BI Norwegian Business School - campus Oslo

GRA 19703

Master Thesis

Thesis Master of Science

Do Sustainable Mutual Funds Offer Protection in Times of Market Instability?

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Start:	15.01.2021 09.00
Finish:	01.07.2021 12.00

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by

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MSc in Finance

Oslo, June 30, 2021

ABSTRACT

Our thesis examines the financial performance of open-ended mutual funds with a Morningstar Sustainability rating from January 2015 to December 2020. We use four different factor models to investigate whether the hypothesis that SRI funds offer protection during times of crisis, such as the COVID-19 pandemic. We distribute the funds based on their level of sustainable investments to see what level of ESG-risk is most profitable on a risk-adjusted basis. Our results indicate that sustainable mutual funds underperform the market portfolio during non-crisis and crisis times, although less in times of crisis.

Acknowledgements

We want to express our gratitude to our thesis supervisor Samuli Knüpfer from the Department of Finance at BI Norwegian Business School for his guidance and assistance through this process.

Most of all, we want to thank our family and friends for their unwavering support during these two years and our masters thesis.

Contents

List of Figures

List of Tables

1 Introduction and Motivation

With an exceeding amount of people placing their money where their values are, the world of sustainable investing has seen a rapid increase over the previous decade [US SIF Foundation, 2020]. However, making value-based investment decisions is not a modern phenomenon; it is indeed ancient, as documented in the Christian Bible, "Better a life of righteousness than vast revenues without justice." Be that as it may, the interest peaked in 2020, with 85 percent of U.S. individual investors and 95 percent of all millennials expressing an interest in sustainable investing [Morgan Stanley: Institute for Sustainable Investing, 2019]. The increased demand has resulted in an offering of sustainable investment vehicles by asset management firms across the globe to meet the demand of investors seeking to merge profits and personal beliefs.

Consequently, as of 2020, one out of every three dollars managed professionally in the United States were invested according to sustainable strategies, valued at USD 17.1 trillion. [US SIF Foundation, 2020] Integrating ESG-criteria into portfolio construction is the most widespread method of moral investing. ESG-forward mutual funds are consequently a popular investment vehicle among retail investors.

Due to consistently underperforming the market net of fees,[Jensen, 1968] the mutual fund industry is undergoing pressure to tighten its margins. Passive index funds are in increased demand as they entail equally good diversification and financial benefits but without the management fees [PWC, 2020]. Notwithstanding, the mutual fund is still vast even if the year-on-year growth rate is decreasing [PWC, 2020]. Then the question arises as to why the industry still seems attractive to investors? Moskowitz [2000] suggests that it is due to a potential hedge against recessions. In 2011, Glode [2011] offered a formalization of this hypothesis, stating that the return of an actively managed fund depends on the business cycle. He argues that an active manager would

work harder when the marginal utility of consumption is higher, as investors would be willing to pay for insurance, indicating that funds achieve greater financial performance during periods where investors need them the most. If that is the case, the fund's unconditional performance understates the fund's true abilities.

The theory regarding the hedge offered can show to be even more significant for sustainable mutual funds. The contributing factor is that there is considerable evidence that SRI funds outperformed conventional funds during the financial crisis of 2008 [Nofsinger and Varma, 2014], Which leads to the theory that sustainable mutual funds should offer even less downside risk during the downside of the business cycle than mutual funds in general. A perfect example of an event that investors would prefer to be hedged against is the unprecedented drop in the market due to the COVID-19 pandemic in March 2020 [Jason, 2020]. Financial instability that followed created an opportunity for an active asset manager to prove their worth, making 2020 the perfect sample period to test if sustainable mutual funds protect against downsides in the business cycle. With the general shift towards sustainability in the financial markets, it would also be interesting to explore if we can identify sustainability as an indicator of financial performance and mutual funds.

We analyze the financial performance of sustainable mutual funds compared to the market from 2015 to 2020. To distinguish between the sustainable performance of funds, we will be looking at funds that have received all ranges of Morningstar Sustainability Ratings. Morningstar rates funds based on the ESG risk their portfolio carries, and although the data started in 2015, it was first publicized in 2016. The reason why we consider these ratings necessary is that investors value them. With the release of the ratings in 2016, the highest-ranking funds saw cash inflows of USD 8 trillion and lowest experienced outflows of USD 12 trillion, a cash movement that suggests that the average

investor perceives the rankings as a positive predictor of future performance [Hartzmark and Sussman, 2019].

Our thesis aims to investigate what level of sustainability is optimal in terms of financial performance and whether it is beneficial at all to invest in sustainable mutual funds. We want to verify if the perception of an average investor is correct. Does sustainability act as a predictor of long-term financial performance? Is it possible that the growth of sustainable investing and the general incorporation of ESG criteria into companies at large has influenced the financial markets? Furthermore, does having a sustainability-forward portfolio offer a hedge against market turmoil such as the one we experienced during the COVID-19 pandemic in 2020.

2 Background

When discussing sustainability and investments jointly, three frequently used terms would benefit from clarification. These are Corporate Social Responsibility (CSR), Socially Responsible Investing (SRI), and Environmental, Social, and Governance (ESG) criteria. CSR is the theory that corporations have responsibilities beyond making a profit, that managers should consider the non-market forces or the social aspect of their activity. The UN's Sustainable Development Goals state that the private sector plays a significant role in addressing environmental and social challenges; the success of reaching the 2030 goals depends on both the private sectors' and governments' actions [United Nations, 2019]. Contradicting the view of Nobel-prize-winning economist Milton Friedman [Friedman, 1970], who is commonly known opinion, that the corporation's single responsibility is to increase profits within the rule of the game.

SRI investment decisions are motivated by personal values, financial returns, and ESG incorporation are the most common way of achieving these objectives. All types of investors, including the average retail investors, high-net-worth individuals, pension funds, institutions, and nonprofit organizations, participate in impact investing. Third-party ESG providers evaluate and rate environmental, social, and corporate governance risks and opportunities, accumulating in a score that serves the purpose of informing the investors. Implementation of the ESG criteria serves to standardize the terminology and provide a forward-looking metric that can assess the portfolio risk beyond financial measures and is the most widely known measurement of sustainability. Market participants consider ESG reports when comparing an asset to their peers. Currently, it exists numerous ESG data providers that vary in scope and coverage. Overall, ESG data help investors find companies with values that match their own.

3 Literature review

Incorporating ESG into a fund comes at the cost of a diversification loss; however, the financial performance can improve in terms of lower downside risk. Hong and Kacperczyk [2009] argue that social norms are shaping the economic behavior of portfolio managers and investors alike. Their research looks at the financial costs of divesting "Sin" stocks. "Sin" stocks include companies involved in alcohol, tobacco, and gaming, among others. Mutual funds pursuing a sustainability-forward strategy divest these stocks in order to minimize their ESG-risk. The actual cost of being an ESG-fund is the loss of a complete diversification strategy to which conventional funds have the option to pursue [Hong and Kacperczyk, 2009]. As a result of the decreasing number of investors willing to hold "sin" stocks, the "sin" stocks have higher expected returns. Ultimately, ESG investors forgo higher yields by divesting.

The increased expected return of holding "sin" stocks might be valid; however, research shows a significantly increased risk to holding "sin" stocks as these are likely to be found in low-growth industries. Climent and Soriano [2011] look into the return of green fund performance compared to conventional funds in two different periods, from 1987-2001 and 2001-2009. The research shows that the present period has more solid returns than in the past. The increased performance can be explained by the increased awareness surrounding sustainability. The results from Climent and Soriano [2011] make a good argument that past performance might not always predict future performance, indicating that the financial performance of SRI funds possibly has improved over the last decade as well. A meta-analysis concerning 85 studies and 190 experiments by Revelli and Viviani [2015] supports this notion that there is no real benefit or cost by investing in SRI and that the level of performance reported in a previous study depends on the researcher's methodology.

Multiple studies argue that although a sustainability focus does not necessarily increase the performance of funds, it lowers the tail-risk by investing in more stable companies. One such study is by Verheyden et al. [2016], who compares the performance of ESG-screened portfolios to non-screened portfolios. While this study shows similar results as Hong and Kacperczyk [2009] regarding the weaknesses of ESG-screened portfolios such as loss of diversification, it reveals a benefit in the reduced tail-risk. A 10 percent best-in-class screened ESG-portfolio improved risk-adjusted returns, lower tail risk, and no significant reduction of diversification in both global and developed markets portfolios [Verheyden et al., 2016]. The tail risk was reduced down to a 25 percent screening filter. The results show that by incorporating ESG data in the decision-making, the fund managers can more easily make the optimal for them configuration depending on ethical preferences and willingness to deviate from an unscreened benchmark. It can be beneficial for any investor to conduct some level of ESG-screening. Interestingly, some of these studies are over a decade old, particularly Climent and Soriano [2011], who demonstrated that ESG-performance had improved with time. We can further contribute to this research as we are currently experiencing the height of ESG demand.

Lower tail-risk may show to be beneficial during times of financial instability. Lean and Pizzutilo [2020] studies the value-added by SRI during financial turmoil using an innovative methodology that considers the higher moments of the explanatory variables to solve the issue regarding non-normality and heteroscedasticity in the return distribution in addition to Fama-French and Carhart models. The validity of their new methodology cannot be confirmed by other research; however, it is noteworthy how they manage the recurring problem of non-normality in financial data [Lean and Pizzutilo, 2020]. The research shows that regardless of the methodology, SRI and conventional indexes perform similarly, independent of the market. Although, some evidence

suggests that North American SRI indexes had less downside risk during the financial crisis of 2008.

Interestingly, there is considerable research that supports the argument of SRI outperformance during the financial crisis. Matallin-Saez et al. [2019] analyze the performance of U.S. socially responsible funds and market timing concerning business cycle regime shifts and different SRI criteria. These criteria are ethical strategy focus, socially responsible attribute scores, and Morningstar categories to accurately compare S.R. funds and conventional funds [Matallin-Saez et al., 2019]. Additionally, they distinguish between recessions and expansions in the economy. The results show that performance improves when specific benchmarks are considered during a recession, particularly environmental funds perform better. However, they find no significant differences between the performance of socially responsible and conventional mutual funds during the recent financial crisis. Overall, they conclude that all socially responsible funds underperform in expansion sub-periods but perform better in recession sub-periods; however, the differences observed are not significant.

A study by Nofsinger and Varma [2014] supports the theory of outperformance by SRI fund during periods of market crisis as they offer less downside risk at the cost of under-performing in non-crisis periods, which can be interpreted as downside protection by SRI funds for investors looking to hedge against volatile market times. The study sample consists of both SRI and conventional funds between 2000 and 2011, periods of crisis and non-crisis. By comparing the alphas in non-crisis periods, the conventional funds outperform the SRI funds by 0.67-0.95 percent annually [Nofsinger and Varma, 2014]. However, in crisis periods, the SRI funds outperform by 1.61-1.70 percent. Furthermore, Nofsinger and Varma [2014] discover that the SRI funds that used positive screened funds outperformed negative-screened ones, supporting the studies' references earlier.

Understanding why sustainable funds have reduced tail-risk and subsequently perform better than conventional funds in crisis is highly relevant for our research. Lins et al. [2017] find supporting evidence that high-CSR companies performed better during the Enron crisis of 2001- 2003 but, more importantly, during the financial crisis of 2008. High- CSR firms had higher profitability, margins, sales growth, and employee productivity than low-CSR firms. However, the findings are more prevalent during the crisis, they also extend to the period after. The financial crisis broke the trust towards the financial industry, and faith in an efficient market was low. Investment in CSR leads to better corporate governance, which the study suggests generates trust between the firm and the different stakeholders, which pays off when the market suffers from a negative shock. [Lins et al., 2017]

Maxfield and Wang [2020] interpret the risk mitigation offered by sustainable investing and look at the risk impact directly instead of comparing it to the business cycle. Their research sample looks at a panel sample of 5,928 U.S.-based equity mutual funds with reported Morningstar sustainability scores and finds that sustainability helps mitigate total, systematic, and idiosyncratic risk. Similar to Verheyden et al. [2016], Maxfield and Wang [2020] conclude that a positive screening process offers greater returns. A positive screen helps the fund manager to identify high-quality stocks that are consequently less risky. Another exciting part of their research is that it offers insight into the aftermath of the financial crisis. Investors seem to pay increasing attention to their allocation strategies to protect themselves from high risk. By including sustainability measures into the portfolio, risk protection follows. However, this risk protection should be so significant to cover the underperformance of mutual funds in general. Jensen [1968], Malkiel [1995], and Fama and French [2010] conclude that actively managed U.S. equity funds underperform the market portfolio, net of fees.

