Do Investors Care About ESG Ratings?

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Abstract

ESG ratings and sustainability are becoming a more important topics by the day. However, do investors care about ESG ratings and thus sustainability? Following the methodology of Bolton and Kacperczyk (2021), we investigate the relationship between ESG scores and returns for US public-listed firms from 2006 to 2022. We find that there is a positive relationship between ESG ratings and returns. This effect is larger after the Paris Agreement compared to before and does not depend on the state of the economy. We construct self-financing portfolios using ESG scores and Carbon Emissions. Traditional Risk factors are not able to explain the returns of these portfolios. The findings regarding the alphas of the ESG portfolios are inconclusive.

Keywords: ESG, Sustainability, Green Firms, Brown Firms

*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.

Contents

1 Introduction

Sustainability is becoming a more popular topic by the day. Not only in politics but also throughout society. One of the measures for sustainability regarding firms is the ESG rating. This stands for Environment (e.g. emissions and energy efficiency), Social (e.g. human rights and diversity), and Governance (e.g. transparency and anti-corruption strategies). In 2006 the United Nations launched an initiative called the Principles for Responsible Investing[1] (PRI) where the goal is to promote the incorporation of ESG ratings into investment decisions to create a sustainable global financial system. If the PRI wants to create a sustainable global financial system, agents who are acting on financial markets need to care about sustainability. Bolton and Kacperczyk (2021) research if investors are concerned about carbon emissions from firms. They find that stocks, whose underlying firm emits more carbon, generate on average a higher return (controlling for other characteristics and risk factors). So, investors want to be compensated for their exposure to carbon risk (impact of climate change and transition risk to low-carbon emissions). This suggests to us that investors care about the risk and do not punish these firms for high carbon emissions.

Carbon emissions are only a part of the impact on the environment for firms because e.g., water waste and energy efficiency are also important. A firm's sustainability is composed of its impact on the environment, how the firm treats its workers, and if its board of directors is trustworthy. The ESG rating is a variable that incorporates these factors into one measurable variable. Pastor, Taylor, and Stambaugh (2021) construct a theoretical equilibrium framework from which they conclude that Green assets (assets with a high ESG rating) have lower expected returns compared to Brown assets. They explain this via the idea that these firms are a hedge against climate change risk and thus investors are tolerant to hold the assets of these firms in their portfolios. Even when these assets do not generate a lucrative return. They use a theoretical approach in their research to look at expected returns, but expected returns can differ from realized returns. We have seen with Bolton and Kacperczyk (2021) that investors care about carbon risk. Carbon risk is a part of the Environment pillar of the ESG rating. Theoretically, there is a relationship between ESG and (expected) returns. Does this relationship exist in reality?

"Do Investors care about ESG ratings?"

Researching this question gives information for several agents acting in the financial world. Companies often need investors to keep their operations going. Furthermore, investors are the owners of publicly traded firms. So, if investors care about ESG ratings then companies cannot circumvent these ratings without any effect on their value. If

[1] $https://www.unpri.org/about-us/about-the-pri$

there is a positive relationship between ESG ratings and returns, firms will have an incentive to improve their sustainability. This will result in firms improving their impact on the environment, working conditions, transparency, and integrity. If there is a negative relationship, then firms will have an incentive to hurt their ESG rating because it will result in a higher return. This will result in the opposite of what we mentioned about what firms will improve if they increase their ESG rating. Governments need to intervene to prevent firms from becoming more unsustainable, if there is a negative relationship. Investors (whether they are just individuals or a mutual fund manager) could also find the answer to this research question useful, because if there is a difference in returns regarding high and low ESG rating firms that could suggest there is an ESG risk factor. Over the years the research regarding ESG and sustainability has been increasing. Hartzmark and Sussman (2019) did research on the US mutual fund market by looking at fund flows. They find causal evidence that sustainability is valued by investors on a market-wide basis. Gillan, Koch, and Starks (2021) look at ESG and CSR[2] ratings and their relationship to a firm's market, ownership, leadership, risk, value, and performance. They look at past research on ESG/CSR ratings and they find a strong relationship between a firm's ESG/CSR rating and the previously stated firm-specific characteristics. Even though they find a strong positive relationship among most papers, there are still some papers that find a negative or non-significant relationship between ESG ratings and those firm-specific characteristics. So, Gillan, Koch, and Starks (2021) are encouraging more research on this topic.

Sustainability is the capacity to uphold the current situation (e.g. a process) for the long term without compromising future needs. Sustainability can influence the valuation of a firm in multiple ways. The valuation of a firm is often determined by certain valuation models. Most of these models determine the value by researching the total outputs of the company during its expected lifespan. By using the value of time and the likelihood of certain outcomes, they determine the value of the total output today. If a firm is not sustainable then it cannot keep its current operations going for the long term without any compromises in the future e.g. lower production, more costs. If a firm is more sustainable the probability for compromises in the future is relatively lower. Resulting in a higher valuation and vice versa for a low sustainable firm. If the sustainability drops then we would expect the valuation to drop as well, resulting in a lower return and vice versa for a rise in sustainability. The compromises could even become so significant that it is not viable for the firm to continue its operations, resulting in bankruptcy or default. A lower life expectancy results in a lower valuation. So, sustainability affects valuation (and thus returns) negatively via a firm's (expected) future gains and life expectancy. This negative effect of sustainability on the valuation could also have a reversed effect. Those

[2]CSR (Corporate Social Responsibility) is like ESG a rating determined by third parties regarding a firm's social responsibility related to the environment and society

unsustainable assets are riskier than sustainable assets, for which investors want to be compensated if they hold them. This would mean that unsustainable firms generate a higher return compared to sustainable firms. The valuation indicates the price of a stock but in reality, it is determent by supply and demand. Demand is determent by investors, therefore it is important for the price of the stock if investors value sustainability. They could do this because investors do not only care about risk-adjusted returns but other factors could also generate utility for them. Investors could accept a lower expected return when they know that the firm does zero or little harm to the environment, cares about its employees, and is transparent. If investor preferences go towards sustainable assets, demand for those assets would increase. Resulting in positive returns as long as the demand is increasing for those assets. We have seen ways in which sustainability affects returns, positively and negatively. The relationship between sustainability and returns will depend on which factor is dominant in our sample period.

As a proxy for sustainability, we use ESG ratings. Third parties determine these ESG ratings, which means that there is no self-assessment bias[3] for this variable. The ESG ratings are retrieved from the Eikon Database, which means that we are using Refinitiv ESG ratings. The data sample begins in 2006 because the PRI was launched in that year. This way we only have data in years where ESG factors are promoted in investment decisions. The end of the sample is 2022, that way we incorporate important milestones regarding sustainability like the Paris Agreement[4] from 2015.

To evaluate whether investors care about ESG ratings, we follow the methodology of Bolton and Kacperczyk (2021). However, they are primarily looking at Carbon emissions and we will use ESG ratings instead. The level of ESG ratings is not the only variable that we are using in our models. We are also using the change in ESG ratings and the 3 different Pillars scores. First, we are investigating if ESG ratings, the change in ESG ratings and the Pillar scores can be explained by certain control variables. Following these models, we will know if there is an association between the ESG ratings and different firm characteristics. Furthermore, we look into the relationship between the different ESG variables and returns. In these models, we use control variables that should have a significant effect on returns (e.g. log of size, roe, momentum, and idiosyncratic volatility). Following these results, we will construct self-financing portfolios according to a firm's ESG rating and its level of Carbon emissions. The returns of these portfolios are evaluated using traditional risk factor models (e.g. the 3-factor model by Fama and French (1993)). Another explanation concerning the potential pricing of sustainability risk is the divestment hypothesis[5]. To see if the effect changed over time, we incorporate the standard model with an interaction effect regarding the Paris Agreement in 2015. To test

[3]Bias where agents (in this case firms) tend to rate themselves better compared to reality

[4]The Paris Agreement is a treaty regarding climate change, which is adopted by 195 parties

[5]Hypothesis that suggests investors can influence corporate behavior by switching their investments to more sustainable firms

our findings, we incorporate some robustness checks relating to separating the Financial crisis and Corona crisis from the standard model (higher volatile periods) and using excess returns instead of normal returns.

We observe in this paper that there is an association between a firm's characteristics and its ESG rating. Not only is there a relationship between certain firm characteristics and ESG ratings, but there is a relationship between ESG ratings and returns. We find this relationship to be positive, resulting in specific perspectives regarding investors and their attitudes toward sustainability. These findings are robust to the checks executed in this research. The risk factors are not able to explain the returns of the self-financing portfolios constructed in this paper. However, the results regarding the alphas of the self-financing portfolios remain inconclusive. The remainder of the paper is organized in the following way: Section 2 is the Literature Section where we discuss relevant theories and previous findings on investors and sustainability, Section 3 is the Data section where we explain our data sample, Section 4 gives us the Methodology used in this paper along with the specific models and techniques that we use, Section 5 presents the Results that follow from our models, and Section 6 is the Discussion and Conclusion where the main findings of this paper are given.

2 Literature Review

Bolton and Kacperczyk (2021) find that investors want to be compensated for their exposure to Carbon risk. They call the difference in returns between firms with high Carbon emissions and low Carbon emissions the Pollution premium. This premium is also found by Hsu, Li, and Tsou (2023), even after controlling for traditional risk factors. The premium cannot be explained by variables e.g. market sentiment and investor preferences. Pastor, Taylor, and Stambaugh (2021) did research specifically on ESG ratings. They find that Green assets have lower expected returns compared to Brown assets. It was found by Hartzmark and Sussman (2019) that investors value sustainability on a market-wide basis. Gillan, Kock, and Starks (2021) find a strong relationship between ESG/CSR ratings and firms' specific characteristics e.g. risk, value, and performance.

In this paper, ESG scores are used as a proxy for sustainability. Clement, Robinot, and Trespeuch (2023) researched 342 academic papers, from which they conclude (with caution) that ESG scores can act as a proxy for sustainability. However, ESG scores and sustainability are not to be used interchangeably. So, we must be careful when using these terms concerning one another. That is why we use ESG ratings in the research question and not sustainability. Nevertheless, from the results, we can carefully link those implications to sustainability, because again ESG can be a proxy for sustainability.

