SCHOOL OF BUSINESS ADMINISTRATION
DEPARTMENT OF ACCOUNTING AND FINANCE
POSTGRADUATE PROGRAM IN ACCOUNTING AND FINANCE

DO LEADING ESG EQUITY PORTFOLIOS OUTPERFORM PEERS AND BENCHMARK? AN EMPIRICAL ANALYSIS ON PORTFOLIOS CONSTRUCTED BY CONSTITUENTS OF THE S&P 500 INDEX.

Master Thesis

by

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1.Introduction

Purpose :

- Examine whether ESG based investing could lead to superior financial performance, thus, rewarding socially conscious investors.

- Investigate if the ESG portfolios could generate abnormal returns.

Extends the empirical research by:

- Analyzing the relationship between ESG ratings and equity portfolios on a more recent time period that involved a financial crisis that emerged from the exogenous COVID-19 pandemic.

- Deriving conclusions regarding a portfolio comprised of firms without exhibiting an ESG rating.

1.Introduction

Questions :

1. Do "ESG leading equity portfolios" generate higher returns compared to the rest of the portfolios and the benchmark?

2. Do "ESG leading equity portfolios" tend to exhibit lower volatility compared to the rest of the portfolios and the benchmark?

3. Do "ESG leading equity portfolios" exhibit higher risk-adjusted returns than the rest of the portfolios and the benchmark?

4. How did the ESG portfolios perform prior, during and post the COVID-19 crisis?

5. Did the "ESG leading equity portfolios" or any of their counterparts manage to generate abnormal returns or their returns could be explained by well-known common factors?

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2.Sustainable Investing

It does not have a consistent definition since it has multiple dimensions:

- Socially responsible investing (SRI) positions ethical guidelines alongside financial goals. The motives vary to personal values, political beliefs or religion.

- Impact investing refers to investments made into firms and funds with the purpose to yield positive, quantifiable, environmental and social impact alongside a financial return.

- ESG Investing incorporates environmental, social and governance factors which are non-financial information into the fundamental investment approach and regards that these factors have an essential impact on a firm's success, valuation and market returns.
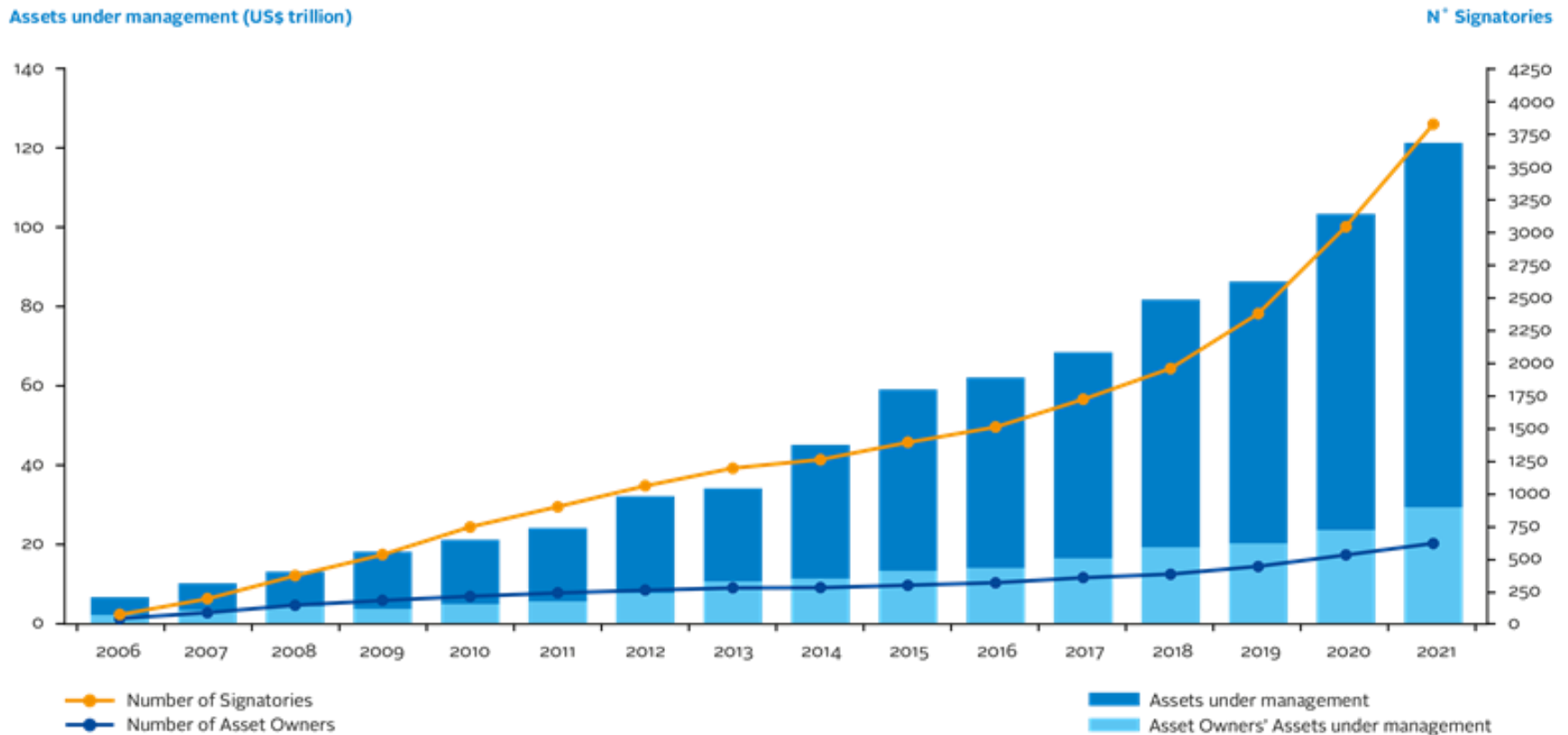
2.Sustainable Investing