There are several economic interpretations by presented research. Previous studies do not find significant differences in performance by sustainable vs. conventional funds; however, sustainable funds seem to offer lower tail-risk. The reduced downside risk contributed to the higher performance of sustainable funds during the 2008 financial crisis. Additionally, it seems that the screening process of funds is detrimental to open-ended mutual funds' financial performance. Based on these findings, we see possibilities to continue research of the development of the performance of sustainable funds now that sustainability is more in demand than ever. With the ongoing COVID-19 pandemic, we can investigate if the reduced tail-risk helped through a time of high market volatility and triggered a recession in several economies worldwide. With the publication of Morningstar Portfolio Sustainability rankings, we can also test what level of ESG integration performes the best compared to the market portfolio.

4 Research Design

Looking at the previous research, we can conclude that there are differences of opinion regarding the financial performance of mutual funds and, in particular sustainable funds. Most seem to agree that sustainable funds underperform compared to the market in non-crisis times. However, with the continued inclusion and popularity growth of sustainability it might have changed, so past performance does not necessarily predict future performance [Climent and Soriano, 2011].

Considering this possible change, we will investigate whether sustainable mutual funds outperform the market in non-crisis times. In previous research, it is generally assumed that although mutual funds have previously underperformed, they are outperforming in times of crisis. Furthermore, as Nofsinger and Varma [2014] concluded, SRI funds performed better than conventional funds during the financial crisis, giving substance to the argument that sustainable mutual funds should outperform during the unexpected impact of the COVID-19 pandemic.

Subsequently, this paper investigates whether sustainable mutual funds outperform the market, taking into consideration various factors as size premium, value premium, momentum, profitability and investment factors, offering less downside. Ultimately we aim to find the optimal sustainability score for hedging against volatile markets.

4.1 Research Questions:

Based on previous studies, in our thesis, we strive to answer the following questions:

4.1.1 Research Question I:

Do sustainable mutual funds still underperform the market in non-crisis periods, and do the funds' performance significantly differ by sustainability score?

4.1.2 Research Question II:

Do sustainable mutual funds outperform the market in periods of financial turmoil, more specifically, the COVID-19 recession?

4.2 Testable Hypothesis:

Concerning these two research questions, our testable hypotheses will be the following:

4.2.1 Hypothesis I

H_0: Sustainable mutual funds do not underperform the market portfolio in non-crisis times.

H_1: Sustainable mutual funds do underperform the market portfolio in non-crisis times.

4.2.2 Hypothesis II

H_0: Sustainable mutual funds do not outperform the market portfolio during the financial turmoil caused by the COVID-19 pandemic in 2020.

H_1: Sustainable mutual funds do outperform the market portfolio during the financial turmoil caused by the COVID-19 pandemic in 2020.

Our hypotheses are referring to the market portfolio as a benchmark for testing the U.S. sustainable mutual funds. The market portfolio consists of the value-weighted return of all CRSP companies that are incorporated in the U.S., and

listed on the NASDAQ, NYSE, AMEX and having CRSP share code of 10 or 11 at the beginning of the month. [Kenneth R. French, n.d.]

5 Methodology

This section describes the factor models and methods used when answering the hypothesis. The first part explains the choice of the factor models and the supporting theory. The second part provides details of the analysis conducted.

5.1 Model Selection

5.1.1 Jensen's Alpha and Capital Pricing Assets Models

Jensen's Alpha is a widely used risk-adjusted financial performance measure used to evaluate funds and companies. This model was introduced by American economist Michael Jensen [1968]. Jensen's Alpha gives the excess return earned by the portfolio suggested by the Capital Asset Pricing Model (CAPM). Jensen's Alpha is often referred to as Alpha. The Alpha can either have a positive, negative, or neutral loading.

$$R_i - R_f = \alpha_i + \beta_i(R_m - R_f) + \varepsilon \quad (1)$$

Where:

- R_i is the return on a security or asset i
- R_f is the risk-free rate
- R_m - R_f is the market risk premium
- β_i is the systematic risk of a security or an asset
- a_i is the risk-adjusted performance measure of a security or asset (Jensen's Alpha), or an intercept

The Capital Asset Pricing Model of Sharpe [1964], Lintner [1965], and Black [1972] is based on the prediction that the market portfolio is mean-variance

efficient [Markowitz, 1959]. It implies that the expected returns of a portfolio or security are a positive linear function of the market betas, which are the slope in the CAPM regression, and that it is enough to describe the cross-section of the returns [Markowitz, 1959]. If the Alpha is significantly high (low), it indicates that the asset is performing better (worse) than the market portfolio. It contributes to the analysis of performance more accurately than by looking at the non-risk-adjusted return. Jensen's Alpha shows if the expected return is justified with the overall risk of the asset, as investors require higher returns to compensate for higher risks, while on the contrary, less risky assets require lower expected returns.

5.1.2 Fama-French three-factor Model

The Fama-French Three-factor Model (FF3) further adjusted the Capital Asset Pricing Model developed by the Nobel laureates Eugene Fama and Kenneth French in 1992 [Fama and French, 1992]. The model has two additional factors, the size factor and the value factor:

$$R_i - R_f = \alpha_i + \beta_i(R_m - R_f) + \beta_{i,2}SMB + \beta_{i,3}HML + \varepsilon \quad (2)$$

Where:

- R_i is the return on a security or asset i
- R_f is the risk-free rate
- R_m - R_f is the market risk premium
- β_i is the systematic risk of a security or an asset
- a_i is the risk-adjusted performance measure of a security or asset (Jensen's Alpha), or an intercept

- *SMB* is the size premium; small minus big
- *HML* is the value premium; high minus low

The model attempts to measure market returns better than the Capital Asset Pricing Model. It is based on the empirical contradiction that one factor is not enough to measure the cross-section of the expected returns. By adding two extra factors, it describes the expected returns more efficiently. These factors stem from empirical research that shows that value stocks tend to outperform growth stocks [Stattman, 1980, Rosenberg et al., 1985] and small-cap stocks tend to outperform large-cap stocks [Banz, 1981].

The *SMB* factor accounts for the small market capitalization stocks that generate more significant returns than the large ones; *HML* accounts for the value stocks with higher book-to-market ratios and generates larger returns than the growth stocks in the long run.

5.1.3 Carhart Four-Factor Model

Carhart's Four-Factor Model is an extension of the Fama-French Three-Factor Model with one additional factor, known as the monthly momentum factor developed by Mark Carhart in 1997 [Carhart, 1997]. By capturing the momentum anomalies in the market over a period, it can increase the explanatory power of both FF3 and CAPM:

$$R_i - R_f = \alpha_i + \beta_i(R_m - R_f) + \beta_{i,2}SMB + \beta_{i,3}HML + \beta_{i,4}MOM + \varepsilon \quad (3)$$

Where:

- R_i is the return on a security or asset i
- R_f is the risk-free rate
- R_m - R_f is the market risk premium

- β_i is the systematic risk of a security or an asset
- a_i is the risk-adjusted performance measure of a security or asset (Jensen's Alpha), or an intercept
- *SMB* is the size premium; small minus big
- *HML* is the value premium; high minus low
- *MOM* is the momentum premium

5.1.4 Fama-French Five-Factor Model

The Fama-French Five-Factor Model (FF5) is a further extension of CAPM and FF3. The two additional factors, a profitability factor *RMW* and an investment factor *CMA* aimed at capturing the size value, profitability, and investment patterns in average stock returns [Fama and French, 2015].

$$R_i - R_f = \alpha_i + \beta_i(R_m - R_f) + \beta_{i,2}\,\mathrm{SMB} + \beta_{i,3}\,\mathrm{HML} + \beta_{i,4}\,\mathrm{RMW} + \beta_{i,5}\,\mathrm{CMA} + \varepsilon \tag{4}$$

- R_i is the return on a security or asset i
- R_f is the risk-free rate
- R_m - R_f is the market risk premium
- β_i is the systematic risk of a security or an asset
- a_i is the risk-adjusted performance measure of a security or asset (Jensen's Alpha), or an intercept
- *SMB* is the size premium; small minus big
- *HML* is the value premium; high minus low

- *RMW* is the profitability factor; robust minus weak
- *CMA* is the investment factor; conservative minus aggressive

The *RMW* factor represents the idea that higher future earnings have more significant returns in the stock market. The *CMA* factor represents a concept that suggests that companies invested in large growth projects are more at risk to the downside in the stock market.

To analyze the financial performance of sustainable mutual funds regarding the asset pricing models described above, we conduct a regression analysis using the Matlab programming platform.

While running the OLS regression, we make sure that our estimators are BLUE (Best Linear Unbiased Estimators). In most cases, we notice heteroscedasticity or autocorrelation (Equation 6) or both in the residuals. According to the BLUE property, we assume that the error term's variance is constant, as reflected in equation 5. In other words, the homoscedasticity of the residuals assumption is not violated. However, if the variance is changing over time, it is known as heteroscedasticity of errors. If the latter is present, it may lead to inappropriate standard errors that cannot be used when conducting the hypothesis tests.

$$Var(u_t) = \sigma^2 < \infty \tag{5}$$

Where:

- u_i is the error term

$$E(u_\mathrm{i}|X) = 0 \tag{6}$$

- u_i is the error term

- X is explanatory variables

We use White's test for heteroscedasticity in the residuals for each factor model to identify whether we have a heteroscedasticity problem.[Newey and West, 1987] In most cases, we find that heteroscedasticity of residuals is present, and White's heteroscedasticity-consistent standard errors are obtained for further tests. By obtaining White's heteroscedasticity-consistent standard errors, we do not change the parameter estimates. White's test only changes the standard errors that increase in value, leading to different test results and consequently reducing the risk of type II error.

Another problem that frequently arises is autocorrelation in the error term. It is a common problem in time-series regressions that indicates a systematic pattern in the order of the error terms, so the residuals correlate with each other.

Autocorrelation negatively affects the results of the testing hypothesis, making OLS no longer BLUE. [Brooks, 2014] We perform the Breusch-Godfrey test for the autocorrelation up to the tenth lag. When autocorrelation is present with heteroscedasticity, we conduct the Newey-West heteroscedasticity and autocorrelation consistent (HAC) standard errors correction. This procedure corrects the t-statistics of the parameters.

We believe that this way, we can investigate whether there are some trends in the sustainable mutual funds' data most efficiently as Jensen's alpha and Fama-French model and its variations are the most universally accepted methods for analyzing securities. To thoroughly conduct our analysis, we need data on sustainable funds and their returns.

6 Data

6.1 Data Collection

6.1.1 Sustainability Data

There are multiple sources to obtain sustainability data. However, none deliver such comprehensive sustainability and financial data related to mutual funds as Morningstar. Consequently, we obtained all sustainability data from Morningstar available at the Morningstar Direct database. Morningstar provides an independent measure of funds' sustainability in terms of a globe rating system, where the best performing funds receive five globes, and the worst-performing receive one globe. Before the launch of this easily assessable rating system, there was no easy way of evaluating the sustainable performance of funds, neither those that have a sustainability-forward investment approach or those that do not purposely include sustainability.[Morningstar Research, 2019] With the Morningstar Sustainability Ratings, which incorporates ESG data provided by Sustainalytics, investors can quickly evaluate how the funds invest their capital. Sustainalytics is a company by Morningstar and is the leading provider of independent ESG research that supplies investors with information to evaluate the financial material ESG risk in publicly traded companies [Sustainalytics, 2019].

The Morningstar Sustainability Rating is a three-step calculation process. The first step is the Morningstar Portfolio Sustainability Score calculation used to calculate the portfolio's Historical Portfolio Sustainability Score. Lastly, each fund is assigned a Morningstar Sustainability Rating based on the historical scores relative to its global category [Morningstar Research, 2019].

First step: Calculate Morningstar Portfolio Sustainability Rating

$$PortfolioSustainability = \sum_{x=1}^{n} ESGRiskxWeightsAdj \tag{7}$$

ESG risk measures how a company's economic value may be at risk due to ESG related issues. For the risk to be considered an issue to the company, the possible risk must have a substantial impact on the economic value of the firm. Consequently, it might affect the risk and return profile of a prospective investment in the company. For a fund to obtain a sustainability score, at least 67% of a fund's assets under management must have received a company ESG Risk Rating by Sustainalytics [Morningstar Research, 2019]. Further, the Morningstar Historical Portfolio Sustainability Score is a weighted average of the scores over the previous twelve months.

