geotagged tweets about climate change. The information that I use from this dataset includes the date, the geolocation (in coordinates) and the climate sentiment of the tweets. The climate sentiment is measured as a simple score on a continuous scale between -1 to 1. Respectively this scale represents a sentiment towards climate change scaling from negative to positive.

3.3 Methodology

The environmental score data of MSCI is not perfectly consistent on a monthly level. This is not unusual or alarming since environmental ratings of a company are not done on a monthly basis. However, for structuring the Green and Brown portfolios, I require consistent monthly environmental score data. As it is a common practice for companies to report their environmental numbers once a year, I performed a procedure which looked back up to 12 months in the data for environmental scores on each instrument. The

end result of this procedure provided me with the consistent environmental score data of companies on a monthly level.

The Datastream stock sample was consistent on a monthly level to begin with. Now having both consistent samples, I merged the Datastream and MSCI data by using the ISIN codes of the stocks as the connecting factor. Furthermore, I filtered out all the instruments that had missing environmental scores or stock returns. The resulting sample of stocks from Nordics and US are represented below:

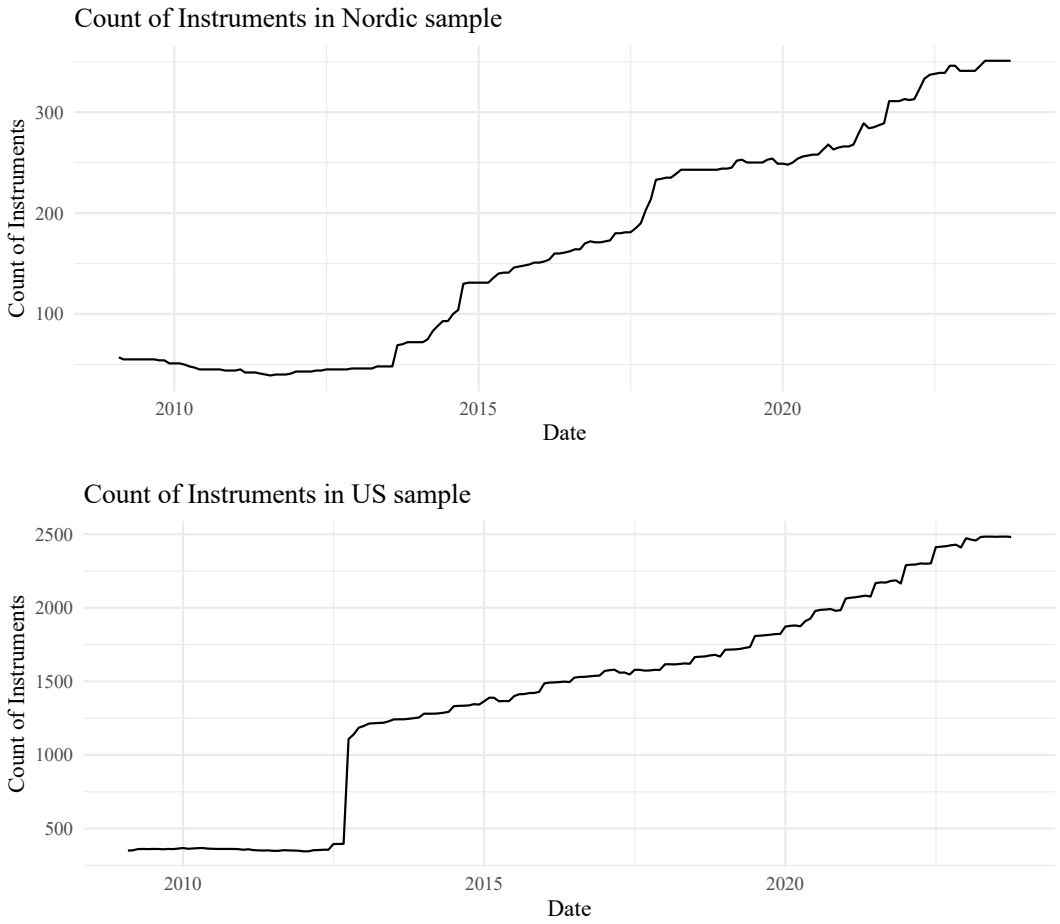

Figure 1: The graphs above represent the count of instruments in the sample of the Nordic and US markets.

