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RELIABILTY OF ESG RATINGS
–
A QUALITATIVE AND QUANTITATIVE ASSESSMENT

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Table of contents

I - Introduction

Financial markets are more accessible than ever as several digital banks and brokers (e.g. Revolut or Ameritrades) offer access to the financial markets from smartphone applications. According to Reamer and Downing (2016), the roots of this democratization of investments are the industrial revolution, the emergence of a modern corporate form and of public markets. In these democratized markets, the desire of investors is to maximize their returns at an appropriate risk level reflecting their financial objectives and constraints as depicted in the modern portfolio theory ("MPT") initiated by Markowitz (1952).

More recently, this democratization of investments and the presence of young investors (especially the millennials) are pushing financial institutions towards sustainable responsible investments ("SRI") (CNBC, 2020). The recent coronavirus outbreak strengthened the importance of sustainable dimensions (especially the social one) as many voices are calling for a "*build back better*" project (Financial Times, 2020a). For instance, a survey revealed that 87% of surveyed wealth managers consider that the current pandemic will increase Environmental, Social and Governance ("ESG") interests (Financial Times, 2020b).

This suggests that current investors do not only consider financial criteria in their investment decision processes. The existence of this enhanced investment paradigm is demonstrated by a number of observations, namely, an increase in sustainable concerns, a growth sustainable assets and a development of sustainable products offerings.

First, several studies have pointed out that many investors have sustainable concerns. In 2019, Morgan Stanley reported that 85% of the United States ("U.S.") based individual investors (especially millennials) have concerns in SRI. This corroborates with the Schroders 2019 Global Investor Study indicating that 61% of the 25,000 interrogated investors from different countries and continents agree (and especially the generation X) that all funds should include sustainability factors in their investment processes.

These sustainable concerns are put into effect as a growing part of investors directs their wealth towards sustainable products resulting in a significant increase in sustainable assets (cf. figure 4 and 5 in appendix). The total SRI assets reached globally $30.7 trillion at the start of 2018 corresponding to a 34% growth in two years (GSIA, 2018). In the U.S., the SRI assets represented $12.0 trillion (a growth of 38% in two years) accounting for a quarter of total assets under professional management States while they reached $14.1 trillion (+11% in two years) in Europe (GSIA, 2018).

As a response of this surging SRI demand, financial institutions have increased or reoriented their offers in order to benefit from this positive trend (cf. figure 6 in appendix). As a matter of fact, many conventional funds have shifted towards the sustainable market to attract inflows. For instance, some of them simply change their names and include ESG considerations in their portfolio construction processes (Hale, 2019). Hale (2020) reported an increase from 81 to 546 funds with ESG consideration and an increase from 270 to 303 funds placing sustainability at the heart of their strategy in 2019. In Europe, Bioy (2019) reported 290 openings of sustainable funds in 2018 and positive inflows since 2014. Private equities are not an exception to this trend and now not only consider ESG as a risk-mitigating tool but as a process to obtain added value (S&P, 2020). In 2018, KKR launched an impact fund dedicated to sustainable investments and has already raised over $1bn (Financial Times, 2020c).

Sustainable products are easily accessible for any investor as plenty ESG-oriented exchange-traded funds ("ETFs") are available on the market these days. Nevertheless, the SRI environment is broad and encompasses a wide range of different strategies. The simplest is the exclusion strategy which was already applied in 1928 by the pioneer fund (Financial Times, 2020d). This strategy avoids investments in non-ethical sectors such as alcohol or weapons (Eurosif, 2018) and is easily accessible through screened ETFs like the "i*Shares MSCI World ESG Screened UCITS ETF*". Besides, some investors are taking stronger positions towards ESG and are willing to invest in most sustainable firms. This is frequently called the best-in-class strategy (Eurosif, 2018). In addition, there is a consensus on what sustainability means among investors, academics and financial institutions. Nevertheless, the sustainability assessment is rather vague. More precisely, while the exclusion strategy is built upon sector classifications, the implementation of a best-in-class strategy is more complex.

Fortunately, ESG ratings provide an easily interpretable way to measure sustainability of firms. In contrast with credit ratings, ESG ratings are unregulated ratings provided by a plethora of private ESG agencies relying on various methodologies. This fragmented and specialized market is consolidating (Avetisyan & Hockerts, 2017 and Novethic 2018) and major players (e.g. S&P and Moody's) have recently entered the market through acquisitions (Financial times, 2019 and Les Echos, 2019). The first agencies were established in the 1980s[1], but these ratings have gained importance during the last years. For instance, Several ETFs or indices determine

[1] Eiris was founded in 1983 (Eiris, 2020)

the selection of stocks or their weights from ESG ratings.[2] In 2020, Jet Blue issued a sustainability-linked loan that relied on Viego Eiris ratings (Wall Street Journal, 2020). On top of that, investors are trusting these ratings as funds with high sustainable scores attract more funds (Amman et al., 2018). Similarly, a study showed independent ratings would encourage more than 60% of investors under 50 years old to invest more in sustainable products (Schroders, 2019).

Besides their simplicity, these ratings are subject to many criticisms regarding their reliability. First, a heterogeneity between different rating providers has been well-established as several academicians found a low correlation between rating agencies (Chatterji et al., 2015, Dorfleitner et al., 2015 and Berg et al., 2019). Nevertheless, Baer Pettit, MSCI's president, highlighted that ratings depend on analyses performed which differ across agencies in a similar way than sell-side reports (Financial Times, 2020e). Apart from this heterogeneity, academics have found interesting relations between ratings and other variables such as the political influence (Di Giuli and Kostovetsky, 2014), the location (Baldini et al., 2018) and the size (Drempetic et al., 2019). Furthermore, there is currently a lack of regulation and ratings are mainly derived from non-audited and self-reported information (Financial Times, 2020e).

On another note, sustainable investments have raised many questions on their performance with two main contradictory arguments. On the one hand, a golden rule of the MPT is the positive effect of diversification. As the application of sustainable criteria reduces the pool of available investment, it reduces the diversification effect and has negative consequences on the risk taken. On the other hand, researchers have proposed a "*doing good when doing well*" principle. It suggests that sustainable firms will overperform thanks to better management and reduced costs (Renneboog, 2008a). Nevertheless, this question remains open as indicated by meta-analysis (Fredie et al. (2015, Revelli and Viviani 2015) and by data specific results (Capelle-Blancard and Monjon, 2012).

Regulations and political decisions are other key factors surrounding sustainable investments. In response to the climate crisis, the European Commission ("EC") presented the Green New Deal and announced in January 2020 that the plan will gather at least a €1 trillion of sustainable investments from public and private sources (EC, 2020a). Regarding the non-financial reporting, the EC has already set a range of obligations for large firms (under Directive 2014/95/EU). Not long ago, the regulation 2019/2088 was issued and aims at improving

[2] ESG MSCI USA Leaders ETF,iShares ESG MSCI EM Leaders ETF, Lyxor MSCI Europe ESG Leaders (DR) UCITS ETF, Euronext Eurozone ESG Large 80

transparency and communication about the integration of sustainable factors in the investment process. However, ESG rating agencies remain to this day unregulated. Steven Maijoor, chair of the European Securities and Markets Authority (ESMA), declared that sustainable agencies need more regulation and supervision to avoid greenwashing (Reuters, 2020). In April 2020, the EC has issued, as part of the European Green New Deal, a consultation on sustainable finance that includes questions on ESG ratings. The investments required to address the climate crisis and the growing importance of SRI will continue to push Europe towards more regulation of sustainable finance.

ESG ratings are at the focal point of several crucial questions. While they remain blurred and subject to biases, they continue to gain importance in the financial environment. This thesis sheds light on the characteristics of ESG ratings and questions their reliability by answering three distinct but related research questions.

The first research question is "*On which basis are ESG ratings derived?"*. To answer this question a qualitative comparison of methodologies of main ESG agencies and case studies will be conducted to further understand the specificities of ESG ratings.

The second research question is "*Are ESG ratings subject to significant biases?"*. Based on existing research and observations of the descriptive data section, determinants of ratings developed by Refinitiv will be assessed using panel regressions.

The third research question is "*Do ESG ratings provide material information leading to overperformance?"*. The third research question aims at testing if portfolios created using ESG ratings and findings from the second research question can lead to over or under performance based multifactor models.

This thesis consists of nine sections. Following this introduction (section I), a comprehensive literature review (section II) will be conducted on sustainable responsible investments. After that, research questions (section III) will be detailed. The first research question (section IV) will be tackled before the data (section V) and methodology (section VI) sections as it provides further explanations on ESG ratings. The data section (section V) aims at describing key patterns of ESG ratings while the methodology section (section VI) explains the methodologies used as part of the second and third research questions. The two following sections will present and discuss the results of the second (section VII) and third (section VIII) research questions. The conclusion (section IX) closes this thesis by pointing out the main outcomes of this thesis and avenue for future research.

II - Literature Review

As part of this literature review, the concept of SRI will be first introduced. This will be followed by the implications of sustainability for investors and firms. Once these implications are investigated, the impact on performance will be studied. The review will end with key findings on the reliability of sustainable ratings and their impacts.

II.1. The SRI landscape

Definition of SRI

Academics define SRI and its equivalent concepts (e.g. responsible investment, sustainable investment and ethical investment as "*the integration of certain non-financial concerns, such as ethical, social or environmental, into the investment process*" (Sandberg, 2009, p.521). Investors and financial institutions have similar definitions (Sandberg, 2009). For instance, BNP Paribas (2020) defines SRI as "*an approach to investment that integrates ESG factors in the evaluation of investments*".

Next to academics and investors, national and international institutions are supporting responsible investments or developing quality standards through labels[3]. In its 2018 Action plan, the EC defines sustainable finance as "*the process of taking due account of environmental and social considerations in investment decision-making*" (p.3) and highlights the importance of governance to achieve social and environmental goals. US SIF[4] (2020), a US-based association supporting the development of sustainable finance, defines SRI as "*an investment discipline that considers ESG criteria to generate long-term competitive financial returns and positive societal impact*". At the international level, the UN PRI[5] (2020) defines SRI as "*a strategy and practice to incorporate ESG factors in investment decisions and active ownership*". In 2020, 521 asset managers have signed the UN PRI representing more than $100 trillion of assets under management (UNPRI, 2020b).

These definitions from different actors in the sustainable investment area show a consensus on SRI definitions (i.e. the integration of ESG criteria alongside financial criteria). Nevertheless, Berry and Junkus (2013) pointed out a confusion for investors due to different objectives and the absence of a general framework to determine the social responsibility of investments. Indeed, SRI can be implemented in a large range of sustainable strategies.

[3] Febelfin launched the label "Towards Sustainability" for Belgian products in November 2019 (Towards Sustainability, 2020)
[4] The Forum for Sustainable & Responsible Investment
[5] United Nations principles for Reponsible Investment

SRI strategies

Schueth (2003) identifies three sustainable investment strategies. The first strategy is the screening strategy consisting of the selection or exclusion of companies based on ESG criteria. The second strategy is the shareholder advocacy through which investors influence the behavior of the companies thanks to active shareholder engagement. The third strategy is named community investing and provides funds to communities at risk or with low income.

The Eurosif[6] (2018) and the GSIA[7] (2018) identifies 7 different strategies:

1. The exclusion strategy consists in excluding investment disrespecting investor's values. For instance, Eurosif (2018) reported that weapons, tobacco, gambling and pornography as the most frequently excluded industries in Europe. This strategy is simple and was already applied by the Pioneer fund in 1928 (Financial Times, 2020d). The exclusion strategy is the largest in Europe (Eurosif, 2018) and the second largest in the USA (GSIA, 2018).
2. Best-in-Class ("BIC") (or Best-in-universe) consists of the selection of the investments with the best ESG profile. This strategy gains strength in Europe as shown by its 20% CAGR[8] for 8 years[9] and is mainly developed in France (Eurosif, 2018).
3. Sustainability themed investment focuses on one or more sustainable themes (such as energy efficiency, waste, building sector, etc). During the last years, investors mainly focused on climate change oriented themes (Eurosif, 2018).
4. Norms-based screening help investors to identify investments that respect international norms[10] covering human rights, environmental protection, etc. Eurosif (2018) highlights that this strategy can be used in combination with other strategies.
5. ESG integration is "*the systematic and explicit consideration by investment managers of ESG factors into financial analysis*" (GSIA, 2018, p.26). However, Eurosif (2018) points out that it is a broad and unclear strategy. Despite this lack of definition, ESG integration is the second biggest strategy globally in terms of assets under management (GSIA, 2018).
6. Engagement and voting correspond to the shareholder advocacy of Schueth (2003). This strategy is especially developed in the United Kingdom and Sweden (Eurosif, 2018).

[6] An European association promoting SRI
[7] Global Sustainable Investment Alliance
[8] Compound annual growth rate
[9] See Figure 5 for a comparison with other strategies, BIC had the second largest growth in 2018 in Europe.
[10] UN Global Compact, OECD Guidelines, International Labor Organization conventions

7. Impact investing is defined as "*targeted investments aimed at solving social or environmental problems*" by GSIA (2018, p.26). This is thus an extension to the community investing defined by Schueth (2003). In contrast with other strategies, Eurosif (2018) identifies three distinctive elements, namely, the intentionality, the additionality and the measurement. This impact investing can be seen as the strongest form of sustainable investment and the measurement aspect is unique across strategies. Green bonds and social bonds are good examples of impact investments (Eurosif, 2018).

To invest in these different strategies, investors can invest in different asset classes. In Europe, bonds (mainly corporate and sovereign bonds) and equity account for 86% of the sustainable investments (Eurosif, 2018).

It is interesting to point out that the SRI market was dominated by institutional investors in Europe who account for more than 90% of SRI investments in 2013 (Eurosif, 2018). Retail investors' interests increased during the following years to reach c. 30% in 2017 (Eurosif, 2018) which coincide with the European asset management industry (EFAMA, 2018).

SRI and Europe regulation

As part of the European engagement on UN sustainable development goals ("SDG") and the Paris Climate agreement, Europe is supporting sustainable finance. In December 2016, the European Commission set up the High-Level Group ("HLEG") on Sustainable Finance.

Their interim report led to a regulation proposal defining environmentally sustainable economic activity at an EU level (European Commission, 2018a). Their purpose is to avoid different definitions of sustainable investments across Europe that could discourage sustainable investments. The proposal considers an activity as environmentally sustainable when it contributes substantially to one or more of the environmental objectives. The objectives are: (1) climate change mitigation, (2) climate change adaptation, (3) sustainable use and protection of water and marine resources, (4) transition to a circular economy, waste prevention and recycling, (5) pollution prevention and control, (6) protection of healthy ecosystems. Moreover, these investments have not to significantly harm one of the environmental objectives and respect the minimum safeguards regarding the fundamental rights of workers (European Commission, 2018b). The EC continues the development of a regulatory framework for SRI as shown by the recent issue of the consultation "*on the renewed sustainable finance strategy*".

These sustainability concept have implications for both the investors and the firms and will be detailed in the two following sections.

II.2. Sustainability and investors

The development of sustainable finance raises questions regarding investors' preferences and the drivers of these non-financial preferences. The inclusion of non-financial criteria in the investment process challenges the traditional mean-variance framework.

Modern Portfolio Theory

The MPT, initiated by Markowitz in 1952, introduced the concept of mean and variance tradeoff to reflect investors' preferences (i.e. investors' utilities are a positive function of return and negative function of risk). According to Markowitz (1952), rationale investors should invest in efficient portfolios. These portfolios provide the highest return for a certain level of risk (measured by the variance). Tobin (1958) added the risk-free rate in the process by introducing combinations between a portfolio made of risky assets and a risk-free asset. Sharpe (1964) showed that, once the market portfolio and the capital market line are established, investors can select the right portfolio to them according to their utilities function (i.e. their variance and return preferences). Under this well-established theoretical framework, investors' preferences are solely measured and affected by financial characteristics, more precisely risk and return. However, all the evidence suggets that a growing part of investors integrates sustainable factors when investing.

Extension to sustainable preferences?

At the beginning of 2018, global assets in sustainable funds reached $30.7 trillion corresponding to an increase of 34% during the two last 2 years (GSIA, 2018). Besides, Hale (2020) reported net flows of USD 21.4 billion into U.S. open-end and exchange-traded sustainable funds in 2019. In 2018, the same net flows were only USD 5.5 billion (Hale, 2019). Hale (2019) highlighted an increase of repurposed funds (i.e. existing funds that include sustainable criteria). Furthermore, 85% of U.S. individual investors (especially millennials) have concerns in SRI (Morgan Stanley, 2019). These facts and figures show a clear shift in the investors' preferences for ESG investments. This contradicts the traditional financial theories as investors include non-financial preferences to make their investment decision.

Even if sustainable investments have broken through the marketplace recently, academics have investigated the underlying reasons of ESG preferences for decades. Schueth (2003) stated that sustainable investors have two main motives: the willingness to invest in accordance with their values and the willingness to improve the environmental and social situation. According to Renneboog et al. (2008b), sustainable investors have two goals: wealth-maximization and

social responsibility. Therefore, they have additional non-financial utility by investing in SRI. But, in contrast with charity, they still have financial motives driving their investments.

Some surveys indicate that investors include sustainable preferences in their investment decisions (Beal and Goyen, 1998, Delsen and Lehr, 2019, Bauer and Smeets, 2015). Investors are even willing to sacrifice financial performance in order to respect their sustainable values (Barreda-Tarrazona et al., 2011). In their experiment, they have shown that investors are willing to pay a premium to respect their sustainable criteria.

However, as these surveys are completed in a hypothetical context, actual preferences and investment attitudes differ (Vyvyan et al., 2007). In other words, these investment studies provide hints on investors motives but do not reflect their actual behaviors. Therefore, other researchers have investigated investors' behaviors from another point of view.

By studying fund flows, Bollen (2007) found that investors have a conditional multi-attribute utility function integrating sustainable preferences (i.e. concerns for sustainable objectives or not). More specifically, investors derive additional utility from responsible investments under the condition that their financial conditions are met. Bollen also found that sustainable investors exhibit lower volatility of flows and lower sensitivity to negative returns. According to Krüger (2015), investors react negatively to negative CSR events and less positively to positive CSR events that show an aversion to negative CSR. Amman et al. (2018) found that funds with higher sustainable ratings provided by Morningstar received more flows than conventional funds and that there is a publication effect (i.e. reconstructed and non-published ratings have no influence on flows).

Alongside investors surveys, these key findings demonstrate that the classic mean-variance tradeoff should be extended with other factors such as the sustainability to reflect investors' preferences. Academics have found that sustainable preferences are influenced by the culture (Scholtens and Sievänen 2013), religious convictions (Gutsche, 2017), age and education (Rosen, 1991).

While the overall SRI concept is well-established as shown in section II.1, these findings show the heterogeneity of sustainable investors' profiles and motives.

II.3. Sustainability and companies

Previous sections focused on investors' behavior towards sustainability and indicated that investors have sustainable preferences. It is interesting to understand how firms (and more precisely listed firms) position themselves towards sustainable investors. Therefore, this section describes the influence of sustainability on companies' behavior.

As for investors, two main theories, namely, the shareholder theory and the stakeholder theory (also called the corporate social responsibility ("CSR")) conflict. In line with these investors' principles, the shareholder theory states that the sole goal of firms is to maximize shareholders' value (Friedman, 1970). According to Friedman, any expenditure related to corporate sustainability does not benefit to shareholders. In other words, this would result in agency costs[11]. Friedman stated that "*there is one and only one social responsibility of business to use its resources and engage in activities designed to increase its profits so long as it stays within the rules of the game, which is to say, engages in open and free competition without deception or fraud*" (Friedman, 1962, p.112).

As opposed to this Friedman Theory, the CSR has been developed in the early 50s with the "*Social Responsibilities of the Businessman*" by H. Bowen in 1953. As explained by Bowen, the shareholder theory can be seen as the application of the "laissez faire" theory. Under this theory, the pursuit of self-interest benefits the society and corporations are only constrained by moral rules[12] enforced by laws. In practice, the "laissez faire" can lead to social conflicts due to noncompetitive markets and non-respect of human rights of workers. The CSR aims at solving these issues. It refers to "*the idea, now widely expressed, that voluntary assumption of social responsibility by businessmen is, or might be, a practicable means toward ameliorating economic problems and attaining more fully the economic goal we seek*" (Bowen, 2013, p.6). A similar concept is the stakeholder theory under which "*managers should make decisions that take account of the interests of all the stakeholders in a firm*" (Jensen, 2010, p1). Bowen observed that pressure from government and labor movement, separation of ownership and control and the willingness of corporations (in order to protect long term interests) have driven the inclusion of societal aspects in companies' decisions. Bowen identified several criticisms to CSR namely the loss of competitivity, the increase in costs, the diversion of focus from profit objectives, the usage of CSR by managers to retain their power and the violation of duties

[11] Jensen and Meckling (1976) define agency costs as "*the sum of: (I) the monitoring expenditures by the principal,' (2) the bonding expenditures by the agent, (3) the residual loss*" (p.308) where the residual loss is the costs due to divergence between the decisions of the agent and the decisions that would maximize the value for the principals.

[12] The respect of private property, contract and avoidance of deception and fraud.

towards stockholders (as the objective of firms should be only to increase stockholder profits). Jensen (2010) highlighted the complexity of the stakeholder theory due to the pursuit of multiple objectives. He proposed an enlightened stakeholder theory (or enlightened shareholder theory) under which long term profit maximization is the tradeoff between stakeholders.

However, the presence of sustainable preferences has an impact on firms' behavior. In their theoretical model, Heinkel et al. (2001) have developed a utility function taking into account these sustainable preferences. They found that a sufficient number of sustainable investors would reduce the cost of equity of green firms. Green firms will invest more (as more projects have positive net present value thanks to a reduced cost of equity) and this would push some firms to reform to become sustainable. Empirically, Haigh and Hazelton (2004) found a lower cost of capital of sustainable firms due to an increase in supply of capital for sustainable firms and conversely a divestment in sin stocks (firms active in unethical industries). Dhaliwal et al. (2011) found that self-disclosure of CSR activities induces a reduction in the cost of capital, a stronger coverage of analysts and an easier capital raising.

Academics have largely debated over the relation between sustainability and performance. On the one hand, academics have emphasized that the integration of sustainability in the decision-making process implies agency costs (Jensen, 2010, Adhikari, 2011), higher costs (Friedman, 1970) and no increase of revenues (Di Giuli and Kostovetsky, 2014). On the other hand, other researchers emphasize the attraction of better human capital (Greening and Turban, 2000), a positive impact on companies' evaluations (Sen and Bhattacharya, 2001) and a better governance (Ferrell et al., 2016).

Overall, there is no consensus over the link between sustainability and performance. As explained in the following section, mixed findings have been found in the stock markets.

II.4. Sustainability and performance

Theoretical approach

Academics have laid down theoretical reasons supporting the overperformance or the underperformance of SRI. It exists theoretical arguments supporting the three underlying hypotheses on the performance of SRI namely the doing good but not well, the doing good when doing well, and the no-effect hypotheses (Statman and Glushkov, 2009).

A loss of diversification

A shrinkage in the universe of possible investments due to sustainable criteria is a supporting argument for the doing good but not well argument. The reduction in the pool of investments for sustainable reasons is in contradiction with the diversification principle which states that investors should diversify their funds across securities (Markowitz, 1952). Alongside with the exclusion of non-sustainable firms, the application of sustainable criteria could lead to the inclusion of sustainable firms with bad financial performance[13] (Renneboog et al., 2008b). However, Barnett and Salomon (2006) point out that a diversified portfolio can be obtained with a subset of securities. Campbell et al. (2001) show that a portfolio of 50 stocks was required to obtain the diversification effect[14].

In their theoretical model, Heinkel et al. (2001) find that in presence of green investors unethical stocks are held by a smaller group of investors and have lower risk-sharing among their investors. Therefore, these investors would have a higher expected return for unethical stocks. At equilibrium, the cost of capital of unethical firms is higher.

Increased costs or long term investments?

A second argument against the integration of sustainability concerns is that firms will divert from their financial objectives and have extra-costs related to their sustainable objectives (Friedman, 1970). According to Jensen (2010), firms acting under the stakeholder theory increase their costs due to higher power of their managers and agency costs.

In contrast and in line with the stakeholder theory, Waddock and Graves (1997) state that corporate social performance and financial performance are correlated[15]. For instance, a

[13] This is based on a theoretical example due to the possible inclusion of positive ESG with negative performance.
[14] Previous studies (Bloomfield et al. 1977) indicates that a smaller portfolio (20 stocks) was enough to obtain the 5% excess standard deviation.
[15] This relation was found by analyzing KLD rating and financial performance metrics. An review study has been conducted by Zhao and Murrel (2016) on an larger number of companies and during a longer period. The positive relation could not be generalized to this extended group.

company with a positive social impact can reduce its hiring costs and retain more easily its employees. Nevertheless, McWilliams and Siegel (2000) have reviewed the study and have shown that the positive relation between CSR and performance can be explained by R&D. Eccles et al. (2014) pointed out that sustainable firms can attract better employees, avoid controversial costs or conflicts and engage in innovations.

Managerial and investors myopia

Another argument supporting the overperformance of sustainable firms is the managerial and investors' myopia (Statman and Glushkov, 2009). The concept of managerial or investors myopia refers to the underestimation of benefits related to long term investments due to focus on short term metrics (Stein, 1988). For instance, Lev et al. (2005) have found that investors are focusing on profitability without fully integrating the benefits of long-term investments[16].

Mosaic theory through ESG information

The mosaic theory is another theoretical argument favoring the overperformance. The mosaic theory states that well-informed investors have an advantage as they can obtain material information from a large set of public information (CFA, 2014). According to Renneboog et al. (2008b), the ESG screening process can help investors to obtain relevant information regarding the value of investments. These screenings enable to find better-managed companies and reduce the risk of higher costs. This is in line with the positive effects of screening found by Barnett and Salomon (2006) and by Statman and Glushkov (2009).

Empirical approach

The cost of exclusion

As described in part II.1, the exclusion strategy is widely applied in Europe and in the USA. Based on the MPT, the exclusion should have a cost due to diversification loss. Some academics have found evidence of overperformance of sin stocks. Fabozzi et al. (2008) explained the overperformance by the unregulated monopoly position of sin firms, and they pointed out the risk of negative impact on performance of exclusion strategies. Hong and Kacperczyk (2009) justified the overperformance by lower analyst's coverage due to exclusion and higher risks (e.g. litigation). In their fund performance analysis, Capelle-Blancard and Monjon (2014) corroborate with these findings as they found a cost for the exclusion strategy.

[16] Their analysis focused on R&D (and is not performed in an ESG context) and showed that conservatism accounting leads to undervaluation.

However, Humphrey and Tan (2014) argued that the exclusion of sin stocks is not necessarily a cost as there is a small portion of sin stocks in mutual funds. Trinks and Scholtens (2017) have questioned this statement as they found over 1,600 sin stocks and indicated that the cost of exclusion depends on the screening. For instance, they found that the exclusion of alcohol or nuclear power has no impact on performance.

The gain of screening

In contrast with the cost of exclusion, some arguments suggest that sustainable firms can overperform over the long term and that the screening process can help to select the best stocks.

Several studies found that strategies buying the best sustainable stocks and selling the worst sustainable stock achieve positive returns (Derwall et al., 2005, Kempf and Osthoff, 2007, Statman and Glushkof, 2009). Halbritter and Dorfleitner (2015) reported no overperformance for different providers both at the pillar and at the global level. However, the results are highly dependent on the metrics used to measure sustainability (Halbritter and Dorfleitner, 2015).

Barnett and Salomon (2006) showed that the screening's intensity and returns are positively correlated. More precisely, they indicated that a weak screening limits the diversification losses whereas a strong screening increases the financial benefits. Therefore, funds with medium intensity have losses related to diversification but no gains from screening. Similarly, Renneboog et al. (2008b) found that performance decreases with the addition of governance and social screens due to a restriction in the universe of investment. And, Statman and Glushkof (2009) indicated an opposite effect between exclusion and selection. Furthermore, Capelle-Blancard and Monjon (2014) found positive relations between returns and screening intensity in their study of French mutual funds. They pointed out that sectoral screening negatively affects performance while transversal screening[17] does not hurt performance.

Conclusion: mixed evidence

Many studies have been conducted and no consensus has been reached yet. While methodologies are similar across studies (mutli-factors model), the underlying of returns are various from theoretical portfolio (based on rating or other criteria) to mutual funds and ETF (see table in part B of appendix). However, concerning the methodologies, Galema et al. (2008) pointed out that the ESG effect is included in the book-to-market effect due to higher inflows and thus higher value of SRI stocks.

[17] Such as international labor organization rights, UN global compact principles,…

Nevertheless, meta-analyses provide a broader picture of the current findings over sustainable performance. Fredie et al. (2015) found a non-negative relation between sustainability and performance while Revelli and Viviani (2015) found no relation. They highlighted that analyses on real funds show a negative relationship whereas theoretical portfolios (i.e. created by the researchers) have positive performance (maybe due to an absence of costs).

However, Capelle-Blancard and Monjon (2012) and Revelli and Viviani (2015) stressed out in their literature review article that many results are data driven. Thus, it is complicated to come up with a clear conclusion on the performance of SRI. Performance depends on how the strategy is applied and on which basis the sustainability is assessed. This sustainability assessment is very heterogenic as explained in the following section.

II.5. Sustainable indicators and their reliability

For financial criteria, investors can rely on well-developed optimization tools to perform their portfolio allocation. The application of sustainable criteria is more blurred. Three main reasons for the heterogeneity of sustainable assessment can be identified. First, there is no clear sustainable investor profile. In contrast, financial criteria are mainly driven by the principle of the highest return for a certain level of risk depending on investors' preferences. Secondly, while the disclosure of financial information is well established, there are not yet common standards on disclosure of sustainable information. Thirdly, the sustainable impact is driven by the companies' activities which complicate comparisons across industries.

Sustainable disclosure and international development

As investments in sustainable funds increase with the disclosure of sustainable information (Barreda-Tarrazona et al., 2011), there is a strong need for the development of sustainable disclosure. Organizations and governments are pushing for the development of common disclosure. For instance, the SASB[18] is developing sustainable accounting standards specific to industries to enhance the quality of sustainable disclosure (SASB, 2020).

Currently, large public-interest companies have the obligation of non-financial reporting since 2018 (under directive 2014/95/EU). The non-financial reporting concerns the environmental protection, the social responsibility and treatment of employees, the respect for human rights, the anti-corruption and bribery and the diversity on company boards. However, this non-financial reporting fails to cover all aspects of ESG disclosure required to issue a rating.

[18] Sustainable Accounting Standards Board

European authorities are currently developing taxonomy with legislative power. Following the work of a technical expert group ("TEG") in July 2018, the European Parliament adopted a taxonomy regulation (COM (2018) 353) in December 2019 which establishes *"the criteria for determining whether an economic activity is environmentally sustainable for the purposes of establishing the degree of environmental sustainability of an investment*" (EC, 2019, p.31). In March 2020, the TEG has published its technical report that set technical screening criteria for sustainable investment. This report shall be translated into regulation. The goal is the application of two out of the 6 objectives by 2021 and the 4 remaining objectives by 2022[19].

The TEG report on taxonomy (European Commission, 2020a) proposes disclosure requirements for companies defined in the Directive 2014/95/EU. The TEG proposes the disclosure of the proportion of turnover and the absolute amount of CAPEX (and OPEX) aligned with the taxonomy. Specific rules have been developed for financial market participants. The technical report suggests the disclosure of the proportion of investments aligned with the taxonomy, the contribution of investments and how the taxonomy has been used to determine the sustainability of the investments.

Besides these disclosure requirements, the TEG has developed (principle-based and industry-specific) screening criteria in line with the climate change mitigation and climate change adaptation (two of the six objectives pursued by sustainable investments). The companies subject to the disclosure should ensure that they respect the screening criteria[20].

To conclude, sustainable reporting is currently at is early stage. Forthcoming regulation will force companies to increase their sustainable disclosure in the coming years.

In order to include sustainable information, assets managers can use raw data (e.g. annual reports, press releases, etc) or use ESG ratings which summarize the sustainable performance. Based on their survey, van Duuren et al. (2016) found that assets managers mainly use ratings due to resource constraints. Besides, they reported that managers use red flagging to determine the non-ethical stocks. The ESG rating agencies provide sustainable indicators to companies and to investors as described in the following section.

[19] The two first objectives are climate change mitigation and climate change adaptation. The four other objectives are sustainable use and protection of water and marine resources, transition to a circular economy, pollution prevention and control, and protection and restoration of biodiversity and ecosystems.

[20] This would ensure that other objectives are not harmed and that minimum safeguards (i.e. standard about business and human rights) are respected.

The usage and development of ESG Rating

Sustainable ratings began in the early 80s with the inception of different sustainable rating agencies (notably Eiris and KLD). Since then, the market has continued to flourish. In 2013, Novethic highlighted the heterogeneity of the ESG rating market as they found 40 different rating agencies ranging from international to local players and from financial providers to specialized agencies. Global providers such as Morningstar, MSCI, Bloomberg and Eikon Thomson Reters became mainstream ESG rating providers. In August 2016, Morningstar launched its sustainability rating on mutual funds. More recently, Moody's and S&P entered the market through acquisitions in 2019 (Financial times, 2019 and Les Echos, 2019). In contrast with credit rating, ESG agencies revenues are steamed from investors and not from the companies (Novethic, 2013). ESG agencies developed their own methods which explain the heterogeneity in ratings (Chatterji et al., 2015). Nevertheless, Novethic (2018) pointed out that the development of SRI and regulatory requirements may push agencies to adopt a common framework.

Some academics point out the shortfalls of ESG ratings. Chelli and Gendron (2013) criticized ratings as the usage of number (or letter) does not provide a full picture of the ESG profile of companies to investors. Avetisyan and Hockerts (2017) highlighted that consolidation between market players was driven by financials (economies of scales) and market share motives that can reduce the quality of ratings (due to reduced costs) and motivation of employees.

Primary users of ratings are investors. As shown by Ammann et al. (2018), funds that received high sustainable scores from Morningstar (especially retail funds) attracted more inflows. Moreover, they found that investors divest from low rated funds. Besides, academics have assessed theimpact on companies' behavior. Based on their interview study, Scalet and Kelly (2010) pointed out that rating agencies do not help companies to tackle their CSR issues. But, Chatterji and Toffel (2010) discovered that ratings influenced firms and their managers. By analyzing companies' responses to KLD scores, they observed a higher improvement in environment performance for low score companies compared to the other companies. Clementino and Perkins (2020) have assessed the impact on Italian companies and identified four different responses (active conformity, passive conformity, active resistance and passive resistance) depending on the engagement and the compliance towards ratings of companies.

The reliability of ESG Rating

Researches pointed out the lack of consensus among ESG agencies and therefore questioned the reliability of rating as sustainable indicators. Scalet and Kelly (2010) pointed out that the heterogeneity across agencies results from different weights and factors as each agency has its own methodology. Chatterji et al. (2015) found a lack of consensus between major rating agencies[21] mostly due to a lack of theoretical frameworks (i.e. ESG definition) and measurements (e.g. measurements, factors weight, etc). Dorfleitner et al. (2015) confirmed this lack of consensus between Bloomberg, Asset4 (Refinitiv) and KLD due to similar underlying reasons, namely, difference in methodologies, different factors and weights used to determine thematic scores. More recently, Berg et al. (2019) found a low correlation between five agencies[22]. They identified three sources of divergence: the scope (i.e. the difference in the factors considered), the weight of factors and the measurement divergence (i.e. when different agencies measure the same factor differently). In contrast, Semoneva and Hassel (2015) found a convergence of environmental ratings between KLD, Asset4 and GES on US companies between 2003 and 2011. At the fund level, Utz and Wimmer (2014) have reconstructed the ESG rating for funds based on Asset4 and Bloomberg ratings. Whereas conventional funds are equally spread across ratings, they found that sustainable funds were less distributed in the lowest quantile but their distribution does not increase with the quantiles.

However, these differences can be explained by specificities of the ESG market. Rating agencies being private organizations, they should use different methodologies for differentiation purposes. Negro et al. (2011) showed that the willingness of members of the same category to have their own identities can lead to a lower consensus between them. As ESG agencies are private organizations, they indeed need their own identity. Windolph (2011) highlighted that this heterogeneity in the ESG market is driven by the competition between agencies and the complexity (i.e. difference in the ESG concept between stakeholders).

Besides this lack of convergence, some interesting relation with ratings have been found. Di Giuli and Kostovetsky (2014) observed that the presence of Democrats as CEO or directors or the establishment of headquarter in democratic state is associated with higher KLD ratings and higher CSR spending. Baldini et al. (2018) have found that ESG disclosures practices vary by country due to differences in political, labor and cultural systems and by firms' visibility (i.e. analyst coverage, cross listing, etc). However, this country influence differed across pillars.

[21] KLD, Asset4, Innovest, DJSI, FTSE4Good and Calvert
[22] KLD, Vigeo-Eiris, RobecoSAM, Sustainalytics and Asset4

Furthermore, Drempetic, Klein and Zwergel (2019) found that larger firms obtained higher ratings explained by a larger amount of resources dedicated to the disclosure of sustainable information. Moreover, they observed that firms in unethical industries such as defense, tobacco and gambling are associated with higher scores. This raises questions on the ability of ratings to reveal the real sustainability performance of firms. Chatterji et al. (2009) indicated that ESG ratings (provided by KLD) are able to aggregate past environmental information. The net environmental score[23] was indicative of future environmental events such as pollution and penalties but has a lower explanatory power than the historical emissions and fines.

The current situation on the ESG market is thus the result of a lack of regulation, competition between private agencies and consolidation between agencies. These biases are surprising and will be studied as part of the second research question.

II.6. Potential impacts of sustainable indicators

ESG ratings aggregate information from three distinct pillars, namely, the environment, the social and the governance. In past decades, academics have studied the specific relations between these pillars and firms. As ESG ratings should reflect the same information, one could question the possible extension of the findings to ESG ratings. The findings on the individual impact of the three pillars on firm performance and behavior are detailed hereunder.

Environment

The Environment pillar encompasses the impact of the firm on its environment by measuring among other things emissions and usage of resources. Alongside the development of SDG goals and the Paris Agreement, more and more companies now integrate their environmental footprint in their decision-making. For instance, Microsoft (2020) has announced in early 2020 its objective to become carbon negative by 2030. Nestle (2020) has integrated four SDG goals into its strategy. Moreover, as part of the European Emission Trading System, firms have to integrate their emissions to avoid excessive cost (European Commission, 2020d).

In 1999, Klassen and Mclaughlin found in their event studies that firms receiving environmental rewards overperform while firms embroiled in environmental crisis underperform in the market. This is supported by potential higher gains (thanks to higher margins, higher market shares and environmental certifications) and lower costs (thanks to better processes, avoidance of environmental fines and reduced usage of raw material). Yamashita et al. (1999) have

[23] Defined by KLD as environmental strengths ratings minus environmental concerns ratings

reported that firms with the worst environmental performance (as measured by Fortune Magazine's environmental score) underperform while the best environmental firms overperform the market.

More recently, Chan and al (2014) found evidence that green firms (i.e. included in green ETF or indexes) have higher returns in the context of initial public offerings (IPO) or seasonal equity offerings (SEO). They reported a positive alpha (a 'green premium') of 7% for environmental friendly firms per year. Derwall et al. (2005) have found overperformance of a long-short strategy based on eco-efficiency score provided by Innovest.

Social

The Social pillar encompasses the impact of the firm on society notably on the customers and the workforce by measuring among other things the reputation of the firm, the respect of human rights and the diversity in the workforce. Researchers have found that employees and customers satisfaction influence firm performance.

On the one hand, employees are influencing the production and have access to material nonpublic information. Edmans (2011) pointed out that employees' satisfaction can be considered as intangible value. He found that a portfolio composed of employees friendly firms can gain a significant positive alpha. Green, Huang and Wen (2019) reported an influence of Glassdoor ratings on stock performance. This rating effect was positive in case of rating improvements. This effect was stronger during the first years of ratings and when issued by headquarters' employees. They explained this relation by the possession of non-public information by employees. This correlation between Glassdoor ratings and stock performance corroborates with the findings of Sheng (2018). He found that employee reviews predict cash flow surprises and indications that hedge funds and short-sellers are using these ratings. Even if employees possess material nonpublic information, these information are not reflected in stock prices. First, employees are refrained to use this information as insider trading is forbidden in many countries. Moreover, the ability of employees to use adequately this information is questioned as Benartzi (2001) found that employees overinvest in their company stocks (as opposed to the diversification rule) and this over exposition is not correlated with future performance.

On the other hand, customers (and more generally the community) play a crucial role on firm's sale and reputation. Academics have carried out studies on the relation between stock returns and customers' satisfaction ("CS"). Even though a positive relation emerges from these studies

as reported by Fornell et al. (2016), there are still debates on this question and on the measurement of CS. Some studies found that CS is a leading indicator of future performance (Aksoy et al. 2008, Anderson et al. 1994) and an indicator of earnings surprises (Fornell et al., 2016) while Ittner et Taylor (2008) found that long terms returns could not be predicted with CS. Most of studies have relied on American Customer Satisfaction Index. Besides, Huang (2018) found that firms with positive customer reviews overperform firms with bad customer reviews and that customers reviews can anticipate earnings surprises.

Governance

The Governance pillar covers the management practices, the involvement of shareholders, the equal treatment of shareholders, the implementation of CSR strategy, etc. While the effect of the CSR strategy has already been discussed, other aspects of governance influence the firms and their performances.

Based on 24 shareholder rights, Gompers et al. (2003) reported that "*firms with stronger shareholder rights had higher firm value, higher profits, higher sales growth, lower capital expenditures, and made fewer corporate acquisitions*" (Gompers et al., 2003, p.107). However, authors are cautious on affirming the causality relation between performance metrics and governance. Core et al. (2006) have confirmed this relation between poor governance and poor operating performance. However, they found no causality effect of governance on performance supported by no surprise on forecast errors, no higher probability of takeovers and no impact of capital expenditures and acquisitions announcements. Restricted to Islamic banks, Nawaz (2017) found that investments in human capital, board size and CEO power positively influence market performance.

These studies have shown that a good environmental, societal or governmental profile can lead to overperformance. Nevertheless, the aforementioned academics have studied the impact of individual factors (such as the environmental scores of the Fortune's magazine, employees satisfaction measured with Glassdoor ratings, the customers' satisfaction, customers' reviews, the shareholder rights, etc.) on performance. In fact, global and pillars ratings aggregate information provided in these specific indicators and therefore abovementioned results may be extended to ESG ratings. The extension of these findings to ESG ratings and their pillars ratings will be studied as part of the third research question.

Now that the SRI environment and its specificities have been set, the three research questions driving this thesis will be detailed in the following section.

III – Research questions

This master thesis is built around three research questions ("RQ"). While the first research question will be answered from a qualitative perspective, the second and third research questions will be answered from a quantitative perspective.

III.1. RQ1: On which basis are ESG ratings derived?

There is an overall consensus on what ESG means. However, the underlying drivers of ratings are still blurred. This raises the following questions: how are rating constructed? how do agencies differ in their methodologies? The first research question will provide an overview of the ESG market and an analysis of the methodologies used by most popular agencies.

This research question aims at shedding light on the reliability of ESG ratings by analyzing and comparing different methodologies. It will also provide the ESG background requisite to answer the second and third research question. Moreover, this question will also provide insights on some findings described in the literature review such as the lack of convergence. To answer this question, a review of methodologies and case studies will be conducted.

III.2. RQ2: Are ESG ratings subject to significant biases?

Besides the increasing usage of ESG ratings, academics have found biases in ratings. The effect of size, location and political influence reported in section II.5 of the literature review and the observation of a learning effect in the data section raises questions on the reliability of ratings. The second research question will identify and explain biases Refinitiv's ratings.

This research question aims at questioning the reliability of ESG ratings by testing the presence of biases. To answer this question, panel regressions will be applied.

III.3. RQ3: Do ESG ratings provide material information leading to overperformance?

One the one hand, existing literature established a link between factors included in ratings (e.g. corporate reviews) and firms' performance. If ratings are reliable, they can mimic these specific indicators. One the other hand, some studies reported overperformance of portfolios constructed with ratings. This third research question will test these findings by integrating the biases identified in the second research question.