Second Step: Calculate Morningstar Historical Portfolio Sustainability Score

$$HistoricalPortfolioSustainabilityScore = \frac{\sum_{i=0}^{11} x(12-i)xPortfolioSustainability_i}{\sum_{i=0}^{11} i+1} \quad (8)$$

Based on the Historical Portfolio Sustainability Scores, the funds are assigned a category rank and a percentage rank within their Global Category. Since this score reflects the ESG risk the fund is facing, the lower the score, thus better. [Morningstar Research, 2019] What is important to note is that throughout our research period, there have been changes in this particular ranking. From January 2015 to September 2019, the Morningstar Portfolio Sustainability Score was calculated differently than shown above. The ESG scores provided from Sustainalytics did not represent the ESG-risk but a score on how well the securities are performing in terms of the ESG criteria. So, the Portfolio Sustainability Score (2015-2019) was calculated as follows:

$$ESG = \sum_{i=1}^{n} w_i ESGNorm_i \quad (9)$$

$$PortfolioSustainabilityScore = PortfolioESGScore - PortfolioControversyDeduction \quad (10)$$

Hence, in this case the higher the score, the better, which was also reflected in the globe ratings.[Morningstar Research, 2016]

Third Step: Distribute Morningstar Sustainability Rating

Descriptive Rank	January 2015- September 2019	September 2019 - December 2020
High	Top 10 %	Lowest 10 %
Above Average	Next 22.5 %	Next 22.5 %
Average	Next 35%	Next 35%
Below Average	Next 22.5 %	Next 22.5%
Low	Lowest 10 %	Top 10 %

Table 1: The table shows the difference in the compilation of the Morningstar rating before and after September 2019. Previously, the highest rating was given to securities or funds based on assessing their level of sustainability. Later, the focus changed to the risk associated with ESG and sustainability. Thus, until September 2019, the higher the Morningstar rating of a fund or security, the higher their involvement in ESG was; since September 2019, the higher the Morningstar rating, the lower the risk associated with ESG factors.

We are using the Portfolio Sustainability Score instead of the historical scores. For our research, the benefit of a more comprehensive data set offsets the loss of consistency that comes with the historical scores. Additionally, what distinguishes the Historical score from the Portfolio Sustainability Score is that the latter produces data in real-time, easily comparable to real-time returns. So, it creates the possibility to fully understand the correlation between the weighted-average ESG-risk and the financial returns.

6.1.2 Financial Data

Morningstar Direct provides comprehensive data on open-ended mutual funds, including weekly returns and fund size relevant to this research. The fund size is populated with aggregated share-class if all are available, otherwise, it is surveyed. The returns are expressed in percentage terms. Morningstar calculates the total return each month by taking the change in monthly net

asset value (NAV), reinvesting all income and capital-gains distributions during that month, and dividing by the starting NAV. It does not consider the sales charges, giving a more clear picture of a fund's performance. The total return does take into account management and administrative costs. For our time-series methodology, we use four different asset pricing models. The first asset model we run is the CAPM, and for that, the necessary data is the excess returns of the market portfolio over the 1-month risk-free rate. Then we progress with the Fama-French Three-Factor model where additional data on small minus big (SML) and the high minus low (HML) factor are needed. For the Fama-French-Carhart model, an additional momentum (MOM) factor is required. As for the Fama-French Five-Factor Model, additional data regarding the profitability (RMW) and investment factor (CMA) have been obtained. All the data for the models were obtained from the online data library of Professor Kenneth R. French. [Kenneth R. French, n.d.]

6.1.3 Time Period

From 2015 through 2020, we identify in total 2,735 U.S. domestic equity open-ended mutual funds. The survivorship-bias-free data set is obtained from Morningstar Direct. While mutual funds have seen a decrease in popularity to the benefit of Exchange Traded Funds (ETFs), mutual funds still hold three times the value of ETFs, making it an essential metric for investment professionals. [Morningstar Research, 2020b] Most mutual funds are actively managed by a portfolio manager who allocates capital in an attempt to produce gains. The price of a mutual fund is referred to as the net asset value per share (NAVPS).

In March 2020, the financial markets experienced a crash after a decade of economic prosperity since recovering from the great recession following the financial crisis in 2008. From 2009 through January 2020, the U.S. economy

was in the longest expansion ever recorded; however, with the peak in the market on February 19th, 2020, the U.S. economy entered a recession. [National Bureau of Economic Research, n.d.]

The SP 500 peaked on February 19th at a record 3,386.15 when the U.S. and global economy experienced a crash following news of the growing severity of the COVID-19 pandemic [Jason, 2020]. With the shock of the ongoing pandemic, global lockdowns, panic buys, and disturbed supply chains, the market saw a massive plunge worldwide. The SP 500 experienced its worst trading day in over a hundred years, dropping 12 % [Jason, 2020] in one trading day. From February 19th to March 23rd, the MSCI world index declined by 34%, and the SP 500 had fallen 34% to a low of 2,237.40 [Jason, 2020]. However, according to IMF, the markets were already vulnerable to a downturn since there had already been a synchronized slowdown in 2019, recording the slowest growth pace since the financial crisis at 3%, weakened by the increasing geopolitical tensions and rising trade barriers [Gopinath et al., 2019]. According to Morningstar research, investors pulled in a total of USD 326 billion from mutual funds and ETFs in March 2020. It broke the record of the outflows during the financial crisis, which peaked at USD 104 billion in October 2008 [Morningstar Research, 2020b].

However, the market experienced a quick change; a bull market quickly followed a short-lived bear market in April 2020. A report from Morningstar in July 2020 reported strong rebounds of sustainable funds after the pandemic sell-off, which was supported by the quick stock market recovery and growing investor interest in ESG issues [Morningstar Research, 2020b]. On a global scale, the inflow into sustainable funds was up 72% in the 2nd quarter of 2020, of which 14.6% were in the U.S. [Morningstar Research, 2020a]. Americans invested USD 5.8 billion into sustainable funds in April, mostly in equity funds, the most significant inflow into sustainable funds ever recorded in the

U.S.[Morningstar Research, 2021] Morningstar concludes that the U.S. aggregate investors seem to rebalance with the rise of the equity market. [Morningstar Research, 2021]

There are several reasons for the increase in the popularity of sustainable funds in the U.S. 2020, a year of social unrest, and significant changes for the U.S. and worldwide. However, the market recovered quickly, the wealth distribution grew more prominent than ever [Eisen, 2020]. COVID-19 pushed social issues to the forefront with the growing concern for the safety of workers, and racial justice moved up the list of priorities of institutional investors. [Badford, 2020] For a long time, the Environmental part of ESG has been the primary concern; now, the Social and Governance aspects are just as important. Additionally, with the election of president Joe Biden in November 2020, ESG investing is expected to increase as he is committed to the U.N.'s sustainable development goals and increase social welfare.

6.2 Portfolio Construction

We choose to limit our data set from January 2015 to December 2020 corresponding with the availability of the Morningstar Portfolio Sustainability Scores. This period includes both times of market prosperity and high market volatility. We want to focus mainly on one single economy to avoid local bias and the United States seem to be a good choice due to the size of the financial market and the investment in ESG in the previous years.

The first step in the screening process is to limit the funds to domestic U.S. equity, excluding such asset classes as global equity or fixed income. It allowed us to link the equity holdings to Portfolio Sustainability Scores and financial returns. Asset management companies offer multiple share classes of investment vehicles allowing the investor to choose the optimal option for them according

to their preferences. Therefore, to exclude multiple share classes of each fund we decide that the retail share class fits best our research.

6.2.1 Dealing with survivorship-bias:

Survivorship bias is to view the performance of existing funds in the market as a comprehensive sample without considering the funds that have been liquidated. If a fund does not perform or has too small of a market value that is not worth sustaining is often liquidated. In other words, the funds that were liquidated during our research period were very likely to have lower returns than the ones that survived. It gives us a reason to assume that containing the survivorship bias portfolios would show better results in our regression analysis, however, not truthful. It is necessary to include surviving and non-surviving funds in the sample to get a bias-free result; only including surviving funds may overestimate performance. [Elton et al., 1996] Another issue with survivorship bias is the fact that it creates an upward bias in the sample. To avoid this bias, our only requirement for the funds to be included was that they offered a return at some point between 2015 and 2020.

Additionally, the search was not limited to funds with a Portfolio Sustainability Score, as this could potentially reject funds that lost or gained a score throughout the period. Which left us with 2,735 funds in total. In 2015, 1,350 funds had Portfolio Sustainability Scores, and by 2020 that number increased to 1,834. This trend is to be expected based on the popularity growth of sustainability and ESG. Interestingly, the number of funds decreased by 51 funds throughout 2020, indicating that the pandemic caused a liquidation of funds due to the hostile market, as can be seen in Table 2.

Year-end	Nr. of funds with Sustainability Score
2015	1,350
2016	1,744
2017	1,758
2018	1,794
2019	1,887
2020	1,834

Table 2: The table presents the number of mutual funds with a Portfolio Sustainability Score from 2015 to 2020.

6.2.2 Portfolio Sustainability Ratings

From 2015 to September 2019, the Portfolio Sustainability Ratings were on a scale of 0-100, with 100 as the best score. Interestingly, we see a decrease in the average Portfolio Sustainability score each year until the trend ended in 2018 as seen in table 3. The average monthly change in Portfolio Sustainability scores is negative until 2019, with the most rapid decrease in 2016 of 0.61%. From September 2019, the Portfolio Sustainability Score changed to a new risk-based system, where the smaller the score, the better. The average monthly change in the last quarter in 2019 was positive, which indicates a worse average sustainability score. On average, the monthly change was -0.66%, indicating a decrease of ESG risk exposure and an improvement in Portfolio Sustainability throughout the year.

It is not apparent why we observe the trend of decreasing portfolio sustainability scores in 2015-2019. One possibility is that the factor *Portfolio Controversy Deduction* in Equation 10 is arguably subjective at best. Besides the development of ESG research, the requirements might have tightened. We have no reason to believe that, on average, as ESG awareness grew, companies and funds performed worse from a sustainability perspective.

Since the introduction of the new Portfolio Sustainability Score in 2019, Morningstar stated that it aimed to increase overall stability and establish rules on dealing with ESG risk [Morningstar Research, 2019].

	Average Portfolio Sustainability Score	Average Monthly Change in (%)
2015	47.80	-0.21
2016	43.73	-0.61
2017	43.58	-0.08
2018	43.85	-0.02
2019	44.08	0.05
2019*	25.99	0.28
2020	25.62	-0.66

Table 3: The table illustrates the average portfolio sustainability score each year from 2015 to 2020 and month-to-month percentage change within each year. The year of 2019 is presented twice as it is the year when Morningstar changed the criteria, so under 2019 is the data for the first three quarter of 2019 with an older criteria, while under 2019* there is the rating after changing the focus to the ESG risk criteria.

6.2.3 Fund Size

It is interesting to see how the cumulative and average fund size has changed over the period. In 2015 the average fund size was USD 2.74 billion and had an average monthly increase of 1.05%. The biggest fund had a value of USD 397.60 billion (Table 25). The total number of funds was on average 963 throughout the year, which speaks to the possibility of most funds being on the smaller side. The total fund size as of December 2015 was USD 3894.53 billion, while in December 2020 it accumulated to USD 8409.02 billion (Table 4), a 116% increase. This increase in assets under management speaks to the popularity of funds with a sustainability rating.

It would be interesting to see if the trends in sustainability funds' capital flows during 2020 also are reflected in our data. We see that the total cumulative fund size overall decreased by 28% in March 2020 but recovered by 11% in

April and was back at the January level already in July.(2) Overall, fund size increased by 17% by December 2020. Hence, our data show similar trends as reported by Morningstar. The out- and inflows of capital from the sample funds in 2020 is illustrated by figure 2 in the Appendix. Additionally, we can see that the average fund size has increased as well. However, there was a decrease in average fund size between 2019 and 2020. The overall trend shows that the average fund with a sustainability score has more assets under management in 2020 than in 2015. The decrease between 2019 and 2020 indicates an average reduction in fund size, resulting from outflows from small-cap funds during the instabilities due to the ongoing pandemic.

	Avg.Fund Size(in billions)	Mthly Change in Avg. Fund Size (%)	Y/E tot. Fund Size (in billions)
2015	2.74	1.05	3894.54
2016	2.43	-0.15	4707.69
2017	2.85	-1.35	5712.63
2018	3.15	-1.83	5251.56
2019	3.25	2.61	6796.61
2020	3.10	2.86	8409.02

Table 4: The table shows the information on the funds size, monthly change in the average fund size and the funds size in the end of the year for every year we observe.

6.2.4 Value Weighted-Returns

We analyze the value-weighted weekly return for all funds over the six years. On a weekly and monthly basis, the returns were volatile, making it hard to make any inferences. Overall, there are positive returns for all years except for 2018. However, we would need to benchmark the returns in order to make any inferences about the performance. The yearly average value-weighted return

of the funds shows that they underperform compared to the SP 500 in 2016, 2017, 2019, and 2020. However, the portfolio offered less downside than the SP 500 in the years 2015 and 2018.

Instead of looking at all the funds in their entirety, we wanted to distinguish between the Portfolio Sustainability Scores based on Morningstar's globe system. By doing this, we research the relationship between financial returns and Portfolio Sustainability scores. First, we create five different portfolios based on the descriptive rank and percentage distribution that Morningstar uses (Table 1); however, our data set is based on Portfolio Sustainability Score and not the Historical Portfolio Sustainability Score.

As a result, we re-balanced the portfolios on a monthly basis relying on the Portfolio Sustainability Scores, creating five different categories: *High*, *Above Average*, *Average*, *Below Average*, and *Low*. We calculate the weekly value-weighted returns for each of these portfolios using the fund size and weekly returns obtained from Morningstar Direct. All in all, this amounts to 360 different portfolios and 1,560 weekly value-weighted returns. Figure 1 in the Appendix presents the weekly results of the mutual funds divided by the five categories described below.