Furthermore, it becomes interesting to look at the relationship between ESG ratings and stock or firm performance. Pedersen, Fitzgibbons, and Pomorski (2021) created a

theoretical framework for an ESG efficient frontier, which looks at the relationship between ESG and Sharp Ratios. Suggesting theoretically that investors choose an optimal portfolio along this frontier. Additionally, they create an ESG-adjusted CAPM[6] where expected returns are dependent on the ESG rating. Like Pastor et al. (2021), this is a theoretical model, but what about the actual relationship between ESG and returns? Friede, Busch, and Bassen (2015) looked at around 2200 studies that research the relationship between ESG ratings and Corporate Financial Performance. The large majority (90%) of the studies find that firms with higher ESG ratings perform similarly or better financially relative to low ESG firms. Meaning that most of these studies find a positive relationship. We do not know how the effect on financial performance relates to stock returns. Traditional theories (e.g. the shareholder's wealth maximization theory) often imply that corporations should maximize the value for their shareholders. The Agency view sees CSR as an agency problem and firms should not use their resources for improving their CSR rating. Ferrel, Liang, and Renneboog (2016) look into these theories. They found a positive relationship between a firm's CSR and its value. Firms that suffer less from agency problems (e.g., too much cash) are more involved with CSR. Lo and Sheu (2007) use Tobin's Q[7] as a proxy for firm value. They do research on large US firms from 1999 until 2002. They find a positive relationship between a firm's sustainability and its corresponding value. The positive relationship between sustainability and value suggests that engaging in sustainable strategies leads to an increase in market value. Derwall, Guenster, Bauer, and Koedijk (2019) look at Socially Responsible Investing (SRI) in the period 1995-2003. They found that portfolios constructed from firms with a high SRI ranking had significantly higher average returns than the low SRI portfolio. The ESG rating for a firm can change over time and it is uncertain in which direction. If ESG ratings affect returns the uncertainty of a potential change in ESG will result in risk for investors. Avramov, Cheng, Lioui, and Tarelli (2021) find that the level of uncertainty of change in ESG ratings affects the relationship between risk and returns. Meaning that if there is high uncertainty regarding a potential change in the level of ESG, then the returns and risk of a stock are affected. Suggesting that a change in ESG rating has a significant impact on returns. Like some of the previous papers, Pastor, Stambaugh, and Taylor (2022) find that Green US stocks (high ESG rating) have on average higher returns relative to Brown US stocks. Even with a difference in returns for Green and Brown stocks, the expected returns are lower for Green stocks compared to Brown stocks. This difference in expected returns and realized returns is contiguous with some of the theoretical models we have seen before. However, not all papers find a significant positive relationship between ESG ratings and return. Limkriangkai, Koh, and Durand (2017) researched ESG ratings for firms in Australia. Firms had a significant difference in characteristics with

[6]Capital Asset Pricing Model

[7]Tobin's Q = Total Market Value/Total Book Value

different ESG ratings. Corporations with a high Environment score and a low Goverance score are more likely to raise less debt. The Social pillar does not affect financing decisions. High ESG companies are more likely to increase their leverage. Thereafter, they construct different portfolios based on ESG ratings. There is not a significant difference in risk-adjusted returns between these portfolios. Suggesting that investors can invest in high ESG firms without there being a punishment or reward regarding their risk-adjusted return (suggesting all other risk factor exposures remain constant). A difference in characteristics between Green and Brown firms is not surprising, according to Gonçalves, Dias, and Barros (2022). They find that ESG ratings are priced in capital markets. However, this relationship differs between the equity and debt markets. Higher ESG performance is positively related to the cost of debt, but negatively to the cost of equity. The cost of capital is not dependent on ESG in periods of crisis. Halbritter and Dorfleitner (2005) make portfolios according to a firm's ESG rating. From there they find that there is not a significant difference between the returns of firms with high ESG ratings compared to low ESG firms. Bansel, Wu, and Yaron (2021) concluded that in times when the economy prospers high-SRI stocks outperform low-SRI stocks. In recessions, this relationship is the other way around. This suggests that a potential difference in returns depends on the state of the economy. A relationship depending on the state of the economy corresponds with one of the findings of Gonçalves et al. (2022), regarding the cost of capital in a period of crisis.

The relationship between ESG ratings and returns in the literature seems contradictory because the expected returns are lower for firms with higher ESG ratings. However, those firms also experience higher realized returns and better financial performance. There should be a reason why this difference is present in the literature. Pastor et al. (2022) find a difference in the realized returns and expected returns for Green and Brown stocks. The difference between the realized and expected returns for Green and Brown stocks can be explained by unexpected increases in climate concerns. Green stocks outperform Brown stocks because the demand for Green stocks increased over the years. De Carvalho Ferreira, Sobreiro, Kimura and Barboza (2016) substantiate these findings. They investigate papers that do research on sustainability in financial markets from where they conclude that sustainability is becoming more important for society. The growing importance of sustainability leads to increasing pressure on companies. If firms want to increase their value, they have to increase their sustainability because otherwise the demand for their products, services, and stock will drop. Individuals are even willing to invest in sustainable companies for their pension when it will hurt their financial performance, according to Bauer, Ruof, and Smeets (2021). The most important reason behind the higher willingness to pay for investors is the strong social preference of the individuals. A crucial factor behind the positive relationship between ESG ratings and returns is the increasing attention and preference regarding sustainability by investors. Heeb, Kölbel, Paetzold, and

Zeisberger (2022) researched if investors care about the impact of their investments using an experiment. From the experiment, they found that investors are willing to pay more for sustainable investments. The higher willingness to pay is consistent with the research of Bauer et al. (2021). Remarkably, investors do not pay significantly more for those investments, according to Paetzold and Zeisberger (2022). Investing in sustainable assets goes accompanied by positive emotions. These findings imply that investors care about the impact of their investments. Not only individual investors could be concerned about the impact of their investments, but also institutional investors. Dyck, Lins, Roth, and Wagner (2019) found that Environmental and Social scores for firms are driven by institutional investors. The reasons for institutions are financial and social factors. The effect is only present for institutional investors who are from countries that value Environmental and Social impact. This research is not the only one that finds a positive relationship between sustainability and institutional investors. Dimson and Karakaş (2015) find that firms, that are more likely to engage with social responsibility, tend to have institutional investors who are socially conscious. Surprisingly, firms with inferior governance also tend to be more engaged. If firms are more concerned about their image and have better tools to implement changes, they have a higher chance of success in social responsibility engagements. If the engagement is successful a corporation often sees an improvement in accounting performance and institutional ownership. Dimson and Karakaş (2015) find a positive relationship between social responsibility and non-negative abnormal returns. Overall, the higher realized returns are because of a growing preference for sustainable assets. Not only are realized returns affected by investor preferences but also expected returns for Green firms, according to Cornell (2021). Of course, risk is also a primary factor, which influences expected returns. Investing in high ESG assets does result in social returns but comes with lower expected returns.

2.1 Hypotheses

A social preference for sustainable assets increases the demand for these assets. The increasing demand leads to higher realized returns, whereas theoretical models found lower expected returns for Green firms. Social preference explains the difference between the realized and expected returns for Green firms. Our sample period starts in 2006 and ends in 2022. In this period sustainability has become more popular and with it, the social preference for sustainable assets has grown. In this paper, we are looking at realized returns and not expected returns.

Hypotheses 1: ESG ratings have a positive effect on Returns

If this hypothesis holds, we have statistical evidence that the increasing demand for sustainable assets is the dominant mechanism in this period. However, that will not give any guarantee for the future. Other mechanisms that can cause a negative relationship

between ESG ratings and returns can become dominant in the future. Investors could want to be compensated for their higher risk exposure when they hold low ESG assets. Assets with a low ESG rating are not sustainable and thus are exposed to a higher possibility of compromises in the future. These compromises can cause higher costs or even default. It could be that this mechanism is already dominant in our sample period. Then the relationship between ESG ratings and realized returns is similar to the relationship between ESG ratings and expected returns. It does not mean that the expected returns are equal to the realized returns or that the magnitudes of both relationships are equal to each other.

We expect ESG scores to have a positive effect on returns, which means that Green firms should outperform Brown firms over a longer period. The outperforming of Green firms means that if we construct a portfolio that goes long in Green firms and short in Brown firms it should generate a positive return. However, the positive return could be the result of some correlations with other existing risk factors. If Green firms outperform Brown firms, a so-called Green-minus-Brown portfolio (GMB) should generate a positive alpha. This gives us our second hypothesis:

Hypotheses 2: A Green-Minus-Brown portfolio generates a positive alpha

This hypothesis can only hold if the first hypothesis is true. If the first hypothesis is rejected and ESG has a negative effect, then we must construct a Brown-minus-Green portfolio (BMG). Thence, we would expect the BMG portfolio to have a positive alpha. If there is no effect, it should not matter which portfolio we construct, because we would expect both to have a non-significant alpha. If hypothesis 1 holds, but hypothesis 2 does not it could mean that a higher return for high ESG firms cannot be exploited by investors. A non-significant alpha could then be the result of a few reasons. The timing could be in such a way that the effect of ESG is not fully exploited, because of the holding period or time of execution. There could be other explanations that would result in a non-negative alpha, like noise. Due to some noise or fluctuations, it could be that a GMB portfolio does not fully capture the ESG effect in the market. We have seen that Bolton and Kacperczyk (2021) have found that high carbon emission (Brown) firms have on average a higher return compared to low carbon emission (Green) firms. So, if we construct a GMB portfolio based on carbon emissions this GMB portfolio should generate a negative alpha. If it does not then it could be because of the same reasons, we gave before. Regarding the timing, holding period, and noise of the portfolio.

3 Data

The firm-specific data used in this research are retrieved from the Refinitiv Eikon Database and Compustat CRSP. Regarding the traditional risk factors, they are retrieved from the

Kenneth R. French Database[8]. The sample began in 2006 because in that year the PRI was launched by the United Nations. As a result, our sample is not exposed to any change in effects through this program. The sample ends in 2022. The dataset consists of all US publicly listed firms in this period for which the ESG ratings from Refinitiv Eikon were available. This gives us 5,595 different firms, resulting in 53,488 year-firm observations in total.

3.1 Firm Specific Variables

The first firm-specific variable that we are using is the ESG scores from Refinitiv Eikon itself. The ESG scores are built out of 3 categorical ratings: Environment, Social, and Governance. All ratings regarding ESG range from 0 to 100. Environment is made up of the firms' use of resources, emissions, and innovation. Social consist of ratings regarding product responsibility, human rights, workforce, and community. Governance is responsible for a rating regarding the management, shareholders, and the firms' CSR strategy. ΔESG is the change in ESG rating from the year before. Returns are the yearly log returns of the corresponding firms' stock prices. Size is the price times the outstanding shares. So, Size is the market capitalization (in millions of dollars) at the end of the fiscal year. Property, Plant, & Equipment (PPE), Cash Holdings & Short-Term Investments are the book values at the end of the fiscal year (in millions of dollars). Net Income and Research & Development are calculated during the fiscal year (in millions of dollars). Leverage is the book value of debt divided by the book value of equity at the end of the fiscal year. Book-to-Market value is the book value of assets divided by the market capitalization at the end of the fiscal year. Return on Equity (ROE) is calculated by dividing the annual net income (during the fiscal year) divided by the value of equity (at the end of the fiscal year). Research and Development are the costs for research and development during the fiscal year. The change in annual earnings (in dollars at the end of the fiscal year) per share divided by the share price is captured by the variable Growth of Earnings per Share (EPS) (in dollars). Volatility is the standard deviation of the stock price in the fiscal year. Momentum is the average monthly return of the corresponding fiscal year. Beta is the sensitivity to the market index (on which the stock is listed) calculated over the fiscal year. Relative Investment is the capital expenditures (during the fiscal year) divided by the book value of assets (in dollars at the end of the fiscal year). Growth of Sales is the change in net sales divided by Size. To reduce the influence of outliers, Return, Leverage, Relative Investment, and Book-to-Market Ratio are winsorized at the 2.5% level. Momentum, Growth of Sales, Growth of EPS, and Volatility are winsorized at 0.5%. Furthermore, values that are theoretically not possible are also removed from the dataset (ESG ratings below 0 and above 100 and

[8] $https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html$

negative Market Capitalizations). Total Emissions are the sum of Scope 1[9] and Scope 2[10] emissions (all gas emissions, e.g., CO2) of the corresponding firm in tonnes during the fiscal year.

3.2 Risk Factors

The risk factors that are retrieved from the Kenneth R. Database are the risk factors from the Fama and French (2015) 5-factor model. The 3-factor model from Fama and French (1993) is already incorporated into this 5-factor model. The first risk factor is the Market Premium, which is the return of the market portfolio minus the risk-free rate. Small-minus-Big (SMB) is the portfolio consisting of shorting big-size firms and going long in small-size firms. High-minus-Low (HML) are the value (high book-to-market ratio) firms minus the growth (low book-to-market ratio) firms. The portfolio which goes long in firms with strong profitability (Robust) and short in weak profitability (Weak) stocks, is captured by Robust-minus-Weak (RMW). Conservative-minus-Aggressive is a risk factor that captures the difference in returns between firms with conservative investment policies and those with aggressive investment policies.

