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MSc. Financial Economics

ESG Investing: Does an ESG Premium Exist and How Does SRI Impact Companies' Cost of Capital?

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Abstract

This paper studies the effect of ESG scores on stock returns and on firms' cost of equity. Through that research, I aim at reconciling the implications of ESG investing for investors and corporations. I first retrieve the sustainability scores for a large universe of U.S. stocks to create ranked portfolios based on the ESG factor. This methodology allows me to unveil an ESG premium in the United States, indicating that investors pay for holding sustainable stocks. Then, to compute companies' cost of equity, I use their monthly market beta values to compute their historical financing costs. This variable helps me to derive a negative relationship between ESG scores and the firms' cost of equity. Additionally, sectorial and geographical dimensions are added to the study to observe the influence of sustainability ratings on specific sectors together with dissimilarities in ESG valuation across continents. Finally, behavioural and fundamental arguments surrounding ESG investing are explored to complement the premium analysis performed beforehand.

1. Introduction

Sustainable responsible investing (SRI) has become a trending term in the financial world. The strategies of many investors, individual or institutional, have changed to include this new dimension in their decision-making process. The terminology SRI is best explained as any type of investment that combines investors' financial objectives with their concerns about environmental, social and governance (ESG) issues. Therefore, firms' ESG performances have been receiving a growing interest from investors and are viewed as key determinants in the portfolio formation process. During the last decades, several debates emerged about the potential benefits and trade-offs related to the inclusion of sustainability measures, which allow for the quantification of a company's ESG profile (Poh, 2019). On the one hand, from a total welfare perspective, the rising interest around ESG issues implies that consumers demand higher standards of sustainability and quality of employment from businesses. Thus, firms are trying to make additional corporate social responsibility (CSR) efforts to please their consumers and shareholders while improving their ESG scores (Subramanian, 2019). In turn, it would eventually lead to the global sustainable development of the economy as a whole. Regulators and policymakers understand that emphasizing on ESG potentially aligns the interests of the public and private sectors. These regulating bodies realise that receiving the help of the corporations could tremendously help them in solving issues such as environmental pollution or workplace diversity (McKinsey, 2020). Furthermore, recent events such as the coronavirus pandemic or the rising importance of climate risk highlight the hedging ability of including ESG criteria in investment decisions. Indeed, equity funds built to track high-ESG indices have been gaining in popularity and appear to protect performance during cyclical downturns, outperforming global market indices (Dekker & Vellinga, 2020). On the other hand, the quantification of sustainable performance represents a major obstacle to ESG incorporation in portfolios. In fact, there is an observable discrepancy between several data providers, which undermines the soundness of this investment criterion (Poh, 2019). Nevertheless, sustainable investing has been growing exponentially and represents nowadays a considerable share of the financial market. According to a 2018's report by the U.S. SIF Foundation, one in four dollars under professional management in the U.S. is invested towards SRI assets, which amounts to a total of $12 trillion. Compared to 2016, this represents an increase of 38 percent, indicating an increasing commitment to invest sustainably.

This thesis project, which builds on the expanding literature around sustainable investing, examines how this new trend has influenced stock return patterns since the inclusion

of ESG scores. It investigates the potential preference that investors exhibit towards ESG stocks, which could translate in an unwillingness to buy underpriced stocks with poor ESG scores or sell overpriced stocks with high ratings (Cao et al., 2019). This particular behaviour potentially supports the presence of an "ESG anomaly" and suggests that investors might pay a premium for holding high-ESG stocks. Furthermore, this paper explores the implications of the rise of SRI for companies and their financing costs. It supplements recent academical research such as the one performed by Gianfrante (2019), who finds a theoretically negative relation between firms' sustainability ratings and their cost of capital. The present thesis project tests this hypothetical relation empirically through the companies' cost of equity calculation. Most importantly, this paper reconciles ESG factor investing with the effect of ESG scores on firms' cost of capital, which has not been done before. Thus, I aim at providing meaningful insights for investors willing to include sustainable investing in their portfolio decisions while also documenting firms on the potential effect of improving their ESG ranking. This leads to the main research question:

"How does ESG incorporation influence portfolio formation and returns, and how does it influence companies' cost of capital?"

In order to address this abovementioned gap in literature, I wish to combine the implications of ESG investing for corporates and investors in one comprehensive study. For that purpose, I form two major hypotheses. The first one builds on Auer et al. (2015)'s paper, which shows evidence of the existence of an ESG premium for a restricted amount of stocks. In order to confirm that finding, I perform a similar study on the whole universe of U.S. stocks covered on ESG matters. The second hypothesis concerns the relationship between the firms' cost of equity and the ESG scores. El Ghoul et al. (2018) unveil a negative relationship between the two variables for a portfolio composed of stocks from various parts of the world. I aim at confirming that finding for the U.S. market through a different methodology that uses the ex-post cost of equity. I decide to create ranked portfolios that are rebalanced each month to test these two hypotheses. This technique, commonly used in factor investing, was first initiated by Carhart (1997) and helps to classify assets based on particular variables. Thus, I am able to construct ten deciles portfolios, the bottom one obtaining the lowest average ESG score and the top one exhibiting the highest average rating.

Regarding the ESG premium analysis, I first retrieve the monthly returns for the whole universe of U.S. stocks from 2003 to 2019. This timeframe represents the coverage of ESG data, which helps me to match each monthly observation to its corresponding sustainability

rating, if available. Then, I derive the mean excess return for each decile portfolio. As these ones are rebalanced monthly based on the ESG scores, this means that the tenth portfolio will always be composed of ESG top performers. Thus, observing the return differential between the first portfolio and the top decile one indicates whether or not a premium exists. In order to push this analysis forward, I decide to control for the Fama-French five factors (FF5). Performing a FF5 regression allows to observe the monthly loadings on academically documented asset pricing factors together with alphas and their significance to examine whether the premium remains or not. This regression helps to obtain a comprehensive model that isolates the effect of ESG scores on returns. Through the results obtained, I uncover an ESG premium as the bottom decile portfolio outperforms the high-ESG one by, on average, 0.4 percent per month. This return spread remains after controlling for common risk factors as I observe a decreasing monthly alpha sequence through portfolios. Furthermore, these alphas become insignificant for the last portfolios composed of highly sustainable stocks.

Then, I wish to study the relationship between companies' cost of equity and ESG scores. Using a similar methodology of ranked portfolios, I form deciles based on firms' ESG ratings. In order to compute the monthly cost of equity of each firm, I choose to use an historical approach, which differs from El Ghoul et al. (2018) and its ex-ante cost of equity. I compute the cost of equity through a CAPM model. Bancel and Mittoo (2014) reveal that this model is the most widely used by financial professionals to estimate the cost of equity while Da et al. (2011) prove its reliability. As I compare Northern American stocks, the variable of interest in this case is the firm's monthly market beta that I retrieve using a 5-year rolling window. Through this technique, I uncover a negative relationship between the companies' ESG score and their monthly market beta. Indeed, a portfolio formed of ESG top performers obtains an average market beta value that is 0.12 lower than the one obtained for low-ESG stocks. Through robustness tests, I confirm that this negative relation also holds for the cost of equity in general.

In addition, this study includes sectorial and geographical aspects. First, by examining the industries that obtain the highest ESG scores on average, I am able to determine whether or not sustainable investing translates in picking renewable energies or non-polluting sectors. Engle et al. (2019) document a low correlation between industry membership and environmental scores[1]. I try to confirm that finding by highlighting the most represented sectors within the high-ESG segment. I find that some industries predominantly compose the top ESG

[1] The Environmental score represents the E-component of the ESG score.

decile while they account for a considerable part of the low-ESG spectrum at the same time. This correspondence shows that some firms score way better than others on ESG matters despite being active in the same sector. Moreover, I put the emphasis on several industries generally considered as environmentally sensitive. Analysing these specific sectors allows me to determine if they profit from a larger reduction in their cost of equity by increasing their ESG scores when compared to the broad market. Taking a basket of carbon-intensive companies helps to unveil a difference of 0.5 in their average monthly market betas between the bottom and top decile portfolios. This larger differential provides evidence of a larger reduction in the cost of equity linked to the improvement of ESG scores for these polluting sectors.

Then, adding a geographical dimension enables me to spot the potential difference that investors make while valuing the ESG criterion. This particular idea was previously explored by Dureen et al. (2016) who documented a potential difference in the ways in which U.S. and European asset managers view ESG. I tackle this hypothesis by empirically searching for differences in ESG valuation between three different regions, namely the United States, Europe and Japan. Similarly, I discover an ESG premium in those last two areas, which proves that investors pay for holding sustainable assets. Nevertheless, the premium is more pronounced in Europe than in Japan, implying dissimilarities in valuation. Similar to the analysis performed on the U.S., I control for the Fama-French five factors to observe the monthly factors loadings along with the abnormal performance that results from the decile portfolios created.

Finally, I discuss the results that I obtained by further explaining the resulting output of those analyses. By observing the factor coefficients obtained through the different Fama-French regressions, I unveil a size bias for every region. Indeed, the portfolios formed of high-ESG stocks appear to include more large firms than small ones. By contrary, low-ESG assets are mainly represented by small companies. This pitfall is created by the tremendous efforts that many large firms make to disclose information about their sustainability profile (Drempetic et al., 2019). This bias highlights a potential correlation between ESG and other factors, such as size or quality (Feldman, 2017). At the same time, I try to uncover a rationale behind the existence of the ESG premium. I explore fundamental explanations as academics document a potential hedging ability of high-ESG stocks regarding climate change news, implying a long-term protection against climate risk (Engle et al., 2019). Contemporary evidence is also used to observe and strengthen this risk hedging capability. The coronavirus outbreak and the financial crisis represent two particularly interesting sub-sample periods that highlight the downside mitigation potential of ESG investing during market corrections (Dekker et al.

(2020); Wojtowicz (2020)). Furthermore, I analyse behavioural reasons such as the greater-fool theory implying more speculation on sustainable stocks, or the "feel-good" sentiment (Miller, 2019).

1.1. Thesis outline

The remainder of this thesis is structured as follows: Section 2 presents the related literature on the topic of ESG investing together with the hypotheses detailed. Then, Section 3 describes the data set and the methodology surrounding the construction of ranked portfolios and the estimation of firms' ex-post cost of equity. In Section 4, I analyse the results that I obtain from my ESG premium analysis and the relation that I unveil between ESG scores and companies' financing costs. Moreover, I complement these findings with sectorial and geographical dimensions. Then, Section 5 further discusses the results and explores behavioural and fundamental aspects surrounding the ESG premium. Finally, Section 6 states the limitations of this study together with suggestions for future research, to arrive at final conclusive remarks in Section 7.

2. Related Literature and Hypotheses

2.1. A review of Environmental, Social and governance (ESG) performance.

ESG investing has been experiencing an exponential growth in the past several years. This revolution surrounding asset management is often associated with sustainable financing (Robeco, 2019). The three letters of the ESG acronym represent the three principal pillars that are studied through this rating. First, as defined by Thomson Reuters (2020), the letter "E" stands for environment and includes companies' sources of energy, pollution, waste management, natural resources usage, and other related areas. It also studies the robustness of a firm toward environmental challenges such as climate change along with the actions that companies undertake to mitigate those risks. Second, the letter "S" represents a social criterion that covers firms' business relationships. As an example, the company's suppliers are monitored to observe if they hold similar social values together. This also includes potential donations to charities, the respect of human rights for every stakeholder or the implementation of good working conditions. Finally, the last letter "G" stands for governance, covering the system of rules and practices used by a firm to direct and control its operations. This comprises the accuracy of reporting methods, the choice of board members and the compliance to several corporate laws (T. Reuters, 2020).

No single company will perform in an exactly similar manner on these three measures. Therefore, obtaining ESG scores helps to quantify how firms manage, on average, their sustainability issues. Nowadays, many agencies act as ESG data providers and construct sustainability scores based on self-directed rules. The most popular databases are KLD, Sustainalytics (MSCI), Asset 4 (Thomson Reuters), Video-Eiris and RobecoSAM. The principal sources of information to construct ESG scores are company reports, which can be analysed and compiled, to create an overall rating. The majority of the score providers use a "rank procedure" in order to compare companies between each other and remove the potential influence of outliers. ESG quantification helps investors to include a sustainability dimension in their stock selection and unveils the best performing sectors and companies on SRI issues.

Nevertheless, the lack of standardization and transparency in ESG scoring represents a major challenge for investors. ESG remains an innovative and evolving concept, and reporting standards surrounding this notion are still opaque. This results in a low correlation of 0.61 between the different sustainability ratings of the major third-party ESG data providers (Poh, 2019). By comparison, the credit rating correlation between Standard and Poors and Moody's is 0.99, highlighting a puzzling difference in methodology between ESG rating agencies. This creates noisy information for any investor that wishes to include sustainability scores in its decision-making as this information considerably differs from one provider to another. (Mayor, 2019). Indeed, there is a lot of subjectivity that comes into place when talking about ESG. It is hard to standardize which sustainable topic is more important than another, which eventually leads to diverging scores due to differing weights used for the ESG score calculation. Overall, there is a lack of regulation around ESG data and ratings providers, which makes them different from any of their counterparts that handles financial information (Foster, 2019).

As this very last point became evident throughout the years, several governing bodies have been attempting to increase the transparency and standardization of sustainability ratings. As an example, the 2022 European Union Taxonomy will enforce disclosure requirements for index and benchmark providers that are involved with SRI. However, this is just the tip of the iceberg as ratings providers say that their system will only improve if companies start to communicate accurately about their sustainability profile (Poh, 2019). Even if some companies willingly disclose their ESG data, there are currently no enforced standard on how they must do it. Nowadays, the Securities and Exchange Commission (SEC), which regulates the US securities market, does not require companies to disclose their ESG data, while other financial regulators in other parts of the world are only starting to implement these requirements (Poh, 2019). Despite that transparency and standardization puzzle, investors are becoming

increasingly interested in ESG issues and these discrepancies between data providers can be seen as diversity if investors know the different weights and guidelines surrounding the score formation. While some third parties will place a great focus on carbon emissions, others could put the emphasis on human rights. Due to the different weights used in the score computation, comparing different ratings could be of great interest (Mayor, 2019).