6.2.5 The Five Categories

High

The *High* portfolio contains the top 10% performing funds according to their Portfolio Sustainability Score. Of the top-performing funds, there are primarily large-cap equity funds. In 2015, 93 out of 98 funds were large-cap, and the trend continued into 2020, wherein in December 2020, 174 out of 185 were large-cap. The funds are a mix of growth and value funds. Summary statistics on *High* is presented in Table 23 in Appendix.

Above Average

The *Above Average* portfolio is the next 22.5% of the entire sample in terms of Portfolio Sustainability score performance. The portfolios have similar trends as *High* in terms of containing mostly US Equity large-cap growth or blend portfolios. The average fund size is larger in *Above Average* than in *High*. Summary statistics on *Above Average* is presented in Table 24 in Appendix.

Average

The *Average* portfolio is the biggest and contains 35% of the sample with scores ranging from 48.59 to 42.50, and 23.23 to 26.46 after the change of score. The portfolio is made up of mostly large-cap funds, although some mid-cap funds are present. Mid-cap funds are more frequent in the later years. Interestingly, there are very few small-cap funds in the top three portfolios, approximately 2%. Summary statistics on *Average* is presented in Table 25 in Appendix.

Below Average

Below Average is the following 22.5% of the funds, with scores ranging from 46.98 to 39.56. At the beginning of Portfolio Sustainability scores in 2015, the portfolio contains mostly large and mid-cap funds; however, in later years, as in 2020, it is a mix of all types of capitalization, however, more small-cap than earlier. The presence of small-cap funds can also be seen as the average fund size throughout the six years is USD 4.494 billion in *Above Average* and USD 1.825 billion in *Below Average* while still holding the same amount of funds. Summary statistics on *Below Average* is presented in Table 26 in Appendix.

Low

The *Low* category is the bottom 10% performance of the funds. It is important to note that these are funds that still get a Morningstar score which does imply that at least 67% of the assets in the portfolio have received an ESG score from Sustainalytics. The *Low* portfolio started off with mostly large and mid-cap funds, but in the later years, it is almost exclusively small-cap funds.

The average fund size is half the average fund size of the *High* portfolio with approximately the same amount of funds. Implying that there is more diversity amongst the categories now than it was earlier. The increasing presence of small-cap funds implies that when the Morningstar scores were published, few (nine in total as of January 2015) small companies and/or funds did not have an ESG-forward investment strategy. The trend is still that small-cap funds are mainly in the *Below Average* and *Low* categories. Summary statistics of *Low* is presented in Table 27 in Appendix.

Table 5 shows the average portfolio sustainability score, average fund size, and average value-weighted return for the five portfolios over the sample period. As suspected, *Average* category had the largest average fund size as well as the smallest average value-weighted return. The portfolios in *High* and *Low* categories have the highest returns, although the most volatile, as presented in graph in the appendix. Further detailed statistics of each portfolio can be found in Table 23 through 27 in the Appendix.

	Ave. Portfolio Sustainability Score		Ave. Fund Size (in bln)	Ave.Value-Weighted Return (%)
	2015-2019	*2019-2020*		
High	49.09	21.50	2.27	0.00211
Above Average	47.16	23.11	4.59	0.00095
Average	45.52	24.72	4.87	0.00065
Below Average	42.52	29.09	1.83	0.00095
Low	40.76	30.59	1.03	0.00183

Table 5: The table represents the average sustainability score for every category before and after September 2019, when the rating criteria changed; average fund size for every category and the average value-weighted return denoted in percentage.

7 Results and analysis

This section presents and discusses the findings concerning our research questions about the financial performance of sustainable mutual funds. First, we introduce our findings in portfolios distributed the same as Morningstar's globe ranking system. We look at the five different portfolios *High*, *Above Average, Average, Below Average,* and *Low.* It is followed by the results of a combination of these portfolios: *Above Average, Average,* and *Below Average,* and how they perform compared to the market and each other. With the three portfolios, we aim to increase our statistical power. Then, we run a robustness analysis of our models.

7.1 Asset Pricing Models with Five Portfolios

7.1.1 Capital Asset Pricing Model

Table 6 in the Appendix presents the capital asset pricing model (CAPM) for all three sample periods. Results show that in the whole sample period, none of the alphas are significantly different from zero. However, when splitting it into five categories, the alphas for the portfolios *High, Above Average,* and *Average* are significantly different from *Below Average* and *Low* at a 1% significance level, shown in Table 10. The top three portfolios do not significantly differ from each other, although portfolio *High* has the highest alpha and *Low* has the lowest, which is consistent through all of the sample periods. In other words, neither of the portfolios outperforms or underperforms the market at a significant level.

Looking at the results from five years before the COVID-19 pandemic, the alphas show a similar trend for the whole sample period. However, even though none of them are significant, *High*- alpha is still the highest and the only one positive, while *Low* is the worst-performing. Similarly, the top three portfolios

are not significantly different from each other but are significantly greater than the two lowest portfolios (Table 11). Except for *Above Average*, all alphas are slightly higher in this period compared to the whole sample. However, none of the alphas are significantly different from zero, so we conclude that neither of the portfolios significantly under- or outperform the market.

The smallest sample containing only the year 2020 shows similar results as the other two sample periods. A similar trend is observed: even during times of instability, the *High* portfolio performs the best, while *Low* performs the worst compared to the market. Furthermore, the top three portfolios are still significantly higher than the bottom two and are higher than the previous two sample periods. However, in 2020, *Below Average* are significantly greater than *Low* at a 5% significance level (Table 12).

We observe the high significance of the market factor for most of the time samples except for *Above Average* and *Below Average* in 2020, with values ranging from 0.88 to 1.17, indicating that the portfolios, on the most part, move together with the market, all other factors being constant.

7.1.2 Fama-French Three-Factor Model

Further, we look into the results by regressing our five portfolios on the Fama-French Three-Factor Model, where *Mkt-rf* is the market premium, *HML* is the value premium, and *SMB* is the size premium. The Fama-French Three-Factor model saw different trends in the alphas in all periods. Table 7 in the Appendix presents the results of FF3.

Looking at 2015-2020, we can see that the *Above Average* portfolio's alpha is significantly different from zero on both a 5% and 10% significance level. The same is observed in 2015-2019. The negative difference from zero indicates that in both periods *Above Average* significantly underperforms the market. According to FF3, none of the alphas are significantly different from each

other. While the *High* alpha outperforms in 2015-2020 and 2015-2019, it is surpassed by *Above Average* and *Below Average* in 2020. The difference in results indicates that the additional variables, SMB and *HML*, have added to the explanatory power of the model, having changed the alphas.

Above Average performed the best in 2020, a notable change from significantly underperforming in 2015-2020 and 2015-2019. We observe that the market factor is highly significant at a 1% significance level for all portfolios across time samples except for *Average* in 2015-2020. The values are positive, ranging from 0.94 to 1.06, indicating that the portfolios positively correlate to the market. The *SMB* factor is highly significant for all portfolios except for *Average* in 2015-2019.

The *SMB* factor loading is always negative for the two top-performing portfolios in terms of sustainability score, which indicates that the funds are highly invested in large-cap companies. The *SMB* loading is positive for the two bottom portfolios, indicating that it is a small-cap portfolio. It is reflected in our earlier discussion.

The *HML* factor shows more significance in the 2020 sample than the other two, where all except *Average* is significant at a 1% basis. For the top two portfolios, the *HML* factor loading is negative in 2015-2020 and 2020, while being positive in the 2015-2019 sample, which might imply that the *High* and *Above Average* portfolios are leaning towards growth companies quite heavily in 2020. The factor loading for *Low* is always positive and highly significant, which indicates the frequent appearance of value funds in that category.

7.1.3 Carhart Four-Factor Model

Further, we regress our data with the Carhart Four-Factor Model, which is in turn, is an extension of the Fama-French Three-Factor Model. Here, an

additional momentum (*MOM*) factor is added, and the results are presented in Table 8 in the Appendix.

Looking at 2015-2020 and 2015-2019, we observe that the *Above Average* portfolio's alpha was significantly different from zero on both a 5% and 10% significance level. It implies that in these periods, *Above Average* significantly underperformed the market. The *High* portfolio has the highest alpha in all periods except for in 2020, although not on a significant level.

In 2015-2020, all alphas are negative, while, in 2020, three out of five portfolios have positive alphas. Indicating that in 2020, the *High*, *Below Average* and *Low* portfolios slightly outperform the market, albeit not on a significant level. *Low* is significantly different on a 10% basis from *Average* in 2020; otherwise, none of the alphas are significantly different from each other. Looking at the market factor, all but one is significant on a 1% level and is approximately equal to one. The *SMB* factor shows similar trends as in FF3. *HML* is in 2015-2020 positive for all categories, implying the presence of value funds. In 2020, the *HML* factor for *High* and *Above Average* have negative loadings, however, not particularly significant.

The newly introduced momentum factor differs through the sample periods. In 2015-2020, it has positive factor loadings; hence, all portfolios showed momentum. In 2015-2019, *High* and *Above Average* have negative loadings, which implied negative momentum; however, these factor loadings are insignificant in most cases. *Low* on the other hand, has an especially significant momentum factor in all sample periods and is always positive.

7.1.4 Fama-French Five-Factor Model

The Fama-French Five-Factor model extends the Fama-French Three-Factor model with two additional factors, *RMW*, the return spread of the most profitable firms minus the least profitable firms; and, *CMA*, the return spread

of the firms that invest conservatively minus aggressively. The results of the regression of the five portfolio returns on these factors are presented in table 9.

Looking at the model results, we see a similar trend in the sense that none of the alphas is significant except for the *Above Average* portfolio in the year 2015-2020 and 2015-2019, where the portfolio significantly underperform the market.

We see that *High* has the highest alpha in those two periods. In the 2020 sample, however, *Below Average* has the highest alpha, suggesting that introducing the new factors helps to describe the results further. In addition, what changes from the Carhart model is that now all alphas are negative in 2020. What is worth mentioning is that none of the alphas does significantly differ from each other. The profitability factor (RMW) is not highly significant. Only for the*High* and *Above Average* portfolios in 2020 it is significant at a 1% level. The investment factor (CMA) is more significant, especially the portfolios with average to low sustainability scores. The factor loadings are negative, indicating an aggressive investment strategy. While, in 2020, only the top two portfolios are highly significant and have gone from positive to negative factor loadings, indicating that those have aggressive investment strategies.

All asset pricing models except for CAPM show similar trends.*Above Average* is underperforming the market on a significant level, *High* is the best performing, and *Low* is the worst performing in 2015-2020 and 2015-2019. However, in 2020 the results differ slightly. Only CAPM indicates a significantly negative alpha in 2020 with the *Low* portfolio, while the *High* and *Above Average* are positive but insignificant. With FF3, all alphas are negative in 2020. Carhart shows positive alphas for *High*, *Below Average* and *Low*. FF5 has all negative alphas.

7.2 Asset Pricing Models with Three Categories

As we know from Fama and French [2010], we expect to see more significant underperforming by the mutual funds compared to the market. Therefore, to increase our statistical power, we decided to run the models with a reduced number of portfolios. By reducing our portfolios from five to three, each contains more funds and thereby is more diversified and hopefully gives us more statistical power.

7.2.1 Capital Asset Pricing Model

As seen in Table 17, the CAPM for 2015-2020 shows no alphas for any of the portfolios that are significantly different from zero, except for *Average*, significant on a 10% level. Similar to the five-portfolio result, the portfolio with the highest sustainability score has a higher alpha than the other portfolios, although it does not significantly differ from zero.

The alpha for *Above Average* is positive in 2020 unlike the negative coefficient in each of the other periods. *Above Average* is significantly different from *Below Average* at a 1% significance level, as well as *Average* from *Below Average* in 2015-2020. In the 2015-2019, *Average* and *Below Average* are significantly different, (Table 16) while in 2020, *Above Average* is significantly different from *Average* on a 10% basis. (Table 18) Moreover, *Above Average* and *Below Average* are different on a 1% significance level. The market factor is highly significant at a 1% or 5% significance level for all except one portfolio, *Average* in 2020.

7.2.2 Fama-French Three-Factor Model

For the Fama-French Three-Factor Model (Table 14), the results are different from the CAPM, indicating that the *SMB* and *HML* factors help to explain

the returns. In this model, the *Above Average* portfolio is significantly underperforming the market in the sample period of 2015-2020 and 2015-2019. Interestingly, these results are negative and more so than the other samples in 2020, not continuing the previous trend. Another tendency is that the highest sustainability score portfolios do not have higher alphas than the other portfolios in all periods anymore. In 2015-2020 and 2015-2019, *Above Average* is the worst-performing category. In 2020, however, it was the best performing out of the three categories. It is important to note, however, that none of the alphas significantly differ from each other.