From the figure 1 it can be seen that on October 2012 there is a sharp increase in the count of instruments of the US sample. On October 2012, MSCI

began covering small US stocks. The count of Nordic instruments starts to increase incrementally starting a year later from October 2013. Consequently, for further calculations I will filter out the dates before October 2013. The MSCI data ends in October 2023 but by looking back in the data I was able to extend it to November 2023.

The environmental score I used was constructed according to the academic paper *Dissecting green returns* by Pastor et al. (2022). It includes using the "Environmental pillar score" (E_score) and "Environmental pillar weight" (E_weight) from the MSCI sample. E_score measures the greenness of a company on a scale of 0 to 10. This score can be analysed as a higher score meaning a greener company. E_weight represents the greenness of the firm's industry on a scale of 0 to 100. E_weight represents the amount of environmental impact that the industry has. More precisely a higher score on E_weight means a larger environmental impact the industry has. Acknowledging this, Pastor et al. constructed the environmental score as demonstrated in equation 1:

$$G_{i,t-1} = -(10 - E\_score_{i,t-1}) \times \frac{E\_weight_{i,t-1}}{100} \quad (1)$$

This score calculates the greenness of a company on a scale of 0 or lower. The more the score is negative the browner a company is. A score of 0 is the best environmental score attainable. For a more informative comparison, I calculated the average G-score for each date of the whole sample. Again, following the methodology of Pastor et al. I subtracted the average G-score from each individual G-score in equation 2.

$$g_{i,t} = G_{i,t} - \overline{G}_t \quad (2)$$

The adjusted g-score now accounts for the market average and therefore gives us the environmental score relative to the market average. This method proves useful for the comparison of the industries which is represented in table 3 below. From the table it can be seen that the greenest industries are less green than the brownest industries are brown compared to the market.

Also, the number of green industries is a little less than half of the industries in the sample. This is in line with the findings of Pastor et al (2022) implying that on average the green industries tend to have higher market capitalization than brown industries.

Table 1: Industries ranked by environmental scores in the Nordics
The table represents the environmental scores of the industries ranked from highest to lowest. The environmental scores are from First of January 2023 in the Nordic sample. The industries are from the MSCI ESG dataset. The Avg. g is the market average adjusted environmental score of a company.

Rank	MSCI Industry	Avg. g	Rank	MSCI Industry	Avg. g
1	Air Freight & Logistics	0.96	33	Automobiles	-0.13
2	Telecommunication Services	0.95	34	Semiconductors & Equipment	-0.17
3	Consumer Finance	0.91	35	Textiles, Apparel & Luxury Goods	-0.17
4	Health Care Technology	0.91	36	Electronic Equipment & Components	-0.21
5	Professional Services	0.87	37	Hotels & Travel	-0.23
6	Diversified Consumer Services	0.87	38	Utilities	-0.23
7	Health Care Equipment & Supplies	0.86	39	Farm Machinery & Heavy Trucks	-0.24
8	Media & Entertainment	0.86	40	Trading Companies & Distributors	-0.29
9	Health Care Providers & Services	0.85	41	Technology Hardware & Peripherals	-0.30
10	Interactive Media & Services	0.84	42	Marine Transport	-0.31
11	Life & Health Insurance	0.79	43	Integrated Oil & Gas	-0.31
12	Asset Management & Custody Banks	0.78	44	Real Estate Management & Services	-0.32
13	Diversified Financials	0.76	45	Auto Components	-0.36
14	Investment Banking & Brokerage	0.68	46	Tobacco	-0.36
15	Casinos & Gaming	0.59	47	Road & Rail Transport	-0.58
16	Biotechnology	0.51	48	Industrial Conglomerates	-0.59
17	Multi-Line Insurance & Brokerage	0.50	49	Electrical Equipment	-0.62
18	Banks	0.49	50	Real Estate Development	-0.63
19	Pharmaceuticals	0.45	51	Building Products	-0.68
20	Commercial Services & Supplies	0.42	52	Industrial Machinery	-0.78
21	Leisure Products	0.39	53	Beverages	-0.92
22	Retail - Food & Staples	0.32	54	Household & Personal Products	-1.05
23	Software & Services	0.25	55	Oil & Gas Exploration & Production	-1.19
24	Airlines	0.24	56	Oil & Gas Refining & Transportation	-1.20
25	Construction Materials	0.22	57	Food Products	-1.27
26	Supranationals & Development Banks	0.03	58	Containers & Packaging	-1.33
27	Household Durables	0.01	59	Metals and Mining - Non-Precious	-1.34
28	Aerospace & Defense	0.00	60	Paper & Forest Products	-1.37
29	Construction & Engineering	-0.07	61	Specialty Chemicals	-1.64
30	Retail - Consumer Discretionary	-0.08	62	Steel	-1.65
31	Property & Casualty Insurance	-0.09	63	Diversified Chemicals	-1.69
32	Energy Equipment & Services	-0.10	64	Commodity Chemicals	-2.74