2.2. ESG Factor investing and ESG premium.

ESG investing first found its roots in its "feel-good" factor provided to investors that wish to be sustainable (Miller, 2019). However, the reasons to invest in ESG go beyond the behavioural spectrum as sustainable investing has the ability to spot financial risks that are hardly identified in companies' financial results (Chen, 2018). Engle et al. (2019) find that ESG can act as a potential hedge against climate risk. By taking the firms' environmental scores as a measure of their exposure towards climate change, they form a portfolio with high E-ratings to prove its robustness to climate-related news. As a result, they discover that stocks with a relatively high E-score exhibit better returns when significant climate risk management summits occur, such as the Paris agreement. Furthermore, the recent coronavirus pandemic proves the resilience of sustainable investing when facing a market downturn. Recent reports from UBS and Kempen (2020) highlight the strength of ESG ETFs and their ability to mitigate portfolio downside risk during market corrections. Wojtowicz (2020) studies the performance of sustainable ETFs during the coronavirus drawdown and is able to derive a significant outperformance of high-ESG ETFs relative to a broad market index, the MSCI World. The SRI 5% capped index, which selects the top 25% firms with the highest sustainable ratings, outperformed the market by 257 bps during that period. In addition, the MSCI ESG leaders index, containing firms that display an ESG score superior to the mean score of all firms in the market, yielded an outperformance of 136 bps. The author further mentions that ESG excellence mattered the most as sustainable leaders realised the best return amidst this recent financial shock.

Therefore, the value of ESG is not only represented by a feeling of doing good but also seems to yield fundamental value to investors, acting as a potential hedge during economic downturns. Risk mitigation is a valuable characteristic for investors, but it might come at a price. Financial theory suggests that if ESG reduces downsize risk, people holding high-ESG stocks will accept lower returns for these assets as they can be considered "less-cyclical" (Wojtowicz, 2020). In other words, investors might be willing to pay an ESG premium for securities that are associated with a higher sustainability score. Auer et al. (2015) performed

preliminary research on the subject by distinguishing two theories. The first one, "doing good while doing well", represents a positive relation between sustainability and financial performance. The investor type aiming for this positive link is called a responsible profit-seeker. This category translates into a willingness to focus on sustainable firms but also on financial profit. Hence, these investors would not invest in regions in which SRI does not yield superior returns. The second theory, "doing good but not well", represents a trade-off theory. Indeed, this would mean that social performance is negatively related to returns. Investors opting for this strategy are considered to be value-driven investors as their utility gain through sustainability is high enough to compensate for a financial loss. Auer et al. (2015)'s paper paves the way for an ESG Premium analysis. Despite using a relatively small number of stocks, it represents a good basis that can be extended and enhanced in this thesis project. They find that a selection of high-ESG stocks does not consistently increase or decrease financial performance in the United States, when compared to a market benchmark. Nevertheless, they discover divergent results in Europe, pointing towards significantly lower risk-adjusted performance for portfolios composed of sustainable assets.

Another study, performed by Cao et al. (2019), examines institutional trading related to ESG preference. They find that socially responsible institutions put the emphasis on ESG performance and devote less attention to quantitative signals of value concerning their holdings. This translates into a reluctance of sustainable institutional investors to sell overpriced stocks with high-ESG scores and, similarly, to buy underpriced stocks with poor sustainable ratings. Their analysis illustrates that investors' preference has a direct impact on portfolio formation along with return patterns. Stocks that feature particular characteristics, which are desired by many investors, will be associated with higher stock prices relative to various measures of fundamental value. This would be consistent with the ESG premium assumption as some institutions willingly give up on a part of their financial profit to hold sustainable assets (Cao et al., 2019).

This thesis project aims at validating past research by trying to unveil a potential ESG premium while using a larger sample of stocks than previous studies and a different methodology based on portfolio sorting, presented in the following sections. This leads to the following hypothesis:

Hypothesis 1 (H1). *There exists an ESG premium that investors pay for holding high-ESG stocks.*

2.3. ESG influence on firm's cost of capital.

In the recent years, several firms have been exposed for their poor environmental risk management. One of the most striking examples would be the Volswagen "dieselgate". The German carmaker found itself in the middle of a global scandal when evidence was made that they had been deceiving regulators and customers by lying about their vehicles' emissions (McGee, 2017). Admitting that the air pollution caused by their cars was up to forty times more than permitted by the emission standards, VW initiated one of the biggest environmental wrongdoing in the decade. The car company saw its market capitalization drop by one-third and received financial penalties in many continents. To this huge financial loss were added the repair costs to fix more than 11 million vehicles that were over-polluting and a long-lasting period of reconstruction to gain shareholders and clients' trust back (McGee, 2017). From a global market perspective, the "dieselgate" raised many questions in the financial world. Different market participants started to view corporate environmental responsibility as a key feature of businesses, hereby giving a rise to ESG investing.

The increasing importance of sustainability in financial decisions suggests that the managerial reaction to environmental and societal risks could be priced by investors and, in turn, impact the cost of capital of the firm. The researches performed on the subject are mainly theoretical and point towards an inverse relationship between the ESG scores and companies' costs of financing. The first study that tackled the subject was conducted by Sharfman and Fernando (2008). By studying the effect of environmental risk management on the cost of capital of roughly 250 companies, they find a significantly negative relation between the two. They conclude that this relation is mainly driven by the cost of equity, which appears to be greatly impacted by the firm's sustainability. Other studies, including the research of El Ghoul et al. (2011), find that industry membership is also an important factor and puts the emphasis on CSR strategies, which relates to the social component of ESG ratings. In this particular paper, they document a positive relation between the cost of equity and firm participation in controversial industries, such as tobacco and nuclear power.

Considering that the cost of capital can be broken down into two components; the cost of equity and the cost of debt, it is possible to study those separately. Regarding the cost of debt, Menz (2010) mentions that, theoretically, firms with higher CSR scores should have a lower cost of debt. However, the study he performs on studying 498 European corporate bonds yields opposite results. He supplements this outcome by stating that credit ratings appear to be a major value driver in the fixed income field, undermining the effect of sustainability scores. Conversely, more recent studies obtain the outcome that Menz (2010) hypothesized. As an

example, Oikonomou et al. (2014) cover 3,240 U.S. bonds and discover that good corporate social performance is associated with a lower cost of debt in general, with a larger effect for longer-maturity bonds. Similarly, Goss and Roberts (2011) observe that poor CSR performers pay a larger interest rates for bank loans compared to responsible companies. Other studies such as Zhou et al. (2018) identify a U-shaped relationship between CSR and the cost of debt in the U.S. and Chinese markets. This relation suggests that there exists an optimal level of CSR spending, beyond which lenders consider additional expenses to be a waste of money. Overall, there is no theoretical framework that exactly explains the relation between the cost of debt and environmental performance. Despite that, most researchers point at environmental performance as a tool to reduce information asymmetry and the risk of financial distress, which would drive down the cost of debt (Gianfrate et al., 2019).

Researches performed solely on the cost of equity capital, confirm the hypothetical relation that CSR is associated with lower financing costs. El Ghoul et al. (2018) use the ex-ante cost of equity, based on financial analysts' earnings forecasts and stock prices, to unveil its relationship with companies' corporate environmental responsibility (CER). Controlling for firm-level characteristics as well as industry, year, and country effects, the authors find that a higher level of CER is associated with a lower cost of equity capital. This relation holds for more than 2,000 companies, representing 30 different countries. Nevertheless, this study covers the period 2002 to 2011 and only considers the environmental dimension of SRI, which leaves a great potential for further research. According to a McKinsey study (2020), firms that exhibit better ESG scores than their peers are likely to experience a ten percent lower cost of capital in the future as they would be considered less risky.

This thesis aims at expanding the literature between ESG and the cost of capital by trying to confirm the negative relation mentioned above using the three ESG pillars. Moreover, it covers a larger investment universe and a longer timeframe. Through this project, I decide to solely focus on the equity market. The reasoning behind that is that unveiling a relation between the cost of equity and ESG scores allows me to associate it directly with the ESG premium analysis that I perform. Furthermore, the cost of debt appears to be impacted by a variety of other variables, such as credit ratings, which dampens the effect that ESG scores could have (Menz, 2010). I decide to use another methodology to compute the cost of equity, which will be described below and relies on the estimation of historical betas. The abovementioned literature leads to the following hypothesis:

Hypothesis 2 (H2). *There exists a negative correlation between ESG scores and the firms' cost of capital.*

By combining the first two hypotheses, this research aims at bridging a gap between the investors and companies' views of ESG. Through the examination of the value derived by investors from including sustainability scores in their portfolio, I also study how ESG can benefit firms through a potential reduction in their cost of capital. Therefore, it contributes to potentially aligning shareholders and corporates' interests in ESG. Providing a comprehensive study of ESG incorporation in financial decisions helps to mitigate the communication gap between firms and investors. Indeed, despite institutions and individuals continuously thriving for more rigorous data about corporates' ESG profile, companies, often fail to accurately disclose this information. As investors start to view ESG as a critical way of understanding the complete risk profile of a company, it could be in the firms' best interest to provide efforts on the release of such information. Loop et al. (2020) document that the main reason behind the existence of this communication gap is an absence of clarity around the benefits of ESG for both parties. On the investors' side, this thesis shows quantitatively how the ESG factor historically impacted returns. It also shows the additional benefits of including sustainability in portfolio decisions through the potential hedge that it offers. Then, it helps to unveil a shortcoming of regulation around ESG data providers and encourages investors to ask for more regulation and the establishment of key ESG-related metrics. From a company's point of view, it provides evidence of the potential effect of ESG score improvement on the costs of financing. Additionally, it documents that pressures for sustainable practices have been increasing in the past and will likely continue in the future. Therefore, establishing best practices in ESG risk management might translate into a commitment towards long-term sustainable performance and establish credibility towards investors (Loop et al., 2020). Reconciling these two views should emphasize on the importance of the disclosure of ESG information and incentivize firms to reduce the existing communication gap on this topic.

2.4. Industry membership and ESG scores.

Even though corporates have had troubles to provide trustworthy and comprehensive information about their sustainability profile, their interest about ESG has been growing exponentially. As a matter of fact, the number of S&P500 companies' earnings call which included the term "ESG" doubled from the first quarter of 2019 to the second. This increasing trend continued until the end of the year, marking an accentuating attention around sustainability issues (FactSet, 2019). At the same time, a 2019's report of the Bank of America Merril Lynch predicts a surge in ESG investments as another $20 trillion could be invested in

ESG funds in the next two to three decades. Additionally, they show that ESG scores do not predict equity returns in a similar way for all industries.

Companies clearly understand that this rise towards sustainable investing could be extremely profitable. Hence, the true motive behind corporate executives' commitments to improve their sustainability score remains unclear. The difficulty to dissociate genuine sustainable leaders from executives that only wish to develop ESG matters for positive public relations leaves an open door for "Greenwashing" (Rust, 2019). Greenwashing refers to practices and policies undertaken by companies that provide a distorted image about their ESG profile. Indeed, some ESG measures might boost sustainable scores in the short-term while having an inconsequential impact on the long-term financial value (Jones, 2019). The recent popularity of ETFs increases the risk of greenwashing as the users of such investment products often fail to scrutinize every component of the fund (Jones, 2019). In 2019, an indexing error affected the Vanguard ESG US Stock ETF and the Vanguard ESG International Stock ETF, which, taken together, represent roughly $1bn market capitalization. This error resulted in the inclusion of 30 stocks in the ETF that were not ESG friendly such as a gun manufacturer. These stocks stayed in both ETFs for roughly one and a half month, provoking anger amongst investors (Nauman, 2019). At the same time, a report from the Financial Times showed that the same ETFs held shares of multiple oil-industry companies despite mentioning the exclusion of these ones in the fund's prospectus (Rennison, 2019). These specific shares were quickly removed from the Vanguard ETFs and the index provider mentioned an error in the fund's design, while refusing to comment further on the issue. Nevertheless, this highlights a large-scale problem surrounding ESG-labelled index products. In many cases, the methodology surrounding the ESG ETFs is arcane and confuses investors. This results from a lack of common definitions and metrics around ESG, leaving index providers with many possible approaches to create the fund (Nauman, 2019).

Thus, the question about what a portfolio composed of ESG leaders should look like remains unanswered. The fact that ESG ETFs include stocks from environmentally controversial industries troubles investors who desire to know which firms and industries receive the best sustainability ratings (Nauman, 2019). Common rationale could lead to the belief that opting for sustainability would mean picking exclusively green energy stocks. Nevertheless, this belief turns a blind eye on the social and governance components of ESG on which firms could compensate for poor environmental scores. Engle et al. (2019) focus on the "E" component of ESG and construct a portfolio formed of firms that score the highest on the environment rating. They find surprising top portfolio weights as the largest long positions are

composed of tobacco and textile mill products, two areas that faced controversy in the past. Thus, Engle et al. (2019) find that industry membership only explains a limited portion of the cross-sectional variation in the companies' environmental scores. This conclusion can be derived from the rejection of the assumption they formed beforehand that a portfolio constructed on the "E" criterion would imply going long green energy stocks while shorting oil companies. In order to confirm this finding and expand it to the three different dimensions of ESG, the following hypothesis is formulated:

Hypothesis 3 (H3). *There is a correlation between industry membership and ESG scores.*

Studying the correlation between industry membership and ESG scores helps to observe whether or not specific sectors are sustainable leaders and which industries represent the largest weights in the ESG portfolio.