7.2.3 Carhart Four-Factor Model

The Carhart four-factor model (Table 15) provides similar results to the Fama-French Three-Factor model in terms of alphas and market factor, with *Above Average* being significantly different from zero in the two first sample periods. Similarly, the *Above Average* has the lowest alpha out of the three portfolios in those same periods. Interestingly, the *Below Average* alpha is the highest and positive for the 2020 sample period, although not significantly outperforming the market. None of the alphas significantly differ from each other.

7.2.4 Fama-French Five-Factor Model

The Fama-French Five-Factor Model provides similar results (Table 16) to the Fama-French Three-Factor Model and the Carhart Four-Factor Model, with *Above Average* being significantly different from zero in the two first sample periods. However, the *Above Average* portfolio significantly underperformed the market at a 5% and 10% significance level in both periods. *Above Average* is now the worst-performing, and *Below Average* is the best-performing category in 2020. None of the alphas are significantly under- or overperforming. Similar

to the previous models, none of the alphas are significantly different from each other.

Summary

As with the five portfolios, the results of the CAPM differ compared to the other models. For CAPM, the *Average* portfolio is significantly worse than the market in the entire sample. In comparison, *Above Average* was the best performing and positive for 2020, although not significant. There are more significant results in the other models, signaling that we have increased our statistical power. *Above Average* is significantly underperforming the market in samples 2015-2020 and 2015-2019 in all models. In Fama-French Three-Factor *Below Average* and *Low* significantly underperform the market in 2020, while *Above Average* is the best performing although still negative.

7.3 Justifying the usage of Fama-French Five-Factor Model

Additionally, to test the fit on the explanatory power of the Fama-French Five-Factor model and to see whether it produces any additional information compared to FF3, we perform a horse race regression between the two models for every category and every category each period. We test if *RMW* and *CMA* are jointly significantly different from zero by applying the F-test. For the five-category analysis, we perform fifteen horse race regressions, and in ten of them, both factors are jointly significant at a 5% level, in eleven of them, the *RMW* and *CMA* factors are jointly significant at a 10% level. No significance are indicated in the *Above Average* category in 2015-2020, *Average* and *Low* categories in 2020. The separate t-tests confirm the same for each of the two coefficients; none of them proves to be significant at the 10% level. In the pre-crisis period, two portfolios show that the additional Fama-French factors in the Five-Factor Model are jointly insignificant at a 5% level: *Average*

and *Below average*. However, it is significant at a 10% level in the *Average* category, mostly explained by the *RMW* factor. It is also significant at a 5% level when testing separately, while *CMA* does not show any significance by separate testing either. In the *Below Average* portfolio, both factors are insignificant when testing separately at a 5% level; only at a 10% level, the *CMA* factor indicates some significance.

For the three categories, we obtain nine results for each of them and the three periods. Seven out of nine results indicate the joint significance of the additional factors at least at a 5% significance level. Non-significant results are indicated in the *Above Average* category in the whole sample period. Separate t-tests confirm the same on each, *RMW* and *CMA*, factor as none of them are significant even at a 10% level. However, for the same category in the pre-crises and especially in the crisis period, the same factors are significant. No significance for the joint test is indicated in the *Average* category for the crisis period, unlike the other periods, as well as neither of two factors is significant when testing them separately.

By performing the horse race regressions, we get the result that most portfolios are explained better with Fama-French Five-Factor Model than with the Fama-French Three-Factor Model, which gives us the right to trust that the model's results are more economically reliable.

7.4 Robustness Analysis

We know that mutual funds are supposed to underperform the market net of fees from the previous research. This is why we would like to run our models with all the funds as one portfolio to see if we have the trend we expect. By performing this, we can verify that our data has economic sense. It then gives us the privilege to draw inferences on sustainable mutual funds as a whole. With the four different models, we see a trend that the alphas for time

samples 2015-2020 and 2015-2019 are significantly different from zero at either a 5% or 10% significance level (Tables 19 through 22). The market factor is also highly significant and positive, with values close to one for all models. The alphas being significantly different from zero in the two periods indicate that the portfolios significantly underperform the market as was expected. Interestingly, the 2020 sample period is not significantly different from zero, although it is negative for all models.

7.5 Discussion

Having performed the analysis, we may answer our research questions.

Firstly, did the sustainable mutual funds underperform in times of non-crisis? By analyzing our entire sample consisting of all funds with a sustainability score from Morningstar from 2015 to 2020, we see an indication of underperformance. Because Jensen's Alpha for all asset models in 2015-2019 is significantly lower than zero; hence, sustainable mutual funds underperform the market.

However, if we look at the sample divided into three categories, we do not obtain the same results. Even though all the alphas are negative, they are not significantly different from zero. In this instance, all asset models except for the CAPM suggests that only the portfolio with the highest sustainability score underperforms the market on a significant level. Again, when we further divide the funds, we obtain different results. All levels of sustainability scores underperform, except for the *High* that are now separated from *Above Average*, are positive for all asset models except for FF5.

What is interesting is that *Above Average* significantly underperforms the market, indicating that Above Average is the worst-performing category and High is the best performing in non-crisis times. However, we believe that this is not the Above Average category's true performance as it has the highest standard

errors of all the categories, and it does not make economic sense that High is the best performing while Above Average is the worst. The large standard errors indicate that the models might be less accurate for this portfolio than others. *Average* is consistently the second-best performing category. However, the alphas do not significantly differ from each other.

Our results endorse that most sustainable mutual funds underperform the market in non-crisis times. As we did expect as there are extensive research on the topic including Fama and French [2010]. However, there seems to be a correlation between high sustainability and higher returns, though not on a significant level. What are the reason behind *High's* superior performance during normal times? First, we can look at the significance of the different factor loadings. *High* has a significant negative loading for the size factor, indicating that it is a large-cap portfolio. The CMA factor loading's significance indicates that *High* has an overall conservative investment strategy.

An interesting argument is that the *High* performs best because the sustainability rating might be related to the funds' quality. It is further may be supported by the assumption that funds in the *High* category are invested in companies with solid fundamentals. If companies are disproportionally engaged in sustainability activities, these funds might outperform due to their fundamentals rather than sustainability. This line of argumentation would make sense if *Low* were the worst performing portfolio; however, it is for most of the time not. It is *Above Average* that most frequently underperform the market. There is no logical reason for this behavior as no difference can be read from the factor loadings, strengthening our suspicion of misleadings in our results.

To answer our second research question, we have to analyze the financial performance of the mutual funds during times of financial instability, namely the COVID-19 pandemic. None of Jensen's Alphas indicate a significant outperfor-

mance of the market by looking at the obtained results from the asset models concerning the entire sample. All alphas were negative, indicating an underperformance in 2020 as well. By looking at the three categories, only *High* and *Below Average* are positive according to CAPM and Carhart Four-Factor Model, respectively. The results do not differ greatly for the five category analyses. However, the *Low* category according to CAPM is significant on a 10% level. Additionally, we observe more portfolios with positive alphas. The Fama-French Three-Factor Model and Fama-French Five-Factor Model illustrate the same results as the three categories. The deviations from the previous results can be observed in the CAPM, where *High* and *Above Average* alphas are positive. At the same time, according to the Carhart Model, *High*, *Below Average* and *Low* alphas are positive as well. The difference in results makes it hard to make any inferences of what categories performed better in 2020.

To summarize, we observe that the alphas for the portfolios are on average higher in 2020 than in 2015-2019, indicating that sustainable funds perform better in 2020 than earlier. However, we cannot conclude that sustainable mutual funds outperform the market during the COVID-19 pandemic based on our results.

8 Conclusion

As discussed above, we cannot observe any significant protection by sustainable mutual funds in 2020, although the financial performance improved compared to previous years.

Based on previous research by Nofsinger and Varma [2014] and Maxfield and Wang [2020], we expected to see downside protection by sustainable mutual funds in economic contraction periods. Lins et al. [2017] suggested that good corporate governance was an essential factor in determining financial performance during the financial crisis of 2008. Corporate Governance is one of the factors being considered when a firm receives its ESG-risk score by Sustainalytics, meaning that funds with high portfolio sustainability scores are likely invested in companies with good corporate governance. During the 2008 financial crisis, the financial institutions were at fault. The trust in the financial markets was at an all-time low. Therefore, trust was a valuable asset that can be obtained by investing in corporate governance.

A possibility for the lack of protection and why good corporate governance did not pay dividends might be because the COVID-19 pandemic was not a financial crisis. The financial industry was not at fault, though it was exposed to the sudden disruption of ordinary life and the uncertain future.

The financial markets recovered faster than first assumed with only a short-lived bear market. We believe that the remarkable recovery contributes to the missing evidence of protection by sustainable mutual funds. As it is hard to offer downside protection when there except the unprecedented drop in March, there was no real downside to protect. Governments, the U.S.'s in particular, learned from the previous financial crisis. The Fed ensured confidence in the market by promising to buy both investment-grade and high-yield bonds if necessary. At the same time, congress's fiscal policy was to employ stimulus

checks to keep the economy going promptly. A combination of the two efforts worked, keeping the downside at a minimum.

Interestingly, we did, regardless, see an improvement in the financial performance of sustainable mutual funds. 2020 helped shift the focus away from the environmental part of ESG to the social aspect. As 2020 proved to a year of racial justice and equality, particularly in the U.S., These trends might have influenced the popularity and performance of the funds, as Americans take their business where their values are supported. However, we believe that the world of investments is moving away from actively managed funds towards ETFs and passive funds. For actively managed funds to sustain, we think they should consider lowering their fees and finding a way to sustain with tighter margins.

For further research, it would be interesting to test if, as we assume, the quality of the funds correlates with sustainability scores and performance. One way of achieving this would be to use Morningstar's star ratings, which assess the fundamentals of the fund's portfolio. Otherwise, it would be interesting to conduct the same analysis with ETFs as we would not expect them to underperform the market significantly, as they have lower fees than the actively managed ones. In hindsight, ETFs might have provided a clearer picture of the true performance of sustainability, both in crisis and non-crisis times.

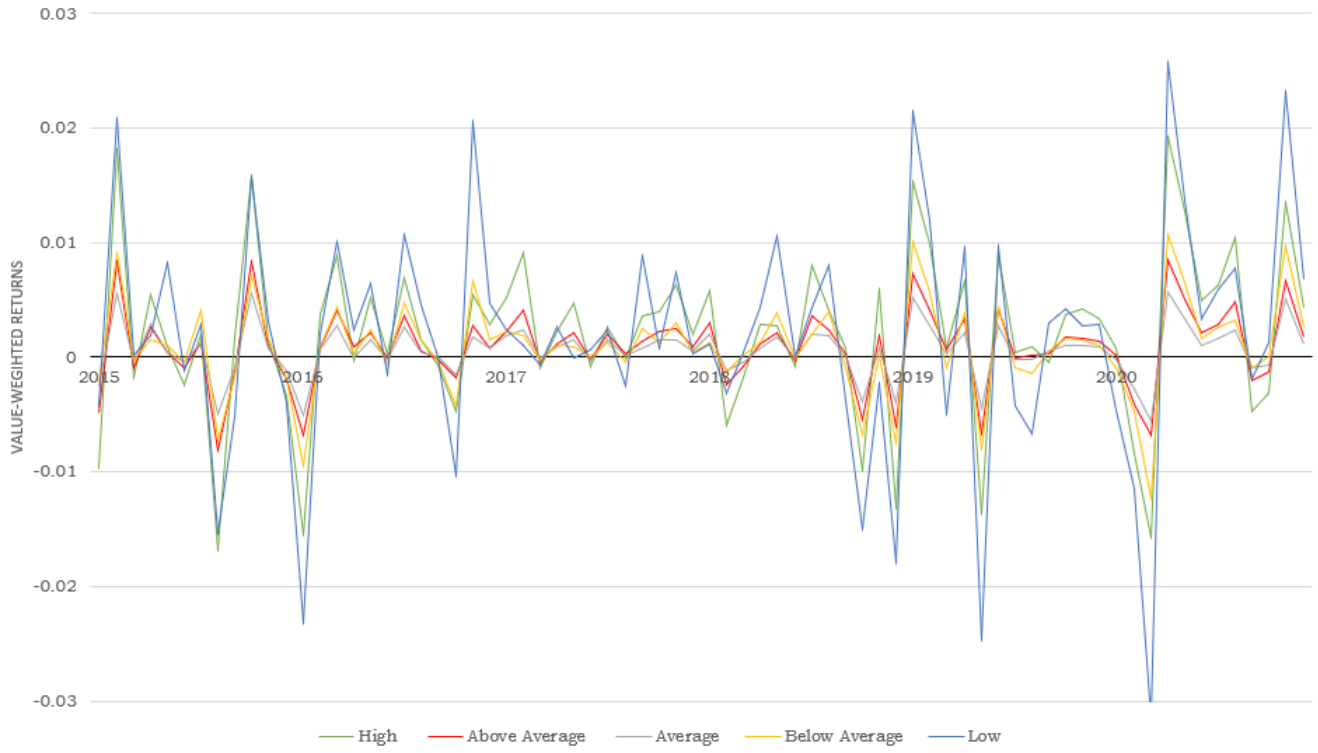

Figure 1: Figure 1 presents the weekly value-weighted returns of five different categories distributed by the Morningstar Portfolio Sustainability Scores from 2015 to 2020.