Now having this environmental score for each instrument, I categorized each instrument in the sample as Green, Brown or Neutral. This I simply do by categorizing top third of instruments as Green according to the constructed g-score. Similarly, the bottom third is categorized as Brown and the rest as Neutral. After the categorization, I formed the portfolios. I weighed the stocks according to their Market Capitalization. This was done so that the weights of the stocks in both portfolios sum up to 1.

For further inspections of statistical significance, I performed a linear regression analysis for the Green and Brown portfolios' risk-adjusted returns. The first factors of the regression were the three- and five-factors of Fama & French (1993, 2015). For the Nordic sample, I downloaded the factor data from the Ken French Data Library website. I used the European factors since there was no specific Nordic factors. However, I constructed specifically Nordic Market Risk premium factor by creating a value-weighted portfolio of the Nordic Index returns. From the returns of this Nordic Index portfolio, I subtracted the European risk-free rate that was given in the data imported from the Ken French Data Library website.

In addition to the Fama & French factors, I add the climate sentiment and it's lagged value to the regression from Effrosynidis' dataset. The use of lagged climate sentiment is motivated by the finding of Pastor et al (2022), that the effect of unexpected climate concerns on stock returns is in some cases lagged by a month. To format the dataset, I first delimit the geolocation to a rectangular area based on the border latitudes and longitudes of the Nordic countries' region in my dataset. Furthermore, I transform the dates from being daily to being monthly by calculating the average of each month of the data.

