Impact of ESG on Financial Performance on the Most Capitalized Stock Markets. Evidence from the USA, Europe, and Asia.

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Abstract

English Version

This paper analyzes the relationship between the corporate Environmental, Social, and Governance (ESG) score and stock returns. Contrary to previous literature, this study covers two recent time frames, 2010-2018 and 2015-2018, in three different regions: USA, Europe, and Asia. To predict each ESG pillar's effect on excess stock returns, a regression model was used. This paper finds a negative impact of the Environmental score on excess returns on the US, a positive impact of the Social score on the US and Asia and a positive impact of the ESG score on stock returns in Asia. Additionally, resourcing to a portfolio construction method, this paper shows evidence that portfolios containing the top ESG score stocks can outperform those containing the bottom ones. Between 2010 and 2018, there was evidence that a portfolio that buys (shorts) the best (worst) Governance score achieved positive abnormal returns in Europe. In the 2015-2018 period, in the USA and Europe, a portfolio that buys (shorts) the best (worst) ESG score stocks achieved positive abnormal returns. In Asia, there was no evidence of positive abnormal returns. Although the relationship between ESG and stock returns will depend heavily on the time frame and region, this paper showed clear benefits in adopting a socially responsible investment approach. Furthermore, an ethical dilemma arises where investors must acknowledge that the returns obtained by a less socially responsible portfolio with stocks linked with the production/distribution of tobacco, alcohol, firearms, and fuels lead to higher returns comparing to ESG rich portfolios.

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Portuguese Version

Este estudo analisa a relação entre a classificação Ambiental, Social e Governamental (ESG) e o retorno de ações em dois períodos recentes em comparação com estudos passados, 2010-2018 e 2015-2018, em três regiões diferentes: EUA, Europa e Ásia. Para prever o efeito de cada componente do ESG no retorno de ações foi utilizado um modelo de regressão. Verificou-se um impacto negativo da pontuação Ambiental no retorno nos EUA, um impacto positivo da pontuação Social nos EUA e na Ásia e um impacto positivo da pontuação do ESG na Ásia. Adicionalmente, recorrendo à construção de portfólios, este estudo demonstrou que, portfólios que contêm as ações com as melhores pontuações ESG, têm um desempenho superior àqueles que contêm as piores. Entre 2010 e 2018, na Europa, os portfólios que compram (vendem) as ações com melhor (pior) pontuação de Governação alcançaram retornos anormais positivos. Entre 2015 e 2018, nos EUA e na Europa, um portfólio que compra (vende) as ações com a melhor (pior) pontuação ESG alcançou retornos anormais positivos. Na Ásia, nenhum portfólio alcançou retornos anormais positivos. Apesar da relação entre a classificação ESG e os retornos das ações depender fortemente do período e da região, este documento mostrou benefícios na adoção de um investimento socialmente responsável. Complementarmente, surge um dilema ético no qual os investidores devem reconhecer que os retornos obtidos por um portfólio socialmente menos responsável, com ações associadas à produção/distribuição de tabaco, álcool, armas e combustíveis, conduz a retornos mais elevados, quando comparados com portfólios com maior pontuação ESG.

Título: Impacto da ESG no Desempenho Financeiro nas Bolsas de Valores Mais Capitalizadas do Mundo. Provas dos EUA, Europa e Ásia.

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Palavras-chave: ESG, Investimento Socialmente Responsável, Sustentabilidade Corporativa, Desempenho Financeiro.

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Table of Contents

List of Figures

List of Tables

List of Appendixes

List of Abbreviations

ESG – Environmental, Social, and Governance

SRI – Socially Responsible Investment[1]

CS – Corporate Sustainability

[1] Table in image format.

1. Introduction

Over the last few years, non-financial factors became more critical to investors' investment decisions. One of these factors is investing in sustainable firms by following a socially responsible investing (SRI) approach. According to the US Forum for Sustainable and Responsible Investment (2018) *Trends Report*, sustainable accountable and impact investing assets by the end of 2018 reached $12 trillion of the $46.6 trillion of total assets in the USA. This represents an increase of 34% relative to 2016, indicating a clear investors' demand for SRI assets.

Some authors studied SRI's impact on financial performance by analyzing socially responsible funds' performance. In papers like Kreander et al. (2005), Bello (2005), and Utz and Wimmer (2014), the authors did not find a significant difference in terms of performance between socially responsible and conventional mutual funds. Another approach used in previous literature on the relationship between SRI and financial performance is comparing SRI stock indices' performance with ordinary ones. The studies Statman (2006), Schröder (2007), Lee and Faff (2009), and Belghitar, Clark, and Deshmukh (2014) find no evidence that SRI indices present significant superior returns.

The drawback of looking at indices and funds' performance is that it is not enough to quantify the impact of corporate sustainability (CS) pillars on stock returns. Additionally, in the case of funds, the performance can depend on non-observable factors like management or screening skills. However, an SRI investment does not mean only to invest directly in sustainable funds or indices. One way to follow an SRI philosophy is to select assets with a high value on CS variables like community relations, corporate governance, diversity, employee relations, environment protection, human rights, and product safety. By using such variables, it is possible to understand what the components of corporate sustainability are that move the stock returns and lead to superior performance (Kempf and Osthoff (2007), Galema, Plantinga, and Scholtnes (2008), Mănescu (2011) and Edmans (2011)).

Another way to implement an SRI approach is to invest in companies with a high ESG score. Environmental (E), Social (S), and Governance (G), ESG, is a score that measures the overall sustainability level of companies. According to the CFA Institute, the Environmental score is related to the conservation of the natural world. The Social pillar evaluates people and relations, and Governance is linked with the standards for running a company, see Table 1. The advantage of ESG is that it is a direct numeric measure of corporate sustainability. In that sense, it is possible to study sustainable investing performance using the ESG score instead of SRI funds or indices and variables related to corporate sustainability. Papers like Halbritter and Dorfleitner (2015), Auer and

Schuhmacher (2016), and Limkriangkrai, Koh, and Durand (2017) conclude that some ESG pillars might have a significant impact on stock returns.

The literature regarding the relation between ESG and financial performance is a long-time covered topic that has increased significantly in the last years. In Friede et al. (2015), the authors collect more than 2200 unique studies between 1970 and 2015 regarding ESG and corporate financial performance. The highest increase in the cumulative number of studies was between 2000 and 2015. However, most of the published studies on the relation between ESG and abnormal stock returns focus only on one method and one country or region. This paper will contribute to the existing literature by analyzing the impact of the Environment, Social, and Governance variables separately on stock returns using two different approaches in three regions in two distinct periods, 2010-2018 and 2015-2108. This study selects the following countries: the USA, Europe, composed of Belgium, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom. Asia comprises China, Hong Kong, India, Indonesia, Japan, Russia, Singapore, South Korea, Thailand, and Australia. The countries selected allow to analyze and compare each ESG pillar's impact on stock returns on the most capitalized stock markets worldwide. This sample aims to increase this study's impact since most stock investors choose to invest in companies exchanged in the most developed markets.

The two different approaches used in this study follow the previous literature. The first method is a panel data regression that allows to quantify and understand how the ESG score influences stock returns, similar to Mănescu (2011); Halbritter, and Dorfleitner (2015); and Limkriangkrai, Koh, and Durand (2017). The second method involves the creation of portfolios based on the top and bottom stocks according to their ESG and respective pillars' scores as in Kempf and Osthoff (2007); Statman and Glushkov (2009) and Auer and Schuhmacher (2016).

This analysis is relevant because it helps to understand how and why it would payoff to introduce an SRI approach on investments in the most capitalized markets worldwide by using a direct numerical value (ESG) in 2010-2018 and 2015-2018, two recent time frames. By clearly stating each ESG pillar's impact on stock excess returns on each analyzed region (panel data regression), investors can quantify corporate sustainability pillars' effect on their stocks' returns. Additionally, by looking at the portfolios' performance and abnormal returns (portfolio method), this study provides a precise performance comparison between top ESG scorers and bottom ones, helping investors understand if there is or not a superior performance from the stocks best ESG scores.

Using the panel data regressions method, this paper concludes that there is a positive and statistically significant Social pillar effect on excess stock returns in the USA and Asia. Additionally, there is evidence of a negative statistically significant impact of the Environment pillar on excess returns for the USA and Asia. Furthermore, this paper found a statically significant and positive effect of the ESG score on excess stock returns in Asia in both periods covered.

Resourcing to the portfolio creation method, this study provides a detailed view of the differences in performance and the existence or not of abnormal returns for the top ESG score stocks and the bottom ones between the regions analyzed. Additionally, to isolate the hypothesis of superior returns from ESG portfolios (SRI approach), another portfolio was created containing stocks that are less appealing to socially responsible investments using SIC codes linked to alcohol, tobacco, firearms, and fuel production. This portfolio had a strong performance.

This study concludes that most portfolios containing top ESG scorers outperformed the bottom ones. When looking for abnormal returns in 2010-2018, the conclusion regarding the possibility of combining a "green" mentality investment with superior performance in the US is not clear. Between 2015 and 2018, a strategy involving buying (shorting) the top (bottom) ESG score stocks led to positive and significant abnormal returns in the US and Europe. A long-short Governance score strategy in Europe led to positive abnormal returns. None of the top scorers or long-short portfolios could achieve positive and significant abnormal returns in both time frames in Asia.

The rest of the paper is structured as follows. Section 2 presents an extensive literature review containing previous studies on the relation between SRI/ESG and stock returns. Section 3 presents the complete description of the data set for each method, including sources, descriptive statistics, and plots. Section 4 describes each method computed. Section 5 reports the empirical findings of this study. Section 6 contains the robustness check of the findings. Section 7 presents a discussion of the findings and their accordance with previous literature. The paper concludes in section 8.

2. Literature review and hypothesis

This section summarizes the significant studies that contributed to analyzing the effect of corporate sustainability on stock returns. The literature described covers the two approaches used in this paper. Some of the authors opted for using variables related to corporate sustainability and SRI. Others used

the ESG score as a single variable or separated Environment, Social, and Governance as three different variables.

In an influential paper, Gompers, Ishii, and Metrick (2003) study the relationship between corporate Governance and equity prices. They construct an index based on several corporate governance provisions extracted from the Investor Responsibility Research Centre (IRRC) to estimate the level of shareholder rights for 1500 US firms during the 1990s. Additionally, they create an investment strategy that buys (sells) the 10% stocks with the highest (lowest) index score. The authors conclude that this strategy earned statistically significant positive abnormal returns for the analyzed sample period.

Derwall et al. (2005) use a portfolio construction approach to test if SRI leads to superior or inferior stock performance using US stock data. Instead of using ESG pillars, the authors resource to corporate eco-efficiency ratio scores. This ratio measures a company's environmental performance as the value the firm adds to the waste the firm generates by its activity. They rank stocks according to the corporate eco-efficiency score and select the top 30% and the bottom 30%. Furthermore, they form a portfolio consisting of a long position on the top 30% and a short position on the bottom 30%. The authors concluded that the top portfolio outperformed the bottom one between 1995 and 2003, indicating that investors can benefit from adopting an SRI (Environmentally based) approach to their investments.

Kempf and Osthoff (2007), use stocks traded on S&P 500 and the DS 400 indexes, between 1992 and 2004, and adopt a portfolio creation method that involved buying the top 10% stocks with high social responsible ratings and short-sell the bottom 10% of the stocks with low socially responsible ratings. The social ratings came from the KLD Research database, and Analytics and the 4-factor model in Carhart (1997) is used to predict abnormal returns. The authors found that this high-low strategy led to abnormal returns up to 8,7% a year, suggesting that investors can have an advantage in following an SRI mentality.

Galema, Plantinga, and Scholtnes (2008) contribute to the literature by explaining the lack of causality between ESG and stock returns in previous studies. They study SRI's effect in excess returns using several variables from the KLD Research and Analytics database. Resorting to Fama and MacBeth (1973) regressions and a vector of control variables, they find that only employee relations scores had a statistically significant impact on excess returns. Additionally, they argue that different SRI

variables might have different impacts (negative or positive) on stock returns. The authors also conclude that since some SRI variables decrease the book-to-market ratio and the HML factor from Fama and French measures the difference between high and low book to market stocks, the alphas (abnormal returns) do not capture SRI effects.

Hong and Kacperczyk (2009), find evidence that the screening coming from an SRI approach can lead to lower returns. The authors reach a controversial conclusion that stocks that are in theory excluded from SRI portfolios since are related to negative ethical issues, "sin stocks", have higher book-to-market values and higher excess returns than SRI portfolios and other comparable portfolios. These "sin stocks" were related to tobacco, alcohol, and gambling. The paper also finds that "sin stocks" are less held by pension funds and have less analyst coverage. The outperformance from "sin stocks" is also verified in this study.

