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Bachelor Thesis [Financial Economics]

Sustainability: Do investors care?

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Abstract

In this paper, the effect of ESG ratings on stock returns is analysed. This is done using a *reghdfe* fixed effects model where time- and firm-level fixed effects are accounted for, and standard errors are clustered by firm. The main findings are that it does matter if a firm has a rating or not, but the specific rating does not matter. Throughout time, the importance of ESG ratings increased. This trend does not seem linear, as this increase in importance flattens out over time. Besides analysing a broad spectrum of firms, high-risk industries are studied. The stock returns of the high-risk industries, e.g., energy, agriculture, and insurance, are more affected by ESG scores than the general sample.

Introduction

Companies have responsibilities. According to the United Nations, global warming is increasing, and certain goals are not being achieved (UNEP, UNEP-CCC, 2021). Companies should act on their responsibility and be sustainable, and not rely on other companies to make investments into sustainability such that they do not have to themselves. They should be inclusive, transparent, have fair governance, and be good for the environment. Nowadays, companies are being rated on their level of sustainability by a so-called Environmental, Social, and Governance rating (ESG rating). In this paper, the main question I ask is do investors care about the sustainability of a company.

There is a vast amount of research on the effects of ESG ratings on stock returns and firm performance (Friede, Busch, & Bassan, 2015). These studies have different conclusions. Some studies found a positive relation between ESG and firm performance, like Zumente and Bistrova (2021) or Beatty and Shimshack (2010). Tarmuji et al. (2016) found that a higher ESG score translates to higher firm performance. As Sharfman and Fernando (2008) said, an ESG rating reflects the way a firm manages its risks. How you manage environmental risk is synonymous with how you manage strategic risk. Other studies, such as Landi and Sciarelli (2018) found negative relations. An investment made into ESG performance is an investment that is not made into the highest NPV project. Investing in ESG performance is not the optimal choice, as you get less return than you possibly could have gotten. This is the classical economic thinking of Friedman.

I have not found any study that exactly researches the effect of having a rating versus not having a rating. Zumente and Lace (2021) studied if the lack of ESG ratings in Central and Eastern Europe affect the stock trading volume and returns. To fill this gap in research I will study what the effect of having an ESG rating versus not having an ESG rating means for stock returns. There have been a lot of studies that show that being introduced into an index leads to higher stock returns (Jain, 1987; Elliot et al., 2006). An ESG rating makes it easier for an investor to see if a firm is sustainable or not. This extra information makes it easier to decide if the investor wants to invest or not. Amel-Zadeh and Serafeim found in their 2018 survey that 82% of their respondents used ESG information ‘because it is material to financial performance’.

I expect to find that having an ESG rating will result in higher stock returns. Even though it is nonfinancial information, there is still a lot of interest in it (Eccles, Serafeim, & Krzus, 2011).

Besides this gap, there has been a lot of research on ESG scores. Studies have shown that good ESG ratings have a positive impact on firm performance (Ahmad, Mobarek, & Nawazesh Roni, 2021; Khan, 2019; Friede, Busch, & Bassen, 2015). A better firm performance leads to higher stock returns (Machdar, 2017). In addition to this, Sharfman, and Fernando (2008) found that an investment into specifically environmental performance reduces the WACC, leading to a more profitable investment climate. Cheng, Ioannou and Serafeim (2011) found that good investor engagement and transparency around CSR (Corporate social responsibility) reduce capital constraints.

Based on all this research, I expect to find that an increase in ESG rating will lead to higher stock returns.

Other research has shown that throughout the years, people care more about sustainable development (Unruh et al., 2016). Several IPCC reports have gotten attention in mainstream media (IPCC, 2007; IPCC 2014). These reports have stated that to reach the Paris goals (a maximum temperature increase of 1.5 ^{o}C), emissions need to be cut by 48% in 2030. At the same time, the responsible investment industry in the United States and Europe grew (Amel-Zadeh & Serafeim, 2018). I expect to find that, throughout the years, the importance of ESG ratings for stock returns has increased.

When thinking about climate change, it is logical to think that some industries are characterised more by risk than others. The insurance, agriculture and energy industry are the industries that face the most consequences and risks regarding climate change (Mills, 2009; Herweijer, Ranger, & Ward, 2009; Dlugolecki, 2000; Aydinalp, & Cresser, 2008; Howden et al., 2007; Krane, 2017; Schaeffer et al., 2012). The insurance industry has a bigger chance of seeing simultaneous claims due to climate change, as more natural disasters occur. The energy industry has a big chance of being negatively affected by policy changes, which are implemented to control climate change. The agricultural industry sees the same challenges as the energy industry, with the added danger that arises from natural disasters such as droughts.

These industries are riskier regarding climate change than other industries. As more risk requires a higher return, I expect to find that ESG ratings have more influence on stock returns for firms that operate in high climate-risk industries than firms that do not operate in these industries.

In short, the previous studies did not all come to the same conclusion. Some studies found a positive effect of ESG ratings, and some studies found a negative effect of ESG ratings. There are even gaps in the literature. Researchers have studied if the lack of not having ESG ratings matters, but not the exact effect of receiving an ESG rating has on stock returns. Some studies that show that being introduced into an index result in a higher stock return, but this has not been studied for the ESG ratings. Throughout time, an increase in interest in climate change can be seen. People care more about climate change, thus it would be logical to think that this increase in interest is reflected in the importance of ESG ratings. Regarding the different industries, there are reasons to think that an ESG rating has a bigger effect than in the general sample, but this has not been studied in such a precise manner.

In this paper, I will first explain the data used. After that, the specific methodology I have chosen will be explained. The reasoning behind this will also be explained. In the next part, the results are shared, after which I will draw conclusions based on these results. Furthermore, a discussion in which recommendations for future research are given. After this, the bibliography can be found. In the appendix, regressions, tables, and mathematics can be found which were not necessary for the main paper, but too useful to leave out.

Data

All data is sourced from Refinitiv Eikon. The sample contains firms that were in the Russell3000 in 2018. Data is measured quarterly from 01/01/2003 until 31/12/2018. This results in a maximum of 64 observations per firm. The dependent variable is $lnreturn_{i,t}$, which is the log difference of the quarterly stock prices.