This research question aims at testing the reliability of ESG ratings in the context of overperformance assessment. To answer this question, Fama-French regressions will be conducted on portfolios constructed with ESG ratings.

IV – RQ1: Qualitative analyses and findings

In this section, a description of methodologies used by rating providers and a case study analysis will be conducted. This section precedes the data and methodology sections as this first research question is useful to better understand the underlying trends in the ESG rating market.

ESG ratings flourished in the early 80s with the inception of different private agencies covering individual companies (Avetisyan and Hockert, 2017). Among main agencies, Sustainalytics, MSCI and Refinitiv (Thomson Reuters) databases currently cover respectively 11,000, 7,500 and 7,250 listed firms worldwide. To derive ratings, agencies rely on hundreds of metrics from annual reports, company website, news and NGO websites, etc. Generally, these raw values are then aggregated into categories that compose the three pillars (ESG). The final ESG score is the weighted average of pillars and can be subject to adjustments (e.g. involvement in scandals).

In line with the literature review, there is a consensus on the definition of ESG across agencies. However, as investors (and their different SRI strategies), sustainable agencies differ in the practical implementation of the ESG concept. Indeed, there is no agreement on the categories and their weights which results in different ratings.

According to the survey conducted as part of the 2019 issue of "Rating the Raters" (Wong et al., 2019), there was an estimated total of 600 ESG ratings globally in 2019. An exhaustive review is therefore not possible as this is a fragmented market composed notably of solicited and unsolicited (minority) ratings, pillars-specialized or global ratings, international or local agencies or more recently global data providers and credit rating agencies through acquisitions (Novethic, 2013 and 2018). Instead, only a few agencies will be investigated.

Respondents of the 2019 Sustainability Survey considered RobecoSam (recently acquired by S&P), MSCI, CDP and Sustainalytics (acquired by Morningstar) as the highest quality rating providers. Therefore, this section will explain the methodologies of the aforementioned agencies. Moreover, as this master thesis will rely on the data provided by Refinitiv, the Refinitiv's methodology will also be described.

Alongside firm ratings, some providers offer ratings for funds which are weighted averages of portfolio asset's scores. Since 2016, Morningstar publishes ESG rating based Sustainalytics ratings. A second provider at the fund level is MSCI that offers ESG rating for c. 36,000 funds.

IV.1. Agencies overview

RobecoSAM - S&P

RobecoSAM was founded in 1995 in Switzerland. At the end of 2019, the rating capabilities of RobecoSAM were sold to S&P Global. Leveraging on the data provided following the acquisition, S&P offers ESG Evaluation and Global ESG Scores (launched in 2020).

The Global ESG Scores covering 7,300 companies are provided on a 100-point scale derived from more than 1,000 data points, 100 questions and 61 industry-specific approaches. These data points are classified on average 23 industry-specific criteria scores and weights.

Besides Global ESG Scores, S&P offers an ESG Evaluation that is meant to be forward-looking and to reflect risks and opportunities. The ESG Evaluation is the combination of the ESG Profile and the Preparedness. While the ESG Profile reflects the exposure to risk and opportunities and is based on an ESG Risk Atlas specific to industries and geographies, the Preparedness reflects the adaptation and anticipation taken by the company in line with its long term risks and opportunities.

As an indicative rule of thumb, firms with high final scores have Best-In-Class or Strong Preparedness. Best-In-Class and Low Preparedness are rare but have a significant impact on final scores. In addition, Best-In-Class is not likely to compensate Low ESG Profile. (S&P, 2020b).

ESG Profile

The ESG profile is a weighted average of the environmental (30%), social (30%) and governance score (40%). Each pillar is driven by 4 factors and reflects current and near-term exposure to ESG risk and opportunities. A high score reflects lower ESG exposure.

The final scores are a combination of the pillar scores. For each pillar, material issues are "*the ones that could potentially lead to a material financial impact on the entity, either directly or indirectly*" (S&P, 2019 p.5). Each pillar score is subject to adjustments specific to the company.

The Environmental Score reflects the sustainability of the firm regarding environmental risks and opportunities and is specific by industry or sector. First, S&P derives a score specific to the industry and the region, called "blended sector-region score". Then, S&P determines how the company behaves compared to similar companies for each of the four factors (i.e. Greenhouse gas emissions, waste, water and land use). The final Environment Score is the combination of the four factors (with sector-specific weights) and the blended sector-region score. A

breakdown by sector or by region of revenues is possible in order to adequately describe the company.

The Social Score reflects the sustainability of the firm and its stakeholders regarding the risks and opportunities on its social license and is specific by industry or sector. S&P defines the social license as "*the continuous acceptance of an entity's practices by the public*" (S&P, 2019 p.8). The Social Score is computed with the same process as the Environmental Score.

The Governance Score reflects the likeliness of a governance failure on a global basis. The blended sector-region score is replaced by a jurisdiction based score (based on the location of the headquarters). As other pillars, specific company scores are computed based on four factors. In contrast, the Governance Score focuses on companies' characteristics and not on sector attributes.

ESG Evaluation - Preparedness

Whereas the ESG Profile is mainly data-driven, the Preparedness is based on qualitative data obtained from among other things meetings with the company management and board representation. The Preparedness reflects the expected ability of the firm (notably the management and the board) to react to adverse ESG changes.

The preparedness is measured based on five factors of which three capabilities and two embeddedness factors. Each factor is measured through "*the role and impact of the oversight or governing body and senior management*" (S&P, 2019, p.15) and is set on a three-point scale (Developing, Good and Excellent). The Preparedness is assessed on 5-point scale: Best In Class, Strong, Adequate, Emerging, or Low.

Awareness reflects the identification of risks and opportunities by the management. Out of the five factors, awareness is considered as a prerequisite of high Preparedness and has therefore the highest weight. Assessment is the analysis of the impact of the identified risks and opportunities on the strategy and the operations. Action plan reflects the management, mitigation and exploitation of the risk and opportunities. The two following factors are embeddedness factors and therefore focus on the ability to adapt to change. Culture is a bottom-up factor and reflects the alignment of the long term strategy and the corporate culture of which the ability to integrate feedback from stakeholders. In contrast, decision-making is a down top factor and reflects the integration of strategy (and especially ESG) in management decisions through an assessment of past decisions.

MSCI

MSCI Companies Ratings

MSCI is an ESG rating provider for more than 15 years. While its initial coverage focused on MSCI indexes constituents, the firm considerably expanded its offer following the acquisition of GMI in 2014 (MSCI, 2014). As of September 2019, MSCI was covering over 8,300 companies (MSCI, 2019a). Since November 2019, MSCI has made publicly available[24] the ratings of 2,800 companies (MSCI, 2019b).

MSCI Ratings are provided on a 7-letter scale or on a 0 to 10 scale. Ratings are weighted average of the pillars. The pillars are made of 10 different themes (4 for the Environment, 4 for the Social and 2 for the Governance). These 10 themes are driven by a total of 37 ESG key issues. The weights of issues are industry-specific depending on the potential contribution (i.e. impact by the industry on the issue) and its time horizon (i.e. expected materialization).

MSCI ESG scores are derived on over 1000 data points. The final ESG score is a weighted average of the three pillars and is industry adjusted. The industry adjustment takes into account the rolling 3 years average of the top and bottom scores.

Key issues scores depend on the exposure to risks and opportunities and their management. For low exposure risks or opportunities, high management is not necessary to achieve a high score. Key issues scores are computed by considering the breakdown of the business. Moreover, ratings are subject to adjustments to reflect involvement in controversies.

In contrast with other themes, the corporate governance theme is computed differently. From the maximum score, MSCI applies deductions reflecting key metrics on the boards, the salaries, the ownership & control and the accounting.

MSCI Fund ratings

Besides corporate ratings, MSCI offers ESG ratings over 36,000 mutual funds and ETFs by leveraging its MSCI ESG ratings available on companies. To derive fund ratings, MSCI applies three criteria; a minimum coverage of holding securities (65%), the availability of funds holdings (less than 1-year-old) and a minimum number of securities (10). The ESG fund ratings are computed first with a weighted average of securities scores (excluding missing values). A trend adjustment is then applied and is reflecting the difference between positive and negative trends and the presence of laggards.

[24] On this website: https://www.msci.com/esg-ratings/

Sustainalytics (Morningstar)

Sustainalytics is a major ESG rating agency for over 25 years and covers over 11,000 companies (Sustainalytics, 2020). Following a minority stake in 2017, Morningstar completed in 2020 the acquisition of remaining shares (60%) of Sustainalytics (Morningstar, 2020).

Sustainalytics provides absolute risk ratings implying that ratings can be compared across industries. Risk ratings only include material risks (i.e. those that can have an impact on the economic value). Sustainalytics dissociates the risk exposure and management.

Risk ratings reflect the unmanaged ESG risk for the different issues identified. Corporate governance is a unique common issue across all industries and accounts for c. 20% of the final score. Then, material ESG issues are assessed. These issues are specific to the business model and business environment of the company. These specific company issues can become material issues for the company and be included in the overall unmanaged risk.

Other critical components are the subindustry exposure, the issue beta, the manageable risk factor and the management score. The subindustry exposure reflects the materiality of the issue and is determined based on quantitative data, sustainable reports and in-house expert views. In line with the financial concept, the issue beta reflects the company's exposure to the key issue identified. Beta indicators are used to determine the beta of each company within the sub-industry such as the total subindustry beta is equal to 1. The manageable risk factor reflects the potentially manageable part of the risk issue and is specific to the company. Management scores are the management of the manageable risk of the firm. As shown in the figure in the appendix, the unmanaged risk of an issue is the difference between the company exposure and the management risk (or equivalently the sum the unmanageable risks and the management gap). The final score is then the sum of unmanaged risk for different issues.

Morningstar Fund ratings

Since 2016, Morningstar has offered ESG funds ratings based on Sustainalytics ratings. Morningstar has also switched from ESG Rating to ESG Risk Rating for its funds. This has two major implications: (1) ESG risk ratings are not normalized across industries and can be compared globally, (2) ESG risk ratings focus only on material issues (Morningstar, 2020).

First, a holding-based weighted average of ESG risk ratings is computed. The historical portfolio sustainability score is then computed as the weighted average of the portfolio sustainability scores for the last 12 months. Finally, the sustainability ratings on a five-point scale are assigned based on percentile ranks within the fund's Morningstar global categories.

Refinitiv (Thomson Reuters, Asset4)

In 2009, Thomson Reuters acquired Asset4, founded in 2004 in Switzerland, to provide ESG data and ratings to its users (Reuters, 2009). Following the sale of 55% of shares of the Financial and Risk business of Thomson Reuters, Refinitiv distributes ratings and covers currently over 8,000 companies (Reuters, 2018).

Refinitiv ratings are given as the overall ESG score or combined ESG score. The overall ESG score of a company is a weighted average score of the three pillars. The combined score is the ESG score adjusted by a controversy factor (reflecting involvement in non-ethical behavior).

Rating process

Refinitiv derives the ESG and ESG combined scores from more than 450 metrics (Refinitiv, 2020). These metrics are aggregated into different categories which compose the pillars and the controversy factors.

The ESG score is the weighted average between the score of each pillar. This score can be seen as a weighted average of 10 categories. As each category can fall only in one particular pillar, the weights of pillars are the sum of the weights of categories composing the pillar. Furthermore, the weights of each category are variable across industries. For instance, the industry of leisure products has an emission weight of 4% whereas the coal industry has an emission weight of 20%.

Categories' weights depend on their materiality. The weight of a category is the ratio of the materiality factor of the category for the industry divided by the sum of all materiality factors across categories. The materiality factor is the average materiality factor of data points composing a category: it is the industry median for numeric data points divided by the sum of all industries median and the percentage of disclosure in the industry for boolean data points. However, materiality factors are fixed across industries for the community category and depend on the number of data points for the governance categories.

Category scores are derived from many indicators and are percentile scores. The indicator are also percentile score and is computed by applying the following percentile score formula:

$$\frac{\#\ firms\ with\ worse\ value + \frac{\#firms\ with\ same\ value\ including\ the\ current\ one}{2}}{\#\ firms\ with\ values}$$

The category percentile score is obtained by applying the percentile score formula on the sum of percentile score of indicators. Only indicators available and relevant for a particular industry are used to determine the score of a category. For the environmental and social pillar, each

indicator is a percentile score within the TRBC industry group of the company. For the governmental score, the benchmark is the country.

As a consequence of using percentile score, some companies active in ”unethical” industries will receive good ratings if their ESG behavior is better than other firms of the industries. For instance, a tobacco company may receive a A grade from Eikon Reuters. However, this is a common practice among ESG rating agencies. And, this is applied too by the best-in-class strategy which invests in the best ESG companies of an industry.

The combined ESG score is the ESG score adjusted by a controversy factor. This factor is derived from 23 ESG topics reflecting the impact of scandals and unethical events. When the controversy score is below the ESG score, the ESG combined score is the average of ESG and controversies score. Otherwise, the ESG combined score is the ESG Score.

CDP

In contrast with other agencies, CDP is a US-based non-profit organization that aims at promoting a sustainable economy by fostering the disclosure of ESG-related information. CDP assesses the sustainability of over 8400 firms, 800 cities and 120 states and regions.

A second difference with other agencies is the source of revenues. CDP has financial support from donators (in US) or from grants (in Europe) and from subscription services. For instance, CDP offers services to companies in order to help them disclose information. Moreover, CDP sells its data to rating agencies such as Oekem, Bloomberg and MSCI. Besides, they gives free access to information such as emissions data (i.e. scope 1, 2 and 3).

Thus, CDP is different than other providers. But, it provides insights on the plethora of actors active on the ESG rating market and their relations.

Concerning ratings, CDP does not provide a global score and instead provides three scores on climate change, water security and forests. CDP scores are provided on a 9 letter scale. The scores are derived from a questionnaire answered by companies (CDP, 2018). The questionnaire is specific by sectors but a firm is assessed only for its primary sector. The three scores (i.e. climate change, water and forest) are broken down into categories reflecting key data points of each sector. Each category has a relative weight-specific by sector. Moreover, to obtain a “A” score, CDP has set specific criteria for each score such as the disclosure of scope 1 and 2 emissions, complete information on the supply chain, etc.

IV.2. Case studies: a comparison of ratings

In this section, ratings of sample companies will be compared with an illustrative purpose. Companies are chosen based on the availability from RobecoSAM and from Sustainalytics. The comparison is carried out with the ratings of MSCI (2,800 MSCI ratings are available freely) and Refinitiv (HEC Liege's has access to Refinitiv). Some extracts are available in appendix.

Case Study 1: RobecoSAM – MSCI – Refinitiv

Unilever: Consumer goods company based in the United Kingdom and in the Netherlands

RobecoSAM and MSCI overall agree on the good ESG profile of the firm. Even if the ESG Score (A+) is in line with the two other agencies, Refinitiv has identified significant controversies lowering the combined score. Therefore, there is a different judgment between RobecoSAM (Best-In-Class Preparedness) and Refinitiv (C- controversy score). Refinitiv has identified controversies in working conditions, product quality and responsible marketing. In contrast, RobecoSAM considered Unilever's preparedness as Best-In-Class due to the inclusion of EGS factors in the long-term strategy, stable strategy even with a change in CEO and analysis of the impact of ESG factors.

There are also differences between RobecoSAM and MSCI. RobecoSAM considers the safety management (including work safety, product safety and food safety) as strong while MSCI classifies the product safety and quality as ESG Laggard.

Repsol S.A.: Energy company based in Spain

Repsol S.A. is a good example of the effect of normalization of ratings. At first sight, RobecoSAM seems less positive than the two other providers. In its methodology, RobecoSAM starts from an industry score and then applies adjustments to reflect the performance of the firm. As Repsol is active in the Oil and Gas industry, the lower score is driven by low industry environmental and social scores. As MSCI and Refinitiv normalized scores by industry, Repsol achieved high ESG scores reflecting its competitive ESG positioning.

Repsol S.A.'s case also highlights the difference in pillars weighting. While RobecoSAM uses fixed weights. Refinitiv uses industry-specific weights and puts more weight of the S and G components for the Oil & Gas Refining and Marketing segment. MSCI uses varying weights but does not disclose weights on its free platform.

NextEra Energy INC: Sustainable energy company based in the United States

RobecoSAM and MSCI consider NextEra Energy INC as a leader in its industry. In contrast, Refinitiv has positive but not as good views as NextEra is the 24th firm out of 132 active in the electric utilities segment. However, the high controversy score (which is good) of Refinitiv is in line with the two other raters.

Moreover, there is a convergence on the environmental position. RobecoSAM points out an outperformance of peers thanks to high water recycling, low use of carbon and investments in renewable energy. MSCI recognizes NextEra as a leader in carbon emissions, water stress and renewable energy. Refinitiv has rated the environment position of NextEra as A-.

Case Study 2: MSCI - Sustainalytics – Refinitiv

Qualcomm: Telecommunication (semiconductors) company based in the United States

In contrast with other ratings, low Sustainalytics ratings imply better ESG positioning. With a score of 20.2, Qualcomm is nearly in the low-risk category (ranging for 10 to 20).

Sustainalytics and Refinitiv consider Qualcomm as an average ESG performer in its industry. Sustainalytics classifies Qualcomm as the 42nd firm out of 123 in the hardware equipment and Refinitiv as the 42nd firm out of 71 in the semiconductor industry. In contrast, with a B score, Qualcomm is in the lowest 30th ESG percentile according to MSCI. Sustainalytics and Refinitiv are aligned on the involvement in controversies. Sustainalytics reported weak business ethics (related to licensing business strategy, poison pill strategy, etc). Refinitiv identified 14 anti-competition and 8 intellectual properties controversies.

IV.3. Conclusion

This review of these ESG ratings providers has shown the plethora of methodologies and their implications. While there is an overall agreement on the good or bad profile of the firms, their significance differs across agencies. Indeed, the strength of this assessment differs across agencies. For instance, RobecoSAM is more positive on the ESG profile of Unilever and Refinitiv is less assertive on the good ESG profile of NextEra (in appendix). Moreover, the underlying drivers of the ratings are varying among agencies. While each agency acknowledges that issues are specific to region and industry, their weights and their selections differ. RobecoSAM uses stable weights for each pillar for all firms. But, MSCI, Refinitiv and Sustainalytics use varying weights (see Unilever, Repsol and NextEra cases).

Moreover, as shown in the summary table (see appendix), the components of each pillar differ across agencies. This implies different impacts of the themes. For instance, water and land use are dissociated for RobecoSAM while Refinitiv includes both in its resource used theme.

However, each of agency recognized the uniqueness of the governance pillar. First, as governance is a global concept significant for all firms, none agency normalizes it by industry. Instead, agencies compare governance globally or based on its geography.

Another key aspect is the normalization of ratings. RobecoSAM and Sustainalytics provide a global score implying that unethical industries have lowest ESG profile. In contrast, MSCI and Refinitiv provide normalized scores implying that unethical firms can obtain high scores. This has consequences for investors. On the one hand, investors should be aware of this normalization for the implementation of the best in class strategy. Investors should compare non-normalized scores by industry. On the other hand, the comparison of normalized scores is complicated and does not reflect the ESG risk taken when investing in these firms. An oil firm with a high environmental rating has certainly still more exposure on the environment than a service provider firm with low environmental rating. This need for comparability was one of the reasons for the switch towards risk rating (not normalized) by Sustainalytics.

MSCI and Refinitiv ratings are available for several periods and their evolution is interesting to analyze. Surprisingly, the four companies of the case studies have stable MSCI ratings. This raises questions on the integration of recent news. Refinitiv ratings are more volatile as a result of the controversies adjustments. For instance, Unilever's MSCI Ratings have remained stable at A since June 2016 while Refinitiv attributed an A score between 2013 and 2018 except in 2014 and 2018 (score of B-) due to lower controversies score. Nevertheless, MSCI does adapt its ratings as shown by the evolution of Tesla's rating (AAA in 2017, AA in 2018 and A in 2019 and 2020). In contrast, Refinitiv remained stable and has attributed a C score to Tesla between 2014 and 2018. The different trends in change of ratings raise questions on their reliability. As ratings are derived on the same data, one could expect that change in ratings would be aligned across agencies.

In conclusion, ESG rating agencies offer the same solution with different features and characteristics. Sustainalytics has a clear positioning and offers insight on the ESG risk exposure and its management. Similarly, RobecoSAM offers an ESG Evaluation which is tempered thanks to the forward-looking Preparedness. MSCI and Refinitiv are closer to each other as they provide ESG ratings reflecting the ESG profile of the firm. Investors have to choose, in this plethora of ratings, the rating that fits their personal appreciation of how companies should be rated for ESG performance. The current consolidation trends and the possible regulation in Europe of ESG ratings (2020 EC consultation) can lead to more convergence in the coming years.

V – Data description

V.1. Introduction

As part of the second and third research questions, quantitative analyses will be conducted on ESG ratings provided by Refinitiv. These ratings were retrieved from the Eikon Desktop and the Eikon API. The list of rated firms was retrieved from the Eikon Desktop. And time series of ratings was then retrieved from the Eikon API. As part of this section, the year of ratings corresponds to the year of ratings issued (which include different month ranging from January to December). The scores are provided in numerical value between 0 and 100 or on an ordinal scale ranging from D- to A+ (for a total of 12 categories). More details are provided in appendix.

V.2. Descriptive statistics

The analysis is first conducted at the global level and then at the European and the U.S. level.

V.2.1. Global level

Since the first year of ratings (2002), the coverage increased each year as shown below. In CY 2018, 6709 ratings have been issued. 2019 is a partial year as not all firms have yet received their ratings (only 3267 as of June 2020).

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
N	508	578	1009	1356	1419	1587	1903	2203	2667	2880	2993	3141	3245	3961	4819	5574	6709	3267

Table 1 : Number of score issued by calendar year globally

Summary table and distribution over years

As explained as part of the first research question, ESG combined scores are industry-specific weighted averages of the three pillars and are adjusted by the controversy factor when the latter is lower than the ESG scores. During the last 5 full years, combined scores had a mean stable around 40% and a standard deviation stable around 19%. At a global level, the governance drives up the ratings while the environmental scores lower the ratings (see table in appendix).

As shown in the figures below, ratings were lower until 2006 due to low environmental and social scores. Moreover, the distribution is skewed to the right in 2018 reflecting a low number of high ratings and a majority of scores below 50.

The reporting score was issued in 2006 and reflects the proportion of activities covered by the rating. However, this ESG metric is not issued for all firms. Less than 10% of firms had a reporting score between 2006 and 2009 and it has increased to c.52% since 2011.

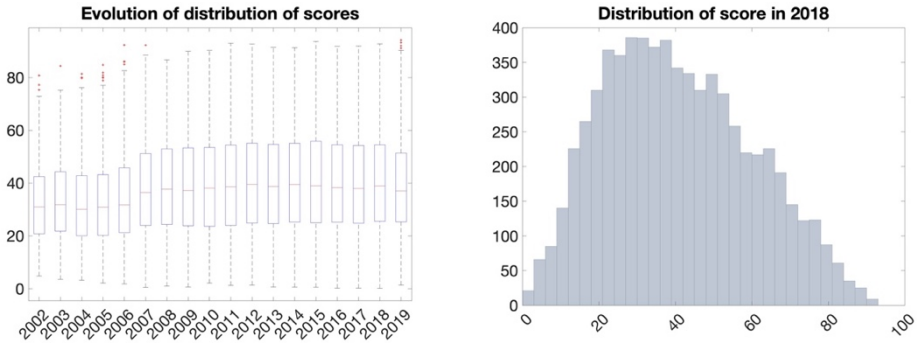

Figure 1 : Distribution of ESG Combined Score

Controversies

As described in the RQ1, the controversy adjustment is one of the main characteristics of the Refinitiv methodology. In the 7207 firms that have received at least one rating since 2002, 1468 (20%) firms have received an adjustment with some firms receive recurring controversies. Out of the 20% of firms that have received at least one adjustment, 33% (resp. 12% and 5%) have received adjustments for more than 25% (resp. 50% and 75%) of their ratings issued.

During the last 4 full years (from 2005 to 2018), c. 7% of the firm had been adjusted each year. Drempetic et al. (2019) observed that firms in unethical sectors obtained higher scores. A parallel could be investigated for the controversy score: do firms embroil in ethical scandals achieved higher ratings? The figure below indicates the adjusted firms have higher non-adjusted ratings.

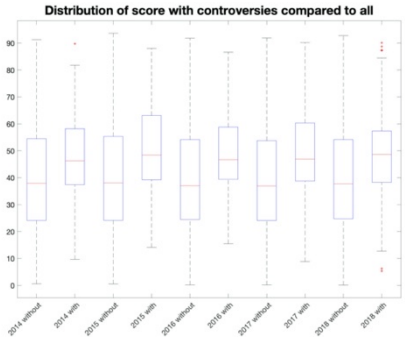

Figure 2 : Distribution of ESG Score without or with adjustment between 2014 and 2018

This raises some questions on the specificities of the adjustment on some countries or industries. However, as shown in the table in the appendix, key statistics suggest adjustments are fairly distributed across industry and headquarters and listing countries. However, there are indications of more controversies (>30%) for firm listed or established in France, South Africa, India and the Netherlands. But this could be a firm-specific effect due to a limited number of observations for these countries.

Correlation

Correlations between the ratings, the controversy adjustments, the three pillars and some explanatory variables (the market capitalization (MC), the price to book ratio (PB), the total assets (TA), the total 52 weeks return (52ret)) can shed indicative lights on their links.

Out of the three pillars, the social score had the highest correlation with ESG or ESG combined ratings and the governance had the lowest correlation. This is in opposition to the importance given by the governance aspect by RobecoSAM and Sustainalytics which consider governance as the most important pillars. The controversy score (taking a value of 100 for firms without controversies) has a negative linear relationship with the non-adjusted score and pillars scores. This corroborates with the findings of the previous sections and indicates that firms with adjustments (low controversy scores) have higher ratings. The controversy adjustment is significantly negatively related to size suggesting that larger firms have more adjustments. However, further analysis is required to establish any causalities between the variables.

There are also indications of a size effect in line with findings of Drempetic et al. (2019) that larger firms have higher ratings. Furthermore, market capitalization and total assets had a correlation of 38% (and null p value) suggesting that these two variables may be redundant and induce multicollinearity in a regression model. These observations (based on the correlation and their p-values) can be extended since 2005.

Distribution by number of issues

An interesting observation of Refinitiv Ratings is the upward shift in the distribution of ratings when the number of ratings issued increases. For instance, the distribution of firms with 11 or 17 issues is left-skewed whereas distribution of firms with less than 5 issues is right-skewed. In other words, firms reporting for several years achieve in general higher ratings than firms reporting for a few years.

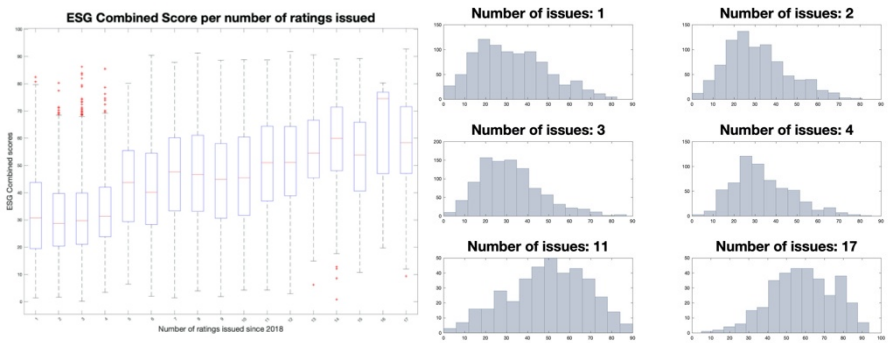

Figure 3 : Distribution of ESG Combined Score across the number of rating issued

There could be several underlying causes. One can argue that the first rated firms are the most sustainable conscious firms. But as the selection of firm is done at the agency discretion, firms that would like to have a rating (i.e. sustainable conscious firms) are not the ones who were rated first. In contrast, a learning process may help firms to increase their rating. Rated firms may have adapted their behavior and/or their reporting in order to achieve higher ratings. Moreover, as agencies first focused on firms in well-established indexes, the first selected firms may have more resources dedicated to ESG than smaller firms.

Distribution by countries and by industries

The database includes 83 different headquarters countries, but only 23 of them have more than 50 observations in 2018. More than 35% of rated companies are from the United States of America. And, China, United Kingdom, Japan and Australia had c. 7.5% of the observations.

Some countries (e.g. France or Brazil) seem to have better ratings than other countries whereas Australia, China and the United States of America have a lower distribution.

Out of the 10 industries, firms active in the financial, the industrial and the Consumer Cyclical sectors are the most represented in 2018 (while other sectors account for less than 10%). The scores are fairly distributed across industries. More details are provided in the appendix.

V.2.2. European level

The analysis conducted at the global level is repeated at the European level in order to test if results can be extended and to detect specificities of European ratings.

Summary table and distribution over years

Many trends of the global level are observed for Europe. The coverage of Refinitiv in Europe has considerably increased in 2018 with the inclusion of 521 new firms. Distribution of ESG ratings has remained relatively stable over time as indicated by their means, medians and standard deviations. In line with the world data, the low ratings from 2002 to 2006 are driven by lower environmental and social scores. Out of the three pillars, the environmental pillars exhibit the lower ratings with the highest variability (standard deviation) as the global level.

Contrary to global data, the social pillar achieves the highest scores and all scores are c. 10 points higher. This should be known if ratings are used to implement a best-in-class strategy globally. Moreover, c. 80% of firms receive a reporting score since 2012 (i.e. 30% more than the global level). As shown in the appendix, the ratings were more symmetrical than the global level.

Controversies

European firms received more adjustments compared to the global level as 455 out of the 1567 European firms (29%) firms have received an adjustment. Some firms received recurring controversies. For instance, out of the 29% of firms that have received at least one adjustment, 34% (resp. 16% and 7%) have received adjustments for more than 25% (resp. 50% and 75%). As the global level, the firms that received adjustments were distributed on higher ratings and controversies are fairly distributed across industry and headquarters and listing countries (excepted few exceptions as indicated globally)., The number of controversies was lower during the last years at the global level. However, the number of European firms involved in controversies each year remained high between 2015 and 2019.

Correlations between variables

As for the global data, the social score had the highest correlation with (ESG or ESG combined) ratings and the governance had the lowest correlation. The findings on controversy factor and size are again observed at the European level. Moreover, these observations (based on the correlation and their p-values) can be extended since 2005.

Distribution by number of issues

At the global level, firms ratings increased with the number of year of reporting and this is also observed at the European level. In the previous section, one possible explanation is that the biggest firms were in the index and therefore have more resources to allocate for ESG management. At the European level, the distribution of the total assets and the number of ratings issued has some similarities with the distribution of the ESG combined score and the number of ratings issued.

Distribution by country and by industry

At the country level, a quarter of European firms have their headquarters established in the United Kingdom (25%) and the second and third most represented countries (c.10%) are Germany and France. Some countries exhibit low or high rating distributions. However, these specificities can be explained by a firm-specific effect as some countries have a limited number of observations. Some industries are over represented. Out of the 10 industries, firms active in the financial, the industrial and the consumer cyclical sectors represent respectively 24%, 20% and 16% of the firms in 2018 (while other sectors account for less than 10%). The scores are fairly distributed across industries.

V.2.3. United States of America

The analysis conducted at the global and European levels is repeated at the U.S. level in order to test if results can be extended and to detect specificities of U.S. ratings.

Summary table and distribution over years

As for the European level, several global trends can be extended to US ratings. However, ratings (mean of c. 35) are lower than the global scores (mean of c. 40) and European scores (mean of c. 48). The difference of ratings could lead to an over exposition towards European stocks when applying a best-in-class strategy with ESG ratings.

Controversies

In line with the global data, 457 of the 2433 American firms (19%) firms have received an adjustment. However, some firms receive recurring controversies. For instance, out of the 19% of firms that have received at least one adjustment, 37% (resp. 15% and 7%) have received adjustments for more than 25% (resp. 50% and 75%) of their ratings issued in line with global and European data. Moreover, while the level of controversy was high until 2014, it remains low between 2015 and 2019 compared to the world and Europe.

Consistent with the global and European observations, the firms that received adjustments have higher ratings than firms without ratings. Concerning industry trends, it seems that firms active in the consumers non-cyclicals (37%) and in utilities (33%).

Correlations between variables

As for the global and European levels, the social score had the highest correlation with (ESG or ESG combined) ratings, the governance had the lowest correlation and high scores are related to controversies (see appendix). The size effect is also present. Moreover, these observations (based on the correlation and their p-values) can be extended since 2005.

Distribution by number of issues

The characteristic of ratings developed by Refinitiv is confirmed at the American level with lower distribution and ratings skewed to the right for firms with a low number of issues.

Distribution by industry

Some industries are again over-represented. Out of the 10 industries, firms active in the financial, the healthcare and the consumer cyclical represent respectively 24%, 16% and 14% of the rated firms in 2018. The scores are fairly distributed across industries.

VI – Methodologies

The second and third research questions required the application of quantitative analysis. The second research question will rely on panel regressions while the third question will use multi-factor models to assess performance. These choices are driven by methodologies used in the relevant papers. Further details are provided hereunder.

VI.1. RQ2: Determinants of ratings

The purpose of the second research question is to examine the influence of firms' characteristics on ratings. Relations have been already established in the literature review such as the political influence (Di Giuli and Kostovetsky, 2014), the location (Baldini et al., 2018) and the size (Drempetic et al., 2019). This research question will test these relations and the ones identified in the descriptive section.

Panel data: definition and characteristics

Panel data are defined as a set of "*repeated observations over the same units (individuals, households, firms), collected over a number of periods*" (Verbeek, 2004, p.341) and is often characterized by few periods and many units (Verbeek, 2004).

In this master thesis, ESG ratings are used as panel data (i.e. observations for each firm over time). ESG ratings have both the characteristics of time series and cross-sectional data. In fact, the evolution of ratings for one firm is a time series while the ratings for all firms at one point in time is cross-sectional data. Verbeek (2004) identified some advantages and some disadvantages of panel data. On the one hand, panel data models are more realistic than a time series or cross-sectional models. On the other hand, the time series aspect may introduce a dependency in the data which has implications for non-linear and dynamic models. Another drawback of panel data is the frequent presence of missing values.

Supporting literature for the model specification

Besides the rationale to use panel regression for ESG ratings, academics have relied on these models to analyze the determinants of ratings (see appendix). Authors have used panel regressions in order to assess the effect of variables on ratings and have applied different features of panel regressions (fixed, random or mixed effects). Capelle-Blanchard et al. (2014) used an ordered logistic regression to assess the determinants of ESG rating at the fund level on one specific year. They relied on a logistic regression in order to reflect the limits of the ratings as a linear model ignores boundaries. But, this is complex to apply for panel regressions.

Panel regressions and their specifications

Panel regressions can be understood as an extension of time series and cross-sectional regressions or as a combination of the two. The general equation of a linear equation is:

$y_{i,t} = x'_{i,t}\beta_{i,t} + \varepsilon_{i,t}$, where:

- i=1,…,N represents the cross sectional aspects (the companies)
- t=1,…,T represents the time-series aspect (the years)
- $y_{i,t}$ is the dependent variable (the ESG rating of the company i at time t)
- $x_{i,t}$ is the Kth independent variable (the firm size, the industry,…)
- $\beta_{i,t}$ are the coefficients of the Kth explanatory variable.
- $\varepsilon_{i,t}$ are the error terms (Verbeek, 2004)

Some specifications can be introduced in the model. Verbeek (2004) indicates that a common assumption is that "β_{it} *is constant for all i and t, except – possibly – the intercept term*" (p. 342). On top of that, the most used models are the fixed-effects model and the random-effects model.

Fixed-effects model

A first variant is the fixed-effects model that assign a slope coefficient to each individual (Verbeek, 2004). The introduction of these slope coefficients induces that all time-invariant effects are included in these slope coefficients and are ignored by the model (Kohler and Kreuter, 2009). Similarly, a dummy variable could be introduced for each individual (Torres-Reyna, 2007). With specific slope coefficients, the general equation is transformed into:

$y_{i,t} = a_i + x'_{i,t}\beta + \varepsilon_{i,t}$, where a_i is the slope fixed for each individual

A specific time-effect can be added (Torres-Reyna, 2007). This could, for instance, be used to reflect the global GDP growth which is specific to time or the sector of a firm that is specific to an individual. The general equation becomes:

$y_{i,t} = a_i + x'_{i,t}\beta + w'_t\gamma_t + \varepsilon_{i,t}$, where:

- w_t are the time-specific variable (that do not vary across individual)
- γ_t are the time-specific coefficients (that do not vary across individual)

The OLS framework provide BLUE estimators of coefficients if $\varepsilon_{i,t} \sim N(0, \sigma_\varepsilon^2)$ and $E(\varepsilon_{i,s}\, x_{i,t}) = 0$ for all s,t.

Random-effects model

A second variant is the random-effects model reflecting that error terms are correlated over individuals (i.e. some explanatory variables are missing in the model). Under this specification, the error terms are split into two components: one component stable over time and distributed over individuals ($a_i \sim IID(0, \sigma_a^2)$) and one component uncorrelated over time ($\mu_{i,t} \sim IID(0, \sigma_\mu^2)$). OLS is consistent if $E(\varepsilon_{i,s}\, x_{i,t}) = 0$ for all s,t and $E(a_i\, x_{i,t}) = 0$. (Verbeek, 2004). Under this random-effects model, the general equation is transformed into:

$y_{i,t} = \beta_0 + x'_{i,t}\beta + a_i + \varepsilon_{i,t}$, where:

- β_0 is the intercept term fixed for all firms
- a_i is the time-invariant part of the error term
- $\varepsilon_{i,t}$ is the second part of the error term and is uncorrelated over time.

While the theoretical difference between the two models is clear, the choice of the model is more blurred (Verbeek, 2004, Baltagi, 2005). Verbeek (2004) pointed out that fixed-effects can be used when "*the individuals in the sample are 'one of a kind', and cannot be viewed as a random draw from some underlying population*" (p.351) while the random-effects is more appropriate to analyze population characteristics and not on the specific individuals (i.e. individual slope coefficients are useless). Similarly, Baltagi (2005) pointed out that a random-effects model is "*an appropriate specification if we are drawing N individuals randomly from a large population*" (p.14). And, Torres-Reyna (2007) indicated that random-effects should be used when "*differences across entities have some influence on your dependent variable*" (p.25).

In case of correlation between a_i and $x_{i,t}$, the random-effects estimator is inconsistent and the fixed-effects model is therefore preferred. This can be tested through a Hausman Test (Verbeek, 2004). If a_i and $x_{i,t}$ are not correlated, then the estimators of both effects are consistent and should therefore not differ significantly. The Hausman test statistic is chi-squared distributed with K – 1 degrees of freedom (under the null hypothesis) and is computed as follows:

$\xi_H = [b - \hat{\beta}]' \psi^{-1} [b - \hat{\beta}]$, where:

- b are the coefficients in the fixed-effects model
- $\hat{\beta}$ are the coefficients in the random-effects model
- $\psi = var[b - \hat{\beta}]$ and as explained by Greene (2005):
    - $var[b - \hat{\beta}] = var[b] + var[\hat{\beta}] - 2\, cov[b - \hat{\beta}]$

But, "*Hausman's essential result is that the covariance of an efficient estimator with its difference from an inefficient estimator is zero*" (Greene, 2005)

Then, $cov\left[(b-\hat{\beta}),\hat{\beta}\right] = cov\left[b,\hat{\beta}\right] - var\left[\hat{\beta}\right] = 0 \Leftrightarrow cov\left[b,\hat{\beta}\right] = var\left[\hat{\beta}\right]$.

And, therefore, $\psi = var\left[b-\hat{\beta}\right] = var[b] - var\left[\hat{\beta}\right]$

However, Verbeek (2004) highlighted that one should be cautious with the results. The rejection does not necessarily imply that the fixed-effects specification is appropriate and the non-rejection does not imply that the random-effects specification is the preferred one.

Dynamic models

Panel regressions can include dynamic factors and are appropriate when the response variable is dependent on the previous level (Verbeek, 2004). The general framework is the following:

$y_{i,t} = x'_{i,t}\beta + \gamma y_{i,t-1} + a_i + \varepsilon_{i,t}$, where:

- γ is the coefficient of the lag variable

The random and fixed-effects in this case suffer from drawbacks. On the one hand, as $y_{i,t-1}$ and a_i are positively correlated, OLS and random-effects are inconsistent (Verbeek, 2004). On the other hand, fixed-effects have small T bias. Furthers details are provided in the next section.

Model estimation

Fixed-effects model

Under the linear framework, the ordinary least square (OLS) is the underlying approach to estimate beta coefficient. With fixed-effects, the introduction of a slope coefficient for each variable significantly makes the resolution of the model difficult when N is large (Verbeek, 2004, Baltagi, 2005). But, by using deviation from individual means, the individual effects are eliminated (Verbeek, 2004). Using this so-called "within transformation", the model becomes:

$$y_{i,t} - \bar{y}_i = (x_{i,t} - \bar{x}_i)'\beta + (\varepsilon_{i,t} - \bar{\varepsilon}_i)$$

In that case, the OLS estimator for β is given by:

$$\hat{\beta}_{FE} = \left(\sum_{i=1}^{N}\sum_{t=1}^{T}(x_{i,t} - \overline{x_i})(x_{i,t} - \overline{x_i})'\right)^{-1} \sum_{i=1}^{N}\sum_{t=1}^{T}(x_{i,t} - \overline{x_i})(y_{i,t} - \overline{y_i})'$$

If $x_{i,t}$ and $\varepsilon_{i,t}$ are independent, the $\hat{\beta}_{FE}$ are unbiased estimators of β. If $x_{i,t}$ and $\varepsilon_{i,t}$ are uncorrelated, the $\hat{\beta}_{FE}$ are consistent estimators of β.

Random-effects model

If $\sigma_a^2 \neq 0$, the error terms $a_i + \varepsilon_{i,t}$ exhibit an autocorrelation which makes OLS inefficient. The usage of GLS is more efficient (Verbeek, 2004). The error terms can be expressed as $a_i l_T + \varepsilon_{i,t}$ where $l_T = (1, \dots, 1)'$ of dimension T and with $var(a_i l_T + \varepsilon_{i,t}) = \Omega = \sigma_a^2 l_T l'_T + \sigma_\varepsilon^2 I_T$ with I_T a T dimensional identity matrix (Verbeek 2004). By multiplying the right-hand side and the left-hand side of the panel equation by Ω^{-1}, the GLS estimator for β are given by:

$$\hat{\beta}_{RE} = \left(\sum_{i=1}^{N} \sum_{t=1}^{T} (x_{i,t} - \bar{x}_i)(x_{i,t} - \bar{x}_i)' + \psi \mathrm{T} \sum_{i=1}^{N} (\bar{x}_i - \bar{x})(\bar{x}_i - \bar{x})' \right)^{-1} \left(\sum_{i=1}^{N} \sum_{t=1}^{T} (x_{i,t} - \bar{x}_i)(y_{i,t} - \bar{y})' + \psi \mathrm{T} \sum_{i=1}^{N} (\bar{x}_i - \bar{x})(\bar{y}_i - \bar{y})' \right)$$

where: $\psi = \frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2 + T\sigma_a^2}$

The random-effects model can also be estimated using the average of the fixed-effects and the between estimators. The between model is derived from the individual mean equation:

$$\bar{y}_i = \beta_0 + \bar{x}_i \hat{\beta}_{BE} + a_i + \bar{\varepsilon}_i$$

And, estimators for $\hat{\beta}_{RE}$ under this methodology are given by

$$\hat{\beta}_{RE} = W\hat{\beta}_{BE} + (I_K - W)\hat{\beta}_{FE}$$

Where W is "*a weighting matrix and is proportional to the inverse of the estimator of the covariance matrix* $\hat{\beta}_{BE}$" (Verbeek, 2004, p.392) and I_K is an identity matrix.