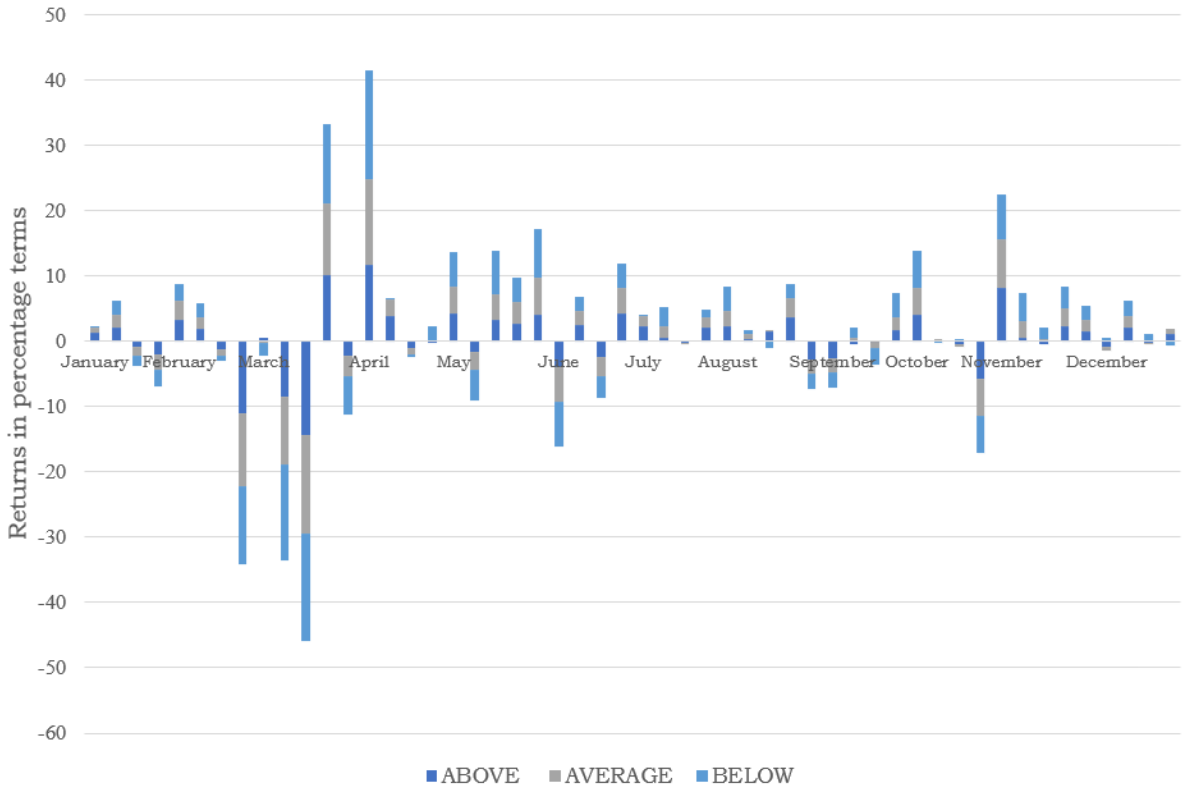

Figure 2: Figure 2 presents the capital inflows and outflows in 2020 represented by level of monthly Morningstar Portfolio Sustainability score.

Portfolio Sustainability Ranking	Alpha	Mkt-rf
2015-2020		
High	0.0009	0.9287***
	0.0429	42.2599
Above average	-0.0134	0.9635***
	-1.1976	142.1495
Average	-0.0238	1.0141***
	-1.7573	79.9275
Below average	-0.0602	1.1173***
	-1.3022	30.7303
Low	-0.0969	1.1577***
	-1.4987	22.0529
2015-2019		
High	0.0037	0.882***
	0.1836	30.3277
Above average	-0.0168	0.9525
	-1.3782	144.4200
Average	-0.0048	0.986***
	-0.6004	193.8700
Below average	-0.0384	1.0346***
	-1.1168	42.9841
Low	-0.0649	1.0649***
	-1.3147	28.0326
2020		
High	0.0293	0.91879***
	0.6318	32.1240
Above average	0.0205	0.9510
	0.8458	63.7740
Average	-0.1033	1.0398***
	-1.6272	46.8879
Below average	-0.0802	1.0981
	-1.0330	22.9820
Low	-0.2508*	1.1779***
	-1.8968	14.4690

Table 6: The table presents the CAPM regression results for the U.S. mutual funds' portfolios of *High*, *Above Average*, *Average*, *Below Average* and *Low* categories for three sample periods. The dependent variable is the excess return of each portfolio (Return minus the risk-free rate). The regression results are reported with coefficients and their corresponding t-statistics. The table shows the intercept, **alpha**, and the slope for the explanatory variable Mkt-rf (Market premium). We use OLS estimation and the standard errors are corrected for heteroscedasticity and autocorrelation with the Newey and West [1987] method.

Portfolio Sustainability Ranking	Alpha	Mkt-rf	SMB	HML
2015-2020				
High	-0.0088	0.9497***	-0.1138***	-0.0116
	-0.3864	35.4239	-4.0413	-0.3163
Above average	-0.023**	0.9817***	-0.0914***	-0.0175
	-2.5312	129.9280	-5.5153	-1.3778
Average	-0.0153	1.0022	0.0454**	0.0263
	-1.2487	101.9914	2.3046	2.7848
Below average	-0.0154	1.0298***	0.4466***	0.0761***
	-0.6050	49.9432	14.1057	4.1168
Low	-0.0162	1.0159***	0.674***	0.1755***
	-0.5751	49.6444	22.7316	8.2595
2015-2019				
High	0.0012	0.8958***	-0.0922***	0.0584
	0.0547	28.2983	-2.6683	1.2171
Above average	-0.0232***	0.9661***	-0.0939***	0.0100
	-2.2050	153.5370	-9.7387	0.5486
Average	-0.0089	0.9859***	-0.0030	0.0493***
	-1.2214	199.9212	-0.3295	-6.9167
Below average	-0.0111	0.98***	0.3798***	-0.0230
	-0.5937	73.8664	7.5605	-0.9754
Low	-0.0091	0.9757***	0.6318***	0.1048***
	-0.3576	52.2163	9.7374	2.8787
2020				
High	-0.0632	1.0166***	-0.0828**	-0.0993***
	-0.8068	39.9217	-2.7110	-3.3605
Above average	-0.0325	1.0022***	-0.0632**	-0.0548***
	-0.7817	70.5396	-2.7086	-4.3965
Average	-0.0655	1.0065***	0.0928***	0.0492
	-1.4197	60.6554	2.9669	3.4831
Below average	-0.0587	1.0629***	0.5221***	0.089***
	-0.7212	34.8447	11.1227	3.9679
Low	-0.0633	1.0445***	0.7217***	0.184***
	-0.7737	35.0168	16.6377	6.1979

Table 7: The table presents the Fama French Three-Factor regression results for the U.S. mutual funds' portfolios of *High*, *Above Average*, *Average*, *Below Average* and *Low* categories for three periods. The dependent variable is the excess return of each portfolio (Return minus the risk-free rate). The regression results are reported with coefficients and their corresponding t-statistics. The table shows the intercept, **alpha**, and the slope for the explanatory variables: *Mkt-rf* (Market premium), *SMB* (Size premium) and *HML* (Value premium). We use OLS estimation and the standard errors corrected for the heteroscedasticity and autocorrelation with Newey and West [1987] method.

Portfolio Sustainability Ranking	Alpha	Mkt-rf	SMB	HML	MOM
2015-2020					
High	-0.0039	0.9505***	-0.8840***	0.0306	0.0582***
	-0.1638	39.3599	-2.8811	0.9427	2.7421
Above average	-0.0225**	0.9636***	-0.0984***	0.0022	0.0135
	-2.1346	147.7262	-11.0490	0.1151	-1.6778
Average	-0.0147	1.0023***	0.0483**	0.0312***	0.0067
	-1.2194	104.4883	2.3231	2.6170	0.7019
Below average	-0.0087	1.0308***	0.4812***	0.1336***	0.0795***
	-0.3601	61.1465	16.0305	5.8500	3.7080
Low	-0.0084	1.017***	0.7141***	0.2420***	0.0918***
	-0.3141	62.3862	25.8808	9.7043	4.2405
2015-2019					
High	0.0013	0.8957***	-0.0925***	0.0580	-0.0007
	0.0564	28.6033	-2.7870	1.2217	-0.0422
Above average	-0.0223**	0.9818	-0.0879***	-0.0117	-0.0079*
	-2.4674	132.4800	-5.1053	-1.0297	0.9527
Average	-0.0091	0.9866***	-0.0015	-0.0468***	0.0044
	-1.2449	196.1925	-0.1604	-6.3897	0.8427
Below average	-0.0146	0.9922***	0.4024***	0.0158***	0.0668***
	-0.8204	64.6078	8.4952	0.6874	3.5349
Low	-0.0130	0.9895***	0.6576***	0.1490***	0.0759***
	-0.4789	55.2840	17.6826	6.0400	3.1357
2020					
High	0.0057	0.9990***	-0.0488	-0.0144	0.0884***
	0.0814	40.4658	-1.4678	-40.8900	2.8740
Above average	-0.0175	0.9984***	-0.0558**	-0.0363**	0.0192
	-0.4007	66.8269	-2.2259	-2.2598	1.4587
Average	-0.0458	1.0015***	0.1025***	0.0734***	0.0253*
	-0.9050	60.6824	3.1890	3.7813	1.8650
Below average	0.0327	1.0396***	0.5672***	0.2016***	0.1174***
	0.4416	58.6580	14.5650	5.3551	4.0299
Low	0.0429	1.0175***	0.7740***	0.3146***	0.1362***
	0.5749	57.0130	19.7380	8.2983	4.6446

Table 8: The table presents the Carhart regression results for the U.S. mutual funds' portfolios of *High*, *Above Average*, *Average*, *Below Average* and *Low* categories for three periods. The dependent variable is the excess return of each portfolio (Return minus the risk-free rate). The regression results are reported with coefficients and their corresponding t-statistics. The table shows the intercept, **alpha**, and the slope for the explanatory variables Mkt-rf (Market premium), SMB (Size premium), HML (Value premium), MOM (Momentum factor). We use OLS estimation and the standard errors corrected for the heteroscedasticity and autocorrelation with Newey and West (1986) method.

Portfolio Sustainability Ranking	Alpha	Mkt-rf	SMB	HML	RMW	CMA
2015-2020						
High	-0.0116	0.9557***	-0.0989***	-0.0396	0.0671**	0.0658
	-0.5261	43.1203	-3.3239	-1.0972	2.0492	1.1133
Above average	-0.0231*	0.9837***	-0.0890***	-0.0237**	0.0067	0.0216
	-1.9396	119.9753	-7.0770	-2.2153	0.5031	0.8632
Average	-0.0161	0.9956	0.0411**	0.0426***	0.0025	-0.0737***
	-1.3247	99.0948	2.2567	4.3787	0.1636	-3.5300
Below average	-0.0168	1.0160***	0.4399***	0.1116***	-0.0010	-0.1548***
	-0.6656	45.9377	14.2423	5.3150	-0.0298	-3.1759
Low	-0.0195	1.0010***	0.6691***	0.2068***	0.0355	-0.1674***
	-0.7029	46.1619	22.1044	8.3840	0.9475	-2.8082
2015-2019						
High	-0.0018	0.9160***	-0.0861**	0.0037	0.0604	0.1488***
	-0.0854	30.0937	-2.4362	0.0751	1.5737	5.5447
Above average	-0.0229**	0.9732***	-0.0959***	-0.0126	-0.0087	0.0674***
	-2.2695	122.6357	-10.6651	-0.8885	-0.7695	2.8146
Average	-0.0079	0.9836***	-0.0058	-0.4510***	-0.0220**	-0.0085
	-1.0908	192.6151	-0.6332	-5.3149	-2.2150	-0.6759
Below average	-0.0110	0.9718***	0.3808***	0.0024	0.0012	-0.0741*
	-0.6027	73.7627	7.5083	0.1087	0.0602	-1.8619
Low	-0.0103	0.9583***	0.6381***	0.1616***	0.0316	-0.1706***
	-0.4050	53.7459	9.6716	5.4228	0.8679	-2.6180
2020						
High	-0.1028	0.9982***	-0.0637**	-0.1107***	0.1826***	-0.2962***
	-1.6195	38.6110	-2.1832	-3.1869	3.0338	-4.5398
Above average	-0.0532	0.9937***	-0.0482**	-0.0671***	0.1019***	-0.127***
	-1.5026	73.7111	-2.3757	-4.3819	3.4715	-4.4492
Average	-0.0569	1.0062***	0.0689**	0.0769***	-0.0656	-0.0453
	-1.2467	64.0064	2.1043	3.8620	-1.6246	-1.4480
Below average	-0.0264	1.0626	0.4351	0.1896	-0.2438	-0.1541
	-0.3569	59.6920	9.5211	4.9611	-3.0204	-1.9894
Low	-0.0513	1.0433***	0.68403***	0.22814***	-0.0975	-0.0872
	-0.5951	50.3300	12.8540	5.1259	-1.0371	-0.9666

Table 9: The table presents the Fama French Five-Factor regression results for the U.S. mutual funds' portfolios of *High*, *Above Average*, *Average*, *Below Average* and *Low* categories for three periods. The dependent variable is the excess return of each portfolio (Return minus the risk-free rate). The regression results are reported with coefficients and their corresponding t-statistics. The table shows the intercept, alpha, and the slope for the explanatory variables Mkt-rf (Market premium), SMB (Size premium), HML (Value premium), RMW (Profitability factor), CMA (Investment factor). We use OLS estimation and the standard errors corrected for the heteroscedasticity and autocorrelation with Newey and West (1986) method.