4 Results

4.1 Comparison between Nordics and US

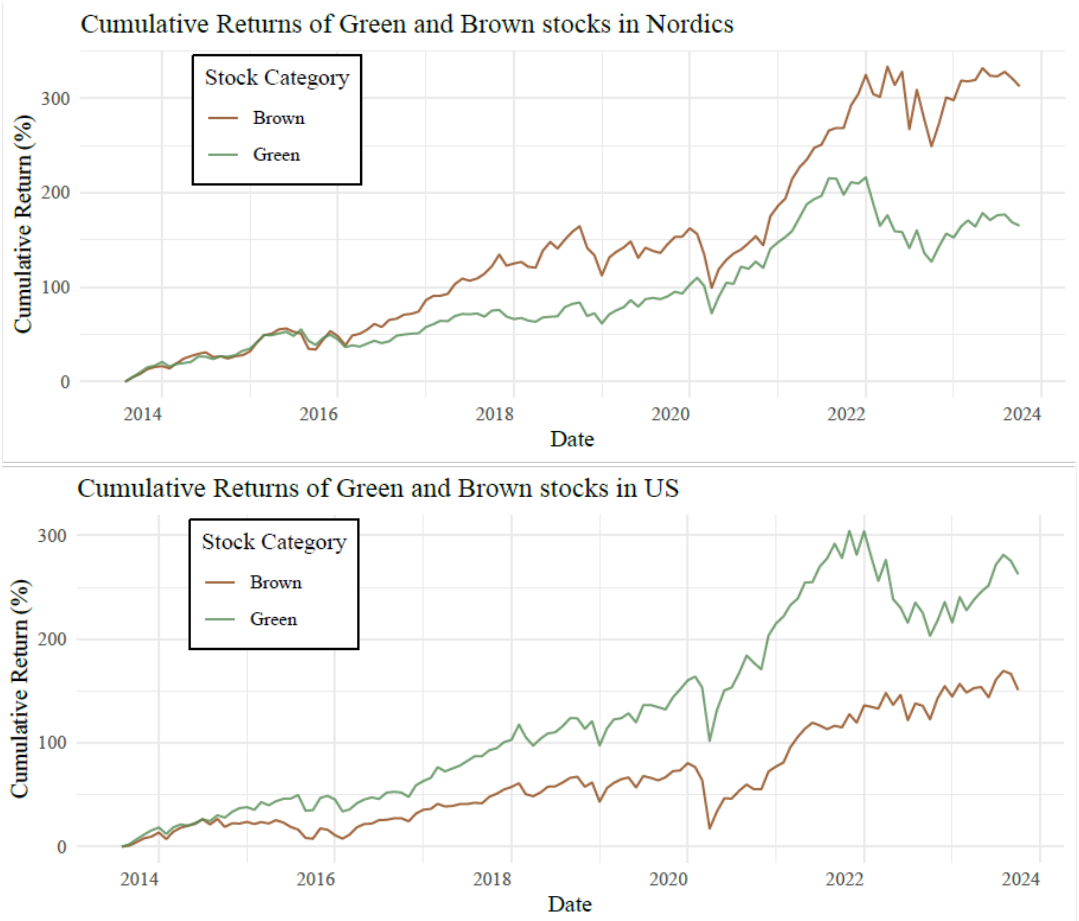

Figure 2: The graphs represent the cumulative returns of value-weighted green and brown portfolios in the Nordic and the US stock market. The graph dates from October 2013 to November 2023. The end value difference, Green – Brown, in the US is 262.5 – 151.1 = 111.4 percentage points over this period. The end value difference in the Nordics is 165.1 – 312.9 = -147.8 percentage points.

The cumulative returns in figure 2 portfolios represent a surprising difference between the two geographical areas. Aligning with the study by Pastor et al (2022), the Green portfolio outperformed the Brown portfolio in the US. Contrary to this result, the Green portfolio underperformed compared to the Brown portfolio in the Nordics. This result is in line with the higher expected

returns for Brown stocks that multiple studies have found but is indicating that the green returns possibly do not contain pricing premium.

When the US industry ranking in Pastor et al. (2022) study and the industry ranking of the Nordics in table 2 are compared, I observed that the US market is in general and on average browner. This could present itself as more systematic neglection of the brownest stocks in the US than what happens in the Nordic. This aligns with the findings of Hong et al. (2009) about socially frowned upon stocks.

Furthermore, the Nordics have taken a stronger stance on green initiatives and combatting climate change than the US, while the US have been inconsistently committed to the climate pacts. If this is also reflected in the investment culture in the stock markets, it might be the case that the Nordic green portfolio is significantly more competitive than that of the US. This would reduce the impact of the green profile of a company leading to smaller effects of greenness to the stock returns.