Dynamic models

Under the fixed-effects approach, the coefficient of the lag variable in a model without exogenous variable ($y_{i,t} = \gamma\, y_{i,t-1} + a_i + \varepsilon_{i,t}$) can be estimated as:

$$\hat{\gamma}_{FE} = \frac{\sum_{i=1}^{N} \sum_{t=2}^{T} (y_{i,t} - \bar{y}_i)(y_{i,t-1} - \bar{y}_{i,-1})}{\sum_{i=1}^{N} \sum_{t=1}^{T} (y_{i,t-1} - \bar{y}_{i,-1})^2}$$

With $\bar{y}_i = \frac{1}{T}\sum_{t=1}^{T} y_{i,t}$ and $\bar{y}_{i,-1} = \frac{1}{T}\sum_{t=1}^{T} y_{i,t-1}$

This estimator suffers of bias. Nickell (1981) showed mathematically that the bias tends to 0 as T tends to infinity. This implies that the fixed-effects approach is inconsistent for small T and large N. However, this bias can be avoided thanks to difference equations. While OLS is inconsistent with the first difference equation[25] (due to correlation between $y_{i,t-1}$ and $\varepsilon_{i,t-1}$),

[25]Without explanatory variables: $(y_{i,t} - y_{i,t-1}) = \gamma(y_{i,t-1} - y_{i,t-2}) + a_i + (\varepsilon_{i,t} - \varepsilon_{i,t-1})$

the second difference equation is consistent under the assumption of non-autocorrelation in the error terms (Verbeek, 2004). For the second difference, the estimators are:

$$\hat{\gamma}_{IV} = \frac{\sum_{i=1}^{N}\sum_{t=2}^{T} y_{i,t-2}\left(y_{it} - y_{i,t-1}\right)}{\sum_{i=1}^{N}\sum_{t=2}^{T} y_{i,t-2}\left(y_{i,t-1} - y_{i,t-2}\right)}$$

Furthermore, others estimators (Anderson-Hsaio and Arennallo-bond) have been developed for dynamic models.

More generally, one can question the use of a linear model for fractional or categorical data. For instance, Capelle-Blanchard and Monjon (2014) have used a logit model as it is more appropriate to reflect the boundaries of scores. However, the usage of logit or probit model introduces incidental parameter problems: there are too many coefficients to estimate (each slope coefficients) and a limited number of observations (small T) leading to inconsistent coefficients (Baltagi, 2005). As there are few observations with extremes ratings (very high or very low), a linear approximation can be suitable. Therefore, I will rely on a linear model as existing research on ratings (see Drempetic et al., 2019, Green et al., 2019, Di Giuli, 2014).

Goodness of fit

The R^2 or adjusted R^2 are only applicable when OLS is the estimation methodology. However, the concept of R^2 can be adapted to the panel model based on the idea that R^2 reflects the squared correlation between the real values and the estimates (Verbeek, 2004). In the context of the fixed-effects model and its within transformation, the following R^2s can be derived:

$$R^2_{within}(\hat{\beta}_{FE}) = corr^2(\hat{y}^{FE}_{i,t} - \hat{y}^{FE}_{i}, y_{i,t} - \bar{y}_i), \text{ where } \hat{y}^{FE}_{i,t} - \hat{y}^{FE}_{i} = (x_{i,t} - \overline{x_i})'\hat{\beta}_{FE}$$

$$R^2_{between}(\hat{\beta}_{BE}) = corr^2(\hat{y}^{BE}_{i}, \bar{y}_i), \text{ where } \hat{y}^{BE}_{i} = (\overline{x_i})'\hat{\beta}_{BE}$$

$$R^2_{overall}(\hat{\beta}) = corr^2(\hat{y}_{i,t}, y_{i,t}), \text{ where } y_{i,t} = (\overline{x_i})'\hat{\beta}$$

Software Application (Stata)

The implementation of this panel regression will rely on the dedicated function (xtreg) for panel data provided by Stata. Besides the traditional R^2 and adjusted R^2, the function *xtreg* provides the within, the between and the overall R^2. The within R^2 is the R^2 from the mean-deviated regression while the between and overall R^2 are squared correlation coefficient (respectively $corr(\bar{x}_i\hat{\beta}, \bar{y}_i)^2$ and $corr(\bar{x}_i\hat{\beta}, y_{i,t})^2$). Detailed on the methodologies applied by Stata are provided in the appendix.

VI.2. RQ3: Performance analyses

Academics have observed the links between financial performance and factors included in ratings such as the governance (Gompers et al., 2003, Core et al., 2005), the environmental performance (Derwall et al., 2005, Chan et al., 2014), the customer satisfaction (Fornell, 2016) and the employee satisfaction (Sheng, 2018, Green et al. , 2019).

Besides that, a large range of studies have focused on the performance of sustainable investments and some investigated the performance associated to ESG ratings (Kempf et al., 2007, Statman et al., 2009, Halbritter et al. 2015).

The purpose of this third research question is to test if ESG and pillars ratings provided by Refinitiv can replicate findings on factors included in ratings and can confirm the results on ratings while taking into account the bias identified as part of the second research question.

Supporting literature of the model

As shown in the appendix many studies have been conducted on sustainable performance. Multi-factor models were used to assess the performance and Fama-Macbeth regressions were used to assess the presence of risk factors.

Fama-French models

The Fama-French models are multi-factor models (Courtois et al. 2007) and are an extension of the CAPM model (see Sharpe 1964 and Lintner 1965 among others). The first Fama-French model introduced in 1993 includes the effect of the market (as the CAPM), the size and the value. Their model reflects that small firms (measured by the market capitalization) and value stocks (measured by the book to market equity) respectively overperform high value and large firms. Their model is driven by the following equation:

$r_{i,t} - r_{f,t} = a_i + \beta_i * (r_{M,t} - r_{f,t}) + s_i SMB_t + h_i HML_t + \varepsilon_{i,t}$, where:

- $r_{i,t}$ is the return of stock/portfolio i at month t
- $r_{f,t}$ is the risk-free rate of return at month t
- $r_{M,t}$ is the market rate of return at month t
- SMB_t, the size premium computed as the difference between a portfolio of small firms and a portfolio of big firms at month t
- HML_t, the value premium computed as the difference between a portfolio of firms with high book-to-market (BM) ratio and a portfolio of firms with low BM ratio at month t

- $\beta_i, s_i \; and \; h_i$ are the coefficients of the market effect, size effect and value effect

Fama and French (1993) constructed portfolios representing the risk exposure to size and value for the American market. These portfolios are created based on some specific breakpoints. The breakpoint for size is the median NYSE market equity at the end of June of the year. As Nasdaq and Amex stocks are included in the portfolios and have generally a smaller size, there is a higher number of stocks in small portfolios. The two breakpoints of the value factors are the 30th and 70th NYSE percentiles of the BE/ME. At June of year t, the BE/ME ratio is the book equity and the market value at the last fiscal year (t-1). Negative equity values are not included in the percentile or in the portfolios. The monthly value weighted returns of these portfolios are computed from July t to June t+1 in order to ensure that the book equity was known at that time. The size and value factors are obtained by computing average and difference between factors:

- SMB = 1/3 (Small Value + Small Neutral + Small Growth) – 1/3 (Big Value + Big Neutral + Big Growth)
- HML = 1/2 (Small Value + Big Value) – 1/2 (Small Growth + Big Growth))

These factors are provided by French[26].

Fama and French extended their findings to international markets (Fama and French, 2012). However, their methodologies differ. First, it is worth noticing that returns are in U.S. dollars. This indicates that factors are sensitive to exchange rates. French uses returns of European stocks in U.S. dollars implying a different exchange rate at each stock price retrieval. Concerning the factor construction, they are obtained as part of the international market assessment conducted by Fama and French and breakpoints are specific for each region (Fama and French, 2012). While the breakpoints for the value are similar (30th and 70th percentiles), Fama-French considered big stocks as the top 10% percentile and the small stocks at the bottom 10% percentile for each region. Then, the methodology applied to the US stocks is repeated. First, monthly value-weighted portfolios returns are computed. Then, factors are computed based on the average and difference between factors.

Several academics have proposed extensions to the Fama-French model. Carhart (1997) added the momentum factor that reflects the continuance of trends (especially for the one year time period) at the mutual fund level.

[26] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

The momentum factor is available on the French database and is computed based on the return of the high portfolio minus the low portfolio derived on the 30th and 70th percentiles of the NYSE prior:

- MOM =1/2 (Small High + Big High) - ½ (Small Low + Big Low)

Fama and French (2015) propose to include profitability (robust minus weak profitability) and investments patterns (conservative minus aggressive) factors are computed as follows:

- RMW = 1/2 (Small Robust + Big Robust) - 1/2 (Small Weak + Big Weak)
- CMA= 1/2 (Small Conservative + Big Conservative) - 1/2 (Small Aggressive + Big Aggressive)

These multifactor models can be extended with other factors.

As any other models and methods, this procedure to assess performance suffers from drawbacks. Lambert, Fays and Hübner (2020) shed light on the importance of the sorting procedure the sorting breakpoints. In the context of SRI and heterogeneous ratings, the risk of data-driven results are high as highlighted by Capelle-Blanchard and Monjon (2012).

To conduct assessments of sustainable performance, many authors have studied the performance based on representative portfolios and not individual stocks (Fabozzi et al., 2008, Hong and Kacperczyk, 2009, Lee and Faff, 2009, Humphrey and Tan, 2014 among others). Moreover, long-short portfolios based on ESG characteristics were frequently used (Derwall et al., 2005, Kempf et al. 2007, Statman et al., 2009 and Habritter et al., 2015).

In order to assess the performance of stocks from a sustainability perspective, the three multi factor models (i.e. the three, four and five factors models) will be applied on portfolio created based on their ESG ratings (e.g. high and low ratings portfolios).

VII – RQ2: Quantitative analyses and findings

VII.1. Introduction

This research question aims at examining the reliability of ESG ratings by testing the presence of biases. Relations have been established in the literature review such as the political influence (Di Giuli and Kostovetsky, 2014), the location (Baldini et al., 2018) and the size (Drempetic et al., 2019). The data descriptive section highlighted the influence of the number of ratings issued. Therefore, the effect of size (measured by market capitalization and total assets), location (America, Europe areas) and number of ratings issued will be tested. To answer this question, panel regressions will be conducted on global and pillars ratings.

Existing research have used a wide range of control variables. Di Giuli and Kostovetsky (2014) used the following control variables: the size, the ROA, the cash, the dividends, the debt and the book-to-market. Baldini et al. (2018) used country-specific control variables such as the market capitalization divided by GDP and firm-specific control variable, namely, the analysts' coverage, the cross listing, the leverage, the size, the market to book value ratio, the profitability (ROA) and the sale growth. Drempetic et al. (2019) used control variables such as EPS, ROIC, leverage and operating profit margin.

Therefore, I will rely on the following firm-specific variables: the 52 weeks total stock returns, the market to book value ratio, the leverage (D/E), the profitability (ROA), the sale growth (i.e. recurring control variables). All the data have been obtained (directly or through computations) from the Eikon API and reflects the information available at the end of each year. Descriptions of each variable are available in the appendix.

The data set is a subset of available ratings made of firms established in the US or established and listed in Europe. This subset has a total of 21431 observations for 3870 different firms covering a period of study from 2007 to 2018[27]. It is therefore an unbalanced panel. The coverage increased over the years and rating are usually updated each year after the first ratings (excepted when firms were delisted). Moreover, c.750 firms have received their first ratings in 2018 implying that they have only one observation in the data (and therefore, no time-series aspect). Summary statistics are provided in the appendix.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
N	1002	1139	1197	1296	1380	1379	1416	1449	1914	2525	2993	3741

Table 2 : number of observations per year

[27] The start date is related to the lower level of ratings before and the last date is the last full year available.

VII.2. Static models

Fixed – effects model

As part of the ESG score analysis, the following model will be estimated:

$Score_{i,t} = Size_{i,t}\beta_1 + Characterstics_{i,t}\beta_2 + Control_{i,t}\beta_3 + \varepsilon_{i,t}$, where:

- i=1,…,N represents the cross sectional aspect (the company)
- t=1,…,T represents the time-series aspect (the year)
- $Score_{i,t}$ represents the ESG combined or ESG score or pillar score
- $Size_{i,t}$, one of the three size metrics (market capitalization, total assets, total employees)
- $Charecteristics_{i,t}$ reflects characteristics of the firm (ratings issued, localization, industry)
- $Control_{i,t}$ are the control variable (return, ROA, leverage, revenue growth)
- β_K are the coefficients of corresponding to the variable (which are of the size of their corresponding independent variables)
- $\varepsilon_{i,t}$ are the error terms

Results at the ESG Combined score level

When using fixed-effects models, all time-invariant variables are omitted (as a result of the integration of individual-specific slopes). The localization and industry dummies are therefore omitted. Moreover, the xtreg function removes observations with at least one missing value.

The first set of fixed-effects models tested includes all the variables. Models only differs in terms of the measurement of size. The table below summarizes the results:

	Model 1 : log market cap.		Model II : log total assets		Model III : log # employees	
Number of obs	18167		18198		17778	
Number of Groups	3350		3353		3268	
R2	0,2678		0,2668		0,2705	
Adj R2	0,1020		0,1009		0,1059	
R2 within	0,2678		0,2668		0,2705	
R2 between	0,2808		0,3004		0,3069	
R2 overall	0,2748		0,2933		0,2958	
Corr(ui , Xb)	0,1781		0,1550		0,1111	
F test (all ß=0)	902,9652		900,0174		17778	
P value (F test)	0,0000		0,0000		0,000	
	coefficient	p	coefficient	p	coefficient	p
size	1,8509	0,0000	2,3181	0,0000	2,3326	0,0000
Numbissue	1,6448	0,0000	1,6497	0,0000	1,7064	0,0000
wret	-0,0073	0,0000	-0,0004	0,8042	-0,0002	0,9107
roa	-0,0200	0,0157	0,0030	0,7031	0,0095	0,2391
td_e	0,0000	0,3252	0,0000	0,1693	0,0000	0,2197
revgrowth	-0,0032	0,0752	-0,0026	0,1548	-0,0012	0,5737
_cons	-6,0514	0,0775	-16,8277	0,0006	14,3009	0,0000

Table 3 : Fixed-effects regression on ESG Combined score

First, the three size metrics are associated with significant and positive coefficients confirming the presence of a size effect on the ratings. There were fewer observations available for the

number of employees due to more missing values. Moreover, interchanging the three variables has an insignificant impact in the coefficients of others variables and in the R^2 suggesting that these variables reflects the same information.

Regarding the learning process, the fixed-effects regression reported a significant positive coefficient related to the number of ratings issued suggesting the presence of a learning process. As a second variant, dummies variables were used as the effect of ratings issued is expected to be nonlinear. Indeed, this effect is expected to be stronger during the first years while having 15 or 16 ratings issues should not impact the learning process. In contrast, the coefficients of dummies variables increased with the number of ratings issued in a linear fashion. This suggests that firms continue to improve their ratings as time goes by and not only in the beginning. Moreover, this indicates that usage of dummies may be useless as an increase of rating is linear with the number of ratings issued. Comparing these two models, the performance measured by the R^2 and the associated coefficients are very close to each other. In the second model, coefficients of the number of ratings issued are similar across the three different size metrics and the impact of an increase in the number of ratings issued is similar to the previous model (mean gap per dummies of c. 1.7).

However, this variable has some specific characteristics. The number of observations decreases with the number of ratings issued. While a low number of ratings issued are made of different periods, the observations with 16 ratings issued are only made of observations in 2018.

Under the hypothesis of higher scores during the last years, the learning effect in the last years could hide a time effect. Year sand number of issues are alike as they have the same increments for one firm. This results in a correlation of 0.2890 between the two variables. The year effect is tested with the inclusion of time fixed-effects in the model and lead to unexpected results.

The inclusion of year fixed-effects in the model results in negative and insignificant effects of the number of ratings issued (both under the dummy or discrete forms). More surprisingly, coefficients associated to years increased through time (similarly than the number of ratings issued). While some years effect would have been expected, an increasing time effect is counterintuitive. As rating distributions are stable over time, there is no economic support for an increase of coefficients with the year.

Regarding control variables, they are most of the time rejected in line with the findings of Drempetic et al. (2019). The usage of total debt or net debt to use leverage does not influence the model as expected due to their 0.99 correlation. The annual return and ROA were significant

only when size was measured with the market capitalization. These variables have low coefficients that may be due to the presence of significant outliers and to the low relevance of these variables. The low coefficients induce that reasonable change in these variables (e.g. 5% in return) do not yield to significant change in ratings. This questions the significance of control variables in the assessment of the determinants of ratings. The removal of the control variables does not influence the R^2 metrics and increase the coefficients associated with the total assets and the employees but reduces the coefficient of the market capitalization (see appendix).

As a robustness check, the analysis performed is repeated with the removal of the 1% extreme outliers of control variables and the lowest 1% value of the number of employees (e.g. 1 full-time employee). As shown in the appendix, this has no impact on the value of the coefficients of other variables. While other variables remain insignificant, revenue growth becomes significant and is associated with negative coefficients. An underlying explanation can be that firms focusing on growth reduce the importance of ESG while mature companies can include ESG in their activities and as a promotion tool (e.g. Nestle and the SDG).

Extension of results at the ESG score level?

Overall, the same patterns can be observed with higher coefficients. In line with the combined scores, the control variables are not significant excepted when size is measured with market capitalization. The truncation has the same effect (i.e. only revenue growth becomes significant).

Without time fixed-effects, the same learning effect is observed. The introduction of time fixed-effects has the same impact on the number of ratings issued. The coefficients associated with year dummies exhibit growing coefficients with the years as the combined case. In contrast, the number of issues remained significant at any reasonable level (e.g. 1%) and is negative. And, they exhibits an opposite trend: coefficients become more negative with the number of ratings issued. In other words, for one firm over time, the increase related to the year is compensated by the decrease related to the number of ratings issued. For instance, firms with larger number of ratings issued will have a downside adjustment compared to firms issuing their first ratings. As for the combined score, there is no economic rationale behind these trends.

Extension of results at the pillars score level?

While the overall observations can be generally extended to each pillar, it is worth noting that some pillars have specific observations (see appendix).

First of all, the environmental score has a different distribution with many null observations. In the first years, the mode was 0. This induces that the linear model is less appropriate than for other pillars as the model ignores boundaries. The models using environmental scores are associated with higher correlations between the error terms and the estimates which vary between c. 0.25 and c 0.30 (while it was c. 0.10 and c. 0.20 for the combined score and c. 0.15 and c. 0.25 for the ESG score). While the R^2 remains high, the correlation and the presence of many null observations question the appropriateness of the model for the environmental pillar.

Concerning the learning effect, all pillars are associated with a learning effect when no time effect is included. However, the inclusion of time effect provides mixed results. On the one hand, there is an opposite effect between the year fixed-effects and the number of ratings issued for environmental scores (this opposite effect is even stronger than for ESG scores). The inclusion increases correlation (ranging from c.0.33 to c.0.48) between the errors and the regressors. On the other hand, for the social and governance score, the time effect is closer to the combined case. The inclusion of a time effect removes the learning effect (as the combined case). When the number of ratings issued is expressed as dummies, the variable has insignificant coefficients. With a discrete number of issues, the effect is significant (p value of 0.96%) and positive (ß of c.0.5) for the social score and less significant (p value of 2.72%) and negative (ß of c.-0.5) for the governance score.

Conclusion

Under the fixed-effects framework, a size effect is reported for all the size metrics and mixed results on the learning effects. More precisely, the introduction of a year dummies removes the learning effect that was observed without year fixed-effects. Surprising results such as increasing coefficients associated with year dummies or negative learning effect raise economical concerns.

The following section uses the random-effects model and may provide different conclusions.

Random – effects model

The analyses conducted for fixed-effects models will be replicated with random-effects models. The same model will be estimated. The only difference will be around the error terms as explained in the methodology section resulting in the inclusion of time-invariant variables.

Results at the ESG Combined score level

The first set of random-effects models include all the variables and three size metrics. Compared with fixed-effects, models achieved higher R^2 (excepted on the within dimension on which the fixed-effects models focus). Moreover, random models include time-invariant variables. Based on descriptive statistics, an effect of localization is expected while industries[28] should not impact firms (due to normalization). The models reported a positive effect of localization on the rating. European firms are associated with on average c. 9.5 higher scores than American firms. Moreover, some industries exhibit significant negative relation (4-Energy, 5-Financials and 9-Telecoms). Nevertheless, the financial industry effect becomes positive and the energy industry effect disappears when size is measured with the number of employees and is certainly related to significant change in the slope coefficients.

As in the fixed-effects case, the size effect is significant for the three different metrics which corroborate with existing findings (see Drempetic et al., 2019).

Concerning the learning process, the three first models reported significant positive coefficients associated with the number of ratings issued. The variants with dummies indicated, as in the fixed-effects model, that the learning effect does not decrease with the number of issues. However, in contrast with the fixed-effects models, the inclusion of time fixed-effects does not influence the significance of the learning process. Some years have a positive and significant influence on ratings but the increasing trends found for the fixed-effect models are not observed anymore. This has more economic rationale as some years may be subject to some adjustments or overall higher score resulting in higher ratings in contrast with other years.

The influence of control variables is in line with the fixed-effects (not significant excepted for 1-year return and ROA when size is measured with market capitalization). The truncation has the same effect. The overall performance measured by R^2 remains unaffected and the revenue growth (expressed in percentage) becomes significant and is associated with a negative influence (ranging between -0.01 and -0.02 for the three models). Coefficients remain not

[28] Basic Materials - 1 , Consumer Cyclicals - 2, Consumer Non-Cyclicals - 3, Energy - 4, Financials - 5, Healthcare - 6, Industrials - 7, Technology - 8, Telecommunications Services - 9, Utilities - 10

economically significant as a firm experiencing an increase of 10% of revenue growth would only lose 0.1 on its ESG combined score out of 100.

Extension of results at the ESG score and pillars?

Results can be extended to ESG score and pillars more generally than with fixed-effects models.

Concerning ESG scores, models generally achieved higher R^2 (c. 0.40). When size is measured with market capitalization, control variables (excepted the leverage) is significant. However, the coefficient remains low and therefore not economically significant. In contrast with the fixed-effects specifications, the introduction of the time fixed-effects does not remove the positive influence of the number of ratings issued.

Models explaining the environmental pillars achieved even higher R^2 (c. 0.45) and the coefficient of the location of the headquarters is nearly doubled. Moreover, the size and learning effects are stronger and industry effects are nearly all significant. Nevertheless, the large proportion of 0 observations makes the linear model less suitable. The social pillar achieves lower R^2 (c. 0.30) but exhibits the same characteristics than the global score. The governance score obtains the lowest R^2 (c. 0.15) and have the lowest coefficients. This indicates that the global score is driven by the environmental score while the governance score has less influence.

Tests

A Breusch Pagan test can be applied to test the presence of individual effects (Verbeek, 2004). Under the null hypothesis, the σ_v is equal to 0 (no individual fixed-effects). However, Verbeek (2004) indicates that the test usually rejects the null. It is indeed the case for all the ratings (combined, ESG and pillars) and there are therefore individual fixed-effects.

A second test, the Hausman test can provide an indication on the choice between the random and fixed-effects models. The test is conducted for all the ratings and with all the variables. The results reported in the appendix use the market capitalization but results can be extended to other metrics.

The rejection indicates that the fixed and random-effects provide different estimates indicating that the random-effects is not consistent. This raises concerns on the reliability of the random-effects models.

We have therefore opposing statistical and economic results. This will be discussed as part of the conclusion. The following section is devoted to dynamics models.

VII.3. Dynamics models

Another specificity of ratings is their relative stability over time. Consequently, a dynamic model may reveal the driver of change in ratings. However, the introduction of lag variables induces a loss of observations as at least two observations are required to fit the model. Moreover, as indicated in the methodology section, the random-effects model and OLS are inconsistent while the fixed-effects model is consistent for large T. A possibility is to focus on observations with large T. However, only 633 firms have an observation covering the 12 years and a bias would remain with 12 observations.

That said, I will rely on the methodologies used in an example from Verbeek (2017, section 10.5). First, OLS and fixed-effects regressions, two inconsistent methodologies, will be conducted in order to derive possible bounds for the coefficients estimates as these methodologies are biased in opposite direction. However, they do not integrate the estimation errors. As a second step, the Anderson-Hsaio and Arennallo-bond methodologies which use instruments variables to resolve this problem will be conducted.

As Verbeek (2017), the robust option was applied to take into account the heteroskedasticity and arbitrary forms of within-firm serial correlation in the standards errors. The OLS and fixed-effects regression results are provided in the appendix.

First of all, one can see that the inclusion of time effects does not materially change the value of lag scores. OLS and fixed-effects suggest that the true value of the lag coefficient is between 0.36 and 0.83. The fixed-effects model reports a high correlation between regressors and error terms suggesting that the model is not appropriate as expected because OLS is inconsistent.

For OLS, the time effects vary over the years and is in general around -1.5. For the fixed-effects, year dummies have increasing coefficients with years and make the learning effect insignificant as static models. Concerning exogenous variables, the size effect (measured only with market capitalization) remains significant and positive but is less strong. Moreover, the fixed-effects models exhibit a high correlation between the error terms and the estimates which were expected due to the construction of the model (see methodology section).

The Anderson-Hsaio estimator is applied on the difference equation ($y_{i,t} - \bar{y}_{i,t-1}$) and use the two-period lag variables as instruments. In line with section 10.5 of Verbeek (2004), the two-period lag variable and the difference at two-period lag variable will be used.

The use of two-period lag variables as instruments considerably reduced the number of observations included in the model. When the two-period lag difference is used, negative coefficients and the high p-values indicate that the instrument may not be relevant. When the two periods lag is used, the model is more significant and reports an economically meaningful coefficient for the lag score. Regarding the other variables, only the number of issues remains relevant at a 1% level. A potential explanation behind this is that firm characteristics (the market capitalization or the location) set the overall level of rating, while the number of rating issue is more a driver of improvement within each firm.

The Arellano and Bond (1991) methodology will be applied as the final approach for dynamic models. Contrasting with Anderson-Hsiao that used the two lag period, Arellano and Bond propose to use as many lags as possible and to resolve the model in the context of the general method of moments. More precisely, this procedure imposes other moments conditions and derive coefficients in a general method of moments framework (GMM). The usage of GMM avoids the loss of additional observations during the process (Verbeek, 2004). The first step estimator is built upon the Anderson-Hsaio estimators with the two-period lag estimator. The two steps estimator relies on the error terms from the one-step estimator to derive coefficients and allows heteroskedasticity. Verbeek (2004) indicates that studies have found that the two steps estimator underestimates the standards errors.

Under homoscedasticity, a Sargan test can be used to check the overidentifying restrictions. The null hypothesis is that "*overidentifying restrictions are valid*" and therefore rejection implies that the model has too many instruments (or heteroscedasticity). A second test (Arellano-Bond test) can be conducted to determine autocorrelation in the error. It tests the autocorrelation in first difference. Therefore, as the model is based on the first difference equation, an autocorrelation of order is only expected for the first order (and not for higher orders).Headquarters and times dummies variables could not be included in the model.

As in the case of the Anderson-Hsiao estimators, only the number of issues remain significant and positive. However, the two tests reveal the poor performance of both models. First, the Sargan test indicates the presence of overidentifying restrictions. But, this may be due to heteroskedasticity. The second test rejects the hypothesis of autocorrelation both at the first and second levels. While the first level rejection is due to the construction of the first difference, the presence of autocorrelation at the second level indicates the poor performance of the models. Results of the different tests are provided in the appendix.

VII.4. Conclusion

The purpose of this section was to test the presence of bias: size (measured by three different metrics), location and the number of ratings issued. To do this, different panel regressions were investigated: the two statics approach (fixed or random-effects) and a dynamic approach. Each approach leads to interesting results and is detailed hereunder.

1st approach: fixed-effects models

Under the fixed-effects framework, entities-specific variables can not be tested. Therefore, the location's effect cannot be tested. Nonetheless, the size and learning effect can be tested.

First, models reported a size effect in line with Drempetic et al. (2019). Panel regressions reported positive and significant coefficients for each of the size metrics and for all the ESG scores namely the two global scores and the three pillar scores.

Fixed models provided mixed results on the learning effect. The first range of models without time fixed-effects reported a learning effect. When used as a discrete variable, the model reported positive and significant coefficients for the number of ratings issued across all the ESG scores. When the variable is converted into a set of dummies variables, coefficients associated with dummies increase linearly with the number of ratings issued. This indicates that the learning effect does not decrease over time. Nevertheless, the inclusion of time fixed-effects produces surprising results. The time effect increases with years which contradicts descriptive analysis and remains economically meaningless. For the ESG combined, the governance and the social scores, the learning effects disappear as coefficients become insignificant. For the ESG and the environment scores, the learning effect becomes increasingly negative and is in opposition to the time effect.

2nd approach: random-effects models

The same models were tested with the random-effects approach.

The random-effects models allow to test the entity-specific results. As indicated in the data section, models confirm that American firms have lower ratings than European firms. In contrast, the model does not report significant trends within industries. Most industries are associated with insignificant coefficients. Only the telecom industry is associated with a significant negative coefficients across the three size metrics and for the two global scores. This is in line with the industry-normalization applied by Refinitiv. Besides, results on the size effect corroborate with the fixed-effects models and existing research.

Regarding the learning effect, the random-effects approach provides more robust results as the inclusion of time fixed-effects does not impact the number of ratings issued. The model reported a positive learning effect with or without time fixed-effects. Moreover, a time effect is only significant for some particular years. These results are economically meaningful.

However, statistical tests raise concerns on their statistical validity. A Hausman test indicates that the random and the fixed-effects models are different suggesting that the random-effects model is not appropriate. However, the random-effects model leads to economically meaningful results whereas the fixed-effects model does not.

3rd approach: dynamic models

The dynamic approach was interesting to reflect the stability of ratings over time. The OLS and fixed-effects models (which are both inconsistent) indicated that the coefficient for the lag score should be between 0.36 and 0.83. For models using instrument variables, only the learning effect and the lag score remained significant and this indicated that only this variable could be an indicator of the change in the score. However, none of the models were statically significant.

Conclusion

Overall, the different models tested provide mixed results.

The size effect is confirmed by the statistics models. Moreover, the random-effects confirm the influence of the location. This is in line with descriptive analyses and existing research.

However, the learning effect could not be confirmed. Without time fixed-effects, statics models reported a learning effect that does not decrease over time. In contrast, the fixed-effects model does not validate the learning effect in presence of time fixed-effects but leads to economically non-meaningful results. The random-effects in contrast is statically not significant according to the Hausmann test but yields to economically meaningful results. Thus, there is an indication of the presence of a learning effect but this could not be validated statically.

This section has shed light on the presence of biases in ratings. The following section is devoted to the third research question and aims at testing the performance of portfolios built upon ESG ratings.

VIII – RQ3: Quantitative analyses and findings

While the overperformance of sustainable investment remains an open question in the academic field, some studies reported significant positive alpha thanks to sustainable ratings (Kempf et al., 2007, Statman et al., 2009) while Halbritter et al. (2015) reported no influence. This can be tested with the global scores provided by Refinitiv.

Moreover, some academics have found a significant overperformance of firms associated to factors included in ratings such as the environment (Klassen and Mclaughlin, 1999, Yamashita et al., 1999, Derwall et al.,2005), the governance (Gompers et al., 2003, Core et al., 2006) customer satisfaction (Aksoy et al., 2008, Anderson et al., 1994, Fornell et al., 2016) or employees satisfaction (Edmans, 201, Sheng, 2018, Wen, 2019). As pillar scores should reflect the same information, they may provide overperformance. Furthermore, according to Eikon, pillar ratings are indicators of the generation of long term shareholder value (see appendix).

The second research question examines the biases of ratings. An enhanced strategy will be applied in order to reflect these biases.

Overperformance of such portfolios would indicate that ratings reveal material information for stock selection. To answer these performance questions, Fama-French regressions will be conducted on portfolios created based on sustainable ratings.

VIII.1. Data overview and methodology

Data overview

The period of 5 years, 10 years and 15 years will be examined. Nevertheless, previous sections have shown that the coverage of Refinitiv ratings increased over the years. This implies that the sample of stock available to construct the portfolios are smaller during the first years of ratings.

Alongside these ratings, monthly returns provided by Eikon (TR.TotalReturn1Mo function) will be used. The following table summarizes the evolution of monthly returns across the years for rated firms. As shown in table hereunder, some years have very high standard deviations, returns higher than 1000% in one month have been removed to conduct the regressions.

Returns	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
N	248	1603	3311	3957	4835	5158	5480	6607	7641	8314	8534	8568	8863	9569	14939	22449	25329	27248
Mean	(1,76)	3,33	1,89	1,37	1,58	0,66	(3,07)	3,99	1,96	0,22	1,61	2,74	1,10	(0,52)	1,93	1,71	10,94	2,98
Std	13,94	9,60	8,35	7,41	7,16	7,71	14,73	19,73	9,83	9,76	8,24	8,23	7,52	9,27	10,96	10,04	1 884,42	88,42

Table 4 : Evolution of Returns for rated firms

The factors have been obtained from the French data library as explained in the methodology section. Correlations between the factors have been computed and are reported in the appendix. The highest correlation is between the excess market returns and the profitability (0.5014 associated with a p-value for the null correlation test of 0). The value and the investment patterns, the momentum and the market returns also exhibit correlation higher than 0.40 in absolute value. In order to test potential collinearity problems between the variables, the variance inflation factors (VIF) have been computed. The VIF is computed as follows (Greene, 2008): $VIF_k = \frac{1}{1-R_k^2}$, where R_k^2 is the R^2 of the following equation $X_k^2 = a_0 + b_1 x_1 + \cdots + b_{k-1} x_{k-1} + b_{k+1} x_{k+1} + \cdots + b_N x_N$. And, the VIF therefore reflects the increase in the variance associated to the coefficient of K^{th} factor due to collinearity with other variables. Threshold of 10 is the most used[29] (O'Brien,2007). Based on the VIF, the models are acceptable.

	RM-RF	SMB	HML	RMW	CMA
VIF	1,5997	1,2995	1,5247	1,5340	1,3219

Table 5 : VIF of French Factors

Portfolio construction

As ratings are issued annually and most often before June, portfolios will be constructed based on ratings in June and hold for a one year time period. Returns will be computed from July (and for the 12 following month) in order to ensure that ratings were available. Derwall et al. (2005), Edmans (2011) and Halbritter et al. (2015) among others have used value-weighted portfolios (1). As part of this thesis, equally-weighted portfolios (2) will also be considered.

$$r_{p,t} = r_{1,t} \frac{MC_1}{\sum_{i=1}^{N} MC_i} + r_{2,t} \frac{MC_2}{\sum_{i=1}^{N} MC_i} + \cdots + r_{N,t} \frac{MC_N}{\sum_{i=1}^{N} MC_i} \quad (1)$$

$$r_{p,t} = r_{1,t} + r_{2,t} + \cdots + r_{N,t} \quad (2)$$

Where:

- i=1,…,N represents the cross-sectional aspect (the company)
- t=1,…,T represents the time-series aspect (the year)
- $r_{1,t}$ represents the price and the return of asset i at time t
- MC_i is the market capitalization of asset i at the time of the rebalancing

[29] Remarks on thresholds are addressed in the paper but concern cases where the threshold are violated.

VIII.2. Strategy based on ESG scores

As a first step of the analysis, portfolios of high and low ESG Scores are constructed. The assessment will be conducted on global and pillar scores.

Different specifications will be tested in ensure to ensure the reliability of the observations. First, 3 periods (5, 10 and 15 years) will be studied. Moreover, portfolios will be constructed for 4 percentile thresholds (10%, 15%, 20%, 25%). Three methodologies (3 and 5 factors of Fama-French and the 4 factor Carhart model) will be tested. On top of that, value weights and equal weights will be used. This results in 72[30] different cases investigated for each score. The purpose is to identify trends independent of one particular period, threshold or methodologies.

As results are similar across different pillars, the analysis will be done jointly but particularities to each rating will be highlighted. First, the value-weighted portfolios are assessed.

2004 ESGC	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 0%	-0,21%	1,05	(0,13)	0,11	0,05	(0,07)	0,96	0,96	44,91
p value	0,81	0,00	0,00	0,00	0,27	0,18			
ESG > 90%	-2,54%	1,08	(0,23)	0,11	(0,00)	(0,01)	0,88	0,88	65,67
p value	0,10	0,00	0,00	0,06	1,00	0,96			
ESG > 85%	-1,02%	1,05	(0,16)	0,11	0,06	(0,01)	0,91	0,90	63,30
p value	0,43	0,00	0,00	0,02	0,42	0,87			
ESG > 80%	-0,66%	1,07	(0,14)	0,13	0,04	0,00	0,91	0,91	61,47
p value	0,61	0,00	0,01	0,01	0,64	0,97			
ESG > 75%	-0,86%	1,07	(0,14)	0,14	0,09	(0,00)	0,93	0,93	59,14
p value	0,45	0,00	0,00	0,00	0,21	1,00			
Low Portfolio									
ESG < 10%	0,25%	1,15	0,16	0,08	0,11	(0,24)	0,81	0,81	15,22
p value	0,91	0,00	0,07	0,32	0,42	0,11			
ESG < 15%	0,19%	1,15	0,17	0,08	0,09	(0,28)	0,85	0,84	17,22
p value	0,93	0,00	0,03	0,28	0,48	0,04			
ESG < 20%	0,16%	1,15	0,09	0,05	0,05	(0,35)	0,86	0,86	18,94
p value	0,93	0,00	0,22	0,52	0,67	0,01			
ESG < 25%	0,87%	1,10	0,06	0,02	0,07	(0,32)	0,89	0,89	20,44
p value	0,58	0,00	0,31	0,77	0,46	0,00			
Long-short portfolio									
ESG - 10%	-2,79%	(0,07)	(0,39)	0,02	(0,11)	0,23	0,14	0,11	-
p value	0,26	0,22	0,00	0,79	0,47	0,16			
ESG - 15%	-1,20%	(0,10)	(0,33)	0,03	(0,02)	0,27	0,18	0,16	-
p value	0,58	0,04	0,00	0,72	0,85	0,06			
ESG - 20%	-0,83%	(0,09)	(0,22)	0,08	(0,01)	0,35	0,15	0,13	-
p value	0,69	0,08	0,01	0,29	0,92	0,01			
ESG - 25%	-1,74%	(0,03)	(0,20)	0,13	0,02	0,32	0,16	0,14	-
p value	0,31	0,44	0,00	0,06	0,87	0,01			

Table 6 : 15Y Fama-French 5 factors results on ESG Combined score

It is worth noticing that the set of rated firms is already a subset of available firms (especially during the first year of ratings). Therefore, any patterns identified could be in fact due to the sample itself. Therefore, a portfolio of all rated stocks (a basis portfolios) has been constructed. While the portfolio does not earn significant alphas, it is negatively exposed to the SMB factors suggesting that biggest firms were first rated.

[30] 2 weights x 3 methodologies x 4 threshold x 3 periods

The combined case achieved high R^2 for both portfolios. Generally, the R^2 and adjusted R^2 are above 80% (excepted some particular cases) and often around 90%. In contrast, all long-short portfolios have very low R^2. The long-short portfolios have lower volatility than the high and low portfolios. The low R^2 may be explained by similar high and low returns resulting in returns of the long-short strategy without any particular patterns (e.g. always 0).

Regarding the beta coefficients, market betas are between the 0.8 and 1.2 indicating portfolios are close to the market. The size effect is in line with previous findings. The high portfolios are negatively exposed to the size factor while the low portfolio is positively exposed to this factor. In contrast, the book to market effect is most of the time not significant at the 1% level expected few cases for the 15 years period. A similar observation can be drawn for the momentum factor and is negative when significant. The inclusion of the profitability and the investment patterns are most of the time insignificant.

The environmental and governance pillars have some interesting characteristics. Many firms have received a 0 score in the environmental pillars this results in a mode of 0 and indifferentiable percentile at the 5% or the 20%. Therefore, the same low portfolios were constructed during the first years. As time goes by, the proportion of 0 is reduced but remains important (i.e. the distribution is close to the uniform distribution but with few high scores). Environment portfolios have achieved significant alpha at the 5% level for the 10 and 15 years period. Regarding governance, the highest portfolios (90%, 85% percentiles) achieved significant positive alpha (between c.3% and c.4.5%) for the three methodologies but only for the 15 years period.

The usage of the equally weighted methodology induces some interesting changes. First, for all ESG measures, the portfolio representing all rated firms has significant positive alpha for the 15 years period. For the same period, the high portfolios have lower positive alpha than this basis portfolios whereas the low portfolios have higher positive alpha. As in the case of value weighting, the low environment portfolios have positive alpha for the 10 years period. Concerning the size effect, while the difference in polarity is not observable anymore, the high (resp. low) portfolios are associated with lower (resp. higher) size coefficients than the basis portfolio.

Overall, the conclusion is that none strategy based on percentile of ESG scores (global or pillar scores) do consistently obtained significant alphas.

VIII.3. Enhanced strategy

As a second step, the purpose is to take into account ratings' specificities in the portfolio creation process. The second research question indicated a size effect, a location effect and a learning effect (in certain circumstances). The location effect can not be applied. However, the size and learning effect can be used to identify the firms that are truly sustainable.

The portfolio construction process is adjusted in order to reflect the size and learning effect. First, ratings are broken into 2 x 4 mutually exclusive groups based on the size and on the number of ratings issued using the quartile as breakpoints. Using different percentile levels (as in section VII), best and worse ESG companies are identified for each of these 8 groups. Then, enhanced final high (resp. low) portfolios are made of stocks that are top (resp. low) performers alongside the two dimensions.

This process aims at achieving equal representation of small and large firms and of firms with many or few ratings issued. The high and low portfolios are expected to represent the high and low ESG performers reflecting ratings' characteristics.

Before discussing performance results, it is worthwhile to compare the enhanced portfolios and the portfolios formed is section VIII.2. The following comments have been derived from the ESG combined score. First, the two procedures lead to similar exposure to industries. Both high and low portfolios have over-exposition to financial firms (c. 20%) and to consumers cyclicals (c. 17%) and low exposition to telecommunications services and utilities. Nevertheless, this is in line with the distributions of ratings across industries.

As desired, enhanced portfolios are less influenced by the number of ratings issued. In 2018, the enhanced low portfolio has on average 3.3 ratings issued while it is only 1.8 issues for the non-enhanced portfolios. Similar observations can be drawn for the high portfolios level (5.4 versus 9.6 for the non-adjusted). Similarly, the size enhancement leads to an increase of size for the low portfolios and a decrease of size for the high portfolios.

While the procedure has reduced both effects, they remain. Indeed, the learning effect and size effect are still present as the low portfolios have a lower number of issues and low market capitalization than the high portfolios.

Nonetheless, the reduction of these biases does not influence the financial performance of the portfolios. Overall, no strategy using these scores lead to significant positive alphas.

At the ESGC level, low portfolios achieved significant positive alphas across the three models and for the 15% and 20% percentile threshold. These alphas are only obtained for the 15 years period and could not be generalized to other periods. The high portfolios obtained significant positive alpha only for the 10 years period and using the 15% and 20% percentiles threshold.

In line with section VIII.2, low environmental portfolios do not differ across percentile due to a large mode at 0 during the first years. These portfolios are close to previous section and associated with the same characteristics (positive alpha for the 15 and 10 years period). The high governance portfolios are associated with significant (at the 1% level) alpha above c.3% only for the 15 years period.

In the case of the Carhart four-factor model, the SMB coefficients remain negative for high portfolios and became not significant for low portfolios for global score (ESGC and ESG). This suggests that enhanced low portfolios are less exposed to small firms. The momentum factor is generally insignificant and negative when significant (e.g. for the 15 years period). Regarding the 5 factors, both the RMW and the CMA factors remain insignificant.

In line with section VIII.2, the equal weights introduce significant positive alpha for the portfolios when assessing the 15 years period. Furthermore, the high portfolios have lower positive alpha than the basis portfolios whereas the low portfolios have higher positive alpha. The size effect also disappears. As in the case of value weighting, the environmental pillars have positive alpha for the 15 years period. The high portfolio has lower alpha while the low portfolio has higher alpha. The HML factor is significant and positive for all periods (excepted for the 5 years period low portfolios). Significant negative momentum factors and insignificant RMW and CMA factors are also observed.