CAPM	High	Above Average	Average	Below Average	Low
High					
Above average	Do not reject H_0				
Average	Do not reject H_0	Do not reject H_0			
Below average	Reject H_0 $**$	Reject H_0 $**$	Reject H_0 $**$		
Low	Reject H_0 $**$	Reject H_0 $**$	Reject H_0 $**$	Do not reject H_0	

Table 10: The table shows the results for the comparison of alphas obtained from the t-tests of each out of five categories in 2015-2020 under the CAPM regression. The null hypothesis for each test states that the value of the intercept is not significantly different from the comparable one. The alternative hypothesis for each test states that the value of the intercept is significantly different from the comparable one.

CAPM	High	Above Average	Average	Below Average	Low
High					
Above average	Do not reject H_0				
Average	Do not reject H_0	Do not reject H_0			
Below average	Reject H_0 $*$	Reject $H_0$$*$	Reject H_0 $**$		
Low	Reject H_0 $**$	Reject H_0 $**$	Reject H_0 $**$	Do not reject H_0	

Table 11: The table shows the results for the comparison of alphas obtained from the t-tests of each out of five categories in 2015-2019 under the CAPM regression. The null hypothesis for each test states that the value of the intercept is not significantly different from the comparable one. The alternative hypothesis for each test states that the value of the intercept is significantly different from the comparable one.

CAPM	High	Above Average	Average	Below Average	Low
High					
Above average	Do not reject H_0				
Average	Do not reject H_0	Do not reject H_0			
Below average	Reject H_0 $**$	Reject H_0 $**$	Reject H_0 $**$		
Low	Reject H_0 $**$	Reject H_0 $**$	Reject H_0 $**$	Reject H_0 $*$	

Table 12: The table shows the results for the comparison of alphas obtained from the t-tests of five categories in 2020 under the CAPM regression. The null hypothesis for each test states that the value of the intercept is not significantly different from the comparable one. The alternative hypothesis for each test states that the value of the intercept is significantly different from the comparable one.

Portfolio Sustainability Ranking	Alpha	Mkt-rf
2015-2020		
Above average	-0.0089	0.9603***
	-0.6728	119.4756
Average	-0.0238*	1.0141***
	-1.7573	79.9275
Below average	-0.0675	1.1253***
	-1.3635	29.1434
2015-2019		
Above average	-0.0110	0.94617**
	0.3182	0.0000
Average	-0.0048	0.986***
	-0.6004	193.8700
Below average	-0.0444	1.0413***
	-1.2499	39.3466
2020		
Above average	0.0105	0.97234**
	0.8629	0.0000
Average	-0.1033	1.0398
	-1.6272	46.8879
Below average	-0.1342	1.1994***
	-0.6012	23.7560

Table 13: The table presents the CAPM regression results for the U.S. mutual funds' portfolios of *Above Average*, *Average* and *Below Average* categories for three periods. The dependent variable is the excess return of each portfolio (Return minus the risk-free rate). The regression results are reported with coefficients and their corresponding t-statistics. The table shows the intercept, alpha, and the slope for the explanatory variable Mkt-rf (Market premium). We use OLS estimation and the standard errors corrected for the heteroscedasticity and autocorrelation with Newey and West (1986) method.

Portfolio Sustainability Ranking	Alpha	Mkt-rf	SMB	HML
2015-2020				
Above average	-0.0182**	0.9792***	-0.0990***	-0.0139
	-2.1668	107.7844	-5.6538	-0.9732
Average	-0.0153	1.0022	0.0454**	0.0263
	-1.2487	101.9914	2.3046	2.7848
Below average	-0.0160	1.0277***	0.4892***	0.0945***
	0.6329	50.6096	16.0758	5.1269
2015-2019				
Above average	-0.0166*	0.9606***	-0.0987***	0.0248**
	-1.8883	184.1984	-9.4557	2.3641
Average	-0.0089	0.9859***	-0.0030	0.0493***
	-1.2214	199.9212	-0.3295	-6.9167
Below average	-0.0116	0.9803***	0.4265***	0.0006
	-0.5968	68.9413	8.0010	0.0251
2020				
Above average	-0.0385	1.0049***	-0.0665***	-0.0624***
	-0.8376	63.6096	-2.8811	-4.3945
Average	-0.0655	1.0065***	0.0928***	0.0492
	-1.4197	60.6554	2.9669	3.4831
Below average	-0.0585	1.0593***	0.5598***	0.1069
	-0.7325	35.5508	12.3495	4.6736

Table 14: The table presents the Fama French Three-Factor regression results for the U.S. mutual funds' portfolios of *Above Average*, *Average* and *Below Average* categories for three periods. The dependent variable is the excess return of each portfolio (Return minus the risk-free rate). The regression results are reported with coefficients and their corresponding t-statistics. The table shows the intercept, alpha, and the slope for the explanatory variables Mkt-rf (Market premium), SMB (Size premium), HML (Value premium). We use OLS estimation and the standard errors corrected for the heteroscedasticity and autocorrelation with Newey and West (1986) method.

Portfolio Sustainability Ranking	Alpha	Mkt-rf	SMB	HML	MOM
2015-2020					
Above average	-0.0168**	0.9794***	-0.0919***	-0.002	0.0164*
	-2.0174	111.8756	-4.9691	-0.2250	1.7465
Average	-0.0147	1.0023***	0.0483**	0.0312***	0.0067
	-1.2194	104.4883	2.3231	2.6170	0.7019
Below average	-0.0091	1.0287***	0.5247***	0.1535***	0.0814***
	-0.3819	62.6037	18.3954	6.8567	3.8895
2015-2019					
Above average	-0.0161*	0.9587***	-0.1021***	0.0189**	-0.0101
	-1.7928	182.0176	-10.5242	2.0640	-1.2136
Average	-0.0091	0.9866***	-0.0015	-0.0468***	0.0044
	-1.2449	196.1925	-0.1604	-6.3897	0.8427
Below average	-0.0151	0.9927***	0.4497***	0.0404*	0.0684***
	-0.8309	60.2576	8.9516	1.6551	3.5409
2020					
Above average	-0.0152	0.999***	-0.0550**	-0.0337*	0.0299*
	-0.3259	61.1675	-2.1920	-1.9211	1.9319
Average	-0.0458	1.0015***	0.1025***	0.0734***	0.0253*
	-0.9050	60.6824	3.1890	3.7813	1.8650
Below average	0.0357	1.0353***	0.6062***	0.2229***	0.1209***
	0.5010	60.8210	16.2070	6.1634	4.3209

Table 15: The table presents the Carhart regression results for the U.S. mutual funds' portfolios of *Above Average*, *Average* and *Below Average* categories for three periods. The dependent variable is the excess return of each portfolio (Return minus the risk-free rate). The regression results are reported with coefficients and their corresponding t-statistics. The table shows the intercept, alpha, and the slope for the explanatory variables Mkt-rf (Market premium), SMB (Size premium), HML (Value premium), MOM (Momentum factor). We use OLS estimation and the standard errors corrected for the heteroscedasticity and autocorrelation with Newey and West (1986) method.

Portfolio Sustainability Ranking	Alpha	Mkt-rf	SMB	HML	RMW	CMA
2015-2020						
Above average	-0.0185**	0.9833***	-0.0936***	-0.0274**	0.0158	0.0456
	-2.1946	125.1532	-5.2114	-1.7638	0.9668	1.2269
Average	-0.0161	0.9956	0.0411**	0.0426***	0.0025	-0.0737***
	-1.3247	99.0948	2.2567	4.3787	0.1636	-3.5300
Below average	-0.0178	1.0133***	0.4796***	0.1306***	0.0044	-0.162***
	-0.7095	46.6134	16.1410	6.2871	0.1298	-3.2652
2015-2019						
Above average	-0.017**	0.9729***	-0.0994***	-0.0124	0.0048	0.1073***
	-2.1292	206.9426	-10.3696	-1.0776	0.4451	6.1198
Average	-0.0079	0.9836***	-0.0058	-0.4510***	-0.022**	-0.0085
	-1.0908	192.6151	-0.6332	-5.3149	-2.2150	-0.6759
Below average	-0.0117	0.9694***	0.4285	0.0346	0.0058	-0.1000**
	-0.6142	70.6272	7.9470	1.5334	0.2471	-2.1477
2020						
Above average	-0.0625	0.9947***	-0.0503**	-0.0751***	0.1167***	-0.1545***
	-1.6500	65.6632	-2.5845	-4.3913	3.6321	-4.9291
Average	-0.0569	1.0062***	0.0689**	0.0769***	-0.0656	-0.0453
	-1.2467	64.0064	2.1043	3.8620	-1.6246	-1.4480
Below average	-0.0298	1.0589***	0.48171***	0.1973***	-0.21776**	-0.1411*
	-0.4025	59.4670	10.5370	5.1604	-2.6965	-1.8206

Table 16: The table presents the Fama French Five-Factor regression results for the U.S. mutual funds' portfolios of *Above Average*, *Average* and *Below Average* categories for three periods. The dependent variable is the excess return of each portfolio (Return minus the risk-free rate). The regression results are reported with coefficients and their corresponding t-statistics. The table shows the intercept, alpha, and the slope for the explanatory variables Mkt-rf (Market premium), SMB (Size premium), HML (Value premium), RMW (Profitability factor), CMA (Investment factor). We use OLS estimation and the standard errors corrected for the heteroscedasticity and autocorrelation with Newey and West (1986) method.

CAPM	Above Average	Average	Below Average
Above Average			
Average	Do not reject H_0		
Below Average	Do not reject H_0	Reject $H_0 * **$	

Table 17: The table shows the results for the comparison of alphas obtained from the t-tests of three categories of the U.S. sustainable mutual funds in 2015-2019 under the CAPM regression. The null hypothesis for each test states that the value of the intercept is not significantly different from the comparable one. The alternative hypothesis for each test states that the value of the intercept is significantly different from the comparable one.

CAPM	Above Average	Average	Below Average
Above Average			
Average	Reject H_0*		
Below Average	Reject $H_0 * **$	Do not reject H_0	

Table 18: The table shows the results for the comparison of alphas obtained from the t-tests of three categories of the U.S. sustainable mutual funds in 2020 under the CAPM regression. The null hypothesis for each test states that the value of the intercept is not significantly different from the comparable one. The alternative hypothesis for each test states that the value of the intercept is significantly different from the comparable one.