Figure 1: UN PRI number of signatories and assets under management (Source: About the PRI)

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3.ESG Factors

Environmental, Social and Governance factors involve a set of criteria that socially conscious asset owners utilize in order to screen potential investments.

- Environmental emphasizes how a company operates as a steward for our planet (i.e. climate change, waste pollution, etc.).

- Social focuses on the connection between the company and its workforce, customers, suppliers and the community where it operates (i.e. human rights, working conditions, etc.).

- Governance refers to a system of rules, practices and procedures by which a company is managed and controlled (i.e. internal controls, executive compensation, etc.).

3.ESG Factors

Figure 2: Example of ESG criteria (Source: Sustainable Investing Basics)

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4.Literature Review

ESG investing is confused with SRI and Corporate Social Responsibility (CSR) and often refer to the same term.

➢ Equity returns and the E, S and G dimension (Derwall et al., 2005; Edmans, 2011; Derwall et al., 2011; Gompers et al., 2003)

➢ Equity returns and the overall ESG:

• <u>Neutral impact</u> (Auer and Schuhmacher, 2016; Breedt et al., 2019; Hsu et al., 2018)

• <u>Positive impact</u> (Friede et al., 2015; Nagy et al., 2016; Kempf and Osthoff, 2007)

• <u>Negative impact</u> (Hong and Kacperczyk, 2009; Das et al., 2018; Renneboog et al., 2008)

ESG equities during COVID-19 (Borovkova and Wu, 2020; Broadstock et al., 2021)

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5.Criticism on ESG Investing

- With the incorporation of constraints such as negative screening the investment universe is limited and leads to an inefficient and suboptimal portfolio.

- In an efficient market, where all investors have access to all newly available information like ESG ratings, such information is immediately priced into the stock market.

- The empirical studies do not differentiate between correlation and causality.

6.Data and Methodology

- The firms that were used were the constituents of the S&P 500 index at the start of August 2021.

- Python code was developed to extract the ESG data from the public "*ESG Ratings Corporate Search Tool*" by MSCI.

- The sample period ranged from 30/06/2017 to 30/06/2021.