VIII.4. Extension to European firms

This section aims at testing if American results can be extended to European markets. As highlighted in the methodology part, factors provided by French are expressed in dollars. Therefore, euro returns of European stocks should be converted into dollars. However, returns including dividends obtained from Eikon API are in the local currency. Euro returns can be converted into dollars returns based on the following formula:

$$r_{i,t}^{USD} = \frac{\frac{P_{i,t}^{EUR}}{USD/EUR_t} - \frac{P_{i,t-1}^{EUR}}{USD/EUR_{t-1}}}{\frac{P_{i,t-1}^{EUR}}{USD/EUR_{t-1}}} = \frac{P_{i,t}^{EUR}}{P_{i,t-1}^{EUR}} * \frac{USD/EUR_{t-1}}{USD/EUR_t} - 1 = \frac{\left(1 + r_{i,t}^{EUR}\right)}{\left(1 + r_{i,t}^{USDE/UR}\right)} - 1$$

where $r_{i,t}^{XXX}$ is the return in currency XXX of asset i at time t, $P_{i,t}^{EUR}$ is the price in euro of asset i at time t, USD/EUR_t is the exchange rate at time t (1 USD =USD/EUR_t EUR at time t). As most of European rated stocks are listed in the United Kingdom, the two approaches can be applied with the USD/GBP exchange rate.

Another approach is to convert the factor in EUR returns (Glück et al, 2020). This second approach requires to do two separate regressions one for stocks in GBP and one for stocks in EUR. In contrast, the first approach can be applied for the two currencies at the same time. Therefore, the first approach will be applied.

Data overview

The European sample is smaller than the American sample resulting in smaller portfolios formed. Therefore, the pool of available stocks may suffer from a lack of diversification for the first years. Details on returns and on factors (correlation, p values and VIF) are provided in the appendix. Few returns (which were higher 1000% in one month) and have been removed to conduct the regressions. Moreover, the RMW and HML have a high significant correlation (c. -0.65) but the VIF factors remain reasonable.

Basis strategy

Results at the European level are similar to American listed stocks. Before anything else, using non-converted prices lead to R^2 around 0.6 and significant high alphas. These alphas are due to different currencies, the conversion raises the R^2 to 0.9 and no significant alphas remains.

As American firms, a size effect is observed: the high portfolios have a negative exposure whereas the small portfolios have a positive exposure. For the 15 years period, a significant negative momentum effect is observed for rated stocks. The significance increases with the length of periods tested. The introduction of the momentum factor results in annualized alphas of 2.5% for the basis portfolios. High and low portfolios have higher alphas but alphas of low portfolios are not significant. The RMW factor is not significant which may be due to the high correlation with the HML factor and coefficient associated with CMA are negative and significant for the 15 years period.

European firms also performed poorly on the environmental dimensions with several null observations. Bottom portfolios are therefore larger between 2004 and 2007 (due to a mode at 0) and are very similar for different percentiles levels. As time goes by, the distribution of environmental scores becomes more uniform and the lower periods tested are thus less affected

by this bias. Similar observations (size effect, no significant alpha, momentum effect, CMA and RMW factors) can be observed at the pillar level. Many low governance portfolios at the 15% percentile level achieved significant alpha across the three models.

Results are very alike when equal weights are used. One difference is a reduction of the size effect for the high portfolios and a stronger effect for the low portfolios.

Enhanced strategy

The same enhanced strategy is applied to European firms. The portfolios of the second strategy are smaller but have similar exposure to industries. The most represented industries are the financial, the consumer cyclical and industrials.

As expected, the enhanced strategy increases (resp. decreases) the size and the number of ratings issued for the bottom (resp. top) portfolios. In 2018, the number of ratings issued increased by 2.02 (from 4.92 to 6.94) for the 25% low portfolio and decreased by 1.7 for 75% the 75% high portfolio (12.46 to 10.76). The mean size of the low portfolios increased from 7.4ç 10^8 to 1.07 10^9 and decreased from 5.76 10^9 to 2.16 10^9 for the high portfolio.

The change in portfolio construction leads to similar performance results and observations. Models achieved in general R^2 higher than 0.90. The size effect is still observable when value weights are used. The value effect is most of the time not significant and negative when significant (a similar trend for both the high and the low portfolios). Coefficients of the momentum factor are negative and significant for the 15 years period and otherwise insignificant. The profitability factor is insignificant while the investment patterns in insignificant excepted few negative cases. Moreover, the significance of factors increases with the number of periods in the model. This can be explained by higher standards errors for the 5 years period due to fewer observations. The bias in environmental score due to a mode in 0 is less strong.

The equal weight portfolios have again some specificities. The size effect is not present for high portfolios and is stronger for small portfolios. For the four-factor model and the 15 years period, the basis portfolios are associated with significant positive alphas (annualized at 4.61%). The high portfolios have slightly higher alpha whereas the low portfolios have smaller (and sometimes not significant) alpha. However, the long-short strategy does not deliver any significant alpha.

VIII.5. Conclusion

This section was devoted to a performance analysis of ESG ratings. Two main segments of empirical results were tested. On the one hand, the performance of ESG tilt portfolios was tested (see Kempf et al., 2007, Statman et al., 2009). On the other hand, the ability of individual pillars to mimic related metrics was investigated (see for the environment Klassen and Mclaughlin, 1999, Yamashita et al., 1999, Derwall et al.,2005, for the governance Gompers et al., 2003, Core et al., 2006, for the customer satisfaction Aksoy et al., 2008, Anderson et al., 1994, Fornell et al., 2016 and for employees satisfaction Edmans, 201, Sheng, 2018, Wen, 2019). The portfolio construction was also improved in order to take into account biases identified in RQ2.

The results of previous sections indicate that a simple strategy of high and low ESG scores do not deliver significant alpha. ESG tilt portfolios are not associated with overperformance and pillars ratings failed to replicated findings on related metrics. This corroborates with existing research (Halbritter et al., 2015). On the one hand, this implies that ESG ratings could not be used alone to obtain overperformance. On the other hand, investors considering ratings as reliable indicators of sustainability can apply best in class strategies in order to satisfy their sustainable criteria without a negative impact on performance.

However, ESG tilt portfolios have some particular features. The high portfolios overrepresent big firms with many issues while the low portfolios overrepresent small firms with few issues. In contrast with existing researches, an enhanced strategy adjusted for the size and learning effect was tested. The purpose was to identify the truly sustainable firms. Nonetheless, this strategy leads to similar results that may be due to not enough distinct criteria.

Nevertheless, the question remains open for the inclusion of sustainable considerations alongside other criteria. In order to obtain overperformance, ESG ratings may be combined with other indicators. The Eikon & MSCI Portfolio Risk Analytics tool allows for the optimization of portfolios while setting ESG rating constraints. This enables, for instance, to obtain a portfolio associated with a rating above 70 while optimizing the risk and return properties of the portfolio. This was not investigated as part of this third research question. On top of that, many ESG funds have already been launched on the market. Some financial institutions relied on ratings to assess the sustainability of firms. Lyxor has launched at the beginning of 2020 an ESG tilt ETF[31] which only include firms with MSCI ratings above BBB.

[31] Lyxor USD High Yield Sustainable Exposure UCITS ETF

IX - Conclusion

IX.1. Background

During the last years, sustainable finance has gained popularity among investors as shown by growing concerns (Schorders, 2019 and Morgan Stanley, 2019), growing assets (GSIA, 2018, Eurosif, 2018) and larger offers by financial institutions (Hale, 2020 and Bioy 2018). These trends suggest an extension of financial preferences with sustainable preferences. However, investors have heterogenous sustainable preferences (Rosen, 1991, Scholtens et al., 2013, Gutsche, 2017) and have to choose between a range of sustainable strategies (Eurosif, 2018).

The presence of sustainable preferences raises questions on the assessment of investments' sustainability. ESG ratings provide simple sustainable metrics for investors and financial institutions. The acquisitions completed by large financial firms such as Morningstar, Refinitiv, S&P and Moody's among others reveal the promising future of ESG ratings.

IX.2. Results of the three research questions

Several academics highlighted the heterogeneity between major agencies (Chatterji et al., 2015, Dorfleitner et al., 2015 and Berg et al., 2019). The first research question sheds light on the distinctions between agencies in terms of methodologies. Sustainalytics and RobecoSAM put further emphasizes on the management of ESG. Sustainalytics focuses on the management of risk while RobecoSAM focuses on the preparedness. In contrast, MSCI and Refinitiv offer similar ratings reflecting the ESG profile of the firms.

Even though agencies have different purposes and methodologies, case studies show that they are overall aligned but with different strengths. If ESG ratings were an absolute concept, there should be no difference between agencies. The differences show that ESG is rather a relative concept as could be considered as sell-side reports (Financial Times, 2020d).

This first research question also indicates that the results of the second and third research questions are specific to Refinitiv and could not be extended to other rating agencies.

Regarding the second research question, some studies identified different biases such as political bias (Di Giuli et al., 2014), location bias (Baldini et al., 2018) and size bias (Drempetic et al., 2019). The second research question was dedicated to an analysis of ratings' determinants namely the effect of size, location and the number of ratings issued. Three different approaches were applied and lead to mixed results.

The fixed-effects approach reported a size and a learning effects (the location effect could not be tested as it is a time-invariant variable). Nonetheless, the introduction of time fixed-effects removes the learning effect and was associated with non-meaningful coefficients.

The random-effects approach leads to economically meaningful results. A size effect, a learning effect and a location effect were reported even with the inclusion of time fixed-effects. Nonetheless, tests raise concerns on the statistical significance of the models.

Concerning the third research question, portfolios of high and low ratings are neither associated with overperformance nor with underperformance for American and European (including UK) stocks. This also showed that pillars ratings failed to replicate findings on governance (Gompers et al., 2003, Core et al., 2005), the environment (Derwall et al., 2005, Chan et al., 2014), the customer satisfaction (Fornell, 2016) and the employee satisfaction (Sheng, 2018, Green et al., 2019). This corroborates with Halbritter et al. (2015). However, these portfolios are influenced by the biases identified in the second research question and an enhanced strategy reflecting these biases was applied. Nevertheless, these enhanced portfolios remained unable to deliver significant alphas. Even so, these findings indicate that the best in class strategy can be applied for investors trusting ESG ratings as sustainable indicators but can lead to exposition to certain risk factors.

Overall, this thesis aimed at testing the reliability of ESG ratings and provides mixed evidence. The first research question supports the reliability of ratings. Even with some specificities among agencies, case studies provide aligned ratings. The analysis conducted indicated that different ratings can complement each other in order to have a broader picture of the ESG performance. In contrast, the second research question raises concerns about the reliability due to the presence of significant biases. However, these biases may have rational support. Regarding the size effect, larger firms can allocate more resources to ESG. The location effect may be explained by difference in reporting requirements. And, the learning effect can be explained by adjustments and better reporting after the attribution of ratings. The third research question showed that ESG pillars and global ratings are not associated with over or under performance. However, it indicates that portfolios constructed upon ratings are subject to the biases identified in the second research question. Taken together, this indicates that ratings should be used cautiously.

IX.3. Conclusions and future outlooks

The results, the future trends and research can be assessed from three different perspectives namely the agency, the investor and the firm perspectives.

This thesis sheds light on the limitations of ratings. More precisely, the specificities of agencies and the presence of biases question the reliability of ratings. The introduction of international regulation (for instance from the EC) and the consolidation trends can reduce this observed heterogeneity. It might be interesting to assess the extension of biases to other agencies. Besides, an exhaustive comparison between agencies can also clarify the reliability of ratings to reflect the sustainability of firms and on the complementarity of ratings.

This thesis showed that investors and more generally financial institutions should use carefully ESG ratings. Agencies specificities showed that different ratings may be used jointly to obtain an appropriate sustainable assessment. It is worth noticing that biases can result in unexpected exposure to certain risk factors. Furthermore, future investment trends may reveal investors' sustainable preferences. For instance, an increase in impact investing would indicate that the investors are equally concerned by financial returns and sustainability. In contrast, an increase in ESG integration might indicate that investors are willing to reduce their exposure to sustainable risk or to obtain higher returns through ESG (CNBC, 2020b). On top of that, the introduction and application of the European taxonomy will clarify sustainable finance. As a matter of fact, financial institutions will have to adapt their offers in order to meet the ESG demand and to respect forthcoming regulations. Future research might take a further look at the impact of ESG on higher moments (and not on returns) and flows' sensitivity towards different ESG ratings (MSCI funds ratings for instance).

Firms will play a central role in the evolution of ratings. Investors' interests may push them to further interpret and react to their ratings. The presence of sustainable investors can encourage them to improve their ESG profile in order to reduce their cost of capital. Moreover, firms may have to develop their non-financial reporting due to stricter regulation. Besides, a growing number of firms are taking strong positions towards SDG goals and the environment (Nestle and Microsoft among others). The commitment to these positions will be crucial for firms' reputation and climate crisis management. The impact of ESG's development in the governance and social aspects of firms, the avoidance of greenwashing and reaction towards ratings can be interesting research subjects.

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XI – Appendix

A. Introduction

A.1. Breakdown of strategies by region

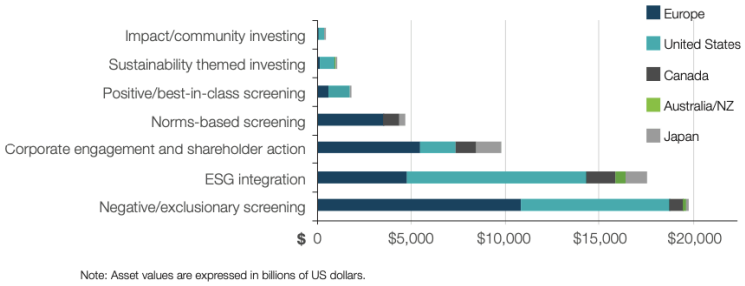

Figure 4 : Sustainable asset by region and by strategy in 2018

Source: GSIA (2018), p.10

A.2. Importance of SRI strategies in Europe

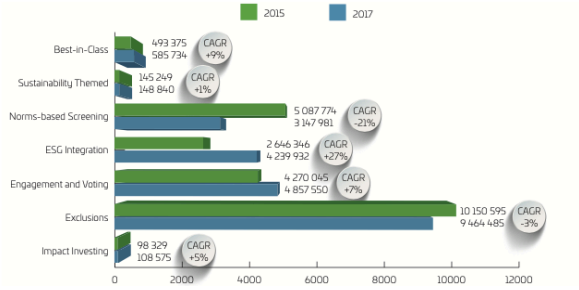

Figure 5 : SRI strategies in Europe

Source: Eurosif (2018), p.16

A.3. ESG funds flows in the U.S.

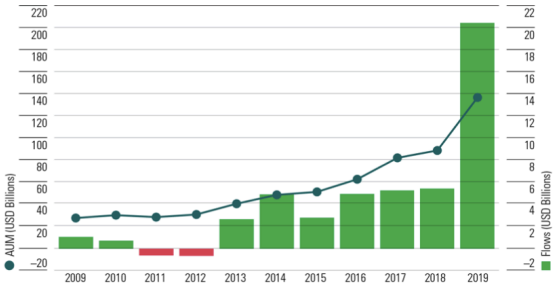

Figure 6 : ESG Funds flows in the U.S. until 2019

Source: Hale (2019), Morningstar Direct. Data as of 12/31/2019.

B. Literature review

B.1. Environmental management and profitability

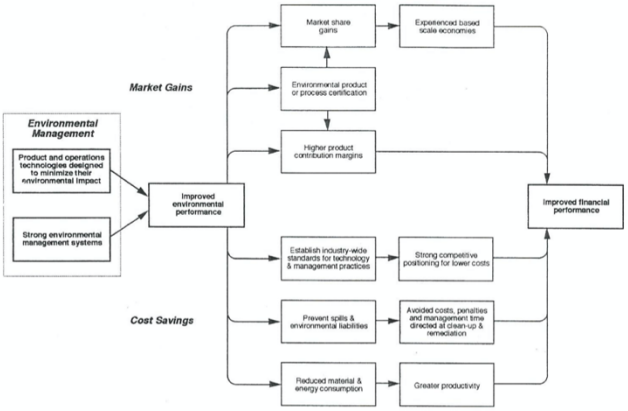

Figure 7 : Linkage of environmental management to firm profitability

Source: Klassen and Mclaughlin (1999)

B.2. Overview of studies on SRI performance

Autors	Year	Underlying	Methodology	Findings
Bauer, R., Koedijk, K., Otten, R.,	2005	103 mutual funds (German, UK and US)	Carhart four factor model	**No difference in performance between sustainable and non-sustainable funds** They analyzed returns of mutual funds over the period 1990 to 2001 and found that returns of sustainable and non-sustainable funds do not differ significantly. They noticed a learning period for sustainable funds at the beginning of the 90s during which they underperformed the conventional funds.
Derwall, J., Guenster, N., Bauer, R., Koedijk, K.	2005	Portfolio based on ESG rating of Innovest	Carhart four factor model	**Overperformance for a long-short strategy based on Innovest score** By constructing long-short portfolio based on Innovest eco-efficiency score, they found overperformance (6% per annum between 1997 and 2003). Their results remain significant with the integration investment style transaction costs and industry-specific factors.
Barnett, M., Salomon, R.,	2006	61 SRI funds	Risk-adjusted performance	**Diversification losses are offset by screening benefits** By assessing risk adjusted performance, they found that returns increase as the screening intensity increase. They found that funds with low and high intensity screening are not hurt. In contrast, funds with medium intensity have loss related to diversification but could not benefit from gains of screening.
Kempf, A., Osthoff, P.	2007	Portfolio based on ESG rating of KLD	Carhart four factor model	**Overperformance for a long-short strategy based on KLD score** By constructing long-short portfolio based on KLD rating (then 10th and 90th percentile of score), they found overperformance (up to 8.7% per year). Besides that, they found that negative screening has no impact and that book-to-market factor is lower for highly rated companies.
Fabozzi, F., Ma, K., Oliphant, B.	2008	Sin stocks in 21 countries	CAPM	**Overperformance of sin portfolios** By constructing a sin portfolio, they found significant outperformance over the market. The sin portfolio had an annual return of 19% between 1970 and 2007. They warned investors on the potential cost of exclusion in order to respect their values.
Galema, R., Plantinga, A., Scholtens, B.	2008	ESG portfolio based on ESG data on KLD	Carhart four factor model, Fama-MacBeth regressions, book to market regressions	**SRI effect included in the book-to-value effect and different effect for thematic scores** They undermined the reliability of the Carhart four factor model in the context of SRI fund. They pointed out that the effect of SRI is measured on the book-to-value ratio and not the alpha. SRI stocks have higher demand and therefore higher book-to-value ratio. Thus, this reduces alpha found in the Carhart four factor model. Moreover, they analyzed impact on return of thematic ESG scores (i.e. E, S and G individually). They found a significant positive effect of governance scores on book-to-value ratio and a significant positive effect of employee relation on returns.
Renneboog, L., Horst, J. T., Zhang, C.	2008b	440 SRI funds	Carhart four factor model, extended factor model, conditional Carhart four factor model	**Underperformance of SRI funds** SRI funds underperforms their benchmarks portfolio (significant negative alphas in the Carhart four factor model) but do not underperforms their non sustainable counterparts. They reported the absence of a smart money effect for sustainable investors (i.e. they are not able to find better performing fund). Nonetheless, investors are able to identify poor performing funds.
Hong, H., Kacperczyk, M.	2009	US firms	Carhart four factor model, Fama-MacBeth regressions	**Overperformance of sin portfolios** They found that a portfolio comprised of ''sin stocks'' (i.e., alcohol, tobacco and gaming) significantly outperforms similar comparable stocks. This implies that investment SRI stocks hurt investors. They explained that overperformance is related to lower analysts' coverage (as some institutional investors exclude these stocks) and higher risks (e.g. litigation).
Lee, D., Faff, R.,	2009	Dow Jones Sustainability Index, Dow Jones Global Index	CAPM, three and four factor model	**Overperformance of non-sustainable performance and no difference for sustainable portfolios** Based on the components of the DJSI and the DJGI, they constructed leading and lagging portfolio in terms of sustainability. They found that non sustainable portfolios outperform the market and sustainable portfolio. Moreover, they found that the sustainable portfolio does not underperform the market.

Statman, M., Glushkov, D	2009	Portfolio based on ESG rating of KLD	CAPM, three and four factor model	**Overperformance of stocks with high score and cost of exclusion** They conclude that performance of SRI portfolios is not statistically different from conventional ones. However, in line with the idea of costs for exclusion and benefits for best in class strategies, high scores portfolio overperform and portfolio with exclusion underperform. They found high excess return for long-short strategy of high and low scores.
Derwall, J., Koedijk, K., Ter Horst, J.	2011	Portfolio based on ESG rating of KLD	Carhart four factor model	**Cost of exclusion persistent over time but temporary benefits of best-in-class** They analyze the effect of exclusion (values-driven) and screening (profit-seeking) on performance. They found that the negative exclusion effect was persistent over time, but the positive screening effect decreased over time.
Belghitar, Y., Clark, E., Deshmukh, N	2014	3 indices	Marginal Conditional Stochastic Dominance	**No conclusion at the mean-variance level but impact on higher moments** Based on Marginal Conditional Stochastic Dominance (MCSD), they found that conventional indices dominate SRI indices. More precisely, they pointed out an absence of impact on the mean and the variance. But they found negative impacts on higher moments.
Chan, P., Walter, T.	2014	748 firms	Carhart four factor model	**Higher returns for green firms in context of IPO or SEO** At the firm level, they found evidence that greens firms have higher return in the context of initial public offerings (IPO) or seasonal equity offerings (SEO). They reported a positive alpha (a ''green premium'') of 7% for environmentally 'friendly firms per year.
Eccles, R., Ioannou, I., Serafeim, G.	2014	180 U.S. firms	Carhart four factor model	**Overperformance of high and low sustainability firms** By comparing firms with and without sustainable policies, they found a financial overperformance on the long term of sustainable companies. These companies outperformed on the stock's markets (4.8% as alpha) and on accounting performance. They observe an overperformance (but lower) for low sustainability firms. This study has covered a long-term period from 1993 to 2010.
Humphrey, J. E., Tan, D. T.	2014	Firms in sustainable index, large cap and in S&P 500	Carhart four factor model	**No cost for exclusion at the portfolio level** By constructing portfolios mimicking mutual funds, they have found that returns of screened portfolios and not screened portfolio are not different. This contradicts the statement that exclusion is costly for investors.
Utz, S., Wimmer, M.	2014	Conventional and sustainable portfolios	Sharpe ratio, Treynor Ratio, CAPM, Carhart four factor model	**No difference in performance between sustainable and non-sustainable funds** Based on the alpha, the Sharpe ratio, the Treynor ratio and the M2, they do not found difference in performance between sustainable and non-sustainable funds.
Friede, G., Busch, T., Bassen, A.	2015	2200 individual studies	Meta-analysis	**Meta-analysis suggesting positive relation between returns and ESG** Their analyses are based on 35 vote-count studies and 25 meta-analyses. According to their meta-analysis, they found that ESG has a positive impact on the financial performance. 90% of studies have found nonnegative relation and a large majority have found positive relationship.
Halbritter, G., Dorfleitner, G.	2015	ESG portfolio based on ESG data on Thomson Reuters, Bloomberg and KLD	Carhart four factor model, Fama-MacBeth regressions	**Positive (and insignificant) relation or no relation between returns and ESG ratings** They applied the Carhart model on long-short studies. They found positive (but insignificant) alpha for Thomson Reuters and no relation for Bloomberg and KLD rating. They found that high ESG scores have higher book-to-market risk. In their cross-sectional analysis, they found positive relation between returns and ESG scores for Thomson Reuters and Bloomberg. But these cross-sectional finding are closely related to the ESG data provider.
Revelli, C., Viviani, J-L	2015	85 studies	Meta-analysis	**No consensus but positive relation on theoretical portfolios and negative relation for real funds** Based on their meta-analysis, ESG performance and financial performance is neither positively nor negatively correlated. They highlight that analysis on real funds show a negative relationship whereas funds created by the researchers themselves have positive performance (maybe due to an absence of cost for the researchers when constructing the portfolio). They emphasize that the lack of consensus can be explained by the wide range of database and methods used and by data-mining bias.
Trinks, P., Scholtens, B	2017	1763 controversial stocks	Carhart four factor model	**Exclusion costs depending on the sectors** By constructing portfolios with exclusion screenings, they found that exclusion can have a cost under certain conditions. For instance, they found that the exclusion of alcohol or nuclear power has no impact on performance.
Chen, X., Scholtens, B.	2018	142 SRI funds	Carhart four factor model, tracking error	**Limited evidence of overperformance of active SRI over passive SRI** By analyzing sustainable ETF and sustainable mutual funds, they found limited evidence of overperformance of the active strategy compared to the passive strategy.
Jin, I.	2018	1425 funds	Six factor model	**ESG risk is priced by the market** Jin added an ESG factor (computed as conventional return minus ESG returns) to the five factor model. The factor is negative implying a downside protection to ESG. The coefficient is positive implying a investment of conventional funds only if it is higher than the down-side protection
Chatterjee, S.	2018	73 sustainable funds	OLS on Sharpe ratio	**Overperformance of low and mid score** Based on Morningstar Scores, they found that funds with low and mid score have higher Sharpe ratio over the 2009-2016 period. However, the high score overperform during the 2005-2008 period and this can indicate a resilience of green stocks to crisis.
Steen, M., Moussaw, J.T., Gjolberg, O.	2019	146 mutual funds	Carhart four factor model	**No impact on returns of Morningstar scores** Authors analyzed the performance of funds based on their ESG scores provided by Morningstar and do not fund difference in return at the global level. However, overperformance is found when focusing on European funds (which have higher governance and social score). They reported a significant (at the 5% level) ESG momentum (0.3%/month). In other words, firms with an increase in their ESG score will have higher returns.

Table 7 : Overview of studies on SRI performance

C. Research Questions

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D. RQ1: Qualitative analyses and findings

D.1. S&P - ESG Profile Building Blocks

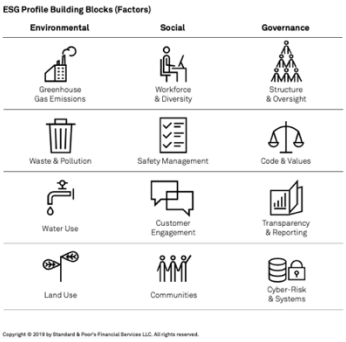

Figure 8 : S&P - ESG Profile Building Blocks

Source: S&P, 2019, Environmental, Social, And Governance Evaluation Analytical Approach

D.2. MSCI

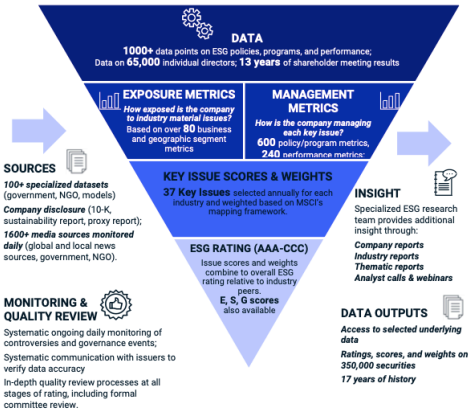

Figure 9 : MSCI rating process (source: MSCI, 2019, p.2)

3 Pillars	10 Themes	37 ESG Key Issues	
Environment	Climate Change	Carbon Emissions	Financing Environmental Impact
		Product Carbon Footprint	Climate Change Vulnerability
	Natural Resources	Water Stress	Raw Material Sourcing
		Biodiversity & Land Use	
	Pollution & Waste	Toxic Emissions & Waste	Electronic Waste
		Packaging Material & Waste	
	Environmental Opportunities	Opportunities in Clean Tech	Opp's in Renewable Energy
		Opportunities in Green Building	
Social	Human Capital	Labor Management	Human Capital Development
		Health & Safety	Supply Chain Labor Standards
	Product Liability	Product Safety & Quality	Privacy & Data Security
		Chemical Safety	Responsible Investment
		Financial Product Safety	Health & Demographic Risk
	Stakeholder Opposition	Controversial Sourcing	
	Social Opportunities	Access to Communications	Access to Health Care
		Access to Finance	Opp's in Nutrition & Health
Governance	Corporate Governance*	Board*	Ownership*
		Pay*	Accounting*
	Corporate Behavior	Business Ethics	Corruption & Instability
		Anti-Competitive Practices	Financial System Instability
		Tax Transparency	

Figure 10 : MSCI - ESG Key issues

Source: MSCI 2019 MSCI ESG Ratings Methodology

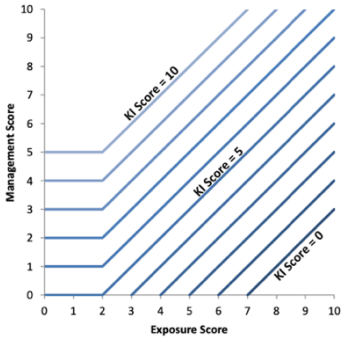

Figure 11 : MSCI - Combining Exposure and Management – 'Risk' Key Issues

Source: MSCI ESG Research, September 2019, MSCI ESG Ratings Methodology (Executive Summary)

D.3. Sustainalytics

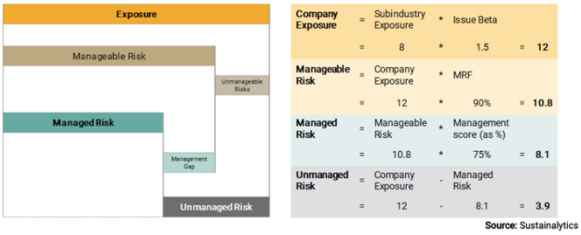

Figure 12 : Sustainalytics rating process

Source: Sustainalytics, 2020, p.11

D.4. CDP – Scores and grades

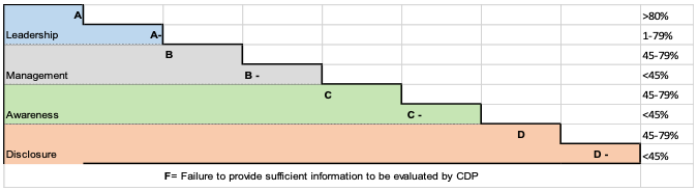

Figure 13 : CDP Rating classification

Source : CDP, 2018, p.6

D.5. Refinitiv process

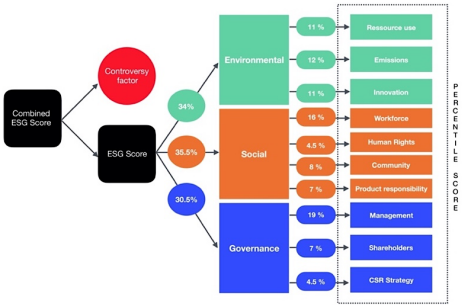

Figure 14 : Refinitiv process

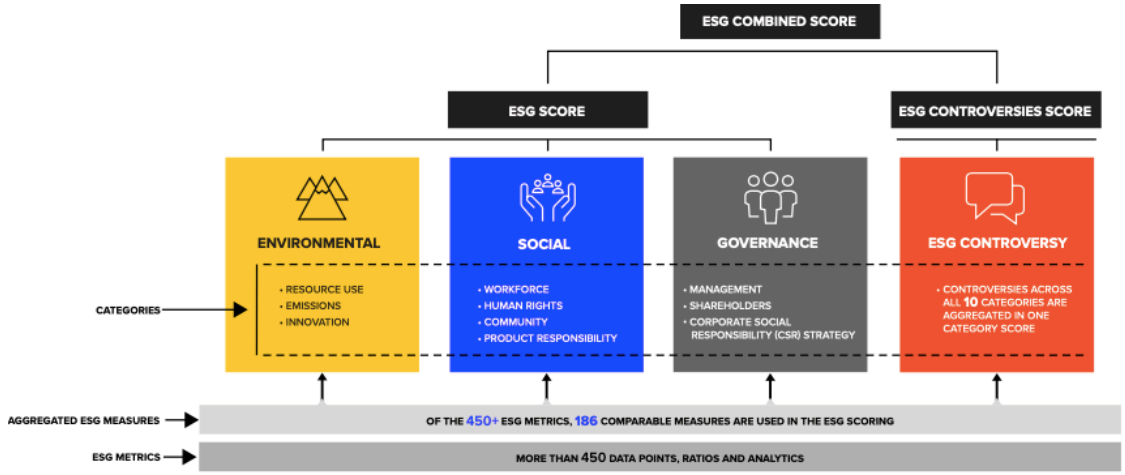

Figure 15 : Refinitiv Methodology as of April 2020

D.6. Case studies

Agency	Company	Final Score	Comments
RobecoSAM	Unilever PLC	89/100 *12/2019*	ESG Profile Score of 75 and Best-In-Class Preparedness Opinion
MSCI	Unilever PLC	A Grade *09/2019*	"Unilever is average among 35 companies in the household & personal products industry"
Refinitiv	Unilever PLC	B *12/2018*	S weight of 49%, E and G weights of 25.5% A+ ESG Score and C- Controversy Score

Table 8 : Case study - Unilever

Agency	Company	Final Score	Comments
RobecoSAM	Repsol S.A.	68/100 *11/2019*	ESG Profile Score of 61 and Strong Preparedness Opinion Low Score but "among more-advanced in the O&G sector"
MSCI	Repsol S.A.	AA *11/2019*	"Repsol is a leader among 29 companies in the integrated oil & gas industry"
Refinitiv	Repsol S.A.	A- *12/2018*	S weight of 42%, E weight of 34.5%, G weight of 23.5% A- ESG Score and B+ Controversy Score

Table 9 : Case study - Repsol

Agency	Company	Final Score	Comments
MSCI	Qualcomm	B 02/2020	B since March 2016 Qualcomm is a laggard in its industry
Sustainalytics	Qualcomm	20.2/100 (Medium) 09/2019	Low exposure and average management but high controversy.
Refinitiv	Qualcomm	C (30-09-19)	E weight of 31%, E weight of 43%, G weight of 26.0% B+ ESG Score and D- Controversy Score

Table 10 : Case study - Qualcomm

Agency	Company	Final Score	Comments
RobecoSAM	NextEra Energy INC	86/100 *06/2019*	ESG Profile Score of 72 and Best-In-Class Preparedness Opinion
MSCI	NextEra Energy INC	AAA *10/2019*	AAA since December 2016 "NextEra is a leader in the utilities industry"
Refinitiv	NextEra Energy INC	B *12/2018*	E weight of 42.5%, S weight of 32.5%, G weight of 25.0% B ESG Score and A+ Controversy Score

Table 11 : Case study – NextEra Energy

D.7. Extracts of case studies

Figure 16 : S&P Global - Unilver PLC Score

Source: S&P Global - Unilver PLC Retrieved on 16 June 2020 from https://www.spglobal.com/ratings/en/research/pdf-articles/191210-esg-evaluation-unliever-plc-n-v

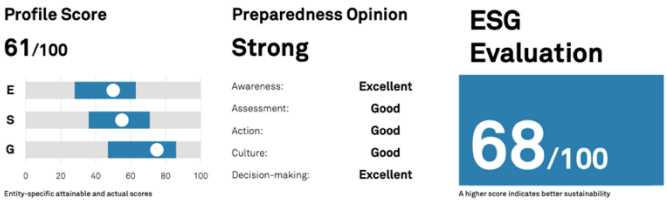

Figure 17 : S&P Global - Repsol S.A Score

Source: S&P Global - Repsol S.A. Retrieved on 16 June 2020 from https://www.spglobal.com/ratings/en/research/pdf-articles/20191125_esg-evaluation-repsol-sa

Figure 18 : S&P Global - NextEra Energy Inc Score

Source: S&P Global - NextEra Energy Inc Retrieved on 16 June 2020 from https://www.spglobal.com/ratings/en/research/pdf-articles/190617-esg-evaluation-nextera-energy-inc

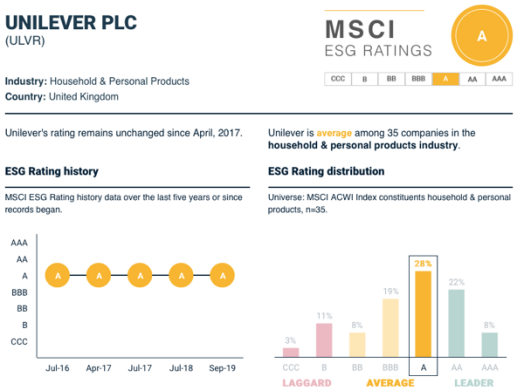

Figure 19 : MSCI – Unilever Score

Source: MSCI – Unilever Retrieved on 16 June 2020 from https://www.msci.com/esg-ratings/issuer/unilever-plc/IID000000002137159

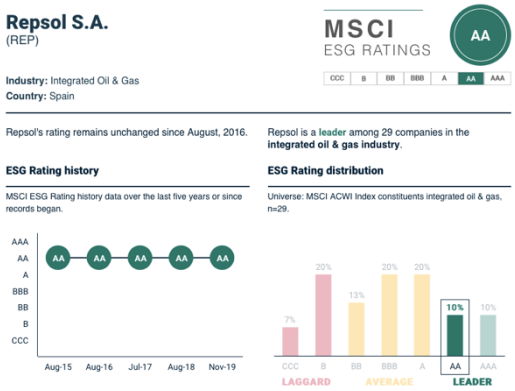

Figure 20 : MSCI – Repsol SA Score

Source: MSCI – Repsol SA Retrieved on 16 June 2020 from https://www.msci.com/esg-ratings/issuer/repsol-sa/IID000000002181334

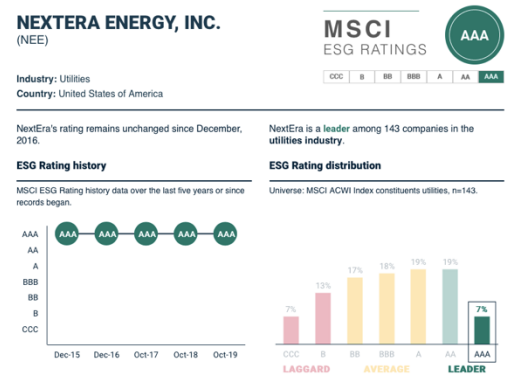

Figure 21 : MSCI – NextEra Energy Score

Source: MSCI – NextEra Energy Retrieved on 16 June 2020 from https://www.msci.com/esg-ratings/issuer/nextera-energy-inc/IID000000002166056

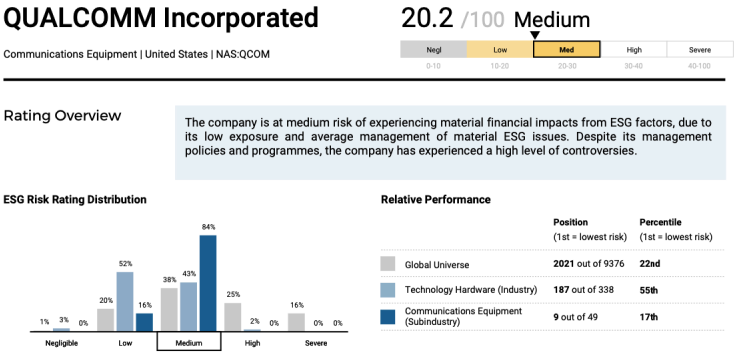

Figure 22 : Sustainalytics - Qualcomm Inc Score

Source: Sustainalytics - Qualcomm Inc Retrieved on 16 June 2020 from https://connect.sustainalytics.com/hubfs/INV%20-%20Reports%20and%20Brochure/Reports/ESG-Risk-Rating-PDF-Report-Qualcomm.pdf

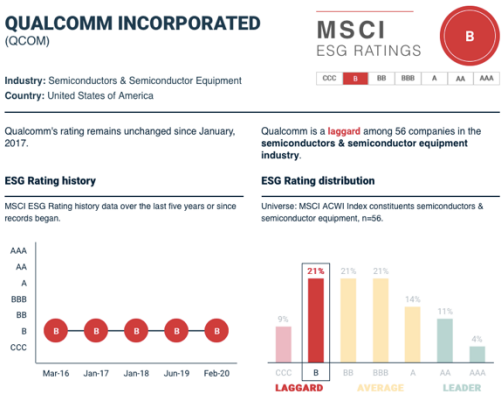

Figure 23 : MSCI - Qualcomm Inc Score

Source: MSCI - Qualcomm Inc Retrieved on 16 2020 June from https://www.msci.com/esg-ratings/issuer/qualcomm-incorporated/IID000000002136704

D.8. Conclusion

Agency	Methodology	Comments
RobecoSAM (S&P)	ESG Profile & Preparedness	Forward looking and information from meetings Scores affected by the industry (not normalized) • E: Greenhouse gas [GHG] emissions, waste, water use, land use • S: workforce and diversity, safety management, customer engagement, and communities • G: structure and oversight, code and values, transparency & reporting, cyber-risk & technological systems
MSCI	Industry Adjusted weighted average	Issues specific by industries and final score normalized by industries • E: Climate Change, Natural Resources, Pollution and Waste, Environmental Opportunities • S: Human Capital, Product Liability, Stakeholder Opposition, Social Opportunities • G: Corporate Governance, Corporate Behavior
Sustainalytics (Morningstar)	Risk Rating based on key issues	Focus on the risk and its management Only consider material issues
Refinitiv	ESG Score & Controversy factor	Industry normalized and controversy scores • E: Resource Use, Emissions, Innovation • S: Workforce, Human Rights, Community, Product Responsibility • G: Management, Shareholders, CSR Strategy

Table 12 : Comparison of agencies rating processes

E. Data description

E.1. Global level

Grade	Range	Total	Percent
D-	0≤ Score ≤8.33	151	2,3%
D	8.33≤ Score ≤16.67	535	8,0%
D+	16.67≤ Score ≤25	927	13,8%
C-	25≤ Score ≤33.33	1054	15,7%
C	33.33≤ Score ≤41.67	1008	15,0%
C+	41.67≤ Score ≤50	896	13,4%
B-	50≤ Score ≤58.33	772	11,5%
B	58.33≤ Score ≤66.67	615	9,2%
B+	66.67≤ Score ≤75	411	6,1%
A-	75≤ Score ≤83.33	252	3,8%
A	83.33≤ Score ≤91.67	85	1,3%
A+	91.67≤ Score ≤100	3	0,0%
Total		6709	100,0%

Table 13 : Repartition of Refinitiv Combined ESG rating in FY2018

		ESG Combined Score			ESG Controversy Score			ESG Score			ESG Environmental Score		
Year	N	μ	Md	σ	μ	Md	σ	μ	Md	σ	μ	Md	σ
2002	508	32,58	30,96	14,94	87,06	100,00	25,28	33,67	31,64	15,79	17,78	5,64	23,09
2003	578	33,62	31,78	15,12	87,07	100,00	25,13	34,63	32,89	15,87	19,76	9,07	23,36
2004	1007	32,20	30,10	15,32	91,31	100,00	22,05	33,11	30,42	16,23	17,02	2,22	23,06
2005	1354	32,95	30,85	16,09	90,87	100,00	22,46	34,03	31,26	17,22	19,53	7,73	24,25
2006	1417	34,14	31,78	17,15	89,93	100,00	23,70	35,53	32,49	18,58	21,67	11,36	25,02
2007	1585	38,12	36,44	18,22	91,09	100,00	21,90	39,41	37,14	19,37	29,80	24,43	27,88
2008	1901	39,16	37,71	18,49	89,58	100,00	24,00	41,26	38,70	20,57	33,14	28,64	28,82
2009	2201	39,20	37,19	19,18	90,54	100,00	22,98	40,96	38,12	20,83	33,16	27,33	29,25
2010	2667	39,52	38,12	19,35	89,01	100,00	24,49	41,45	39,17	21,13	33,73	28,73	29,30
2011	2880	39,64	38,60	19,65	89,24	100,00	24,18	41,54	39,89	21,31	34,25	30,26	29,01
2012	2992	40,52	39,50	19,76	90,17	100,00	23,38	42,20	40,88	21,15	35,32	31,94	28,89
2013	3140	40,30	38,75	19,56	89,68	100,00	23,85	42,05	40,53	20,92	34,74	30,70	28,94
2014	3245	40,70	39,46	19,47	90,09	100,00	23,45	42,40	40,98	20,82	34,61	31,04	28,92
2015	3961	40,97	38,97	19,99	94,89	100,00	17,38	41,88	39,64	20,74	32,30	26,39	28,88
2016	4818	40,28	38,27	19,34	94,08	100,00	18,78	41,39	38,73	20,35	30,11	22,60	29,04
2017	5574	40,14	37,96	19,54	94,33	100,00	18,39	41,15	38,49	20,48	29,55	21,93	28,68
2018	6709	40,77	38,90	19,26	92,74	100,00	20,66	42,16	39,75	20,49	30,76	24,18	28,63
2019	3267	39,43	37,01	18,18	91,91	100,00	22,08	40,85	37,76	19,51	27,58	19,69	27,49
Mean	2767	38,01	36,24	18,26	90,75	100,00	22,45	39,43	37,14	19,52	28,60	21,33	27,36