For each firm, specific ESG ratings are observed. These scores are based on verifiable reported data. The final score is based on 630 measures (Refnitiv Eikon, 2022). In addition to ESG scores, I included a binary variable which equals one if firm *i* has an ESG rating in period *t*, and zero if it does not. This variable is called $RatedDummy_{i,t}$. To analyse a time trend in the effect of ESG ratings on stock returns, I included a factor variable called $President_t$, which equals zero if President Bush was in office at time *t*, one if President Obama was in office at time *t*, and two if President Trump was in office at time *t*.

To analyse the possible industry effects, I included industry binary variables. I used The Refinitiv Business Classification (TRBC) code to sort firms into groups. The energy industry contains the business sectors Energy – Fossil Fuels (code 5010; business sector) and Energy – Renewable Energy (code 5020; business sector). The insurance industry contains Insurance (code 5530; business sector). The agricultural industry does not have a main code, which meant that I had to select it myself. I decided to select Fishing and Farming (code 54102010; industry) and Food Processing (code 54102020; industry). The agricultural industry I selected turned out to be smaller than the energy and insurance industry. This could be a point where a bias is introduced into the research, as the agricultural industry is selected by myself. One should take caution in interpreting the results from regressions including this agricultural industry. The final industry binary variable I have created equals one if a firm is in one of the three aforementioned categories.

The regressions are controlled for total asset turnover at time *t* by the variable $TAT_{i,t}$, total assets growth at time *t* by $TAG_{i,t}$, total assets at time *t* by $lTA_{i,t}$, which is the natural logarithm of total assets to handle outliers and non-normality, return on assets at time *t* by $ROA_{i,t}$, financial leverage at time *t* by $FL_{i,t}$, and book-to-market ratio at time *t* by $BTM_{i,t}$. See Table 1 for a detailed explanation of each control variable. As the return on assets ($ROA_{i,t}$) variable had significant outliers, this variable has been winsorized at 1%. winsorizing modifies the data. I have tried to modify my data as little as possible to stay true to the real observations and data.

I cleaned the data, removing any observations for which the stock price at *t* was unobserved, for which the company name equals "*NA*", for which the total asset turnover was unobserved at *t*, for which the total assets at *t* were unobserved, for which the return on assets at *t* was unobserved, and for which the book-to-market ratio at *t* was unobserved. I then removed any companies for which I had less than 5 years' worth of observations or twenty observations.

TABLE 1: Explanation of variables

Variable	Explanation
Dependent variable	
Stock return *(lnreturn$_{i,t}$)*	It is the quarterly log-return of closing stock prices. It is calculated as ln(stock price at time *t*) minus ln(stock price at time *t -1*).
Independent variables	
$RatedDummy_{i,t}$	This binary variable reflects if firm *i* had an ESG rating at time *t*.
$ESG_{i,t}$	These are the ESG ratings for firm *i* at time *t*. The scores range from 0 – 100 and are based on annual reports, company websites, NGO websites, stock exchange filings, CSR reports and news sources (Refinitiv Eikon, 2022).
$President_t$	This factor variable indicates which president was in office during *t*. If Bush was in office, it equals 0, if Obama was in office, it equals 1, and if Trump was in office, it equals 2.
Control variables	
Total assets turnover ($TAT_{i,t}$)	It is defined as the net sales (or revenue) at time *t* divided by the total assets at time *t*. For banks it is defined as follows: net sales (or revenue) at time *t* divided by total assets at time *t* minus customer liabilities on acceptances at time *t*. for other financial companies it is defined as the net sales or revenue at time *t* divided by total assets at time *t* minus custody securities at time *t* (Worldscope, 2022).
Total assets growth ($TAG_{i,t}$)	This is the yearly total assets growth. It is calculated by taking the log difference of the total assets.
Total assets (l$TA_{i,t}$)	It represents the sum of total current assets, long-term receivables, investments in unconsolidated subsidiaries, other investments, net property plant and equipment and other assets (Worldscope, 2022). The natural logarithm of it is taken.
Return on assets ($ROA_{i,t}$)	It is calculated as the Net income minus the bottom line. Then the interest expense on debt-interest capitalized times (1 – tax rate) is added to this. This is then divided by the average of last year's and current year's total assets times 100 (Worldscope, 2022). It has been winsorized at 1%.
Financial Leverage ($FL_{i,t}$)	This is the financial leverage of a firm. It is calculated as the total debt divided by the total assets (Alareeni, & Hamdan, 2020).

Book-to-market ratio ($BTM_{i,t}$)	This shows the book-to-market ratio of firm *i* at time *t*. It is calculated as the book value of equity over market capitalization (Engelhardt, Ekkenga, & Posch, 2021).

Methodology

In this paper, the data is sorted into a longitudinal panel dataset in Stata. To find out which panel regression method is suitable for the data, I performed the following procedure. I first performed a normal regression, after which a white test was done, which indicated that I needed to adjust for heteroskedasticity. Next, Mundlak's Approach (Pinzon, 2015; Woolridge, 2019; Mundlak, 1978) was performed, which strengthened my belief in a fixed effects model. To confirm this, a random effects regression was performed. In post estimation, a Breusch and Pagan Lagrange Multiplier test for random effects showed that Pooled OLS should be refused (Baltagi, & Li, 1990; Breusch, & Pagan, 1990; Hausman, 1978). It is logical to use an FE-model when looking at the data and goal of research. An FE-model is used to study the causality of changes within a specific firm, which is what is studied in this paper.

To confirm the need for heteroskedastic standard errors in my fixed effects model a modified Wald statistic for groupwise heteroskedasticity was performed (Baum, 2000)**.** This concluded the need for heteroskedastic robust standard errors. Panel data has a tendency for serial correlation, which is logical (Woolridge, 2002; Drukker, 2003). If there were no serial correlation, then the ESG scores in period t would not influence on the ESG scores in $t + 1$. A company that has a good ESG score, will probably have a good ESG score in the next rating session unless the specific rating measures change. The data I used in this study had serial correlation according to Woolridge's method. The need for time-fixed effects was tested and indicated by an F-test for a time variable.