- Closing stock prices were taken from Google Sheets using the GOOGLEFINANCE function.

- Dividends and transaction costs were not taken into account.

- The risk-free rate (Rf) and the values for MKTRF, SMB and HML were derived from Kenneth R. French data library.

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6.Data and Methodology

- For the portfolios construction, each July the firms were ranked according to their ESG rating starting in July 2017.

- The implemented strategy was "buy and hold".

- Overall eight long-only, annually rebalanced, equal-weighted portfolios were constructed.

- A "Non-ESG" portfolio was constructed to include stocks with missing ESG data as in Hsu et al. (2018).

- A nominal capital of $100.000 was equally allocated to the constituted stocks of each of the eight portfolios.

- As a benchmark the S&P 500 Equal Weight Index (S&P 500 EWI) was used.

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6.Data and Methodology

Table 1 : Number of constituents in every portfolio					
	1 Year	2 Year	3 Year	4 Year	Mean
Total Sample	491	491	496	498	494
Portfolio 7 (AAA)	9	13	16	18	14
Portfolio 6 (AA)	36	55	63	77	58
Portfolio 5 (A)	59	95	102	106	91
Portfolio 4 (BBB)	103	121	132	135	123
Portfolio 3 (BB)	68	100	100	95	91
Portfolio 2 (B)	45	51	39	28	41
Portfolio 1 (CCC)	10	14	13	8	11
Portfolio 0 (NON-ESG)	161	42	31	31	66
With ESG Rating	330	449	465	467	428

Note: The last row refers to the number of firms that exhibited an ESG rating. The first year spans from 30/06/2017 to 29/06/2018. The second year refers to 29/06/2018 until 28/06/2019 while the third year ranges from 28/06/2019 to 30/06/2020. Finally, the last year spans from 30/06/2020 until 30/06/2021.

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6.Data and Methodology

Sub-periods Prior, During and Post COVID-19 :

- According to the National Bureau of Economic Research, the recession that emerged from COVID-19 pandemic lasted two months in the US, starting from February 2020 and ending in March 2020. That period corresponds to the "COVID-19" sub-period.

- End of June 2017 until the end of January 2020 corresponds to the "pro-COVID-19" period.

- The "post-COVID-19" period ranged from the end of April 2020 until June 2021 - the end of the sample.

- The portfolios were ranked during the three different sub-periods by their cumulative returns.

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6.Data and Methodology

If the ESG portfolios generated abnormal returns and which factors explained their performance was examined with Capital Asset Pricing Model and Fama-French Three Factor Model.

Capital Asset Pricing Model (CAPM)

$$R_{it} - R_{ft} = \alpha_i + \beta_i MKTRF_t + \varepsilon_{it} \ (1)$$

Where:

- R_{it}-R_{ft} = is the monthly excess return of portfolio i over the risk-free rate at time t

- $MKTRF_t$ = is the monthly excess return of the market portfolio over the risk-free rate at time t

- ε_{it} = error term of portfolio i at time t

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6.Data and Methodology

Fama-French Three Factor Model (FF3FM)

$$R_{it} - R_{ft} = \alpha_i + \beta_{i1}MKTRF_t + \beta_{i2}SMB_t + \beta_{i3}HML_t + \varepsilon_{it} \quad (2)$$

Where:

- R_{it}-R_{ft} = is the monthly excess return of portfolio i over the risk-free rate at time t

- $MKTRF_t$ = is the monthly excess return of the market portfolio over the risk-free rate at time t

- SMB_t = is the monthly excess return of small-cap portfolio over large-cap portfolio at time t

- HML_t = is the monthly excess return of a value portfolio over a growth portfolio at time t