3.3 Summary Statistics

In Table 1 we can see the summary statistics of the most important variables that are going to be used in the methodology. The summary statistics of the other variables are given in Table A of the Appendix. There we can see that the minimum year is 2005 because some variables (e.g.) Return need a prior observation before 2006. However, in the results, only observations between 2006 and 2022 are used. ESG score has a mean of around 39.3, which is not high considering the possible range of the ESG scores. The mean is higher than the median, which is 36. So, the ESG score follows a positively skewed distribution. The Environment score has quite a poor average, especially comparing it to the Social and Governance pillars. The Governance score is on average almost double the mean of Environment. Environment score also has a positively skewed distribution and Social negatively skewed. The average Return is relatively close to zero (0.3%). Returns (per year) follow a symmetrical distribution. Size has a large standard deviation (compared to the mean) and a high maximum value relative to the mean and median. This is also true for Property, Plant, and Equipment. These findings support the use of the logarithm of both variables in our regressions. Book-to-Market, Return on Equity, and Relative Investment follow a positively skewed distribution. On average, firms invest around 3.7% of their book value of assets on their long-term assets. Looking at the median of Growth

[9]Direct emissions from company-owned assets and resources

[10]Indirect emissions: emissions from the energy that is used by the company (e.g. Electricity, Water, and Gas.)

Table 1: Summary Statistics of the Main Regression Variables

In the table below we can see the summary statistics for the corresponding dataset for all US public firms for the period 2006-2022. All values are rounded up to 3 decimals. Book-to-Market, Leverage Net Investment, and Return on Equity are winsorized at 2.5%. Momentum, Volatility, Growth of Sales, and Growth of EPS are winsorized at 0.5%. ESG, Environment, Social, and Governance score range from 0-100. Returns and Momentum are presented as fractions, to get to percentages multiply by 100. Volatility is already given in percentages. Size and Property, Plant, and Equipment are given in millions of dollars. In the table above we can see the summary statistics for the corresponding dataset for all US public firms for the period 2006-2022. All values are rounded up to 3 decimals. Book-to-Market, Leverage Net Investment, and Return on Equity are winsorized at 2.5%. Momentum, Volatility, Growth of Sales, and Growth of EPS are winsorized at 0.5%. ESG, Environment, Social, and Governance score range from 0-100. Returns and Momentum are presented as fractions, to get to percentages multiply by 100. Volatility is already given in percentages. Size and Property, Plant, and Equipment are given in millions of dollars. Further explanations of the variables are given in the Data Section

Variable	**Observation**	**Mean**	**S.D.**	**Min**	**25%**	**Median**	**75%**	**Max**
ESG score	28,949	39.335	19.072	0	25.020	36.060	51.770	95.160
Environment Score	28,611	23.959	27.022	0	0	14.560	42.170	98.550
Social Score	28,441	41.830	20.507	0.260	26.200	38.490	55.800	98.940
Governance Score	28,609	48.604	22.140	0.160	30.990	49.100	66.340	99.480
Return	46,180	0.003	0.544	-8.594	-0.154	0	0.212	8.009
Size	41,355	9,320.91	45,000	0.008	337.677	1,267.284	4,692.625	2,300,000
Book-to-Market	31,436	1.129	1.361	0.053	0.376	0.702	1.254	7.005
Return on Equity	41,307	-0.018	0.197	-0.891	-0.014	0.038	0.068	0.200
Leverage	33,318	0.298	0.230	0.002	0.107	0.261	0.437	0.924
Relative Investment	40,599	0.037	0.043	0.000	0.007	0.022	0.049	0..193
Property, Plant & Equipment	50,189	1,952.463	9,512.482	0	15.007	96.014	614.900	260,000
Growth of Sales	29,781	0.044	0.453	-3.070	-0.009	0.0300	0.103	2.663
Growth of EPS	32,007	-0.011	0.446	-3.642	-0.024	0.003	0.026	2.778
Volatility	41,554	29.969	12.539	11.320	20.500	26.850	36.920	71.220
Momentum	44,613	0	0.041	-0.174	-0.016	0.004	0.021	0.127

of Sales and EPS we can see that around half of the observations have a negative growth and the other half positive growth. Volatility has a mean of around 30%. However, we do not know if the magnitude is high or low considering we do not know the average for other periods or countries.

4 Methodology

We want to know if investors value ESG factors, so we need a model that captures this effect. That effect needs to solely capture the ESG effect and not for other potential variables. In this research, all the regressions are Ordinarily Least Squares (OLS) regressions. For every model, we use a test from Breusch and Pagan (1979) to find if the regression is exposed to heteroscedasticity. If this test rejects the zero hypothesis with homoscedastic standard errors then the regression will be run with robust standard errors (White(1980)). We want to remove potential time and/or Industry-Fixed effects in the regressions. So, to tackle this problem for all regressions we use Time-Fixed effects in the regressions

(per year). Next up for some regressions we also incorporate industry fixed effects (per industry according to the SIC[11]). As stated before, the regressions are inspired by the methodology of Bolton and Kacperczyk (2021). However, we do not use the Herfindahl-Hirschman Index[12] (HHI). Industry Fixed effects will make this industry-specific measure redundant in the models.

4.1 ESG Ratings and Firm Characteristics

We want to test if the ESG ratings can be explained by the characteristics of a firm. For these models (Equations 1 and 2), we use the ESG ratings and the change of ESG ratings as dependent variables. The independent variables are firm-specific variables that could potentially explain the cross-sectional returns of the firms. We use a top-down approach with relevant firm characteristics. This approach gives us the regression in Equations 1 and 2. μ are the Time fixed effects and the Industry Fixed effects.

$$\begin{aligned}\text{ESG Rating}_{i,t} = \beta_0 &+ \beta_1 \log(\text{Size}_{i,t}) + \beta_2 \text{Book-to-Market Ratio}_{i,t} \\ &+ \beta_3 \text{ROE}_{i,t} + \beta_4 \text{Leverage}_{i,t} + \beta_5 \text{Relative Investment}_{i,t} \\ &+ \beta_6 \log(\text{PPE}_{i,t}) + \beta_7 \text{Growth of Sales}_{i,t} + \beta_8 \text{Growth of EPS}_{i,t} \\ &+ \mu_t + \varepsilon_{i,t}\end{aligned} \tag{1}$$

$$\begin{aligned}\Delta\text{ESG Rating}_{i,t} = \beta_0 &+ \beta_1 \log(\text{Size}_{i,t}) + \beta_2 \text{Book-to-Market Ratio}_{i,t} \\ &+ \beta_3 \text{ROE}_{i,t} + \beta_4 \text{Leverage}_{i,t} + \beta_5 \text{Relative Investment}_{i,t} \\ &+ \beta_6 \log(\text{PPE}_{i,t}) + \beta_7 \text{Growth of Sales}_{i,t} + \beta_8 \text{Growth of EPS}_{i,t} \\ &+ \mu_t + \varepsilon_{i,t}\end{aligned} \tag{2}$$

Thereafter, we will use Equation 1 and the different pillars of the ESG score as dependent variables. In that way, we can see if the different firm characteristics have a different effect on the separate ESG score pillars (Environment, Social, and Governance).

4.2 Effect of ESG ratings on Returns

Subsequently, we want to look at the effect of ESG ratings on the cross-sectional returns of US firms. This is the main regression and is given in Equation 3, with Return as the dependent variable. The independent variable of interest is the ESG ratings. The control variables are the logarithm of Size, the Book-to-Market ratio, Return on Equity, Leverage, Momentum, Relative Investment, the logarithm of Property, Plant and Equipment, Market Beta, Volatility, the Growth of Sales, and the Growth of Earnings per Share. Research

[11] Standard Industrial Classification – A 4 digit code, which indicates the primary operating industry of the firm

[12] An industry-specific index, which indicates the competitiveness of the market

and Development (R&D) is not incorporated, because not all firms have R&D costs. To avoid having a sample selection bias in our regression results we do not incorporate this variable in our regressions. This decision does not influence the results regarding the independent variable of interest. Furthermore, we do not only use the full ESG ratings. In Equation 4 we use the change in ESG ratings as the independent variable of interest. Again, we also incorporate the control variables. Subsequently, we also would like to know the effect of the different pillars of the ESG rating. So, using the same models as Equations 3 and 4 we split up the ESG ratings into the different pillars (Environment, Social, and Governance). μ are the Time Fixed effects and if indicated in the table also Industry Fixed effects.

$$\text{Return}_{i,t} = \beta_0 + \beta_1 \text{ESG Rating}_{i,t} + \beta_1 \text{Control Variables}_{i,t-1} + \mu_t + \varepsilon_{i,t} \tag{3}$$

$$\text{Return}_{i,t} = \beta_0 + \beta_1 \Delta\text{ESG Rating}_{i,t} + \beta_1 \text{Control Variables}_{i,t-1} + \mu_t + \varepsilon_{i,t} \tag{4}$$

In 2015 there was a large worldwide conference in Paris regarding Climate Change. The so-called Paris Agreement could have had an impact on the effect of ESG ratings. Therefore we use Equations 3 and 4, but we add an interaction effect on our independent variable of interest using a dummy variable which has a value of 1 if the observation is from 2015 or later and 0 otherwise.

4.3 ESG and Carbon Emission Portfolios

Furthermore, we want to see if a portfolio of Green firms outperforms a portfolio solely consisting of Brown Firms. Or the other way around depending on the results from the regression from equation 3. Green firms are the high ESG stocks and stocks with low Carbon emissions. Brown firms are the low ESG stocks and stocks with high Carbon emissions. Thereby, if there is a positive relationship, we will construct a trading method by going long in the Green portfolio (consisting of Green stocks) and short in the Brown portfolio (consisting of Brown stocks). We will refer to this portfolio as the Green-minus-Brown (GMB) portfolio. We will construct the portfolios by categorizing the firms according to their ESG rating. The Green firms will consist of the top 30 percent ESG-rated firms every year. The Brown portfolio will be a portfolio of the bottom 30 percent. If we find that Brown firms (a lower ESG rating) generate on average a higher return relative to Green firms then we will construct a Brown-minus-Green (BMG) portfolio. We will use the same percentiles and holding period as the GMB portfolio. As a comparison, we will also construct these portfolios by dividing the firm according to their Total Emissions, by using the same percentiles as the ESG portfolios. The portfolios will be held for 1 year and then we rebalance the portfolio again by using the 30th percentile threshold. The portfolios are rebalanced at the beginning of each year. Transaction costs are not

taken into account. The returns of portfolios will be evaluated using the 3-factor model by Fama and French (1993) and the 5-factor model by Fama and French (2015). We are using monthly returns for the portfolios.

4.4 Robustness Checks

We need to perform some robustness checks to validate the findings of our results. In the control variables, we use Size and the Book-to-Market Ratio. These variables are in the models to control for the size and value effects from the Fama and French (1993) three-factor model. However, it is also possible to incorporate these effects in a benchmark return. So, for every observation, we find the corresponding portfolio according to its Size and B/M ratio. For Size and Value, there are 5 groups, which means in total there are 25 value-weighted portfolios. For every observation, we have a benchmark return for the same year. Then we estimate the same models as Equations 3 and 4, but we change the dependent variable to Return minus the Benchmark Return. We also remove the log of Size and the Book-to-Market Ratio as control variables. In the sample period, there are 2 major crises (The financial crisis and the Covid-19 crisis) incorporated, which could have a significant effect on our results. Therefore, we also regress Equations 3 and 4 without the highly volatile periods (2008, 2009, and 2020). If this does not change then our results are not sensitive to volatile periods.