Moreover, sector dissection allows to determine which industries make the most effort in improving their sustainability score. A strong emphasis can be placed on sectors that are known for their environmental scandals or other public backlashes. Nowadays, carbon-intensive firms are considered as the new sin stocks and represent a particularly interesting field of study, especially when looking at ESG matters (Wilkins et al., 2019). The average ESG score of all carbon-intensive industries can be studied to examine their sustainability profile along with the rating differential when compared to the period of ESG implementation. In 2019, S&P Global Ratings created the ESG Risk Atlas, aiming at identifying the various ESG risks that different countries and sectors face. Among all industries, the ones that face the highest risks are the Oil and gas, metals and mining, power generation (coal) and refining sectors (Wilkins et al., 2019). These sectors constitute a comprehensive baseline to study the effect of ESG scores on controversial industries, leading to this thesis' fourth hypothesis:

Hypothesis 4 (H4). *Firms from controversial industries that obtain good ESG scores benefit from a larger reduction in their cost of equity than their peers and the market in general.*

2.5. Geographical scope and ESG valuation.

Dureen et al. (2016) document a substantial difference in the ways in which American and European asset managers view ESG. They find U.S. managers to be more pessimistic about the benefits of ESG incorporation in terms of financial performance. These managers also believe that including a sustainable dimension in the portfolio formation does not have a big impact and does not revolutionize asset management. However, in Europe, the idea prevails that SRI is part of fundamental investing and ESG is becoming an essential characteristic in

the stock selection process. This is confirmed by the fact that European investors appear to surpass their US counterparts in terms of ESG adoption. Indeed, 58 percent of the pension funds in Europe tend to view sustainability as an important consideration compared to only 21 percent in the United States (Ralston, 2016). When surveyed, only 14 percent of the European pension funds declare that ESG is never likely to become an important matter in their opinion. By contrary, this portion rises to 53 percent in Northern America (Ralston, 2016). Additionally, Auer and Schumacher (2015) uncover that investors in Europe tend to pay a price for socially responsible investing. This means that a portfolio formed of European sustainability leaders tends to have a lower risk-adjusted performance than an MSCI world passive benchmark. However, they fail to validate a similar finding in the American continent. This thesis aims at validating the results obtained in the past by taking into account a large number of stocks and replicating the same quantitative analysis for different continents. Overall, Europe seems to hold the role of ESG leader in the world with clear sustainable goals and beliefs. Other regions, namely the U.S. and Japan, started to follow the movement a few years later (Ross, 2015). Thus, these 3 parts of the world are candidates of choice when studying ESG investing. Differentiating between these regions leads to the fifth and final hypothesis, split in two parts:

Hypothesis 5a (H5a). *There are dissimilarities between the U.S., Europe and Japan in terms of ESG valuation, implying a substantial difference in the ESG premium.*

Hypothesis 5b (H5b). *This disparity leads to variations in the high-ESG sectors between the three regions.*

3. Data & Methodology

3.1. Data

The first four hypotheses are tested on a universe of U.S. equity stocks. Then, I decide to replicate the ESG premium analysis on the European and Japanese dataset to test the last hypothesis. The U.S. sample contains 3,214 stocks, obtained from the Wharton Research Data Service (WRDS) database, and covers a period ranging from 2003 to 2019. The main driver behind this data selection is the availability of ESG scores. All of these stocks have at least obtained one score during the sample period. The starting and ending points of this period correspond to the date of ESG implementation and the last year for which scores can be obtained through the chosen data provider. One of the advantages of this list of U.S. stocks is that it allows to retain an unbiased sample of stocks. In fact, 605 stocks are considered large-cap, 1,155 mid-cap, and 1,454 small-cap; providing a thorough coverage of the U.S. market.

Monthly stock returns, including dividends, are retrieved from The Center for Research in Security Prices (CRSP), using the WRDS database. Additionally, in order to compute excess returns, monthly US risk-free rates are collected from the Kenneth R. French online library. The Fama-French five factors (FF5) are extracted from the same database and allow to obtain monthly factor loadings for the regressions in order to isolate the effect of ESG scores on returns.

Then, another essential input for this research lies around the acquisition of a score for environment, social and governance (ESG) performance. One of the most used and comprehensive databases on ESG factors is Thomson Reuters Refinitiv. It provides a complete scoring methodology for a large sample of US stocks with scores ranging from 0 to 100 and analysing each component of ESG. The scores provided by T. Reuters Refinitiv represent an enhancement to the existing ASSET4 ratings. The major modification is that it deviates from the equal weighting scoring methodology by using adjusted weights (Refinitiv, 2020). Nowadays, T. Reuters Refinitiv is recognized as one of the most comprehensive ESG databases in the industry, covering more than 9,000 public companies across the world while accounting for approximately 450 different sustainability metrics. The strategic framework they employ allows for the constitution of a robust indicator of companies' ESG profile where size and transparency biases are minimal (Refinitiv, 2020). The 450 company-level ESG measures are grouped into ten categories that reformulate the three pillar scores and the final ESG score, as shown in *Appendix A*. The ratings are computed based on different sources, including annual reports, company fillings, websites, etc. These ESG scores are retrieved from Datastream and cover the same sample period as the stock returns obtained beforehand. The final sample with the merged data contains 216,000 monthly stocks returns with a corresponding company ESG score.

In addition, the ESG combined (ESGC) scores are obtained to provide a comprehensive scoring of a company's ESG performance with an added ESG controversy overlay captured from global media sources. The main purpose of this rating is to discount the ESG performance score based on negative media stories. When companies are involved in public scandals, the ESGC score is calculated as the weighted average of the ESG and ESG controversy scores. The latter is calculated based on 23 ESG controversy topics such as anti-competition, tax fraud, child labor, etc. During the year, if a scandal arises, the company involved is penalized and their overall ESGC rating is penalized (Refinitiv, 2020). Using the combined scores helps to verify firms' actions compared to their commitments and takes into account the effect of

controversies, which can be omitted when looking at the publicly disclosed company information.

Moreover, this project aims at unveiling the potential effect of ESG ratings on firms' cost of equity. Since the cost of equity can be calculated using a CAPM model, as described in the methodology section, the only variable that is not stationary between firms is the company's market beta. In order to compute these historical betas, the Beta Suite tool on the WRDS database is used. It calculates stocks' loadings on various risk factors, and especially the market, which is of particular interest in this case. Furthermore, it allows for the specification of different frequencies and rolling windows to compute an individual stock's beta based on its historical returns, providing flexibility to the calculation (WRDS, 2019). 202,000 monthly beta observations are obtained in total, corresponding to the universe of stocks previously mentioned. This slightly lower number of observations compared to the stock returns is due to a minimum rolling window of 3 years imposed for the β_{Mkt} estimation.

Finally, the ESG premium analysis is replicated on other geographical areas. For that purpose, 1,244 European stocks that are covered by Refinitiv on sustainable matters are chosen. This dataset provides a thorough coverage of the European market as it comprises 15 different countries. The most represented ones are Belgium, France, Germany, Italy, the Netherlands, Spain and the United Kingdom. Daily closing stock prices (PRCCD), ranging from 2002 to 2019, are retrieved from the Compustat global database, available via WRDS. Furthermore, in order to establish a comparison with the Eastern world, Japanese stocks are used and undergo a similar analysis. Despite China being my primary choice due to its size and large dissimilarities with the Western market, the ESG coverage provided by T. Reuters on this market is rather small and recent, resulting in less than 200 stocks. Thus, I decided to opt for Japan considering Refinitiv's coverage amounting to 444 stocks, with a majority of those already obtaining sustainability scores since the implementation of ESG in 2003. Similarly, Japanese stock prices are obtained through Compustat global. For both regions, the Kenneth French Library provides the Fama-French 5 factors, which allows me to perform an analysis similar to the one performed on the U.S. market. Nevertheless, monthly returns are not available directly through Compustat, such as in CRSP. Therefore, I have to compute them following a particular methodology, described in the following section. Overall, the dataset contains 150,000 and 87,000 monthly observations for Europe and Japan respectively.

Table 1.1 reports the summary statistics of firm-related characteristics and the five asset pricing risk factors for the United States. It displays the number of monthly returns that have been associated with a corresponding ESG score, to arrive at a total of 221,000 monthly

observations. The ESG and ESGC scores, shown in panel A, quantify firms' sustainability profiles. As ESGC ratings control for a controversy overlay, its mean value is logically lower than the one of ESG. Then, the β_{MKTRF} variable represent the five-year rolling betas, recalculated each month, for every firm in the dataset. Finally, panel B presents the asset pricing factors that will be used to perform the Fama-French 5 regression.

TABLE 1.1

Summary Statistics of Explanatory Variables and Risk Factors for the U.S. dataset

Variable	Obs	Mean	Std.Dev.	Min	Max
Panel A. Firm-Related Variables (U.S.)					
Ret *(decimals)*	221,000	.0108	.112	-.921	7.695
ESG	221,000	48	16.9	7.32	97.7
ESGC	221,000	42.13	14.574	7.32	95.59
Exret *(decimals)*	221,000	.0101	.112	-.922	7.694
β_{MKTRF}	202,000	1.173	.679	-3.395	6.914
Panel B. Asset pricing factors (U.S.)					
MktRF	221,000	0.733	3.903	-17.23	11.35
SMB	221,000	0.064	2.446	-4.78	6.81
HML	221,000	-0.095	2.530	-11.18	8.29
RMW	221,000	0.207	1.584	-6.92	5.08
CMA	221,000	-0.014	1.492	-3.33	3.7
RF	221,000	0.079	0.108	0	0.44

Table 1.2 and *Table 1.3* describe the summary statistics for Europe and Japan respectively. In order to perform an ESG premium analysis, I retrieve 97,000 monthly return observations for the European continent and 70,000 for Japan, as shown in panel A. Then, panel B exhibits the Fama-French five factors corresponding to both continents to pursue an analysis similar to the one performed on North America.

TABLE 1.2
Summary Statistics of Explanatory Variables and Risk Factors for the European dataset

Variable	Obs	Mean	Std.Dev.	Min	Max
Panel A. Firm-Related Variables (EU)					
Ret *(decimals)*	96,559	.006	.094	-.836	1.673
ESG	96,559	57.928	16.651	7.46	95.87
Exret *(decimals)*	96,559	.005	.094	-.836	1.673
Panel B. Asset pricing factors (EU)					
MktRF	96,559	0.475	5.045	-22.03	13.67
SMB	96,559	0.183	1.708	-4.64	4.69
HML	96,559	0.004	2.167	-4.98	7.52
RMW	96,559	0.322	1.496	-4.73	4.1
CMA	96,559	0.046	1.288	-3.53	5.44
RF	96,559	0.092	0.123	0	0.44

TABLE 1.3
Summary Statistics of Explanatory Variables and Risk Factors for the Japanese dataset

Variable	Obs	Mean	Std.Dev.	Min	Max
Panel A. Firm-Related Variables (JPN)					
Ret *(decimals)*	69,600	.006	.091	-.779	1.325
ESG	69,600	50.5	18.2	5.06	93.7
Exret *(decimals)*	69,600	.005	.091	-.779	1.325
Panel B. Asset pricing factors (JPN)					
MktRF	69,600	0.382	4.118	-13.55	15.03
SMB	69,600	0.280	2.430	-6.46	8.21
HML	69,600	0.172	2.504	-6.19	7.07
RMW	69,600	0.073	1.489	-4.57	4.05
CMA	69,600	0.136	1.840	-5.78	7.54
RF	69,600	0.095	0.132	0	0.44

3.2. Methodology:

The method that I use to test the potential ESG premium follows Carhart (1997) and is based on the creation of ranked portfolios. More recent researches studying factor investing pursue the same methodology to isolate the effect of a particular factor (Blitz and Van Vliet, (2007); Asness, Frazzini and Pedersen, (2019)). For each month, ten equally weighted ranked portfolios are constructed based on companies' ESG scores. In other words, the bottom decile portfolio is composed of low-ESG firms, while the top decile portfolio contains the high-ESG ones. In order to confirm that every portfolio is formed accordingly, the table shown in *Appendix B* depicts the mean ESG score of each portfolio decile in the U.S. sample. For every period, an average excess return is computed for each ranked portfolio. It represents the returns earned over the risk-free rate by an equally invested investor in each stock with dividends

reinvestment. Then, the mean return of every decile portfolio is regressed on several factors, retrieved from the Kenneth French Library. The Fama-French 5 factors are added in order to capture the market return along with the small firm and value premiums, supplemented by two additional factors. The FF5 model is an extension of the CAPM model as it adds the size (SMB) and value (HML) dimensions to the market risk factor. The SMB factor is the return of the top 30% minus bottom 30% stocks based on size and is a proxy for the size premium. The HML factor represents the difference between high book-to-market minus low book-to-market stocks (30%) and is necessary to control for the value vs. growth risk reward (Fama & French, 1993). Moreover, two other factors, profitability (RMW) and investment (CMA), are added. Fama and French (2015) prove that adding those two dimensions results in a better model as it reduces the anomaly average return left unexplained in their previous FF3 model. Thus, the Fama French 5 regression used in this research has the following form:

$$EWreturn_{ESGDecile} = \alpha + \beta_{Mkt}MKT + \beta_{SMB}SMB + \beta_{HML}HML + \beta_{RMW}RMW + \beta_{CMA}CMA + \varepsilon_i \quad (1)$$

This regression allows to unveil the effect of ESG scores on stock returns while controlling for academically documented factors. The resulting monthly alpha of this FF5 regression signals abnormal performance and represents the portion of returns not explained through equation (1).

In order to overcome the pitfalls of the equally weighted strategy, I also use a value-weighted methodology. For this purpose, I compute the market capitalization of every stock to derive specific weights by using companies' respective value, divided by the overall market capitalization. This methodology uses ranked portfolios depending on their ESG scores and analyses their performance by computing the sum of their value-weighted returns. Thus, the first equation is updated to the following:

$$VWreturn_{ESGDecile} = \alpha + \beta_{Mkt}MKT + \beta_{SMB}SMB + \beta_{HML}HML + \beta_{RMW}RMW + \beta_{CMA}CMA + \varepsilon_i \quad (2)$$

Then, the cost of equity can be estimated using the Capital Asset Pricing Model (CAPM), which establishes a relation between systematic risk and the required return. The cost of equity is computed using the following equation[2] :

$$K_e = R_f + \beta_{Mkt} * (R_{Mkt} - R_f) \quad (3)$$

[2] K_e stands for the the cost of equity.
R_f is the risk-free rate and $(R_{Mkt} - R_f)$ is the market risk premium
β_{Mkt} is the individual security's beta

The CAPM model has been used in several empirical researches to compute historical betas while withstanding frequent testing. This model appears to work better than others, such as the dividend growth model, due to its risk comparison technique (Bancel and Mittoo, 2014). Indeed, the CAPM considers a company's systematic risk compared to the risk of the overall market (Watson et al., 2007). Bancel and Mittoo (2014) document that this model is the most widely used by financial professionals to estimate the cost of equity. Additionally, Da et al. (2011) find empirical evidence in favour of the CAPM by stating that it yields a more reliable estimation of the cost of equity than other models such as the dividend discount one.

Therefore, regarding the cost of equity analysis, the variable of interest is the individual stock's market beta. Since I choose to focus on the American market to study the cost of equity evolution through ESG-ranked portfolios, the only variable that is not stationary in equation (3) between assets is the β_{Mkt} coefficient. Indeed, for each month, the risk-free rate (R_f) and the market risk premium ($R_{Mkt} - R_f$) are stationary and apply to every asset for a same market. Therefore, the only input from equation (3) that changes across stocks will be each security's exposure to systematic risk, represented by market betas. Considering that the ranked portfolios created are rebalanced monthly, this methodology appears suitable to provide a reliable estimation of the cost of equity. Since betas are considered to be relatively unstable over time, this instability must be accounted for in its calculation. One of the most common method is to assume that betas are constant over a short interval of time and estimate them over a longer period through regression techniques such as OLS (Chang & Weiss, 1991). An extension of this method is to use a rolling regression technique which shifts the n-year period forward by one month at a time to obtain a monthly time series for beta. Five years of monthly data are usually taken as a rule of thumb for the sample period used (Groenewold & Fraser,1999). Thus, the rolling window chosen on the WRDS Beta Suite is five years, as driven by common academical practice. By applying the same sorting strategy as in the ESG premium analysis, and therefore ranking the stocks depending on their ESG score, it is possible to create decile portfolios. These portfolios can be characterized by their mean beta value to observe which deciles obtain the largest betas.