- ε_{it} = error term of portfolio i at time t

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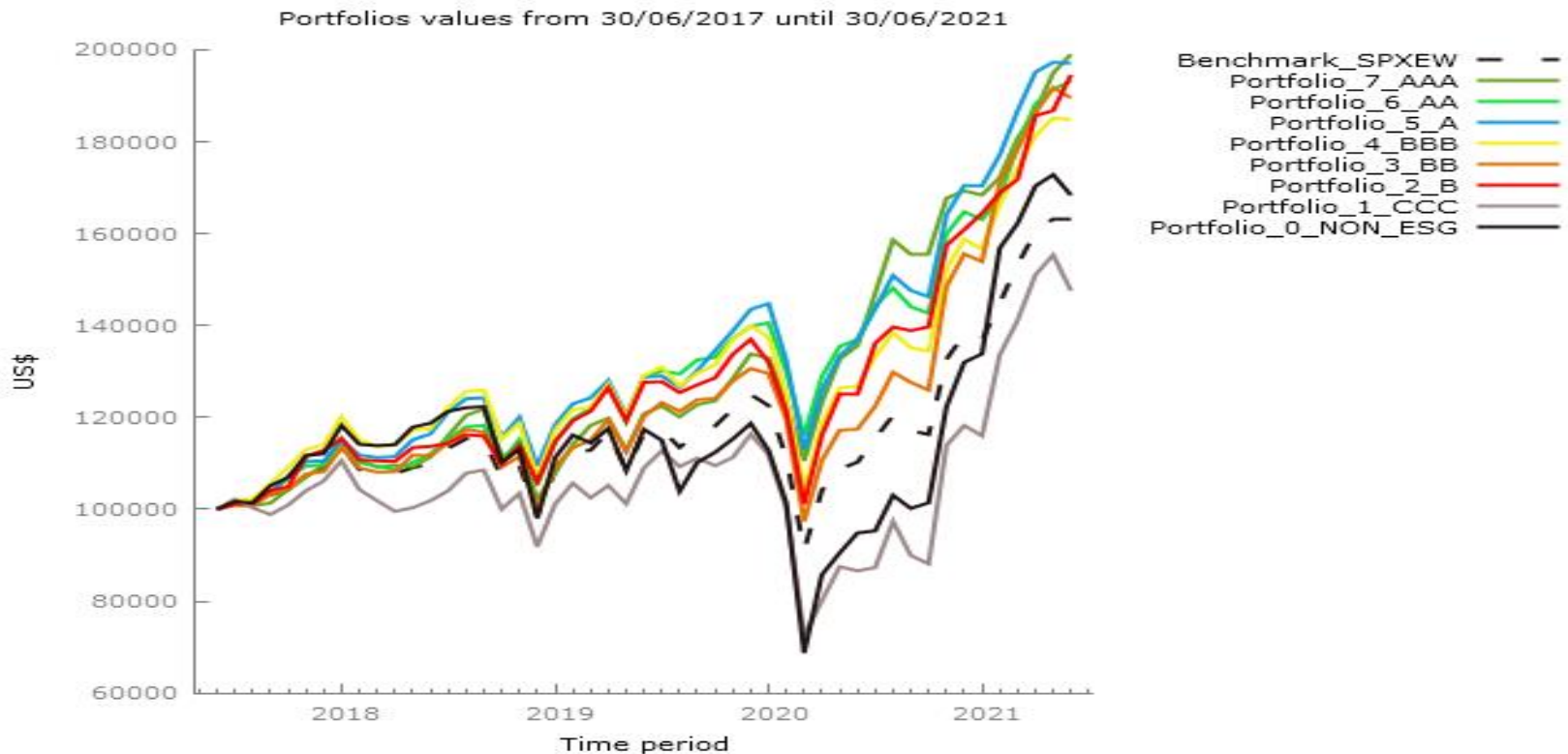ΠΑΝΕΠΙΣΤΗΜΙΟ
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7.Empirical Results

Figure 3: Evolution of $100.000 invested in each portfolio (Source: Own contribution)