5 Results

5.1 ESG Ratings and Firm Characteristics

Table 2 gives us the regression results from Equations 1 and 2 from the Methodology, with the first 2 columns ESG and the change of ESG as dependent variables. Regressions 3, 4, and 5 have the 3 pillar scores as dependent variables. Looking at the first regression, we can see that all coefficients are significant at 5%. Most of them are even significant at 1%. This result suggests that firm characteristics have a significant influence on the level of ESG. The R^2 tells us that these firm characteristics can explain approximately half of the variation in ESG scores among companies. However, the sign and magnitude differ between the characteristics. Size has a significant positive effect on ESG, so when the market capitalization is 1% higher the ESG score is on average 0.092 units higher. The effect is economically speaking not exceptionally large, but the effect is present. This effect could have a few explanatory reasons because firstly a larger firm could have better and larger resources to increase its sustainability. A larger corporation is often more concerned about its reputation in the media, so they have a bigger incentive to have a higher ESG if they are large. Book-to-Market Ratio has a significant (at 1%) positive

Table 2: Regression Results ESG Ratings and Firm Characteristics

In the Table below we see the regression results following Equations 1 and 2. All values are rounded up to 3 decimals. Robust standard errors (White (1980)) are between brackets. The definitions of the variables can be found in the Data section. Return on Equity, Relative Investment, Growth of Sales, and Growth of EPS are presented in absolute values, not percentages.

	ESG Score		Pillar Scores		
	(1)	(2)	(3)	(4)	(5)
	ESG	ΔESG	Environment	Social	Governance
Log(Size)	9.270***	0.310*	12.999***	10.799***	3.744***
	(0.374)	(0.188)	(0.501)	(0.418)	(0.511)
Book-to-Market	0.666***	-0.126	1.832***	1.018***	0.164
	(0.187)	(0.090)	(0.244)	(0.202)	(0.262)
Return on Equity	-4.761***	0.541	-9.564***	-6.228***	1.581
	(0.825)	(0.446)	(1.090)	(0.956)	(1.195)
Leverage	-1.454**	0.069	-1.953**	0.316	-2.895***
	(0.675)	(0.350)	(0.897)	(0.790)	(0.953)
Relative Investment	-50.180***	-0.455	-65.173***	-50.319***	-29.038***
	(4.090)	(2.292)	(5.436)	(4.530)	(5.904)
Log(PPE)	8.816***	-0.105	11.783***	8.685***	6.772***
	(0.334)	(0.167)	(0.449)	(0.368)	(0.460)
Growth of Sales	-1.109***	0.602***	-1.082***	-0.802**	-0.931**
	(0.283)	(0.150)	(0.383)	(0.316)	(0.426)
Growth of EPS	0.700**	0.043	1.488***	0.455	-0.183
	(0.315)	(0.169)	(0.419)	(0.385)	(0.484)
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	15,502	14,200	15,303	15,213	15,301
R^2	0.538	0.053	0.576	0.510	0.279
Adjusted R^2	0.526	0.027	0.565	0.498	0.260

The significance of the coefficients is portrayed by the stars (* $p < 0.10$ ** $p < 0.05$ and *** $p < 0.01$).

effect on the ESG rating. We can see in Table 1 that 75% of the observations have a Book-to-Market ratio between 0.05 and 1.25. The coefficient is 0.67, so the difference in ESG rating between most growth and value firms is economically not very noticeable. Return on Equity, Leverage, Relative Investment, and Growth of Sales has a negative significant influence on the level of ESG. All these variables are in fractions and not percentages, so to get the effect of a 1 percentage point increase we need to divide the coefficient by 100 (Also for Growth of EPS). The logarithm of Property, Plant, and Equipment has a similar significant positive effect as the logarithm of Size. However, this effect is on average 0.088 units when PPE is 1% larger. The effects for ROE, Leverage, and Growth of Sales are on average economically not significant. However, if capital expenditures as a fraction of the book value of assets (Relative Investment) is 10 percentage points higher then the ESG score is on average 5 points lower (holding everything else constant). This effect could be because firms who on average invest relatively more into their total long-term assets have less money spare to invest in sustainability. Also, corporations that have high capital expenditures are often capital-intensive firms. Those firms are often more polluting and employ more low-skilled workers, who are oftentimes underpaid (especially in the USA where they have a poor social system). Growth of Earnings per Share has a positive significant effect. However, this is economically not significant.

Looking at the second regression with the ESG change as the dependent variable, we can see that almost no variables have a significant effect on the change of ESG. The logarithm at Size is only significant at 10% and the Growth of Sales is significant at 1%. However, both coefficients are very small looking at their magnitude. It is remarkable that the sign changes with ESG to the change of ESG for the Growth of Sales. Firms whose sales grow steadily each year are often smaller firms or growing firms. We can see with Size that smaller firms tend to have a lower ESG rating, often because they do not spend much attention on sustainability. Nonetheless, firms with growing sales are frequently growing as a firm. That is why Growing of Sales has a positive significant influence on the change of ESG. The (adjusted) R^2 is considerably small especially when we compare it to the other (adjusted) R^2 from the other regressions. Altogether, this means that firm characteristics are not able to explain the change in ESG scores.

The last 3 regressions give us the coefficients from the regressions with the different pillar scores as the dependent variables. The R^2 is for Environment and Social approximately the same as the first regression. Firm characteristics do explain less variation of the Governance pillar. However, it is still around 28%. For Environment, almost all coefficients are significant at 1%, except for Leverage which is significant at 5%. The signs of the coefficients are identical for all variables in comparison with regression 1. Although, the magnitudes of the coefficients are noticeably larger than for ESG. Except for Growth of Sales, because here the magnitude is approximately similar. The coefficient for Return on Equity is even double the coefficient in the ESG regression. So, firm characteristics

do have the largest influence on the Environmental pillar. Environmental is frequently part of ESG which gets the most attention in the media. So, corporations often spend the most attention on this part of ESG relative to the other pillars. If we look at the Social regression, we can see that the coefficients go more toward the magnitudes of the first regression. However, the Leverage and Growth of EPS are now not significant. The significance of Growth of Sales goes from significant at 1% to significant at 5%. That is the same for the Governance regression, but the magnitude is a little bit larger compared to the Social regression. The magnitude of the logarithm of Size is a lot smaller compared to regressions 1, 3, and 4. The significance stayed the same. Book-to-Market, Return on Equity, and Growth of EPS are not significant. These firm characteristics do not affect the Governance score. The coefficients for Relative Investment and the logarithm of PPE have the same sign and significance, however, the magnitude for these variables is considerably smaller. One of the reasons could be that Governance is often the least important aspect of sustainability by society (compared to Environment and Social). Leverage, however, does have a negative significant effect on the level of Governance and the magnitude is almost double compared to regression 1. This effect is expected if we look at the components of Governance because Governance is a measure of how well the corporation is managed. Firms with high leverage are more or less considered not to be the best-managed firms. That is not always true and that is why the magnitude is economically speaking not very large. A Leverage of 10% higher means on average a -0.29 lower Governance score. Overall, we can see that these firm characteristics are good determents of the ESG score. Especially for the Environment pillar, but the magnitude of the effect is not very large for every characteristic. However, these firm characteristics are not able to explain changes in ESG scores. We did not expect beforehand that firm characteristics were able to explain the cross-sectional difference in ESG scores for US firms.

5.2 Effect of ESG ratings on Returns

Table 3: Regression Results ESG Ratings and Returns

The table shows the regression results following equations 3 and 4. The dependent variable Return is presented in absolute values, so to get to percentages multiply by 100. All values are rounded up to 3 decimals. The robust standard errors (White (1980)) are between brackets. The definitions of all variables are presented in the Data section. All control variables are the lagged values as indicated in equations 3 and 4. Momentum and Volatility are in percentages. Growth of Sales, Growth of EPS, Return on Equity, Leverage, and Relative Investments are presented in absolute values, so we need to divide these coefficients by 100 to get the effect of the percentages.

	ESG		Change of ESG		Pillar Scores	
	(1)	(2)	(3)	(4)	(5)	(6)

ESG	0.001***	0.001***				
	(0.000)	(0.000)				
ΔESG			0.001*	0.001*		
			(0.001)	(0.001)		
Environment					0.000	0.000
					(0.000)	(0.000)
Social					0.001***	0.001***
					(0.000)	(0.000)
Governance					0.000	0.000
					(0.000)	(0.000)
Log(Size)	-0.031***	-0.073***	-0.012	-0.056***	-0.033***	-0.073***
	(0.011)	(0.014)	(0.011)	(0.015)	(0.011)	(0.014)
Book-to-Market	0.023***	0.031***	0.022***	0.028***	0.025***	0.032***
	(0.006)	(0.008)	(0.006)	(0.008)	(0.006)	(0.008)
Leverage	0.079***	0.107***	0.072***	0.102***	0.089***	0.118***
	(0.021)	(0.025)	(0.022)	(0.026)	(0.021)	(0.025)
Momentum	-0.183	-0.228	-0.147	-0.193	-0.182	-0.229
	(0.193)	(0.192)	(0.200)	(0.200)	(0.192)	(0.192)
Relative Investment	-0.206*	-0.196	-0.350***	-0.293*	-0.242**	-0.217
	(0.122)	(0.150)	(0.129)	(0.160)	(0.122)	(0.151)
Return on Equity	-0.143***	-0.136***	-0.155***	-0.152***	-0.145***	-0.140***
	(0.038)	(0.039)	(0.039)	(0.041)	(0.037)	(0.039)
Log(PPE)	-0.026***	0.008	-0.012	0.023*	-0.026***	0.007
	(0.009)	(0.013)	(0.009)	(0.014)	(0.009)	(0.013)
Beta	-0.006	-0.011	-0.001	-0.007	-0.008	-0.014
	(0.008)	(0.009)	(0.009)	(0.010)	(0.008)	(0.009)
Volatility	-0.003***	-0.004***	-0.004***	-0.004***	-0.003***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Growth of Sales	-0.010	-0.017	-0.009	-0.014	-0.013	-0.021*
	(0.013)	(0.013)	(0.013)	(0.014)	(0.012)	(0.013)
Growth of EPS	-0.025	-0.031**	-0.032*	-0.040**	-0.032**	-0.038**
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	No	Yes	No	Yes	No	Yes
Observations	12,287	12,287	11,445	11,445	12,107	12,107
R^2	0.157	0.194	0.157	0.196	0.157	0.194
Adjusted R^2	0.155	0.169	0.155	0.169	0.155	0.169

The significance of the coefficients is portrayed by the stars (* $p < 0.10$ ** $p < 0.05$ and *** $p < 0.01$).