Finally, I need to compute the monthly returns for Europe and Japan in order to compare those two regions with the U.S. in terms of ESG valuation. The raw price that I obtain for every stock in Compustat is unadjusted, making it hard to account for stock splits or stock dividends, while prices are not easily comparable through time. Hence, I download the daily adjustment

factor (AJEXDI) for each asset in order to calculate the adjusted stock prices through the following formula:

$$Adjusted\ Price\ = \left(\frac{PRCCD^{3}}{AJEXDI}\right) \tag{4}$$

Nevertheless, this adjusted price does not include dividends paid, which is also problematic as a company paying large dividends will be considerably penalized in terms of returns. In order to solve this issue, I retrieve the daily total return factor (TRFD) for each stock from Compustat global security daily. The TRFD variable includes cash equivalent distributions along with the reinvestment of dividends and the compounding effect of dividends paid on reinvested ones. Another issue, specific to Europe, concerns the multiple currencies featured in the sample of stocks[4]. Thus, I derive daily returns in order to ease the comparison between assets to express the resulting value in percentages. Daily returns are obtained as follows:

$$Daily\ Return\ = \frac{\left(\left(\frac{PRCCD}{AJEXDI}\right) * TRFD\right)^{t}}{\left(\left(\frac{PRCCD}{AJEXDI}\right) * TRFD\right)^{t-1}} - 1 \tag{5}$$

This methodology, computing daily returns from the closing daily prices, was also performed and validated in other researches such as the one performed by Alexander (2012). Ultimately, I use a Stata package "Ascol" to convert my daily returns into monthly frequencies while allowing returns to be cumulative from one period to another.

4. Results

4.1. ESG Premium

4.1.1. Premium calculation using equally weighted portfolios

The portfolio sorting method detailed in the section above results in ten different portfolios. *Appendix B* depicts the average ESG score obtained for each of the portfolios along with the number of observations per decile. It validates the fact that these portfolios are ranked based on the stocks' ESG scores as the bottom decile portfolio has an average score of 24 while the top decile one obtains 80. Then, *Table 2* shows the regression output studying the potential existence of an ESG premium. There is a difference in average monthly excess return between portfolios. The first portfolio yields a monthly excess return of 1.19%, which is higher than the

[3] PRCCD stands for the closing price of a particular day.
[4] My European dataset includes UK and other countries with a different currency than €.

top decile's one of 0.78%, amounting to a 0.41% monthly differential. From a risk-adjusted basis, the tenth portfolio also performs worse than the low-ESG one as the Sharpe Ratio decreases by 0.04 between the two. Nevertheless, looking at the Sharpe Ratios obtained reveals that the high-ESG portfolio yields the same risk adjusted performance as the fourth portfolio. By taking a closer look at the excess returns, it appears that ESG excellence matters the most regarding the ESG premium. In fact, the return differential becomes much harder to observe when examining middle decile portfolios. Therefore, investors do not appear to pay a premium for stocks with a slightly above-average sustainability score but only for leaders in that matter.

TABLE 2

ESG Premium in U.S.

ESG deciles (EW)	***D1***	***D2***	***D3***	***D4***	***D5***	***D6***	***D7***	***D8***	***D9***	***D10***
Excess Return *(monthly)*	1.19%	1.03%	1.12%	1.01%	1.12%	0.98%	1.04%	0.95%	0.82%	0.78%
Standard Deviation	0.052	0.051	0.054	0.052	0.055	0.052	0.052	0.052	0.047	0.042
Sharpe Ratio	0.23	0.20	0.21	0.19	0.20	0.19	0.20	0.18	0.17	0.19
MktRF (β_{Mkt})	1.01	0.95	1.08	1.06	1.10	1.06	1.12	1.12	1.08	1.03
SMB (β_{SMB})	0.71	0.67	0.70	0.57	0.64	0.60	0.53	0.43	0.32	0.07
HML (β_{HML})	0.19	0.11	0.23	0.17	0.21	0.15	0.06	0.18	0.12	0.09
RMW (β_{RMW})	-0.02	-0.27	0.04	-0.11	-0.05	-0.01	0.00	0.05	0.15	0.09
CMA (β_{CMA})	-0.24	-0.19	-0.16	-0.25	-0.21	-0.27	0.05	0.01	0.06	0.08
FF Alpha *(monthly)*	0.42%	0.36%	0.30%	0.23%	0.30%	0.18%	0.19%	0.11%	-0.01%	0.01%
(t-value)	*(43.64)**	*(35.54)**	*(29.64)**	*(26.57)**	*(28.75)**	*(20.27)**	*(18.29)**	*(10.09)**	*(-1.8)*	*(1.52)*
Adj. R^2 *(FF5 model)*	0.93	0.92	0.93	0.94	0.92	0.94	0.92	0.91	0.94	0.96

*: significant at the 1% level

This finding is reinforced by looking at the regression output from *Table 2*, which controls for the five Fama-French factors. When looking at the abnormal performance, represented by the FF5 alpha in this case, the difference between the low and high-ESG portfolio is again noticeable. The portfolio composed of low-ESG assets has a positive and significant alpha of 0.42% per month. This abnormal performance remains positive but slowly declines through the different portfolios until it completely disappears from the ninth portfolio onwards. Indeed, the alpha values obtained for the two very high-ESG deciles are statistically insignificant, as evidenced by the t-tests performed. In other words, it seems that a considerable portion of the returns in the low-ESG stocks cannot be explained by the different factors used in this regression, hereby representing abnormal performance in regard of this model. This

unexplained performance declines slowly as the assets become characterized by higher ESG ratings until it vanishes when looking at ESG leaders. Taken together, *Table 2* highlights the existence of an ESG premium as sustainable leaders yield a lower excess return in the sample period when compared to low-ESG portfolios, which is reinforced by the observation that alphas decline and even become insignificant. Hence, this result validates this thesis' first hypothesis.

Another interesting finding from this regression lies in the different values of β_{SMB} obtained. The bottom decile portfolio features a positive and significant coefficient for the size factor of 0.71. This indicates that the excess return is, in part, due to the size of the company. More especially, it indicates that this low-ESG segment is mainly composed of small companies. Analysing the other portfolios underlines that they also contain small companies as the SMB factor loadings remain positive. However, they continuously decline to arrive at a β_{SMB} value of 0.07 for the top decile portfolio. Hence, the high-ESG assets capture a tinier part of the small-firm premium meaning that this segment is more represented by large firms than others. This observation highlights the size bias that will be further discussed in section 5. However, the alpha values show that controlling for the SMB factor does not remove the outperformance yielded by low-ESG portfolios. Hence, this return differential cannot entirely be explained by the small-firm premium.

4.1.2. ESGC: another measure of sustainability

I further analyse the results presented above through robustness checks by using a different sustainability rating; the ESG Combined score (ESGC). This particular rating mechanism helps to give a comprehensive view of the ESG performance of a company while accounting for a controversy overlay. The main purpose behind ESGC is to discount traditional sustainability ratings based on negative media stories that could impact their sustainability profile. When a particular firm is involved in ESG controversies, the combined score is calculated to be a weighted average of the classic three ESG pillars and a controversy score. Despite being transparent on the different topics that are considered as scandals, Refinitiv does not provide a clear-cut methodology behind the different weights used in the combined scoring (Refinitiv, 2020).

Table 3 displays a similar premium as in *Table 2*. The bottom decile portfolio has an average monthly excess return of 1.11% while the portfolio formed of high-ESGC stocks obtains an excess return of 0.86%. Therefore, it appears that investors pay a premium for holding stocks that are ESGC leaders. Nevertheless, the relation is less distinct when compared

to ESG only as portfolios in the middle do not appear to earn significantly lower returns than their counterparties with a lower ESGC score. This slight modification reveals that the components of the portfolio have slightly been modified when taking this new measure into consideration. Despite that, ESGC excellence is still associated with lower monthly excess returns, which is interesting in the context of this research.

TABLE 3

ESGC Premium in U.S.

ESGC deciles (EW)	***D1***	***D2***	***D3***	***D4***	***D5***	***D6***	***D7***	***D8***	***D9***	***D10***
Excess Return *(monthly)*	1.11%	0.94%	0.95%	1.13%	0.98%	1.02%	1.11%	0.96%	0.97%	0.86%
Standard Deviation	0.052	0.052	0.051	0.054	0.050	0.050	0.051	0.049	0.053	0.047
Sharpe Ratio	0.23	0.20	0.21	0.19	0.20	0.19	0.20	0.18	0.17	0.19
MktRF (β_{Mkt})	1.02	1.03	1.02	1.08	1.05	1.06	1.06	1.07	1.13	1.09
SMB (β_{SMB})	0.62	0.66	0.64	0.58	0.50	0.46	0.53	0.46	0.50	0.30
HML (β_{HML})	0.18	0.13	0.14	0.25	0.18	0.17	0.21	0.02	0.14	0.08
RMW (β_{RMW})	-0.11	-0.09	-0.09	-0.03	0.01	-0.05	0.06	-0.02	0.05	0.13
CMA (β_{CMA})	-0.18	-0.16	-0.17	-0.12	-0.22	-0.14	-0.23	0.02	0.02	0.05
FF Alpha *(monthly)*	0.35%	0.17%	0.19%	0.33%	0.19%	0.23%	0.31%	0.16%	0.12%	0.03%
(t-value)	*(35.61)**	*(17.11)**	*(21.32)**	*(32.31)**	*(24.29)**	*(25.18)**	*(29.47)**	*(17.72)**	*(11.04)**	*(2.27)*
Adj. R^2 *(FF5 model)*	0.93	0.93	0.94	0.92	0.95	0.93	0.92	0.94	0.92	0.93

*: significant at the 1% level

Additionally, this different result eventually leads to some hypotheses regarding the implications of this metric. As depicted in *Table 3*, controlling for the FF5 factors unveils a significant alpha of 0.35% per month for the bottom decile portfolio. Looking at the high-ESG deciles reveals a significant alpha of 0.12% at the 1% level for the ninth portfolio and no significant abnormal performance for the last decile. Thus, the ESGC premium remains after controlling for those factors as the alpha value is higher for low-ESGC assets. These abnormal performances remain while having a comprehensive model through the factors added, as evidenced by the average R-squared value of 0.94. Nevertheless, some variables show some dissimilarities with the output obtained in the ESG premium analysis shown in *Table 2*. First, the alpha sequence is not monotonically decreasing. At the same time, the values obtained for β_{SMB} show that the last deciles are composed of more small firms than before as the coefficient only drops to 0.3 in the end. This reveals that the ESGC rating revamped the firms' ranking compared to the ESG classification. Moreover, it provides evidence that these are mainly large

firms that have suffered a downgrade. This observation points towards a pitfall of ESGC and especially its embedded controversy overlay. Fang and Peress (2009) find that firm size has an overwhelming effect on media coverage. Therefore, large firms are more likely to be covered and penalised for their involvement in public scandals. While this rating could effectively reduce the influence of the size bias previously documented, it could also unfairly punish big corporations. The tendency to downgrade larger firms along with the opaqueness surrounding ESGC scores calculation will be further discussed in section 5. Overall, this ESGC premium analysis exhibits mixed results. On the one hand, it shows the existence of a premium when comparing portfolios at the outer ends. On the other hand, performing a paired t-test on the alphas obtained in the ESG and ESGC premium analyses reveals that the difference between the two is insignificant at the 1% level, as shown in *Appendix B2* which shows a p-value of 0.98. Thus, ESGC can be viewed as an alternative sustainability metric but the premiums obtained in the two analyses do not significantly differ from each other.

4.1.3. Value-weighted portfolios

An important limitation of equal-weighting strategies lies around rebalancing. As its name indicates, this portfolio weighting method gives an equal magnitude to every stock and observation in a dataset. Although being interesting and mainly used in researches with a finance topic, this theory is hard to translate into reality. Indeed, this strategy requires monthly rebalancing, which is hard to achieve, and also suffers from high transaction costs as it provides the same importance to small and big assets. As a result, Plyakha et al. (2015) show that equally weighted portfolios outperform the value weighted ones in terms of total mean return and four-factor alpha from the Fama & French and Carhart models. Furthermore, they explain that the higher systematic return of the equally weighted strategy comes from its higher exposure to the market, size, and value factors. Malladi & Fabozzi (2017) confirm this finding by demonstrating that rebalancing is a key driver behind the positive excess returns of equally weigthted portfolios while highlighting its outperformance when compared to 14 different portfolio weighting strategies.

Hence, constructing value-weighted portfolios based on ESG scores serves as a robustness test to confirm the existence of the ESG premium in the United States. Using the stock prices along with the number of shares outstanding, retrieved from the CRSP database, I compute the monthly market capitalization of each asset from 2003 to the end of 2019. At the same time, I construct portfolio deciles based on ESG scores to rank stocks based on their sustainability profile. Adding the market capitalization of each security from a particular decile

portfolio gives a total capitalization value, which is then used to calculate the different weights that will be assigned to each asset. Afterwards, I obtain the value-weighted returns by multiplying the monthly excess return of every stock with its corresponding weight for that particular month. This technique ensures that the decile portfolios are rebalanced continuously as the weights are updated each month. Finally, taking the sum of the value-weighted excess returns for one portfolio gives an overall excess return for each decile, which can then be regressed on the different Fama-French factors.

Table 4 displays the results obtained with the value-weighted methodology. It confirms the existence of an ESG premium as the bottom portfolio decile obtains a monthly excess return of 1.46% while the high-ESG portfolio exhibits a return of 0.99%. Additionally, this premium is especially noticeable when looking at ESG leaders as the return differential considerably widens from the eighth portfolio onwards. Moreover, the size bias is even more pronounced with this sorting methodology. The SMB factor loading is positively significant with the value of 0.38 for the low-ESG portfolio and this value becomes negative when moving to the outer end of the ESG ranking. Essentially, this means that the top decile portfolio is mainly composed of large companies. In a similar way, the analysis of the average market capitalization per portfolio decile validates this observation as the average capitalization is more than multiplied by ten when going from the first to the last portfolio, as shown in the last row of the table. This differential does not mean that assets in the bottom decile exclusively represent small firms' stocks, but it points towards a dominance of big companies within the ESG leaders.

TABLE 4

ESG Premium in U.S.