Statman and Glushkov (2009) follow a high minus low social responsibility, equally weighted, portfolio method built on KLD ratings. In order to extract abnormal returns of the portfolios, the authors use three different models CAPM, Markowitz (1959), three-factor model, Fama and French (1993), and the four-factor model, Carhart (1997). Additionally, they compare the performance of these socially responsible portfolios with conventional portfolios and non-socially responsible portfolios that contain stocks related to tobacco, alcohol, gambling, firearms, military or nuclear operations. The findings are that some socially responsible portfolios have a better performance than conventional ones but do not outperform the non-socially responsible portfolios.

Edmans (2011), studies the relationship between employee satisfaction, linked with the ESG Social pillar, table 1, and long-run stock returns. The author creates a value-weighted portfolio with the best companies to work in the USA and analyzes the portfolio's performance from 1984 to 2009. Using the Four-Factor model, Carhart (1997), the paper finds that portfolios containing high employee satisfaction companies can earn statistically significant and positive abnormal returns. The findings suggest that SRI can improve the returns of investors.

In Mănescu (2011), the author studies the relation between ESG and stock returns using USA stock data from 1991 to 2006. To analyze the effect of ESG on stock returns, seven variables related to ESG are used together with a Fama and MacBeth (1973) model: Community relations, Corporate Governance, Diversity, Employee relations, Environment, Human rights, and Product safety. In the end, only community relations has a statistically significant effect on stock returns.

To identify if an SRI approach leads to superior stock performance, Humphrey and Tan (2014) create value-weighted portfolios that included stocks that comply with SRI and portfolios that exclude stocks related to undesirable activities like gambling or alcohol production. The stocks considered were the ones exchanged (historically) on the S&P 500 index. CRSP is used to extract stock returns, and the period considered was from 1996 to 2010. Using the CAPM model, Markowitz (1959), and the Four-Factor model, Carhart (1997), the authors cannot obtain positive and statistically significant abnormal returns for either portfolio. Additionally, the authors do not find a significant difference in performance between the portfolios that include and not non-SRI stocks, contrary to this paper.

Halbritter and Dorfleitner (2015) study the impact of ESG on stock returns by using three different platforms for collecting ESG data: Asset 4, Bloomberg, and KLD. They use monthly stock data from the USA from 2002 to 2012. Also, the authors use the two methods covered in this paper. For predicting excess stock returns, the authors resort to the Fama and MacBeth (1973) model and E, S, and G as three different variables. They also divide the dataset into two time periods, 2002 to 2006 and 2007 to 2012, for robustness purposes. They find that the influence of ESG on returns depends on the platform and time frame covered. Furthermore, portfolios that buy (short) high (low) ESG score stocks do not obtain abnormal returns.

Dimson, Karakas, and Li (2015) study the impact of ESG on stock returns by using corporate social responsibility engagements linked to Environmental, Social, and Governance concerns for US companies between 1999 and 2009. A large institutional investor (not identified) committed to responsible investments provided the engagements. This investor specified if the companies had acceptable ESG practices or needed to adopt changes to achieve a satisfactory score. Using monthly stock data from CRSP, the authors create a portfolio that buys stocks that, according to the unidentified asset manager, needed engagement to improve ESG and sell the same stocks when they achieve a satisfactory ESG level. These portfolios achieved positive abnormal returns suggesting that companies can benefit (in terms of stock performance) in adopting ESG improvement practices.

Auer and Schuhmacher (2016), also cover three different regions and use the ESG directly as a variable. Using monthly stock data for the USA, Europe, and the Asia Pacific, they evaluate if high ESG portfolios can perform better than low ones. The method consisted of ranking each month stocks according to their ESG score, select the top 5%, and building an equal-weighted portfolio. Subsequently, the authors compare the high ESG portfolio to a portfolio of socially fewer desirable

stocks (bottom 5% ESG monthly score) in average return and Sharpe Ratio, Sharpe (1966). The study's main conclusion is that there is no evidence of a precise superior performance of high ESG portfolios for all the analyzed regions. This thesis covers the same regions but adds that it is possible to obtain superior returns from high portfolios.

Limkriangkrai, Koh, and Durand (2017) analyze the separate effect of Environment, Social, and Governance pillars on Australian stock market returns from 2009 to 2014. To predict stocks' excess returns, the authors used the Fama-French-Carhart four-factor model, Carhart (1997), and a risk adjustment variable. There was no influence of ESG on stock returns. The authors also compare the performance of stocks with a high ESG score with low ESG score ones. Finally, they do not find abnormal returns for high ESG, E, S, and G stocks.

After analyzing the literature, the effect of corporate sustainability and ESG pillars on abnormal stock returns is unclear. This paper contributes to the literature by extracting each ESG pillar's effect on stock returns using the two most common previous literature approaches. The first method is a panel data regression on a dataset composed of stock data from the USA, Europe, and Asia. Furthermore, the regressions also contain real economic activity - GDP growth, Fama (1990). The second approach analyzes the top and bottom ESG pillar score portfolios' performance using stock data from the same financial markets. Additionally, differently from most previous studies, this paper compares each of the portfolios' performance between each region and for more recent time frames: 2010-2018 and 2015-2018.

Based on the findings summarized in the literature review, I developed the following hypothesis to test for each of the regions and periods:

H1: There is a positive impact of the ESG, Environmental, Social, or Governance score on excess stock returns (panel data regression).

H2: There is a superior performance for portfolios composed of high ESG, Environmental, Social, or Governance scores compared to low scores portfolios (portfolio method).

H3: There is a superior performance for portfolios composed of high ESG, Environmental, Social, or Governance scores compared to low SRI portfolios (portfolio method).

H4: There are positive abnormal returns for portfolios composed of high ESG, Environmental, Social, or Governance score stocks (portfolio method).

3. Data

3.1 Panel Data Regressions Method

The ESG, Environment, Social, and Governance scores were extracted from ASSET4-Datastream yearly from 2009 to 2018 since ESG scores in this platform are released annually. Each of the pillars' values varies between 0 and 100, being 100 the highest possible score. The time frame ends in 2018 due to the reduced number of companies with ESG values for 2019 on ASSET4. For the same period, was extracted annual stock prices from Datastream for each company.

I focus on developed financial markets. The countries selected were the USA and the top 10 countries from Europe and Asia according to their Market Capitalization of Listed Domestic Countries from the World Bank, see table 2. Australia was included in the Asian dataset since it had a significant value of Market Capitalization of Listed Domestic Countries. I choose to include Indonesia instead of Saudi Arabia due to the lack of stock data available for the last one in Datastream.

The Fama and French 5 factors were obtained from Kenneth and French Data Library from 2010 to 2018. since this study uses countries from different regions, there was the need to collect 5-factor data for the USA, Europe, Japan, and the Asia Pacific that includes Australia. The values for GDP growth were extracted from the World Bank Database for the 2009-2018 timeframe.

I select the stocks based on the major countries' indexes. Each stock had to be active during 2010-2018 and had to have values for the E, S, and G pillars during the same period to be selected. The final number of stocks for each country are in table 3. The USA database comprises 722 stocks, the Europe database 717 stocks, and the Asia database 789 stocks. The descriptive Statistics of each panel are in Table 4.

The USA data set has 6498 observations for 722 stocks in 9 years. In terms of ESG pillars, the USA has the lowest average Environment value. The US's low average Environmental score can be directly linked to the high presence of polluting industries in the US. Figure 2 plots the CO2 emissions in metric tons for all the countries analyzed between 2010 and 2018 taken from the World Bank data. By analyzing figure 2, it is possible to conclude that China and the USA between 2010 and 2018 had the highest CO2 emissions of all the countries covered in this study. However, China is in the Asian dataset, together with other countries with much lower CO2 emissions. The USA is a single country leading to a higher impact of CO2 on the average Environmental pillar.

The Europe data set comprises 6453 observations for a total of 717 stocks for nine years. The average ESG pillars values for Europe are the highest of the three analyzed regions. The high values are most likely related to a higher focus on corporate sustainability on a European level. According to the European Commission (2011) *Strategy on Corporate Social Responsibility*, since 2011, the European Commission created a new Corporate Social Responsibility (CSR) strategy, which encourages companies to be more responsible through regulation and disclosure of information related to social and environmental pillars.

The Asia data set comprises 7101 observations for 789 stocks in 9 years. The average value of the Social pillar is the lowest of the three regions. The Asian data set comprises non-developed countries like India, Indonesia, and Thailand that have cultures that do not promote gender egalitarianism, have a high level of corruption, lack economic development, economic freedom, and political freedom. There is empirical evidence that these factors can negatively impact corporate sustainability practices, like in Baughn et al. (2007) and Miska, Szőcs, and Schiffinger (2017), leading to lower ESG values.

For a better comparison of the average ESG scores' evolution, figure 2 plots the average ESG values of all the active companies during the full 2010-2018 period in each region. When analyzing the left column of figure 2 is possible to conclude that in the three regions, the average value of the ESG pillars is increasing between 2010 and 2018, indicating a shift of the corporate mentality towards a higher inclusion of sustainability on corporate strategies on a global basis, Derqui (2020).

In the right column of figure 2, it is possible to compare the evolution of each ESG pillar's mean value between regions. Regarding the Environmental pillar, all three regions face a steadily increasing trend, with Europe having a much higher mean value during the full period. The Social pillar situation is similar. Between 2010 and 2018, the mean value for the Social pillar also faces a steady growth.

Lastly, in the right column of figure 2 is possible to conclude that the governance pillar's mean value in the USA does not face a steady increase. Between 2014 and 2016, there is a growth pick of the Governance pillar's mean value in the USA. That pick may relate to a significant increase in shareholder proposals during the year 2015. According to the Institutional Shareholder Services (ISS), 2015 was marked by an increase of approximately 37% in shareholder proposals compared to 2014. According to the database, the most common shareholder proposal topics were "political and lobbying activities," "proxy access," and "independent chair." All the topics are related to the Governance pillar.

3.2 Portfolio Method

The platforms used for extracting the data for the portfolio creation method are the same as those used in the panel data regression. However, for the portfolio method, I collected monthly stock data for each of the countries represented in Table 3, to analyze monthly performance and extract monthly abnormal returns. For the same purposes, monthly Fama and French 5 factor data are considered for this dataset. However, the filters applied for extracting data are different from the ones used in the first method. This time all stocks that had ESG data from 2009 to 2018 were considered despite being active or not during the sample period to avoid a survivorship bias, Auer and Schuhmacher (2016). Lastly, from DataStream was possible to obtain the SIC codes for each one of the stocks picked.

Table 5 presents the descriptive statistics of the data used for the portfolios' construction in each region. The returns' values are the average monthly returns for each year. The ESG, Environmental, Social, and Governance values are the average annual scores. When analyzing the descriptive statistics of the data set used to form portfolios, the conclusions do not change despite non-active firms' inclusion. The average ESG, E, S, and G scores are higher for the selected European countries than the USA and Asia.

4. Methodology

4.1 Panel Data Regressions

This paper uses panel data regressions to quantify the impact of ESG on stock returns. The five-factor model, Fama and French (2015), is used to include systematic risk factors predicting excess returns. Since this paper covers three different regions, each stock had to match the five factors from the corresponding region/country.

Two regression models, equations 1 and 2, are computed every year for each region from 2010 to 2018.

$$R_{it} - Rf_{jt} = \alpha + \beta 1 ESG_{it-1} + \beta 2 SMB_{jt} + \beta 3 \mathrm{HML}_{jt} + \beta 4 \mathrm{RMW}_{jt} + \beta 5 \mathrm{CMA}_{jt} + \beta 6 \mathrm{MRP}_{jt} + \beta 7 GDP_{zt-1} + \varepsilon_{it} \quad (1)$$

$$R_{it} - Rf_{jt} = \alpha + \partial 1 E_{it-1} + \partial 2 S_{it-1} + \partial 3 G_{it-1} + \partial 4 SMB_{jt} + \partial 5 \mathrm{HML}_{jt} + \partial 6 \mathrm{RMW}_{jt} + \partial 7 \mathrm{CMA}_{jt} + \partial 8 \mathrm{MRP}_{jt} + \partial 9 GDP_{zt-1} + \varepsilon_{it} \quad (2)$$

Equation one uses ESG as a single independent variable to quantify the overall impact of the ESG score on excess stock returns. In equation two, each pillar is considered as a single independent variable to quantify the impact of each on stock excess returns. Following Chen (1991) and Fama

(1990), that argue that measures of real economic activity are strong predictors of stock returns, I decided to include the GDP growth of each country in the regression models, representing a proxy for the health of the economy, as another control variable.

In equation one, ESGit-1 represents the ESG score for the company i on year t-1. In equation two, the variables Eit-1, Sit-1, and Git-1 represent the Environment, Social, and Governance score, respectively, for the company i on year t-1.

Rit-Rfjt represents the annual excess returns of stock i on year t. Rit is the annual return of stock i in year t, obtained by computing ln(pricet/pricet-1), and Rfjt is the risk-free rate taken from the Kenneth and French library for each region j on year t.