Portfolio Sustainability Ranking	Alpha	Mkt-rf
2015-2020		
All sustainability categories	-0.0228**	1.0079***
	-2.2307	77.0304
2015-2019		
All sustainability categories	-0.0122**	0.9811***
	-2.0104	219.904
2020		
All sustainability categories	-0,0599	1.0317***
	-1.1980	52.5055

Table 19: The table shows the results for the excess return of the portfolio consisting of all U.S. mutual funds with Morningstar sustainability rating on the CAPM regression for three periods. The regression results are reported with coefficients and their corresponding t-statistics. The table represents the intercept, alpha, and the slope for the explanatory variable Mkt-rf (Market premium). We use OLS estimation and the standard errors corrected for the heteroscedasticity and autocorrelation with Newey and West (1986) method

Portfolio Sustainability Ranking	Alpha	Mkt-rf	SMB	HML
2015-2020				
All sustainability categories	-0.0167*	0.9975***	0.0485***	0.0136*
	-1.7718	110.6739	3.2550	1.9417
2015-2019				
All sustainability categories	-0.0125**	0.978***	0.0198***	-0.0221***
	-2.1360	213.2510	3.4700	-4.4910
2020				
All sustainability categories	-0.0515	1.0114***	0.0863***	0.0124
	-1.2726	63.4208	3.4275	1.0436

Table 20: The table shows the results for the excess return of the portfolio consisting of all U.S. mutual funds with Morningstar sustainability rating on the FF3 regression for three periods. The regression results are reported with coefficients and their corresponding t-statistics. The table represents the intercept, alpha, and the slope for the explanatory variables Mkt-rf (Market premium), SMB (Size premium), HML (Value premium). We use OLS estimation and the standard errors corrected for the heteroscedasticity and autocorrelation with Newey and West (1986) method

Portfolio Sustainability Ranking	Alpha	Mkt-rf	SMB	HML	MOM
2015-2020					
All sustainability categories	-0.0151*	0.9977***	0.0568***	0.0274***	0.0191**
	-1.6629	119.9723	3.7437	3.1587	2.8050
2015-2019					
All sustainability categories	-0.0129**	0.9796***	0.0227***	-0.0171***	0.0086*
	-2.2202	209.1172	3.9620	-3.4402	2.1915
2020					
All sustainability categories	-0.023	1.0041***	-0.1004***	0.0475***	0.0366**
	-0.5419	65.1284	3.8723	2.9880	3.0294

Table 21: The table shows the results for the excess return of the portfolio consisting of all U.S. mutual funds with Morningstar sustainability rating on the Carhart regression for three periods. The regression results are reported with coefficients and their corresponding t-statistics. The table represents the intercept, alpha, and the slope for the explanatory variables Mkt-rf (Market premium), SMB (Size premium), HML (Value premium) and MOM (Momentum factor). We use OLS estimation and the standard errors corrected for the heteroscedasticity and autocorrelation with Newey and West (1986) method

Portfolio Sustainability Ranking	Alpha	Mkt-rf	SMB	HML	RMW	CMA
2015-2020						
All sustainability categories	-0.0174**	0.9931***	0.00461***	0.0240***	0.0046	-0.0493***
	-1.8654	108.0326	3.3714	3.1004	0.4074	-2.8310
2015-2019						
All sustainability categories	-0.0119**	0.9779***	0.018***	-0.0233***	-0.0131**	0.0056**
	-2.0564	207.2879	3.1307	-3.7000	-16.7340	0.5245
2020						
All sustainability categories	-0.0530	1.0076***	0.0714***	0.0318*	-0.016	-0.0938***
	-1.3580	64.7600	2.7990	1.8720	-0.5140	-32.3780

Table 22: The table shows the results for the excess return of the portfolio consisting of all U.S. mutual funds with Morningstar sustainability rating on the FF5 regression for three periods. The regression results are reported with coefficients and their corresponding t-statistics. The table represents the intercept, alpha, and the slope for the explanatory variables Mkt-rf (Market premium), SMB (Size premium), HML (Value premium), RMW (Profitability factor), CMA (Investment factor). We use OLS estimation and the standard errors corrected for the heteroscedasticity and autocorrelation with Newey and West (1986) method

High		Mean	Observations	Std. Dev	Max	Min	Mean
Portfolio Sustainability Score	2015	51.22	98	1.012	55.34	50.16	50.93
	2016	49.40	118	1.125	54.32	48.30	49.03
	2017	47.88	130	1.052	52.51	46.79	47.56
	2018	48.32	132	1.004	52.58	47.20	48.06
	2019 Q1 - Q2	48.63	125	0.929	52.39	47.58	48.39
	2019 Q3	21.94	191	0.798	22.78	18.69	22.21
	2020	21.05	184	0.788	21.88	17.93	21.28
Fund size (in billions)	2015	2.1789	98	5.6933	39.6479	0.0030	0.2815
	2016	1.8162	118	4.6658	36.6693	0.0011	0.2783
	2017	2.4805	130	6.4639	47.2700	0.0017	0.3096
	2018	2.5801	132	6.5453	53.5108	0.0023	0.3363
	2019 Q1 - Q2	2.5355	125	5.8331	45.5416	0.0024	0.4085
	2019 Q3	2.1587	191	5.9304	62.1173	0.0008	0.3330
	2020	2.1048	184	5.9163	57.9303	0.0004	0.2958
Value-weighted return	2015	0.00092	98	0.01810	0.06860	-0.05748	0.00013
	2016	0.00111	118	0.01513	0.07115	-0.06397	0.00015
	2017	0.00316	130	0.00996	0.07490	-0.01024	0.00045
	2018	-0.00011	132	0.01354	0.05141	-0.06517	0.00000
	2019 Q1 - Q2	0.00365	125	0.01742	0.10695	-0.04033	0.00042
	2019 Q3	0.00270	191	0.00914	0.08944	-0.00719	0.00040
	2020	0.00335	184	0.02405	0.15696	-0.07333	0.00049

Table 23: The table presents the data for the High category portfolio: the mean sustainability rating, the number of observations, the mean of the fund size, the mean of the value-weighted return; and the standard deviation, the maximum, minimum and the median of the portfolio sustainability rating, the fund size and the value-weighted returns for each observing year.

Above Average		Mean	Observations	Std. Dev	Max	Min	Mean
Portfolio Sustainability Score	2015	49.26	216	0.435	50.14	48.61	49.21
	2016	47.49	266	0.378	48.28	46.97	47.41
	2017	45.98	291	0.386	46.77	45.43	45.91
	2018	46.33	293	0.411	47.18	45.71	46.28
	2019 Q1 - Q2	46.72	279	0.386	47.56	46.12	46.64
	2019 Q3	23.57	432	0.414	24.15	22.79	23.60
	2020	22.65	416	0.391	23.22	21.89	22.71
Fund size (in billions)	2015	2.2225	216	5.4888	49.2109	0.0015	0.4404
	2016	3.2754	265	14.6413	186.9516	0.0008	0.6016
	2017	5.0162	291	26.0295	337.6613	0.0004	0.6710
	2018	4.8825	455	35.5373	706.0393	0.0004	0.6463
	2019 Q1 - Q2	5.9265	279	32.6509	466.5966	0.0020	0.8259
	2019 Q3	4.6019	432	28.5062	512.7484	0.0001	0.5521
	2020	5.5342	416	31.0601	548.0545	0.0008	0.6093
Value-weighted return	2015	0.00032	216	0.00796	0.03392	-0.03320	0.00003
	2016	0.00054	283	0.00807	0.06897	-0.02596	0.00006
	2017	0.00151	291	0.00877	0.10444	-0.00482	0.00018
	2018	-0.00005	293	0.01387	0.09126	-0.10071	-0.00004
	2019 Q1 - Q2	0.00161	279	0.01880	0.20072	-0.06989	0.00022
	2019 Q3	0.00126	432	0.00860	0.15176	-0.00798	0.00012
	2020	0.00148	416	0.02132	0.24320	-0.12944	0.00015

Table 24: The table presents the data for the Above Average category portfolio: the mean sustainability rating, the number of observations, the mean of the fund size, the mean of the value-weighted return; and the standard deviation, the maximum, minimum and the median of the portfolio sustainability rating, the fund size and the value-weighted returns for each observing year.

Average		Mean	Observations	Std. Dev	Max	Min	Mean
Portfolio Sustainability Score	2015	47.89	337	0.462	48.59	46.99	47.95
	2016	46.10	409	0.568	46.96	44.91	46.17
	2017	44.29	449	0.770	45.42	42.50	44.40
	2018	44.50	455	0.857	45.70	42.51	44.69
	2019 Q1 - Q2	44.80	433	0.939	46.11	42.68	45.00
	2019 Q3	25.15	651	0.658	26.46	24.16	25.09
	2020	24.28	651	0.695	25.69	23.23	24.23
Fund size (in billions)	2015	5.1988	337	28.4718	397.6016	0.0017	0.5736
	2016	4.3203	409	25.6547	427.6861	0.0008	0.5126
	2017	4.2339	449	30.0498	591.6727	0.0002	0.5350
	2018	4.8825	455	35.5373	706.0393	0.0004	0.6463
	2019 Q1 - Q2	5.0177	433	39.6159	784.4594	0.0008	0.6348
	2019 Q3	5.1575	651	35.9007	861.1624	0.0007	0.6221
	2020	5.3022	650	37.8978	908.4554	0.0002	0.6200
Value-weighted return	2015	0.00050	337	0.01292	0.10871	-0.06780	0.00002
	2016	0.00030	409	0.00890	0.10292	-0.04960	0.00002
	2017	0.00104	449	0.00765	0.13333	-0.00655	0.00009
	2018	-0.00003	455	0.01176	0.10585	-0.12675	-0.00001
	2019 Q1 - Q2	0.00101	433	0.01749	0.25201	-0.09083	0.00013
	2019 Q3	0.00087	651	0.00628	0.14733	-0.00282	0.00009
	2020	0.00084	651	0.01835	0.29576	-0.14465	0.00008

Table 25: The table presents the data for the Average category portfolio: the mean sustainability rating, the number of observations, the mean of the fund size, the mean of the value-weighted return; and the standard deviation, the maximum, minimum and the median of the portfolio sustainability rating, the fund size and the value-weighted returns for each observing year.

Below Average		Mean	Observations	Std. Dev	Max	Min	Mean
Portfolio Sustainability Score	2015	46.23	208	0.475	46.98	45.34	46.27
	2016	43.74	263	0.663	44.90	42.65	43.71
	2017	40.77	290	0.847	42.48	39.56	40.63
	2018	40.86	294	0.727	42.49	39.80	40.79
	2019 Q1 - Q2	40.98	279	0.753	42.65	39.85	40.87
	2019 Q3	28.15	423	1.039	29.91	26.47	28.08
	2020	30.04	418	0.960	28.90	25.71	27.20
Fund size (in billions)	2015	2.4715	208	8.4873	92.1731	0.0025	0.4163
	2016	1.8972	263	7.0193	80.2346	0.0011	0.3336
	2017	1.6552	290	6.3322	77.6952	0.0004	0.3400
	2018	1.7774	294	7.0999	88.0666	0.0007	0.3479
	2019 Q1 - Q2	1.7705	279	7.3999	90.6881	0.0009	0.3683
	2019 Q3	1.5696	423	6.2623	93.4386	0.0007	0.3922
	2020	1.6652	417	6.3818	91.0289	0.0005	0.3299
Value-weighted return	2015	0.00090	208	0.01056	0.06608	-0.04691	0.00019
	2016	0.00063	263	0.01191	0.08641	-0.04925	0.00010
	2017	0.00117	290	0.00521	0.05717	-0.00552	0.00010
	2018	-0.00033	294	0.01006	0.05159	-0.07467	-0.00011
	2019 Q1 - Q2	0.00158	279	0.01899	0.15584	-0.07930	0.00032
	2019 Q3	0.00121	423	0.00537	0.07266	-0.00624	0.00024
	2020	0.00152	418	0.01934	0.18199	-0.09895	0.00024

Table 26: The table presents the data for the Below Average category portfolio: the mean sustainability rating, the number of observations, the mean of the fund size, the mean of the value-weighted return; and the standard deviation, the maximum, minimum and the median of the portfolio sustainability rating, the fund size and the value-weighted returns for each observing year.

Low		Mean	Observations	Std. Dev	Max	Min	Mean
Portfolio Sustainability Score	2015	44.40	104	0.890	45.32	40.62	44.63
	2016	41.91	117	0.707	42.64	38.72	42.11
	2017	39.00	128	0.502	39.55	36.33	39.13
	2018	39.24	129	0.527	39.79	36.14	39.37
	2019 Q1 - Q2	39.26	124	0.500	39.84	36.99	39.39
	2019 Q3	31.14	189	1.294	40.24	29.94	30.78
	2020	30.04	187	1.004	34.91	28.92	29.78
Fund size (in billions)	2015	1.6439	104	4.1855	34.0403	0.0013	0.3697
	2016	0.8562	117	1.9166	14.2024	0.0013	0.1942
	2017	0.8436	128	2.1384	16.0569	0.0009	0.1478
	2018	1.0040	129	2.3760	17.8711	0.0006	0.2425
	2019 Q1 - Q2	1.0209	124	2.3513	17.2759	0.0008	0.2387
	2019 Q3	0.9953	189	4.2048	50.9954	0.0005	0.1974
	2020	0.8752	187	1.8502	14.0237	0.0005	0.2301
Value-weighted return	2015	0.00188	104	0.01738	0.07809	-0.04556	0.00003
	2016	0.00219	117	0.02085	0.11243	-0.05675	0.00043
	2017	0.00192	128	0.00775	0.04646	-0.02162	0.00033
	2018	-0.00110	129	0.01454	0.04330	-0.06926	-0.00022
	2019 Q1 - Q2	0.00151	124	0.02827	0.11830	0.00055	0.00055
	2019 Q3	0.00319	189	0.00936	0.08491	0.00067	0.00067
	2020	0.00319	187	0.02559	0.11730	-0.08562	0.00096

Table 27: The table presents the data for the Low category portfolio: the mean sustainability rating, the number of observations, the mean of the fund size, the mean of the value-weighted return; and the standard deviation, the maximum, minimum and the median of the portfolio sustainability rating, the fund size and the value-weighted returns for each observing year.

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