Table 14 : Evolution of the combined, controversy and ESG scores at the global level

		ESG Social Score			ESG Governance Score			ESG Reporting Scope		
Year	N	μ	Md	σ	μ	Md	σ	μ	Md	σ
2002	508	32,24	29,68	18,45	47,49	48,20	20,92			
2003	578	33,57	31,44	19,46	47,33	48,32	21,32			
2004	1007	32,52	29,48	18,91	47,12	47,59	21,76			
2005	1354	33,14	29,90	19,68	46,76	46,19	22,18	100,0	100,0	-
2006	1417	34,71	31,16	21,14	47,67	48,39	22,48	100,0	100,0	-
2007	1585	38,71	35,68	22,36	47,60	47,08	22,38	93,00	100,0	22,14
2008	1901	40,63	37,27	23,22	48,18	47,78	22,85	92,30	100,0	20,67
2009	2201	39,81	36,54	23,18	48,36	48,64	22,98	92,64	100,0	18,49
2010	2667	40,11	36,58	23,91	49,33	49,34	23,14	95,24	100,0	14,26
2011	2880	40,38	36,86	24,01	48,88	48,95	23,12	93,00	100,0	17,94
2012	2992	41,18	38,58	23,98	49,10	49,19	22,89	92,02	100,0	18,59
2013	3140	41,22	38,25	23,93	48,95	48,69	22,67	92,14	100,0	18,79
2014	3245	42,05	39,58	24,00	49,03	49,24	22,64	91,47	100,0	20,41
2015	3961	42,69	39,84	23,71	48,47	49,22	22,75	90,42	100,0	21,70
2016	4818	43,02	40,02	23,04	47,91	48,41	22,48	89,39	100,0	23,01
2017	5574	43,18	40,37	23,37	47,47	48,09	22,81	89,42	100,0	23,20
2018	6709	44,46	42,02	23,23	47,88	48,58	22,82	89,29	100,0	23,23
2019	3267	43,98	41,10	22,06	46,85	47,11	22,50	92,75	100,0	19,35
Mean	2767	39,31	36,35	22,31	48,02	48,28	22,48	92,87	100,0	17,45

Table 15 : Evolution of the environmental, social, governance and reporting scores at the global level

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
N	508	578	1009	1356	1419	1587	1903	2203	2667	2880	2993	3141	3245	3961	4819	5574	6709	3267
N contro	46	49	77	104	128	149	211	216	298	334	297	331	343	242	309	351	513	256
%	9%	8%	8%	8%	9%	9%	11%	10%	11%	12%	10%	11%	11%	6%	6%	6%	8%	8%
Mean adj.	12,0	11,8	12,0	14,1	15,3	13,7	18,9	18,0	17,3	16,4	17,0	16,6	16,1	15,0	17,3	16,1	18,2	18,2
Std adj.	8,1	7,9	9,4	10,2	11,5	10,7	11,5	11,1	12,2	11,6	11,7	11,0	11,5	11,0	11,4	11,7	11,4	12,5
Mean ESG with	37,1	34,6	39,8	41,0	41,8	47,4	48,4	48,5	48,9	48,4	48,3	47,5	47,8	51,1	49,2	49,2	48,4	45,3
Mean ESG w/o	32,1	33,5	31,5	32,3	33,4	37,1	38,0	38,2	38,3	38,5	39,6	39,4	39,9	40,3	39,7	39,5	40,1	38,9

Table 16 : Controversies adjustment at the global level

Industry	N	Con.	Ratio	Listing	N	Con.	Ratio	Headquarters	N	Con.	Ratio
				United States of				United States of			
Basic Materials	661	175	26%	America	2593	487	19%	America	2433	457	19%
Consumer Cyclicals	998	232	23%	United Kingdom	465	136	29%	China	450	20	4%
Consumer Non-Cyclicals	485	117	24%	Japan	437	101	23%	Japan	437	101	23%
Energy	439	110	25%	Australia	383	74	19%	United Kingdom	435	137	31%
Financials	1689	236	14%	China	316	12	4%	Australia	375	73	19%
Healthcare	680	107	16%	Canada	300	56	19%	Canada	303	58	19%
Industrials	1115	239	21%	Hong Kong	239	16	7%	Germany	175	52	30%
Technology	706	131	19%	Germany	186	52	28%	France	150	56	37%
Telecommunications Services	157	56	36%	France	156	58	37%	Taiwan	138	21	15%
Utilities	277	65	23%	Taiwan	140	21	15%	Switzerland	134	31	23%
				Sweden	136	28	21%	S.Korea	133	31	23%
				S.Korea	133	31	23%	Sweden	132	26	20%
				South Africa	126	51	40%	Hong Kong	130	10	8%
				Switzerland	124	26	21%	South Africa	123	51	41%
				India	109	43	39%	India	110	43	39%
				Italy	101	32	32%	Italy	97	29	30%
				Brazil	94	24	26%	Brazil	95	24	25%
				Spain	69	20	29%	Spain	71	21	30%
				Norway	66	15	23%	Netherlands	68	21	31%
				Malaysia	60	8	13%	Malaysia	61	8	13%
				Netherlands	58	21	36%	Turkey	57	11	19%

Table 17 : Controversies and industries and countries at the global level

2018	ESGC	C	ESG	ESG E	ESG S	ESG G	MC	PB	TA	52W
ESGC	100%									
C	-5%	100%								
ESG	96%	-28%	100%							
ESG E	81%	-27%	86%	100%						
ESG S	85%	-27%	89%	74%	100%					
ESG G	67%	-16%	69%	41%	41%	100%				
MC	17%	-32%	27%	26%	25%	16%	100%			
PB	0%	0%	0%	-1%	0%	0%	0%	100%		
TA	11%	-23%	18%	18%	15%	12%	39%	0%	100%	
52W	-1%	1%	-1%	-1%	-1%	0%	0%	0%	0%	100%

Table 18 : Correlation at the global level

2018	ESGC	C	ESG	ESG E	ESG S	ESG G	MC	PB	TA	52W
ESGC	100%									
C	0,0%	100%								
ESG	0,0%	0,0%	100%							
ESG E	0,0%	0,0%	0,0%	100%						
ESG S	0,0%	0,0%	0,0%	0,0%	100%					
ESG G	0,0%	0,0%	0,0%	0,0%	0,0%	100%				
MC	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	100%			
PB	69,9%	88,1%	73,6%	56,2%	87,7%	84,8%	89,7%	100%		
TA	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	99,4%	100%	
52W	48,7%	65,5%	46,1%	67,8%	29,2%	95,9%	86,0%	99,2%	83,6%	100,%

Table 19 : P values of correlation at the global level

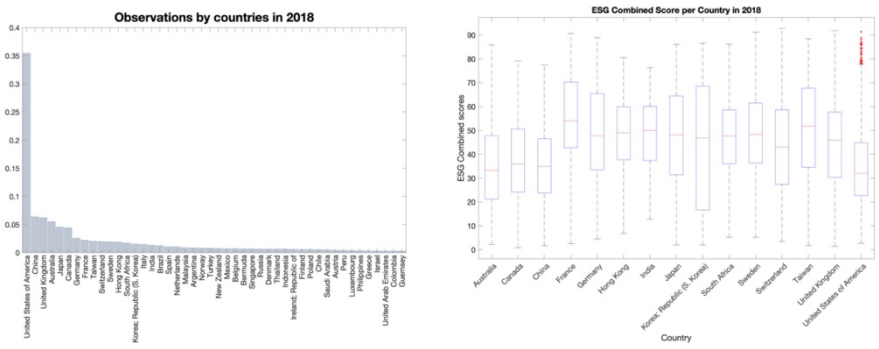

Figure 24 : Observations per country at the global level

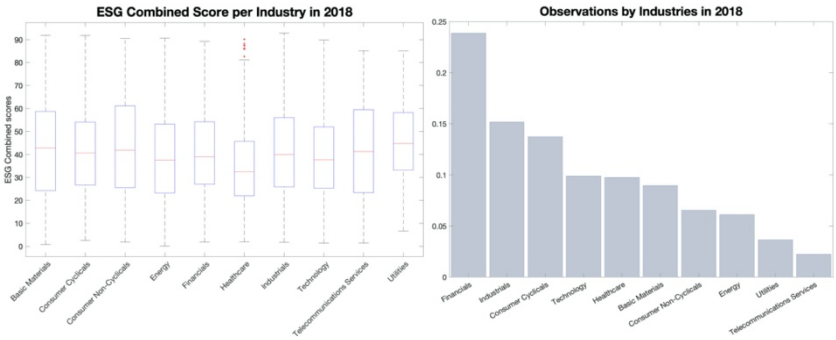

Figure 25 : Representation per industry in 2018

E.2. European data

		ESG Combined Score			ESG Controversy Score			ESG Score		
Issue year	N	Mean	Median	σ[32]	Mean	Median	σ	Mean	Median	σ
2002	174	35,69	34,94	15,57	88,99	100,00	24,97	37,12	35,63	16,69
2003	186	36,96	37,15	15,46	89,96	100,00	23,02	37,77	37,39	15,95
2004	301	35,69	34,41	16,49	92,96	100,00	20,23	36,58	34,41	17,31
2005	386	36,19	33,87	17,31	91,37	100,00	22,13	37,46	34,83	18,60
2006	391	37,14	35,00	18,25	91,67	100,00	21,61	38,44	35,36	19,63
2007	424	41,86	41,24	18,69	91,55	100,00	21,91	43,59	42,09	20,25
2008	439	43,74	44,80	18,81	87,77	100,00	26,15	46,64	47,56	21,22
2009	466	45,35	46,03	19,30	89,78	100,00	24,51	47,76	48,95	20,93
2010	489	46,13	47,42	19,31	88,33	100,00	25,51	48,86	50,16	21,34
2011	521	46,32	46,43	19,53	89,18	100,00	24,71	48,99	48,69	21,54
2012	533	47,35	46,61	19,12	89,69	100,00	24,08	49,63	49,06	20,78
2013	525	47,49	47,26	19,39	89,28	100,00	24,68	49,75	49,55	20,75
2014	558	47,23	47,35	19,07	89,34	100,00	24,65	49,72	49,84	20,82
2015	632	48,70	49,39	20,05	94,35	100,00	17,84	49,93	50,05	20,93
2016	674	49,20	49,82	19,43	90,76	100,00	23,22	51,31	52,12	20,65
2017	742	49,28	50,26	19,09	91,00	100,00	23,36	51,60	52,00	20,60
2018	1218	45,70	45,54	19,60	90,85	100,00	23,24	47,86	47,44	21,23
2019	593	48,71	48,07	18,34	88,30	100,00	26,26	51,68	51,76	20,26
Mean	514	43,82	43,64	18,49	90,28	100,00	23,45	45,82	45,38	19,97
Mean 14-18	765	48,02	48,47	19,45	91,26	100,00	22,46	50,08	50,29	20,85

Table 20 : Evolution of the combined, controversy and ESG scores at the European level

	ESG Env. Score			ESG Social Score			ESG Governance Score			ESG Reporting Scope		
Issue year	Mean	Median	σ	Mean	Median	σ	Mean	Median	σ	Mean	Median	σ
2002	22,75	14,71	24,73	37,16	35,31	18,63	47,40	47,89	22,20			
2003	23,54	15,64	23,75	37,51	34,81	18,82	48,37	50,14	21,59			
2004	22,01	12,95	24,22	37,26	34,64	19,49	47,87	47,61	21,99			
2005	23,63	16,70	24,73	38,90	35,84	19,95	46,98	46,31	23,51			
2006	25,41	20,05	24,82	39,35	34,94	22,04	47,78	50,17	23,86	100,00	100,00	0,00
2007	36,70	35,76	27,80	43,65	39,80	23,69	48,97	50,09	22,36	100,00	100,00	0,00
2008	42,17	41,14	28,25	47,17	44,94	24,37	48,54	49,25	23,19	100,00	100,00	0,00
2009	44,18	43,90	28,27	47,87	46,99	24,58	49,47	50,46	22,75	97,17	100,00	7,56
2010	45,80	46,14	28,25	49,42	50,33	24,87	49,96	51,61	22,78	97,16	100,00	8,96
2011	45,90	45,80	28,52	49,65	50,27	25,00	49,84	49,51	22,82	95,69	100,00	12,30
2012	46,81	47,14	27,90	50,29	50,27	24,02	50,40	51,00	22,72	94,59	100,00	14,39
2013	46,37	46,65	27,56	51,05	49,92	23,82	50,11	48,90	22,34	95,17	100,00	12,90
2014	45,57	45,48	28,30	51,54	51,41	24,19	50,13	50,98	22,56	95,90	100,00	13,14
2015	44,65	42,98	28,29	52,80	52,40	23,65	50,08	50,86	23,27	95,98	100,00	12,24
2016	46,03	45,76	27,67	55,22	55,33	23,28	49,78	51,15	23,44	95,00	100,00	15,00
2017	45,23	44,50	27,67	56,69	57,55	22,86	49,76	50,16	23,22	93,59	100,00	18,41
2018	39,41	36,90	27,71	53,06	53,54	23,12	47,74	47,55	23,86	92,83	100,00	18,99
2019	43,81	42,48	27,60	56,55	56,60	21,92	51,67	53,17	23,56	94,14	100,00	17,84
Mean	38,33	35,82	27,00	47,51	46,38	22,68	49,16	49,82	22,89	96,23	100,00	10,84
Mean 14-18	44,18	43,13	27,93	53,86	54,05	23,42	49,50	50,14	23,27	94,66	100,00	15,56

Table 21 : Evolution of the environmental, social, governance and reporting score at the European Level

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
N	264	286	426	533	557	585	629	649	681	711	726	748	755	841	877	977	1 498	744
N contro.	29	25	39	51	52	65	96	77	108	123	99	107	101	71	107	115	192	107
%	11%	9%	9%	10%	9%	11%	15%	12%	16%	17%	14%	14%	13%	8%	12%	12%	13%	14%
Mean adj.	11,7	11,1	12,0	13,9	15,9	16,4	20,4	20,2	18,0	18,3	18,9	18,2	18,4	15,0	19,6	19,5	19,4	21,7
Std adj.	8,8	7,2	10,1	9,8	11,9	12,0	11,5	11,7	12,6	11,9	13,0	12,2	12,3	12,4	11,7	12,7	12,1	13,6
Mean ESG With	39,1	34,4	42,2	41,6	45,9	51,8	50,6	51,9	54,5	54,1	53,3	53,6	54,6	58,8	53,3	53,8	52,9	51,3
Mean ESG without	34,8	36,7	35,2	35,4	36,6	41,0	43,3	45,6	46,3	47,2	48,5	48,4	49,1	50,4	51,6	52,1	47,8	51,6

Table 22 : Controversies adjustments across years at the European level

[32] Represent the standard deviation.

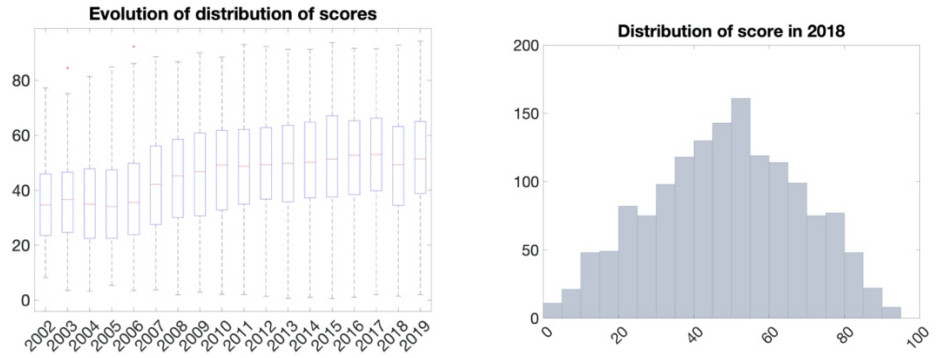

Figure 26 : Distribution of ESG Combined Score at the European level

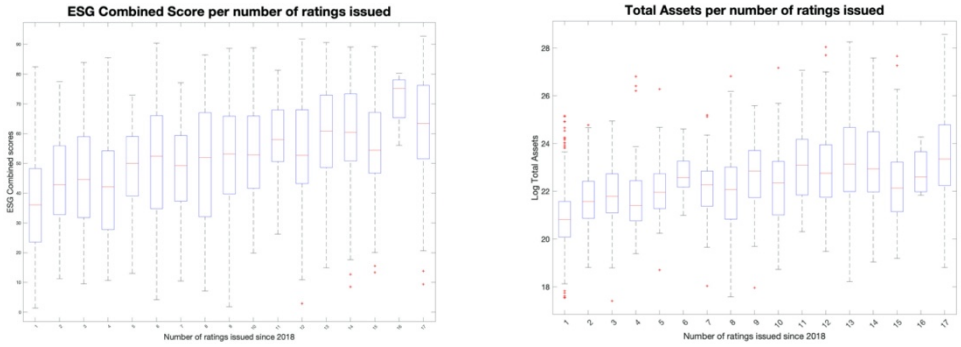

Figure 27 : ESG Combined score and Total asset per number of ratings issued at the European level

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
N	264	286	426	533	557	585	629	649	681	711	726	748	755	841	877	977	1 498	744
Ncontro	29	25	39	51	52	65	96	77	108	123	99	107	101	71	107	115	192	107
%	11%	9%	9%	10%	9%	11%	15%	12%	16%	17%	14%	14%	13%	8%	12%	12%	13%	14%
Mean adj.	11,7	11,1	12,0	13,9	15,9	16,4	20,4	20,2	18,0	18,3	18,9	18,2	18,4	15,0	19,6	19,5	19,4	21,7
Std adj.	8,8	7,2	10,1	9,8	11,9	12,0	11,5	11,7	12,6	11,9	13,0	12,2	12,3	12,4	11,7	12,7	12,1	13,6
Mean ESG With	39,1	34,4	42,2	41,6	45,9	51,8	50,6	51,9	54,5	54,1	53,3	53,6	54,6	58,8	53,3	53,8	52,9	51,3
Mean ESG without	34,8	36,7	35,2	35,4	36,6	41,0	43,3	45,6	46,3	47,2	48,5	48,4	49,1	50,4	51,6	52,1	47,8	51,6

Table 23 : Controversies adjustments across years at the European level

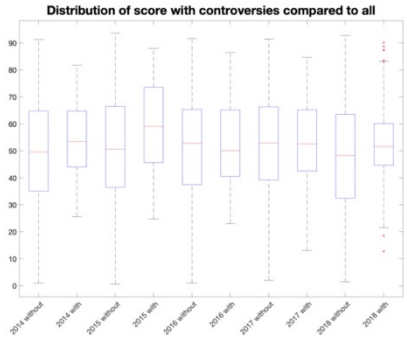

Figure 28 : Controversy and score at the European level

Country	Belgium	France	Germany	Italy	Netherl.	Norway	Spain	Sweden	Switz.	U.K.
N	50	151	176	97	61	53	69	131	129	409
%	3,2%	9,5%	11,1%	6,1%	3,9%	3,3%	4,4%	8,3%	8,1%	25,8%

Table 24 : Observation across countries with +50 of observations at the European level

Industry	N	Contro	Ratio
Basic Materials	126	55	44%
Consumer Cyclicals	246	77	31%
Consumer Non-Cyclicals	106	40	38%
Energy	76	34	45%
Financials	374	74	20%
Healthcare	116	22	19%
Industrials	317	86	27%
Technology	112	19	17%
Telecomm. Services	41	24	59%
Utilities	53	24	45%

Listed	N	Contro	Ratio
United Kingdom	423	130	31%
Germany	186	52	28%
France	156	58	37%
Sweden	133	27	20%
Switzerland	123	26	21%
Italy	101	32	32%
Spain	69	20	29%
Netherlands	57	21	37%
Norway	55	15	27%
Belgium	46	10	22%
Poland	44	6	14%
Denmark	43	10	23%
Finland	36	19	53%
Austria	29	8	28%
Greece	26	8	31%
Portugal	16	6	38%
Ireland	12	5	42%
Hungary	5	1	20%
Czech Republic	4	1	25%
Luxembourg	2	0	0%
Cyprus	1	0	0%

HeadQ	N	Contro	Ratio
United Kingdom	403	125	31%
Germany	175	52	30%
France	149	56	38%
Sweden	131	25	19%
Switzerland	128	29	23%
Italy	97	29	30%
Spain	69	20	29%
Netherlands	61	21	34%
Norway	53	13	25%
Belgium	48	10	21%
Denmark	42	10	24%
Poland	42	6	14%
Finland	37	20	54%
Austria	32	8	25%
Greece	26	8	31%
Ireland; Republic of	24	12	50%
Luxembourg	20	3	15%
Portugal	15	6	40%
Cyprus	5	0	0%
Hungary	5	1	20%
Czech Republic	4	1	25%
Ukraine	1	0	0%

Table 25 : Controversies and industries and countries at the European Level

2018	ESGC	C	ESG	ESG E	ESG S	ESG G	MC	PB	TA	52W
ESGC	100%									
C	-1%	100%								
ESG	93%	-34%	100%							
ESG E	80%	-31%	87%	100%						
ESG S	84%	-29%	90%	75%	100%					
ESG G	72%	-25%	77%	49%	52%	100%				
MC	25%	-36%	39%	37%	35%	29%	100%			
PB	-1%	-6%	2%	3%	1%	0%	-1%	100%		
TA	10%	-36%	25%	24%	21%	20%	38%	-1%	100%	
52W	4%	9%	1%	1%	1%	0%	12%	-1%	-4%	100%

Table 26 : Correlation table at the European level

2018	ESGC	C	ESG	ESG E	ESG S	ESG G	MC	PB	TA	52W
ESGC	100%									
C	74,1%	100%								
ESG	0,0%	0,0%	100%							
ESG E	0,0%	0,0%	0,0%	100%						
ESG S	0,0%	0,0%	0,0%	0,0%	100%					
ESG G	0,0%	0,0%	0,0%	0,0%	0,0%	100%				
MC	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	100%			
PB	84,1%	2,3%	52,6%	31,0%	60,2%	89,9%	84,5%	100%		
TA	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	62,7%	100%	
52W	11,3%	0,0%	69,7%	56,8%	62,4%	96,7%	0,0%	83,8%	12,4%	100%

Figure 29 : correlation (p values) at the European level

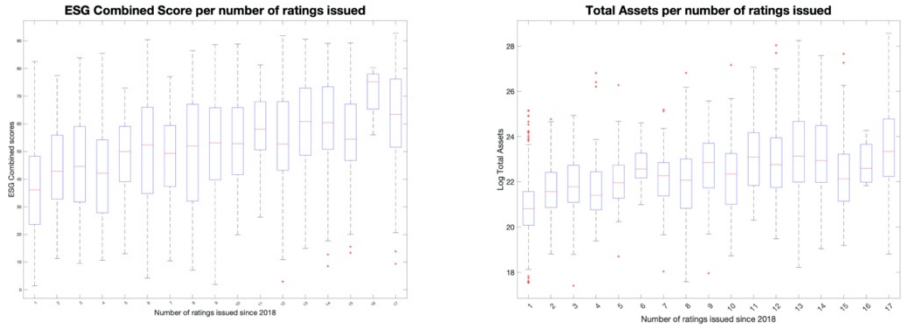

Figure 30 : Number of issues and scores at the European level

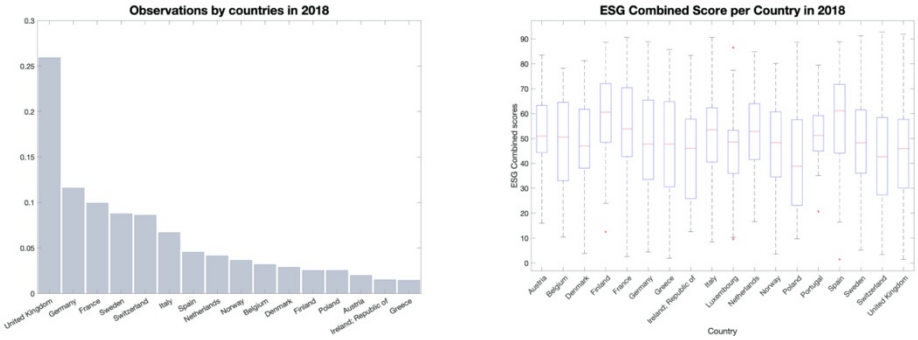

Figure 31 : Distribution across countries at the European level

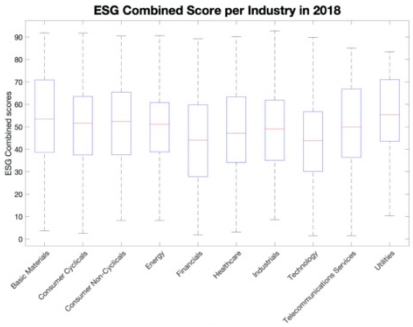

Figure 32 : Distribution across industries at the European level

E.3. American level

		ESG Combined Score			ESG Controversy Score			ESG Score		
Year	N	μ	Md	σ	μ	Md	σ	μ	Md	σ
2002	198	28,30	26,28	14,24	86,19	100,00	25,08	29,18	26,99	14,87
2003	229	29,07	26,92	13,59	85,85	100,00	26,09	30,14	27,47	14,79
2004	299	29,33	27,35	13,47	87,26	100,00	25,52	30,35	28,37	14,39
2005	369	31,15	29,02	15,07	87,27	100,00	26,11	32,64	29,63	16,61
2006	385	32,16	29,11	15,72	84,15	100,00	29,02	34,35	30,73	17,97
2007	420	36,92	34,62	16,64	86,10	100,00	25,94	38,43	36,06	17,61
2008	513	36,42	34,35	16,21	84,46	100,00	29,04	39,53	35,72	19,49
2009	585	36,42	33,56	17,34	84,88	100,00	27,98	39,06	34,37	19,95
2010	641	37,33	35,35	16,92	78,22	100,00	32,14	40,83	36,78	19,95
2011	652	37,86	36,02	17,29	80,99	100,00	30,26	40,84	37,69	19,73
2012	650	39,36	37,86	18,19	82,39	100,00	29,17	41,83	39,90	19,90
2013	667	38,97	36,56	17,49	81,15	100,00	30,61	41,96	41,02	19,58
2014	687	39,86	37,93	17,60	82,20	100,00	29,78	42,63	40,78	19,49
2015	1132	36,72	33,69	17,41	93,75	100,00	19,42	37,85	33,90	18,57
2016	1768	35,11	31,64	16,61	94,86	100,00	17,67	36,02	31,74	17,77
2017	2090	34,61	31,01	16,85	95,54	100,00	16,53	35,32	31,14	17,74
2018	2326	35,19	31,98	16,62	92,61	100,00	21,12	36,41	32,36	18,04
2019	1385	31,97	30,16	13,85	93,51	100,00	19,76	32,63	30,54	14,58
Mean	833	34,82	32,41	16,17	86,74	100,00	25,62	36,67	33,62	17,83

Table 27 : Evolution of the combined, controversy and ESG scores at the American level

		ESG Environmental Score			ESG Social Score			ESG Governance Score			ESG Reporting Scope		
Year	N	μ	Md	σ	μ	Md	σ	μ	Md	σ	μ	Md	σ
2002	198	8,42	-	17,35	27,40	23,08	17,80	46,85	45,24	21,01			
2003	229	9,12	-	16,22	29,03	26,38	18,92	47,52	46,63	20,99			
2004	299	8,55	-	17,41	31,64	28,12	18,48	46,08	45,94	21,00			
2005	369	12,33	-	21,29	34,18	31,00	19,77	46,60	47,05	21,59			
2006	385	14,60	-	22,85	36,72	33,38	20,32	46,20	45,17	21,92			
2007	420	22,35	11,49	26,04	42,16	38,69	19,58	46,11	45,52	22,06			
2008	513	24,93	14,93	27,32	42,38	38,79	20,67	47,54	47,07	23,08	100,00	100,0	-
2009	585	25,79	15,14	28,58	41,11	36,82	20,36	47,05	46,24	23,66	98,59	100,0	5,92
2010	641	28,67	21,09	28,51	42,74	39,16	21,05	48,20	47,45	23,55	96,54	100,0	14,13
2011	652	28,89	21,48	28,18	43,24	40,42	20,73	47,51	47,85	23,14	96,26	100,0	13,18
2012	650	31,31	25,11	28,73	43,99	40,40	20,73	47,48	47,37	23,10	95,72	100,0	13,61
2013	667	30,56	23,77	28,70	44,42	40,99	20,87	47,82	47,97	23,19	95,72	100,0	13,27
2014	687	31,37	25,16	28,74	45,40	42,72	20,69	47,87	48,48	23,12	94,45	100,0	16,34
2015	1132	22,64	9,72	27,00	40,67	36,84	20,00	46,38	46,74	22,31	94,61	100,0	15,03
2016	1768	18,08	4,05	25,29	39,19	35,65	19,10	45,87	45,77	22,08	94,22	100,0	16,02
2017	2090	17,01	3,66	24,53	38,53	34,95	19,21	45,40	45,69	22,62	94,09	100,0	17,35
2018	2326	18,92	5,45	25,56	39,65	35,56	19,69	45,71	45,89	22,43	93,81	100,0	17,49
2019	1385	13,19	3,94	19,08	36,83	33,77	17,08	41,73	40,94	21,12	97,10	100,0	13,09
Mean	833	20,37	10,28	24,52	38,85	35,37	19,72	46,55	46,28	22,33	95,93	100,0	12,95

Table 28 : Evolution of the environmental, social, governance and reporting score at the American Level

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
N	198	229	299	369	385	420	513	585	641	652	650	667	687	1132	1768	2090	2326	1385
Ncontro	14	20	27	36	54	55	80	88	126	116	101	118	114	76	93	92	156	68
%	7%	9%	9%	10%	14%	13%	16%	15%	20%	18%	16%	18%	17%	7%	5%	4%	7%	5%
Mean adj.	12,4	12,2	11,3	15,3	15,6	11,5	19,9	17,6	17,8	16,7	15,9	16,9	16,7	16,9	17,4	16,0	18,2	13,4
Std adj.	5,8	8,3	8,0	11,3	11,2	8,8	11,9	10,5	12,1	11,6	11,2	10,8	11,9	10,7	11,4	11,5	11,6	10,3
MeanESG With	32,7	32,3	33,5	37,8	39,3	42,8	44,2	45,0	43,3	42,3	44,3	41,9	42,4	47,2	47,6	46,4	43,4	37,9
MeanESG without	28,0	28,8	28,9	30,4	31,0	36,0	35,0	34,9	35,9	36,9	38,5	38,3	39,4	36,0	34,4	34,1	34,6	31,7

Table 29 : Controversies adjustments across years at the US level

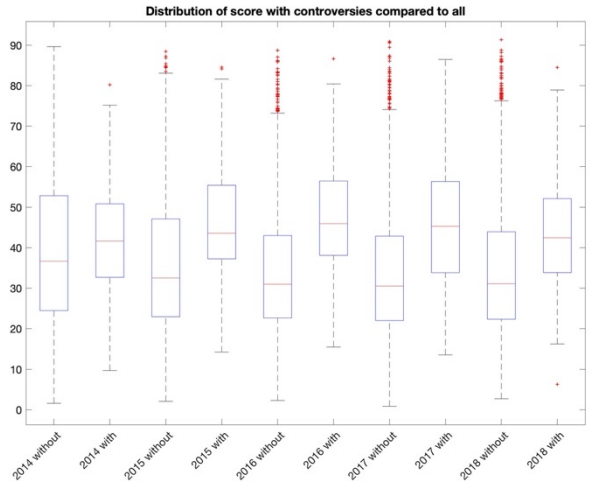

Figure 33 : Distribution of ESG Score depending on the application of adjustment at the US level

Industry	N	Contro	Ratio
Basic Materials	116	34	29%
Consumer Cyclicals	354	83	23%
Consumer Non-Cyclicals	114	42	37%
Energy	144	30	21%
Financials	577	73	13%
Healthcare	386	51	13%
Industrials	327	56	17%
Technology	323	61	19%
Telecommunications Services	26	5	19%
Utilities	66	22	33%

Table 30 : Controversies and industries and countries at the US level

2018	ESGC	C	ESG	ESG E	ESG S	ESG G	MC	PB	TA	52W
ESGC	100%									
C	-8%	100%								
ESG	95%	-32%	100%							
ESG E	78%	-34%	84%	100%						
ESG S	80%	-30%	85%	72%	100%					
ESG G	70%	-14%	70%	42%	33%	100%				
MC	17%	-45%	33%	35%	32%	15%	100%			
PB	1%	-3%	2%	3%	5%	-5%	6%	100%		
TA	10%	-34%	23%	24%	22%	10%	42%	-3%	100%	
52W	-2%	4%	-2%	-4%	0%	-5%	4%	16%	-2%	100%

Table 31 : correlation at the US level

2018	ESGC	C	ESG	ESG E	ESG S	ESG G	MC	PB	TA	52W
ESGC	100%									
C	0,0%	100%								
ESG	0,0%	0,0%	100%							
ESG E	0,0%	0,0%	0,0%	100%						
ESG S	0,0%	0,0%	0,0%	0,0%	100%					
ESG G	0,0%	0,0%	0,0%	0,0%	0,0%	100%				
MC	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	100%			
PB	70,0%	20,5%	36,5%	20,2%	1,0%	2,9%	0,5%	100%		
TA	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	15,4%	100%	
52W	40,4%	3,6%	32,8%	5,1%	91,1%	1,2%	4,4%	0,0%	38,8%	100%

Table 32 : correlation (p value) at the US level

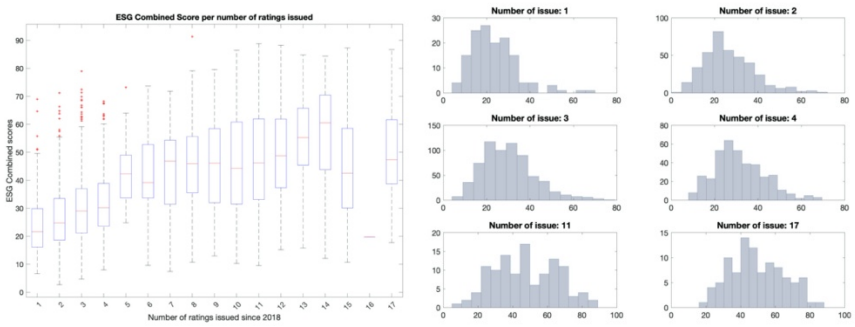

Figure 34 : ESG Combined score and Total asset per number of ratings issued at the US level

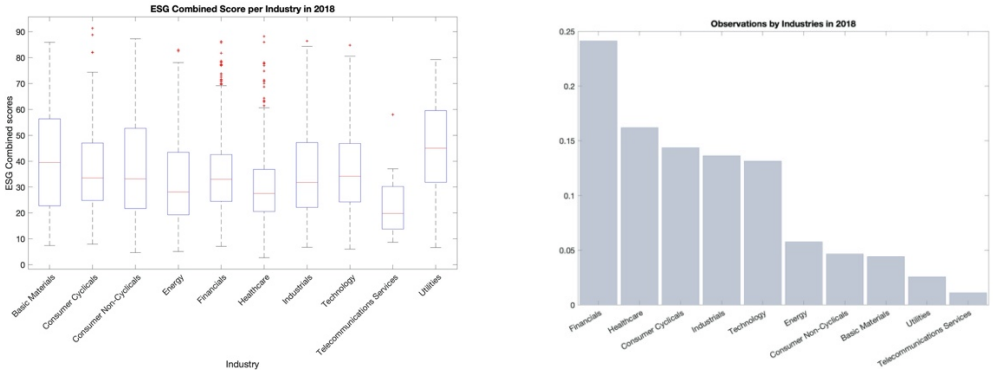

Figure 35 : Distribution by Industry at the US level

F. Methodologies

F.1. RQ2: Methodologies

Authors	Date	Purpose	Comments
Di Giuli and Kostovetsky	2014	Analysis of political characteristics and ratings	Pooled OLS regression to determine the influence of the political context on the ratings.
Capelle-Blanchard and Monjon	2014	Analysis of ratings' determinants at the fund level	An ordered logistic regression was conducted to assess the determinants of ESG rating at the fund level during one specific year.
Baldini, Dal Maso, Liberatore, Mazzi and Terzani	2018	Analysis of country and firm characteristics and ratings	Panel regressions of percentile ranking ESG disclosure provided by Bloomberg on country and firm characteristics.
Green, Huang, Wen and Zhou	2019	Analysis of determinants of (Glassdoor) ratings	Fixed-effects panel regressions of ratings and changes in ratings based on variables such as market capitalization, book-to-market ratio, return-on- assets, etc.
Drempetic, Klein and Zwergel	2019	Analysis the effect of size on ratings	Linear mixed effects panel of the corporate sustainability scorerelying on random-effects (the time, the business field, country) and fixed-effects (company size, data availability and resources dedicated to ESG data)

Table 33 : Literature using panel regressions

F.2. RQ2: Stata Specifications

Under the fixed-effects specifications, the *xtreg* function derives coefficients applying OLS on the within transformation (Stata, 2020):

$$y_{i,t} - \bar{y}_i + \bar{y} = a + \left(x_{i,t} - \bar{x}_i + \bar{x}\right)\beta + \left(\varepsilon_{i,t} - \bar{\varepsilon}_i + \bar{v}\right) + \bar{\varepsilon}$$

The general framework used by Stata is : $y_{i,t} = a + x_{i,t}\beta + \varepsilon_{i,t} + v_i$ and include a global constant (a). The unique difference with the methodology described previously is the addition of the global mean of the dependent and independent variable which results in the global constant. In fact, centering the variables (removing $\bar{y}$ and $\bar{x}$) results in a model with the same β coefficients and a null global constant.

The same model can be estimated using the *areg* function which provides a solution the general linear model ($y_{i,t} = a + x_{i,t}\beta + \varepsilon_{i,t}$) and a slope coefficient specific for each individual. In other words, the fixed-effects model can be seen as extension of a linear regression with slope specific to each individual. Of course, the β coefficients of the linear model without individual specific constant differs from the β coefficients of the panel model.

In order to derive parameters of the random-effects model, Stata applied the approach combining the fixed and the between estimators and solve the following equation (Stata, 2020):

$$(y_{i,t} - \theta\bar{y}_i) = (1-\theta)a + \left(x_{i,t} - \theta\bar{x}_i\right)\beta + \left\{\left(v_{i,t} - \theta\bar{v}_i\right) + \left(\varepsilon_{i,t} - \theta\bar{\varepsilon}_i\right)\right\}$$

Where θ depends on σ_v and σ_ε the two component of the error terms in the regression equation[33]. To better understand this factor (θ), the two extreme cases (0,1) can be enlightening. When $\sigma_v = 0$, there are no individual effect and $\theta = 0$. In that particular case, the model can be resolved through OLS (as

[33] $y_{i,t} = a + x_{i,t}\beta + \varepsilon_{i,t} + v_i$, where v_i is the unit-specific component of the error term

would be a time-series). When $\sigma_\varepsilon = 0$, there are no time effect (and no variation over time) and $\theta = 1$. The mean of each individual contains all the information and fixed-effects model with the within estimator would provide a R^2 equal to 1. The three R^2 are reported. The between and overall R^2 are computed in the similar manner ($corr(\bar{x}_i\hat{\beta}, \bar{y}_i)^2$ and $corr(\bar{x}_i\hat{\beta}, y_{i,t})^2$). However, the within R^2 is computed as follows $corr((x_{it} - \bar{x}_i)\hat{\beta}, \bar{y}_{i,t} - \bar{y}_i)^2$. As for the fixed-effects case, the function reported the t value (and their corresponding p values) associated with each coefficient.

F.3. RQ3: Methodologies

Literature on performance

Authors	Date	Purpose	Comments
Gompers, P., Ischii, J., Metrick, A.	2003	Impact of corporate governance on performance	Relying on Carhart four factor model, Gompers et al. found that portfolios with better governance obtained higher alphas. Fama MacBeth regressions were used to determine the relevance of the governance indicators alongside other metrics.
Core, J., Guay, W., Rusticus, T.	2005	Impact of corporate governance on performance	They observed over performance with Carhart four factor model. And relying on Fama MacBeth regressions, they found that poor governance is associated(but does not causes) with poor stock performance.
Derwall, J., Guenster, N., Bauer, R., Koedijk, K.	2005	Impact of environmental score on performance	By constructing long-short portfolio based on Innovest eco-efficiency score, they found overperformance according to the Carhart four factor model.
Kempf, A., Osthoff, P.	2007	KLD ratings and performance	By constructing long-short portfolio based on KLD rating (then 10th and 90th percentile of score), they found overperformance according to the Carhart four factor model.
Statman, M., Glushkov, D.	2009	KLD ratings and performance	They found high excess return for long-short strategy of high and low scores according to the Carhart four factor model.
Edmans, A.	2011	Impact of customer satisfaction on performance	He used a Carhart four factor model on a portfolio composed of firms with high customer satisfaction to assess stock performance.
Chan, P., Walter, T.	2014	Impact of environmental friendly on performance	They used a Carhart four factor model to assess the impact of green characteristics on performance in the context of initial public offerings (IPO) or seasonal equity offerings (SEO).
Halbritter, G., Dorfleitner, G.	2015	ESG ratings and performance	Relying on the Carhart four factor model, they found insignificant positive alpha for Thomson Reuters and no relation for Bloomberg and KLD rating.
Fornell, C., Morgeson, V., Hult, T.	2016	Customer satisfaction and performance	They found overperformance according to the Carhart four factor model of long-short portfolio based on American customer satisfaction index
Sheng, J.	2018	Impact of Glassdoor ratings on performance	Relying on Carhart four factor model, Sheng found that a portfolio composed of firms with higher employees reviews obtained alpha. Moreover, Fama MacBeth regressions indicated that new information was revealed from these ratings.
Green, C., Huang, R., Wen, Q., Zhou,D.	2019	Impact of Glassdoor ratings on stock performance	Green et al. constructed portfolios based on change of ratings and apply a Fama-French regressions to assess the impact of performance. They have conducted Fama MacBeth regressions on returns and changes in ratings to test the relevance of ratings.