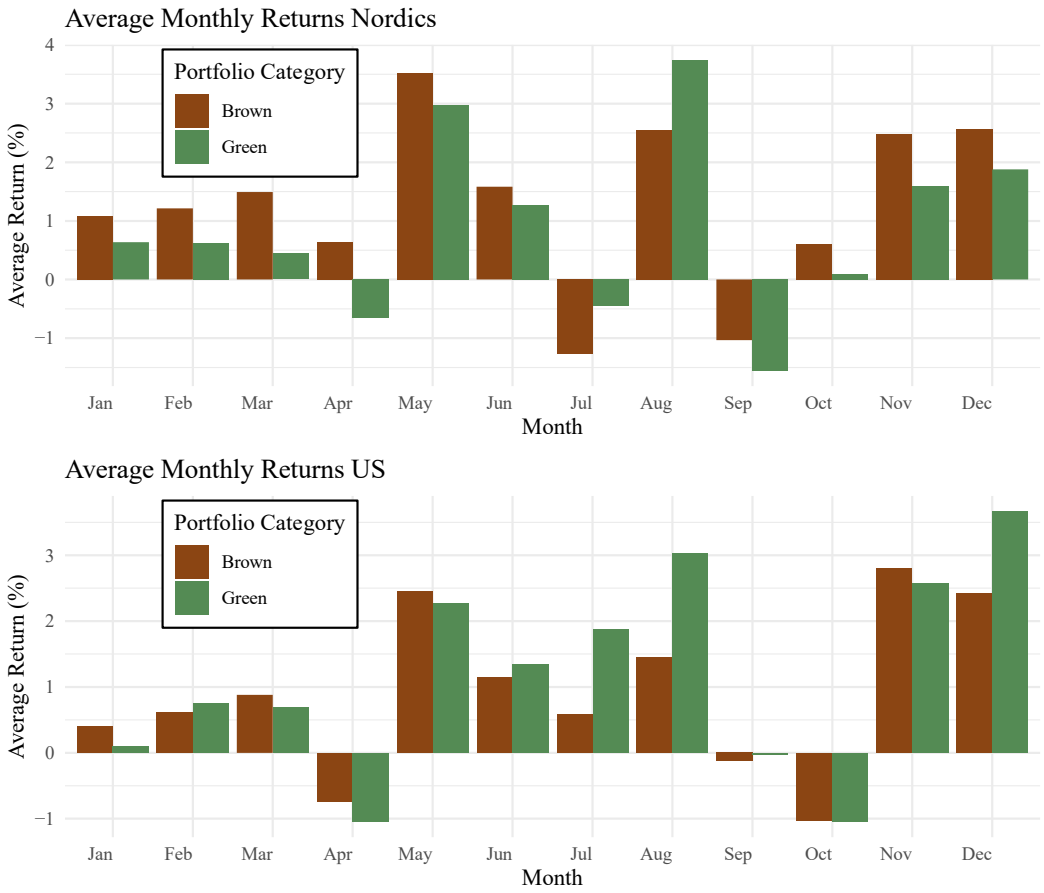

Figure 3: The pillar diagram above represents the average monthly returns of green and brown portfolios in the Nordic and US stock market. The Average Return is as percentages.

The average monthly returns of the portfolios in the 2 geographical areas in figure 3 show some interesting characteristics. Both portfolios in both areas seem to experience modest returns during the months from January to April as well as September and October. The best performing months for both portfolios on both regions seem to be May, August, November and December. This result is not in line with the Sell in May and Go Away effect found by Bouman & Jacobsen (2002) nor does it accord with the January effect found by Wachtel (1942) and Rozeff & Kinney (1976).

4.2 Discussion of Nordic results

Looking at the portfolio performance metrics in table 2, it can be seen that the Brown portfolio beat the market portfolio in the average returns and Sharpe Ratio. Meanwhile the Green portfolio performed in an opposite manner while having a lower standard deviation than the market.

Table 2: Portfolio Performance Metrics
This table presents the performance metrics of the Nordic Green, Brown and Market portfolios using data from October 2013 to November 2023.

Portfolio	Average Monthly Return	Standard Deviation	Sharpe Ratio
Green	0.822	3.17	0.259
Brown	1.28	4.10	0.312
Market	1.02	3.62	0.283

Table 3 below represents the linear regression analysis of the Green portfolio returns. Interestingly, the Green portfolio displays varying levels of statistical significance when adjusted for the three- and five-factors of Fama & French (1993, 2015). The model (1) already indicates the failure to reject the null hypothesis that the returns of the Green portfolio are explained by chance alone. However, when the three-factors are presented in model (2), the statistical significance is regained by the Green portfolio, indicating a negative alpha. Also, I notice a very strong relationship between the market risk premium and the Green returns with a T-value of 18.67.

In models (3) and (4), the climate sentiment score and its lagged value by one month are presented to the regression. They remain statistically insignificant while the Green returns retain their statistical significance. Hence, I concluded that the climate sentiment factors have no predictive effect on the Green returns. Lastly, in model (5), I observed the disappearance of the statistically significant alpha of the Green returns. The five-factors of Fama & French are capable of explaining the returns of the Green portfolio.

Table 3: Regression Results of Nordic Green portfolio

In the table I estimate monthly time-series regressions using data from October 2013 to November 2023. The dependent variable is the returns of the Nordic green portfolio. Mkt_RF is the market risk premium calculated from the Nordic Index returns. SMB and HML are the size and value factors of Fama and French (1993). RMW and CMA are the profitability and investment factors of Fama and French (2015). Sentiment is the climate sentiment score from the Effrosynidis Twitter data and Lagged Sentiment is its lagged score by one month. The returns are in percent per month and robust t-values are in parentheses.