Value-weighted portfolios

ESG deciles (VW)	***D1***	***D2***	***D3***	***D4***	***D5***	***D6***	***D7***	***D8***	***D9***	***D10***
Excess Return *(monthly)*	1.46%	1.34%	1.28%	1.53%	1.43%	1.31%	1.27%	1.21%	1.13%	0.99%
Standard Deviation	0.043	0.044	0.045	0.045	0.045	0.043	0.043	0.042	0.039	0.036
Sharpe Ratio	0.34	0.30	0.28	0.34	0.32	0.31	0.30	0.29	0.29	0.27
MktRF (β_{Mkt})	0.91	0.95	0.97	1.00	1.03	0.97	1.01	0.99	1.01	0.95
SMB (β_{SMB})	0.38	0.36	0.40	0.25	0.28	0.25	0.20	0.05	0.01	-0.20
HML (β_{HML})	0.04	-0.14	0.05	-0.01	0.01	-0.01	-0.01	-0.08	-0.04	0.07
RMW (β_{RMW})	-0.02	-0.11	0.12	-0.11	0.01	0.02	0.09	-0.03	0.19	0.04
CMA (β_{CMA})	-0.20	-0.13	-0.16	-0.24	-0.01	-0.19	0.05	0.06	0.15	0.06
FF Alpha *(monthly)*	0.77%	0.63%	0.52%	0.80%	0.66%	0.57%	0.50%	0.48%	0.35%	0.31%
(t-value)	*(75.70)**	*(57.94)**	*(50.38)**	*(77.26)**	*(68.83)**	*(62.01)**	*(59.10)**	*(47.76)**	*(55.40)**	*(59.99)**
Adj. R^2 *(FF5 model)*	0.89	0.88	0.9	0.89	0.91	0.91	0.92	0.88	0.95	0.96
Average Mkt Cap	4,144,890	4,406,760	4,594,781	5,285,994	5,650,572	7,040,707	9,658,177	14,467,977	22,953,194	56,459,340

*: significant at the 1% level

Overall, this cap-weighted methodology validates the first hypothesis that investors appear to pay a premium when holding high-ESG stocks, which is a conclusive result as both methodologies point in the same direction. Nevertheless, the fact that alpha values are positively significant at the 1% level for all portfolio deciles suggests that this model does not capture a considerable part of the stocks' returns. This issue will be further addressed in Section 5 while discussing the results.

4.2. Cost of equity and ESG scores

In order to confirm the hypothetical negative relationship between the cost of equity and sustainability scores, I use the CAPM model to derive historical market betas. By using five-years rolling betas, I assign a β_{Mkt} coefficient value to each monthly observation from the dataset previously obtained. Moreover, portfolio deciles are formed in a similar way to the ESG premium analysis by ranking stocks according to their scores. Then, a mean market beta value is computed for each decile. *Table 5* exhibits the results obtained and validates the second hypothesis of this paper. Indeed, the average market beta of the bottom decile portfolio is 1.16 while the high-ESG portfolio gets a beta value of 1.04. This differential of 0.12 highlights that ESG leaders benefit from a reduction in their beta and, hence, in their cost of equity.

Nevertheless, the relation is not monotonic and is more pronounced within securities that are considered to be ESG excellent. Indeed, the reduction in beta is considerably higher when analysing the last two portfolios while it sometimes increases for portfolios in the middle deciles.

To validate this finding, I create an average ESG score for every firm present in the dataset to observe if ESG leaders do really experience a reduction in their cost of equity from 2003 onwards until today. In other words, I create a firm overlay so that companies that improved their sustainability rating over time will be in higher deciles while the observations that were linked to poor scores were directly put into low-ESG portfolios before. *Table 5* confirms the result previously obtained as the beta differential between the bottom and top decile portfolios amount to 0.125. Additionally, it puts once again the emphasis on ESG excellence as the considerable decrease in beta value occurs in the ninth and tenth deciles.

Considering the study of Groenewold and Fraser (1999), which mentions that the five-year rule of thumb used in the beta calculation is itself dominated by other estimation windows that provide additional explanatory power regarding returns, I decide to perform a robustness test on this analysis. As the authors mention that a three-year rule of thumb is optimal for their sample, I run the same analysis using a 36-month rolling window instead of 60. *Table 5* depicts the mean beta value obtained for each portfolio with this methodology and supports the outcome obtained with the five-year rule of thumb. The low-ESG portfolio obtains an average cost of equity of 1.17 which decreases to 1.04 when going to sustainability leaders. Furthermore, this test confirms the non-monotonicity of the relation and the slight mean beta increase in the mid-ESG portfolios. Overall, this historical beta calculation establishes a negative relationship between the average market beta value and high-ESG scores. Hence, assuming that the historical betas provide a reliable estimation of firms' cost of equity, ESG leaders profit from a reduction in their financing costs compared to lower-rated companies, validating the second hypothesis.

TABLE 5

Average beta calculation

ESG deciles	***D1***	***D2***	***D3***	***D4***	***D5***	***D6***	***D7***	***D8***	***D9***	***D10***
5-year rolling avg beta	1.162	1.194	1.219	1.221	1.231	1.215	1.184	1.181	1.078	1.045
5-year average beta *(grouped by firm)*	1.150	1.201	1.213	1.224	1.264	1.182	1.175	1.174	1.121	1.025
3-year rolling avg beta	1.173	1.199	1.213	1.224	1.219	1.216	1.179	1.171	1.091	1.041
No. of obs.	20,276	20,159	20,177	20,150	20,153	20,174	20,184	20,155	20,174	20,055

4.3. Sectorial Analysis

4.3.1. Industry membership and ESG scores

The SIC-2 classification is used to determine the industry membership of every stock. In order to test whether or not a portfolio formed of ESG leaders mainly translates into going long in green energy stocks, I analyse the top portfolio weights per industry in the high-ESG segment of the dataset. Furthermore, I conduct a similar research regarding the components of the bottom decile portfolio to observe which sectors are the most represented in the unsustainable portion of the data. *Table 6* exhibits the industries obtaining the highest shares in both portfolios. Concerning the high-ESG portfolio, the sectors that are the most represented are "chemical and allied products", "business services" and "electric, gas, and sanitary services". Regarding the bottom decile holdings, the industries with the most recurrent appearances are "depository institutions", "business services" and "electronic, and other electric equipment". These top weights confirm the third hypothesis of this research that a portfolio composed of high-ESG stocks does not necessarily mean going exclusively long into green energy stocks. Indeed, apart from the electric, gas, and sanitary services, none of the other six most represented sectors falls into the renewable energy classification (SICCODE, 2020). Surprisingly, five of the top industry weights are identical in the top and bottom decile portfolios. Several explanations can be derived from this observation. First, there could be good and bad ESG performers in these industries, leading to large differences in their sustainability scores. Second, these sectors could be the most represented ones in this dataset. Thus, the frequency at which these industries are observed within the decile portfolios would be larger than the one for other industries.

TABLE 6

Largest positions by industry in the bottom and top decile portfolios (by 2-digit SIC code)

Top weights High-ESG portfolio	***SIC2***	**Top weights Low-ESG portfolio**	***SIC2***
Chemical & Allied Products	*28*	Depository Institutions	*60*
Business Services	*73*	Business Services	*73*
Electric, Gas, & Sanitary Services	*49*	Electronic & Other Electric Equipment	*36*
Food & Kindred Products	*20*	Communications	*48*
Electronic & Other Electric Equipment	*36*	Industrial Machinery & Equipment	*35*
Depository Institutions	*60*	Chemical & Allied Products	*28*
Industrial Machinery & Equipment	*35*	Holding & Other Investment Offices	*67*

Then, for robustness concerns and to test the abovementioned potential reasons, I calculate the industries' average ESG score using the whole dataset to uncover the ones that perform best on sustainability issues. *Table 7* shows the sectors that obtain, on average, the highest ratings. The top three performing ones are "petroleum and coal products", "metals and mining", and "railroad transportation". The only industry that remains from the top weights obtained in *Table 6* is the food and kindred products' business.

TABLE 7

Sectors with highest ESG value on average (by 2-digit SIC code)

Highest ESG sectors	***SIC2***
Petroleum & Coal Products	*29*
Metal, Mining	*10*
Railroad Transportation	*40*
General Merchandise Stores	*53*
Food & Kindred Products	*20*
Building Materials & Gardening Supplies	*52*
Coal Mining	*12*

This dissimilarity can be explained by the overall representation per industry, which is depicted in *Appendix D*. The table shows that these 3 sectors just mentioned merely represent 1.5% of the stocks included in the dataset. Thus, these sectors that score particularly well on sustainability could be driven by some firms that obtain a very high rating, which considerably impacts the industry's overall score. Conversely, the table depicts that the weights of the sectors that were most present both in the bottom and top decile portfolios account for a large portion of the total observations, hereby 30 percent. Therefore, it appears that these industries are composed of companies that score particularly well on sustainability matters while also

containing a lot of ESG underperformers, driving the average score downwards. Overall, this analysis confirms a low correlation between industry membership and ESG scores, as evidenced by the top weights similarities, which provides elements of answer to the third hypothesis. Furthermore, it confirms that a portfolio of stocks built on the ESG criterion is not only composed of green energy stocks as sectors like petroleum and coal products perform astonishingly well. This observation can be explained by the tremendous efforts that some companies from controversial industries make to improve their ESG practices. As an example, many petroleum and gas companies are taking steps to curb their environmental impact. Firms, such as Total SA recently invested in renewable energy projects in their pledge to use alternative sources of power. Similarly, Equinor, a large company developing oil and wind energy, announced plans in 2019 to align its business strategy with the Paris agreement's objectives (GlobalData Energy, 2020). These firms are also making considerable efforts in their social and governance practices to create a holistic approach that can tackle their ESG risks moving forward (S&PGlobal, 2019).

4.3.2. A comparison to a clean energy ETF.

In order to reinforce the abovementioned finding that going long into high-ESG stocks does not exclusively translates into picking assets from green energy sectors, I compare the return of the top decile portfolio to an energy ETF. This methodology is similar to the one used by Engle et al. (2019) who decide to compare their climate change hedging portfolio, based on environmental scores[5], to ETFs to observe their return correlation. For the purpose of a reliable comparison, I narrow down the ETF universe to the energy ones and I choose to pick the "iShares Global Clean Energy UCITS ETF". This fund holds stocks in several geographical areas but mainly covers the U.S. as more than 45 percent of its holdings are located in the United States. Hence, it provides me with a list of 9 stocks that represent the largest American companies, focusing on greener and renewable sources of energy, which is available in *Appendix D*. From this list, I retrieve these stocks' return from 2003 to 2019 from CRSP to create an equally weighted portfolio composed of those assets. The correlation between the monthly excess returns of this new green portfolio with the top decile portfolio formed by high-ESG stocks is 0.46, as shown in *Table 8*. As this number is considerably smaller than one, it confirms that the sustainable portfolio is not only composed of green energy stocks. The positive correlation between the excess returns of the two portfolios suggests that the top decile

[5] Hereby the E component of the overall ESG score.

one is likely to hold long positions in several green energy firms, but the low coefficient value obtained imposes caution around this interpretation.

TABLE 8
Correlation matrix between the returns of the high-ESG portfolio and a portfolio of clean energy stocks

Variables	(1)	(2)
(1) ew_return_highESG	1.000	
(2) ew_return_CleanEnergyETF	0.459	1.000

4.3.3. ESG scores and the cost of equity in controversial industries.

El Ghoul et al. (2018) and Gregory et al. (2016) document that the reduction on the cost of capital driven by an increase in the CSR performance would be higher in carbon-intensive industries. To validate this observation, combined with my previous finding that ESG scores and the cost of equity are inversely related, I decompose the different sectors into groups by putting the emphasis on the high-emissions industries. I specifically take into account five different sectors that have been found to be carbon-intensive to analyse if the ESG leaders of these businesses experience a lower cost of equity than their peers. These sectors are respectively "petroleum and coal products", "coal mining", "oil and gas extraction", "air transportation", and "chemical and allied products" (The Guardian, 2012). Additionally, I add the industries that are considered to face the most ESG risks based on the ESG risk atlas; "metals and mining" and "refining sectors" (S&P Global, 2019). I use a similar methodology to the one adopted for the cost of equity in section 4.2. with a restricted dataset comprising carbon-intensive industries exclusively. By sorting the remaining observations based on their corresponding ESG scores, I obtain ten decile portfolios ranked on the sustainability factor. Using five-year rolling betas allows me to derive an average beta value for each portfolio. *Table 9* confirms the fourth hypothesis that high-emissions sectors experience a larger reduction in cost of equity if they improve their ESG score, compared to other industries. Indeed, the β_{Mkt} differential between the top and bottom deciles widens to 0.5. The high-ESG portfolio exhibits an average cost of equity of 0.85, which is considerably lower than the 1.04 obtained with the beta study on the whole dataset. For robustness concerns, I further add a firm overlay to mitigate the fact that low ESG scores could be linked to observations that are associated with a low return but still represent a firm that has a high sustainability score in general. Hence, I group the observations per firm and derive the average rating they obtained from 2003 to 2019. Then, I repeat a similar analysis by creating ranked portfolio, which results

in the same conclusion as before. Despite the difference being slightly lower, ESG leaders experience an average β_{Mkt} value of 0.845 while ESG underperformers obtain 1.31.

TABLE 9

Average beta calculation for carbon-intensive sectors

ESG deciles ***(Carbon intensive)***	***D1***	***D2***	***D3***	***D4***	***D5***	***D6***	***D7***	***D8***	***D9***	***D10***
5-year rolling avg beta	1.348	1.316	1.35	1.331	1.335	1.295	1.279	1.158	1.118	0.849
5-year average beta *(grouped by firm)*	1.31	1.424	1.455	1.323	1.153	1.278	1.34	1.152	1.097	0.845
No. of obs.	2,547	2,445	2,463	2,465	2,420	2,476	2,481	2,430	2,476	2,360

Overall, these tests confirm the fourth hypothesis and the conclusions made by El Ghoul et al. (2018) that carbon-intensive industries experience a larger negative relation between their cost of equity and ESG score. More specifically, firms in the last three portfolio deciles experience a considerable reduction in their exposure to market risk, hereby reducing their financing costs.

4.4. Geographical comparison

In order to compare the results obtained in the U.S. to other regions, I retrieve data on European and Japanese stocks. Using these three regions allows for an overview of the Western market along with one major market participant of the Eastern world, Japan, to see how the ESG premium evolves across geographies. Results for Europe, displayed in *Table 10*, reveal a similar pattern as in the United States. The bottom decile portfolio yields a monthly excess return of 0.76 percent while the high-ESG portfolio obtains 0.29 percent. It suggests that the ESG premium is relatively larger in Europe compared to the U.S. as monthly excess returns drop by more than half when going from the first to the tenth portfolio. Additionally, the β_{SMB} values provide evidence of a size bias as they slowly decline through deciles. The significant β_{SMB} coefficient of -0.32, obtained for the top decile portfolio, shows that the average excess return of the portfolio is mainly driven by large companies.