Following the literature, using clustered standard errors is advised when dealing with heteroskedastic and serial correlated standard errors as they account for heteroskedasticity and serial correlation (Stock, & Watson, 2008; Abadie et al., 2017; Watermark Silverchair, XX[1]). You should cluster standard errors when you believe that standard errors are correlated within your clusters, but not between clusters. Each company sees a different effect from unobserved components. A company that harvests fruits is very susceptible to droughts, whereas a sweet potato farmer does not see that same risk (Warmund, 2016; Hahn, 1977). My standard errors are correlated within each firm, but not between firms. My final model accounts for time- and firm-fixed effects, by accounting for the individual firm and the specific quarter. Standard errors are clustered on firm id. The regression is performed as a modified fixed effects model, using *reghdfe*, which has the following form (Correia, 2017):

[1] This was a very nice paper. However, I am unable to find it again. I have tried everything. As I used it a lot, I will still cite it as best I can. https://watermark.silverchair.com/hhn053.pdf?token=AQECAHi208BE49Ooan9kkhW_Ercy7Dm3ZL_9Cf3qfKAc485ysgAAAtUwggLRBgkqhkiG9w0BBwagggLCMIICvgIBADCCArcGCSqGSIb3DQEHATAeBglghkgBZQMEAS4wEQQMioCPlZyzBRekGbMQAgEQgIICiNs7hDPS_zp02i2-QIW70zsyAUy2hwU9Rm8phC9Kq_eHU7B

$$lnreturn_{i,t} = \alpha_i + \beta_1 Xvar_{i,t} + \beta_2 TAT_{i,t} + \beta_3 TAG_{i,t} + \beta_4 \ln(TA)_{i,t} + \beta_5 ROA_{i,t} + \beta_6 FL_{i,t} + \beta_7 BTM_{i,t} + \delta_T QT_t + \varepsilon_i \quad (1)$$

With $T = 2, 3, \ldots, 64$.

The more intuitive way of interpreting this function is as follows:

$$lnreturn_{i,t} = Xvar_{i,t} + Controls_{i,t} + FirmFixedEffects + TimeFixedEffects + \varepsilon_i \quad (2)$$

For the first hypothesis $Xvar_{i,t}$ is replaced with $RatedDummy_{i,t}$. Firms that have not received a rating in the time span of my dataset have been removed from this regression. This has been done to see what receiving a rating means for a company's stock returns. If this had not been done, Stata would have included firms that never received an ESG rating. This could and would alter my results since it could be that rated and non-rated firms are inherently different, and thus have different stock returns. After testing for this, the difference between the two groups was significant. By removing this group that never received an ESG rating, the true effect of receiving an ESG rating is studied, without it being influenced by the inherent difference between never-rated firms and rated firms. In the end, $RatedDummy_{i,t}$ equals 1 if firm *i* at time *t* had an ESG rating, and equals 0 if that same firm *i* did not have a rating at time *t*.

For the second hypothesis $Xvar_{i,t}$ is replaced with $ESG_{i,t}$. For the third hypothesis $Xvar_{i,t}$ is replaced with $ESG_{i,t}$. An interaction effect between $ESG_{i,t}$ and $President_t$ is added to analyse the effect of time on ESG rating influence. Even though the model has time-fixed effects, the interaction effect is different from these time-fixed effects. With the interaction effect, three different periods are defined, whereas the time-fixed effects can be seen as a series of time-specific dummy variables. The integration of the interaction effect is done as a factor variable, to analyse the effect of a specific time, and as a continuous variable, which allows analysing of a possible trend. For the fourth hypothesis, interaction effects between $ESG_{i,t}$ and specific industry binary variables were added. $Xvar_{i,t}$ is replaced with $ESG_{i,t}$. Appendix A1 contains the specific regressions used per hypothesis.

Results

In this section, decimals are rounded down to as many decimals as are necessary for the correct interpretation of coefficients and standard errors.

Firstly, I share the descriptive statistics of the sample. Next per hypothesis, the regression results will be shared. In Table 2, the descriptive statistics are presented. For the descriptive statistics per industry, I refer to Appendix A2: Descriptive statistics per industry.

TABLE 2: Descriptive statistics

Variable		Mean	Standard Deviation	Min	Max	Observations	
Firm ID	Overall	1383.688	788.493	1	2751	N =	120879
	Between		793.014	1	2751	n =	2193
	Within		0	1383.688	1383.688	T-bar =	55.120
lnreturn	Overall	0.018	0.215	-5.976	3.788	N =	118822
	Between		0.026	-0.216	0.120	n =	2193
	Within		0.213	-5.741	3.773	T-bar =	54.182
ESG	Overall	38.867	18.015	0.64	92.52	N =	56052
	Between		13.525	4.115	82.403	n =	2082
	Within		10.482	-16.718	85.715	T-bar =	26.922
TAT	Overall	0.839	1.333	-0.04	182.21	N =	120879
	Between		0.820	0	12.292	n =	2193
	Within		1.042	-11.453	170.757	T-bar =	55.120
TAG	Overall	0.093	0.284	-3.091	7.240	N =	112103
	Between		0.106	-0.235	1.179	n =	2193
	Within		0.267	-4.094	6.237	T-bar =	51.119
lTA	Overall	14.334	1.848	0	21.392	N =	120875
	Between		1.756	6.448	20.787	n =	2193
	Within		0.561	4.144	18.181	T-bar =	55.119
ROA	Overall	3.040	13.629	-74.49	31.35	N =	120879
	Between		11.537	-74.49	31.174	n =	2193
	Within		8.485	-77.398	95.259	T-bar =	55.120
FL	Overall	0.260	1.845	0	223.483	N =	120839
	Between		0.832	0	28.468	n =	2193
	Within		1.712	-28.209	198.632	T-bar =	55.102
BTM	Overall	0.508	3.010	-451.214	25.039	N =	120879
	Between		1.901	-84.533	3.916	n =	2193
	Within		2.740	-366.172	89.323	T-bar =	55.120
RatedDummy	Overall	0.464	0.499	0	1	N =	120879
	Between		0.342	0	1	n =	2193
	Within		0.359	-0.521	1.448	T-bar =	55.120

When taking a closer look at the descriptive statistics, a few things stand out. For most variables, each company has at least fifty observations. Only the ESG variable is less observed, with each company having, on average, 26 observations. This is logical, as not every company received a rating at the same time. As not every variable has the same number of observations, my dataset is unbalanced and contains, after removing certain observations, data for 2193 companies. In general, there are not a lot of worrisome outliers in my dataset, especially not in the variables of interest. The main variables of interest, $lnreturn_{i,t}$ and $ESG_{i,t}$ have enough variation to be able to comfortably run regressions on them. The mean of the ESG rating for the whole sample is 38.867, with it ranging from 0.64 to 92.52. The mean of logarithmic stock returns is 0.018, which indicates increasing stock prices. It ranges from -5.976 to 3.788.