Model	(1)	(2)	(3)	(4)	(5)
(Intercept)	0.54	-0.44*	-0.45*	-0.44*	-0.34
	(1.23)	(-1.98)	(-2.04)	(-1.97)	(-1.47)
Mkt_RF		0.88***	0.87***	0.88***	0.86***
		(18.67)	(18.20)	(18.61)	(18.00)
SMB		0.24	0.23	0.24	0.23
		(1.80)	(1.64)	(1.79)	(1.64)
HML		-0.14	-0.14	-0.14	-0.44*
		(-1.26)	(-1.27)	(-1.24)	(-2.15)
RMW					-0.39
					(-1.51)
CMA					0.20
					(0.93)
Sentiment				0.49	
				(0.22)	
Lagged Sentiment			1.55		
			(0.65)		
Observations	70	70	69	70	70

Note: The significance levels are marked as follows: * t 1.96, ** t 2.33, *** t 3.29.

Table 4 below represents an identical regression analysis for the Brown portfolio. Contrary to the Green returns, the Brown returns in model (1) are statistically significant, although it disappears in the next model remaining insignificant also in models (3) to (5). The sentiment factors do not have statistical significance in this regression either. This indicates that the sentiment score in the same period or lagged one month, does not influence Green or Brown portfolio returns.

Table 4: Regression Results of Nordic Brown portfolio
In the table I estimate monthly time-series regressions using data from October 2013 to November 2023. The dependent variable is the returns of the Nordic brown portfolio. Mkt_RF is the market risk premium calculated from the Nordic Index returns. SMB and HML are the size and value factors of Fama and French (1993). RMW and CMA are the profitability and investment factors of Fama and French (2015). Sentiment is the climate sentiment score from the Effrosynidis Twitter data and Lagged Sentiment is its lagged score by one month. The returns are in percent per month and robust t-values are in parentheses.

Model	(1)	(2)	(3)	(4)	(5)
(Intercept)	0.90*	-0.10	-0.11	-0.10	-0.14
	(1.96)	(-0.50)	(-0.54)	(-0.54)	(-0.64)
Mkt_RF		0.94***	0.94***	0.95***	0.95***
		(18.86)	(18.06)	(18.06)	(18.71)
SMB		0.18	0.17	0.18	0.18
		(0.97)	(0.92)	(0.92)	(0.96)
HML		0.04	0.05	0.05	0.15
		(0.43)	(0.46)	(0.46)	(0.77)
RMW					0.14
					(0.61)
CMA					-0.06
					(-0.27)
Sentiment				1.19	
				(0.48)	
Lagged Sentiment			1.19		
			(0.48)		
Observations	70	70	69	70	70

Note: The significance levels are marked as follows: * $t > 1.96$, ** $t > 2.33$, *** $t > 3.29$.

4.3 Propositions for further studies

It is important to note that the climate sentiment I used in this study is fundamentally different from the MCCC index Pastor et al (2022) used in their study. This twitter data consists of interpreted personal sentiments towards climate change while the MCCC represents the media coverage of climate change. For future research, a comparison study of personal beliefs and media coverage of climate sentiments could be an interesting focal point for finance literature.

Critical assessment is also applied to the environmental ratings. Even though they have greatly improved, determining how "green" a company is, remains rather difficult. Furthermore, environmental rating companies' scoring methodologies are subject to change over time. For instance, MSCI updated its methodology for ESG calculation in 2017 during this study's time period. (Berg et al., 2021).

Another area for improvement in this thesis is the eventual sample size of the Nordic stock data. The count of instruments in the beginning of the final sample in October 2013, started from 69 stocks with only 23 stocks in the Green and Brown portfolios respectively. This count of instruments increased to a 100 in 12 months but still compared to the US sample, it is very little. The US sample starts from 1243 stocks in October 2013.

The Nordic sample allowed for singular stocks to have significantly large weights in the green and brown portfolios. In the sample of Green and Brown stocks between October 2013 to November 2023, there was 274 stocks that acquired a weight higher than 10 % out of 18148 observations. The highest weight acquired in the sample was 27.9 % in Green portfolio by Hennes & Mauritz B. Thus, the future research should aim for a larger sample size in order to minimize the effect of singular stocks.