7.Empirical Results

Table 2: Portfolio annual returns from 30/06/2017 until 30/06/2021					
Annual Return	1 Year	2 Year	3 Year	4 Year	Overall Period
Benchmark	9,89%	5,99%	-5,34%	47,99%	13,02%
Portfolio 7 (AAA)	11,35%	8,46%	**12,28%**	46,76%	**18,77%**
Portfolio 6 (AA)	12,06%	**14,85%**	6,43%	**41,03%**	17,89%
Portfolio 5 (A)	16,41%	10,60%	6,30%	44,01%	18,49%
Portfolio 4 (BBB)	17,52%	9,83%	-1,80%	45,82%	16,60%
Portfolio 3 (BB)	11,61%	7,67%	-2,31%	61,44%	17,33%
Portfolio 2 (B)	13,67%	12,28%	-2,05%	55,61%	18,10%
Portfolio 1 (CCC)	**1,86%**	6,99%	**-20,55%**	70,42%	**10,21%**
Portfolio 0 (NON-ESG)	**18,72%**	**-1,12%**	-19,22%	**77,52%**	13,91%

Note: The bolded returns represent the best and the worst return for each year.

7.Empirical Results

Table 3: Portfolio annualized volatility from 30/06/2017 until 30/06/2021					
Annualized Volatility	1 Year	2 Year	3 Year	4 Year	Overall Period
Benchmark	7,83%	19,74%	26,14%	14,74%	18,96%
Portfolio 7 (AAA)	7,96%	18,84%	19,68%	**11,54%**	15,72%
Portfolio 6 (AA)	7,25%	18,71%	**18,43%**	13,35%	**15,48%**
Portfolio 5 (A)	**6,77%**	18,09%	22,55%	12,91%	16,52%
Portfolio 4 (BBB)	8,50%	20,10%	25,67%	14,03%	18,68%
Portfolio 3 (BB)	7,54%	19,05%	25,55%	19,02%	19,73%
Portfolio 2 (B)	8,09%	**16,36%**	25,72%	13,23%	17,76%
Portfolio 1 (CCC)	**9,53%**	20,61%	33,44%	**33,48%**	27,47%
Portfolio 0 (NON-ESG)	8,20%	**25,04%**	**44,44%**	24,29%	**29,60%**

Note: The bolded annualized volatilities signify the best and the worst volatilities for each year. The lower the better.

7.Empirical Results

Table 4: Portfolio Sharpe ratios	
	Overall Period
Benchmark	0,72
Portfolio 7 (AAA)	**1,19**
Portfolio 6 (AA)	1,15
Portfolio 5 (A)	1,13
Portfolio 4 (BBB)	0,92
Portfolio 3 (BB)	0,92
Portfolio 2 (B)	1,04
Portfolio 1 (CCC)	**0,48**
Portfolio 0 (NON-ESG)	0,60

Note: The table presents the Sharpe ratios of the portfolios for the period 30/06/2017 to 30/06/2021. The highest and lowest Sharpe ratios are marked in bold.

7.Empirical Results

Table 5: Portfolio ranking by the Sharpe ratio, geometric mean return and annualized volatility					
	Sharpe Ratio		Geometric Mean Return		Annualized Volatility
Portfolio 7 (AAA)	1,19	Portfolio 7 (AAA)	18,77%	Portfolio 6 (AA)	15,48%
Portfolio 6 (AA)	1,15	Portfolio 5 (A)	18,49%	Portfolio 7 (AAA)	15,72%
Portfolio 5 (A)	1,13	Portfolio 2 (B)	18,10%	Portfolio 5 (A)	16,52%
Portfolio 2 (B)	1,04	Portfolio 6 (AA)	17,89%	Portfolio 2 (B)	17,76%
Portfolio 4 (BBB)	0,92	Portfolio 3 (BB)	17,33%	Portfolio 4 (BBB)	18,68%
Portfolio 3 (BB)	0,92	Portfolio 4 (BBB)	16,60%	Benchmark	18,96%
Benchmark	0,72	Portfolio 0 (NON-ESG)	13,91%	Portfolio 3 (BB)	19,73%
Portfolio 0 (NON-ESG)	0,60	Benchmark	13,02%	Portfolio 1 (CCC)	27,47%
Portfolio 1 (CCC)	0,48	Portfolio 1 (CCC)	10,21%	Portfolio 0 (NON-ESG)	29,60%

Note: In this table, the portfolios are ranked from the best to the worst in terms of their Sharpe ratio, geometric mean return and annualized volatility that exhibited for the period from 30/06/2017 until 30/06/2021.