For hypothesis 1, I ran a regression of stock returns on being rated or not. Equation (A1.1) was used. Below are the results of that specific regression.

TABLE 3: Regression results hypothesis 1

Variable	Results (1)
Independent variable	
$RatedDummy_{i,t}$	0.0073***
	(0.0019)
Control variables	
Total assets turnover ($TAT_{i,t}$)	0.0054
	(0.0036)
Total assets growth ($TAG_{i,t}$)	0.0661***
	(0.0069)
Total assets ($lTA_{i,t}$)	-0.0223***
	(0.0018)
Return on assets ($ROA_{i,t}$)	0.0022***
	(0.0001)
Financial Leverage ($FL_{i,t}$)	-0.0001
	(0.0009)
Book-to-market ratio ($BTM_{i,t}$)	-0.0022
	(0.0078)
Constant	0.3179***
	(0.0273)
Number of observations	109 214

Notes: This table reports the effect of getting an ESG rating for companies in the Russell3000 during the time span of 2003 – 2018. The regression has been done by means of double fixed effects and clustered standard errors. Standard errors are in brackets (* p<0.10 ** p<0.05 *** p<0.01). The R-squared is 0.2466. The adjusted R-squared is 0.2315.

In table 3 the regression results for the first hypothesis are shown. Getting an ESG rating is associated with an increase of 0.0073% of the stock returns of a firm. There is a 95% probability that this increase lies between 0.0036% and 0.0109%. These results are significant on a 1% level. When a firm gets rated, its stock returns will increase. We cannot fully interpret the coefficient due to the independence assumption not being met. There could still be observable and unobservable factors correlated with being rated or not rated and stock returns which causes omitted variable bias. I tried to correct this by means of a fixed effects model, which takes care of all time-unvarying factors. The time-varying factors are, however, still an issue of concern. One should, therefore, take caution in directly interpreting the coefficient without realizing its constraints. This caution should be taken for every regression.

For the second hypothesis, I ran a regression of stock returns on ESG scores**.** Equation (A2.1) was used. What I found was that the specific ESG score does not have a significant effect on stock returns. However, when Total assets ($TA_{i,t}$) are not logged, then my results become significant. To be constant throughout this paper, I will use the logged variant. In Table 4 the regression results are given.

TABLE 4: Regression results hypothesis 2

Variable	Results (1)
Independent variable	
$ESG_{i,t}$	-0.0001 (0.00007)
Control variables	
Total assets turnover ($TAT_{i,t}$)	-0.0083 (0.0053)
Total assets growth ($TAG_{i,t}$)	0.0507*** (0.0046)
Total assets ($lTA_{i,t}$)	-0.0249*** (0.0030)
Return on assets ($ROA_{i,t}$)	0.0019*** (0.0002)
Financial Leverage ($FL_{i,t}$)	-0.0502*** (0.0101)
Book-to-market ratio ($BTM_{i,t}$)	-0.0200*** (0.0074)
Constant	0.4234*** (0.0460)
Number of observations	54 947

Notes: This table reports the effect of an increase of ESG rating by 1 on stock returns companies in the Russell3000 during the time span of 2003 – 2018. The regression has been done by means of double fixed effects and clustered standard errors. Standard errors are in brackets (* p<0.10 ** p<0.05 *** p<0.01). The R-squared is 0.2745. The adjusted R-squared is 0.2451.

The effect of ESG ratings on stock returns is insignificant. The specific effect of an increase of 1 in ESG rating on stock returns is -0.0001% and ranges from -0.0003% to 0.00004% with 95% probability. These results indicate that the specific ESG rating does not or should not matter to investors. We cannot say that an increase or decrease in ESG rating is associated with a change in stock returns.

When the total assets are not logged, then the coefficient of $ESG_{i,t}$ becomes -0.0002%, significant at the 1% level.

For the third hypothesis, I ran two regressions. Equation (A3.1) was used. In this regression, an interaction effect between a president variable and ESG rating was added. See Table 5 for the regression results where the president variable is added as a factor variable.

TABLE 5: Regression results hypothesis 3, factor-variant

Variable	Results (1)
Independent variable	
$ESG_{i,t}$	-0.0002**
	(0.0001)
Interaction effect ($President_t$ x $ESG_{i,t}$)	
Obama	0.00015
	(0.00011)
Trump	0.00022*
	(0.00013)
Control variables	
Total assets turnover ($TAT_{i,t}$)	-0.0082
	(0.0053)
Total assets growth ($TAG_{i,t}$)	0.0505***
	(0.0046)
Total assets ($lTA_{i,t}$)	-0.0247***
	(0.0030)
Return on assets ($ROA_{i,t}$)	0.0020***
	(0.0002)
Financial Leverage ($FL_{i,t}$)	-0.0501***
	(0.0101)
Book-to-market ratio ($BTM_{i,t}$)	-0.0200***
	(0.0074)
Constant	0.4198***
	(0.0459)
Number of observations	54 947

Notes: This table reports the effect of an increase of ESG rating by 1 on stock returns companies in the Russell3000 during the time span of 2003 – 2018. It also shows how this effect changes over time, by means of an interaction effect. This interaction effect is input as a dummy variable. The regression has been done by means of double fixed effects and clustered standard errors. Standard errors are in brackets (* $p<0.10$ ** $p<0.05$ *** $p<0.01$). The R-squared is 0.2746. The adjusted R-squared is 0.2451.