TABLE 10

ESG Premium in Europe

ESG deciles (EW)	***D1***	***D2***	***D3***	***D4***	***D5***	***D6***	***D7***	***D8***	***D9***	***D10***
Excess Return *(monthly)*	0.76%	0.66%	0.58%	0.69%	0.56%	0.44%	0.43%	0.39%	0.45%	0.29%
Standard Deviation	0.048	0.046	0.049	0.047	0.046	0.046	0.049	0.048	0.045	0.049
Sharpe Ratio	0.16	0.15	0.12	0.15	0.12	0.09	0.09	0.08	0.10	0.06
MktRF (β_{Mkt})	0.69	0.68	0.73	0.72	0.70	0.69	0.72	0.73	0.68	0.66
SMB (β_{SMB})	0.38	0.43	0.47	0.30	0.20	0.22	0.04	-0.10	-0.14	-0.32
HML (β_{HML})	0.38	0.22	0.16	0.16	0.17	0.36	0.48	0.35	0.17	0.56
RMW (β_{RMW})	0.08	-0.02	-0.16	0.08	-0.05	0.13	0.21	0.10	-0.08	-0.04
CMA (β_{CMA})	-0.60	-0.54	-0.65	-0.59	-0.47	-0.47	-0.48	-0.34	-0.07	-0.66
FF Alpha *(monthly)*	0.35%	0.29%	0.22%	0.28%	0.21%	0.04%	0.02%	0.03%	0.16%	0.06%
(t-value)	*(12.18)**	*(10.94)**	*(8.29)**	*(10.04)**	*(7.98)**	*(1.45)*	*(0.57)*	*(1.13)*	*(5.62)**	*(2.05)*
Adj. R^2 *(FF5 model)*	0.73	0.75	0.78	0.73	0.75	0.74	0.74	0.75	0.71	0.77

*: significant at the 1% level

By contrary, ESG premium results for Japan are less apparent. Despite an excess return differential between the bottom decile portfolio and the high-ESG one of 0.11 percent per month, as shown in *Table 11*, the return gap between assets is less significant, suggesting a lower premium in the region. Indeed, compared to other geographies, the first portfolio, composed of the larger ESG underperformers, does not obtain the highest return of all as the fifth and seventh portfolios exhibit a larger return. Another difference is that the top decile portfolio experiences a higher return than its two previous peers. Therefore, ESG excellence is not associated with the lowest returns as in the two other areas. Nevertheless, the lower return of the last three portfolios containing ESG leaders compared to other deciles along with the decreasing alphas pattern suggest that investors still pay a premium to hold highly sustainable assets. Regarding the Fama-French factors, it appears that high-ESG Japanese firms invest more aggressively than others, as indicated by the β_{CMA} value. Additionally, the SMB coefficient points towards a size bias as it decreases through deciles, indicating a dominance of large firms.

The output tables of these two additional geographies display a lower adjusted R-squared than in the research performed on the U.S. continent. This decrease is probably due to in-variable errors as the returns for these two regions have been calculated, which will be further explored in the limitations section.

TABLE 11

ESG Premium in Japan

ESG deciles (EW)	***D1***	***D2***	***D3***	***D4***	***D5***	***D6***	***D7***	***D8***	***D9***	***D10***
Excess Return *(monthly)*	0.59%	0.48%	0.55%	0.62%	0.70%	0.57%	0.68%	0.41%	0.39%	0.48%
Standard Deviation	0.050	0.047	0.051	0.051	0.053	0.057	0.056	0.054	0.055	0.058
Sharpe Ratio	0.12	0.10	0.11	0.12	0.13	0.10	0.12	0.08	0.07	0.08
MktRF (β_{Mkt})	1.02	0.90	1.02	0.98	1.00	1.12	1.07	0.99	1.04	1.07
SMB (β_{SMB})	0.05	0.10	0.06	0.10	-0.16	-0.21	-0.23	-0.26	-0.27	-0.42
HML (β_{HML})	0.46	0.26	0.37	0.48	0.50	0.46	0.52	0.52	0.52	0.56
RMW (β_{RMW})	0.19	-0.28	0.04	0.04	0.07	0.25	0.23	0.15	0.12	0.17
CMA (β_{CMA})	-0.18	-0.32	-0.32	-0.45	-0.51	-0.31	-0.48	-0.62	-0.54	-0.54
FF Alpha *(monthly)*	0.11%	0.13%	0.12%	0.19%	0.34%	0.15%	0.30%	0.08%	0.05%	0.16%
(t-value)	*(3.28)**	*(3.92)**	*(3.39)**	*(5.50)**	*(9.05)**	*(3.75)**	*(7.76)**	*(2.15)*	*(1.20)*	*(3.90)**
Adj. R^2 *(FF5 model)*	0.69	0.67	0.69	0.68	0.67	0.69	0.69	0.69	0.70	0.69

*: significant at the 1% level

Then, the last hypothesis also tackles a sectorial analysis of the European and Japanese markets regarding which industries perform best on ESG issues. *Table 12* displays the most represented industries within the low-ESG portfolio and the top decile portfolio for Europe. The two industries that account for the largest percentage within the sustainable underperformers are "depository institutions" and "holding and other investment offices". On the opposite, the two sectors that dominate the high-ESG portfolio are "depository institutions" and "chemical and allied products". This similarity in the top weights regarding portfolios at the outer ends highlights that some sectors perform admirably and poorly on ESG matters at the same time. This observation was already made in the sectorial analysis performed for the United Sates.

TABLE 12

Largest positions by industry in the bottom and top decile portfolios in EU (by 2-digit SIC code)

Top weights <u>High-ESG</u> portfolio *(Europe)*	***SIC2***	**Top weights <u>Low-ESG</u> portfolio *(Europe)***	***SIC 2***
Depository Institutions	*60*	Holding & Other Investment Offices	*67*
Chemical & Allied Products	*28*	Depository Institutions	*60*
Insurance Carriers	*63*	Communications	*48*
Communications	*48*	Real Estate	*65*
Electric, Gas, & Sanitary Services	*49*	Business Services	*73*
Electronic & Other Electric Equipment	*36*	Transportation Equipment	*37*
Transportation Equipment	*37*	Industrial Machinery & Equipment	*35*

In order to accompany this sector dissection, *Table 13* exhibits the industries that obtain the highest average ESG score for the whole sample period. Surprisingly, tobacco and coal products obtain a tremendous rating. Nevertheless, this observation needs to be handled cautiously as this score could be driven by a few companies that drive the overall rating upwards.

TABLE 13

Sectors with highest ESG value on average in EUROPE (by 2-digit SIC code)

Highest ESG sectors (*Europe*)	***SIC2***
Building Materials & Gardening Supplies	*52*
Tobacco Products	*21*
European Postal Service	*43*
Petroleum & Coal Products	*29*
General Merchandise Stores	*53*
Coal Mining	*12*
Food Stores	*54*

Regarding Japan, the two sectors that mainly compose the top decile portfolio are "electronic equipment" and "chemical and allied products". Conversely, the two industries bearing the largest weights in the low-ESG portfolio are "local and interurban passenger transit" and "depository institutions". Similar to Europe, some sectors receive large weights in both portfolios, as shown in *Table 14*. Additionally, common prior beliefs are challenged once again as *Table 15* displays that "tobacco products" receive the highest average ESG score.

TABLE 14

Largest positions by industry in the bottom and top decile portfolios in JAPAN (by 2-digit SIC code)

Top weights <u>High-ESG</u> portfolio *(Japan)*	***SIC2***	**Top weights <u>Low-ESG</u> portfolio *(Japan)***	
Electronic & Other Electric Equipment	*36*	Local & Interurban Passenger Transit	*41*
Chemical & Allied Products	*28*	Depository Institutions	*60*
Industrial Machinery & Equipment	*35*	Food & Kindred Products	*20*
Transportation Equipment	*37*	Primary Metal Industries	*33*
Instruments & Related Products	*38*	Electronic & Other Electric Equipment	*36*
Security & Commodity Brokers	*62*	General Building Contractors	*15*
Business Services	*73*	Industrial Machinery & Equipment	*35*

TABLE 15

Sectors with highest ESG value on average in Japan (by 2-digit SIC code)

Highest ESG sectors (Japan*)*	***SIC2***
Tobacco Products	*21*
Printing & Publishing	*27*
Educational Services	*82*
Petroleum & Coal Products	*29*
Insurance Carriers	*63*
Transportation Services	*47*
Footwear	*31*

Overall, the ESG premium exists in other regions as well. Nevertheless, the premium observed in Europe is the largest of all while being less pronounced in Japan. This confirm the first part of the fifth hypothesis mentioned in this paper along with the research of Dureen et al. (2016) which mentions dissimilarities in ESG valuation across geographies. Furthermore, it validates the findings of Ross (2015) that mentions that all regions are starting to adopt ESG investing as investors appear to give up returns to hold sustainable stocks. Across the three different regions, some industries compose the low and high-ESG segments at the same time, highlighting that companies within a same sector handle ESG issues differently. Moreover, the industries that obtain the highest average sustainability score challenge common prior expectations as companies considered as "sin stocks" or brown energy firms score admirably. This finding is consistent with the one obtained by Engle et al. (2019) who also discover a dominance of tobacco companies in their portfolio containing leaders on environmental matters. The high-ESG sectors differ depending on the continent, providing support for the second part of the fifth hypothesis.

5. Discussion

5.1. The Size Bias in ESG

The portfolio composed of high-ESG assets appears to include more large firms than the low-ESG deciles. This discovery is directly related to an academically documented pitfall concerning ESG scoring, namely the size bias. Drempetic et al. (2019) study the ASSET4 database, developed by Thomson Reuters, to investigate the potential influence of firm size in the measurement of sustainable performance. They find that larger firms have more resources and use better reporting tools to disclose their ESG data. Thus, data availability is greater for

large firms, which influences the ratings as sustainability data providers focus on publicly available information. In a similar way, Gallo and Christensen (2011) discover that the complexity of sustainability reports increases with firm size. This fits particularly well with the ESG data requirements used by ratings agencies, which include a multi-dimensional data tool. Based on the hypothesis that data providers interpret the non-availability of information as negative news (Schreck & Raithel, 2015), Drempetic et al. (2019) prove that the availability of information positively influences sustainability scores. Thus, they conclude that large firms generally score better than their smaller peers on ESG matters. The potential reason behind this size bias is the visibility of larger firms. The greater publicity and the exposition that big companies receive induce them to provide additional efforts regarding CSR activities (Hörisch et al., 2015). This bias emphasizes on the potential correlation of ESG investing with other factors. A 2017's research performed by RobecoSAM, the sustainable asset management branch of Robeco, shows that ESG can have over 20 percent risk exposure to the firm size factor. In other words, if this factor does well, meaning that large firms yield higher returns than smaller ones during a particular period, then ESG investing will also exhibit positive performance (Feldman, 2017).

Despite the efforts of the new Thomson Reuters data tool, Refinitiv, to lessen the effect of the size bias in their ESG ratings, it appears that it is still not perfect. The slowly decreasing significant values of β_{SMB} provide evidence that sustainability leaders are mainly composed of large firms. Therefore, a potential correlation of ESG with other factors, such as firm size, is possible and interferes with the isolation of the benefits of sustainable and responsible investing.

5.2. Alternatives to the ESG Premium analysis.

5.2.1. Other types of sustainability ratings.

Altogether, the ESGC rating points in the direction that other scores could provide useful information when considering the inclusion of a stock in a portfolio based on SRI. Indeed, if ESGC reveals itself to be a reliable measure of sustainable performance, it could effectively include a controversy overlay that penalise firms for their involvement in ESG scandals (Refinitiv, 2020). At the same time, it could also reduce the influence of the size bias on ratings as large firms get more media attention (Fang and Peress, 2009). Nevertheless, this alternative measure needs further research in order to draw such conclusion. First, there is uncertainty around the accuracy of this new rating as the weights used in its calculation by the data provider are opaque. Second, the fundamental value academically documented around

ESG investing is not necessarily associated with these alternative metrics as they lack some theoretical background (Clementino et al., 2020). Finally, the time frame around these scores also forces caution as scandals impact a company's score for a whole year while this public outcry could be resolved and merely impact several months in terms of returns.

5.2.2. Value weighting methodology

The results obtained with value-weighted portfolios are not aligned with the academical research performed on the differences in returns regarding the equal and value weighting strategies. Larger excess returns are obtained with value-weighted portfolios, as shown in *Table 4*, which contradicts the observations made by Plyakha et al. (2015) and Malladi & Fabozzi (2017). Although it is arduous to provide exact reasons that justify this difference, it is possible to explore several explanations to that phenomenon. The first argument lies around the dataset and the timeframe it covers. Refinitiv provides scores from 2003 to 2019 but its market coverage considerably evolved through time. As this research matches every monthly return of a particular stock to its corresponding ESG score, the broadening of the ESG database has a considerable influence on the decile portfolio holdings. Indeed, *Appendix C* shows that there is a massive difference between the number of observations obtained in 2003 compared to the last years of the time period chosen. This indicates a preponderance of more recent observations. Considering this bias towards more recent years, if the market portfolio performs well during this period, it will increase the market capitalization of large firms significantly, hereby affecting value-weighted returns. Additionally, if the size premium is small during that time interval, which means that small stocks have lower returns than larger ones, this effect will be amplified. *Appendix C* exhibits the market and small-firm premiums for the years covered by this research. From 2012 onwards, the market premium has been particularly high with a mean value of 15 percent while the SMB premium has mainly been negative. These two factors could eventually explain the stronger performance of value-weighted portfolios when considering the prevalence of more recent data in this research. This is consistent with recent research of Jackson (2019), who compares the returns of an equally-weighted S&P500 with a value-weighted portfolio representing the same index. It appears that equal-weighting only slightly beats the cap-weighted index over the past ten years and that this outperformance is very low compared to the historical one (Jackson, 2019). As the equal-weighting strategy, performed in section 4.1., gives a similar importance to small and large stocks, this bias towards more recent data does not impact excess returns in a similar manner.