The value of each of the five factors, Fama and French (2015), used in both models in year t, is given by the variables: SMBjt (Small Minus Big), HMLjt (High Minus Low), RMWjt (Robust Minus Weak), CMAjt (Conservative Minus Aggressive), MRPjt (Market Risk Premium). Each stock had the corresponding factors according to the respective region j and year t from the Kenneth and French data library (USA, Europe, Asia Pacific, and Japan).

Lastly, the variable GDPzt-1 is the GDP growth rate in year t-1 for each country z. The coefficients of the regression models of equations 1 and 2 can be analyzed in table 6 and table 7, respectively.

4.2 Portfolio Method

To evaluate companies' financial performance with a high level of corporate sustainability, I created portfolios based on four variables: ESG, Environmental, Social, and Governance scores. The portfolios were formed on an annual basis, and the performance was analyzed on a monthly basis. Following Kempf and Osthoff (2007) and Auer and Schuhmacher (2016), this paper created a top, bottom, and a long-short equally weighted portfolio for each variable (ESG, Environmental, Social, and Governance) from 2010 to 2018. These portfolios were computed for each region.

The top (bottom) portfolio comprises the top (bottom) 10% stocks regarding each variable's score on year t-1. The long-short portfolio buys the top portfolio and shorts the bottom portfolio. This approach simulates an investor that picks stocks annually, based on year t-1 and keeps them during year t. Every month, the number of stocks was adjusted to get only the active stocks in that month. Each year, 12 equally weighted portfolios were created (4 variables x 3 portfolios) in each region. After the portfolio

creation, the average monthly returns, the average monthly standard deviation, and the Sharpe ratio, Sharpe (1966), were extracted between 2010 and 2018, see table 8.

In Table 8, the Market and Low SRI portfolios were computed to compare the ESG, Environmental, Social, and Governance portfolios with benchmarks. The market portfolio is an equally weighted portfolio containing all the dataset's active stocks at the end of each month. The less socially desirable portfolio (Low SRI portfolio) goes in line with Hong and Kacperczyk (2009) and Statman and Glushkov (2009). In both studies, the authors recur to the KLD Research & Analytics (KLD) to identify if a company is associated with less socially desirable products like tobacco or alcohol. However, it was not possible to get an academic license to extract data from KLD. Instead, this paper uses SIC codes linked to non-SRI industries. The following SIC codes are considered for all the regions: 2100 (tobacco products), 5180 (beer, wine, and distilled beverages), 5170 (petroleum and petroleum products), 5980 (fuel dealers), 3842 (small arms ammunition), 3843 (ammunition, except for small arms) and 3484 (small arms). Every month if a stock had one of the SIC codes considered and was active, it was included in the Low SRI equally weighted portfolio.

Using the five-factor model, Fama and French (2015), the regression model in equation three was estimated for each of the 12 portfolios in each of the three regions to extract the alpha given by the model's constant (α). If the constant is positive (negative) means that the market is undervaluing (overvaluing), the excess returns of the portfolio, and there is the existence of positive (negative) abnormal returns. Table 9 presents the values of the constants from the regression model in equation three for each portfolio.

$$R_{it} - Rf_{jt} = \alpha + \theta 1 SMB_{jt} + \theta 2 \mathrm{HML}_{jt} + \theta 3 \mathrm{RMW}_{jt} + \theta 4 \mathrm{CMA}_{jt} + \theta 5 \mathrm{MRP}_{jt} + \varepsilon_{it} \quad (3)$$

In Equation three, Rit-Rft is the excess return of the portfolio i on month t. The monthly risk-free rate (Rfjt) was extracted from the Kenneth and French data library for each region j. The explanatory variables are the five factors from Fama and French (2015) for each region j.

5. Findings

5.1 Panel Data Regressions

Table 6 presents the coefficients of the annual regressions presented in equation one. In this model, the ESG score was considered as a single explanatory variable. Only in Asia was possible to observe

a statistically significant (for a 5% significance level) impact of ESG on excess stock returns. According to Table 6, an increase of 1 unit on the ESG score increases by 0,04% annual excess stock returns in Asia. Furthermore, the significant effect of GDP in line with Fama (1990) was not verified in this model.

To better understand each pillar's impact on excess returns, the regression model's coefficients in equation two are presented in Table 7. In this regression model, each pillar was considered as a different explanatory variable: Environmental (E), Governance (G), and Social (S). This model's main finding is that there is a statistically significant positive impact (for a 1% significance level) of the social pillar on excess returns in the USA and Asia. A one-point increase in a firm's Social score leads to an increase in stocks' annual excess returns of 0,05% for the USA and Asia. Despite the positive impact of the Social pillar, it is possible to observe a negative impact of the Environmental score on excess returns for the US and Asia. A one-point increase in the Environmental score leads to a decrease of 0,04% and 0,03% on annual excess returns in the US and Asia, respectively. Furthermore, in this model, it was also not possible to observe the significant effect of GDP growth.

5.2 Portfolio Method

Table 8 presents the monthly average returns and Sharpe ratios of all the equally weighted portfolios created, including the market portfolio and the low SRI portfolio. This table aims to compare the performance of the top ESG portfolios with the bottom ones. Also, it allows understanding if any of the portfolios can beat the benchmarks used - the market and low SRI portfolio. The values highlighted in bold print are cases where a top portfolio's Sharpe ratio was higher than the Sharpe ratio of the corresponding variable bottom portfolio. In 12 top portfolios (4 variables x 3 regions), 11 portfolios outperformed the respective variable bottom portfolio.

Overall, in 36 cases (12 portfolios x 3 regions), 30 had higher Sharpe ratios than the market benchmark portfolio. From those 30 cases, 12 came from all the top portfolios containing the 10% stocks with the best ESG, E, S, and G scores annually. Furthermore, 9 cases were from bottom portfolios containing the 10% stocks with the worst ESG, E, S, and G scores each year. The remaining 9 cases were long-short strategies that buy the best corporate sustainability performers' stocks and shorts the worst on an annual basis.

Additionally, the underlined values in table 8 represent cases where the portfolio had a higher Sharpe ratio than the low SRI portfolio. Only three portfolios outperformed the respective region's low SRI

portfolio: the long-short ESG, Environmental, and Governance portfolios in Asia. None of the top portfolios was able to outperform the Low SRI portfolio. For the cumulative 1 dollar return of the Low SRI and top portfolios in each region, see Figure 3.

The returns and Sharpe ratios of the top ESG performers portfolio in the USA, Europe, and Asia were higher than the bottom ESG performers portfolio for the respective region. Regarding the top Environmental portfolio, again, in all the regions, the top Environmental portfolio had a higher mean return and Sharpe ratio than the bottom one. Concerning the top Social portfolio, the mean and Sharpe ratios were higher than the bottom ones except for Europe. In all the regions, the top Governance portfolios had a higher return and Sharpe ratio than the bottom ones. Overall, all the top portfolios were able to beat the bottom ones, apart from the top Social portfolio in Europe, indicating a superior performance from an SRI approach.

Regarding the long-short portfolios, all the long-short portfolios in Europe and Asia outperformed the market portfolio. In the US, the long-short ESG portfolio was the only portfolio capable of outperforming the market. Furthermore, only in Asia, there was a superior performance of long-short portfolios comparing to the low SRI portfolio. The long-short portfolios were the ESG, Environmental, and Governance ones.

Table 9 presents the alphas (abnormal returns) extracted from the regression model in equation three for the 12 portfolios for each of the regions. For the full regressions, see appendixes A, B, and C. By observing table 9, all the top portfolios in the US achieved negative and significant monthly abnormal returns, suggesting that the market is overvaluing companies with high corporate sustainability levels in the USA. The top ESG, E, S, and G portfolios achieved negative abnormal returns of -0,51%, -0,52%, -0,59% and -0.56%, respectively.

Most of the US's bottom portfolios had even lower negative abnormal returns compared to the top portfolios: -0,95%, -0.50%, -0,63%, and -0.99% for the portfolios containing the annual bottom 10% ESG, Environmental, Social and Governance performers, respectively. This decrease leads to the conclusion that, despite not being possible to achieve positive abnormal returns by investing in "greener" firms, it does not mean that investing in firms with lower CS levels can bring positive abnormal returns for US investors.

Regarding Europe's situation, a long-short strategy that buys (sells) the top (bottom) 10% Governance performers leads to significant positive monthly abnormal returns of 0.30%. The bottom 10% Governance scorers' portfolio led to negative and significant abnormal returns of -0.53%. These results are encouraging for investors in European markets looking for new investment criteria that could include companies with high corporate Governance levels undervalued by the market. Furthermore, in Europe, there were negative and significant abnormal returns for the bottom ESG portfolio of -0,45%.

Lastly, Asia was the region with the most inconclusive results. The bottom ESG, Environmental, and Governance portfolios led to negative and significant monthly abnormal returns of -0.53%, -0.58%, and -0.42%. The negative abnormal returns from bottom portfolios suggest that the market is overvaluing Asian companies with low CS levels.

6. Robustness

This section presents the findings of the panel data regressions and portfolio methods applied in a more recent period (2015-2018) to test the previous findings' robustness.

6.1 Panel Data Regressions

Table 10 and Table 11 present the coefficients for the regressions described in equations 1 and 2, respectively, for the 2015-2018 time period. Each stock picked had to be active during the full period of 2015-2018 and had to have values for the E, S, and G in 2014-2018.

From Table 10, the positive and significant effect of ESG on excess returns on Asia still applies. Additionally, for the 2015-2018 period, a significant positive effect of the ESG score on excess returns was verified for the USA. By observing Table 11, there is still a significant negative effect of the Environmental pillar (E) on excess returns in the USA for the 2015-2018 time period. Furthermore, the same coefficient decreased its value from -0,0005 to -0,0006, meaning a higher negative impact. The positive effect of the Social pillar prevailed only for the US. In the USA's case, the Social pillar (S) coefficient increased its value from 0,0006 to 0,0010.

6.2 Portfolio Method

For the performance of the portfolios in the 2015-2018 period, see Table 12. When analyzing Table 12, in the 2015-2018 time frame, the number of top portfolios that outperformed bottom ones decreased compared to 2010-2018. In 12 top portfolios, 10 had higher Sharpe ratios than the

corresponding bottom portfolio. The only top portfolios that could not outperform the bottom ones were the US's top Environmental and Governance portfolios.

In all the 36 portfolios, 35 were able to outperform the respective region market portfolio. The only portfolio not able to beat the market was the bottom Environmental portfolio in Europe. Additionally, four portfolios outperformed the low SRI portfolio, and all of them were long-short portfolios in Asia.

The alphas from equation three were also estimated for the 2015-2018 period in Table 13. For the full regressions, see appendixes D, E, and F. In the USA's case, the significance and sign of the 2010-2018 alphas remained the same. However, for the 2015-2018 period, there were positive and significant monthly abnormal returns for the portfolio that buys the top annual 10% ESG score stocks and shorts the bottom 10% ones. In the case of Europe, there were also positive abnormal returns for the long-short ESG strategy. Also, there were positive and significant abnormal returns for the long-short Environment strategy in Europe. However, for the 2015-2018 period, there were no abnormal returns from the European long-short Governance portfolio. Regarding Asia, there were no statistically significant abnormal returns for the 2015-2018 time period.

7. Discussion

This section looks at possible explanations for the main findings from the two methods applied in this study and their conformity with previous literature.

Negative environment impact on excess returns for the USA and Asia

When computing the panel data regression method, there was evidence of a statistically significant negative impact from the Environment pillar on annual excess stock returns in the US and Asia, see Table 7. This impact was even more aggravated in the USA for the 2015-2018 time period when checking for robustness, see Table 11. When analyzing the Environment pillar components in Table 1, it is possible to conclude that events like decreasing carbon emissions, increasing energy efficiency, and waste management can imply a severe firm restructuring leading to an increase in costs and decreasing financial performance. This increase in costs should be higher in the short term justifying the aggravated negative impact on a shorter period.

Positive Social pillar impact on excess returns

The positive impact on annual excess returns of the social pillar was verified in the USA and Asia. When analyzing Table 1, it is possible to conclude that all the Social pillar components may be linked to better company performance. Customer satisfaction can imply higher customer loyalty, which can

be a strong revenue driver. A healthy respect for gender and diversity, human rights, and labour standards may generate increased employee satisfaction leading to better corporate performance.

The positive impact of Social pillar variables in stock returns is not new in the literature. In Galema, Plantinga, and Scholtnes (2008) and Mănescu (2011), there was evidence of a positive effect of social variables on stock's returns.

Positive ESG impact on excess return on Asia

This study also finds evidence of a positive impact of the ESG score in annual stock excess returns in Asia in both periods covered, Table 6 and 10. In Laskar, Chakraborty, and Maji (2017), the authors found a positive relationship between corporate sustainability and financial performance in India and Japan. Both countries are in this study's dataset.

Furthermore, the positive impact of the overall ESG score on stock returns goes in line with Dimson, Karakas, and Li (2015) that find that companies who increase their ESG scores can reach higher returns than those who do not.