In this regression, the effect of ESG on stock returns is significant at 5%, where with 95% probability, the true effect of an increase of 1 of the ESG score will lead to a decrease of stock returns between -0.00045% and -0.00002%. Compared to when Bush was in office, the effect of ESG ratings on stock returns when Obama was in office increased by 0.00014%. This effect, however, is insignificant. The true effect lies with 95% probability between -0.00006% and 0.00035%. When Trump was in office, the effect of ESG ratings on stock returns as compared to when Bush was in office increased by 0.00022%, significant at 10%. The real effect lies with 95% probability between -0.00002% to 0.00047%. An F-test was performed to see if the Obama period is significantly different from the Trump period. The two periods are not significantly different from each other. See the results from the F-test below. This indicates that the time trend of ESG ratings on stock returns follows a non-linear trend.

$$F(1, 2075) = 0.74$$
$$Prob > F = 0.3898$$

If a company is in the Obama period, an increase in ESG rating of 1 will result in a decrease of -0.0000694% of the stock returns. If a company is in the Trump period, an increase in ESG rating of 1 will result in an increase of 0.0000045% in stock returns. These are the net effects of ESG ratings in each time period.

Besides introducing the president-variable as a factor variable, it was also introduced as a continuous variable, by prefixing the $President_t$ variable with *c.* , which indicates to Stata that it should be used as a continuous instead of a factor (*i.*) variable. An increase of 1 of $President_t$ will mean that a new president has been elected and inaugurated. In Table 6, the results of this regression are shown.

TABLE 6: Regression results hypothesis 3, continuous variant

Variable	Results (1)
Independent variable	
$ESG_{i,t}$	-0.0002**
	(0.0001)
Interaction effect ($President_t$ x $ESG_{i,t}$)	0.0001*
	(0.00006)
Control variables	
Total assets turnover ($TAT_{i,t}$)	-0.0082
	(0.0053)
Total assets growth ($TAG_{i,t}$)	0.0505***
	(0.0046)
Total assets ($lTA_{i,t}$)	-0.0247***
	(0.0030)
Return on assets ($ROA_{i,t}$)	0.0020***
	(0.0002)
Financial Leverage ($FL_{i,t}$)	-0.0501***
	(0.0101)
Book-to-market ratio ($BTM_{i,t}$)	-0.0200***
	(0.0074)
Constant	0.4195***
	(0.0459)
Number of observations	54 947

Notes: This table reports the effect of an increase of ESG rating by 1 on stock returns companies in the Russell3000 during the time span of 2003 – 2018. It also shows how this effect changes over time, by means of an interaction effect. This interaction effect is introduced as a continuous variable. The regression has been done by means of double fixed effects and clustered standard errors. Standard errors are in brackets (* p<0.10 ** p<0.05 *** p<0.01). The R-squared is 0.2746. The adjusted R-squared is 0.2451.

This table indicates that, if an ESG rating increases by 1, the stock returns will decrease by 0.0002%, significant at 5%. The true effect of ESG ratings lies, with 95% probability, between -0.0004% and -0.00005%. The interaction effect has a coefficient of 0.0001, significant at 10%. Through time, the importance of ESG ratings has increased. Thus, ESG ratings will positively impact stock returns. The true effect of this lies with 95% probability between -0.00002% to 0.0002%.

For the final hypothesis, I performed multiple regressions. Equation (A4.1) was used. I analysed the effect that being in a specific industry has on stock returns and ESG ratings. As stated before, the industries I am analysing are the energy, agriculture, and insurance industry. I refer to Appendix A3 for the industry-specific regressions.

TABLE 7: Regression results hypothesis 4

Variable	Results (1)
Independent variable	
$ESG_{i,t}$	-0.00005
	(0.0001)
Interaction effect (*$Industry_t$* x *$ESG_{i,t}$*)	-0.0003*
	(0.0002)
Control variables	
Total assets turnover (*$TAT_{i,t}$*)	-0.0088*
	(0.0053)
Total assets growth (*$TAG_{i,t}$*)	0.0480***
	(0.0046)
Total assets (l*$TA_{i,t}$*)	-0.0250***
	(0.0030)
Return on assets (*$ROA_{i,t}$*)	0.0020***
	(0.0002)
Financial Leverage (*$FL_{i,t}$*)	-0.0496***
	(0.0102)
Book-to-market ratio (*$BTM_{i,t}$*)	-0.0197***
	(0.0074)
Constant	0.4254***
	(0.0465)
Number of observations	54 583

Notes: This table reports the effect of an increase of ESG rating by 1 on stock returns companies in the Russell3000 during the time span of 2003 – 2018. It also shows the interaction effect between ESG rating and being in a specific industry. The regression has been done by means of double fixed effects and clustered standard errors. Standard errors are in brackets (* p<0.10 ** p<0.05 *** p<0.01). The R-squared is 0.2740. The adjusted R-squared is 0.2443.

An increase in ESG rating of 1 results in a decrease in stock returns by -0.00005%. It is, however, insignificant. The interaction effect has a coefficient of -0.0003, which means that, if a firm is in either the agriculture, energy or insurance industry, the effect of an increase of 1 in ESG rating is amplified by -0.0003%. this is significant at 10%, where the true effect lies with 95% probability between -0.0006 and 0.00002. In these specific industries, an ESG rating has more effect than in the general Russell3000 sample.

Conclusion

In the following section, I will discuss the conclusions that can be drawn based on the regressions per hypothesis. Naturally, the first hypothesis is the first that will be discussed.

In the first hypothesis, the question of does having an ESG rating matters or not is analysed. As stated in the Results section, having an ESG rating increases the stock returns by 0.0073%, significant at 1%. If a company gets an ESG rating, it will have a higher stock return than it did before it had a rating. ESG ratings share information in an easy-to-interpret way. This could be the reason why having an ESG rating increases stock returns, as Amel-Zadeh and Serafeim (2018) found. The prediction I made stands correct. Getting an ESG rating results in a higher stock return. This follows existing literature.

For the second hypothesis, it is analysed if having a specific ESG rating matters. An increase in ESG rating of 1 decreases the stock returns by 0.0001%. This result, however, was insignificant, meaning it is not possible to draw any conclusions. When altering one thing in the control variables, precisely the decision to take the logarithm of total assets or not, changed the results of this regression drastically. When the total assets are logged, the ESG rating is insignificant. When it is not logged, it is significant. Then an increase in ESG ratings results in a decrease in stock returns of 0.0002%. This can be explained by the fact that to have a higher ESG rating, a firm needs to invest in its sustainability. They need to be inclusive, transparent, and good for society. This is money that is not invested in the highest NPV projects. Companies are ‘losing’ money by investing in ESG ratings. This could be an explanation for the negative coefficient. However, I chose to keep the total assets logged for ease of interpretation, to correct for non-normality, to deal with outliers, and for consistency throughout the paper. I cannot draw any conclusions on the effect of ESG ratings on stock returns, indicating that I was wrong. My hypothesis in which I predict that ESG ratings have a positive influence on stock returns is rejected, as we cannot say that there is an effect of the specific rating. This contrasts with some of the existing literature.