In Table 3 we can see the regression results following Equations 3 and 4 from the Method-

ology. The regressions are separated, according to the corresponding independent variable of interest. The first 2 regressions have ESG scores as the independent variable of interest. ESG scores have a positive significant effect on the yearly returns (at 1%). This effect is approximately 0.1% per ESG score (0.001 * 100). This means that a firm, whose ESG score is 10 points higher, has on average a yearly return of approximately 1% higher (holding everything else constant). This result is consistent with the hypothesis that we formed in the Literature section. Considering that the mean of the returns is approximately zero, this effect is economically quite substantial. So, investors do value sustainability. More sustainable firms are thus higher valued by the market. This effect does not change when Industry Fixed effects are incorporated. Size has a negative significant (at 1%) effect on returns, which in is line with the Fama and French (1993) Size risk factor. In addition, we find that the book-to-market has a positive significant effect on returns (at 1%). Meaning that Value firms outperform growth firms, which is one of the other risk factors from Fama and French's (1993) 3-factor model. Leverage has a positive significant effect on returns between 0.08% and 0.11% (0.11*100/100) because companies who have a higher Leverage are riskier. Investors often want to be compensated for their risk. Momentum, Relative Investment, Beta, and Growth of Sales do not have a noteworthy influence on the yearly return. Return on Equity has a negative significant (at 1%) influence on Return of around -0.14% (-0.14*100/100). This effect is remarkable because one would expect if the net income as a percentage of equity rises the stock price would increase. However, the control variables are all lagged values. So, it could be possible that if a corporation has a positive net income that the performance the following year is disappointing. If the performance rises one year, then so, do the expectations. If the expectations are not met the following year then the stock price usually drops. Property, Plant, and Equipment have a negative significant effect, however, when we incorporate Industry Fixed effects the significance disappears. Volatility has a negative significant effect on Return. If the yearly Volatility goes up 1% then the return of the following year drops between 0.3% (-0.03 * 100) and 0.4% on average. We would expect Volatility to have a positive effect like Leverage, because of the higher risk. However, we do not know if the higher Volatility also means a higher Volatility in the next year. The Growth of Earnings only has a negative significant (at 5%) effect when we incorporate Industry Fixed Effects, but this effect (-0.03%) is economically speaking not substantial.

Regressions 3 and 4 have the change of ESG as the independent variable of interest. The magnitude and sign are similar to the level of ESG, there is however a difference in significance. This coefficient is only significant at 10%. So, a change in ESG does not have a significant effect on the yearly return (at 5% significance). If the sustainability changes the return should also change as well. However, we see here that a change in ESG does not have a significant effect on returns. So, it seems that a difference in returns is not driven by a change in sustainability. On the other hand, a lower level

of sustainability comes with more risk for the investor. So, if the investor wants to be compensated for this risk both effects of change in sustainability could cancel each other out. Thus, meaning a non-significant effect. Size does not have a significant effect, but if we incorporate Industry Fixed effects the coefficient becomes significant at 1%. The magnitude and sign are relatively in the same range as models 1 and 2. The coefficients for Book-to-market are also similar to the first 2 models, looking at magnitude, sign, and significance. Meaning that this model is also in line with the 3-factor model of Fama and French (1993). Leverage has a positive significant (at 1%) effect on Return. If Leverage is 10% higher, the yearly return of the following year is on average between 0.7% (0.7 * 100/100 * 10) and 1% higher. Momentum, Property Plant and Equipment, Beta, and the Growth of Sales do not have a significant effect on Returns. Relative Investments have a negative significant (at 1%) effect, however, when Industry Fixed effects are added the significance changes to 10%. So, we cannot conclude at the moment, regarding Relative Investment. The effect of Return on Equity is comparable to the effect of ROE in the first 2 models. However, the magnitude is slightly larger here. Also, for Volatility, the coefficient does not change, regarding magnitude, significance, and sign. The Growth of Earnings per Share does not have a significant effect (at 5%) when do not incorporate Industry Fixed effects. However, like the first 2 regressions when we do use Industry Fixed effects (IFE) the coefficient becomes significant at 5%. The magnitude of the coefficient with IFE is (like model 2) economically not very significant.

For the last 2 regressions the ESG score (as an independent variable of interest) is switched out for the Pillar scores. Social has a positive significance (at 1%) on the yearly return, which is on average 0.1% (0.001 * 100) per score. Environment and Governance do not have a significant effect. That is remarkable for Environment because overall that is the pillar score that gets the most attention in the media. So, one would expect that at least this pillar score would have a significant effect. However, it looks like if the pillar scores stand on their own that investors only care about Social sustainability. It could be that the information for Environment and Governance is already incorporated into the stock prices. Then it is not a surprise that these variables do not have a significant effect on returns. The coefficients of Size, Book-to-Market, Leverage, Return on Equity, and Volatility are almost identical to their corresponding coefficients of the first 2 regressions. Momentum, Beta, and the Growth of Sales do not have a significant effect (at 5%). Relative Investment does have a negative significant effect at 5%, but the significance disappears when we incorporate IFE. We also see this happen with Property, Plant, and Equipment (PPE). Without IFE there is a negative significant effect, but with IFE there is no significant effect. Growth of Earnings per Share has a negative significance (at 5%) on the yearly returns. Looking at all R^2, we can see that they are all quite similar. However, incorporating IFE does improve both R^2 and the adjusted R^2 for all models.

Taking all regressions into account, we can see that investors care about the level of

ESG score. This is in line with hypothesis 1 and thus could be because of the rising demand for sustainable assets. It seems that investors only care about the Social pillar. However, the change in ESG score does not have a significant effect on returns. Size has a negative effect on returns, which is in line with Fama and French (1993). If Size goes up 1% then the yearly return drops on average between 0.03% and 0.07% (0.07*100/100). Firms with a higher Book-to-Market (B/M) ratio (Value firms) have a higher return than companies with a low B/M ratio (Growth firms), which is the theory behind the other risk factor from Fama and French (1993). Firms with a higher Leverage have on average a higher return of around 0.07% and 0.12% per year holding everything else constant. So, investors want to be compensated for their exposure to the default risk of the firm. Return on Equity has a negative effect, which could be due to the change in expectations for the following year. The ROE is of the year before the observed return. PPE and Relative Investment often change when we incorporate IFE. This is because these variables are often correlated with different industries. These variables are often higher in capital-intensive industries, so it is not a surprise that the significance changes when IFE is used. Momentum, Beta, and the Growth of Sales do not have any significant effect. Volatility has a negative effect, which is remarkable. However, this effect could be due to the same reason we gave regarding the ROE. The effect of the Growth of EPS seems to be negative, but we lack statistical evidence to connect a conclusion to the Growth of EPS variable.

We would like to know if the effect of ESG scores on returns differs from before and after the Paris Agreement in 2015. That is why we add an interaction term with the independent variable of interest and a Paris dummy variable, which gives 1 if the observation is from 2015 or later. Furthermore, we use the same methods as Table 3 and the results can be found in Table B of the Appendix. The coefficients of the control variables are almost identical, looking at their sign, magnitude, and significance. Looking at ESG as the first independent variable of interest, we can see that before the Paris Agreement, the effect is non-existent. The interaction variable of the Paris Agreement and the level of ESG ratings has a positive significant effect on Returns at 1%. So, after The Paris Agreement, there is a positive relationship between ESG ratings and Returns. Since 2015, attention to sustainability has only increased, and thus the demand for sustainable assets. The positive effect after the Paris Agreement gives support that the positive relationship between ESG ratings and returns is driven by the increasing demand for sustainable assets. We see the same thing happen with the Change of ESG as the independent variable of interest. The variable before 2015 is insignificant but becomes positive and significant after the Agreement. This suggests that before 2015 a change in sustainability does not have an effect, because higher sustainability has a positive (change in life expectancy) and a negative effect (change in risk compensation). After the Agreement, the positive effect of change in ESG is probably also caused by the rising demand for sustainable stocks. If a firm's sustainability rises the demand also rises

for this stock resulting in a higher return. Looking at the Pillar scores, we can see that the Paris Agreement did not have a significant effect on the coefficient of these Pillar scores. However, it does have a positive significant effect (at 5%) on Environment. That is not completely unexpected, because the Paris Agreement was about addressing climate change. Remarkably, over the whole sample period Social has a positive significant effect, but when incorporating the Paris interaction variable this coefficient is non-significant (before and after the Agreement). This means that we cannot connect a conclusion to the Social pillar, because the effect is completely different among Table 3 and Table B. So overall, we can see that the Paris Agreement did affect the valuation of sustainability by investors. It resulted in a positive relationship between ESG and returns, suggesting that, partly due to the Paris Agreement, the demand for sustainable assets has risen among investors. Especially for stocks, whose underlying firm has a good Environment score.

5.3 ESG and Carbon Emission Portfolios

We have seen in part 5.2 that ESG has a positive significant effect on returns. So, we constructed a Green-Minus-Brown Portfolio by going long in a Green portfolio and short in a Brown Portfolio. As we have already discussed in the Methodology, we do this using ESG and Carbon Emissions to divide firms into Green and Brown firms. Table C gives us the summary statistics and for the GMB portfolios the significance of one-sample t-tests. These significances show us whether the means of these factor portfolios are significantly higher or lower than zero, depending on whether the mean is positive or negative. The monthly return of the ESG equally-weighted portfolio on average 0.5% and significant at 1%. Thus, this portfolio generates a positive return during our sample period. However, we do not know if the portfolio also generates positive alphas. That is what we want to know for our second hypothesis. Both value-weighted portfolios also generate on average a positive monthly return, however, these means are statistically not larger than zero. The Carbon equally-weighted portfolio has a negative mean, but this mean is not significantly smaller than zero. Looking at the distribution of all Green-minus-Brown portfolios we can see that it seems that the absolute monthly returns of all portfolios follow symmetric distributions. Unlike the separate Green and Brown portfolios, because they all have a skewed distribution. Most of them are negatively skewed. To get a better understanding of the returns of the GMB factor portfolios we can see the monthly returns over time in Figures A and B of the Appendix. Figure A shows the returns of the equally-weighted portfolios. Until the beginning of 2021, it does not seem that one portfolio outperforms the other or that one portfolio has a return above zero. However, from January 2021 onwards the ESG GMB portfolio outperforms the Carbon GMB portfolio. Here, the ESG GMB portfolio has a positive average return compared to the negative average return for the Carbon GMB portfolio. Looking at the Literature Review, we would expect that

this difference exists over the whole sample period. High Carbon (Brown) firms should generate a higher return on average compared to low Carbon (Green) firms, which means that the Carbon GMB portfolio should have a negative return on average. Thereby, we have seen that high ESG firms have a higher return on average in comparison with low ESG firms. So, a GMB portfolio based on ESG should generate a positive return on average. With equally-weighted portfolios we only see this happen in the period January 2021 until the end of the sample period. Figure B gives the timeline for the value-weighted portfolios. What we have seen in Figure A until January 2021, we see in Figure B over the whole sample period. There is not a portfolio that outperforms the other or one portfolio that has an average return above zero. The last part is to be expected because both value-weighted GMB portfolios are statistically not smaller or larger than zero. The value-weighted ESG GMB portfolio is more volatile than the value-weighted GMB portfolio. We can see in Table C that the value-weighted ESG GMB portfolio also has the highest standard deviation out of all the GMB portfolios.

However, we also want to know more about the alphas and the exposure to the established Risk factor of the different portfolios. This way we have statistical evidence to either accept or reject our second hypothesis. We calculate the alphas with the 3-factor model from Fama and French (1993) and the 5-factor model from Fama and French (2015). The results for the 3-factor models are presented in Table 4. The equally-weighted (EW)

Table 4: Green-Minus-Brown Portfolio and the 3-Factor Model

The table below shows the results following the GMB portfolios of ESG and Carbon Emissions with the 5 Factor Model from Fama and French (2015). All values are rounded up to 3 decimals. The standard errors are between brackets. Regressions 1 and 2 have heteroskedasticity, so these regressions have robust standard errors (White(1980)). The dependent variables are the monthly excess returns of the corresponding GMB portfolio. The definitions of the variables are presented in the Data section

	ESG		Carbon Emissions	
	(1)	(2)	(3)	(4)
	Equally Weighted	Value Weighted	Equally Weighted	Value Weighted
Alpha	0.005**	-0.000	-0.002	0.001
	(0.002)	(0.004)	(0.002)	(0.002)
Mkt-RF	-0.017	0.129	0.071	0.047
	(0.055)	(0.127)	(0.047)	(0.042)
SMB	-0.080	-0.044	-0.027	0.059
	(0.081)	(0.110)	(0.089)	(0.081)
HML	0.153**	-0.086	-0.075	-0.081
	(0.067)	(0.119)	(0.065)	(0.059)

The significance of the coefficients is portrayed by the stars (* $p < 0.10$ ** $p < 0.05$ and *** $p < 0.01$).