Top ESG portfolios outperform bottom ones

In both periods analyzed, there was an outperformance of most top portfolios comparing to bottom ones. Contrary to Auer and Schuhmacher (2016), this paper shows evidence of outperformance from most top portfolios in all the regions. The only top portfolio that could not outperform the bottom one was the top Social portfolio in Europe. Between 2015 and 2018, only the US's top Environmental and Governance portfolios could not outperform the corresponding bottom portfolios.

The different results from this paper may be related to the time frame used. In Auer and Schuhmacher (2016), the authors resort to the 2002-2012 time period. However, in more recent years, ESG assets' integration in investments has experienced exponential growth. According to the US Forum for Sustainable and Responsible Investment (2018) *2018 Trends Report*, in 2012 the value of ESG assets in investments was 2000 billion us dollars and 10000 billion in 2018 (400% increase) in the US. In Europe, the Eurosif (2019) *European SRI Study 2019* reports a CAGR of 27% of ESG assets between 2015 and 2018. Lastly, according to Oliver Wyman (2019) *Driving ESG Investing in Asia* between 2014 and 2016, ESG investing assets grew 16% in Asia. The increase in demand for ESG assets can change the market trends and influence share prices, leading to entirely different results in terms of ESG portfolios performance.

Higher expected returns from low SRI portfolio

The low SRI portfolio outperformed all the top portfolios (except for the top ESG portfolio in the USA for 2015-2018) in expected monthly return and Sharpe ratio, see Table 8 and 12. The findings are similar to Hong and Kacperczyk (2009). The authors also conclude that "sin stocks" related to industries like alcohol or tobacco are lees held by institutions like pension funds and receive less analyst coverage. Figure 2 plots the Low SRI portfolio and the top portfolios' cumulative 1 dollar return for each region. When observing Figure 2, it is possible to identify a clear outperformance from the Low SRI portfolio in all the regions.

As stated in Hong and Kacperczyk (2009), the outperformance of "sin stocks" goes in line with Merton (1987). Merton affirms that the neglected stocks by a significant group of investors (the institutions) lead to a decrease in those stocks' price relative to their values, making them outperform other comparable stocks.

However, this study contributes to the literature by showing that it was possible to outperform the "sin stocks" using sustainable long-short portfolios in Asia.

Negative abnormal returns from top portfolios in the USA

When computing abnormal returns for all the regions, see table 9 and 13, there were negative and significant abnormal returns for all the top portfolios in the USA in both periods covered. These results can be controversial since the top portfolios contain the stocks with the highest ESG, Environmental, Social, and Governance scores each year.

According to the US Forum for Sustainable and Responsible Investment (2018) *Trends Report*, in 2018, sustainable responsible and impact investing (SRI) assets by the end of 2018 reached approximately 26% of total assets in the USA (a 34% increase relative to the year 2016). Following Merton (1987) and Heinkel et al. (2001), increased demand for SRI stocks can lead to the overpricing of such stocks making the market overvalue the same stocks, a clear explanation for negative and statistically significant abnormal returns reached by the USA's top ESG portfolios.

Positive abnormal returns from the long-short ESG portfolio in the USA and Europe

The long-short ESG portfolios in the USA and Europe reached positive and significant abnormal returns between 2015 and 2018. Regarding the USA, these results go in line with Kempf and Osthoff (2007) that found a long-short strategy that buys the top socially responsible stocks (most likely

associated with a high ESG score) and shorts the bottom ones can lead to positive abnormal returns. Additionally, Dimson, Karakas, and Li (2015) also show that stocks that achieve high ESG levels can have positive abnormal returns. This paper contributes to the literature by using more recent timeframes and including European stocks, increasing the impact of this study.

Positive abnormal returns from the long-short Governance portfolio in Europe

The performance of corporate governance portfolios in European stocks is not as covered as US stocks in previous literature. In Drobetz et al. (2004), the authors constructed a corporate governance rating for public firms in Germany. Similarly, to this paper, they created a long-short Governance portfolio. This portfolio was able to achieve positive and significant returns between 1998 and 2002. However, for a more extensive European dataset (including the UK and European Monetary Union countries), in Bauer et al. (2004), the authors do not find significant abnormal returns for long-short Governance portfolios. Despite previous literature, this study found positive and significant abnormal returns for the European long-short Governance portfolio for a much more recent time frame between 2015 and 2018.

8. Conclusion

This study quantified each ESG pillars' impact on excess stock returns and analyzed stocks' performance with a high ESG, E, S, and G score resourcing to two different methods and two different time frames.

During the 2010-2018 and 2015-2018 period, the study finds a positive and significant impact of the ESG score on annual excess stock returns in Asia. This goes in line with Laskar, Chakraborty, and Maji (2017). I also find a positive and significant impact of the ESG score on excess stock returns for the USA during the 2015-2018 period.

Moreover, the results provide evidence of a negative and significant effect of the Environmental pillar on excess returns verified in the USA in the two time periods covered and for Asia in 2015-2018 period. The social pillar between 2010 and 2018 had a positive and significant impact on excess stock returns familiar to the USA and Asia. The social pillar's significant impact on stocks' returns goes in line with previous literature, Galema, Plantinga, and Scholtnes (2008) and Mănescu (2011).

Focusing on the ESG portfolios' performance in 2010-2018 and 2015-2018, there is evidence of superior performance from top portfolios in most cases for both periods. However, an ethical dilemma arises in which investors who choose high ESG stocks cannot beat the much higher returns of a low

SRI portfolio, similarly to Hong and Kacperczyk (2009). Despite the previous literature, this paper shows evidence of the possibility of beating "sin stocks" with sustainable portfolios in Asia.

In Europe, it is possible to achieve positive abnormal returns for 2010-2018 using a long-short Governance portfolio. In the USA and Asia, the evidence is unclear if investors can benefit from abnormal returns from buying high ESG stocks. For a shorter and more recent period, there is proof that US and European investors can achieve positive and significant abnormal returns by adopting a strategy that buys the best ESG performers' stocks and shorts the worst on an annual basis.

To sum up, the empirical evidence differs for different time frames and regions, see Table 14. However, there is clear evidence of a relationship between some pillars and stock returns and clear evidence of benefits from a socially responsible investment approach.

The main limitations of this study are linked with the value of the ESG. The ESG score may vary in distribution and risk according to the platform from which the data is extracted, Dorfleitner, Halbritter, and Nguyen (2014). Additionally, the different ESG values coming from different rating agencies may influence the score's impact on financial performance, Billio et al. (2020). Lastly, this paper only covered the most developed financial markets leaving open the hypothesis of entirely different results if the methods used were applied to less developed financial markets.

9. References

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10. Tables and figures

Table 1

ESG pillars.

Environmental	Social	Governance
Climate change and carbon emissions	Customer satisfaction	Board composition
Air and water pollution	Data protection and privacy	Audit committee structure
Biodiversity	Gender and diversity	Bribery and corruption
Deforestation	Employee engagement	Executive compensation
Energy efficiency	Community relations	Lobbying
Waste management	Human rights	Political contributions
Water scarcity	Labour standards	Whistle-blower schemes

This table presents several variables that are related to each ESG pillar, according to the CFA Institute. Each column represents a pillar: Environmental, Social, and Governance.

Table 2

Market Capitalization of Listed Domestic Countries (current US$).

Country	Market Capitalization of Listed Domestic Companies	Last Year Available
	Asia	
China	$6 324 880 000 000,00	2018
Japan	$5 296 810 000 000,00	2018
Hong Kong	$3 819 220 000 000,00	2018
India	$2 083 480 000 000,00	2018
Korea	$1 413 720 000 000,00	2018
Australia (added)	$1 262 800 000 000,00	2018
singapore	$687 257 000 000,00	2018
Russia	$576 116 000 000,00	2018
Thailand	$500 741 000 000,00	2018
Saudi Arabia (not selected)	$496 353 000 000,00	2018
Indonesia	$486 766 000 000,00	2018
	Europe	
France	$2 365 950 000 000,00	2018
United Kingdom	$1 868 150 000 000,00	2008
Germany	$1 755 170 000 000,00	2018
Switzerland	$1 441 160 000 000,00	2018
Netherlands	$1 100 110 000 000,00	2017
Spain	$723 691 000 000,00	2018
Italy	$522 088 000 000,00	2008
Belgium	$321 094 000 000,00	2018
Sweden	$289 877 000 000,00	2003
Norway	$267 382 000 000,00	2018

This table reports the top ten countries according to their last value available for Market Capitalization of Listed Domestic Countries (current US$) for the USA and Europe region, extracted from the World Bank Database. For the Asia region, Australia was added since it has a significant value of Market Capitalization. Additionally, Saudi Arabia was not considered due to ESG data unavailability for the country in DataStream. For the USA, no changes were made.

Table 3

Stocks' exchange.

Asia	**Exchange**	**Stocks**
Australia	ASX	132
China	Shanghai Stock Exchange Shenzhen stock exchange	40
Hong Kong	Hong Kong Stock Exchange	79
India	National Stock Exchange of India Limited Bombay stock exchange	31
Indonesia	Indonesia stock exchange	13
Japan	Tokyo Stock Exchange	365
Russia	Moscow Stock Exchange	27
Singapore	Singapore Exchange	43
South Korea	KOSDAQ	37
Thailand	Thailand stock exchange	22
Europe	**Exchange**	**Stocks**
Belgium	Euronext Life Brussels	23
France	Euronext Life Paris	80
Germany	Deutsche Börse XETRA	136
Italy	Italian Bourse – Milan	42
Netherlands	Euronext Amsterdam	25
Norway	Oslo Bors	20
Spain	Mercado Continuo Español Bolsa de Madrid	34
Sweden	Nasdaq Stockholm AB	61
Switzerland	Six Swiss	58
United Kingdom	London Stock Exchange	238
USA	**Exchange**	**Stocks**
USA	NASDAQ NYSE AMEX	722

This table reports the exchanges considered for extracting annual stock data from DataStream. Also, it shows the number of stocks selected for the USA and the number of stocks considered per country for Europe and Asia. For a stock to be considered, the stock had to be active from 2010 to 2018 and have values for the ESG, the Environmental, Social, and Governance pillar during the same period. On total were considered 722 stocks for the US, 717 for Europe, and 789 for Asia.

Table 4

Panel data descriptive statistics.

USA

Statistics	**Returns**	**ESG**	**E**	**S**	**G**
Observations	6498	6498	6498	6498	6498
Mean	0.08	46.4	34.98	48.00	52.59
Std Deviation	0.27	19.57	29.4	21.12	22.31
Min	-1.72	1.54	0.00	0.26	0.25
Max	2.05	95.07	98.53	97.75	98.51

Europe

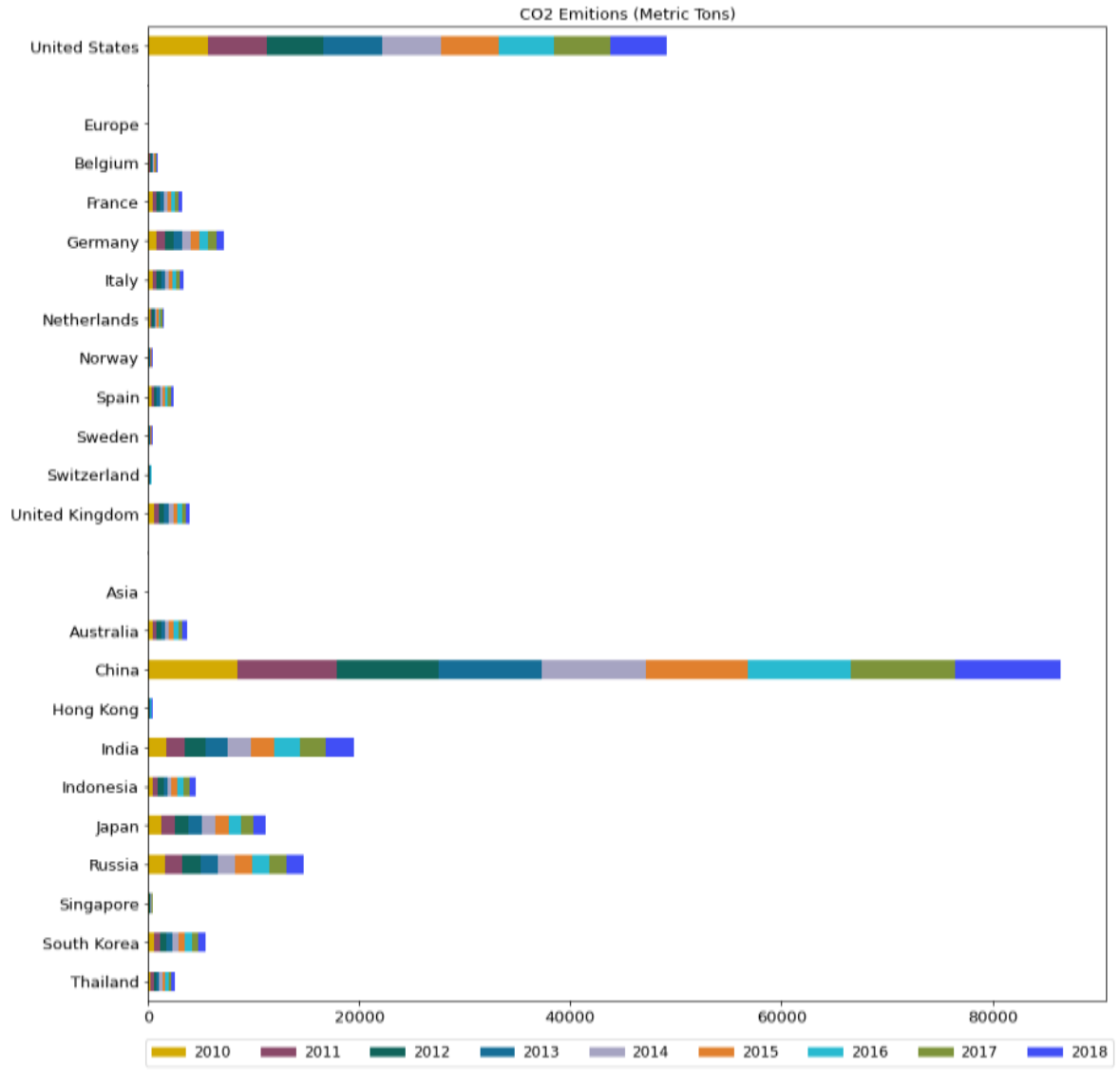
Statistics	**Returns**	**ESG**	**E**	**S**	**G**
Observations	6453	6453	6453	6453	6453
Mean	0.02	56.03	54.89	58.09	52.88
Std Deviation	0.34	20.25	27.33	23.83	22.3
Min	-4.02	0.5	0.00	0.15	0.82
Max	2.12	95.01	98.46	98.54	98.33