For the third hypothesis, a time trend was analysed. What was found was that through time, the importance of ESG ratings did indeed increase. When the president variable is introduced as a continuous variable, it was still significant, indicating an increase through time. This increase does seem to flatten out after a certain time, meaning that the time trend is not linear. There was no significant difference between the period Obama and period Trump. My prediction was correct. Through time, there is an increase in the importance of ESG ratings for stock returns, which is in line with existing literature regarding awareness of climate change.

In the final hypothesis, specific industries are analysed. The industries that were identified as high-risk regarding sustainability and climate change did indeed see a bigger effect of ESG ratings that the general Russell3000 sample. If a firm is in either the energy, insurance, or agricultural industry, it sees that it is more affected by ESG ratings than comparable firms that are not in one of those industries. Hypothesis four regarding the industries stands correct.

Discussion

The originality of this paper can be found in two aspects. First, it studies a longer timespan than any paper on ESG ratings I was able to find. I study a sample that runs from 2003 until 2018. This can show the long-term benefits of ESG ratings. The second aspect is the research on receiving an ESG rating. I have not been able to find a paper that studies the exact consequence of receiving an ESG rating. However, being original is not all that matters. Having a sense of shortcomings is important as well.

This paper has its shortcomings. First, there is subjectivity in deciding on the specific industries, especially in the creation of the agriculture industry. This can introduce a serious bias. Another shortcoming is the strange results that follow from logging control variable total assets. Logging or not logging the control variable results in a different outcome regarding significance and coefficient per hypothesis. This indicates that something is wrong with the dataset, as nothing in the real world changes, thus nothing in the results should change. Furthermore, this paper uses a quite basic definition of stock returns. One could improve on this by using a more complex definition for stock returns, which could for example take dividends into account.

I have suggestions for future research. What I have found is that an increase in ESG score results in a decrease in stock returns. The relationship between ESG ratings and stock returns may be nonlinear. Perhaps in the segment ESG score 0 – 20 there is a positive relationship, but in the segment 80 – 100, there is a negative relationship. One could study what the ‘optimal’ ESG score is. One could also delve more into the time trend. As I have found, the relationship is nonlinear. One could study what the real relationship is. Perhaps the time trend is a logarithmic trend or a root trend.

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Appendix

Appendix A1: Regressions

Hypothesis 1:

$$lnreturn_{i,t} = \alpha_i + \beta_1 RatedDummy_{i,t} + \beta_2 TAT_{i,t} + \beta_3 TAG_{i,t} + \beta_4 \ln(TA)_{i,t} + \beta_5 ROA_{i,t} + \beta_6 FL_{i,t} + \beta_7 BTM_{i,t} + \delta_2 Q2_t + \ldots + \delta_T QT_t + \varepsilon_i \quad \text{(A1.1)}$$

Intuitive interpretation:

$$lnreturn_{i,t} = \beta_1 RatedDummy_{i,t} + Controls_{i,t} + FirmFixedEffects + TimeFixedEffects + \varepsilon_i \quad \text{(A1.2)}$$

Hypothesis 2:

$$lnreturn_{i,t} = \alpha_i + \beta_1 ESG_{i,t} + \beta_2 TAT_{i,t} + \beta_3 TAG_{i,t} + \beta_4 \ln(TA)_{i,t} + \beta_5 ROA_{i,t} + \beta_6 FL_{i,t} + \beta_7 BTM_{i,t} + \delta_2 Q2_t + \ldots + \delta_T QT_t + \varepsilon_i \quad \text{(A2.1)}$$

Intuitive interpretation:

$$lnreturn_{i,t} = \beta_1 ESG_{i,t} + Controls_{i,t} + FirmFixedEffects + TimeFixedEffects + \varepsilon_i \quad \text{(A2.2)}$$

Hypothesis 3:

$$lnreturn_{i,t} = \alpha_i + \beta_1 ESG_{i,t} + \beta_2 ESG_{i,t} President_t + \beta_3 TAT_{i,t} + \beta_4 TAG_{i,t} + \beta_5 \ln(TA)_{i,t} + \beta_6 ROA_{i,t} + \beta_7 FL_{i,t} + \beta_8 BTM_{i,t} + \delta_2 Q2_t + \ldots + \delta_T QT_t + \varepsilon_i \quad \text{(A3.1)}$$

Intuitive interpretation:

$$lnreturn_{i,t} = \beta_1 ESG_{i,t} + \beta_2 ESG_{i,t} President_t + Controls_{i,t} + FirmFixedEffects + TimeFixedEffects + \varepsilon_i \quad \text{(A3.2)}$$

Hypothesis 4:

$$lnreturn_{i,t} = \alpha_i + \beta_1 ESG_{i,t} + \beta_2 ESG_{i,t} Industry_{i,t} + \beta_3 TAT_{i,t} + \beta_4 TAG_{i,t} + \beta_5 \ln(TA)_{i,t} + \beta_6 ROA_{i,t} + \beta_7 FL_{i,t} + \beta_8 BTM_{i,t} + \delta_2 Q2_t + \ldots + \delta_T QT_t + \varepsilon_i \tag{A4.1}$$

With $Industry_{i,t}$ being a combination or one of the following industries:

- Energy
  - TRBC codes 5010 & 5020
- Insurance
  - TRBC code 5530
- Agriculture
  - TRBC codes 54102010 & 54102020

Intuitive interpretation:

$$lnreturn_{i,t} = \beta_1 ESG_{i,t} + \beta_2 ESG_{i,t} Industry_{i,t} + Controls_{i,t} + FirmFixedEffects + TimeFixedEffects + \varepsilon_i \tag{A4.2}$$