ESG GMB portfolio has a positive significant alpha at 5%. This is in line with our second hypothesis. Only HML has a (positive) significant effect (at 5%). The other 2 factors do not have a significant coefficient. The value-weighted (VW) ESG GMB portfolio has a non-significant alpha. This is not what we would expect concerning our second hypothesis. The Risk factors do not have a significant effect. The EW Carbon GMB and the VW Carbon GMB portfolios do not have a significant alpha. As discussed before, we would expect a negative alpha. The 3 risk factors do not have a significant effect on the excess returns of both Carbon GMB portfolios. Table 5 gives the results regarding the GMB portfolios and the 5-factor model from Fama and French (2015). The EW ESG GMB portfolio has a positive alpha which is significant at 10%. So, it has a positive alpha like with the 3-factor model. The alpha is here a little bit smaller, which is here in fact 0.3%. However, the statistical evidence of this alpha is not very convincing in supporting hypothesis 2. The Mkt-Rf, SMB, and HML do not have a significant effect. RMW has a positive significant effect at 5% on the monthly excess returns of the portfolio. This

Table 5: Green-Minus-Brown Portfolio and the 5-Factor Model

The table below shows the results following the GMB portfolios of ESG and Carbon Emissions with the 5 Factor Model from Fama and French (2015). All values are rounded up to 3 decimals. All values are absolute values. The standard errors are between brackets. Only regression 2 has heteroskedasticity, so this regression has robust standard errors (White(1980)). The dependent variables are the monthly excess returns of the corresponding GMB portfolio. The definitions of the variables are presented in the Data Section

	ESG		Carbon Emissions	
	(1)	(2)	(3)	(4)
	Equally Weighted	Value Weighted	Equally Weighted	Value Weighted
Alpha	0.003*	0.000	-0.002	0.001
	(0.002)	(0.003)	(0.002)	(0.002)
Mkt-RF	0.021	0.095	0.064	0.046
	(0.039)	(0.122)	(0.049)	(0.044)
SMB	-0.000	-0.049	-0.060	0.034
	(0.077)	(0.122)	(0.095)	(0.087)
HML	-0.004	0.054	-0.047	-0.075
	(0.068)	(0.175)	(0.085)	(0.077)
RMW	0.193**	0.074	-0.101	-0.088
	(0.094)	(0.140)	(0.117)	(0.106)
CMA	0.363***	-0.371	-0.054	0.000
	(0.112)	(0.227)	(0.138)	(0.126)

The significance of the coefficients is portrayed by the stars (* $p < 0.10$ ** $p < 0.05$ and *** $p < 0.01$).

effect is 0.19% on average. CMA has a positive significant effect at 1% on the monthly excess return of 0.3% on average. The VW ESG GMB portfolio has a non-significant alpha, so like Table 4, this portfolio does give inconclusive evidence for hypothesis 2. It does not contradict hypothesis 2, but it does not give evidence for hypothesis 2. All of the 5 risk factors do not have a significant effect on this portfolio. Looking at regression 3 and 4 in Table 5 concerning the Caron GMB portfolios, we can see that both alphas are insignificant. Similar to Table C, this is would not what we expected beforehand. The risk factors do not have a significant effect on the EW and VW Carbon GMB portfolios.

Taking both Table 4 and Table 5 into account, we see that the different risk factors are not able to explain the excess returns of the different GMB portfolios (with a few exceptions). It would suggest that this GMB factor could be a new risk factor, which would concern sustainability risk. However, the portfolios should then also generate a significant alpha. The EW ESG GMB factor is the only portfolio that generates a significant alpha, but the significance of this alpha in Table 5 is relatively weak at 10%. Concerning our second hypothesis, the statistical evidence is not monotonous towards accepting or rejecting this hypothesis. So, the conclusion regarding this hypothesis is inconclusive. We expected the Carbon GMB portfolios to generate a negative alpha. However, we have seen that the Carbon GMB portfolios do not generate positive or negative alphas. This could have several reasons and is discussed in the Literature Review section.

5.4 Robustness Checks

In Table D of the Appendix, we can see the results of the regressions, using almost the same method as Table 3. However, instead of using Size and Book-to-Market as control variables, we are using them as benchmark returns. Using this benchmark return we calculate the excess return for every observation. This is further explained in the Methodology. Looking at the independent variables of interest we can see that for ESG scores there is no change in magnitude, sign, or significance. These results give further support for us to accept hypothesis 1. For the Change of ESG only the significance changes from 10% to non-significant. When using the 5% as the significance boundary this change is not noteworthy. The coefficients of the Pillar scores do not change in magnitude or significance. Overall, using Size and Book-to-Market as control variables or as a benchmark return does not have a significant effect on our results. For the control variables, there is not so much of a difference, except for small changes in the magnitudes and significances for some coefficients. However, the change in Momentum is remarkable. The coefficients for this variable go from negative non-significant to positive significant (at 5% and sometimes even at 1%). This suggests that Momentum does not have an effect on absolute returns but does have a positive significant effect on excess returns.

Table E gives us the results of the regressions by omitting the Financial crisis (2008

and 2009) and Covid-19 Crisis (2020) from the sample. The methods are the same as in Table 3. Comparing the coefficients of Table E with Table 3, we can see that the effect of ESG does differ in sign, magnitude, or significance. These results also support hypothesis 1, regarding the positive effect of ESG scores on returns. Also, the change in ESG is the same in terms of sign, magnitude, and significance relative to the coefficient in Table 3. The Pillar scores also have the same coefficients as in Table 3. These results indicate that crises (the more volatile periods) do not affect the relationship between ESG scores and yearly Returns. Most of the control variables' coefficients are relatively the same, except for some minor magnitude and significance changes. However, the coefficients of Momentum and Growth of Earnings per Share are significantly different from Table 3. Momentum has a negative significant effect (at 5% significance) compared to the non-negative effect in Table 3. This effect suggests that, outside of the volatile periods, there is a reversion effect. Firms with past positive returns are more likely to generate a negative return in the next period and vice versa. Of course, this is only regarding the absolute returns because we have seen in Table D that Momentum has a positive effect on the excess returns. Growth of EPS has a negative significant effect in Table 3, but a non-negative effect in Table E. So, the effect suggests that the crises affect the coefficients of Growth of Earnings per Share. Taking everything into account, we can see that the results of Table 3 are robust to the checks we have done. At least for the independent variables of interest which give us reason to accept hypothesis 1. ESG scores have a positive effect on yearly returns.

6 Discussion & Conclusion

Sustainability is a topic that becomes increasingly prominent in our world, also for investors. One of the proxies for sustainability is the ESG scores determined by third parties. It is interesting to know if investors care about those scores and if the stock market attaches any value to them. Subsequently, if investors attach any value to ESG scores, can you as an investor take advantage of this difference in value in his or her portfolio? Using the model of Bolton and Kacperczyk (2021) as a starting point, we research the relationship between ESG scores and returns on the stock market. We investigate this relationship by using a sample of US publicly traded firms, where the sample begins in 2006 and ends in 2022. We look into the relationship between firm characteristics and the level of ESG scores. We find that different firm characteristics can explain the level of ESG scores, especially for Environment and the Social pillar. However, firm characteristics are in general not able to explain the changes in ESG. So, if we only look at certain firm characteristics, we can get a prognosis on whether the company has a high or low ESG score. Although, not whether the corresponding firm will have a higher or lower ESG score in the future. That there is a difference in characteristics between high

and low ESG firms is not surprising to Gonçalves et al. (2022) and Limkriangkai et al. (2017). Both papers also found a difference in characteristics for different types of ESG firms. Gonçalves et al. (2022) explain this difference through a different valuation of ESG in capital markets.

We investigate the effect of ESG ratings on returns. These results give insight into our first hypothesis, which states that ESG ratings have a positive effect on returns. Our results state that indeed firms with a higher ESG rating have on average a higher yearly return. An ESG score of 10 points higher results on average in a higher return of 1% on average. This effect is consistent during various robustness checks. The effect is robust to using excess returns instead of total returns. Thereby, the effect is not influenced by the Financial crisis and the Covid-19 crisis. This finding goes against the findings of Bansel et al. (2021), who state that the relationship between returns and sustainability depends on the state of the economy. Through our findings we can accept our first hypothesis, meaning that ESG scores have a positive effect on returns. A change in ESG scores does not seem to influence the return of stocks during the whole sample period. A drop in sustainability leads to a lower life expectancy, but an investor would then also want to be compensated for his/her higher risk and vice versa. These effects cancel each other out. We find that the Paris Agreement has a positive influence on the value of ESG scores for investors, and also on the change of ESG scores on yearly returns. This finding gives support for the idea that the positive relationship is driven by a rise in demand for sustainable stocks. For the different Pillar scores, we can only connect a conclusion to Governance. Investors do not care about Governance. For Environment and Social, we are not certain because of some variation regarding significance in our different models. Overall, these findings (regarding the effect of ESG ratings on returns) are in line with the research of Pastor, Taylor, and Stambaugh (2022), because they also find that firms with a high ESG rating have on average a higher return compared to companies with a low ESG rating. They say that the increasing demand for those stocks is the main driver behind this difference. If we look at the effect of the Paris Agreement, we can only agree with Pastor et al. (2022). The enormous amount of attention that this agreement got in the media, probably increased demand for sustainable stocks. Their demand for their stock rises because of that. That would result in a higher return. Thus, a positive effect of ESG on returns, which we see in our research. Also, for the change of ESG scores, if a firm's ESG score rises the demand for their stock should increase. As discussed for the whole sample, but also before 2015 there is an ambiguous effect. However, after 2015 a rise in demand for sustainable stocks comes into play. Resulting in the positive effect of a change in ESG dominating the ambiguous effect. The positive relationship between ESG and returns does not guarantee a significant difference in return for the future. The future relationship depends on the rising demand for sustainable assets. If it keeps rising there still would be a positive relationship, however, if this is not the case the relationship

could change. Pastor et al. (2021) find a negative relationship between ESG and returns, but they use expected returns instead of realized returns which are used in this paper. So, it can become possible that somewhere in the future the relationship between ESG and returns will become negative.

We construct a Green-Minus-Brown portfolio using ESG and Carbon Emissions as criteria for allocating the different stocks into groups. Because high ESG firms generate on average a higher return our second hypothesis states that a GMB portfolio should generate a positive alpha. Bolton and Kacperczyk (2021) find that high Carbon (Brown) firms generate on average a higher return compared to low Carbon (Green) firms. So, a GMB portfolio based on Carbon should generate a negative alpha. We find that a GMB portfolio based on Carbon emissions does not generate an alpha. We cannot connect a conclusion to our second hypothesis. We cannot say for certain whether a GMB portfolio constructed through ESG scores will generate a positive alpha or not, because the significance of the alphas in the models is not consistent. The returns of the GMB portfolio for both criteria are not explainable by traditional risk factors. Looking at previously discussed papers and our findings in this paper we would expect both types of GMB portfolios to generate alphas significantly different than zero (for ESG and Carbon). There could be several reasons why this difference is present in our research. The holding period and the time of execution could be in such a way that they do not fully exploit the difference in returns regarding Green and Brown firms. There could also be some unexpected noise or fluctuations in our portfolios that are causing the non-significant alphas. If these things are not the cause of the non-significant alphas, then it could be that this difference in returns cannot be exploited by investors using a self-financing portfolio.