Moreover, *Table 4* exhibits significant alpha values for every portfolio decile. This suggests that abnormal performance can be found in each decile despite controlling for the FF5 factors, which is dubious. A potential explanation surrounding these alphas concerns the coverage performed by ESG data providers. Indeed, there might be a selection bias as this coverage evolves throughout the years. Thomson Reuters gradually expanded its ESG database from 2003 to 2019 (Refinitiv, 2020). Their coverage is also influenced by popularity and demand of ESG data. Thus, there might be a bias towards winning stocks. In other words, a stock freshly joining the S&P500 is likely to have experienced positive returns in the past few periods (Reuling, 2016). As its score is determined for the whole year, this score, whether it is good or bad, impacts the monthly returns of this particular year. Similarly, if a small stock gains in popularity and exhibits great returns, Thomson Reuters will be more likely to analyse its ESG profile when compared to a small stock that goes bankrupt during the same period. Although it is impossible to say with certainty that these alphas are caused by this potential issue, it probably helps to uncover part of the explanation and suggests including other factors, such as momentum, in future studies.

5.3. Geographical comparison

The results depicted in *Table 10* and *Table 11* provide evidence of an ESG premium in Europe and Japan respectively. This premium appears to be larger in Europe than in any of the other regions studied. Thus, consistent with Dureen et al. (2016)'s observations, there are differences in ESG valuation between different continents. Similar patterns can be observed when observing the premium analysis performed on the three areas. First, the excess returns decrease considerably for portfolios composed of high-ESG assets. Similarly, the alpha values become insignificant for highly sustainable portfolios. Second, the size bias, documented by Drempetic et al. (2019), is observable in all three regions, emphasizing on the presence of this ESG pitfall across continents. However, there are dissimilarities between the FF5 regression outputs that need to be further explored. The first one concerns *Table 10* and the β_{Mkt} values obtained. Since the European dataset that I use supposedly provides a thorough representation of the overall European market, obtaining β_{Mkt} averaging at 0.72 is peculiar. Similar observations cannot be made for Japan, which obtains market beta coefficients similar to the ones obtained in the ESG premium study on the United States. Thus, potential reasons for that low β_{Mkt} values lie in the stock selection or in the factors retrieved from the Kenneth-French library. It appears that the ESG coverage in Europe starts with Western Europe and expands

afterwards. Therefore, the first years of the stock sample that I use are not representative of the overall market. Conversely, the market risk premium presented in the Kenneth-French library covers the whole European market from 2003 to 2019 (Kenneth R. French, 2020).

Then the R-squared values obtained for the regressions in Europe and Japan raise questions. Compared to the average R-squared obtained for the U.S. premium analysis averaging at 0.94, as shown in *Table 2*, this value drops to 0.76 and 0.70 for Europe and Japan respectively, as indicated in *Table 10* and *11*. This decrease provides evidence of a lower explanatory power of the model used in Europe and Japan. A potential explanation is that I computed the stock returns using the closing stock price and total return factors, as described in Section 3. Hence, there might be errors-in-variable that potentially reduce the accuracy of the overall model, which will be further explored in the limitations section.

5.4. A rationale behind the ESG Premium

In this research, I discover that investors pay an ESG premium to hold highly sustainable stocks. Thus, they are ready to give up on part of their return to obtain high-ESG assets. Nevertheless, the side value of ESG should also be taken into account. As described in the literature review section, elements of behavioural finance together with fundamental components can directly be linked to sustainable investing. Although it is impossible to say which one of the two prevails, it helps to unveil an explanation to why people choose to possess assets with a good ESG profile.

5.4.1 A behavioural explanation

Sustainable investing first found its roots within the investment portfolios of religious groups, who decided to invest based on ethical criteria. As an example, the Muslims used that method to invest while complying with the Islamic law (Townsend, 2017). Then, ethical investing evolved in the 1970's when the notion of "sin stocks" appeared. This period viewed the creation of investment vehicles that avoid businesses such as alcohol, tobacco, and gambling (Townsend, 2017). Therefore, the essence of SRI lies in a behavioural shift from different market participants who decided to invest differently, based on ethical principles. Sustainable investing started to include an environmental aspect during the 1990's when nations signed the Kyoto protocol to respond to the global warming phenomenon (Townsend, 2017). At the same time, the public started to acknowledge the importance of this environmental issue and began to look for sustainable investment alternatives (Liu, 2020). However, the true considerable shift towards ESG investing has been performed in the last

decade. Several issues such as climate change or labour practices increasingly gained public interest and consumers started to make purchase decisions while considering these sustainability problems. This shift translated in a rising pressure for companies to be good stewards of the environment and ensure the well-being of all stakeholders. Thus, in the 2010's, ESG investment substantially proliferated, accompanied by new regulations (Liu, 2020).

Nowadays, government-invested funds from all around the globe are playing a key role in the expansion of sustainable investing. Institutional investors realise that SRI is in line with their liability-based objectives as ESG is seen as long-term oriented and prudent (Bloomberg, 2018). Therefore, corporations are being driven by these large investors and are now entitled to disclose additional information about their sustainability profile. At the same time, there has been several efforts from different leading market participants to modify the choice architecture of investors by nudging them towards sustainable responsible investing (Pilaj, 2017). Indeed, countries are starting to see the potential of ESG as a driver to an inclusive and environmental-friendly society.

This rise towards sustainable investing generated a behavioural shift for many investors, who are now very conscious about ESG matters. In their ESG investor sentiment study of 2018, Allianz finds that the emotional payoff matters when tackling SRI. This so called "feel-good investing" mostly relates to choosing to support companies that hold the same values as investors. Other than that, some investors mentioned that ESG makes them feel that they have used their money for good purposes. Hence, emotions and values appear to be a key part of sustainable investing (Miller, 2019).

Another behavioural argument surrounding SRI is the "Greater fool theory". This phenomenon is based on the fact that some investors are ready to pay for an overvalued security due to the belief that someone else will be ready to pay an even higher price for it (Lamont & Thaler, 2003). Empirical evidence suggests that this theory is usually linked to overvaluation as a starting point and often results in bubbles as this inflated valuation cannot last forever (Zou, 2018). The considerable inflows into ESG funds through the past few years, which could eventually be partly linked to the greater fool theory, raises concerns over its bubble potential in the near future. A study performed by the bank of America reveals that high-ESG companies currently trade at a 30 percent premium to the poorest performers as measured by their forward price-to-earnings ratios (Temple-West, 2020). This premium could lead to additional speculation by sustainable investors who would wish to sell at a higher price to "greater fools". Eventually, this could drive ESG stock prices to unsustainable highs and induce a bubble.

Despite that apparent behavioral shift, a gap exists between the willingness to invest sustainably and the actual investment (Miller, 2019). It indicates a disparity between the importance that investors give to ESG matters and their investment decisions. Indeed, the Allianz ESG Clarity Survey (2018) reveals that ninety percent of the survey participants care about sustainability and that eighty percent declare to take action on sustainability matters in their everyday lives. At the same time, only 40 percent of the investors surveyed declare knowing that there exists investment tools and strategies to invest sustainably. Moreover, merely half of those say that they consider ESG issues in their investment by choosing assets accordingly (Allianz, 2018).

5.4.2. A fundamental explanation

The study performed by Engle et al. (2019) paves the way for a factor of fundamental value that would potentially be associated with ESG investing. The authors mention that a hedge portfolio against climate change could be built based on an ESG criterion. This suggests some resilience of high-ESG assets towards recent climate events along with a potential strength to future climate shocks. Thus, a fundamental component hedging for risk would be embedded in a portfolio composed of sustainable stocks, which would safeguard the long-term value of those assets. This resilience has also been proven in periods of market downturns, as explained in Section 2. Dekker et al. (2020) document that ESG equity funds perform better during crisis periods such as the Great Recession. This finding is reinforced by Wojtowicz (2020) who finds that the SRI 5% Capped Index outperforms the MSCI World index by 189 basis points through the financial crisis.

In order to validate the statements above, I test the impact of the financial crisis on my high-ESG portfolio. The period associated with the largest drop in value for the S&P 500 during the crisis ranges from November 2007 to March 2009. I decide to restrict my U.S. sample to this time period to observe how the ten different portfolios evolved. The monthly excess return obtained for the bottom decile portfolio is 0.13 percent lower compared to the tenth portfolio, composed of high-ESG stocks, as shown in *Table 16*. Therefore, the ESG premium vanishes and the average excess return obtained is higher in the portfolio deciles with sustainable assets. Despite that observation, this higher performance compared to ESG underperformers is only true for assets with an excellent ESG profile. Effectively, the ninth portfolio has a lower excess return than the bottom decile portfolio, indicating that the resilience towards the financial crisis was only true for the very last portfolio. In this particular case, the fact that excess returns are negative makes the Sharpe Ratio analysis obsolete

(McLeod & Van Vuuren, 2004). Nevertheless, as the high-ESG portfolio exhibits a higher excess return together with a lower standard deviation than other portfolios, this means that it should obtain the best risk-adjusted performance.

TABLE 16

ESG Premium in U.S. during the Financial Crisis (Nov. 2007 – March 2009)

ESGC deciles (EW)	***D1***	***D2***	***D3***	***D4***	***D5***	***D6***	***D7***	***D8***	***D9***	***D10***
Excess Return *(monthly)*	-3.45%	-4.01%	-3.83%	-4.02%	-3.79%	-3.81%	-3.63%	-3.49%	-3.66%	-3.32%
Standard Deviation	0.075	0.075	0.078	0.075	0.077	0.074	0.073	0.080	0.078	0.061
MktRF (β_{Mkt})	1.11	1.09	1.20	1.18	1.08	1.14	1.02	1.13	1.24	0.91
SMB (β_{SMB})	0.25	0.45	0.05	0.18	0.40	0.21	0.23	0.28	0.37	0.41
HML (β_{HML})	0.08	-0.19	0.17	0.09	0.18	0.03	-0.06	0.11	-0.06	-0.05
RMW (β_{RMW})	-0.16	-0.48	-0.49	-0.34	-0.38	-0.31	-0.49	-0.53	-0.24	-0.12
CMA (β_{CMA})	-0.57	-0.14	-0.15	-0.01	-0.33	-0.25	-0.71	-0.50	0.13	-0.28
FF Alpha *(monthly)*	1.03%	0.53%	1.49%	0.89%	0.89%	0.91%	0.91%	1.63%	1.12%	0.13%
(t-value)	*(14.54)**	*(6.3)**	*(20.54)**	*(14.56)**	*(11.62)**	*(15.61)**	*(13.08)**	*(23.22)**	*(14.77)**	*(2.89)**
Adj. R^2 *(FF5 model)*	0.96	0.95	0.96	0.97	0.96	0.97	0.96	0.97	0.96	0.98

*: significant at the 1% level

Despite the ESG coverage being relatively low at the time of the financial crisis, these results point into the direction of a higher performance from ESG leaders during market drawdowns. The alpha values obtained in *Table 16* have to be taken with caution. Indeed, every portfolio obtains a significantly positive alpha, which unveils an abnormal performance for every portfolio decile. A potential reason for that phenomenon is the ESG coverage. First, as mentioned above, the ESG data for this time period is extremely restricted and mainly contains large firms. Second, the financial crisis caused the bankruptcy of many companies. These bankrupt firms ceased to be covered on ESG matters when they stopped their operations, which could create a survivorship bias. This bias could lead to the overestimation of the historical performance. Then, in order to obtain a true comparison with Wojtowicz (2020), who uses assets that represent the five percent top performers on sustainable matters, I split my sample in twenty ranked portfolios so that they each contain one twentieth of the observations. *Appendix E* depicts the results obtained through this methodology and reveals that the twentieth vintile portfolio has a significantly higher return than any other portfolios. The top vintile portfolio obtains a monthly excess return of -2.7 percent while the low-ESG portfolio yields -

3.1 percent. Therefore, this crisis mitigation potential is even higher when I only use the top five percent of ESG performers.

Similarly, Wojtowicz (2020) documents that sustainable funds delivered better returns than broad market indices during the Covid-19 outbreak. This resilience is accompanied by a large difference in fund flows. While the overall fund market suffered a $384.7 billion outflow during the sell-off induced by the pandemic, global sustainable funds pulled in $45.6 billion (Liu, 2020). In general, these results and observations prove that the inclusion of assets with an excellent ESG profile would reduce the overall portfolio's downside risk, which is consistent with the findings of Hoepner et al. (2018).

Overall, behavioural and fundamental reasons help to explain ESG investing beyond its related premium. Despite the historical returns pointing towards a lower cumulative performance of high-ESG assets, their risk-hedging ability along with the recent behavioural shift towards SRI justify a rising ESG preference for some investors.

5.5. Cost of equity analysis

This research shows that there is a negative relationship between the ESG scores and the average β_{Mkt} value, at least for the high-ESG segment. By using ranked portfolios that are rebalanced each month, I hypothesize that the only cost of equity variable that changes between U.S. firms is β_{Mkt}. For robustness concerns, I use equation (4) to compute the monthly average cost of equity per portfolio decile. I use the risk-free rate and the market risk premium for each month, retrieved from the Kenneth-French library, together with the five years rolling market betas that I previously obtained. *Table 17* depicts the results obtained and confirms the methodology used beforehand. On average, a high-ESG company experiences a reduction in their historical cost of equity of 0.12 percent per month. This observation reinforces the hypothetical relation that ESG scores are negatively related with the ex-post cost of equity. Nevertheless, this reduction in K_e only occurs for ESG excellent firms as sustainable mid-performers do not experience it.

TABLE 17

Average Cost of Equity (K_e) per decile portfolio

ESG deciles	***D1***	***D2***	***D3***	***D4***	***D5***	***D6***	***D7***	***D8***	***D9***	***D10***
Cost of equity (K_e) *(monthly)*	0.95%	0.96%	0.99%	1.03%	1.05%	0.97%	0.97%	0.97%	0.88%	0.87%
Standard Deviation	0.046	0.048	0.049	0.050	0.049	0.049	0.048	0.048	0.044	0.042
No. of obs.	20,300	20,200	20,200	20,200	20,200	20;200	20,000	20,200	20,200	20,100

This negative relationship between ESG score and financing costs is further reinforced by the sectorial analysis. Firms that are considered to be "carbon-intensive" experience a considerable reduction in their cost of equity when they have a better ESG score than their peers from the same industry. This reduction is larger than the one observed for the broad market, inducing managers from polluting sectors to make additional efforts on sustainability matters.

The results obtained in the cost of equity analysis suffer from one major pitfall; the absence of statistical testing. Conversely to the ESG premium research, which observes the significance of the remaining alpha values after controlling for the FF5 factors, it is roughly impossible to do the same with the cost of equity. Thus, the reduction in financing costs observed cannot be attributed to variations in ESG scores with certainty. The only factual comment that can be made is that there is a correlation between a reduction in the cost of equity and an increase in the ESG scores. Despite correlation not being causation (Barrowman, 2014), the methodology that I use to estimate the cost of equity leads to a potential link between the different parts of my research. Through the findings of Curran and Velic (2020), it appears that market model betas represent a relevant measure of risk going forward. Therefore, this cost of equity analysis supplements the ESG premium analysis to confirm the premium obtained beforehand while adding a proxy for risk through historical betas. Moreover, it provides insights to companies about the potential effect of improving their ESG scores on their financing costs.