Table 34 : Performance analysis

G. RQ2: Quantitative analyses and findings

G.1. Introduction

Name	Description from the Eikon API
ESG C	Overall company score based on the reported information in the environmental, social and corporate governance pillars (ESG Score) with an ESG controversies overlay
C	Measure a company's exposure to ESG controversies and negative events reflected in global media
ESG	Overall company score based on the self-reported information in the environmental, social and corporate governance pillars
ESG Env.	Measures a company's impact on living and non-living natural systems, including the air, land and water, as well as complete ecosystems. It reflects how well a company used best management practices to avoid environmental risks and capitalizes on environmental opportunities in order to generate long term shareholder value
ESG Soc.	Measure a company's capacity to generate trust and loyalty with its workforce, customers and society, through its use of best management practices. It is a reflection of the company's reputation and the health of its license to operate, which are key factors in determining its ability to generate long term shareholder value
ESG Gov.	The corporate governance pillar measure a company's systems and processes, which ensure that its board members and executives act in the best interests of its long term shareholders. It reflect a company's capacity, through its use of best management practices, to direct and control its rights and responsibilities through the creation of incentives, as well as checks and balances in order to generate long term shareholder value.
MC	Sum of market value for all relevant issue level share type
TEmp	Number of full-time employees and full-time equivalents of part-time/temporary employees as reported, as of the fiscal period end date
TA	Total assets of a company
wRet	Price change and any relevant dividends for the last 52 weeks
PBV	Latest closing price by the book value per share computed as the total equity from latest fiscal period divided by current total share outstanding
ROA*	Ratio of the sum of net income before extraordinary items and total extraordinary items and the total assets
TD_E*	Ratio of the total debt outstanding(which includes notes payable/short-term debt, current portion of long-term debt/capital leased and total long term debt) and total equity (the equity value of preferred shareholders, general and limited partners, and common shareholders but does not include minority shareholders' interest)
ND_E*	Ratio of the net debt (sum of total debt, minority interest, proffered stock net less cash & equivalents, short term investments and net debt capital) and total equity
RevGrowth*	Revenue from all of a company's operating activities after deducting any sales adjustments and their equivalents
# Issue	Number of ratings issued for the firm previously (i.e. is equal to 0 for the first issue)

Table 35 : Description of Thomson Reuters Eikon API Proxy – Data Item Browse

Authors	Date	Purpose	Comments
Di Giuli and Kostovetsky	2014	Analyzingthe link of political characteristics and ratings	Pooled OLS panel regression to determine the influence of the political context on the ratings. They used control variable such as the size, the ROA, the cash, the divends; the debt and the book-to-market.
Capelle-Blanchard and Monjon	2014	Analyzingdeterminants of ratings at the fund level	An ordered logisitc regression was conducted to assess the determinants of ESG rating at the fund level (and more precisly, the effect of sreening). They use control variables such as the size (total assets), the age, the maagement fees of fund.
Baldini, Dal Maso, Liberatore, Mazzi and Terzani	2018	Analyzing the link of country and firm characteristics and ratings	Fixed-effects panel Regression of percentile ranking ESG disclosure provided by Bloomberg on country and firm characteristics (the Legal Framework, Corruption, the labor protection, the unemployment rate, the social cohesion, the equal opportunities, the CSR law, the market capitalization divided by GDP, the analysts coverage, the crosslist, the leverage, the size, the market to book value ratio, the provfitability and the sale growth.)
Green, Huang, Wen and Zhou	2019	Analyzing determinants of (Glassdoor) ratings	Fixed-effects panel Regression of ratings and changes in ratings based on market capitalization, book-to-market ratio, return-on- assets, analyst forecast dispersion, turnover ratio, Amihud illiquidity, idiosyncratic volatility, institutional ownership, past stock returns, analyst recommendation changes, and insider trading.
Drempetic, Klein and Zwergel	2019	Analyzing the effect of size on ratings	Linear mixed effects panel of the corporate sustainability score on the random-effects corportions, the time, the business field, country, as well as on the fixed-effects the prior year's company size, the same year's data availability in the Refinitiv database and resources for providing ESG data for corporation and a set of company-specific, time-varying control variables (EPS, ROIC, Leverage, operting profit margin, certified environmental management systems)
Drempetic, Klein and Zwergel	2019	Analyzing the effect of size on ratings	A co-variance based SEM was used as a confirming analysis of the panel regression. The SEM was used "to be able to control all the influences of the three independent variables on the ES score and between the independent variables simultaneously."

Table 36 : Overview of panel regressions used

G.2. Data overview

The data has not been truncated excepted the price to book value below 0 (586 observations) and above 500 (15 observations) and null number of employees (223 observations). The highest value of market capitalization and total assets corresponds respectively to Amazon, Apple, Miscrosoft and Google and to large banks. The large maximum number of employee is attributed to Walmart and is confirmed in its financial statements. Concerning other variables (wRet, PBV, ROA, TD_E, ND_E and RevGrowth), some observations remain surprising (leverage ratio over 100,000, etc) and this can cause problems in the model. As a robustness check, observations lower than the 0.5% or higher than 99.5% percentile are removed. The impact of the truncation on summary statistics is provided in the appendix.

	N	Mean	Std	Min	Max
Numb Issue	21431	4,7	3,7	0,0	16,0
ESGC	21431	42,2	19,1	0,4	93,5
C	21427	89,4	24,4	0,5	100,0
ESG	21431	44,3	20,8	0,4	95,1
ESG Env	21427	34,2	30,3	0,0	98,5
ESG Soc	21427	46,9	22,8	0,1	98,6
ESG Gov	21431	48,5	22,8	0,2	98,5
ESG Rep	9144	93,8	16,3	1,0	100,0
MC	21284	1,4E+10	3,5E+10	4,4E+06	8,7E+11
TEmp	20798	26 741,5	71 308,2	1,0	2 300 000,0
TA	21357	4,4E+10	2,0E+11	6,8E+05	3,7E+12
wRet	21118	10,1	48,5	(99,7)	1 774,3
PBV (%)	20557	3,9	11,7	0,0	426,2
ROA (%)	21356	3,1	17,2	(1 170,6)	251,8
TD_E (%)	21354	101,1	2 144,0	(140 852,2)	213 151,3
ND_E (%)	18862	67,9	2 173,6	(136 722,2)	208 746,2
RevGrowth	18442	6,3	41,3	(933,8)	1 117,1

Table 37 : Summary statistics for RQ2

	N	Mean	Std	Min	Max
wRet	20906	8,9	37,6	-81,8	213,7
PBV	20351	3,3	4,3	0,2	51,5
ROAPct	21142	3,5	10,2	-75,0	37,7
TD_EPct	21140	99,1	212,4	-1640,8	2319,8
ND_EPct	18674	65,5	207,4	-1655,9	2332,3
RevGrowth	18258	6,0	22,8	-125,3	168,6

Table 38 : Effect of truncation on summary statistics

Over the years, the ESG combined scores and ESG scores remained relatively stable.. The mean number of ratings issued (i.e. the seniority) per year increases until 2014 and then remained stable due to many new firms receiving their first ratings. As market capitalizations are taken at particular dates, they can be subject to some specific macro environment (e.g. bear market at the end of 2018). The 52 week return, price to book and leverage exhibit large volatilities due to extreme values.

	# Issue	ESGC	ESG	MC	TEmp	TA	wRet	PBV(%)	ROA(%)	TD_E(%)	ND_E(%)	RevGrow(%)
μ 2007	1,2	39,6	41,5	2,2E+10	38130,9	7,1E+10	5,6	4,4	7,2	149,6	100,1	15,6
σ 2007	1,7	17,9	19,6	4,2E+10	87423,3	2,8E+11	38,1	11,3	9,4	547,7	490,8	25,1
μ 2008	2,0	40,8	43,9	1,1E+10	37095,4	6,6E+10	-40,8	2,6	3,6	123,6	94,6	4,1
σ 2008	1,7	18,1	20,7	2,6E+10	90582,4	2,8E+11	24,3	10,6	13,0	1821,4	1528,0	37,4
μ 2009	2,7	42,7	45,4	1,5E+10	35499,8	6,1E+10	54,2	3,2	3,0	-40,0	-90,0	-9,4
σ 2009	1,8	19,2	21,2	3,0E+10	87943,3	2,4E+11	89,2	11,3	11,3	4264,3	4401,4	45,9
μ 2010	3,4	42,9	46,0	1,4E+10	31075,7	5,3E+10	22,7	3,2	5,8	100,6	62,1	7,1
σ 2010	2,0	18,7	20,9	2,9E+10	58633,6	2,3E+11	35,7	5,2	8,4	410,2	365,1	28,6
μ 2011	4,1	43,3	46,4	1,3E+10	33464,1	5,7E+10	-8,2	2,8	5,3	77,8	41,4	10,7
σ 2011	2,1	19,1	21,2	3,0E+10	83581,0	2,3E+11	27,3	5,5	8,6	938,4	956,5	47,5
μ 2012	5,0	44,4	46,8	1,4E+10	31609,7	5,8E+10	21,7	3,0	4,5	129,6	97,1	5,2
σ 2012	2,2	19,0	20,7	2,8E+10	81966,5	2,4E+11	33,9	6,5	11,2	1098,1	682,7	38,6
μ 2013	5,8	44,7	47,6	1,9E+10	31801,5	5,7E+10	35,0	4,5	4,7	166,2	134,8	4,7
σ 2013	2,3	18,9	20,5	3,9E+10	61671,8	2,2E+11	43,4	16,5	11,4	2604,9	2483,4	29,9
μ 2014	6,5	45,1	47,8	1,9E+10	32807,9	5,3E+10	7,0	3,9	4,5	232,3	214,7	0,1
σ 2014	2,5	18,8	20,3	4,0E+10	84393,2	2,1E+11	26,9	10,0	12,5	5677,0	5858,0	28,4
μ 2015	5,8	44,0	45,1	1,4E+10	26191,4	4,0E+10	6,6	4,8	2,8	88,0	46,0	-1,0
σ 2015	3,8	20,0	20,9	3,4E+10	74228,5	1,7E+11	51,2	16,5	14,3	1999,6	2047,1	34,2
μ 2016	5,2	41,2	42,6	1,2E+10	21577,7	3,2E+10	18,6	4,4	1,6	87,1	64,3	2,0
σ 2016	4,3	19,1	20,5	3,4E+10	67800,0	1,5E+11	41,6	12,0	17,4	731,0	747,6	42,0
μ 2017	5,2	40,6	41,9	1,3E+10	18850,6	3,0E+10	22,1	4,9	0,9	72,5	41,2	15,4
σ 2017	4,5	19,4	20,6	4,0E+10	48451,5	1,5E+11	45,4	14,2	28,8	830,8	866,1	53,0
μ 2018	5,3	40,9	42,6	9,9E+09	17552,5	2,6E+10	-10,6	3,8	1,4	88,7	54,8	10,4
σ 2018	4,6	19,1	20,6	3,6E+10	59341,7	1,3E+11	40,1	9,6	19,3	772,7	818,3	43,8

Table 39 : Evolution over the year

As indicated in the methodology section, dynamic models can be applied in the context of panel regression. This could be useful in order to reflect the stability over ratings. Indeed, ESG ratings are persistent over the years. The change in ESG combined score is the more volatile as the controversy score reflect bad events of the year and is thus more year specific than other ESG metrics. Moreover, the change in ESG score is less volatile than change in the pillars suggesting that the change in the pillars compensate each other. Histogram of change for ESG combined and ESG score are available in the appendix.

	N	Mean	Std	Min	Max
ESGC	15807	1,63	8,91	-75,75	75,79
ESG	15807	1,86	6,67	-75,75	75,79
ESG Env	15802	2,02	8,58	-85,71	76,11
ESG Soc	15802	1,96	7,95	-81,73	84,71
ESG Gov	15807	1,54	13,25	-62,52	81,02

Table 40 : ESG difference year over year

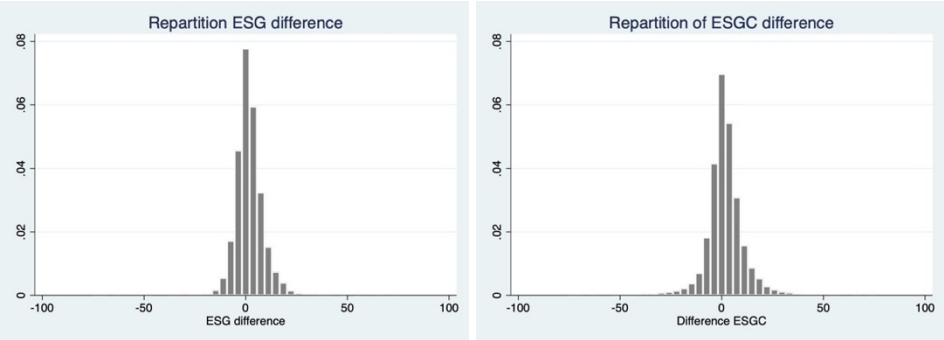

Figure 36 : Repartition of ESG and ESG C difference

As in the data descriptive section, correlation table shed lights on relation between the variables and lead to similar observations. Controversy score is negatively correlated with other ESG metrics (excepted with the combined score) and with the size. Size metrics (market capitalization, total employees and total assets) will be studied individually due to their high correlation. Similarly, leverage ratios (Net debt and Total debt divided by equity) are highly correlated. The headquarters (HQ) metrics confirm that American firms (HQ=0) have lower ratings. Concerning control variables, they have low correlation with ESG metrics. But, ROA has significant correlation with the Price to Book value and the 52 weeks returns. P values are available in the appendix.

	# Issue	ESGC	C	ESG	Env	Soc	Gov	Repo.	MC	TEmp	TA	wRet	PBV	ROA	TD_E	ND_E	RevGr	Industry	HQ
# Issue	1,00	0,45	-0,12	0,45	0,43	0,41	0,28	0,00	0,16	0,12	0,07	-0,01	0,00	0,10	0,01	0,01	-0,08	-0,04	0,21
ESGC	0,45	1,00	-0,03	0,94	0,81	0,83	0,66	-0,04	0,20	0,21	0,13	-0,02	-0,02	0,11	-0,01	-0,01	-0,08	-0,02	0,33
C	-0,12	-0,03	1,00	-0,31	-0,29	-0,28	-0,20	0,00	-0,44	-0,34	-0,31	0,01	0,02	-0,02	-0,01	-0,01	0,02	0,01	0,01
ESG	0,45	0,94	-0,31	1,00	0,87	0,89	0,70	-0,05	0,35	0,33	0,25	-0,03	-0,02	0,11	0,00	-0,01	-0,09	-0,02	0,32
Env	0,43	0,81	-0,29	0,87	1,00	0,75	0,43	-0,07	0,33	0,32	0,24	-0,02	-0,04	0,11	0,00	0,00	-0,10	-0,05	0,41
Soc	0,41	0,83	-0,28	0,89	0,75	1,00	0,41	-0,07	0,33	0,32	0,22	-0,02	-0,01	0,07	0,00	-0,01	-0,06	-0,01	0,27
Gov	0,28	0,66	-0,20	0,70	0,43	0,41	1,00	0,03	0,22	0,18	0,17	-0,03	-0,02	0,09	-0,01	-0,01	-0,06	0,01	0,09
Repo.	0,00	-0,04	0,00	-0,05	-0,07	-0,07	0,03	1,00	0,02	-0,04	-0,02	0,02	0,01	0,02	0,00	0,01	0,02	-0,04	-0,05
MC	0,16	0,20	-0,44	0,35	0,33	0,33	0,22	0,02	1,00	0,43	0,35	0,04	0,03	0,08	0,00	0,00	0,00	0,03	-0,03
TEmp	0,12	0,21	-0,34	0,33	0,32	0,32	0,18	-0,04	0,43	1,00	0,26	-0,01	0,00	0,04	0,00	0,00	-0,02	-0,04	0,07
TA	0,07	0,13	-0,31	0,25	0,24	0,22	0,17	-0,02	0,35	0,26	1,00	-0,03	-0,04	-0,02	0,02	0,01	-0,02	0,01	0,09
wRet	-0,01	-0,02	0,01	-0,03	-0,02	-0,02	-0,03	0,02	0,04	-0,01	-0,03	1,00	0,11	0,07	0,00	-0,01	0,05	0,01	-0,04
PBV	0,00	-0,02	0,02	-0,02	-0,04	-0,01	-0,02	0,01	0,03	0,00	-0,04	0,11	1,00	0,05	-0,02	-0,04	0,04	0,01	-0,06
ROA	0,10	0,11	-0,02	0,11	0,11	0,07	0,09	0,02	0,08	0,04	-0,02	0,07	0,05	1,00	-0,01	0,00	0,06	-0,04	0,08
TD_E	0,01	-0,01	-0,01	0,00	0,00	0,00	-0,01	0,00	0,00	0,00	0,02	0,00	-0,02	-0,01	1,00	0,99	0,00	-0,01	0,00
ND_E	0,01	-0,01	-0,01	-0,01	0,00	-0,01	-0,01	0,01	0,00	0,00	0,01	-0,01	-0,04	0,00	0,99	1,00	0,00	-0,01	-0,01
RevGr	-0,08	-0,08	0,02	-0,09	-0,10	-0,06	-0,06	0,02	0,00	-0,02	-0,02	0,05	0,04	0,06	0,00	0,00	1,00	0,02	-0,07
Industry	-0,04	-0,02	0,01	-0,02	-0,05	-0,01	0,01	-0,04	0,03	-0,04	0,01	0,01	0,01	-0,04	-0,01	-0,01	0,02	1,00	-0,05
HQ	0,21	0,33	0,01	0,32	0,41	0,27	0,09	-0,05	-0,03	0,07	0,09	-0,04	-0,06	0,08	0,00	-0,01	-0,07	-0,05	1,00

Table 41 : correlation over the years

	# Issue	ESGC	C	ESG	Env	Soc	Gov	Repo.	MC	TEmp	TA	wRet	PBV	ROA	TD_E	ND_E	RevGr	Industry	HQ
# Issue	1,00	0,00	0,00	0,00	0,00	0,00	0,00	0,94	0,00	0,00	0,00	0,03	0,79	0,00	0,26	0,30	0,00	0,00	0,00
ESGC	0,00	1,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,39	0,23	0,00	0,00	0,00
C	0,00	0,00	1,00	0,00	0,00	0,00	0,00	0,85	0,00	0,00	0,00	0,05	0,01	0,01	0,09	0,43	0,00	0,42	0,34
ESG	0,00	0,00	0,00	1,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,78	0,40	0,00	0,00	0,00
Env	0,00	0,00	0,00	0,00	1,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,65	0,87	0,00	0,00	0,00
Soc	0,00	0,00	0,00	0,00	0,00	1,00	0,00	0,00	0,00	0,00	0,00	0,01	0,25	0,00	0,88	0,48	0,00	0,08	0,00
Gov	0,00	0,00	0,00	0,00	0,00	0,00	1,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,30	0,21	0,00	0,08	0,00
Repo.	0,94	0,00	0,85	0,00	0,00	0,00	0,01	1,00	0,07	0,00	0,06	0,05	0,62	0,03	0,66	0,53	0,17	0,00	0,00
MC	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,07	1,00	0,00	0,00	0,00	0,00	0,00	0,90	0,69	0,78	0,00	0,00
TEmp	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,00	0,00	0,11	0,56	0,00	0,53	0,84	0,00	0,00	0,00
TA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,06	0,00	0,00	1,00	0,00	0,00	0,01	0,01	0,10	0,00	0,22	0,00
wRet	0,03	0,00	0,05	0,00	0,00	0,01	0,00	0,05	0,00	0,11	0,00	1,00	0,00	0,00	0,54	0,43	0,00	0,45	0,00
PBV	0,79	0,00	0,01	0,00	0,00	0,25	0,00	0,62	0,00	0,56	0,00	0,00	1,00	0,00	0,00	0,00	0,00	0,06	0,00
ROA	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,03	0,00	0,00	0,01	0,00	0,00	1,00	0,40	0,66	0,00	0,00	0,00
TD_E	0,26	0,39	0,09	0,78	0,65	0,88	0,30	0,66	0,90	0,53	0,01	0,54	0,00	0,40	1,00	0,00	0,59	0,25	0,73
ND_E	0,30	0,23	0,43	0,40	0,87	0,48	0,21	0,53	0,69	0,84	0,10	0,43	0,00	0,66	0,00	1,00	0,73	0,22	0,32
RevGr	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,17	0,78	0,00	0,00	0,00	0,00	0,00	0,59	0,73	1,00	0,01	0,00
Industry	0,00	0,00	0,42	0,00	0,00	0,08	0,08	0,00	0,00	0,00	0,22	0,45	0,06	0,00	0,25	0,22	0,01	1,00	0,00
HQ	0,00	0,00	0,34	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,73	0,32	0,00	0,00	1,00

Table 42 : p value associated with RQ2

G.3. Fixed-effects

	Model 1 : log market cap.		Model II : log total assets		Model III : log employee	
Number of obs	18 167		18198		17778	
Number of Groups	3 350		3353		3268	
R2	0,2690		0,2676		0,2714	
Adj R2	0,1025		0,1010		0,1060	
R2 within	0,2690		0,2676		0,2714	
R2 between	0,2788		0,2992		0,3060	
R2 overall	0,2754		0,2929		0,2954	
Corr(ui , Xb)	0,1753		0,1550		0,1119	
F test (all ß=0)	259,3192		257,9827		256,9446	
P value (F test)	0,0000		0,0000		0,000	
	coefficient	p	coefficient	p	coefficient	p
size	1,8864	0,0000	2,3046	0,0000	2,3063	0,0000
1.numbissue	2,4030	0,0000	2,0259	0,0000	2,1622	0,0000
2.numbissue	4,1336	0,0000	3,7062	0,0000	3,9175	0,0000
3.numbissue	5,2253	0,0000	4,7944	0,0000	5,1147	0,0000
4.numbissue	7,3040	0,0000	6,8247	0,0000	7,2127	0,0000
5.numbissue	8,6999	0,0000	8,2948	0,0000	8,7420	0,0000
6.numbissue	10,2721	0,0000	9,9175	0,0000	10,4256	0,0000
7.numbissue	12,0525	0,0000	11,7407	0,0000	12,3155	0,0000
8.numbissue	14,0143	0,0000	13,7365	0,0000	14,2789	0,0000
9.numbissue	15,2699	0,0000	15,0450	0,0000	15,6289	0,0000
10.numbissue	16,5256	0,0000	16,3444	0,0000	16,9946	0,0000
11.numbissue	17,9112	0,0000	17,6816	0,0000	18,3459	0,0000
12.numbissue	20,5836	0,0000	20,4319	0,0000	21,2803	0,0000
13.numbissue	22,6132	0,0000	22,4671	0,0000	23,1999	0,0000
14.numbissue	23,3409	0,0000	23,1796	0,0000	24,0785	0,0000
15.numbissue	25,3556	0,0000	25,1150	0,0000	25,9734	0,0000
16.numbissue	28,0327	0,0000	27,4689	0,0000	28,3407	0,0000
wret	-0,0074	0,0000	-0,0004	0,7897	-0,0002	0,8772
roa	-0,0200	0,0160	0,0035	0,6576	0,0100	0,2152
td_e	0,0000	0,3389	0,0000	0,1767	0,0000	0,2271
revgrowth	-0,0029	0,1041	-0,0024	0,1839	-0,0009	0,6626
_cons	-7,3230	0,0339	-16,6860	0,0007	14,2670	0,0000

Table 43 : Fixed-effects regression on ESG Combined score with number of issue as dummy

	Model 1 : log market cap.		Model II : log total assets		Model III : log employee	
Number of obs	18167		18198		17778	
Number of Groups	3350		3353		3268	
R2	0,2846		0,2816		0,2855	
Adj R2	0,1210		0,1174		0,1227	
R2 within	0,2846		0,2816		0,2855	
R2 between	0,0421		0,0114		0,0000	
R2 overall	0,0204		0,0324		0,0490	
Corr(ui , Xb)	-0,1909		-0,1557		-0,1511	
F test (all ß=0)	183,8340		181,4184		180,8001	
P value (F test)	0,0000		0,0000		0,0000	
	coefficient	p	coefficient	p	coefficient	p
Size	2,1718	0,0000	2,2430	0,0000	2,3560	0,0000
numbissue	-0,2176	0,1631	-0,2153	0,1684	-0,2285	0,1477
7b.year	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
8.year	4,0065	0,0000	2,7909	0,0000	2,8556	0,0000
9.year	6,9325	0,0000	5,9546	0,0000	6,1294	0,0000
10.year	8,1625	0,0000	7,5214	0,0000	7,7752	0,0000
11.year	9,6582	0,0000	8,7657	0,0000	9,0833	0,0000
12.year	11,2209	0,0000	10,3596	0,0000	10,7850	0,0000
13.year	11,2128	0,0000	10,7110	0,0000	11,1945	0,0000
14.year	12,1445	0,0000	11,7215	0,0000	12,1951	0,0000
15.year	16,1512	0,0000	15,6840	0,0000	16,1220	0,0000
16.year	17,9014	0,0000	17,4109	0,0000	17,9032	0,0000
17.year	19,4707	0,0000	19,0624	0,0000	19,7143	0,0000
18.year	21,1069	0,0000	20,3562	0,0000	21,1092	0,0000
wret	-0,0096	0,0000	-0,0026	0,1057	-0,0024	0,1385
roapct	-0,0196	0,0176	0,0070	0,3790	0,0132	0,1027
td_epct	0,0000	0,4877	0,0000	0,2462	0,0000	0,3016
revgrowth	-0,0025	0,1739	-0,0018	0,3181	-0,0003	0,8694
_cons	-18,1652	0,0000	-19,5340	0,0001	9,6964	0,0000

Table 44 : Fixed-effects regression on ESG Combined score with time fixed-effects

# of obs	21284		# of obs	21357		# of obs	20798	
# of Groups	3854		# of Groups	3869		# of Groups	3769	
R2	0,2433		R2	0,2470		R2	0,2506	
Adj R2	0,0760		Adj R2	0,0804		Adj R2	0,0847	
R2 within	0,2433		R2 within	0,2470		R2 within	0,2506	
R2 between	0,2997		R2 between	0,3080		R2 between	0,3281	
R2 overall	0,2733		R2 overall	0,2956		R2 overall	0,3072	
corr(ui , Xb)	0,2038		corr(ui , Xb)	0,1012		corr(ui , Xb)	0,1134	
	coefficient	p		coefficient	p		coefficient	p
logmc	1,5983	0,0000	logta	2,9553	0,0000	logtemp	2,6029	0,0000
numbissue	1,5705	0,0000	numbissue	1,5415	0,0000	numbissue	1,6175	0,0000
10o.industry	0,0000	0,0000	10o.industry	0,0000	0,0000	10o.industry	0,0000	0,0000
_cons	-0,4548	0,8720	_cons	-31,4386	0,0000	_cons	12,3478	0,0000

Table 45 : Effect of removal of control variables

Number of obs	18167	0	Number of obs	18198	0	Number of obs	17778	0	Number of obs	18167	0	Number of obs	18167	0
Number of Groups	3350	0	Number of Groups	3353	0	Number of Groups	3268	0	Number of Groups	3350	0	Number of Groups	3350	0
R2	0,3328	0	R2	0,3371	0	R2	0,3426	0	R2	0,3610	0	R2	0,3604	0
Adj R2	0,1817	0	Adj R2	0,1871	0	Adj R2	0,1942	0	Adj R2	0,2149	0	Adj R2	0,2149	0
R2 within	0,3328	0	R2 within	0,3371	0	R2 within	0,3426	0	R2 within	0,3610	0	R2 within	0,3604	0
R2 between	0,3179	0	R2 between	0,3562	0	R2 between	0,3532	0	R2 between	0,0864	0	R2 between	0,0807	0
R2 overall	0,3021	0	R2 overall	0,3605	0	R2 overall	0,3532	0	R2 overall	0,0057	0	R2 overall	0,0071	0
corr(ui , Xb)	0,2392	0	corr(ui , Xb)	0,2244	0	corr(ui , Xb)	0,1660	0	corr(ui , Xb)	-0,2577	0	corr(ui , Xb)	-0,2461	0
F	1231,5376	0	F	1257,8949	0	F	1259,6298	0	F	261,0424	0	F	490,5401	0
p	0,0000	0	p	0,0000	0	p	0,0000	0	p	0,0000	0	p	0,0000	0
	coefficient	p		coefficient	p		coefficient	p		coefficient	p		coefficient	p
logmc	1,6027	0,0000	logta	2,9219	0,0000	logtemp	2,8596	0,0000	logmc	2,0528	0,0000	logmc	2,0541	0,0000
numbissue	1,7129	0,0000	numbissue	1,6826	0,0000	numbissue	1,7538	0,0000	0b.numbissue	0,0000	0,0000	numbissue	-0,4680	0,0006
o.hq	0,0000	0,0000	o.hq	0,0000	0,0000	o.hq	0,0000	0,0000	1.numbissue	-0,6245	0,0330	7b.year	0,0000	0,0000
1b.industry	0,0000	0,0000	1b.industry	0,0000	0,0000	1b.industry	0,0000	0,0000	2.numbissue	-1,3282	0,0008	8.year	5,6003	0,0000
2o.industry	0,0000	0,0000	2o.industry	0,0000	0,0000	2o.industry	0,0000	0,0000	3.numbissue	-2,0952	0,0001	9.year	8,6514	0,0000
3o.industry	0,0000	0,0000	3o.industry	0,0000	0,0000	3o.industry	0,0000	0,0000	4.numbissue	-2,3989	0,0003	10.year	10,7889	0,0000
4o.industry	0,0000	0,0000	4o.industry	0,0000	0,0000	4o.industry	0,0000	0,0000	5.numbissue	-2,8844	0,0003	11.year	12,4022	0,0000
5o.industry	0,0000	0,0000	5o.industry	0,0000	0,0000	5o.industry	0,0000	0,0000	6.numbissue	-3,2750	0,0004	12.year	13,6616	0,0000
6o.industry	0,0000	0,0000	6o.industry	0,0000	0,0000	6o.industry	0,0000	0,0000	7.numbissue	-3,5765	0,0008	13.year	14,2078	0,0000
7o.industry	0,0000	0,0000	7o.industry	0,0000	0,0000	7o.industry	0,0000	0,0000	8.numbissue	-4,2144	0,0004	14.year	15,3114	0,0000
8o.industry	0,0000	0,0000	8o.industry	0,0000	0,0000	8o.industry	0,0000	0,0000	9.numbissue	-4,5493	0,0005	15.year	18,5617	0,0000
9o.industry	0,0000	0,0000	9o.industry	0,0000	0,0000	9o.industry	0,0000	0,0000	10.numbissue	-5,3211	0,0002	16.year	21,2663	0,0000
10o.industry	0,0000	0,0000	10o.industry	0,0000	0,0000	10o.industry	0,0000	0,0000	11.numbissue	-6,1760	0,0001	17.year	23,2445	0,0000
wret	-0,0082	0,0000	wret	-0,0017	0,1829	wret	-0,0015	0,2504	12.numbissue	-5,3921	0,0020	18.year	25,7650	0,0000
roapct	-0,0226	0,0020	roapct	-0,0036	0,6120	roapct	0,0045	0,5286	13.numbissue	-6,4039	0,0006	wret	-0,0101	0,0000
td_epct	0,0000	0,8580	td_epct	0,0000	0,5062	td_epct	0,0000	0,6660	14.numbissue	-6,8699	0,0007	roapct	-0,0246	0,0006
revgrowth	-0,0037	0,0214	revgrowth	-0,0035	0,0276	revgrowth	-0,0022	0,2300	15.numbissue	-7,0425	0,0019	td_epct	0,0000	0,8771
_cons	1,1329	0,7077	_cons	-28,3793	0,0000	_cons	11,5285	0,0000	16.numbissue	-7,0112	0,0048	revgrowth	-0,0032	0,0404
									7b.year	0,0000	0,0000	_cons	-15,3750	0,0000
									8.year	5,6844	0,0000			
									9.year	8,8392	0,0000			
									10.year	11,0917	0,0000			
									11.year	12,6735	0,0000			
									12.year	13,9683	0,0000			
									13.year	14,5153	0,0000			
									14.year	15,5456	0,0000			
									15.year	18,8077	0,0000			
									16.year	21,4629	0,0000			
									17.year	23,5356	0,0000			
									18.year	26,1832	0,0000			
									wret	-0,0102	0,0000			
									roapct	-0,0245	0,0007			
									td_epct	0,0000	0,8747			
									revgrowth	-0,0033	0,0359			
									_cons	-15,2250	0,0000			

Table 46 : Fixed-effects and ESG score

Number of obs	17494	0	Number of obs	17521	0	Number of obs	17151	0	Number of obs	17494	0	Number of obs	17494	0
Number of Groups	3289	0	Number of Groups	3292	0	Number of Groups	3210	0	Number of Groups	3289	0	Number of Groups	3289	0
R2	0,2698	0	R2	0,2688	0	R2	0,2715	0	R2	0,2867	0	R2	0,2860	0
Adj R2	0,1004	0	Adj R2	0,0993	0	Adj R2	0,1035	0	Adj R2	0,1196	0	Adj R2	0,1196	0
R2 within	0,2698	0	R2 within	0,2688	0	R2 within	0,2715	0	R2 within	0,2867	0	R2 within	0,2860	0
R2 between	0,2858	0	R2 between	0,3015	0	R2 between	0,3046	0	R2 between	0,0209	0	R2 between	0,0147	0
R2 overall	0,2777	0	R2 overall	0,2961	0	R2 overall	0,2937	0	R2 overall	0,0312	0	R2 overall	0,0352	0
corr(ui , Xb)	0,1726	0	corr(ui , Xb)	0,1529	0	corr(ui , Xb)	0,1038	0	corr(ui , Xb)	-0,1527	0	corr(ui , Xb)	-0,1381	0
F	874,4744	0	F	871,3951	0	F	865,7353	0	F	178,0138	0	F	334,2426	0
p	0,0000	0	p	0,0000	0	p	0,0000	0	p	0,0000	0	p	0,0000	0
	coefficient	p		coefficient	p		coefficient	p		coefficient	p		coefficient	p
logmc	1,9660	0,0000	logta	2,3853	0,0000	logtemp	2,3896	0,0000	logmc	2,3047	0,0000	logmc	2,3079	0,0000
numbissue	1,6446	0,0000	numbissue	1,6511	0,0000	numbissue	1,7056	0,0000	0b.numbissue	0,0000	0,0000	numbissue	-0,1782	0,2614
o.hq	0,0000	0,0000	o.hq	0,0000	0,0000	o.hq	0,0000	0,0000	1.numbissue	-0,1948	0,5750	7b.year	0,0000	0,0000
1b.industry	0,0000	0,0000	1b.industry	0,0000	0,0000	1b.industry	0,0000	0,0000	2.numbissue	-0,5632	0,2285	8.year	3,6536	0,0000
2o.industry	0,0000	0,0000	2o.industry	0,0000	0,0000	2o.industry	0,0000	0,0000	3.numbissue	-1,2951	0,0344	9.year	6,7881	0,0000
3o.industry	0,0000	0,0000	3o.industry	0,0000	0,0000	3o.industry	0,0000	0,0000	4.numbissue	-1,0438	0,1777	10.year	7,9334	0,0000
4o.industry	0,0000	0,0000	4o.industry	0,0000	0,0000	4o.industry	0,0000	0,0000	5.numbissue	-1,4925	0,1054	11.year	9,4168	0,0000
5o.industry	0,0000	0,0000	5o.industry	0,0000	0,0000	5o.industry	0,0000	0,0000	6.numbissue	-1,5935	0,1399	12.year	10,9908	0,0000
6o.industry	0,0000	0,0000	6o.industry	0,0000	0,0000	6o.industry	0,0000	0,0000	7.numbissue	-1,5035	0,2250	13.year	10,9117	0,0000
7o.industry	0,0000	0,0000	7o.industry	0,0000	0,0000	7o.industry	0,0000	0,0000	8.numbissue	-1,7020	0,2189	14.year	11,6316	0,0000
8o.industry	0,0000	0,0000	8o.industry	0,0000	0,0000	8o.industry	0,0000	0,0000	9.numbissue	-2,0403	0,1827	15.year	15,6829	0,0000
9o.industry	0,0000	0,0000	9o.industry	0,0000	0,0000	9o.industry	0,0000	0,0000	10.numbissue	-2,4972	0,1369	16.year	17,5123	0,0000
10o.industry	0,0000	0,0000	10o.industry	0,0000	0,0000	10o.industry	0,0000	0,0000	11.numbissue	-2,9035	0,1123	17.year	19,0439	0,0000
wret	-0,0097	0,0000	wret	0,0004	0,8540	wret	0,0004	0,8442	12.numbissue	-2,1691	0,2848	18.year	20,5083	0,0000
roapct	-0,0105	0,4040	roapct	0,0281	0,0195	roapct	0,0316	0,0095	13.numbissue	-2,0080	0,3574	wret	-0,0136	0,0000
td_epct	-0,0005	0,2934	td_epct	-0,0008	0,0751	td_epct	-0,0006	0,1832	14.numbissue	-3,1159	0,1864	roapct	-0,0097	0,4370
revgrowth	-0,0143	0,0001	revgrowth	-0,0112	0,0023	revgrowth	-0,0087	0,0215	15.numbissue	-2,8333	0,2828	td_epct	-0,0006	0,2102
_cons	-8,2901	0,0294	_cons	-18,1112	0,0006	_cons	13,9445	0,0000	16.numbissue	-1,7886	0,5368	revgrowth	-0,0127	0,0008
									7b.year	0,0000	0,0000	_cons	-20,5855	0,0000
									8.year	3,6656	0,0000			
									9.year	6,8868	0,0000			
									10.year	8,2321	0,0000			
									11.year	9,6290	0,0000			
									12.year	11,2901	0,0000			
									13.year	11,2286	0,0000			
									14.year	11,8763	0,0000			
									15.year	15,9005	0,0000			
									16.year	17,7445	0,0000			
									17.year	19,3220	0,0000			
									18.year	20,8973	0,0000			
									wret	-0,0137	0,0000			
									roapct	-0,0092	0,4629			
									td_epct	-0,0006	0,2164			
									revgrowth	-0,0129	0,0007			
									_cons	-20,4228	0,0000			

Table 47 : Fixed-effects regression on ESG Combined score with truncation

Number of obs	18167	0	Number of obs	18198	0	Number of obs	17778	0	Number of obs	18167	0	Number of obs	18167	0
Number of Groups	3350	0	Number of Groups	3353	0	Number of Groups	3268	0	Number of Groups	3350	0	Number of Groups	3350	0
R2	0,3328	0	R2	0,3371	0	R2	0,3426	0	R2	0,3610	0	R2	0,3604	0
Adj R2	0,1817	0	Adj R2	0,1871	0	Adj R2	0,1942	0	Adj R2	0,2149	0	Adj R2	0,2149	0
R2 within	0,3328	0	R2 within	0,3371	0	R2 within	0,3426	0	R2 within	0,3610	0	R2 within	0,3604	0
R2 between	0,3179	0	R2 between	0,3562	0	R2 between	0,3532	0	R2 between	0,0864	0	R2 between	0,0807	0
R2 overall	0,3021	0	R2 overall	0,3605	0	R2 overall	0,3532	0	R2 overall	0,0057	0	R2 overall	0,0071	0
corr(ui , Xb)	0,2392	0	corr(ui , Xb)	0,2244	0	corr(ui , Xb)	0,1660	0	corr(ui , Xb)	-0,2577	0	corr(ui , Xb)	-0,2461	0
F	1231,5376	0	F	1257,8949	0	F	1259,6298	0	F	261,0424	0	F	490,5401	0
p	0,0000	0	p	0,0000	0	p	0,0000	0	p	0,0000	0	p	0,0000	0
	coefficient	p		coefficient	p		coefficient	p		coefficient	p		coefficient	p
logmc	1,6027	0,0000	logta	2,9219	0,0000	logtemp	2,8596	0,0000	logmc	2,0528	0,0000	logmc	2,0541	0,0000
numbissue	1,7129	0,0000	numbissue	1,6826	0,0000	numbissue	1,7538	0,0000	0b.numbissue	0,0000	0,0000	numbissue	-0,4680	0,0006
o.hq	0,0000	0,0000	o.hq	0,0000	0,0000	o.hq	0,0000	0,0000	1.numbissue	-0,6245	0,0330	7b.year	0,0000	0,0000
1b.industry	0,0000	0,0000	1b.industry	0,0000	0,0000	1b.industry	0,0000	0,0000	2.numbissue	-1,3282	0,0008	8.year	5,6003	0,0000
2o.industry	0,0000	0,0000	2o.industry	0,0000	0,0000	2o.industry	0,0000	0,0000	3.numbissue	-2,0952	0,0001	9.year	8,6514	0,0000
3o.industry	0,0000	0,0000	3o.industry	0,0000	0,0000	3o.industry	0,0000	0,0000	4.numbissue	-2,3989	0,0003	10.year	10,7889	0,0000
4o.industry	0,0000	0,0000	4o.industry	0,0000	0,0000	4o.industry	0,0000	0,0000	5.numbissue	-2,8844	0,0003	11.year	12,4022	0,0000
5o.industry	0,0000	0,0000	5o.industry	0,0000	0,0000	5o.industry	0,0000	0,0000	6.numbissue	-3,2750	0,0004	12.year	13,6616	0,0000
6o.industry	0,0000	0,0000	6o.industry	0,0000	0,0000	6o.industry	0,0000	0,0000	7.numbissue	-3,5765	0,0008	13.year	14,2078	0,0000
7o.industry	0,0000	0,0000	7o.industry	0,0000	0,0000	7o.industry	0,0000	0,0000	8.numbissue	-4,2144	0,0004	14.year	15,3114	0,0000
8o.industry	0,0000	0,0000	8o.industry	0,0000	0,0000	8o.industry	0,0000	0,0000	9.numbissue	-4,5493	0,0005	15.year	18,5617	0,0000
9o.industry	0,0000	0,0000	9o.industry	0,0000	0,0000	9o.industry	0,0000	0,0000	10.numbissue	-5,3211	0,0002	16.year	21,2663	0,0000
10o.industry	0,0000	0,0000	10o.industry	0,0000	0,0000	10o.industry	0,0000	0,0000	11.numbissue	-6,1760	0,0001	17.year	23,2445	0,0000
wret	-0,0082	0,0000	wret	-0,0017	0,1829	wret	-0,0015	0,2504	12.numbissue	-5,3921	0,0020	18.year	25,7650	0,0000
roapct	-0,0226	0,0020	roapct	-0,0036	0,6120	roapct	0,0045	0,5286	13.numbissue	-6,4039	0,0006	wret	-0,0101	0,0000
td_epct	0,0000	0,8580	td_epct	0,0000	0,5062	td_epct	0,0000	0,6660	14.numbissue	-6,8699	0,0007	roapct	-0,0246	0,0006
revgrowth	-0,0037	0,0214	revgrowth	-0,0035	0,0276	revgrowth	-0,0022	0,2300	15.numbissue	-7,0425	0,0019	td_epct	0,0000	0,8771
_cons	1,1329	0,7077	_cons	-28,3793	0,0000	_cons	11,5285	0,0000	16.numbissue	-7,0112	0,0048	revgrowth	-0,0032	0,0404
									7b.year	0,0000	0,0000	_cons	-15,3750	0,0000
									8.year	5,6844	0,0000			
									9.year	8,8392	0,0000			
									10.year	11,0917	0,0000			
									11.year	12,6735	0,0000			
									12.year	13,9683	0,0000			
									13.year	14,5153	0,0000			
									14.year	15,5456	0,0000			
									15.year	18,8077	0,0000			
									16.year	21,4629	0,0000			
									17.year	23,5356	0,0000			
									18.year	26,1832	0,0000			
									wret	-0,0102	0,0000			
									roapct	-0,0245	0,0007			
									td_epct	0,0000	0,8747			
									revgrowth	-0,0033	0,0359			
									_cons	-15,2250	0,0000			