Appendix A2: Descriptive statistics per industry

TABLE A1: Descriptive statistics for risky industries

Variable		Mean	Standard Deviation	Min	Max	Observations	
Firm ID	Overall	1202.985	809.292	1	2714	N =	13506
	Between		841.372	1	2714	n =	241
	Within		0	1202.985	1202.985	T-bar =	56.042
lnreturn	Overall	0.014	0.218	-2.593	2.536	N =	13278
	Between		0.030	-0.191	0.106	n =	241
	Within		0.216	-2.441	2.510	T-bar =	55.095
ESG	Overall	38.825	17.949	4.39	91.88	N =	7460
	Between		14.309	7.745	72.082	n =	230
	Within		10.254	-13.197	71.734	T-bar =	32.435
TAT	Overall	0.763	1.054	-0.04	19.91	N =	13506
	Between		1.004	0.026	8.472	n =	241
	Within		0.361	-3.259	12.201	T-bar =	56.042
TAG	Overall	0.089	0.291	-3.091	7.240	N =	12860
	Between		0.121	-0.235	1.096	n =	241
	Within		0.269	-4.098	6.233	T-bar =	53.361
lTA	Overall	15.005	1.961	0	20.621	N =	13506
	Between		1.855	10.190	20.267	n =	241
	Within		0.549	4.815	18.050	T-bar =	56.042
ROA	Overall	3.349	9.995	-74.49	31.35	N =	13506
	Between		6.232	-40.435	26.407	n =	241
	Within		7.932	-68.915	50.138	T-bar =	56.042
FL	Overall	0.210	0.718	0	57	N =	13506
	Between		0.237	0	2.675	n =	241
	Within		0.684	-2.465	54.535	T-bar =	56.042
BTM	Overall	0.596	7.849	-451.214	16.171	N =	13506
	Between		5.525	-84.533	3.916	n =	241
	Within		7.071	-366.084	89.411	T-bar =	56.042

TABLE A2: Descriptive statistics for the energy industry

Variable		Mean	Standard Deviation	Min	Max	Observations	
Firm ID	Overall	1264.103	834.998	1	2714	N =	6028
	Between		832.602	1	2714	n =	113
	Within		0	1264.103	1264.103	T-bar =	53.345
lnreturn	Overall	0.008	0.262	-2.593	2.536	N =	5922
	Between		0.039	-0.191	0.086	n =	113
	Within		0.260	-2.447	2.503	T-bar =	52.407
ESG	Overall	34.002	17.740	6.01	84.41	N =	3289
	Between		13.848	7.745	68.427	n =	104
	Within		9.696	-12.037	66.910	T-bar =	31.635
TAT	Overall	0.805	1.358	0	19.91	N =	6028
	Between		1.271	0.026	8.472	n =	113
	Within		0.489	-3.217	12.243	T-bar =	53.345
TAG	Overall	0.122	0.382	-3.091	7.240	N =	5756
	Between		0.154	-0.235	1.096	n =	113
	Within		0.355	-4.065	6.266	T-bar =	50.938
lTA	Overall	14.607	1.860	0	18.996	N =	6028
	Between		1.707	10.190	18.558	n =	113
	Within		0.678	4.418	17.652	T-bar =	53.345
ROA	Overall	2.319	13.381	-74.49	31.35	N =	6028
	Between		7.715	-40.435	12.06	n =	113
	Within		11.005	-70.241	48.812	T-bar =	53.345
FL	Overall	0.295	1.056	0	57	N =	6028
	Between		0.285	0	2.675	n =	113
	Within		1.022	-2.380	54.620	T-bar =	53.345
BTM	Overall	0.406	11.725	-451.214	16.171	N =	6028
	Between		8.052	-84.533	3.110	n =	113
	Within		10.573	-366.275	89.221	T-bar =	53.345

TABLE A3: Descriptive statistics for the agriculture industry

Variable		Mean	Standard Deviation	Min	Max	Observations	
Firm ID	Overall	1282.376	739.206	13	2522	N =	2739
	Between		745.384	13	2522	n =	46
	Within		0	1282.376	1282.376	T-bar =	59.544
lnreturn	Overall	0.022	0.169	-0.790	1.603	N =	2695
	Between		0.017	-0.016	0.068	n =	46
	Within		0.169	-0.0836	1.566	T-bar =	58.587
ESG	Overall	48.357	23.437	4.39	91.88	N =	1292
	Between		18.425	9.315	72.082	n =	45
	Within		15.512	-3.665	78.734	T-bar =	28.711
TAT	Overall	1.422	0.712	0.19	4.45	N =	2739
	Between		0.660	0.353	2.936	n =	46
	Within		0.318	0.293	2.935	T-bar =	59.544
TAG	Overall	0.075	0.176	-0.715	1.201	N =	2591
	Between		0.063	-0.080	0.227	n =	46
	Within		0.165	-0.560	1.055	T-bar =	56.326
lTA	Overall	14.179	1.668	9.785	18.372	N =	2739
	Between		1.600	10.678	18.018	n =	46
	Within		0.475	12.383	15.768	T-bar =	59.544
ROA	Overall	8.062	6.924	-21.17	31.35	N =	2739
	Between		4.968	-0.503	26.407	n =	46
	Within		4.891	-17.475	39.914	T-bar =	59.544
FL	Overall	0.252	0.170	0	0.880	N =	2739
	Between		0.150	0.001	0.598	n =	46
	Within		0.088	-0.088	0.706	T-bar =	59.544
BTM	Overall	0.471	0.336	-0.096	2.893	N =	2739
	Between		0.264	-0.056	1.216	n =	46
	Within		0.209	-0.339	2.304	T-bar =	59.544

TABLE A4: Descriptive statistics for the insurance industry

Variable		Mean	Standard Deviation	Min	Max	Observations	
Firm ID	Overall	1079.357	800.310	3	2569	N =	4739
	Between		813.326	3	2569	n =	82
	Within		0	1079.357	1079.357	T-bar =	57.793
lnreturn	Overall	0.017	0.177	-1.826	1.702	N =	4661
	Between		0.018	-0.030	0.106	n =	82
	Within		0.176	-0.800	1.684	T-bar =	56.842
ESG	Overall	40.058	12.634	5	83.24	N =	2879
	Between		10.037	16.95	69.576	n =	81
	Within		7.561	-0.499	61.333	T-bar =	35.543
TAT	Overall	0.329	0.292	-0.04	2.17	N =	4739
	Between		0.278	0.029	1.516	n =	82
	Within		0.089	-0.250	1.102	T-bar =	57.793
TAG	Overall	0.055	0.186	-2.562	1.721	N =	4513
	Between		0.071	-0.112	0.278	n =	82
	Within		0.174	-2.478	1.783	T-bar =	55.037
lTA	Overall	15.988	1.843	9.151	20.621	N =	4739
	Between		1.830	11.033	20.267	n =	82
	Within		0.379	14.018	17.475	T-bar =	57.793
ROA	Overall	2.779	3.880	-25.78	26.04	N =	4739
	Between		1.993	-1.580	8.618	n =	82
	Within		3.384	-23.633	28.187	T-bar =	57.793
FL	Overall	0.077	0.095	0	0.725	N =	4739
	Between		0.094	0	0.595	n =	82
	Within		0.041	-0.111	0.482	T-bar =	57.793
BTM	Overall	0.911	0.716	0.059	10.579	N =	4739
	Between		0.480	0.263	3.916	n =	82
	Within		0.538	-2.293	7.574	T-bar =	57.793