6. Limitations & suggestions for further research

The research surrounding ESG investing that I perform in this thesis is, in general, supportive of the hypotheses formed beforehand. However, the research design implies some limitations and the conclusions drawn eventually lead to suggestions for future analyses on SRI. First, the main limitation of that paper is the historical data. The ESG premium discovered corresponds to historical stock returns. Thus, there is uncertainty around its continued existence

in the future. Similarly, I use historical betas to study the impact of ESG on the cost of equity to study this relation from a different angle than El Ghoul et al. (2018). Despite obtaining conclusive results through this methodology, the disadvantage of using such betas is that they are based on historical data, which may not predict the future cost of equity accurately. A suggestion to ensure the robustness of the negative relationship discovered would be to pursue the methodology used by El Ghoul et al. (2018) on the same panel of stocks together with the three ESG pillars. This technique would imply collecting analysts' forecasts about future earnings and stock prices to estimate the ex-ante cost of equity.

Second, another limitation of this study revolves around the factors used to isolate the effect of ESG scores on returns. It appears that some factors, such as size or quality, have a natural bias towards ESG (Drempetic et al., 2019). Therefore, uncovering the ESG premium becomes a troublesome task. As documented in the results section, the size bias translates in the fact that large firms receive, on average, better scores due to their ability to report their information more accurately (Feldman, 2017). This problem potentially results in a double factor-exposure through SRI. Indeed, if large firms perform better than smaller ones in general, meaning that the small-firm premium is low or negative, ESG investing will also yield good results. In addition, the quality factor is also closely related to ESG. Supposing that a firm is considered to be high-quality, which means that it obtains satisfying profitability and safety metrics, it is probable that this company will receive a good sustainability rating. Indeed, the ESG risk mitigation reflected through the score is closely related to the quality factor often used in factor investing (Feldman, 2017). Although I did not use a quality component in my research, the β_{SMB} coefficients obtained show evidence of the size bias, suggesting that ESG investing could be a mix of factors and not a separate investment criterion. Sustainable performance, taken as a factor, is complex and recent. Therefore, it does not have the same academical background as other well-documented factors. Several studies, such as the one performed by RobecoSAM (2018), show that ESG can provide an additional risk factor, independent of factors usually present in models, with significant explanatory power. Nevertheless, further research should be performed on the topic to discover the exact relation of ESG with other factors to develop a model that will reliably extract the effect of sustainability ratings on returns while not suffering from collinearity (Lioui, 2018).

Third, the geographical comparison that I perform in this study could be augmented and improved. A notable issue is that I compute the stock returns by retrieving the stock prices and other variables for Europe and Japan. Even though this monthly return calculation is supported academically (Alexander, 2012), this raises the possibility of in-variables errors.

Similar analysis should be performed by using the exact monthly returns to confirm the results obtained in this thesis. Additionally, my analysis covers a large part of the world but omits the emerging markets. For future research, studying the BRIC regions would be interesting if Refinitiv starts providing additional ESG scores for these countries. This analysis would potentially unveil dissimilarities in ESG valuation between the developed world and the emerging economies. In fact, ESG implementation in China, for example, seems to be gaining an increasing spotlight and is starting to attract a lot of foreign capital (Mio et al., 2019). This shift points towards a rising importance around sustainability issues for emerging countries, making them interesting candidates to study the implications of sustainable investing.

Finally, the ESG pitfalls presented in this research represent a considerable obstacle to the veracity of the outcomes obtained. The low correlation between ESG data providers, documented by Mayor (2019), raises questions about the reliability of the scores obtained. Despite T. Reuters Refinitiv being a trusted third party on the subject through its past ESG coverage, it is relatively unknown if ratings from other providers would exhibit similar results. Therefore, pursuing a similar research with ratings from other sources would be interesting. Then, the opaqueness of the methodology used by Refinitiv to calculate the scores is problematic. The sustainability topics presented in *Appendix A* provide a thorough overview of the matters covered by the ratings but the weights associated to every matter in the score calculation are unclear. This suggests to researchers and investors to ask for clarification about the construction of ESG scores when tackling SRI (Loop et al., 2020). Additionally, the inclusion of ESG Combined Score (ESGC) that I perform paves the way for alternative sustainable ratings. Considering the fact that raw ESG scores represent information retrieved from public reports, many companies have been found to improve their disclosure practices when receiving a poor rating. This reaction could eventually be seen as score manipulation, challenging the sustainable impact of ESG in general (Clementino and Perkins, 2020). By using the ESGC score, I try to capture a controversy overlay, which reduces the influence that firms have on their own score. This new type of rating presents several drawbacks due to the ambiguity surrounding the score construction and the higher propensity of large firms to be covered in the media (Fang et al., 2009). Nevertheless, it leaves an open door to new types of ESG ratings that could provide a trustworthy image of the firms' sustainability profile.

7. Conclusion

This thesis investigates the link between stock returns and their corresponding ESG scores. Moreover, it adds the cost of equity component to the study to observe the relation between sustainability ratings and companies' financing costs. Thus, it aims at reconciling the investors' and corporates' views of ESG in order to fill a documented information gap on the matter (Loop et al., 2020). Indeed, this combined analysis allows investors to understand the potential effect of ESG inclusion in their portfolio. At the same time, it helps firms to realise the possible effect of an improvement in their ESG score on their cost of equity. Through my analysis, I derive an ESG premium in the United States meaning that investors are ready to give up on part of their profit to hold sustainable stocks. This finding is consistent with the one made by Auer et al. (2015) but considers a larger sample of stocks and covers ESG scoring since its implementation. Regarding the cost of equity study, I uncover the same negative relationship that El Ghoul et al. (2018) while using a different methodology relying on historical market betas and a longer sample period. Hence, ESG scores appear to be, on average, inversely related to companies' cost of equity.

Additionally, I perform a sectorial and geographical analysis. Dissecting industries allows me to observe that similar sectors mainly compose portfolios composed of low and high-ESG assets at the same time. Therefore, ESG scores do not appear to be linked to industry membership. Moreover, I restrict my sector list to carbon-intensive industries to perform a cost of equity analysis on this restrained sample. I discover that firms from those sectors with an outstanding performance on sustainability issues profit from a larger reduction in their cost of equity than the market in general. Then, I compare ESG valuation across different continents following Dureen et al. (2016)'s paper which points towards dissimilarities in ESG preferences between regions. I decide to study Europe and Japan due to the extensive availability of sustainability scores for these regions and I unveil an ESG premium regarding these two areas as well. Nevertheless, this premium is larger in Europe than in any of the two other regions, which suggests differences in ESG valuation. Similarly, the industries that receive, on average, the highest ESG scores differ between continents.

Finally, in addition to these new empirical findings, this thesis explores additional aspects surrounding ESG such as the size bias (Drempetic et al., 2019) or the score dissimilarities between distinct ESG data provider (Poh, 2019). It paves the way for further research surrounding ESG investing to determine whether ESG should be treated as a factor in particular or as a mix of factors (Feldman, 2017). Moreover, it explores reasons that explain

the recent behavioural shift towards SRI such as the “feel-good” sentiment (Miller, 2019). At the same time, fundamental explanations could justify the existence of the ESG premium such as the climate risk-hedging ability or the downside risk mitigation potential associated with ESG (Engle et al. (2019); Dekker et al. (2020); Wojtowicz (2020)).

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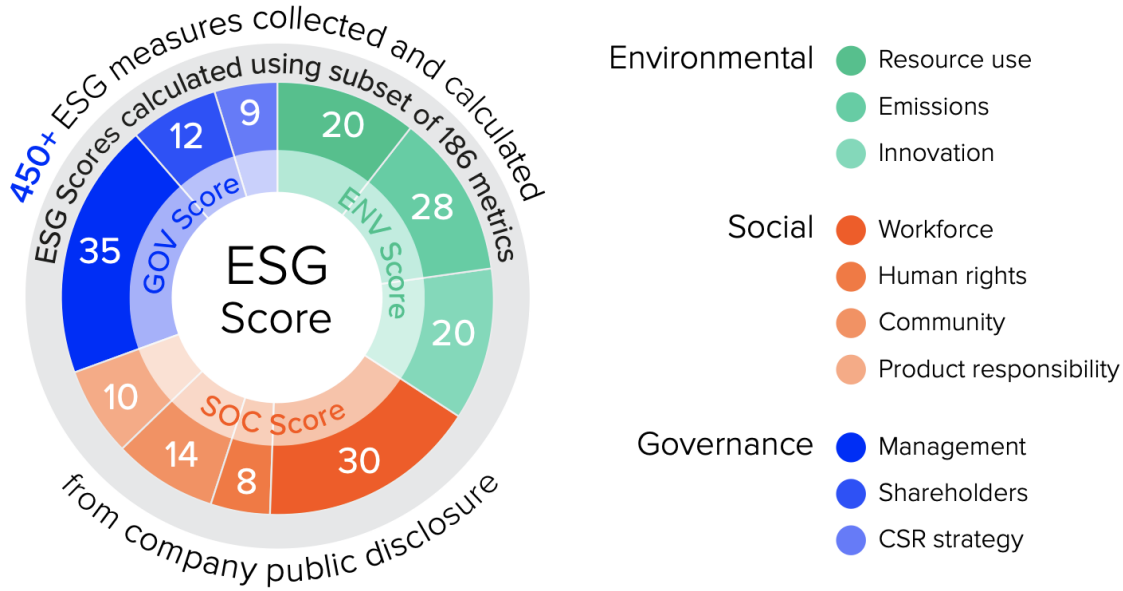
Appendix

Appendix A

1. Decomposition of the Refinitiv ESG score based on its three pillars.



Retrieved from Refinitiv (2020).

Appendix B

1.

Appendix B1

Average ESG score and number of observations per decile portfolio.

ESG deciles (U.S.)	***D1***	***D2***	***D3***	***D4***	***D5***	***D6***	***D7***	***D8***	***D9***	***D10***
Average ESG score	23.98	30.76	35.09	38.98	43.01	47.61	53.06	59.95	68.29	79.89
N. of obs.	22,209	22,090	22,129	22,037	22,065	22,102	22,100	22,082	22,096	21,987

2.

Appendix B2

Paired t-test: ESG and ESGC premium (alpha values)

	obs	*Mean1*	*Mean2*	*dif*	*St_Err*	*t_value*	*p_value*
ESG - ESGC	10	.002	.002	0	.001	.05	.978

Appendix C

1.

Appendix C1

Number of observations per year with corresponding market risk and small firm premium

Year	***N. of obs.***	***Mkt-RF*** *(%)*	***SMB*** *(%)*
2003	4,938	30.75	24.48
2004	6,699	10.72	7.34
2005	7,549	3.09	-0.75
2006	7,587	10.60	1.52
2007	7,714	1.04	-7.94
2008	10,032	-38.34	3.36
2009	11,335	28.26	7.94
2010	11,673	17.37	13.30
2011	11,617	0.44	-5.77
2012	11,580	16.28	-0.05
2013	11,584	35.20	7.66
2014	11,647	11.70	-8.07
2015	19,163	0.07	-5.87
2016	27,531	13.30	9.18
2017	29,154	21.50	-5.85
2018	28,037	-6.93	-5.32
2019	3,057	28.28	-6.09

Appendix D

1.

Appendix D1

Sector representation by SIC-2 code.

SIC2	Percentage	Cum. Percentage
0	0.04	0.04
10	0.41	0.46
12	0.17	0.63
13	3.5	4.12
14	0.22	4.34
15	0.76	5.1
16	0.3	5.4
17	0.19	5.59
20	2.31	7.9
21	0.32	8.23
22	0.17	8.4
23	0.6	9
24	0.32	9.32
25	0.53	9.85
26	0.92	10.76
27	1.08	11.84
28	6.31	18.14
29	0.92	19.06
30	0.79	19.86
31	0.1	19.96
32	0.32	20.28
33	1.23	21.51
34	1.17	22.68
35	4.62	27.29
36	5.57	32.86
37	2.3	35.16
38	4.07	39.23
39	0.5	39.73
40	0.36	40.09
42	0.48	40.57
44	0.53	41.1
45	0.58	41.68
46	0.1	41.78
47	0.37	42.16
48	2.83	44.99
49	5.1	50.09
50	1.63	51.72
51	1.17	52.89

52	0.39	53.28
53	1.09	54.36
54	0.42	54.79
55	0.6	55.39
56	1.26	56.65
57	0.44	57.1
58	0.98	58.08
59	1.42	59.49
60	5.71	65.2
61	1.04	66.24
62	2.24	68.48
63	4.56	73.04
64	0.44	73.48
65	0.65	74.13
67	6.85	80.98
70	0.69	81.67
72	0.27	81.94
73	7.55	89.49
74	0.05	89.53
75	0.19	89.72
76	0.01	89.73
78	0.39	90.12
79	0.55	90.67
80	1.47	92.14
82	0.35	92.48
83	0.08	92.56
87	1.63	94.19
89	0.1	94.29
94	0.02	94.31
96	0.01	94.32
99	5.68	100
Total	100	

2.

Appendix D2

Green Energy ETF U.S. holdings.

Company	Green Energy ETF Representation
Enphase Energy Inc.	6.01%
First Solar Inc.	5.53%
Ormat Technologies Inc.	2.70%
Plug Power Inc.	6.58%
Renewable Energy Group Inc.	2.82%
Solaredge Technologies Inc.	6.93%
Sunpower Corp.	1.83%
Sunrun Inc.	6.79%
Atlantica Yield Plc	3.32%
Cum.	42.51%

Retrieved from Blackrock (2020)

Appendix E

1.

Appendix E1

ESG premium in U.S. during the Financial Crisis using vintile (20) portfolios

ESG ventiles (EW)	Excess Return (monthly)	Standard Deviation
V1	-3.19%	0.073
V2	-3.71%	0.080
V3	-3.20%	0.072
V4	-4.81%	0.079
V5	-3.70%	0.090
V6	-3.96%	0.071
V7	-3.40%	0.072
V8	-4.62%	0.080
V9	-4.11%	0.080
V10	-3.46%	0.077
V11	-4.39%	0.073
V12	-3.24%	0.076
V13	-3.77%	0.068
V14	-3.50%	0.083
V15	-3.72%	0.090
V16	-3.25%	0.072
V17	-3.39%	0.068
V18	-3.93%	0.089
V19	-3.84%	0.057
V20	-2.78%	0.067