Table 48 : Fixed-effects and ESG score

Number of obs	18164	0	Number of obs	18195	0	Number of obs	17775	0	Number of obs	18164	0	Number of obs	18164	0
Number of Groups	3350	0	Number of Groups	3353	0	Number of Groups	3268	0	Number of Groups	3350	0	Number of Groups	3350	0
R2	0,2288	0	R2	0,2373	0	R2	0,2379	0	R2	0,2731	0	R2	0,2725	0
Adj R2	0,0540	0	Adj R2	0,0647	0	Adj R2	0,0659	0	Adj R2	0,1069	0	Adj R2	0,1070	0
R2 within	0,2288	0	R2 within	0,2373	0	R2 within	0,2379	0	R2 within	0,2731	0	R2 within	0,2725	0
R2 between	0,3109	0	R2 between	0,3807	0	R2 between	0,3648	0	R2 between	0,1833	0	R2 between	0,1846	0
R2 overall	0,2579	0	R2 overall	0,3521	0	R2 overall	0,3280	0	R2 overall	0,0317	0	R2 overall	0,0320	0
corr(ui , Xb)	0,2907	0	corr(ui , Xb)	0,3109	0	corr(ui , Xb)	0,2758	0	corr(ui , Xb)	-0,4830	0	corr(ui , Xb)	-0,4832	0
F	732,0057	0	F	769,4918	0	F	754,6429	0	F	173,5731	0	F	325,9592	0
p	0,0000	0	p	0,0000	0	p	0,0000	0	p	0,0000	0	p	0,0000	0
	coefficient	p		coefficient	p		coefficient	p		coefficient	p		coefficient	p
logmc	1,5142	0,0000	logta	3,8946	0,0000	logtemp	3,1950	0,0000	logmc	2,2140	0,0000	logmc	2,2092	0,0000
numbissue	1,8478	0,0000	numbissue	1,7816	0,0000	numbissue	1,8819	0,0000	0b.numbissue	0,0000	0,0000	numbissue	-1,5311	0,0000
o.hq	0,0000	0,0000	o.hq	0,0000	0,0000	o.hq	0,0000	0,0000	1.numbissue	-2,0739	0,0000	7b.year	0,0000	0,0000
1b.industry	0,0000	0,0000	1b.industry	0,0000	0,0000	1b.industry	0,0000	0,0000	2.numbissue	-3,6827	0,0000	8.year	9,4656	0,0000
2o.industry	0,0000	0,0000	2o.industry	0,0000	0,0000	2o.industry	0,0000	0,0000	3.numbissue	-5,3279	0,0000	9.year	14,6860	0,0000
3o.industry	0,0000	0,0000	3o.industry	0,0000	0,0000	3o.industry	0,0000	0,0000	4.numbissue	-6,8671	0,0000	10.year	18,5347	0,0000
4o.industry	0,0000	0,0000	4o.industry	0,0000	0,0000	4o.industry	0,0000	0,0000	5.numbissue	-8,2227	0,0000	11.year	21,5606	0,0000
5o.industry	0,0000	0,0000	5o.industry	0,0000	0,0000	5o.industry	0,0000	0,0000	6.numbissue	-9,6230	0,0000	12.year	24,2610	0,0000
6o.industry	0,0000	0,0000	6o.industry	0,0000	0,0000	6o.industry	0,0000	0,0000	7.numbissue	-10,9302	0,0000	13.year	25,3320	0,0000
7o.industry	0,0000	0,0000	7o.industry	0,0000	0,0000	7o.industry	0,0000	0,0000	8.numbissue	-12,6119	0,0000	14.year	27,1688	0,0000
8o.industry	0,0000	0,0000	8o.industry	0,0000	0,0000	8o.industry	0,0000	0,0000	9.numbissue	-13,8363	0,0000	15.year	30,9591	0,0000
9o.industry	0,0000	0,0000	9o.industry	0,0000	0,0000	9o.industry	0,0000	0,0000	10.numbissue	-15,6892	0,0000	16.year	34,2937	0,0000
10o.industry	0,0000	0,0000	10o.industry	0,0000	0,0000	10o.industry	0,0000	0,0000	11.numbissue	-17,8648	0,0000	17.year	36,8588	0,0000
wret	-0,0035	0,0573	wret	0,0033	0,0553	wret	0,0032	0,0700	12.numbissue	-17,5742	0,0000	18.year	40,5906	0,0000
roapct	-0,0306	0,0026	roapct	-0,0148	0,1272	roapct	-0,0057	0,5652	13.numbissue	-20,3897	0,0000	wret	-0,0092	0,0000
td_epct	0,0000	0,6942	td_epct	0,0000	0,4218	td_epct	0,0000	0,5892	14.numbissue	-22,1473	0,0000	roapct	-0,0302	0,0023
revgrowth	-0,0069	0,0020	revgrowth	-0,0071	0,0014	revgrowth	-0,0081	0,0015	15.numbissue	-23,7814	0,0000	td_epct	0,0000	0,8148
_cons	-6,7144	0,1094	_cons	-59,6314	0,0000	_cons	-1,1684	0,5992	16.numbissue	-24,8101	0,0000	revgrowth	-0,0052	0,0182
									7b.year	0,0000	0,0000	_cons	-33,8087	0,0000
									8.year	9,7234	0,0000			
									9.year	14,9903	0,0000			
									10.year	18,8559	0,0000			
									11.year	21,8625	0,0000			
									12.year	24,5259	0,0000			
									13.year	25,5530	0,0000			
									14.year	27,2523	0,0000			
									15.year	31,0225	0,0000			
									16.year	34,2808	0,0000			
									17.year	36,9871	0,0000			
									18.year	40,8861	0,0000			
									wret	-0,0092	0,0000			
									roapct	-0,0300	0,0025			
									td_epct	0,0000	0,8126			
									revgrowth	-0,0053	0,0154			
									0	0,0000	0,0000			

Table 49 : Fixed-effects and environmental pillar

Number of obs	18164	0	Number of obs	18195	0	Number of obs	17775	0	Number of obs	18164	0	Number of obs	18164	0
Number of Groups	3350	0	Number of Groups	3353	0	Number of Groups	3268	0	Number of Groups	3350	0	Number of Groups	3350	0
R2	0,3059	0	R2	0,3069	0	R2	0,3112	0	R2	0,3206	0	R2	0,3189	0
Adj R2	0,1486	0	Adj R2	0,1500	0	Adj R2	0,1557	0	Adj R2	0,1652	0	Adj R2	0,1640	0
R2 within	0,3059	0	R2 within	0,3069	0	R2 within	0,3112	0	R2 within	0,3206	0	R2 within	0,3189	0
R2 between	0,2174	0	R2 between	0,2384	0	R2 between	0,2350	0	R2 between	0,0081	0	R2 between	0,0539	0
R2 overall	0,2510	0	R2 overall	0,2783	0	R2 overall	0,2767	0	R2 overall	0,0999	0	R2 overall	0,1299	0
corr(ui , Xb)	0,1613	0	corr(ui , Xb)	0,1449	0	corr(ui , Xb)	0,1099	0	corr(ui , Xb)	0,0381	0	corr(ui , Xb)	0,0946	0
F	1087,5474	0	F	1094,9891	0	F	1091,8928	0	F	218,0108	0	F	407,5968	0
p	0,0000	0	p	0,0000	0	p	0,0000	0	p	0,0000	0	p	0,0000	0
	coefficient	p		coefficient	p		coefficient	p		coefficient	p		coefficient	p
logmc	1,7753	0,0000	logta	2,5844	0,0000	logtemp	2,5085	0,0000	logmc	2,1775	0,0000	logmc	2,1919	0,0000
numbissue	1,9825	0,0000	numbissue	1,9746	0,0000	numbissue	2,0433	0,0000	0b.numbissue	0,0000	0,0000	numbissue	0,4373	0,0096
o.hq	0,0000	0,0000	o.hq	0,0000	0,0000	o.hq	0,0000	0,0000	1.numbissue	-0,0277	0,9393	7b.year	0,0000	0,0000
1b.industry	0,0000	0,0000	1b.industry	0,0000	0,0000	1b.industry	0,0000	0,0000	2.numbissue	-0,1381	0,7797	8.year	4,7149	0,0000
2o.industry	0,0000	0,0000	2o.industry	0,0000	0,0000	2o.industry	0,0000	0,0000	3.numbissue	-0,1023	0,8748	9.year	6,2111	0,0000
3o.industry	0,0000	0,0000	3o.industry	0,0000	0,0000	3o.industry	0,0000	0,0000	4.numbissue	0,3427	0,6770	10.year	7,8179	0,0000
4o.industry	0,0000	0,0000	4o.industry	0,0000	0,0000	4o.industry	0,0000	0,0000	5.numbissue	0,2424	0,8046	11.year	8,9731	0,0000
5o.industry	0,0000	0,0000	5o.industry	0,0000	0,0000	5o.industry	0,0000	0,0000	6.numbissue	0,5539	0,6295	12.year	9,6404	0,0000
6o.industry	0,0000	0,0000	6o.industry	0,0000	0,0000	6o.industry	0,0000	0,0000	7.numbissue	1,0255	0,4364	13.year	9,5217	0,0000
7o.industry	0,0000	0,0000	7o.industry	0,0000	0,0000	7o.industry	0,0000	0,0000	8.numbissue	1,5092	0,3054	14.year	10,1981	0,0000
8o.industry	0,0000	0,0000	8o.industry	0,0000	0,0000	8o.industry	0,0000	0,0000	9.numbissue	1,6783	0,3026	15.year	13,1903	0,0000
9o.industry	0,0000	0,0000	9o.industry	0,0000	0,0000	9o.industry	0,0000	0,0000	10.numbissue	1,9409	0,2772	16.year	15,4981	0,0000
10o.industry	0,0000	0,0000	10o.industry	0,0000	0,0000	10o.industry	0,0000	0,0000	11.numbissue	2,0046	0,3029	17.year	16,9759	0,0000
wret	-0,0070	0,0000	wret	-0,0002	0,8949	wret	-0,0002	0,9212	12.numbissue	4,4306	0,0401	18.year	18,3564	0,0000
roapct	-0,0346	0,0001	roapct	-0,0129	0,1346	roapct	-0,0062	0,4813	13.numbissue	4,2582	0,0666	wret	-0,0078	0,0000
td_epct	0,0000	0,6216	td_epct	0,0000	0,9206	td_epct	0,0000	0,7802	14.numbissue	4,8888	0,0516	roapct	-0,0369	0,0000
revgrowth	-0,0012	0,5430	revgrowth	-0,0006	0,7498	revgrowth	0,0005	0,8075	15.numbissue	5,9004	0,0358	td_epct	0,0000	0,4238
_cons	-1,1208	0,7623	_cons	-19,4226	0,0003	_cons	15,9897	0,0000	16.numbissue	4,8004	0,1196	revgrowth	-0,0013	0,5047
									7b.year	0,0000	0,0000	_cons	-15,0849	0,0001
									8.year	5,0157	0,0000			
									9.year	6,8675	0,0000			
									10.year	8,7263	0,0000			
									11.year	10,0156	0,0000			
									12.year	10,9424	0,0000			
									13.year	10,9948	0,0000			
									14.year	11,7030	0,0000			
									15.year	14,6548	0,0000			
									16.year	16,9983	0,0000			
									17.year	18,6596	0,0000			
									18.year	20,2969	0,0000			
									wret	-0,0078	0,0000			
									roapct	-0,0367	0,0000			
									td_epct	0,0000	0,4152			
									revgrowth	-0,0016	0,4273			
									0	0,0000	0,0000			

Table 50 : Fixed-effects and social pillar

Number of obs	18167	0	Number of obs	18198		Number of obs	17778		Number of obs	18167		Number of obs	18167	
Number of Groups	3350	0	Number of Groups	3353		Number of Groups	3268		Number of Groups	3350		Number of Groups	3350	
R2	0,0779	0	R2	0,0797		R2	0,0823		R2	0,0894		R2	0,0886	
Adj R2	-0,1310	0	Adj R2	-0,1286		Adj R2	-0,1247		Adj R2	-0,1188		Adj R2	-0,1187	
R2 within	0,0779	0	R2 within	0,0797		R2 within	0,0823		R2 within	0,0894		R2 within	0,0886	
R2 between	0,1320	0	R2 between	0,1420		R2 between	0,1254		R2 between	0,0381		R2 between	0,0486	
R2 overall	0,1141	0	R2 overall	0,1336		R2 overall	0,1166		R2 overall	0,0046		R2 overall	0,0013	
corr(ui , Xb)	0,1189	0	corr(ui , Xb)	0,0636		corr(uiXb)	-0,0433		corr(ui , Xb)	-0,1830		corr(ui , Xb)	-0,2314	
F	208,4506	0	F	214,0953	0	F	216,9224	0	F	45,3690	0	F	84,5968	0
p	0,0000	0	p	0,0000	0	p	0,0000	0	p	0,0000	0	p	0,0000	0
	coefficient	p		coefficient	p		coefficient	p		coefficient	p		coefficient	p
logmc	1,3974	0,0000	logta	2,7458	0,0000	logtemp	3,0106	0,0000	logmc	1,6742	0,0000	logmc	1,6660	0,0000
numbissue	1,1908	0,0000	numbissue	1,1551	0,0000	numbissue	1,2099	0,0000	0b.numbissue	0,0000	0,0000	numbissue	-0,5307	0,0272
o.hq	0,0000	0,0000	o.hq	0,0000	0,0000	o.hq	0,0000	0,0000	1.numbissue	0,1315	0,7991	7b.year	0,0000	0,0000
1b.industry	0,0000	0,0000	1b.industry	0,0000	0,0000	1b.industry	0,0000	0,0000	2.numbissue	-0,4923	0,4832	8.year	2,7680	0,0001
2o.industry	0,0000	0,0000	2o.industry	0,0000	0,0000	2o.industry	0,0000	0,0000	3.numbissue	-1,3475	0,1447	9.year	5,9310	0,0000
3o.industry	0,0000	0,0000	3o.industry	0,0000	0,0000	3o.industry	0,0000	0,0000	4.numbissue	-1,3633	0,2442	10.year	7,0532	0,0000
4o.industry	0,0000	0,0000	4o.industry	0,0000	0,0000	4o.industry	0,0000	0,0000	5.numbissue	-1,3307	0,3400	11.year	7,6719	0,0000
5o.industry	0,0000	0,0000	5o.industry	0,0000	0,0000	5o.industry	0,0000	0,0000	6.numbissue	-1,4682	0,3688	12.year	8,1315	0,0000
6o.industry	0,0000	0,0000	6o.industry	0,0000	0,0000	6o.industry	0,0000	0,0000	7.numbissue	-1,8931	0,3126	13.year	9,0159	0,0000
7o.industry	0,0000	0,0000	7o.industry	0,0000	0,0000	7o.industry	0,0000	0,0000	8.numbissue	-2,8007	0,1813	14.year	9,6761	0,0000
8o.industry	0,0000	0,0000	8o.industry	0,0000	0,0000	8o.industry	0,0000	0,0000	9.numbissue	-3,1568	0,1730	15.year	12,8556	0,0000
9o.industry	0,0000	0,0000	9o.industry	0,0000	0,0000	9o.industry	0,0000	0,0000	10.numbissue	-4,1753	0,1004	16.year	15,1781	0,0000
10o.industry	0,0000	0,0000	10o.industry	0,0000	0,0000	10o.industry	0,0000	0,0000	11.numbissue	-4,5247	0,1022	17.year	17,0419	0,0000
wret	-0,0133	0,0000	wret	-0,0075	0,0006	wret	-0,0070	0,0015	12.numbissue	-4,9987	0,1036	18.year	19,8153	0,0000
roapct	0,0042	0,7422	roapct	0,0207	0,0908	roapct	0,0291	0,0185	13.numbissue	-5,3863	0,1030	wret	-0,0137	0,0000
td_epct	0,0000	0,6065	td_epct	0,0000	0,4430	td_epct	0,0000	0,5102	14.numbissue	-6,0924	0,0883	roapct	0,0006	0,9605
revgrowth	-0,0055	0,0474	revgrowth	-0,0054	0,0490	revgrowth	-0,0039	0,2215	15.numbissue	-6,2478	0,1182	td_epct	0,0000	0,7730
_cons	12,0801	0,0214	_cons	-18,0260	0,0166	_cons	16,7490	0,0000	16.numbissue	-3,3679	0,4428	revgrowth	-0,0055	0,0467
									7b.year	0,0000	0,0000	_cons	2,4570	0,6584
									8.year	2,3742	0,0011			
									9.year	5,4074	0,0000			
									10.year	6,5512	0,0000			
									11.year	6,9304	0,0000			
									12.year	7,1938	0,0000			
									13.year	7,8787	0,0000			
									14.year	8,4263	0,0000			
									15.year	11,6826	0,0000			
									16.year	13,9036	0,0000			
									17.year	15,7141	0,0000			
									18.year	18,3710	0,0000			
									wret	-0,0137	0,0000			
									roapct	0,0006	0,9639			
									td_epct	0,0000	0,7696			
									revgrowth	-0,0053	0,0545			
									_cons	2,3693	0,6700			

Table 51 : Fixed-effects and governance pillar

G.4. Random-effects

	Model 1 : log market cap.		Model II : log total assets		Model III : log employee	
Number of obs	18167		18198		17778	
Number of Groups	3350		3353		3268	
R2 within	0,2656		0,2658		0,2700	
R2 between	0,3841		0,3946		0,4002	
R2 overall	0,3604		0,3654		0,3630	
Wald: chi (all ß=0)	7509,0249		7628,0012		7609,2978	
Wald: p	0,0000		0,0000		0,0000	
	coefficient	p	coefficient	p	coefficient	p
size	2,8856	0,0000	3,3280	0,0000	2,9950	0,0000
numbissue	1,6080	0,0000	1,6089	0,0000	1,6874	0,0000
hq	10,0185	0,0000	9,2264	0,0000	9,0673	0,0000
1b.industry	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
2.industry	-0,8058	0,4142	-0,0542	0,9559	-2,0121	0,0388
3.industry	-0,9452	0,4369	-0,0356	0,9765	-1,4582	0,2242
4.industry	-4,5337	0,0002	-5,1951	0,0000	-1,4347	0,2303
5.industry	-3,9470	0,0001	-4,8809	0,0000	4,5985	0,0000
6.industry	-2,4613	0,0195	0,9984	0,3458	1,3177	0,2104
7.industry	-1,7119	0,0788	-1,2233	0,2068	-3,3134	0,0006
8.industry	-0,4436	0,6753	1,9940	0,0590	0,6601	0,5271
9.industry	-7,5448	0,0000	-7,8748	0,0000	-5,6664	0,0010
10.industry	3,6438	0,0127	1,5326	0,2937	6,4419	0,0000
wret	-0,0109	0,0000	0,0001	0,9469	0,0003	0,8407
roapct	-0,0161	0,0119	0,0055	0,3781	0,0106	0,1418
td_epct	0,0000	0,3665	0,0000	0,1076	0,0000	0,1757
revgrowth	-0,0063	0,0003	-0,0047	0,0074	-0,0028	0,1666
_cons	-31,6879	0,0000	-41,9447	0,0000	4,9626	0,0001

Table 52 : Random-effects regression on ESG Combined score

	Model 1 : log market cap.		Model II : log total assets		Model III : log employee	
Number of obs	18167		18198		17778	
Number of Groups	3350		3353		3268	
R2 within	0,2745		0,2729		0,2768	
R2 between	0,2929		0,3016		0,3056	
R2 overall	0,2951		0,3033		0,2989	
Wald: chi	7026,9509		7067,5965		7034,9976	
Wald: p	0,0000		0,0000		0,0000	
	coefficient	p	coefficient	p	coefficient	p
size	3,2405	0,0000	3,5783	0,0000	3,1837	0,0000
numbissue	1,5213	0,0000	1,4143	0,0000	1,4944	0,0000
7b.year	0,0000	0,0000	2,7694	0,0000	0,0000	0,0000
8.year	2,9399	0,0000	2,8757	0,0000	1,1642	0,0057
9.year	4,1082	0,0000	2,5412	0,0000	2,8204	0,0000
10.year	3,5421	0,0000	2,5309	0,0000	2,9453	0,0000
11.year	3,4816	0,0000	1,3730	0,0046	2,6218	0,0000
12.year	3,3788	0,0000	0,8756	0,0877	2,7103	0,0000
13.year	1,6053	0,0010	3,3788	0,0000	1,5913	0,0012
14.year	0,8673	0,0915	3,5477	0,0000	0,9719	0,0595
15.year	3,3382	0,0000	3,5785	0,0000	3,3212	0,0000
16.year	3,4480	0,0000	3,2644	0,0000	3,4795	0,0000
17.year	3,2720	0,0000	-0,0017	0,2865	3,6910	0,0000
18.year	3,3580	0,0000	0,0083	0,1833	3,3741	0,0000
wret	-0,0130	0,0000	0,0000	0,1748	-0,0017	0,2729
roapct	-0,0166	0,0094	-0,0042	0,0175	0,0147	0,0416
td_epct	0,0000	0,6095	-49,6347	0,0000	0,0000	0,2744
revgrowth	-0,0055	0,0018	0,0000	0,0000	-0,0022	0,2817
_cons	-42,1722	0,0000	1,2203	0,0034	1,0629	0,4551

Table 53 : Random-effects regression on ESG Combined score with time fixed-effects (non-exhaustive)

The headquarter and industry are not reported but are in line with the case without time fixed-effects.

Number of obs	18 167		Number of obs	18198		Number of obs	17778	
Number of Groups	3 350		Number of Groups	3353		Number of Groups	3268	
R2 within	0,2669		R2 within	0,2666		R2 within	0,2708	
R2 between	0,3848		R2 between	0,3946		R2 between	0,4004	
R2 overall	0,3608		R2 overall	0,3655		R2 overall	0,3629	
Wald: chi	7 551,0514		Wald: chi	7649,0910		Wald: chi	7633,2151	
Wald: p	0,0000		Wald: p	0,0000		Wald: p	0,0000	
	coefficient	p		coefficient	p		coefficient	p
logmc	2,8933	0,0000	logta	3,3238	0,0000	logtemp	2,9796	0,0000
1.numbissue	2,5123	0,0000	1.numbissue	1,9443	0,0000	1.numbissue	2,1496	0,0000
2.numbissue	4,2315	0,0000	2.numbissue	3,5733	0,0000	2.numbissue	3,9124	0,0000
3.numbissue	5,3443	0,0000	3.numbissue	4,6709	0,0000	3.numbissue	5,1072	0,0000
4.numbissue	7,5046	0,0000	4.numbissue	6,7268	0,0000	4.numbissue	7,2466	0,0000
5.numbissue	8,8239	0,0000	5.numbissue	8,1489	0,0000	5.numbissue	8,7515	0,0000
6.numbissue	10,2703	0,0000	6.numbissue	9,6731	0,0000	6.numbissue	10,3678	0,0000
7.numbissue	11,9650	0,0000	7.numbissue	11,4277	0,0000	7.numbissue	12,1971	0,0000
8.numbissue	13,8887	0,0000	8.numbissue	13,3985	0,0000	8.numbissue	14,1451	0,0000
9.numbissue	15,0831	0,0000	9.numbissue	14,6691	0,0000	9.numbissue	15,4829	0,0000
10.numbissue	16,2622	0,0000	10.numbissue	15,9259	0,0000	10.numbissue	16,8358	0,0000
11.numbissue	17,6345	0,0000	11.numbissue	17,2394	0,0000	11.numbissue	18,1894	0,0000
12.numbissue	20,2146	0,0000	12.numbissue	19,9294	0,0000	12.numbissue	21,0549	0,0000
13.numbissue	22,2341	0,0000	13.numbissue	21,9448	0,0000	13.numbissue	22,9654	0,0000
14.numbissue	22,9192	0,0000	14.numbissue	22,6026	0,0000	14.numbissue	23,7947	0,0000
15.numbissue	24,8080	0,0000	15.numbissue	24,3702	0,0000	15.numbissue	25,5666	0,0000
16.numbissue	27,5448	0,0000	16.numbissue	26,6283	0,0000	16.numbissue	27,8758	0,0000
hq	10,0857	0,0000	hq	9,2589	0,0000	hq	9,1086	0,0000
2.industry	-0,7705	0,4341	2.industry	-0,0510	0,9585	2.industry	-1,9935	0,0401
3.industry	-0,9070	0,4549	3.industry	-0,0290	0,9808	3.industry	-1,4319	0,2313
4.industry	-4,5307	0,0002	4.industry	-5,2034	0,0000	4.industry	-1,4531	0,2230
5.industry	-3,9036	0,0001	5.industry	-4,8799	0,0000	5.industry	4,5728	0,0000
6.industry	-2,4113	0,0218	6.industry	0,9885	0,3495	6.industry	1,3105	0,2116
7.industry	-1,6726	0,0854	7.industry	-1,2210	0,2066	7.industry	-3,2935	0,0006
8.industry	-0,3679	0,7279	8.industry	2,0028	0,0574	8.industry	0,6876	0,5087
9.industry	-7,5515	0,0000	9.industry	-7,8669	0,0000	9.industry	-5,6640	0,0010
10.industry	3,6189	0,0131	10.industry	1,5306	0,2932	10.industry	6,4276	0,0000
wret	-0,0110	0,0000	wret	0,0001	0,9663	wret	0,0002	0,8901
roapct	-0,0162	0,0117	roapct	0,0057	0,3562	roapct	0,0109	0,1279
td_epct	0,0000	0,3769	td_epct	0,0000	0,1115	td_epct	0,0000	0,1806
revgrowth	-0,0060	0,0006	revgrowth	-0,0045	0,0094	revgrowth	-0,0025	0,2074
_cons	-32,5102	0,0000	_cons	-42,0131	0,0000	_cons	4,7926	0,0002

Table 54 : Random-effects and number of score issued as dummies

Number of obs	18167		Number of obs	18198		Number of obs	17778		Number of obs	18167		Number of obs	18167	
Number of Groups	3350		Number of Groups	3353		Number of Groups	3268		Number of Groups	3350		Number of Groups	3350	
R2 within	0,3280		R2 within	0,3352		R2 within	0,3416		R2 within	0,3467		R2 within	0,3458	
R2 between	0,4198		R2 between	0,4458		R2 between	0,4387		R2 between	0,4281		R2 between	0,4274	
R2 overall	0,4062		R2 overall	0,4381		R2 overall	0,4204		R2 overall	0,4216		R2 overall	0,4211	
Wald: chi	9630,7470		Wald: chi	10234,4720		Wald: chi	10128,3057		Wald: chi	10343,5803		Wald: chi	10303,1953	
Wald: p	0,0000		Wald: p	0,0000		Wald: p	0,0000		Wald: p	0,0000		Wald: p	0,0000	
	coefficient	p		coefficient	p		coefficient	p		coefficient	p		coefficient	p
logmc	3,0668	0,0000	logta	4,2617	0,0000	logtemp	3,727	0,0000	logmc	3,5251	0,0000	logmc	3,5271	0,0000
numbissue	1,6667	0,0000	numbissue	1,6351	0,0000	numbissue	1,7394	0,0000	0b.numbissue	0	0,0000	numbissue	1,6310	0,0000
hq	10,3792	0,0000	hq	9,4655	0,0000	hq	9,2066	0,0000	1.numbissue	1,6924	0,0000	hq	10,4492	0,0000
1b.industry	0,0000	0,0000	1b.industry	0,0000	0,0000	1b.industry	0,0000	0,0000	2.numbissue	3,2505	0,0000	1b.industry	0,0000	0,0000
2.industry	-0,8530	0,4122	2.industry	0,1511	0,8831	2.industry	-2,3216	0,0247	3.numbissue	4,8427	0,0000	2.industry	-0,8810	0,3973
3.industry	0,0887	0,9448	3.industry	0,9776	0,4395	3.industry	-0,6938	0,5858	4.numbissue	6,9758	0,0000	3.industry	-0,1513	0,9060
4.industry	-4,0954	0,0013	4.industry	-4,9215	0,0001	4.industry	-0,2237	0,8602	5.numbissue	8,6599	0,0000	4.industry	-4,0814	0,0013
5.industry	-4,9621	0,0000	5.industry	-6,0767	0,0000	5.industry	5,4259	0,0000	6.numbissue	10,3974	0,0000	5.industry	-4,9689	0,0000
6.industry	-2,6639	0,0161	6.industry	2,0023	0,0699	6.industry	2,2869	0,0398	7.numbissue	12,2688	0,0000	6.industry	-2,6223	0,0184
7.industry	-2,0209	0,0491	7.industry	-1,3245	0,1918	7.industry	-3,9137	0,0001	8.numbissue	13,5828	0,0000	7.industry	-2,0395	0,0472
8.industry	-0,7534	0,4992	8.industry	2,3924	0,0303	8.industry	0,6601	0,5508	9.numbissue	15,1471	0,0000	8.industry	-0,8555	0,4445
9.industry	-6,5130	0,0004	9.industry	-7,3521	0,0001	9.industry	-4,4717	0,0149	10.numbissue	16,3080	0,0000	9.industry	-6,8118	0,0002
10.industry	4,0987	0,0079	10.industry	0,9884	0,5183	10.industry	7,3016	0,0000	11.numbissue	17,4021	0,0000	10.industry	3,8222	0,0132
wret	-0,0129	0,0000	wret	-0,0009	0,4476	wret	-0,0008	0,5157	12.numbissue	20,3402	0,0000	7b.year	0,0000	0,0000
roapct	-0,0236	0,0001	roapct	-0,0010	0,8620	roapct	0,0059	0,3673	13.numbissue	21,1765	0,0000	8.year	4,4304	0,0000
td_epct	0,0000	0,9813	td_epct	0,0000	0,3509	td_epct	0,0000	0,5874	14.numbissue	22,6037	0,0000	9.year	5,3293	0,0000
revgrowth	-0,0069	0,0000	revgrowth	-0,0055	0,0004	revgrowth	-0,0034	0,0506	15.numbissue	24,2802	0,0000	10.year	5,2618	0,0000
_cons	-34,5584	0,0000	_cons	-61,1942	0,0000	_cons	-0,2267	0,8619	16.numbissue	26,3987	0,0000	11.year	5,0222	0,0000
									hq	10,4063	0,0000	12.year	4,2579	0,0000
									1b.industry	0,0000	0,0000	13.year	2,6274	0,0000
									2.industry	-0,8510	0,4118	14.year	1,7303	0,0003
									3.industry	-0,1252	0,9219	15.year	3,1486	0,0000
									4.industry	-4,0588	0,0014	16.year	3,8626	0,0000
									5.industry	-4,9010	0,0000	17.year	3,6783	0,0000
									6.industry	-2,5491	0,0215	18.year	4,3056	0,0000
									7.industry	-2,0061	0,0501	wret	-0,0145	0,0000
									8.industry	-0,7971	0,4746	roapct	-0,0259	0,0000
									9.industry	-6,7882	0,0002	td_epct	0,0000	0,6551
									10.industry	3,8299	0,0127	revgrowth	-0,0062	0,0001
									7b.year	0,0000	0,0000	_cons	-48,2316	0,0000
									8.year	4,3441	0,0000			
									9.year	5,2114	0,0000			
									10.year	5,1412	0,0000			
									11.year	4,7206	0,0000			
									12.year	3,9193	0,0000			
									13.year	2,2550	0,0000			
									14.year	1,2619	0,0106			

Table 55 : Random-effects and ESG

Number of obs	18164		Number of obs	18195		Number of obs	17775		Number of obs	18164		Number of obs	18164	
Number of Groups	3350		Number of Groups	3353		Number of Groups	3268		Number of Groups	3350		Number of Groups	3350	
R2 within	0,2212		R2 within	0,2343		R2 within	0,2363		R2 within	0,2513		R2 within	0,2497	
R2 between	0,4885		R2 between	0,5292		R2 between	0,4923		R2 between	0,5018		R2 between	0,5009	
R2 overall	0,4364		R2 overall	0,4846		R2 overall	0,4413		R2 overall	0,4536		R2 overall	0,4526	
Wald: chi	7458,6650		Wald: chi	8388,0111		Wald: chi	7709,4093		Wald: chi	8403,6021		Wald: chi	8339,9943	
Wald: p	0,0000		Wald: p	0,0000		Wald: p	0,0000		Wald: p	0,0000		Wald: p	0,0000	
	coefficient	p		coefficient	p		coefficient	p		coefficient	p		coefficient	p
logmc	4,0217	0,0000	logta	6,1971	0,0000	logtemp	4,784006677	0,0000	logmc	4,506789652	0,0000	logmc	4,514513473	0,0000
numbissue	1,7940	0,0000	numbissue	1,7248	0,0000	numbissue	1,891259799	0,0000	0b.numbissue	0	0,0000	numbissue	1,946422854	0,0000
hq	20,0257	0,0000	hq	18,7823	0,0000	hq	18,2042	0,0000	1.numbissue	1,6355	0,0000	7b.year	0,0000	0,0000
1b.industry	0,0000	0,0000	1b.industry	0,0000	0,0000	1b.industry	0,0000	0,0000	2.numbissue	3,6569	0,0000	8.year	7,4457	0,0000
2.industry	-7,2429	0,0000	2.industry	-5,7730	0,0000	2.industry	-9,2188	0,0000	3.numbissue	5,8905	0,0000	9.year	9,1393	0,0000
3.industry	-2,2245	0,1989	3.industry	-1,1197	0,5076	3.industry	-3,1319	0,0764	4.numbissue	8,3172	0,0000	10.year	9,3636	0,0000
4.industry	-5,7144	0,0009	4.industry	-6,9202	0,0000	4.industry	-0,8847	0,6159	5.numbissue	10,5109	0,0000	11.year	9,3110	0,0000
5.industry	-15,5795	0,0000	5.industry	-17,1588	0,0000	5.industry	-3,8707	0,0122	6.numbissue	12,6086	0,0000	12.year	8,6766	0,0000
6.industry	-15,5799	0,0000	6.industry	-8,7215	0,0000	6.industry	-9,3132	0,0000	7.numbissue	14,8740	0,0000	13.year	6,1642	0,0000
7.industry	-7,3516	0,0000	7.industry	-6,2816	0,0000	7.industry	-9,7870	0,0000	8.numbissue	16,4338	0,0000	14.year	4,7069	0,0000
8.industry	-10,3028	0,0000	8.industry	-5,6635	0,0001	8.industry	-8,4376	0,0000	9.numbissue	18,3361	0,0000	15.year	5,3959	0,0000
9.industry	-12,0840	0,0000	9.industry	-13,6256	0,0000	9.industry	-9,3605	0,0002	10.numbissue	19,6421	0,0000	16.year	5,4386	0,0000
10.industry	4,7953	0,0215	10.industry	-0,0270	0,9895	10.industry	8,9480	0,0000	11.numbissue	20,6576	0,0000	17.year	4,4659	0,0000
wret	-0,0114	0,0000	wret	0,0046	0,0071	wret	0,0043	0,0138	12.numbissue	24,5054	0,0000	18.year	5,0707	0,0000
roapct	-0,0420	0,0000	roapct	-0,0161	0,0427	roapct	-0,0029	0,7521	13.numbissue	24,6998	0,0000	wret	-0,0160	0,0000
td_epct	0,0000	0,9133	td_epct	0,0000	0,3051	td_epct	0,0000	0,5656	14.numbissue	26,1049	0,0000	roapct	-0,0422	0,0000
revgrowth	-0,0115	0,0000	revgrowth	-0,0095	0,0000	revgrowth	-0,0095	0,0001	15.numbissue	27,4729	0,0000	td_epct	0,0000	0,8489
_cons	-64,6250	0,0000	_cons	-112,7716	0,0000	_cons	-18,5761	0,0000	16.numbissue	29,7861	0,0000	revgrowth	-0,0088	0,0001
									7b.year	0,0000	0,0000	hq	19,6859	0,0000
									8.year	7,4996	0,0000	1b.industry	0,0000	0,0000
									9.year	9,0939	0,0000	2.industry	-7,0139	0,0000
									10.year	9,1774	0,0000	3.industry	-2,3110	0,1815
									11.year	8,9040	0,0000	4.industry	-5,6680	0,0010
									12.year	8,1545	0,0000	5.industry	-15,0640	0,0000
									13.year	5,5732	0,0000	6.industry	-14,7276	0,0000
									14.year	3,9702	0,0000	7.industry	-7,0291	0,0000
									15.year	4,8874	0,0000	8.industry	-9,8312	0,0000
									16.year	4,9808	0,0000	9.industry	-12,3503	0,0000
									17.year	4,1885	0,0000	10.industry	4,4156	0,0340
									18.year	4,9564	0,0000	_cons	-81,5607	0,0000
									wret	-0,0160	0,0000			
									roapct	-0,0421	0,0000			
									td_epct	0,0000	0,8675			
									revgrowth	-0,0086	0,0001			
									hq	19,5700	0,0000			

Table 56 : Random-effects and Environmental pillar

Number of obs	18164		Number of obs	18195		Number of obs	17775		Number of obs	18164		Number of obs	18164	
Number of Groups	3350		Number of Groups	3353		Number of Groups	3268		Number of Groups	3350		Number of Groups	3350	
R2 within	0,3023		R2 within	0,3051		R2 within	0,3100		R2 within	0,3138		R2 within	0,3128	
R2 between	0,3230		R2 between	0,3364		R2 between	0,3363		R2 between	0,3363		R2 between	0,3363	
R2 overall	0,3256		R2 overall	0,3414		R2 overall	0,3358		R2 overall	0,3440		R2 overall	0,3437	
Wald: chi	8035,6630		Wald: chi	8255,4019		Wald: chi	8210,1572		Wald: chi	8446,5200		Wald: chi	8420,7263	
Wald: p	0,0000		Wald: p	0,0000		Wald: p	0,0000		Wald: p	0,0000		Wald: p	0,0000	
	coefficient	p		coefficient	p		coefficient	p		coefficient	p		coefficient	p
logmc	3,257366617	0,0000	logta	4,066745063	0,0000	logtemp	3,573059438	0,0000	logmc	3,842768411	0,0000	logmc	3,830451234	0,0000
numbissue	1,904467354	0,0000	numbissue	1,894634048	0,0000	numbissue	1,998501682	0,0000	0b.numbissue	0	0,0000	numbissue	1,65481537	0,0000
hq	11,0490	0,0000	hq	10,1190	0,0000	hq	9,8478	0,0000	1.numbissue	1,4612	0,0000	7b.year	0,0000	0,0000
1b.industry	0,0000	0,0000	1b.industry	0,0000	0,0000	1b.industry	0,0000	0,0000	2.numbissue	2,8405	0,0000	8.year	4,4738	0,0000
2.industry	3,0434	0,0138	2.industry	3,9736	0,0013	2.industry	1,5768	0,2031	3.numbissue	4,4497	0,0000	9.year	4,5700	0,0000
3.industry	1,2023	0,4295	3.industry	2,1967	0,1478	3.industry	0,5022	0,7420	4.numbissue	6,5106	0,0000	10.year	4,7482	0,0000
4.industry	-3,1378	0,0379	4.industry	-3,9307	0,0092	4.industry	0,5284	0,7285	5.numbissue	7,8574	0,0000	11.year	4,8871	0,0000
5.industry	2,6563	0,0349	5.industry	1,5564	0,2157	5.industry	12,1776	0,0000	6.numbissue	9,4859	0,0000	12.year	4,2971	0,0000
6.industry	4,2884	0,0011	6.industry	8,6516	0,0000	6.industry	8,8989	0,0000	7.numbissue	11,3642	0,0000	13.year	2,7585	0,0000
7.industry	1,4284	0,2415	7.industry	2,0722	0,0888	7.industry	-0,4083	0,7384	8.numbissue	13,1010	0,0000	14.year	2,2420	0,0001
8.industry	4,3478	0,0010	8.industry	7,3573	0,0000	8.industry	5,7078	0,0000	9.numbissue	14,5015	0,0000	15.year	4,2156	0,0000
9.industry	-6,3270	0,0040	9.industry	-6,9272	0,0016	9.industry	-4,2096	0,0557	10.numbissue	16,0114	0,0000	16.year	5,3292	0,0000
10.industry	1,7856	0,3299	10.industry	-0,9597	0,6012	10.industry	5,0029	0,0064	11.numbissue	17,3070	0,0000	17.year	5,4561	0,0000
wret	-0,0120	0,0000	wret	0,0004	0,7861	wret	0,0005	0,7596	12.numbissue	21,1422	0,0000	18.year	5,8908	0,0000
roapct	-0,0418	0,0000	roapct	-0,0165	0,0189	roapct	-0,0158	0,0483	13.numbissue	22,1557	0,0000	wret	-0,0125	0,0000
td_epct	0,0000	0,5511	td_epct	0,0000	0,8761	td_epct	0,0000	0,8776	14.numbissue	23,9667	0,0000	roapct	-0,0446	0,0000
revgrowth	-0,0040	0,0395	revgrowth	-0,0021	0,2645	revgrowth	0,0000	0,9833	15.numbissue	26,1965	0,0000	td_epct	0,0000	0,3162
_cons	-39,9822	0,0000	_cons	-58,3019	0,0000	_cons	-0,2388	0,8792	16.numbissue	26,4224	0,0000	revgrowth	-0,0041	0,0344
									7b.year	0,0000	0,0000	hq	11,5582	0,0000
									8.year	4,5439	0,0000	1b.industry	0,0000	0,0000
									9.year	4,7600	0,0000	2.industry	2,8191	0,0219
									10.year	4,9649	0,0000	3.industry	0,7806	0,6063
									11.year	4,9963	0,0000	4.industry	-3,1307	0,0374
									12.year	4,4720	0,0000	5.industry	2,2292	0,0762
									13.year	2,9604	0,0000	6.industry	3,7697	0,0042
									14.year	2,3276	0,0001	7.industry	1,1528	0,3428
									15.year	4,2466	0,0000	8.industry	3,7861	0,0042
									16.year	5,3080	0,0000	9.industry	-6,7228	0,0021
									17.year	5,4714	0,0000	10.industry	1,5087	0,4080
									18.year	6,0015	0,0000	_cons	-56,3761	0,0000
									wret	-0,0126	0,0000			
									roapct	-0,0445	0,0000			
									td_epct	0,0000	0,3118			
									revgrowth	-0,0042	0,0295			
									hq	11,5098	0,0000			

Table 57 : Random-effects and Social pillar

Number of obs	18167		Number of obs	18198		Number of obs	17778		Number of obs	18167		Number of obs	18167	
Number of Groups	3350		Number of Groups	3353		Number of Groups	3268		Number of Groups	3350		Number of Groups	3350	
R2 within	0,0769		R2 within	0,0795		R2 within	0,0821		R2 within	0,0856		R2 within	0,0840	
R2 between	0,1558		R2 between	0,1615		R2 between	0,1552		R2 between	0,1581		R2 between	0,1567	
R2 overall	0,1452		R2 overall	0,1534		R2 overall	0,1417		R2 overall	0,1501		R2 overall	0,1489	
Wald: chi	1861,5266		Wald: chi	1955,8959		Wald: chi	1919,3302		Wald: chi	2034,2339		Wald: chi	2000,5001	
Wald: p	0,0000		Wald: p	0,0000		Wald: p	0,0000		Wald: p	0,0000		Wald: p	0,0000	
	coefficient	p		coefficient	p		coefficient	p		coefficient	p		coefficient	p
logmc	2,288539332	0,0000	logta	3,018547861	0,0000	logtemp	2,693474991	0,0000	logmc	2,44762335	0,0000	logmc	2,467351943	0,0000
numbissue	1,179252308	0,0000	numbissue	1,15426019	0,0000	numbissue	1,22006319	0,0000	0b.numbissue	0	0,0000	numbissue	1,325364956	0,0000
hq	-0,3014	0,6492	hq	-0,9503	0,1499	hq	-0,9564	0,1513	1.numbissue	2,1693	0,0000	7b.year	0,0000	0,0000
1b.industry	0,0000	0,0000	1b.industry	0,0000	0,0000	1b.industry	0,0000	0,0000	2.numbissue	3,4268	0,0000	8.year	1,4387	0,0273
2.industry	-6,5239	0,0000	2.industry	-5,8112	0,0000	2.industry	-7,4802	0,0000	3.numbissue	4,3612	0,0000	9.year	2,8011	0,0000
3.industry	-2,5549	0,1384	3.industry	-1,8815	0,2732	3.industry	-3,0487	0,0747	4.numbissue	6,3433	0,0000	10.year	2,0524	0,0016
4.industry	-3,6031	0,0351	4.industry	-4,2087	0,0136	4.industry	-0,5862	0,7309	5.numbissue	8,0602	0,0000	11.year	0,9688	0,1511
5.industry	-8,3026	0,0000	5.industry	-9,1085	0,0000	5.industry	0,1369	0,9274	6.numbissue	9,6982	0,0000	12.year	-0,3011	0,6691
6.industry	-7,5452	0,0000	6.industry	-4,3656	0,0038	6.industry	-4,0191	0,0075	7.numbissue	11,0242	0,0000	13.year	-1,2362	0,0914
7.industry	-3,1132	0,0242	7.industry	-2,6624	0,0532	7.industry	-4,5191	0,0010	8.numbissue	11,6523	0,0000	14.year	-2,3528	0,0022
8.industry	-6,9736	0,0000	8.industry	-4,8070	0,0014	8.industry	-5,9879	0,0001	9.numbissue	12,8112	0,0000	15.year	-0,7485	0,3459
9.industry	-6,0465	0,0149	9.industry	-6,5323	0,0083	9.industry	-4,4776	0,0685	10.numbissue	13,3641	0,0000	16.year	-0,1428	0,8622
10.industry	5,2609	0,0110	10.industry	3,1143	0,1330	10.industry	7,6388	0,0002	11.numbissue	14,6275	0,0000	17.year	-0,1678	0,8439
wret	-0,0163	0,0000	wret	-0,0073	0,0006	wret	-0,0070	0,0012	12.numbissue	15,8199	0,0000	18.year	0,7333	0,4092
roapct	0,0198	0,0382	roapct	0,0343	0,0002	roapct	0,0463	0,0000	13.numbissue	16,9700	0,0000	wret	-0,0166	0,0000
td_epct	0,0000	0,5684	td_epct	0,0000	0,3300	td_epct	0,0000	0,4302	14.numbissue	17,7458	0,0000	roapct	0,0174	0,0675
revgrowth	-0,0094	0,0004	revgrowth	-0,0081	0,0022	revgrowth	-0,0067	0,0268	15.numbissue	19,0337	0,0000	td_epct	0,0000	0,7741
_cons	-3,3748	0,3902	_cons	-19,7220	0,0000	_cons	22,9384	0,0000	16.numbissue	23,7210	0,0000	revgrowth	-0,0091	0,0007
									7b.year	0,0000	0,0000	hq	-0,5657	0,4021
									8.year	0,9689	0,1552	1b.industry	0,0000	0,0000
									9.year	2,2133	0,0013	2.industry	-6,4886	0,0000
									10.year	1,5795	0,0193			
									11.year	0,2802	0,6900			
									12.year	-1,0768	0,1388			
									13.year	-2,0953	0,0056			
									14.year	-3,1833	0,0001			
									15.year	-1,2076	0,1332			
									16.year	-0,5078	0,5414			
									17.year	-0,4671	0,5869			
									18.year	0,4447	0,6184			
									wret	-0,0164	0,0000			
									roapct	0,0174	0,0685			
									td_epct	0,0000	0,7597			
									revgrowth	-0,0087	0,0012			
									hq	-0,4985	0,4609			