7.Empirical Results

Table 6: Portfolio ranking during three sub-periods by cumulative returns					
	pro-COVID-19		COVID-19		post-COVID-19
Portfolio 5 (A)	44,77%	Portfolio 7 (AAA)	-16,88%	Portfolio 0 (NON-ESG)	144,96%
Portfolio 6 (AA)	40,58%	Portfolio 6 (AA)	-17,52%	Portfolio 1 (CCC)	103,68%
Portfolio 4 (BBB)	37,46%	Portfolio 5 (A)	-22,10%	Portfolio 3 (BB)	94,66%
Portfolio 7 (AAA)	32,93%	Portfolio 2 (B)	-23,33%	Portfolio 2 (B)	92,31%
Portfolio 2 (B)	31,94%	Portfolio 4 (BBB)	-24,45%	Portfolio 7 (AAA)	80,09%
Portfolio 3 (BB)	29,55%	Portfolio 3 (BB)	-24,85%	Benchmark	79,15%
Benchmark	22,56%	Benchmark	-25,69%	Portfolio 4 (BBB)	77,98%
Portfolio 0 (NON-ESG)	12,83%	Portfolio 1 (CCC)	-35,25%	Portfolio 5 (A)	74,78%
Portfolio 1 (CCC)	11,87%	Portfolio 0 (NON-ESG)	-39,09%	Portfolio 6 (AA)	66,60%

Note: The pro-COVID-19 period spans from 30/06/2017 until 31/01/2020, thus, 31 return observations. The crisis period starts from 31/01/2020 and ends on 31/03/2020 with 2 return observations. Finally, the post-COVID-19 period ranges from 31/03/2020 until the end of the observation sample, 30/06/2021, resulting in 15 return observations.

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7.Empirical Results

Table 7: Capital Asset Pricing Model regression results from 30/06/2017 until 30/06/2021								
CAPM	Portfolio 7 AAA	Portfolio 6 AA	Portfolio 5 A	Portfolio 4 BBB	Portfolio 3 BB	Portfolio 2 B	Portfolio 1 CCC	Portfolio 0 NON-ESG
Alpha	0,002078	0,001304	0,000846	-0,001887	-0,001550	0,000385	-0,009578	-0,008564
	(0,002462)	(0,001927)	(0,001642)	(0,001995)	(0,002989)	(0,002906)	(0,006162)	(0,005791)
MKTRF	**0,856607*****	**0,864031*****	**0,936085*****	**1,053493*****	**1,077734*****	**0,960471*****	**1,375631*****	**1,542651*****
	(0,047403)	(0,037103)	(0,031614)	(0,038422)	(0,057559)	(0,055951)	(0,118656)	(0,111512)
Adjusted R squared	0,873842	0,920108	0,949064	0,941088	0,881490	0,862039	0,739480	0,802002

Note: Displayed in parenthesis is the standard error of the coefficient. Bold coefficients are significant. Significance levels are presented as follows: * Significant at a 10% level, ** Significant at a 5% level, *** Significant at a 1% level.