Asia

Statistics	**Returns**	**ESG**	**E**	**S**	**G**
Observations	7101	7101	7101	7101	7101
Mean	0.03	43.54	40.13	38.87	51.12
Std Deviation	0.33	20.85	28.37	23.73	23.33
Min	-3.22	1.24	0.00	0.05	0.43
Max	2.65	92.84	97.58	97.14	99.4

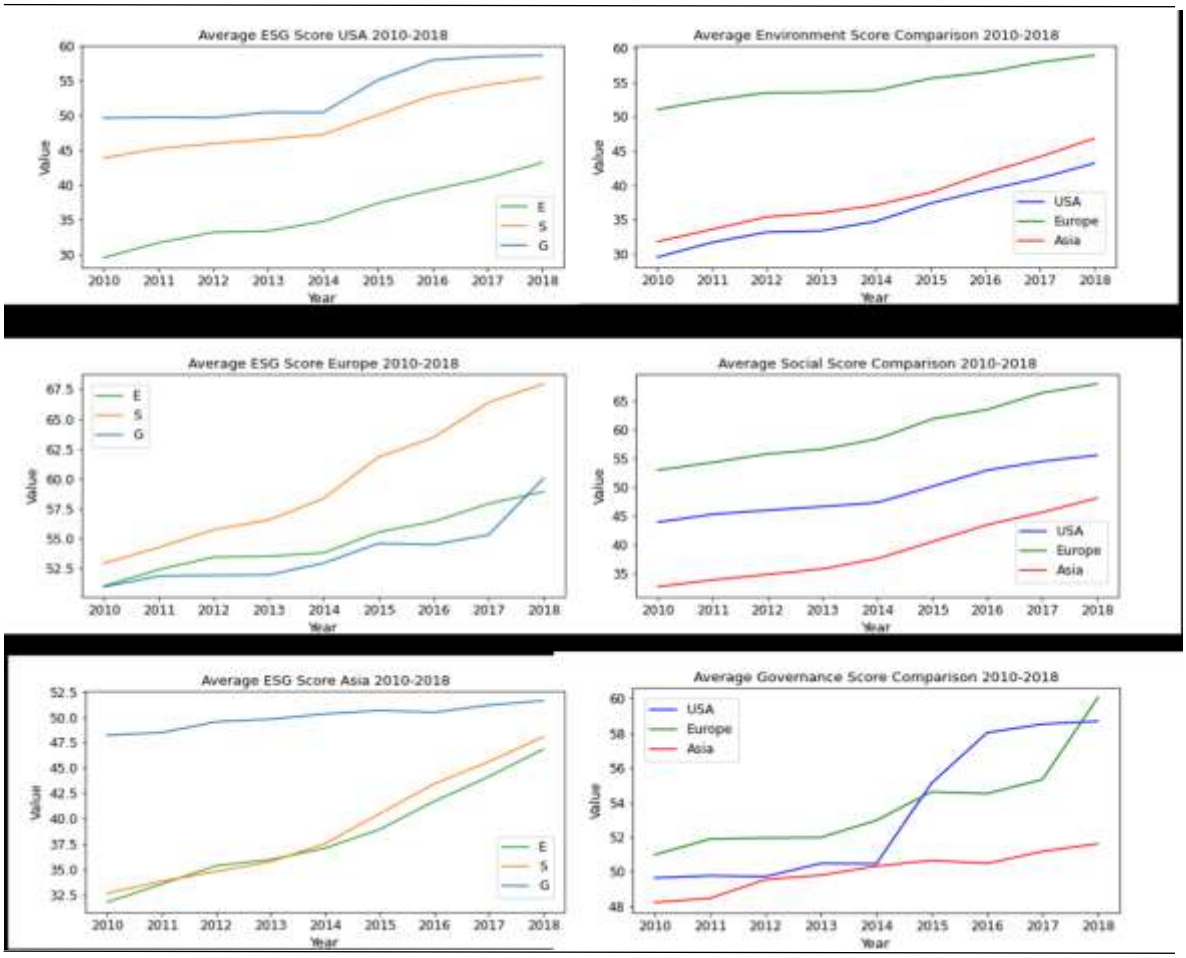
This table reports the descriptive statistics of the panel data considered for computing the regression method. The observations are given by the number of stocks per region times the number of years considered (9 years). This way, for the USA, there were 6498 (722 stocks x 9 years) observations, for Europe 6453 (717 stocks x 9 years), and Asia 7101 (789 stocks x 9 years). The mean values for returns, ESG, Environmental (E), Social (S), and Governance (G) represent the annual average of each variable between 2010-2018 of the stocks considered for each region. The annual standard deviation, the maximum and minimum value for each variable, and region are also reported in this table.

Figure 1
CO2 emissions (metric tons per capita) per country.



This figure presents the total CO2 emissions in metric tons for all the countries considered in this study between 2010 and 2018. The data was collected from the Our World in Data's data library.

Figure 2
ESG plots**.**



The figure reports the plots for the ESG pillars in the panel data regression method. The left column plots the evolution of the active companies' average annual score between 2010 and 2018 of each ESG pillar. On the right side of the figure, each plot compares the evolution of the average annual score of an ESG pillar between each region.

Table 5

Descriptive statistics portfolio method.

Variable	**USA**		**Europe**		**Asia**	
Returns	Mean	St Dev	Mean	St Dev	Mean	St Dev
2010	0.0041	0.0895	-0.0014	0.1553	0.0448	0.1335
2011	-0.0012	0.0879	-0.0101	0.1424	0.0072	0.1002
2012	0.0031	0.0823	-0.007	0.1378	-0.0093	0.0932
2013	0.0058	0.073	-0.0006	0.1168	-0.0024	0.0982
2014	0.0034	0.0712	0.002	0.1006	0.0082	0.1012
2015	0.0008	0.0801	-0.0026	0.1058	0.0088	0.092
2016	-0.0057	0.0887	-0.0049	0.1099	0.0107	0.1037
2017	0.0038	0.078	0.0033	0.108	-0.0091	0.1054
2018	0.0005	0.0841	-0.002	0.1053	0.0072	0.0854
ESG	Mean	St Dev	Mean	St Dev	Mean	St Dev
2010	40.0	19.0	51.0	21.0	37.0	20.0
2011	41.0	19.0	51.0	22.0	37.0	20.0
2012	42.0	19.0	52.0	21.0	38.0	21.0
2013	42.0	19.0	52.0	21.0	38.0	21.0
2014	43.0	19.0	53.0	21.0	39.0	21.0
2015	38.0	19.0	54.0	21.0	40.0	21.0
2016	36.0	18.0	55.0	20.0	42.0	20.0
2017	36.0	18.0	56.0	20.0	42.0	20.0
2018	37.0	18.0	53.0	21.0	44.0	20.0
Environment	Mean	St Dev	Mean	St Dev	Mean	St Dev
2010	31.0	27.0	52.0	28.0	33.0	27.0
2011	32.0	27.0	52.0	28.0	33.0	27.0
2012	34.0	27.0	53.0	27.0	34.0	28.0
2013	33.0	27.0	53.0	27.0	33.0	28.0
2014	34.0	27.0	53.0	27.0	33.0	28.0
2015	25.0	26.0	52.0	28.0	35.0	28.0
2016	22.0	25.0	54.0	27.0	38.0	28.0
2017	21.0	25.0	53.0	27.0	38.0	28.0
2018	23.0	26.0	47.0	28.0	40.0	28.0
Social	Mean	St Dev	Mean	St Dev	Mean	St Dev
2010	43.0	20.0	52.0	24.0	33.0	22.0
2011	43.0	20.0	52.0	25.0	33.0	22.0
2012	44.0	20.0	54.0	24.0	34.0	23.0
2013	45.0	20.0	54.0	24.0	34.0	23.0
2014	45.0	20.0	55.0	24.0	36.0	23.0
2015	41.0	20.0	58.0	24.0	39.0	24.0
2016	39.0	19.0	60.0	23.0	42.0	24.0
2017	39.0	20.0	61.0	23.0	41.0	24.0

2018	40.0	20.0	58.0	23.0	43.0	24.0
Governance	Mean	St Dev	Mean	St Dev	Mean	St Dev
2010	48.0	23.0	50.0	23.0	47.0	23.0
2011	47.0	23.0	50.0	23.0	47.0	23.0
2012	48.0	23.0	50.0	22.0	48.0	23.0
2013	48.0	23.0	50.0	22.0	48.0	23.0
2014	47.0	23.0	50.0	23.0	48.0	23.0
2015	46.0	23.0	51.0	23.0	48.0	23.0
2016	46.0	22.0	51.0	22.0	48.0	23.0
2017	46.0	22.0	52.0	23.0	48.0	22.0
2018	46.0	22.0	51.0	23.0	49.0	22.0

This table presents the descriptive statistics of the data set considered to create the ESG portfolios. Every stock for every exchange in table 3 was considered independently of being active or not. The statistics presented are the mean and standard deviation for each year between 2010 and 2018 for each of the three regions considered. The returns statistics are in monthly values for each year. The statistics for the ESG, Environmental, Social, and Governance scores are in yearly values.

Table 6

ESG regression.

D.V. Rit-Rft	USA	Europe	Asia
ESG	0.0000	0.0002	0.0004**
	(0.0002)	(0.0002)	(0.0002)
MRP	0.8814***	0.8654***	0.8292***
	(0.0400)	(0.0583)	(0.0259)
SMB	-0.1236	0.5221***	-0.0566
	(0.0859)	(0.1126)	(0.0586)
HML	-0.3016***	-2.4097***	-0.7179***
	(0.0798)	(0.3514)	(0.0641)
RMW	-0.0893	-2.4250***	0.0371
	(0.0686)	(0.3548)	(0.0876)
CMA	0.6040***	1.4651***	-0.3519***
	(0.1201)	(0.2729)	(0.1051)
GDP	0.4520	-0.0873	-0.0047
	(0.4252)	(0.2161)	(0.1158)
Cons	-0.0455***	0.0104	-0.0104
	(0.0142)	(0.0157)	(0.0110)
N	6498	6453	7101
R2	0.14	0.16	0.16

This table presents the panel data regression coefficient results, where ESG is considered a single explanatory variable in year t-1. The 5-factor model, Fama, and French (2015) were considered: MRP (Market Risk Premium), SMB (Small Minus Big), HML (High Minus Low), RMW (Robust Minus Weak), and CMA (Conservative Minus Aggressive). GDP represents the annual GDP growth for each country in year t-1, and Const is a constant. N represents the number of observations, and R2 the r squared. Each column of the table represents the same regression for each region, and the period considered was 2010-2018. Standard errors are reported in parentheses, and significance at the ten-percent, five-percent, and one-percent levels is indicated by *,**, and ***, respectively.

Table 7

Environmental, Social and Governance regression.