Going back to the main question of this paper: "Do investors care about ESG ratings?". We have seen that ESG ratings do affect returns, so we can conclude that investors do care about ESG ratings. Investors care in such a way about those ratings that ESG ratings have a positive effect on returns. We find evidence that the investor's demand for sustainable assets is one of the drivers behind this positive relationship. If there is a negative relationship, it is because low ESG-rated firms seem to be riskier, so investors want to be compensated for this risk. However, we find a positive relationship meaning that investors are not compensated for this additional risk. It would mean that the positive effect of an increase in demand for sustainable (in this case high ESG) stocks dominates the negative effect of risk compensation. Investors care more about ESG ratings after the Paris Agreement, which gives further support for the idea that the positive relationship is driven by an increase in demand for high ESG stocks. The Agreement got a lot of attention in the media, and it is in all probability that thence investors took sustainability into their investment decisions, resulting in a higher demand for sustainable assets. So far, it does not seem that investors can take advantage of this difference in returns regarding high and low ESG firms. We do have to note in these findings that the past does not give

any certainty for the future. The relationship between ESG and returns could change, thereby also the alpha of a GMB portfolio.

These findings would implicate that investors can sustainable assets (in this case high ESG stocks) into their portfolio without there being a punishment. Investors are rewarded for high ESG stocks. We can draw the same line towards firms. Companies can invest in sustainability and as a result, they would please their investors. We cannot say whether the initial increase in sustainability will result in a positive return in the next period. However, Green firms generate higher returns than Brown firms, holding everything else constant. This way management can keep all their investors satisfied regardless of their valuation of sustainability. For academic research, these results imply that ESG should be a control variable when using returns as a dependent variable. We have seen that ESG ratings can explain some deviation in the returns. So, if ESG scores are omitted from certain models then the models can be exposed to an omitted variable bias. For the GMB portfolio, it seems that investors cannot generate a positive alpha in their portfolio using a self-financing portfolio based on ESG scores. However, we do not know this for certain. So far, there is no evidence that models in the future should incorporate a GMB portfolio as a new risk factor.

It would be interesting to find out in the future if certain GMB portfolios do generate a positive return. That could be using a different holding period, execution date, or different dividers (e.g., using the top and bottom 20%). Thereafter, one would know if GMB is certainly not a risk factor or if there is something in our GMB portfolio that prevents us from generating a significant alpha. Of course, in our portfolio, we are only using the US public market. We do not know how these results relate to the private sector and other national markets, like Europe. It would be interesting for future research to find out if investors also care about ESG ratings in those markets.

7 References

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8 Appendix

Table A: Summary Statistics of the Other Variables

In the table below we see the summary statistics of the remaining variables. All values are rounded up to 3 decimals. Total Assets, Total Debt, Net income, Net Sales, BV of Equity, Cash Holdings and Short Term Investments, Net Income, Research & Development, and Capital Expenditures are in millions of dollars. Emissions are the total of Scope 1 and Scope 2 gas emissions in millions of tonnes. Earnings per Share are in dollars. Excess returns are the normal Returns minus the corresponding Benchmark return. To get the percentages of Excess returns, multiply by 100. Further explanations of the variables are given in the Data Section

Variable	**Observations**	**Mean**	**S.D.**	**Min**	**25%**	**Median**	**75%**	**Max**
Fiscal Year	53,488	2014.901	4.800	2005	2011	2015	2019	2022
Total Assets	52,718	22,000	150,000	0	459.090	1750.054	6,439	4,300,000
Total Debt	39,075	4,587.876	76,000	0	9.441	248.301	1,435	4,200,000
EPS	44,078	1.860	82.707	-11,000	-0.230	0.900	2.430	8548
Net Income	44,200	380.421	2,504.901	-99,000	-9.244	29.781	180.323	100,000
Net Sales	44,200	5,129.613	20,000	-13,000	138.176	670.758	2,773.313	570,000
BV of Equity	33,318	9,670.722	57,000	-8,400	298.214	1057.310	3,696	2,100,000
Excess Returns	46,180	-0.111	0.531	-8.896	-0.316	-0.102	0.122	8.544
Emissions	8,615	3,800,000	14,000,000	0.110	52,000	230,000	1,300,000	170,000,000
Capital Expenditures	44,020	300.872	1,440.865	-3,300	2.234	18.348	109.104	64,000
Cash and Short Term Investments	44,279	1,884.262	19,000	0	35.142	126.158	443.447	1,000,000
Net Income	44,200	380.421	2,504.901	-99,000	-9.244	29.781	180.323	100,000
Research and Development	24,477	208.554	1,269.175	-0.648	1.025	18.800	75.204	73,000

Table B: Regression Results ESG Ratings and Returns with Paris Agreement

The table above shows the regression results following equations 3 and 4. The dependent variable Return is presented in absolute values, so to get to percentages multiply by 100. All values are rounded up to 3 decimals. The robust standard errors (White (1980)) are between brackets. All control variables are the lagged values as indicated in equations 3 and 4. Momentum and Volatility are in percentages. Growth of Sales, Growth of EPS, Return on Equity, Leverage, and Relative Investments are presented in absolute values, so we need to divide these coefficients by 100 to get the effect of the percentages. Paris is a dummy variable with a value of 1 if the observation was after the Paris Agreement in 2015. (including 2015). The definitions of all variables are presented in the Data section.

	ESG		Change of ESG		Pillar Scores	
	(1)	(2)	(3)	(4)	(5)	(6)
ESG	0.000	-0.000				
	(0.000)	(0.000)				
Paris * ESG	0.002***	0.002***				
	(0.000)	(0.000)				
ΔESG			-0.001	-0.001		
			(0.001)	(0.001)		
Paris * ΔESG			0.003***	0.003***		
			(0.001)	(0.001)		
Environment					-0.000	-0.001**
					(0.000)	(0.000)
Paris * Environment					0.001**	0.001***
					(0.000)	(0.000)

Social					0.001*	0.001
					(0.000)	(0.000)
Paris * Social					0.000	0.001
					(0.000)	(0.001)
Governance					-0.000	-0.000
					(0.000)	(0.000)
Paris * Governance					0.001*	0.000
					(0.000)	(0.000)
					(0.000)	(0.001)
Log(Size)	-0.036***	-0.078***	-0.012	-0.056***	-0.036***	-0.077***
	(0.011)	(0.014)	(0.011)	(0.015)	(0.011)	(0.014)
Book-to-Market	0.023***	0.032***	0.022***	0.028***	0.025***	0.033***
	(0.006)	(0.008)	(0.006)	(0.008)	(0.006)	(0.008)
Leverage	0.074***	0.102***	0.072***	0.101***	0.084***	0.112***
	(0.021)	(0.025)	(0.021)	(0.026)	(0.021)	(0.025)
Momentum	-0.183	-0.228	-0.146	-0.192	-0.187	-0.229
	(0.193)	(0.192)	(0.200)	(0.200)	(0.192)	(0.192)
Relative Investment	-0.209*	-0.207	-0.355***	-0.298*	-0.241**	-0.225
	(0.123)	(0.150)	(0.129)	(0.160)	(0.122)	(0.151)
Return on Equity	-0.144***	-0.136***	-0.156***	-0.152***	-0.145***	-0.139***
	(0.038)	(0.039)	(0.039)	(0.041)	(0.037)	(0.039)
Log PPE	-0.025***	0.007	-0.012	0.024*	-0.027***	0.005
	(0.009)	(0.013)	(0.009)	(0.013)	(0.009)	(0.013)
Beta	-0.008	-0.013	-0.001	-0.007	-0.011	-0.015
	(0.008)	(0.009)	(0.009)	(0.010)	(0.008)	(0.009)
Volatility	-0.003***	-0.003***	-0.004***	-0.004***	-0.003***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Growth of Sales	-0.009	-0.017	-0.009	-0.014	-0.013	-0.020
	(0.013)	(0.013)	(0.013)	(0.014)	(0.012)	(0.013)
Growth of EPS	-0.025	-0.031**	-0.032*	-0.040**	-0.032**	-0.038**
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	No	Yes	No	Yes	No	Yes
Observations	12,287	12,287	11,445	11,445	12,107	12,107
R^2	0.159	0.195	0.157	0.196	0.159	0.196
Adjusted R^2	0.157	0.171	0.155	0.170	0.157	0.171

The significance of the coefficients is portrayed by the stars (* $p < 0.10$ ** $p < 0.05$ and *** $p < 0.01$).

Table C: Summary Statistics Green-Minus-Brown Portfolios

In the table above we can see the Summary Statistics for the Green, Brown, and Green-Minus-Brown (GMB) portfolios. All values are rounded up to 3 decimals. The Green portfolios are the top (bottom) 30% level of ESG (Carbon Emissions). The Brown portfolios are at the bottom (top) 30% level of ESG (Carbon Emissions). All values are in absolute values, so to get to percentages multiply by 100. The GMB portfolios go long in the Green portfolio and short in the Brown portfolio. Every portfolio is reconstructed every year. Stars show the significance (* p¡0.10 ** p¡0.05 and *** p¡0.01) of a one-sample t-test on whether the mean of the GMB portfolio is significantly higher or lower than zero depending on the sign of the mean. In the table above we can see the Summary Statistics for the Green, Brown, and Green-Minus-Brown (GMB) portfolios. All values are rounded up to 3 decimals. The Green portfolios are the top (bottom) 30% level of ESG (Carbon Emissions). The Brown portfolios are at the bottom (top) 30% level of ESG (Carbon Emissions). All values are in absolute values, so to get to percentages multiply by 100. The GMB portfolios go long in the Green portfolio and short in the Brown portfolio. Every portfolio is reconstructed every year. Further explanations of the variables are given in the Data Section

Variable	**Months**	**Mean**	**S.D.**	**Min**	**25%**	**Median**	**75%**	**Max**
ESG - Equally-Weighted								
Green Portfolio	193	0.003	0.068	-0.376	-0.024	0.012	0.037	0.185
Brown Portfolio	193	-0.002	0.076	-0.425	-0.031	0.006	0.037	0.204
GMB Portfolio	193	0.005***	0.024	-0.078	-0.01	0.003	0.015	0.086
ESG - Value Weighted								
Green Portfolio	193	0.007	0.058	-0.255	-0.018	0.013	0.038	0.163
Brown Portfolio	193	0.006	0.059	-0.233	-0.02	0.006	0.034	0.154
GMB Portfolio	193	0.002	0.045	-0.272	-0.018	0.003	0.023	0.162
Carbon - Equally-Weighted								
Green Portfolio	193	0.002	0.071	-0.367	-0.027	0.012	0.039	0.194
Brown Portfolio	193	0.003	0.065	-0.404	-0.022	0.011	0.033	0.171
GMB Portfolio	193	-0.001	0.028	-0.197	-0.014	0.001	0.016	0.067
Carbon - Value Weighted								
Green Portfolio	193	0.008	0.063	-0.257	-0.02	0.016	0.04	0.173
Brown Portfolio	193	0.006	0.053	-0.242	-0.019	0.014	0.034	0.144
GMB Portfolio	193	0.002	0.026	-0.102	-0.013	0.002	0.016	0.092

The stars show the significance (* $p < 0.10$ ** $p < 0.05$ and *** $p < 0.01$) of a one-sample t-test on whether the mean of the GMB portfolio is significantly higher or lower than zero depending on the sign of the mean.

Table D: Regression Results ESG Ratings and Excess Returns

The table below shows the regression results following equations 3 and 4. The dependent variable Excess Return is presented in absolute values, so to get to percentages multiply by 100. The Excess returns are calculated using benchmark returns of the 5x5 Size and B/M portfolio's from the Kenneth R. French database All values are rounded up to 3 decimals. The robust standard errors (White (1980)) are between brackets. All control variables are the lagged values as indicated in equation 3 and 4. Momentum and Volatility are in percentages. Growth of Sales, Growth of EPS, Return on Equity, Leverage and Relative Investments are presented in absolute values, so we need to divide these coefficients by 100 to get the effect of the percentages. The definitions of all variables are presented in the Data section.