7.Empirical Results

Table 8: Fama-French Three Factor Model regression results from 30/06/2017 until 30/06/2021								
FF3FM	Portfolio 7 AAA	Portfolio 6 AA	Portfolio 5 A	Portfolio 4 BBB	Portfolio 3 BB	Portfolio 2 B	Portfolio 1 CCC	Portfolio 0 NON-ESG
Alpha	0,002247	0,002275	**0,002469***	0,000456	0,001698	0,001716	-0,003679	-0,001581
	(0,002515)	(0,001905)	(0,001454)	(0,001603)	(0,002494)	(0,002917)	(0,005521)	(0,004013)
MKTRF	**0,882110***	**0,864939***	**0,901862***	**1,00312***	**0,997176***	**0,910096***	**1,24595***	**1,31547***
	(0,051049)	(0,038664)	(0,029506)	(0,032526)	(0,050611)	(0,059213)	(0,112063)	(0,081454)
SMB	**-0,159226***	-0,104173	0,024786	0,04133	0,116888	0,144544	0,119652	**0,551848***
	(0,090263)	(0,068365)	(0,052171)	(0,057513)	(0,089489)	(0,1047)	(0,198148)	(0,144027)
HML	0,032866	**0,105028****	**0,155048***	**0,22313***	**0,303245***	0,114288	**0,560391***	**0,620879***
	(0,063384)	(0,048007)	(0,036635)	(0,040386)	(0,062840)	(0,073521)	(0,139142)	(0,101137)
Adjusted R squared	0,877079	0,927113	0,962724	0,964529	0,923020	0,870185	0,804770	0,911243

Note: Displayed in parenthesis is the standard error of the coefficient. Bold coefficients are significant. Significance levels are presented as follows: * Significant at a 10% level, ** Significant at a 5% level, *** Significant at a 1% level.

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8.Discussion

- The majority of the ESG portfolios outperformed the benchmark both on absolute returns and when adjusted for risk (similar with Nagy et al., 2016; in contrast with Auer and Schuhmacher, 2016).

- The Non-ESG portfolio displayed lower returns both absolute and risk-adjusted compared to the jointly ESG categories. Moreover, it had significantly higher volatility and sensitivity to the systematic risk. Lastly, it tilted to small capitalization and value stocks.

- Throughout the "COVID-19" period the high ESG portfolios were more resilient to the crisis but in the aftermath, they grew at a smaller pace than the rest of the portfolios (similar with Borovkova and Wu, 2020; consistent with Das et al., 2018).

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8.Discussion

Answers to the early questions :

1,2,3. The high ESG portfolios exhibited higher absolute and risk-adjusted returns and lower volatility than the rest of the portfolios and the benchmark.

4. There is evidence of a "flight to quality" effect during crisis periods meaning that sustainable firms are more resilient and outperform their less sustainable counterparts during hard times.

5. Positive correlation between the ESG rating category and the alphas of the ESG portfolios. Although those alphas are insignificant, thus, the ESG portfolios generated the theoretical expected return that was predicted by the model. Therefore, their returns could be explained by well-known common factors.

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8.Discussion

When grouping the portfolios into the three major categories someone can identify below patterns:

- Negative correlation between the ESG rating category and the sensitivity of the portfolios to the market risk.

- Negative correlation between the ESG rating category and the exposure of the portfolios to the SMB and the HML factors.

In other words, the ESG leading portfolios exhibit lower exposure to the systematic risk. Moreover, the ESG laggard portfolios tilt to small-cap and value stocks while the ESG leading portfolios tend to large-cap and value stocks but this slope to value stocks is relatively low.

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9.Limitations & Suggestions

Limitations :

- ESG ratings from one data vendor, MSCI, were utilized.
- The investment strategy was tested only in the US market.
- One weighting methodology was tested.
- The sample period was relatively short.

Suggestions :

- Use of an alternative ESG data provider or a mix of them.
- Test different weighting methodologies.
- Expand the sample period.
- Test the investment strategy on other capital markets.
- Include dividends and transaction costs in the calculations.
- Measure performance with other well-known multifactor models.

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10.Conclusions

- It is better for firms to be appraised in terms of ESG and exhibit a rating as they are not omitted from the investment universe of socially conscious investors. The Non-ESG portfolio ended up with lower returns and higher risk even when compared to the ESG laggard category.

- An investor who has preferences for ESG should invest in portfolios with high ESG ratings since the Sharpe ratio is, on average, greater and because these portfolios are more resilient during market turmoil. However, the results from the CAPM and the FF3FM displayed that a high-ESG oriented investor should not expect abnormal returns. Nevertheless, probable outperformance from the best ESG portfolios in the future should not be ruled out.

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Thank you very much for your time!