To robustness check the findings, I constructed equal-weighted portfolios for green and brown. Their cumulative returns are represented in the figure 4. The return relationship between the green and the brown portfolios remain the same even with equal weights as illustrated.

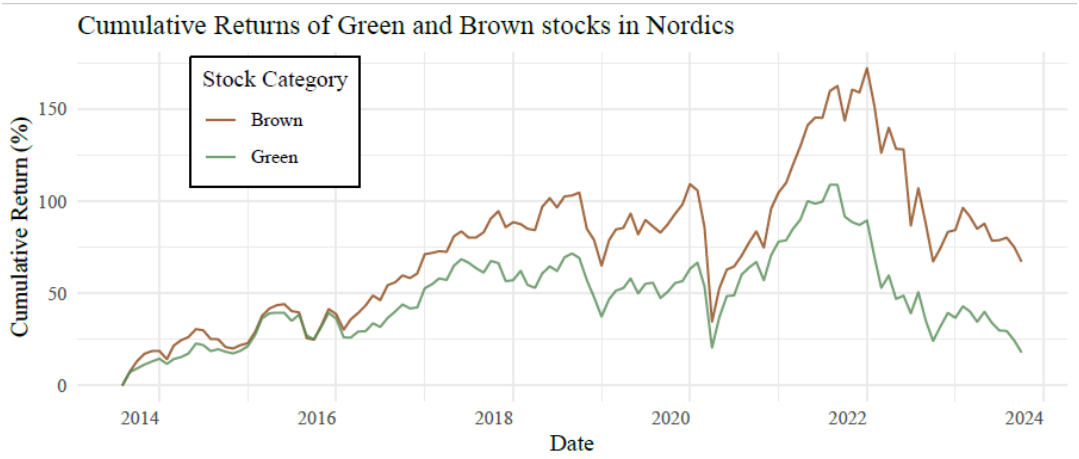

Figure 4: The graph represents the cumulative returns of equal-weighted green and brown portfolios in the Nordic stock market. The graph dates from October 2013 to November 2023. The end value difference, Green – Brown, is 17.9 – 67.3 = -49.4 percentage points over this period.

5 Conclusion

My main objective was to examine the performance of Green and Brown stocks in the Nordic stock market. The study by Pastor et al. (2022) that discovered a significant outperformance of green stocks over brown stocks served as the catalyst for this. A large portion of the methods I employed to rank the stocks using the MSCI environmental data was based on the techniques employed in the Pastor et al. (2022) study. My analysis of the Nordic stock data, spanning over 10 years, revealed an interesting difference between the US and Nordic stock markets. When compared to the performance of comparable portfolios in the Nordic region, the cumulative realized returns of the Green and Brown portfolios in the US showed an inverse relationship with each other. This result challenges the concept of universal green premium and shines a light on geographical variability in environmental investing.

The linear regression of the portfolio returns revealed that contrary to the findings from the US market by Pastor et al (2022), the Nordic portfolio performances lost their statistical significance when regressed against market risk factors. Moreover, neither the brown nor the green portfolios showed statistical significance from the regressions against the same period or the lagged climate sentiment score. This finding shows that human opinions about climate change expressed on social media did not predict the returns of green and brown stocks in the Nordics. Therefore, the existence of a predictive factor for the returns on the Green and Brown portfolio in the Nordic region is still up for debate.

This study along with its result acts as a modest peek at the subject of environmental investing in the Nordic countries. To gain a more comprehensive understanding of the impact of environmental factors on stock returns, future studies should try to increase the sample size of the Nordic stock data. This would reduce the effect of outliers and provide a more robust result. The

creation of the Nordic and European MCCC Index would also be a noteworthy advancement in this area. The European MCCC may provide insightful information that the sentiments on Twitter were unable to clarify.

The results of this thesis contribute to the current conversation concerning the financial implications of a company's environmental profile. Despite the lack of statistically significant factors in my study to explain the green phenomenon, the realized returns of the portfolios emphasize the importance of conducting comparative studies across different regions.

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