	ESG		Change of ESG		Pillar Scores	
	(1)	(2)	(3)	(4)	(5)	(6)
ESG	0.001***	0.001***				
	(0.000)	(0.000)				
ΔESG			0.001	0.001		
			(0.001)	(0.001)		
Environment					0.000	-0.000
					(0.000)	(0.000)
Social					0.001***	0.001***
					(0.000)	(0.000)
Governance					-0.000	-0.000
					(0.000)	(0.000)
Leverage	0.077***	0.106***	0.066***	0.100***	0.087***	0.117***
	(0.021)	(0.026)	(0.022)	(0.027)	(0.021)	(0.026)
Momentum	0.679***	0.547**	0.841***	0.704***	0.667***	0.539**
	(0.215)	(0.217)	(0.225)	(0.227)	(0.216)	(0.217)
Relative Investment	-0.245**	-0.246	-0.456***	-0.359**	-0.272**	-0.256*
	(0.118)	(0.150)	(0.122)	(0.159)	(0.118)	(0.152)
Return on Equity	-0.171***	-0.197***	-0.180***	-0.207***	-0.172***	-0.201***
	(0.041)	(0.042)	(0.043)	(0.044)	(0.041)	(0.042)
Log(PPE)	-0.024***	-0.017**	-0.001	0.006	-0.025***	-0.017*
	(0.006)	(0.008)	(0.006)	(0.008)	(0.007)	(0.009)
Beta	0.002	-0.004	0.005	-0.001	0.000	-0.005
	(0.009)	(0.010)	(0.009)	(0.011)	(0.009)	(0.010)
Volatility	-0.003***	-0.002***	-0.003***	-0.003***	-0.002***	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Growth of Sales	0.002	-0.005	0.002	-0.003	-0.002	-0.010
	(0.014)	(0.015)	(0.015)	(0.016)	(0.014)	(0.014)
Growth of EPS	-0.090***	-0.105***	-0.097***	-0.116***	-0.097***	-0.111***
	(0.018)	(0.018)	(0.019)	(0.019)	(0.018)	(0.018)
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	No	Yes	No	Yes	No	Yes
Observations	12,287	12,287	11,445	11,445	12,107	12,107

R2	0.046	0.081	0.046	0.087	0.047	0.084
Adjusted R2	0.044	0.054	0.044	0.057	0.045	0.056

The significance of the coefficients is portrayed by the stars (* $p < 0.10$ ** $p < 0.05$ and *** $p < 0.01$).

Table E: Regression Results ESG Ratings and Returns without the Financial and Corona crisis

The table below shows the regression results following equations 3 and 4. The sample period for these regressions is from 2006-2022, where the years of the Financial crisis (2008, 2009) and the Corona Crisis (2020) are removed. The dependent variable Return is presented in absolute values, so to get to percentages multiply by 100. All values are rounded up to 3 decimals. The robust standard errors (White (1980)) are between brackets. All control variables are the lagged values as indicated in equations 3 and 4. Momentum and Volatility are in percentages. Growth of Sales, Growth of EPS, Return on Equity, Leverage, and Relative Investments are presented in absolute values, so we need to divide these coefficients by 100 to get the effect of the percentages. The definitions of all variables are presented in the Data section.

	ESG		Change of ESG		Pillar Scores	
	(1)	(2)	(3)	(4)	(5)	(6)
ESG	0.001***	0.001***				
	(0.000)	(0.000)				
ΔESG			0.001*	0.001*		
			(0.001)	(0.001)		
Environment					0.000	0.000
					(0.000)	(0.000)
Social					0.001***	0.001***
					(0.000)	(0.000)
Governance					0.000	0.000
					(0.000)	(0.000)
Log(Size)	-0.055***	-0.099***	-0.040***	-0.085***	-0.055***	-0.097***
	(0.011)	(0.016)	(0.011)	(0.016)	(0.011)	(0.016)
Book-to-Market	0.022***	0.027***	0.021***	0.022**	0.023***	0.027***
	(0.007)	(0.009)	(0.007)	(0.009)	(0.007)	(0.009)
Leverage	0.104***	0.126***	0.095***	0.115***	0.110***	0.132***
	(0.022)	(0.027)	(0.023)	(0.028)	(0.022)	(0.027)
Momentum	-0.450**	-0.459**	-0.440**	-0.446**	-0.451**	-0.463**
	(0.211)	(0.211)	(0.218)	(0.218)	(0.211)	(0.211)
Relative Investment	-0.299**	-0.337**	-0.464***	-0.481***	-0.314**	-0.331**
	(0.132)	(0.162)	(0.138)	(0.172)	(0.131)	(0.163)
Return on Equity	-0.095**	-0.091**	-0.134***	-0.137***	-0.094**	-0.094**
	(0.045)	(0.046)	(0.046)	(0.048)	(0.045)	(0.046)
Log(PPE)	-0.002	0.022	0.012	0.043***	-0.005	0.020
	(0.009)	(0.014)	(0.010)	(0.015)	(0.009)	(0.014)
Beta	-0.005	-0.014	-0.001	-0.011	-0.006	-0.015
	(0.009)	(0.011)	(0.010)	(0.011)	(0.009)	(0.011)
Volatility	-0.005***	-0.006***	-0.006***	-0.006***	-0.005***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Growth of Sales	-0.010	-0.016	-0.005	-0.009	-0.013	-0.019

	(0.013)	(0.013)	(0.014)	(0.014)	(0.013)	(0.013)
Growth of EPS	-0.000	-0.002	-0.003	-0.007	-0.008	-0.010
	(0.017)	(0.017)	(0.018)	(0.018)	(0.017)	(0.018)
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	No	Yes	No	Yes	No	Yes
Observations	9,825	9,825	9,139	9,139	9,728	9,728
R2	0.134	0.178	0.145	0.192	0.130	0.174
Adjusted R2	0.132	0.147	0.143	0.159	0.127	0.142

The significance of the coefficients is portrayed by the stars (* $p < 0.10$ ** $p < 0.05$ and *** $p < 0.01$).

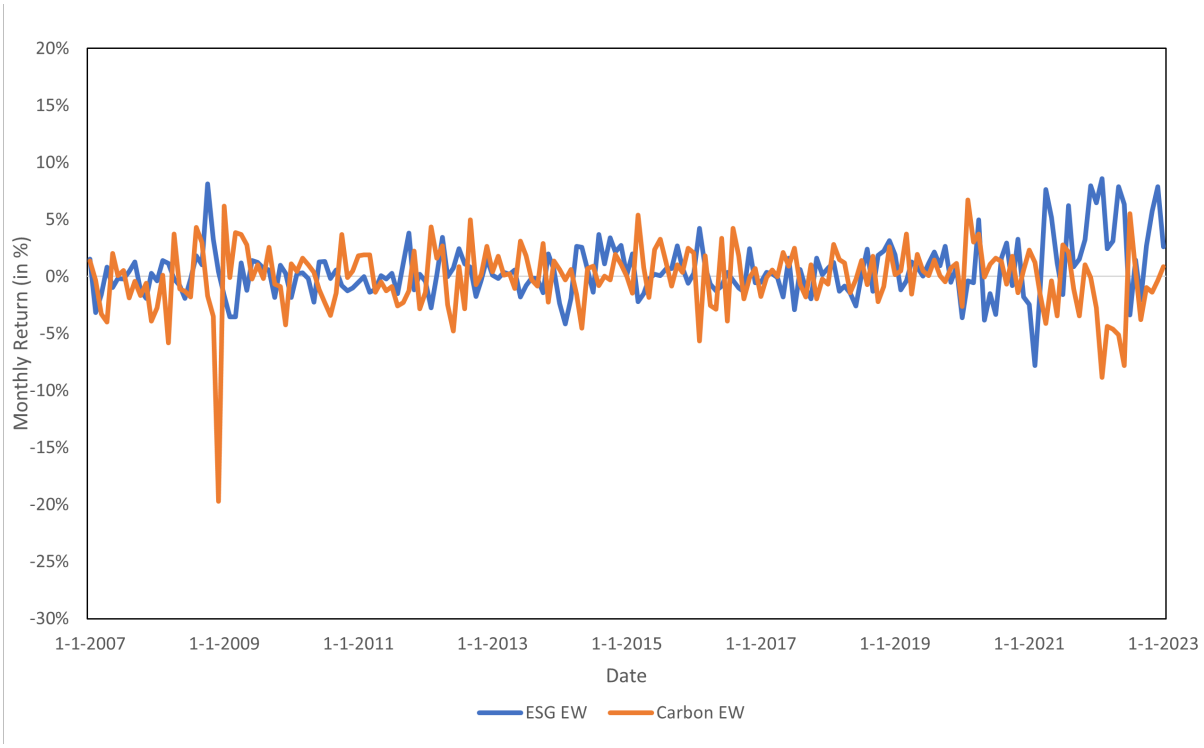

Figure A: Monthly Returns Equally-Weighted GMB portfolios from 2007-2022

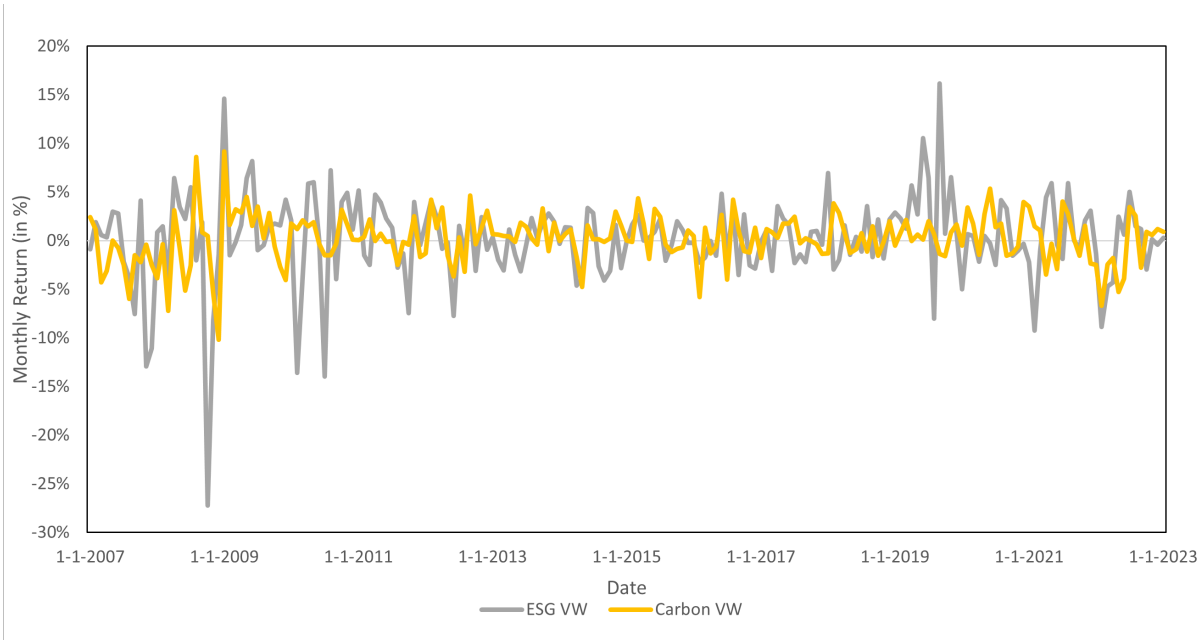

Figure B: Monthly Returns Value Weighted GMB portfolios from 2007-2022