D.V. Rit-Rft	USA	Europe	Asia
E	-0.0004***	-0.0001	-0.0003*
	(0.0002)	(0.0002)	(0.0002)
S	0.0005**	0.0003	0.0005**
	(0.0002)	(0.0003)	(0.0002)
G	-0.0000	0.0000	0.0003
	(0.0002)	(0.0002)	(0.0002)
MRP	0.8814***	0.8722***	0.8312***
	(0.0400)	(0.0586)	(0.0259)
SMB	-0.1228	0.5137***	-0.0353
	(0.0859)	(0.1129)	(0.0596)
HML	-0.2999***	-2.4416***	-0.7166***
	(0.0798)	(0.3527)	(0.0641)
RMW	-0.0907	-2.4384***	0.0429
	(0.0686)	(0.3551)	(0.0878)
CMA	0.6018***	1.4964***	-0.4018***
	(0.1200)	(0.2744)	(0.1068)
GDP	0.4623	-0.0931	-0.0040
	(0.4251)	(0.2162)	(0.1158)
Cons	-0.0533***	0.0073	-0.0113
	(0.0153)	(0.0160)	(0.0114)
N	6498	6453	7101
R2	0.14	0.16	0.16

This table presents the panel data regression coefficient results, where each ESG pillar was considered a single explanatory variable for year t-1. E is the annual environmental score, S the annual social score, and G the annual governance score for each company. The 5-factor model, Fama, and French (2015) were considered: MRP (Market Risk Premium), SMB (Small Minus Big), HML (High Minus Low), RMW (Robust Minus Weak), and CMA (Conservative Minus Aggressive). GDP represents the annual GDP growth for each country in year t-1, and Const is a constant. N represents the number of observations, and R2 the r squared. Each column of the table represents the same regression for each region, and the period considered was 2010-2018. Standard errors are reported in parentheses, and significance at the ten-percent, five-percent, and one-percent levels is indicated by *, **, and ***, respectively.

Table 8

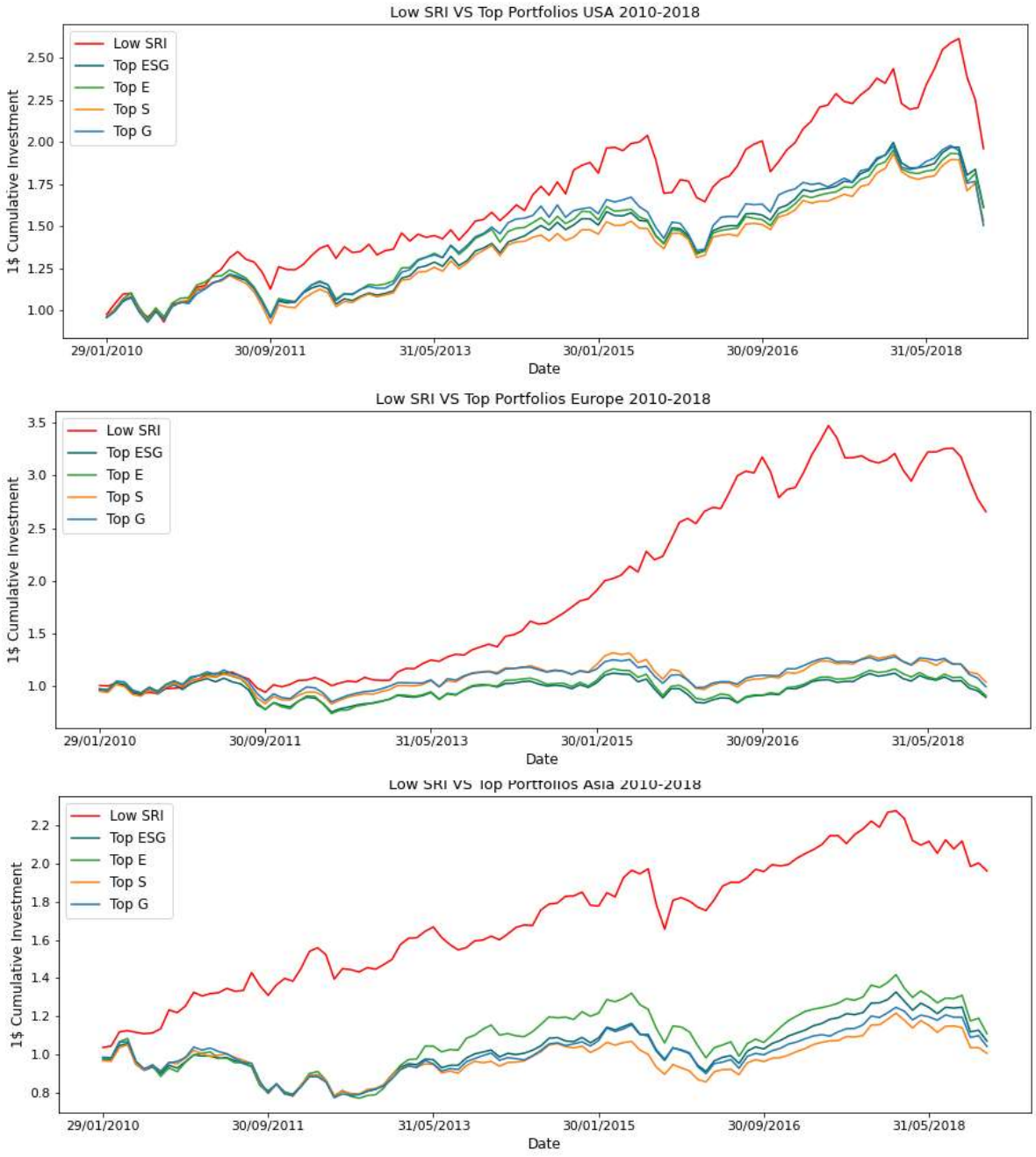
Portfolios' performance.

Portfolios	USA	Europe	Asia
Top			
ESG			
Mean	0.0052	-0.0001	0.0013
Standard Deviation	0.0386	0.0434	0.0365
Sharpe Ratio	**0.1345**	**-0.0028**	**0.0354**
Environmental			
Mean	0.0052	0.0002	0.0018
Standard Deviation	0.0393	0.0468	0.0419
Sharpe Ratio	**0.132**	**0.0043**	**0.0438**
Social			
Mean	0.0048	0.0012	0.0007
Standard Deviation	0.0404	0.0408	0.0354
Sharpe Ratio	**0.1181**	0.0285	**0.0191**
Governance			
Mean	0.0047	0.0007	0.001
Standard Deviation	0.0419	0.04	0.0366
Sharpe Ratio	**0.1115**	**0.018**	**0.0286**
Bottom			
ESG			
Mean	0.0031	-0.0012	-0.0043
Standard Deviation	0.0664	0.0432	0.0422
Sharpe Ratio	0.0462	-0.0288	-0.1011
Environmental			
Mean	0.0064	-0.0015	-0.0046
Standard Deviation	0.0577	0.0476	0.0409
Sharpe Ratio	0.1109	-0.0316	-0.1119
Social			
Mean	0.0045	0.0013	-0.0015
Standard Deviation	0.0547	0.0429	0.0436
Sharpe Ratio	0.0816	0.0294	-0.0354
Governance			
Mean	0.0055	-0.0013	-0.0031

Standard Deviation	0.0837	0.039	0.0374
Sharpe Ratio	0.0662	-0.0342	-0.0841
Long-Short			
ESG			
Mean	0.0021	0.0011	0.0056
Standard Deviation	0.0389	0.0255	0.0204
Sharpe Ratio	0.0547	0.0439	0.2726
Environmental			
Mean	-0.0012	0.0017	0.0064
Standard Deviation	0.0291	0.0262	0.0253
Sharpe Ratio	-0.0417	0.0651	0.2535
Social			
Mean	0.0003	-0.0001	0.0022
Standard Deviation	0.0252	0.0235	0.0229
Sharpe Ratio	0.012	-0.0041	0.0971
Governance			
Mean	-0.0009	0.0021	0.0042
Standard Deviation	0.0538	0.018	0.0165
Sharpe Ratio	-0.0162	0.1145	0.2545
Market			
Mean	0.0018	-0.006	-0.0024
Standard Deviation	0.0442	0.0288	0.0326
Sharpe Ratio	0.0402	-0.2088	-0.0736
Low SRI Portfolio			
Mean	0.0073	0.0097	0.0067
Standard Deviation	0.0452	0.0357	0.0308
Sharpe Ratio	0.161	0.2719	0.2186

This table presents the mean monthly return, the monthly standard deviation of returns, and the Sharpe ratio of the top, bottom, and long-short ESG, Environmental, Social, and Governance portfolios for the 2010-2018 time period. The top (bottom) portfolios are composed of the top (bottom) 10% stocks with the highest (lowest) ESG, Environmental, Social, and Governance scores on the previous. The long-short portfolios represent a strategy that buys the top and shorts the bottom portfolios. The market portfolio is an equally weighted portfolio of all the available stocks each month and is used as a benchmark for comparison with the other portfolios. Each column represents a different region. The Low SRI is an equally weighted portfolio containing stocks linked with the production/distribution of tobacco, alcohol, firearms, and fuels. The boldly printed values represent cases where a top portfolio's Sharpe ratio was higher than the corresponding bottom portfolio. The underlined values represent cases where a portfolio's Sharpe ratio was higher than the corresponding region's low SRI portfolio.

Figure 3
Low SRI vs top portfolios.



This figure presents the 1$ cumulative investment of all the Top portfolios and the Low SRI portfolio for each region between 2010 and 2018 monthly. The Top portfolios are composed of the top 10% stocks with the highest ESG (Top ESG), Environmental (Top E), Social (Top S), and Governance (Top G) scores on the previous year. The Low SRI is an equally weighted portfolio containing stocks linked with the production/distribution of tobacco, alcohol, firearms, and fuels.

Table 9

Abnormal returns.

	Alphas 2010-2018		
Portfolios	**USA**	**Europe**	**Asia**
Top-ESG	-0.0051***	-0.0015	-0.0024
	(0.0008)	(0.0022)	(0.0024)
Bot-ESG	-0.0095***	-0.0045*	-0.0053**
	(0.003)	(0.0026)	(0.0026)
Long-Short-ESG	0.0041	0.0027	0.0025
	(0.0028)	(0.0018)	(0.0019)
Top-E	-0.0052***	-0.0008	-0.0028
	(0.0007)	(0.0024)	(0.0033)
Bot-E	-0.005**	-0.0045	-0.0058***
	(0.002)	(0.0027)	(0.0022)
Long-Short-E	-0.0005	0.0034	0.0027
	(0.0019)	(0.0021)	(0.0025)
Top-S	-0.0059***	-0.0008	-0.0029
	(0.0008)	(0.0022)	(0.0021)
Bot-S	-0.0063***	-0.0025	-0.0032
	(0.0019)	(0.0023)	(0.003)
Long-Short-S	0.0002	0.0014	-0.0001
	(0.0018)	(0.0016)	(0.0023)
Top-G	-0.0056***	-0.002	-0.002
	(0.0011)	(0.002)	(0.0024)
Bot-G	-0.0099**	-0.0053**	-0.0042*
	(0.0044)	(0.0022)	(0.0023)
Long-Short-G	0.0041	0.003**	0.0018
	(0.004)	(0.0015)	(0.0017)

This table presents the alphas for each ESG and pillars portfolio for each region using a five-factor model regression. The dependent variable is the monthly excess returns of each portfolio for a period between 2010 and 2018, and the five factors were omitted. Standard errors are reported in parentheses, and significance at the ten-percent, five-percent, and one-percent levels is indicated by *, **, and ***, respectively. The full regressions can be consulted in appendixes A, B, and C.

Table 10

ESG regression, 2015-2018.

D.V. Rit-Rft	USA	Europe	Asia
ESG	0.0006**	0.0003	0.0006**
	(0.0003)	(0.0003)	(0.0002)
MRP	-0.3399***	0.4664***	0.7010***
	(0.0448)	(0.0436)	(0.0338)
SMB	-0.5191***	0.9779***	-0.1963**
	(0.0477)	(0.1132)	(0.0778)
HML	0.5786***	-0.6066***	-0.9412***
	(0.0486)	(0.0759)	(0.1150)
RMW	-0.1398***	0.5440***	0.3488**
	(0.0321)	(0.0603)	(0.1383)
CMA	0.1278***	0.0510	1.4991***
	(0.0477)	(0.0693)	(0.1963)
GDP	0.1063***	1.8691***	-0.3089
	(0.0204)	(0.4288)	(0.2014)
Cons	0.0672***	-0.1190***	-0.0546***
	(0.0143)	(0.0197)	(0.0138)
N	3328	3352	5260
R2	0.06	0.13	0.11

This table presents the coefficient results, between 2015 and 2018, for the panel data regression where ESG is considered as a single explanatory variable in year t-1. The 5-factor model, Fama, and French (2015) were considered: MRP (Market Risk Premium), SMB (Small Minus Big), HML (High Minus Low), RMW (Robust Minus Weak), and CMA (Conservative Minus Aggressive). GDP represents the annual GDP growth for each country in year t-1, and Const is a constant. N represents the number of observations, and R2 the r squared. Each column of the table represents the same regression for each region, and the period considered was 2010-2018. Standard errors are reported in parentheses, and significance at the ten-percent, five-percent, and one-percent levels is indicated by *, **, and ***, respectively.