Appendix A3: Regression results per industry

TABLE A5: Regression results for the energy industry

Variable	Results (1)
Independent variable	
$ESG_{i,t}$	-0.0001 (0.0001)
Interaction effect (*$Industry_t$* x *$ESG_{i,t}$*)	-0.0008*** (0.0003)
Control variables	
Total assets turnover (*$TAT_{i,t}$*)	-0.0085 (0.0053)
Total assets growth (*$TAG_{i,t}$*)	0.0504*** (0.0046)
Total assets (l*$TA_{i,t}$*)	-0.0247*** (0.0030)
Return on assets (*$ROA_{i,t}$*)	0.0020*** (0.0002)
Financial Leverage (*$FL_{i,t}$*)	-0.0498*** (0.0101)
Book-to-market ratio (*$BTM_{i,t}$*)	-0.0200*** (0.0074)
Constant	0.4213*** (0.0453)
Number of observations	54 947

Notes: This table reports the effect of an increase of ESG rating by 1 on stock returns companies in the Russell3000 industry during the time span of 2003 – 2018. It also shows the interaction effect between ESG rating and being in the energy industry. The regression was performed by means of double fixed effects and clustered standard errors. Standard errors are in brackets (* p<0.10 ** p<0.05 *** p<0.01). The R-squared is 0.2746. The adjusted R-squared is 0.2452.

TABLE A6: Regression results for the insurance industry

Variable	Results (1)
Independent variable	
$ESG_{i,t}$	-0.0001
	(0.00008)
Interaction effect ($Industry_t$ x $ESG_{i,t}$)	-0.0002
	(0.0002)
Control variables	
Total assets turnover ($TAT_{i,t}$)	-0.0084
	(0.0053)
Total assets growth ($TAG_{i,t}$)	0.0507***
	(0.0046)
Total assets ($lTA_{i,t}$)	-0.0248***
	(0.0030)
Return on assets ($ROA_{i,t}$)	0.0020***
	(0.0002)
Financial Leverage ($FL_{i,t}$)	-0.0501***
	(0.0101)
Book-to-market ratio ($BTM_{i,t}$)	-0.0200***
	(0.0074)
Constant	0.4226***
	(0.0460)
Number of observations	54 947

Notes: This table reports the effect of an increase of ESG rating by 1 on stock returns companies in the Russell3000 industry during the time span of 2003 – 2018. It also shows the interaction effect between ESG rating and being in the insurance industry. The regression was performed by means of double fixed effects and clustered standard errors. Standard errors are in brackets (* p<0.10 ** p<0.05 *** p<0.01). The R-squared is 0.2745. The adjusted R-squared is 0.2451.

TABLE A7: regression results for the agriculture industry

Variable	Results (1)
Independent variable	
$ESG_{i,t}$	-0.0001
	(0.00008)
Interaction effect (*Industry*$_t$ x $ESG_{i,t}$)	-0.0001
	(0.0002)
Control variables	
Total assets turnover ($TAT_{i,t}$)	-0.0082
	(0.0053)
Total assets growth ($TAG_{i,t}$)	0.0507***
	(0.0046)
Total assets ($lTA_{i,t}$)	-0.0249***
	(0.0030)
Return on assets ($ROA_{i,t}$)	0.0020***
	(0.0002)
Financial Leverage ($FL_{i,t}$)	-0.0502***
	(0.0101)
Book-to-market ratio ($BTM_{i,t}$)	-0.0200***
	(0.0074)
Constant	0.4237***
	(0.0459)
Number of observations	54 947

Notes: This table reports the effect of an increase of ESG rating by 1 on stock returns companies in the Russell3000 industry during the time span of 2003 – 2018. It also shows the interaction effect between ESG rating and being in the agriculture industry. The regression was performed by means of double fixed effects and clustered standard errors. Standard errors are in brackets (* p<0.10 ** p<0.05 *** p<0.01). The R-squared is 0.2645. The adjusted R-squared is 0.2451.

Regarding Table A7, the agriculture industry includes fishing and farming as well as food processing. Excluding Food processing results in a significant interaction effect, which is show in Table A8.

TABLE A8: regression results for the agriculture industry, excluding the food processing industry

Variable	Results (1)
Independent variable	
$ESG_{i,t}$	-0.0001
	(0.00008)
Interaction effect ($Industry_t$ x $ESG_{i,t}$)	-0.0123***
	(0.0012)
Control variables	
Total assets turnover ($TAT_{i,t}$)	-0.0083
	(0.0053)
Total assets growth ($TAG_{i,t}$)	0.0507***
	(0.0046)
Total assets ($lTA_{i,t}$)	-0.0249***
	(0.0030)
Return on assets ($ROA_{i,t}$)	0.0020***
	(0.0002)
Financial Leverage ($FL_{i,t}$)	-0.0502***
	(0.0101)
Book-to-market ratio ($BTM_{i,t}$)	-0.0200***
	(0.0074)
Constant	0.4237***
	(0.0459)
Number of observations	54 947

Notes: This table reports the effect of an increase of ESG rating by 1 on stock returns companies in the Russell3000 industry during the time span of 2003 – 2018. It also shows the interaction effect between ESG rating and being in the fishing and farming industry. The regression was performed by means of double fixed effects and clustered standard errors. Standard errors are in brackets (* p<0.10 ** p<0.05 *** p<0.01). The R-squared is 0.2645. The adjusted R-squared is 0.2451.