Table 11

Environmental, Social and Governance regression, 2015-2018.

D.V. Rit-Rft	USA	Europe	Asia
E	-0.0005**	0.0001	0.0002
	(0.0002)	(0.0003)	(0.0003)
S	0.0010***	0.0000	0.0002
	(0.0003)	(0.0004)	(0.0003)
G	0.0002	0.0003	0.0002
	(0.0002)	(0.0003)	(0.0002)
MRP	-0.3428***	0.4669***	0.7005***
	(0.0448)	(0.0437)	(0.0339)
SMB	-0.5141***	0.9748***	-0.1997**
	(0.0479)	(0.1136)	(0.0799)
HML	0.5740***	-0.6058***	-0.9416***
	(0.0487)	(0.0760)	(0.1150)
RMW	-0.1399***	0.5426***	0.3441**
	(0.0321)	(0.0605)	(0.1403)
CMA	0.1289***	0.0494	1.5056***
	(0.0477)	(0.0695)	(0.1995)
GDP	0.1042***	1.8644***	-0.3095
	(0.0205)	(0.4289)	(0.2016)
Cons	0.0525***	-0.1228***	-0.0556***
	(0.0169)	(0.0203)	(0.0146)
N	3328	3352	5260
R2	0.07	0.13	0.11

This table presents the panel data regression coefficient results between 2015 and 2018, where each ESG pillar was considered a single explanatory variable for year t-1. E is the annual environmental score, S the annual social score, and G the annual governance score for each company. The 5-factor model, Fama, and French (2015) were considered: MRP (Market Risk Premium), SMB (Small Minus Big), HML (High Minus Low), RMW (Robust Minus Weak), and CMA (Conservative Minus Aggressive). GDP represents the annual GDP growth for each country in year t-1, and Const is a constant. N represents the number of observations, and R2 the r squared. Each column of the table represents the same regression for each region, and the period considered was 2010-2018. Standard errors are reported in parentheses, and significance at the ten-percent, five-percent, and one-percent levels is indicated by *, **, and ***, respectively.

Table 12
Portfolios' performance, 2015-2018.

Portfolios	USA	Europe	Asia
Top			
ESG			
Mean	0.0016	-0.0012	0.0008
Standard Deviation	0.0371	0.0425	0.0357
Sharpe Ratio	**0.044**	**-0.028**	**0.023**
Environmental			
Mean	-0.0016	0.0007	0.0009
Standard Deviation	0.0417	0.0383	0.0417
Sharpe Ratio	-0.0387	**0.0184**	**0.0211**
Social			
Mean	0.0008	0.0019	0.0024
Standard Deviation	0.0404	0.0351	0.036
Sharpe Ratio	**0.0187**	**0.0532**	**0.0668**
Governance			
Mean	-0.0021	0.0006	0.0019
Standard Deviation	0.0457	0.0342	0.0399
Sharpe Ratio	-0.0466	**0.0179**	**0.048**
Bottom			
ESG			
Mean	-0.0055	-0.0056	-0.0046
Standard Deviation	0.083	0.046	0.0418
Sharpe Ratio	-0.0667	-0.1228	-0.1103
Environmental			
Mean	0.0014	-0.0051	-0.0064
Standard Deviation	0.0687	0.0492	0.0416
Sharpe Ratio	0.0203	-0.1033	-0.1535
Social			
Mean	-0.0019	-0.0017	-0.0033
Standard Deviation	0.0622	0.0419	0.0459
Sharpe Ratio	-0.0299	-0.0399	-0.072
Governance			
Mean	-0.0014	-0.0016	-0.0038

Standard Deviation	0.1124	0.0404	0.0366
Sharpe Ratio	-0.0126	-0.039	-0.1036
Long-Short			
ESG			
Mean	0.0072	0.0045	0.0054
Standard Deviation	0.0545	0.0286	0.0216
Sharpe Ratio	0.1315	0.156	0.252
Environmental			
Mean	-0.003	0.0058	0.0073
Standard Deviation	0.0422	0.0259	0.0216
Sharpe Ratio	-0.0713	0.2233	0.3371
Social			
Mean	0.0026	0.0035	0.0057
Standard Deviation	0.0318	0.0206	0.0235
Sharpe Ratio	0.0824	0.172	0.2435
Governance			
Mean	-0.0007	0.0022	0.0057
Standard Deviation	0.079	0.0175	0.0193
Sharpe Ratio	-0.0091	0.1248	0.2953
Market			
Mean	-0.005	-0.0059	-0.004
Standard Deviation	0.0425	0.0274	0.032
Sharpe Ratio	-0.1189	-0.2159	-0.1239
Low SRI Portfolio			
Mean	0.002	0.0086	0.0025
Standard Deviation	0.0463	0.0407	0.0317
Sharpe Ratio	0.0428	0.2121	0.0791

This table presents the mean monthly return, the monthly standard deviation of returns, and the Sharpe ratio of the top, bottom, and long-short ESG, Environmental, Social, and Governance portfolios for the 2015-2018 time period. The top (bottom) portfolios are composed of the top (bottom) 10% stocks with the highest (lowest) ESG, Environmental, Social, and Governance scores on the previous year. The long-short portfolios represent a strategy that buys the top and shorts the bottom portfolios. The market portfolio is an equally weighted portfolio of all the available stocks each month and is used as a benchmark for comparison with the other portfolios. Each column represents a different region. The Low SRI is an equally weighted portfolio containing stocks linked with the production/distribution of tobacco, alcohol, firearms, and fuels. The boldly printed values represent cases where a top portfolio's Sharpe ratio was higher than the corresponding bottom portfolio. The underlined values represent cases where a portfolio's Sharpe ratio was higher than the corresponding region's low SRI portfolio.

Table 13

Abnormal returns, 2015-2018

	Alphas 2015-2018		
Portfolios	**USA**	**Europe**	**Asia**
Top-ESG	-0.0048***	0.0003	-0.001
	(0.0012)	(0.0035)	(0.0035)
Bot-ESG	-0.0151***	-0.0062	-0.0041
	(0.0049)	(0.0042)	(0.0041)
Long-Short-ESG	0.0097**	0.0057**	0.0025
	(0.0045)	(0.0027)	(0.0029)
Top-E	-0.0082***	0.0011	-0.0002
	(0.0022)	(0.0032)	(0.0042)
Bot-E	-0.0071***	-0.0055	-0.0056
	(0.0028)	(0.0043)	(0.0038)
Long-Short-E	-0.0017	0.0059*	0.0048
	(0.0037)	(0.0033)	(0.0032)
Top-S	-0.0058***	0.0016	0.0009
	(0.0014)	(0.0031)	(0.0031)
Bot-S	-0.0086***	-0.0029	-0.0031
	(0.0027)	(0.0037)	(0.0044)
Long-Short-S	0.0021	0.0038	0.0034
	(0.0029)	(0.0025)	(0.0035)
Top-G	-0.0082***	-0.0011	0.0008
	(0.0021)	(0.0031)	(0.0036)
Bot-G	-0.0155**	-0.0034	-0.003
	(0.0067)	(0.0034)	(0.0033)
Long-Short-G	0.0066	0.0016	0.0033
	(0.0067)	(0.0024)	(0.0029)

This table presents the alphas for each ESG and pillars portfolio for each region using a five-factor model regression. The dependent variable is the monthly excess returns of each portfolio between 2015 and 2018, and the five factors were omitted. Standard errors are reported in parentheses, and significance at the ten-percent, five-percent, and one-percent levels is indicated by *, ** and ***, respectively. The full regressions can be consulted in appendixes D, E, and F.

Table 14
Hypothesis summary.

	Hypothesis	USA	Europe	Asia
Regression Method	**H1:** There is a positive impact of the ESG, Environmental, Social, or Governance score on excess stock returns.			
	- ESG	15-18		**X**
	- Environmental			
	- Social	**X**		10-18
	- Governance			
Portfolio Method	**H2:** There is a superior performance for portfolios composed of high ESG, Environmental, Social, or Governance scores compared to low scores portfolios.			
	- Top ESG	**X**	**X**	**X**
	- Top Environmental	10-18	**X**	**X**
	- Top Social	**X**	15-18	**X**
	- Top Governance	10-18	**X**	**X**
	H3: There is a superior performance for portfolios composed of high ESG, Environmental, Social, or Governance scores compared to low SRI portfolios.			
	- ESG	15-18*		**X***
	- Environmental			**X***
	- Social			10-18*
	- Governance	15-18*		**X***
	H4: There are positive abnormal returns for portfolios composed of high ESG, Environmental, Social, or Governance score stocks.			
	- ESG	15-18*		15-18*
	- Environmental		15-18*	
	- Social			
	- Governance		10-18*	

This table presents a summary of the conclusions regarding the hypothesis studied in this paper. The dotted line separates the hypothesis tested using the regression method from the ones tested using the portfolio method. The X represents a situation where the respective variable's hypothesis was verified in the 2010-2018 and 2015-2018 periods. A 10-18 represents a situation where the respective variable's hypothesis was only verified for the 2010-2018 period. A 15-18 represents a situation where the respective variable's hypothesis was only verified for the 2015-2018 period. If there is a * after a value, this means that the hypothesis was verified for a long-short portfolio of the corresponding variable.

11. Appendixes

Appendix A

Abnormal returns five-factor full regression USA.

	Top ESG	Bot ESG	Long-Short ESG	Top E	Bot E	Long-Short E	Top S	Bot S	Long-Short S	Top G	Bot G	Long-Short G
MRP	1.0183***	1.3012***	-0.2811***	1.0358***	1.2520***	-0.2145***	1.0550***	1.1127***	-0.0559	1.0390***	1.5495***	-0.5087***
	(0.0228)	(0.0853)	(0.0786)	(0.0193)	(0.0706)	(0.0672)	(0.0231)	(0.0531)	(0.0487)	(0.0302)	(0.1227)	(0.1122)
SMB	0.0208	0.8907***	-0.8682***	0.0389	0.8258***	-0.7852***	0.0744*	0.7625***	-0.6864***	0.2145***	1.0596***	-0.8434***
	(0.0379)	(0.1419)	(0.1309)	(0.0321)	(0.1175)	(0.1118)	(0.0384)	(0.0884)	(0.0811)	(0.0502)	(0.2042)	(0.1867)
HML	0.0713	0.0799	-0.0056	0.0985**	-0.2744*	0.3759***	0.0762	0.1832*	-0.1039	0.1647***	-0.2468	0.4145*
	(0.0473)	(0.1770)	(0.1633)	(0.0400)	(0.1466)	(0.1395)	(0.0479)	(0.1102)	(0.1012)	(0.0626)	(0.2547)	(0.2329)
RMW	0.1245**	0.0381	0.0903	0.0426	-0.0855	0.1319	0.1231**	0.0391	0.0880	0.0884	-0.0024	0.0947
	(0.0573)	(0.2146)	(0.1979)	(0.0485)	(0.1777)	(0.1691)	(0.0581)	(0.1337)	(0.1227)	(0.0759)	(0.3088)	(0.2824)
CMA	0.0799	-0.5389**	0.6162**	0.1033*	-0.5432**	0.6439***	0.0336	-0.3035*	0.3346**	0.0099	-0.9476**	0.9549***
	(0.0709)	(0.2655)	(0.2449)	(0.0601)	(0.2198)	(0.2092)	(0.0719)	(0.1654)	(0.1518)	(0.0940)	(0.3821)	(0.3493)
Cons	-0.0052***	-0.0092***	0.0037	-0.0047***	-0.0055**	0.0005	-0.0059***	-0.0061***	-0.0000	-0.0057***	-0.0099**	0.0039
	(0.0008)	(0.0030)	(0.0028)	(0.0007)	(0.0025)	(0.0024)	(0.0008)	(0.0019)	(0.0017)	(0.0011)	(0.0043)	(0.0040)
N	108	108	108	108	108	108	108	108	108	108	108	108
R2	0.96	0.81	0.52	0.97	0.85	0.57	0.96	0.89	0.55	0.94	0.75	0.48

Appendix B

Abnormal returns five-factor full regression Europe.

	Top ESG	Bot ESG	Long-Short ESG	Top E	Bot E	Long-Short E	Top S	Bot S	Long-Short S	Top G	Bot G	Long-Short G
MRP	0.6761***	0.6954***	-0.0165	0.7115***	0.7325***	-0.0182	0.6761***	0.7276***	-0.0487	0.7069***	0.6672***	0.0425
	(0.0506)	(0.0599)	(0.0409)	(0.0556)	(0.0572)	(0.0424)	(0.0514)	(0.0544)	(0.0388)	(0.0481)	(0.0533)	(0.0352)
SMB	-0.4492***	0.6171***	-1.0608***	-0.3491**	0.5744***	-0.9181***	-0.4391***	0.5869***	-1.0205***	-0.2008*	0.4788***	-0.6741***
	(0.1266)	(0.1496)	(0.1022)	(0.1390)	(0.1429)	(0.1059)	(0.1284)	(0.1361)	(0.0971)	(0.1202)	(0.1333)	(0.0880)
HML	0.1520	-0.1815	0.3310**	0.2361	-0.1977	0.4313***	0.0504	-0.1526	0.2005	0.0288	-0.0246	0.0509
	(0.1776)	(0.2099)	(0.1434)	(0.1951)	(0.2005)	(0.1487)	(0.1802)	(0.1909)	(0.1363)	(0.1687)	(0.1871)	(0.1235)
RMW	-0.2524	-0.4308	0.1851	-0.5313**	-0.2935	-0.2310	-0.1252	-0.3703	0.2518	-0.0771	-0.1402	0.0698
	(0.2300)	(0.2719)	(0.1857)	(0.2527)	(0.2597)	(0.1925)	(0.2334)	(0.2473)	(0.1765)	(0.2185)	(0.2422)	(0.1599)
CMA	-0.2876	-0.4319*	0.1537	-0.3653	-0.5258**	0.1699	-0.1710	-0.4790**	0.3174*	-0.1839	-0.3850*	0.2104
	(0.2199)	(0.2599)	(0.1775)	(0.2416)	(0.2483)	(0.1841)	(0.2232)	(0.2364)	(0.1687)	(0.2089)	(0.2316)	(0.1529)
Cons	-0.0009	-0.0044*	0.0032*	-0.0009	-0.0024	0.0013	-0.0006	-0.0018	0.0009	-0.0019	-0.0051**	0.0029*
	(0.0021)	(0.0025)	(0.0017)	(0.0024)	(0.0024)	(0.0018)	(0.0022)	(0.0023)	(0.0016)	(0.0020)	(0.0023)	(0.0015)
N	108	108	108	108	108	108	108	108	108	108	108	108
R2	0.78	0.69	0.58	0.79	0.72	0.61	0.76	0.74	0.57	0.78	0.71	0.43

Appendix C

Abnormal returns five-factor full regression Asia.

	Top ESG	Bot ESG	Long-Short ESG	Top E	Bot E	Long-Short E	Top S	Bot S	Long-Short S	Top G	Bot G	Long-Short G
MRP	0.5457***	0.6483***	-0.1009**	0.5680***	0.6745***	-0.1048**	0.5438***	0.6548***	-0.1093**	0.5710***	0.5732***	-0.0005
	(0.0443)	(0.0482)	(0.0387)	(0.0630)	(0.0426)	(0.0525)	(0.0363)	(0.0567)	(0.0463)	(0.0419)	(0.0433)	(0.0322)
SMB	0.1294	0.3727***	-0.2394***	0.2095	0.3709***	-0.1575	0.1217	0.4250***	-0.2993***	0.1411	0.2452**	-0.1002
	(0.1038)	(0.1130)	(0.0906)	(0.1476)	(0.0999)	(0.1229)	(0.0850)	(0.1329)	(0.1084)	(0.0981)	(0.1014)	(0.0754)
HML	0.3424**	0.1530	0.1902	0.4339**	0.0574	0.3773**	0.3178***	0.2566	0.0620	0.2119	0.1343	0.0784
	(0.1415)	(0.1540)	(0.1235)	(0.2011)	(0.1361)	(0.1675)	(0.1158)	(0.1811)	(0.1477)	(0.1337)	(0.1382)	(0.1028)
RMW	0.0945	-0.1006	0.1956	0.1371	0.0208	0.1168	0.0662	-0.0763	0.1430	0.0550	-0.1644	0.2199*
	(0.1610)	(0.1751)	(0.1405)	(0.2288)	(0.1548)	(0.1906)	(0.1317)	(0.2060)	(0.1680)	(0.1520)	(0.1572)	(0.1169)
CMA	-0.1543	-0.5272***	0.3809***	-0.0870	-0.4698***	0.3908**	-0.1848	-0.4230**	0.2460	-0.1405	-0.3912**	0.2587**
	(0.1567)	(0.1705)	(0.1368)	(0.2227)	(0.1507)	(0.1855)	(0.1282)	(0.2005)	(0.1636)	(0.1480)	(0.1530)	(0.1138)
Cons	-0.0022	-0.0050**	0.0025	-0.0025	-0.0062***	0.0034	-0.0026	-0.0033	0.0004	-0.0022	-0.0039*	0.0014
	(0.0023)	(0.0025)	(0.0020)	(0.0032)	(0.0022)	(0.0027)	(0.0018)	(0.0029)	(0.0024)	(0.0021)	(0.0022)	(0.0016)
N	108	108	108	108	108	108	108	108	108	108	108	108
R2	0.64	0.72	0.32	0.48	0.77	0.22	0.72	0.64	0.22	0.68	0.70	0.16

Appendix D

Abnormal returns five-factor full regression USA, 2015-2018.

	Top ESG	Bot ESG	Long-Short ESG	Top E	Bot E	Long-Short E	Top S	Bot S	Long-Short S	Top G	Bot G	Long-Short G
MRP	1.0688***	1.7478***	-0.6771***	1.1437***	1.4578***	-0.3122***	1.1087***	1.3686***	-0.2580***	1.1925***	2.2503***	-1.0559***
	(0.0375)	(0.1490)	(0.1368)	(0.0678)	(0.0846)	(0.1138)	(0.0444)	(0.0840)	(0.0895)	(0.0636)	(0.2060)	(0.2061)
SMB	0.0694	1.2596***	-1.1874***	0.1104	1.0553***	-0.9421***	0.2059***	0.9524***	-0.7436***	0.3371***	1.6949***	-1.3550***
	(0.0527)	(0.2090)	(0.1918)	(0.0951)	(0.1187)	(0.1596)	(0.0623)	(0.1178)	(0.1255)	(0.0892)	(0.2889)	(0.2891)
HML	0.0175	0.0413	-0.0168	0.0030	0.0505	-0.0405	0.0495	0.1889	-0.1324	0.1734	-0.4316	0.6119*
	(0.0662)	(0.2629)	(0.2412)	(0.1196)	(0.1492)	(0.2007)	(0.0783)	(0.1482)	(0.1578)	(0.1122)	(0.3633)	(0.3635)
RMW	0.1783*	-0.1100	0.2949	0.1152	-0.2398	0.3616	0.1109	-0.1483	0.2659	0.0299	-0.2813	0.3178
	(0.0897)	(0.3562)	(0.3269)	(0.1621)	(0.2022)	(0.2719)	(0.1061)	(0.2008)	(0.2138)	(0.1521)	(0.4922)	(0.4926)
CMA	0.1950*	-0.3996	0.5841	0.2558	-0.6602***	0.9055***	0.0518	-0.1242	0.1656	0.2170	-0.9484	1.1549**
	(0.1037)	(0.4117)	(0.3778)	(0.1873)	(0.2337)	(0.3143)	(0.1226)	(0.2320)	(0.2471)	(0.1758)	(0.5689)	(0.5693)
Cons	-0.0048***	-0.0151***	0.0097**	-0.0082***	-0.0071**	-0.0017	-0.0058***	-0.0086***	0.0021	-0.0082***	-0.0155**	0.0066
	(0.0012)	(0.0049)	(0.0045)	(0.0022)	(0.0028)	(0.0037)	(0.0014)	(0.0027)	(0.0029)	(0.0021)	(0.0067)	(0.0067)
N	48	48	48	48	48	48	48	48	48	48	48	48
R2	0.96	0.86	0.73	0.89	0.93	0.69	0.95	0.92	0.66	0.92	0.86	0.71

Appendix E

Abnormal returns five-factor full regression Europe, 2015-2018.

	Top ESG	Bot ESG	Long-Short ESG	Top E	Bot E	Long-Short E	Top S	Bot S	Long-Short S	Top G	Bot G	Long-Short G
MRP	0.8954***	0.9306***	-0.0275	0.7821***	0.9704***	-0.1806*	0.7716***	0.9046***	-0.1253*	0.8286***	0.9464***	-0.1101
	(0.1026)	(0.1228)	(0.0805)	(0.0933)	(0.1280)	(0.0963)	(0.0914)	(0.1091)	(0.0736)	(0.0902)	(0.1000)	(0.0706)
SMB	-0.9742***	0.1316	-1.0818***	-0.3372	0.0663	-0.3795	-0.4429*	0.1784	-0.5973***	-0.0304	0.0486	-0.0549
	(0.2532)	(0.3032)	(0.1986)	(0.2304)	(0.3159)	(0.2379)	(0.2257)	(0.2693)	(0.1817)	(0.2227)	(0.2468)	(0.1743)
HML	-0.0603	-0.9754**	0.9097***	-0.0146	-0.9097*	0.8897**	-0.1738	-0.8862**	0.7071**	-0.3338	-0.7872**	0.4481*
	(0.3675)	(0.4401)	(0.2883)	(0.3345)	(0.4586)	(0.3453)	(0.3275)	(0.3909)	(0.2637)	(0.3232)	(0.3583)	(0.2531)
RMW	-0.3769	-1.3793***	1.0179***	-0.6820*	-1.4186**	0.7521*	-0.3384	-1.0640**	0.7411**	-0.2411	-0.6698	0.4442
	(0.4247)	(0.5086)	(0.3332)	(0.3865)	(0.5299)	(0.3990)	(0.3785)	(0.4517)	(0.3048)	(0.3735)	(0.4140)	(0.2924)
CMA	-0.1748	-0.4829	0.3411	-0.5116	-0.8125	0.3339	-0.2289	-0.2277	0.0318	0.3434	-0.0444	0.4208
	(0.4378)	(0.5242)	(0.3434)	(0.3984)	(0.5462)	(0.4112)	(0.3901)	(0.4656)	(0.3141)	(0.3850)	(0.4267)	(0.3014)
Cons	0.0003	-0.0062	0.0057**	0.0011	-0.0055	0.0059*	0.0016	-0.0029	0.0038	-0.0011	-0.0034	0.0016
	(0.0035)	(0.0042)	(0.0027)	(0.0032)	(0.0043)	(0.0033)	(0.0031)	(0.0037)	(0.0025)	(0.0031)	(0.0034)	(0.0024)
N	48	48	48	48	48	48	48	48	48	48	48	48
R2	0.76	0.71	0.67	0.76	0.72	0.43	0.72	0.72	0.47	0.72	0.75	0.33

Appendix F

Abnormal returns five-factor full regression Asia, 2015-2018.

	Top ESG	Bot ESG	Long-Short ESG	Top E	Bot E	Long-Short E	Top S	Bot S	Long-Short S	Top G	Bot G	Long-Short G
MRP	0.6997***	0.7904***	-0.0878	0.8016***	0.8186***	-0.0141	0.7567***	0.8884***	-0.1287	0.8155***	0.7116***	0.1068
	(0.0855)	(0.1002)	(0.0722)	(0.1042)	(0.0940)	(0.0792)	(0.0758)	(0.1072)	(0.0854)	(0.0875)	(0.0818)	(0.0721)
SMB	-0.1184	0.1061	-0.2198	0.0475	0.1673	-0.1150	0.0185	0.1483	-0.1251	0.2038	0.0008	0.2077
	(0.1716)	(0.2011)	(0.1450)	(0.2091)	(0.1887)	(0.1589)	(0.1522)	(0.2151)	(0.1715)	(0.1755)	(0.1642)	(0.1448)
HML	0.0315	-0.2177	0.2448	-0.0764	-0.3327	0.2521	-0.0099	-0.1993	0.1851	-0.0118	-0.2627	0.2467
	(0.2544)	(0.2982)	(0.2151)	(0.3101)	(0.2798)	(0.2357)	(0.2256)	(0.3190)	(0.2543)	(0.2603)	(0.2435)	(0.2148)
RMW	-0.0435	-0.3051	0.2580	-0.1780	-0.1032	-0.0785	-0.1139	-0.2632	0.1457	-0.0066	-0.3511	0.3408
	(0.2916)	(0.3417)	(0.2465)	(0.3553)	(0.3206)	(0.2701)	(0.2586)	(0.3656)	(0.2915)	(0.2983)	(0.2790)	(0.2461)
CMA	-0.0616	-0.3152	0.2683	-0.0594	-0.3495	0.3048	-0.0397	-0.3166	0.2916	-0.1694	-0.3491	0.1944
	(0.2934)	(0.3439)	(0.2480)	(0.3576)	(0.3226)	(0.2718)	(0.2602)	(0.3679)	(0.2933)	(0.3002)	(0.2808)	(0.2477)
Cons	-0.0010	-0.0041	0.0025	-0.0002	-0.0056	0.0048	0.0009	-0.0031	0.0034	0.0008	-0.0030	0.0033
	(0.0035)	(0.0041)	(0.0029)	(0.0042)	(0.0038)	(0.0032)	(0.0031)	(0.0044)	(0.0035)	(0.0036)	(0.0033)	(0.0029)
N	48	48	48	48	48	48	48	48	48	48	48	48
R2	0.64	0.64	0.29	0.61	0.68	0.15	0.72	0.66	0.16	0.70	0.69	0.12