Table 58 : Random-effects and Governance pillar

	With Time effect			
	chi(5)	p value	chi(15)	p value
ESGC	139.42	0.0000	210.76	0.0000
ESG	454.33	0.0000	507.20	0.0000
Env	484.26	0.0000	673.13	0.0000
Soc	300.51	0.0000	307.29	0.0000
Gov	52.91	0.0000	59.66	0.0000

Table 59 : Hausman test (Random-effects models)

G.4. Dynamic models

	Without time effect				With time effect			
	Number of obs =	13,502	Number of obs =	13,502	Number of obs =	13,502	Number of obs =	13,502
	F(17, 2709)	3006.07	within	0.3347	F(27, 2709) =	2068.84	within	0.3421
	Prob > F	0.0000	between	0.8446	Prob > F =	0.0000	between	0.8863
	R-squared	0.8038	Overall	0.7284	R-squared =	0.8058	Overall	0.7225
	Root MSE	8.5537	corr(u_i, Xb)	0.6717	Root MSE =	8.514	corr(u_i, Xb)	0.7138
	coefficient	p	coefficient	p	coefficient	p	coefficient	p
logmc	.8090012	0.000	1.347425	0.000	.8064562	0.000	1.506832	0.000
numbissue	.153514	0.000	.885804	0.000	.1605772	0.000	.2150014	0.454
wret	-.0044256	0.006	-.0068901	0.000	-.0031546	0.065	-.0074247	0.000
roapct	.0018848	0.722	-.0054865	0.599	.002658	0.610	-.0057612	0.579
td_epct	-.00006	0.071	-.0000319	0.243	-.0000554	0.089	-.0000252	0.357
revgrowth	.0017069	0.258	.0003675	0.830	.0030262	0.052	.0011765	0.506
hq	2.428926	0.000			2.372166	0.000		
industry								
2	-.8560486	0.008			-.856913	0.008		
3	-.7439208	0.063			-.747271	0.060		
4	-1.113685	0.004			-1.117645	0.003		
5	-.8357345	0.018			-.8252791	0.019		
6	-.8302178	0.020			-.8420548	0.018		
7	-.8510064	0.007			-.855203	0.006		
8	-.5855592	0.104			-.5980136	0.096		
9	-1.732582	0.001			-1.758009	0.001		
10	-.069738	0.871			-.0567722	0.894		
ESG lag	.8316884	0.000	.3680905	0.000	.8325968	0.000	.36684	0.0000

Table 60 : Dynamics models OLS and fixed-effects (non-exhaustive results)

	$\Delta Score_{i,t-2}$		$Score_{i,t-2}$	
	Number of obs =	7,612	Number of obs =	10,018
	coefficient	p	coefficient	p
$\Delta Esgc_{t-1}$	-0,0334	0,5190	0,3600	0,0000
logmc	0,2173	0,5440	0,3663	0,2640
numbissue	1,4723	0,0000	0,7342	0,0000
wret	-0,0010	0,6320	-0,0018	0,3150
roapct	0,0023	0,8700	0,0098	0,4850
td_epct	0,0000	0,5800	0,0000	0,3680
revgrowth	0,0002	0,8800	0,0020	0,3120
hq	0,1966	0,1810	0,2508	0,0200
industry	0,0000	0,0000	0,0000	0,0000
2	0,0082	0,9750	0,1633	0,4140
3	-0,1850	0,5980	0,0010	0,9970
4	-0,0445	0,8850	0,2118	0,3770
5	0,3485	0,2400	0,3109	0,1410
6	0,4837	0,1420	0,1381	0,5560
7	-0,2899	0,2710	-0,1416	0,4650
8	0,1203	0,7020	0,2030	0,3780
9	-0,8387	0,0750	-0,5105	0,1320
10	-1,0550	0,0080	-0,7628	0,0300

Table 61 : Dynamic models - Anderson Hsiao (non-exhaustive results)

One-step results			**Two-step results**		
Number of obs	10,018		Number of obs	10,018	
Number of instruments	61		Number of instruments	61	
	Coef	p>z		Coef	p>z
Lag esgc	0,2771	0,0000	Lag esgc	0,3393	0,0000
logmc	0,5606	0,0580	logmc	0,3859	0,1800
numbissue	0,8673	0,0000	numbissue	0,9099	0,0000
wret	-0,0028	0,1490	wret	-0,0019	0,2310
roapct	0,0068	0,5310	roapct	0,0062	0,6330
td_epct	0,0000	0,3370	td_epct	-0,0000	0,5290
revgrowth	0,0014	0,5040	revgrowth	0,0009	0,5930
			Warning: gmm two-step standard errors are biased		
Sargan test of overidentifying restrictions			**Sargan test of overidentifying restrictions**		
H0: overidentifying restrictions are valid			H0: overidentifying restrictions are valid		
Chi2(54)	249,8385		Chi2(54)	186,4912	
Prob > chi2	0		Prob > chi2	0	
Arellano-Bond test for zero			**Arellano-Bond test for zero**		
H0: no autocorrelation			H0: no autocorrelation		
Order	z	Prob > z	Order	z	Prob > z
1	-29,5790	0,0000	1	-15,9220	0,0000
2	7,3395	0,0000	2	5,4474	0,0000

Table 62 : Arellano and Bond results

H. RQ3: Quantitative analyses and findings

H.1. Data overview

ESGC	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
N	3	105	276	330	408	443	466	553	663	723	745	759	767	794	1221	1893	2213	2375	2475
Mean	16,06	28,15	28,44	30,42	31,46	33,03	37,57	37,29	37,91	38,07	39,17	40,40	39,99	40,62	38,71	36,22	35,93	35,77	36,33
Std	7,24	14,50	13,77	13,79	15,26	15,75	16,48	16,30	17,76	16,91	17,31	18,26	17,53	17,40	18,24	17,02	17,15	16,82	16,78

Table 63 : ESG Ratings coverage in January of each year

	RM-RF	SMB	HML	RMW	CMA	MOM
RM-RF	1,0000	0,3479	0,1799	(0,5014)	(0,0262)	(0,4166)
SMB	0,3479	1,0000	0,2815	(0,3376)	0,1680	(0,1308)
HML	0,1799	0,2815	1,0000	(0,0295)	0,4568	(0,3096)
RMW	(0,5014)	(0,3376)	(0,0295)	1,0000	(0,0809)	0,3591
CMA	(0,0262)	0,1680	0,4568	(0,0809)	1,0000	(0,1244)
MOM	(0,4166)	(0,1308)	(0,3096)	0,3591	(0,1244)	1,0000

Table 64 : Correlation of French Factors (US)

	RM-RF	SMB	HML	RMW	CMA	Mom
RM-RF		0,0000	0,0081	0,0000	0,7015	0,0000
SMB	0,0000		0,0000	0,0000	0,0134	0,0550
HML	0,0081	0,0000		0,6663	0,0000	0,0000
RMW	0,0000	0,0000	0,6663		0,2363	0,0000
CMA	0,7015	0,0134	0,0000	0,2363		0,0680
Mom	0,0000	0,0550	0,0000	0,0000	0,0680	

Table 65 : P values of correlations between the French Factor

H.2. US results

	Size				Learning				
	1	2	3	4	1	2	3	4	
Bottom	A				B				Bottom
Top	C				D				Top

Table 66 : ESG tilting including size and learning effect

ESGC	Basic Materials	Consumer Cyclicals	Consumer Non-Cyc.	Energy	Financials	Healthcare	Industrials	Technology	Telecomm. Services	Utilities
Bottom - VIII.2	7%	18%	7%	10%	20%	9%	14%	9%	2%	3%
Top - VIII.2	7%	16%	10%	5%	16%	10%	12%	15%	0%	8%
Bottom - VIII.3	6%	18%	8%	11%	21%	7%	15%	8%	3%	2%
Top - VIII.3	8%	16%	9%	4%	17%	9%	12%	16%	0%	8%

Table 67 : Exposition to industries of portfolios

	Bottom				Bottom - Enhanced				Top				Top - Enhanced			
	Issued	MC - 25%	MC - Mean	MC - 75%	Issued	MC - 25%	MC - Mean	MC - 75%	Issued	MC - 25%	MC - Mean	MC - 75%	Issued	MC - 25%	MC - Mean	MC - 75%
2004	0,4857	3,68E+09	1,84E+10	9,51E+09	0,5439	3,71E+09	2,18E+10	1,23E+10	0,4638	8,59E+09	4,03E+10	4,44E+10	0,5294	6,42E+09	3,21E+10	4,11E+10
2005	1,2439	3,96E+09	8,89E+09	9,24E+09	1,3385	4,53E+09	1,03E+10	1,09E+10	1,2976	8,48E+09	4,44E+10	5,40E+10	1,2381	6,25E+09	3,17E+10	3,35E+10
2006	1,5882	3,92E+09	8,04E+09	9,17E+09	1,6709	4,09E+09	1,01E+10	1,19E+10	2,0769	1,31E+10	4,73E+10	6,33E+10	1,7297	7,78E+09	3,44E+10	4,12E+10
2007	2,3761	4,90E+09	1,02E+10	1,08E+10	2,4831	4,94E+09	1,41E+10	1,46E+10	2,7568	1,50E+10	4,87E+10	4,87E+10	2,5890	1,08E+10	4,64E+10	4,23E+10
2008	2,9828	3,65E+09	1,08E+10	9,59E+09	3,1395	4,35E+09	1,52E+10	1,35E+10	3,9316	9,68E+09	3,72E+10	4,02E+10	3,6667	6,42E+09	2,93E+10	3,66E+10
2009	2,3957	1,68E+09	4,40E+09	4,63E+09	3,0435	2,37E+09	8,37E+09	6,67E+09	4,5532	4,50E+09	2,02E+10	2,31E+10	4,0101	3,12E+09	1,42E+10	1,68E+10
2010	2,4817	2,01E+09	6,55E+09	5,28E+09	2,9016	2,26E+09	8,75E+09	6,65E+09	5,3473	6,39E+09	2,01E+10	2,20E+10	4,0152	2,96E+09	1,21E+10	1,54E+10
2011	3,0506	2,86E+09	8,56E+09	7,69E+09	3,8406	3,19E+09	1,52E+10	1,07E+10	6,0718	5,97E+09	2,13E+10	2,49E+10	4,9931	4,26E+09	1,43E+10	1,73E+10
2012	3,6054	2,27E+09	6,91E+09	5,70E+09	4,5245	2,55E+09	1,40E+10	9,88E+09	7,0215	6,53E+09	2,40E+10	2,34E+10	5,9220	3,46E+09	1,67E+10	1,74E+10
2013	4,6223	2,70E+09	1,16E+10	8,75E+09	5,5786	3,20E+09	2,10E+10	1,36E+10	7,9263	7,32E+09	2,50E+10	2,62E+10	6,9167	4,79E+09	1,93E+10	2,02E+10
2014	5,4053	3,25E+09	1,22E+10	9,47E+09	6,3403	4,12E+09	2,73E+10	1,66E+10	8,8549	8,82E+09	2,62E+10	2,90E+10	7,7500	5,45E+09	2,23E+10	2,46E+10
2015	5,7576	2,80E+09	1,33E+10	1,03E+10	7,2532	3,40E+09	2,84E+10	1,81E+10	9,6000	9,30E+09	2,86E+10	3,14E+10	8,7895	5,82E+09	2,39E+10	2,73E+10
2016	2,2610	1,36E+09	6,48E+09	4,20E+09	4,0876	1,64E+09	1,51E+10	7,91E+09	10,0915	7,39E+09	3,29E+10	3,28E+10	7,1767	1,89E+09	2,45E+10	2,51E+10
2017	1,4403	7,23E+08	3,97E+09	2,97E+09	3,0224	8,69E+08	1,29E+10	5,03E+09	9,3934	4,44E+09	2,59E+10	2,73E+10	5,4622	1,08E+09	1,81E+10	1,59E+10
2018	1,8050	6,32E+08	2,84E+09	2,75E+09	3,3416	8,77E+08	8,90E+09	4,98E+09	9,6124	4,33E+09	2,78E+10	2,77E+10	5,4232	1,07E+09	1,62E+10	1,55E+10

Table 68 : Biases effect on portfolios

Top	ESGC	ESG	E	S	G
100%	0,96%	0,96%	0,96%	0,96%	0,96%
10	0,92%	1,00%	0,92%	0,90%	0,99%
15	0,88%	0,96%	0,89%	0,96%	0,96%
20	0,91%	0,96%	0,88%	0,96%	0,92%
25	0,90%	0,92%	0,91%	0,94%	0,88%

Bottom	ESGC	ESG	E	S	G
100%	0,96%	0,96%	0,96%	0,96%	0,96%
10	1,05%	1,00%	1,05%	1,04%	1,01%
15	1,09%	1,05%	1,05%	1,01%	0,97%
20	1,09%	1,03%	1,05%	1,02%	1,00%
25	1,05%	1,01%	1,05%	1,03%	1,04%

Top	ESGC	ESG	E	S	G
100%	5,40%	5,40%	5,40%	5,40%	5,40%
10	5,22%	4,91%	5,01%	5,23%	5,33%
15	5,13%	5,31%	5,37%	5,34%	5,26%
20	5,18%	5,14%	5,29%	5,25%	5,15%
25	5,32%	5,25%	5,41%	5,22%	5,19%

Bottom	ESGC	ESG	E	S	G
100%	5,40%	5,40%	5,40%	5,40%	5,40%
10	5,65%	5,38%	5,61%	5,08%	5,85%
15	5,62%	5,51%	5,60%	5,17%	5,92%
20	5,58%	5,48%	5,60%	5,17%	5,79%
25	5,45%	5,50%	5,58%	5,21%	5,65%

Table 69 : Mean and standard deviations of US portfolios

Top	ESGC	ESG	E	S	G
100%	0,96%	0,96%	0,96%	0,96%	0,96%
10	0,92%	1,00%	0,92%	0,90%	0,99%
15	0,88%	0,96%	0,89%	0,96%	0,96%
20	0,91%	0,96%	0,88%	0,96%	0,92%
25	0,90%	0,92%	0,91%	0,94%	0,88%
Bottom	ESGC	ESG	E	S	G
100%	0,96%	0,96%	0,96%	0,96%	0,96%
10	1,05%	1,00%	1,05%	1,04%	1,01%
15	1,09%	1,05%	1,05%	1,01%	0,97%
20	1,09%	1,03%	1,05%	1,02%	1,00%
25	1,05%	1,01%	1,05%	1,03%	1,04%

Top	ESGC	ESG	E	S	G
100%	5,40%	5,40%	5,40%	5,40%	5,40%
10	5,22%	4,91%	5,01%	5,23%	5,33%
15	5,13%	5,31%	5,37%	5,34%	5,26%
20	5,18%	5,14%	5,29%	5,25%	5,15%
25	5,32%	5,25%	5,41%	5,22%	5,19%
Bottom	ESGC	ESG	E	S	G
100%	5,40%	5,40%	5,40%	5,40%	5,40%
10	5,65%	5,38%	5,61%	5,08%	5,85%
15	5,62%	5,51%	5,60%	5,17%	5,92%
20	5,58%	5,48%	5,60%	5,17%	5,79%
25	5,45%	5,50%	5,58%	5,21%	5,65%

Table 70 : Mean and standard deviations of US enhanced portfolios

2004 ESGC	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	-0,21%	1,05	(0,13)	0,11	0,05	(0,07)	0,96	0,96	44,91
p value	0,81	0,00	0,00	0,00	0,27	0,18			
ESG > 90%	-2,54%	1,08	(0,23)	0,11	(0,00)	(0,01)	0,88	0,88	65,67
p value	0,10	0,00	0,00	0,06	1,00	0,96			
ESG > 85%	-1,02%	1,05	(0,16)	0,11	0,06	(0,01)	0,91	0,90	63,30
p value	0,43	0,00	0,00	0,02	0,42	0,87			
ESG > 80%	-0,66%	1,07	(0,14)	0,13	0,04	0,00	0,91	0,91	61,47
p value	0,61	0,00	0,01	0,01	0,64	0,97			
ESG > 75%	-0,86%	1,07	(0,14)	0,14	0,09	(0,00)	0,93	0,93	59,14
p value	0,45	0,00	0,00	0,00	0,21	1,00			
Low Portfolio									
ESG < 10%	0,25%	1,15	0,16	0,08	0,11	(0,24)	0,81	0,81	15,22
p value	0,91	0,00	0,07	0,32	0,42	0,11			
ESG < 15%	0,19%	1,15	0,17	0,08	0,09	(0,28)	0,85	0,84	17,22
p value	0,93	0,00	0,03	0,28	0,48	0,04			
ESG < 20%	0,16%	1,15	0,09	0,05	0,05	(0,35)	0,86	0,86	18,94
p value	0,93	0,00	0,22	0,52	0,67	0,01			
ESG < 25%	0,87%	1,10	0,06	0,02	0,07	(0,32)	0,89	0,89	20,44
p value	0,58	0,00	0,31	0,77	0,46	0,00			
Long-short portfolio									
ESG - 10%	-2,79%	(0,07)	(0,39)	0,02	(0,11)	0,23	0,14	0,11	-
p value	0,26	0,22	0,00	0,79	0,47	0,16			
ESG - 15%	-1,20%	(0,10)	(0,33)	0,03	(0,02)	0,27	0,18	0,16	-
p value	0,58	0,04	0,00	0,72	0,85	0,06			
ESG - 20%	-0,83%	(0,09)	(0,22)	0,08	(0,01)	0,35	0,15	0,13	-
p value	0,69	0,08	0,01	0,29	0,92	0,01			
ESG - 25%	-1,74%	(0,03)	(0,20)	0,13	0,02	0,32	0,16	0,14	-
p value	0,31	0,44	0,00	0,06	0,87	0,01			

Table 71 : ESGC - Fama-French 5 factors results value weights (15 Y)

2004 ESG	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High portfolio									
ESG > 100%	-0,21%	1,05	(0,13)	0,11	0,05	(0,07)	0,96	0,96	55,37
p value	0,81	0,00	0,00	0,00	0,27	0,18			
ESG > 90%	-1,08%	0,97	(0,27)	0,16	0,16	0,08	0,91	0,91	75,31
p value	0,33	0,00	0,00	0,00	0,02	0,27			
ESG > 85%	-0,72%	0,99	(0,28)	0,19	0,10	0,00	0,92	0,92	72,63
p value	0,51	0,00	0,00	0,00	0,12	0,97			
ESG > 80%	-0,62%	1,00	(0,24)	0,14	0,09	0,04	0,93	0,93	70,61
p value	0,55	0,00	0,00	0,00	0,14	0,54			
ESG > 75%	-0,23%	1,02	(0,23)	0,14	0,08	(0,00)	0,94	0,94	68,77
p value	0,81	0,00	0,00	0,00	0,16	1,00			
Low Portfolio									
ESG < 10%	0,04%	1,13	0,15	0,07	0,11	(0,29)	0,81	0,80	15,61
p value	0,99	0,00	0,09	0,42	0,41	0,05			
ESG < 15%	0,13%	1,12	0,17	0,09	0,08	(0,32)	0,85	0,84	17,72
p value	0,95	0,00	0,03	0,21	0,50	0,02			
ESG < 20%	-0,38%	1,14	0,13	0,05	0,07	(0,34)	0,87	0,86	19,04
p value	0,84	0,00	0,06	0,45	0,51	0,01			
ESG < 25%	0,15%	1,08	0,15	0,05	0,12	(0,26)	0,89	0,89	20,56
p value	0,92	0,00	0,01	0,35	0,20	0,01			
Long-short portfolio									
ESG - 10%	-1,12%	(0,15)	(0,42)	0,09	0,05	0,37	0,25	0,23	-
p value	0,65	0,01	0,00	0,35	0,75	0,02			
ESG - 15%	-0,85%	(0,13)	(0,45)	0,10	0,02	0,32	0,29	0,26	-
p value	0,70	0,01	0,00	0,23	0,87	0,03			
ESG - 20%	-0,24%	(0,14)	(0,37)	0,09	0,02	0,39	0,29	0,27	-
p value	0,91	0,00	0,00	0,25	0,88	0,00			
ESG - 25%	-0,38%	(0,06)	(0,38)	0,08	(0,04)	0,26	0,26	0,24	-
p value	0,82	0,16	0,00	0,20	0,71	0,02			

Table 72 : ESG - Fama-French 5 factors results value weights (15 Y)

2004 E	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	-0,21%	1,05	(0,13)	0,11	0,05	(0,07)	0,96	0,96	47,16
p value	0,81	0,00	0,00	0,00	0,27	0,18			
ESG > 90%	-1,44%	1,01	(0,25)	0,14	0,09	0,14	0,90	0,90	76,63
p value	0,25	0,00	0,00	0,00	0,20	0,08			
ESG > 85%	-1,47%	1,02	(0,24)	0,13	0,13	0,07	0,93	0,93	73,32
p value	0,17	0,00	0,00	0,00	0,04	0,35			
ESG > 80%	-1,15%	1,02	(0,26)	0,08	0,11	0,07	0,94	0,94	70,26
p value	0,22	0,00	0,00	0,03	0,05	0,30			
ESG > 75%	-0,48%	1,02	(0,24)	0,10	0,08	0,02	0,95	0,95	67,23
p value	0,58	0,00	0,00	0,00	0,12	0,70			
Low Portfolio									
ESG < 10%	2,33%	1,01	0,12	0,13	(0,12)	(0,28)	0,89	0,89	2,02
p value	0,12	0,00	0,04	0,02	0,18	0,01			
ESG < 15%	2,33%	1,01	0,12	0,13	(0,12)	(0,28)	0,89	0,89	2,02
p value	0,12	0,00	0,04	0,02	0,18	0,01			
ESG < 20%	2,33%	1,01	0,12	0,13	(0,12)	(0,28)	0,89	0,89	2,02
p value	0,12	0,00	0,04	0,02	0,18	0,01			
ESG < 25%	2,21%	1,01	0,12	0,14	(0,11)	(0,28)	0,90	0,89	2,06
p value	0,14	0,00	0,04	0,01	0,20	0,00			
Long-short portfolio									
ESG - 10%	-3,77%	0,00	(0,37)	0,01	0,21	0,42	0,32	0,30	-
p value	0,02	0,99	0,00	0,85	0,03	0,00			
ESG - 15%	-3,80%	0,02	(0,36)	(0,00)	0,25	0,34	0,33	0,31	-
p value	0,01	0,67	0,00	0,94	0,01	0,00			
ESG - 20%	-3,48%	0,01	(0,38)	(0,05)	0,23	0,34	0,36	0,34	-
p value	0,02	0,83	0,00	0,36	0,01	0,00			
ESG - 25%	-2,69%	0,01	(0,36)	(0,04)	0,19	0,30	0,36	0,34	-
p value	0,05	0,85	0,00	0,42	0,02	0,00			

Table 73 :- Fama-French 5 factors results value weights (15 Y)

2004 S	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 90%	-1,00%	0,99	(0,26)	0,04	0,11	0,16	0,92	0,91	81,20
p value	0,36	0,00	0,00	0,39	0,09	0,03			
ESG > 85%	-0,83%	1,01	(0,27)	0,13	0,07	0,03	0,93	0,93	77,95
p value	0,42	0,00	0,00	0,00	0,27	0,63			
ESG > 80%	-0,39%	1,02	(0,24)	0,16	0,04	0,00	0,94	0,94	75,67
p value	0,70	0,00	0,00	0,00	0,47	0,94			
ESG > 75%	-0,31%	1,02	(0,23)	0,19	0,05	(0,05)	0,94	0,94	73,31
p value	0,76	0,00	0,00	0,00	0,45	0,42			
Low Portfolio									
ESG < 10%	0,53%	1,11	0,21	(0,00)	0,09	(0,12)	0,83	0,83	15,95
p value	0,80	0,00	0,01	0,98	0,45	0,36			
ESG < 15%	0,94%	1,12	0,14	(0,01)	0,06	(0,11)	0,86	0,86	18,45
p value	0,60	0,00	0,04	0,93	0,60	0,38			
ESG < 20%	1,10%	1,04	0,09	0,01	(0,04)	(0,25)	0,86	0,86	20,42
p value	0,52	0,00	0,17	0,83	0,67	0,03			
ESG < 25%	0,92%	1,03	0,13	0,06	0,04	(0,22)	0,89	0,89	22,08
p value	0,53	0,00	0,02	0,24	0,64	0,02			
Long-short portfolio									
ESG - 10%	-1,53%	(0,13)	(0,47)	0,04	0,02	0,28	0,27	0,25	-
p value	0,51	0,02	0,00	0,67	0,88	0,07			
ESG - 15%	-1,77%	(0,10)	(0,41)	0,14	0,01	0,14	0,25	0,22	-
p value	0,39	0,03	0,00	0,08	0,93	0,31			
ESG - 20%	-1,49%	(0,02)	(0,33)	0,15	0,09	0,26	0,20	0,18	-
p value	0,43	0,58	0,00	0,04	0,44	0,04			
ESG - 25%	-1,23%	(0,01)	(0,36)	0,12	0,00	0,17	0,21	0,19	-
p value	0,46	0,89	0,00	0,05	0,96	0,13			

Table 74 : S - Fama-French 5 factors results value weights (15 Y)

2004 G	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	-0,21%	1,05	(0,13)	0,11	0,05	(0,07)	0,96	0,96	57,92
p value	0,81	0,00	0,00	0,00	0,27	0,18			
ESG > 90%	2,31%	0,96	(0,21)	0,14	0,24	(0,14)	0,90	0,90	82,23
p value	0,05	0,00	0,00	0,00	0,00	0,07			
ESG > 85%	1,89%	0,97	(0,19)	0,18	0,20	(0,16)	0,91	0,90	79,96
p value	0,11	0,00	0,00	0,00	0,01	0,05			
ESG > 80%	0,63%	1,00	(0,22)	0,22	0,16	(0,15)	0,92	0,92	78,15
p value	0,59	0,00	0,00	0,00	0,02	0,05			
ESG > 75%	0,32%	1,00	(0,21)	0,16	0,14	(0,05)	0,93	0,93	76,42
p value	0,76	0,00	0,00	0,00	0,02	0,46			
Low Portfolio									
ESG < 10%	0,57%	1,14	0,08	0,13	0,02	(0,14)	0,78	0,77	17,17
p value	0,82	0,00	0,41	0,18	0,90	0,38			
ESG < 15%	1,66%	1,13	0,06	0,09	0,04	(0,11)	0,83	0,83	19,70
p value	0,42	0,00	0,41	0,24	0,74	0,41			
ESG < 20%	1,11%	1,13	0,05	0,10	0,04	(0,15)	0,86	0,86	22,90
p value	0,54	0,00	0,47	0,17	0,71	0,20			
ESG < 25%	0,83%	1,12	0,02	0,04	(0,01)	(0,12)	0,90	0,89	25,09
p value	0,59	0,00	0,70	0,51	0,92	0,22			
Long-short portfolio									
ESG - 10%	1,74%	(0,18)	(0,28)	0,02	0,22	0,00	0,20	0,17	-
p value	0,51	0,00	0,01	0,87	0,16	1,00			
ESG - 15%	0,23%	(0,15)	(0,26)	0,09	0,16	(0,05)	0,20	0,18	-
p value	0,92	0,00	0,00	0,26	0,22	0,75			
ESG - 20%	-0,49%	(0,13)	(0,27)	0,12	0,12	0,01	0,22	0,20	-
p value	0,80	0,00	0,00	0,09	0,29	0,96			
ESG - 25%	-0,51%	(0,12)	(0,23)	0,13	0,15	0,07	0,25	0,23	-
p value	0,75	0,00	0,00	0,04	0,12	0,50			

Table 75 : G - Fama-French 5 factors results value weights (15 Y)

2004 ESGC	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	1,71%	1,14	0,35	0,23	0,06	(0,05)	0,93	0,93	37,49
p value	0,20	0,00	0,00	0,00	0,44	0,57			
ESG > 90%	-0,46%	1,11	(0,01)	0,11	0,08	0,00	0,91	0,91	66,38
p value	0,74	0,00	0,83	0,03	0,30	0,99			
ESG > 85%	0,55%	1,11	0,08	0,16	0,14	(0,05)	0,91	0,91	63,23
p value	0,69	0,00	0,15	0,00	0,10	0,61			
ESG > 80%	0,98%	1,12	0,10	0,18	0,09	(0,04)	0,91	0,91	60,71
p value	0,49	0,00	0,07	0,00	0,26	0,64			
ESG > 75%	0,86%	1,13	0,12	0,20	0,11	0,02	0,93	0,93	58,41
p value	0,51	0,00	0,02	0,00	0,15	0,81			
Low Portfolio									
ESG < 10%	1,89%	1,18	0,52	0,15	0,16	(0,13)	0,88	0,87	14,75
p value	0,35	0,00	0,00	0,05	0,17	0,32			
ESG < 15%	2,96%	1,14	0,52	0,18	0,14	(0,21)	0,89	0,89	16,55
p value	0,10	0,00	0,00	0,01	0,19	0,09			
ESG < 20%	3,02%	1,14	0,50	0,19	0,10	(0,24)	0,90	0,90	18,18
p value	0,08	0,00	0,00	0,00	0,31	0,03			
ESG < 25%	2,75%	1,14	0,48	0,17	0,10	(0,21)	0,91	0,91	19,56
p value	0,09	0,00	0,00	0,01	0,30	0,05			
Long-short portfolio									
ESG - 10%	-2,34%	(0,07)	(0,53)	(0,04)	(0,08)	0,13	0,34	0,32	-
p value	0,21	0,10	0,00	0,58	0,48	0,28			
ESG - 15%	-2,40%	(0,03)	(0,45)	(0,02)	(0,00)	0,16	0,34	0,32	-
p value	0,12	0,33	0,00	0,75	0,97	0,12			
ESG - 20%	-2,04%	(0,02)	(0,41)	(0,01)	(0,01)	0,20	0,30	0,28	-
p value	0,17	0,61	0,00	0,90	0,92	0,05			
ESG - 25%	-1,89%	(0,00)	(0,36)	0,03	0,01	0,23	0,29	0,27	-
p value	0,17	0,89	0,00	0,57	0,87	0,01			

Table 76 : ESGC - Fama-French 5 factors results equal weights (15 Y)

2004 ESG	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	1,71%	1,14	0,35	0,23	0,06	(0,05)	0,93	0,93	39,93
p value	0,20	0,00	0,00	0,00	0,44	0,57			
ESG > 90%	0,72%	1,06	(0,06)	0,14	0,10	0,08	0,93	0,93	73,48
p value	0,53	0,00	0,19	0,00	0,14	0,29			
ESG > 85%	0,49%	1,08	(0,00)	0,19	0,12	(0,00)	0,93	0,92	70,13
p value	0,69	0,00	0,94	0,00	0,09	0,97			
ESG > 80%	0,29%	1,09	0,04	0,16	0,14	0,03	0,93	0,93	67,22
p value	0,81	0,00	0,35	0,00	0,05	0,72			
ESG > 75%	0,51%	1,11	0,07	0,19	0,11	(0,03)	0,92	0,92	64,54
p value	0,69	0,00	0,18	0,00	0,14	0,70			
Low Portfolio									
ESG < 10%	1,45%	1,15	0,52	0,12	0,16	(0,11)	0,88	0,88	14,78
p value	0,44	0,00	0,00	0,08	0,16	0,38			
ESG < 15%	2,83%	1,12	0,49	0,16	0,12	(0,20)	0,89	0,89	16,64
p value	0,11	0,00	0,00	0,01	0,26	0,08			
ESG < 20%	2,75%	1,14	0,49	0,18	0,12	(0,20)	0,90	0,90	18,28
p value	0,10	0,00	0,00	0,01	0,21	0,06			
ESG < 25%	2,61%	1,13	0,48	0,17	0,11	(0,18)	0,91	0,91	19,68
p value	0,10	0,00	0,00	0,01	0,24	0,09			
Long-short portfolio									
ESG - 10%	-0,73%	(0,09)	(0,58)	0,02	(0,05)	0,19	0,44	0,42	-
p value	0,67	0,02	0,00	0,81	0,59	0,10			
ESG - 15%	-2,34%	(0,04)	(0,50)	0,02	0,01	0,20	0,40	0,38	-
p value	0,12	0,30	0,00	0,67	0,93	0,05			
ESG - 20%	-2,46%	(0,05)	(0,44)	(0,01)	0,02	0,23	0,40	0,38	-
p value	0,08	0,15	0,00	0,82	0,82	0,01			
ESG - 25%	-2,10%	(0,02)	(0,41)	0,02	0,00	0,15	0,33	0,31	-
p value	0,13	0,54	0,00	0,77	0,98	0,11			

Table 77 : ESG - Fama-French 5 factors results equal weights (15 Y)

2004 E	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	1,71%	1,14	0,35	0,23	0,06	(0,05)	0,93	0,93	25,20
p value	0,20	0,00	0,00	0,00	0,44	0,57			
ESG > 90%	0,38%	1,06	0,01	0,15	0,16	0,06	0,91	0,91	74,89
p value	0,77	0,00	0,86	0,00	0,04	0,45			
ESG > 85%	0,07%	1,08	0,03	0,12	0,15	0,03	0,94	0,94	70,31
p value	0,95	0,00	0,52	0,01	0,03	0,64			
ESG > 80%	0,17%	1,10	0,07	0,12	0,15	0,00	0,93	0,93	66,12
p value	0,89	0,00	0,14	0,01	0,03	0,98			
ESG > 75%	0,53%	1,11	0,12	0,15	0,15	(0,01)	0,93	0,93	62,20
p value	0,67	0,00	0,01	0,00	0,04	0,89			
Low Portfolio									
ESG < 10%	3,64%	1,09	0,46	0,28	(0,12)	(0,13)	0,92	0,91	1,16
p value	0,02	0,00	0,00	0,00	0,21	0,22			
ESG < 15%	3,64%	1,09	0,46	0,28	(0,12)	(0,13)	0,92	0,91	1,16
p value	0,02	0,00	0,00	0,00	0,21	0,22			
ESG < 20%	3,64%	1,09	0,46	0,28	(0,12)	(0,13)	0,92	0,91	1,16
p value	0,02	0,00	0,00	0,00	0,21	0,22			
ESG < 25%	3,41%	1,10	0,45	0,28	(0,10)	(0,12)	0,92	0,91	1,22
p value	0,03	0,00	0,00	0,00	0,26	0,23			
Long-short portfolio									
ESG - 10%	-3,25%	(0,03)	(0,45)	(0,12)	0,27	0,19	0,48	0,47	-
p value	0,03	0,36	0,00	0,03	0,00	0,05			
ESG - 15%	-3,56%	(0,01)	(0,43)	(0,16)	0,26	0,16	0,51	0,49	-
p value	0,01	0,72	0,00	0,00	0,00	0,07			
ESG - 20%	-3,47%	0,01	(0,39)	(0,15)	0,27	0,13	0,48	0,46	-
p value	0,01	0,74	0,00	0,00	0,00	0,13			
ESG - 25%	-2,89%	0,01	(0,33)	(0,13)	0,26	0,11	0,41	0,40	-
p value	0,02	0,70	0,00	0,01	0,00	0,18			

Table 78 : E - Fama-French 5 factors results equal weights (15 Y)

2004 S	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG

High Portfolio									
ESG > 100%	1,71%	1,14	0,35	0,23	0,06	(0,05)	0,93	0,93	42,17
p value	0,20	0,00	0,00	0,00	0,44	0,57			
ESG > 90%	0,14%	1,09	(0,00)	0,08	0,11	0,08	0,92	0,92	79,00
p value	0,91	0,00	0,92	0,09	0,13	0,34			
ESG > 85%	0,38%	1,13	0,03	0,14	0,11	0,03	0,93	0,92	75,15
p value	0,76	0,00	0,56	0,00	0,14	0,73			
ESG > 80%	0,69%	1,13	0,07	0,21	0,07	(0,00)	0,93	0,93	71,78
p value	0,59	0,00	0,15	0,00	0,34	0,98			
ESG > 75%	1,28%	1,12	0,09	0,23	0,05	(0,04)	0,93	0,93	68,87
p value	0,30	0,00	0,07	0,00	0,46	0,61			
Low Portfolio									
ESG < 10%	2,56%	1,07	0,51	0,12	0,09	(0,05)	0,87	0,86	15,13
p value	0,18	0,00	0,00	0,11	0,42	0,68			
ESG < 15%	2,96%	1,09	0,51	0,12	0,08	0,02	0,89	0,89	17,10
p value	0,08	0,00	0,00	0,07	0,41	0,86			
ESG < 20%	2,82%	1,08	0,50	0,12	0,08	0,00	0,91	0,90	18,89
p value	0,07	0,00	0,00	0,05	0,41	0,99			
ESG < 25%	2,68%	1,09	0,49	0,18	0,10	(0,02)	0,92	0,92	20,38
p value	0,07	0,00	0,00	0,00	0,25	0,80			
Long-short portfolio									
ESG - 10%	-2,42%	0,02	(0,52)	(0,04)	0,02	0,13	0,28	0,26	-
p value	0,20	0,57	0,00	0,61	0,85	0,30			
ESG - 15%	-2,58%	0,04	(0,48)	0,02	0,03	0,01	0,29	0,27	-
p value	0,11	0,29	0,00	0,72	0,77	0,93			
ESG - 20%	-2,13%	0,06	(0,43)	0,09	(0,00)	(0,00)	0,25	0,23	-
p value	0,17	0,10	0,00	0,13	0,99	0,97			
ESG - 25%	-1,40%	0,04	(0,40)	0,05	(0,05)	(0,02)	0,28	0,26	-
p value	0,30	0,23	0,00	0,33	0,57	0,84			

Table 79 : S - Fama-French 5 factors results equal weights (15 Y)

2004 G	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	1,71%	1,14	0,35	0,23	0,06	(0,05)	0,93	0,93	48,60
p value	0,20	0,00	0,00	0,00	0,44	0,57			
ESG > 90%	1,80%	1,07	0,17	0,30	0,16	(0,06)	0,88	0,88	81,13
p value	0,29	0,00	0,01	0,00	0,11	0,58			
ESG > 85%	2,05%	1,07	0,21	0,32	0,17	(0,10)	0,91	0,90	78,16
p value	0,17	0,00	0,00	0,00	0,05	0,33			
ESG > 80%	0,69%	1,09	0,20	0,27	0,15	(0,02)	0,91	0,91	75,73
p value	0,63	0,00	0,00	0,00	0,08	0,83			
ESG > 75%	0,76%	1,09	0,20	0,26	0,13	0,03	0,92	0,91	73,56
p value	0,59	0,00	0,00	0,00	0,12	0,78			
Low Portfolio									
ESG < 10%	1,47%	1,22	0,47	0,20	0,04	(0,16)	0,84	0,84	15,62
p value	0,54	0,00	0,00	0,03	0,79	0,32			
ESG < 15%	2,40%	1,16	0,47	0,13	0,03	(0,09)	0,87	0,87	18,84
p value	0,23	0,00	0,00	0,08	0,80	0,47			
ESG < 20%	2,24%	1,16	0,46	0,16	0,06	(0,16)	0,89	0,88	21,23
p value	0,23	0,00	0,00	0,02	0,61	0,18			
ESG < 25%	2,05%	1,17	0,43	0,14	0,05	(0,15)	0,91	0,90	23,40
p value	0,22	0,00	0,00	0,03	0,61	0,18			
Long-short portfolio									
ESG - 10%	0,33%	(0,14)	(0,30)	0,10	0,12	0,10	0,26	0,24	-
p value	0,86	0,00	0,00	0,15	0,27	0,44			
ESG - 15%	-0,34%	(0,09)	(0,26)	0,19	0,14	(0,00)	0,25	0,23	-
p value	0,83	0,01	0,00	0,00	0,13	0,99			
ESG - 20%	-1,55%	(0,07)	(0,26)	0,11	0,10	0,14	0,31	0,29	-
p value	0,23	0,02	0,00	0,03	0,21	0,10			
ESG - 25%	-1,29%	(0,08)	(0,23)	0,13	0,08	0,17	0,33	0,32	-
p value	0,27	0,00	0,00	0,01	0,27	0,03			

Table 80 : G - Fama-French 5 factors results equal weights (15 Y)

2004 ESGC	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	-0,21%	1,05	(0,13)	0,11	0,05	(0,07)	0,96	0,96	44,91
p value	0,81	0,00	0,00	0,00	0,27	0,18			
ESG > 90%	-0,58%	1,00	(0,17)	0,04	(0,04)	0,06	0,85	0,84	68,55
p value	0,73	0,00	0,01	0,48	0,72	0,61			
ESG > 85%	-1,48%	1,00	(0,12)	0,02	0,00	0,05	0,89	0,88	67,04
p value	0,28	0,00	0,03	0,76	0,98	0,57			
ESG > 80%	-1,54%	1,02	(0,13)	(0,00)	0,02	0,11	0,91	0,91	65,28
p value	0,21	0,00	0,00	0,94	0,75	0,19			
ESG > 75%	-1,36%	1,06	(0,16)	0,11	0,03	(0,02)	0,91	0,91	63,73
p value	0,30	0,00	0,00	0,03	0,69	0,78			
Low Portfolio									
ESG < 10%	-0,80%	1,17	(0,01)	0,01	0,07	(0,11)	0,81	0,80	17,05
p value	0,72	0,00	0,90	0,90	0,59	0,46			
ESG < 15%	2,67%	1,03	(0,07)	0,11	(0,07)	(0,25)	0,83	0,83	20,12
p value	0,15	0,00	0,36	0,10	0,55	0,04			
ESG < 20%	2,28%	1,00	(0,02)	0,08	(0,08)	(0,16)	0,86	0,86	22,57
p value	0,16	0,00	0,79	0,20	0,43	0,14			
ESG < 25%	1,65%	1,01	(0,05)	0,08	(0,04)	(0,16)	0,88	0,88	25,08
p value	0,26	0,00	0,36	0,13	0,65	0,10			
Long-short portfolio									
ESG - 10%	0,23%	(0,17)	(0,16)	0,03	(0,11)	0,17	0,09	0,07	-
p value	0,93	0,01	0,12	0,74	0,50	0,35			
ESG - 15%	-4,15%	(0,03)	(0,05)	(0,10)	0,07	0,30	0,05	0,02	-
p value	0,05	0,61	0,54	0,22	0,59	0,03			
ESG - 20%	-3,82%	0,02	(0,12)	(0,08)	0,10	0,26	0,05	0,02	-
p value	0,05	0,58	0,12	0,26	0,39	0,04			
ESG - 25%	-3,01%	0,05	(0,11)	0,03	0,07	0,14	0,03	0,00	-
p value	0,10	0,27	0,13	0,69	0,52	0,26			

Table 81 : Enhanced ESGC - Fama-French 5 factors results value weights (15 Y)

2004 ESG	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	-0,21%	1,05	(0,13)	0,11	0,05	(0,07)	0,96	0,96	55,37
p value	0,81	0,00	0,00	0,00	0,27	0,18			
ESG > 90%	0,37%	0,99	(0,19)	0,16	0,15	0,19	0,85	0,85	80,33
p value	0,81	0,00	0,00	0,01	0,11	0,08			
ESG > 85%	0,11%	1,00	(0,21)	0,17	0,19	0,08	0,88	0,88	78,10
p value	0,93	0,00	0,00	0,00	0,02	0,38			
ESG > 80%	-0,46%	1,00	(0,23)	0,22	0,16	(0,02)	0,91	0,91	76,25
p value	0,71	0,00	0,00	0,00	0,02	0,84			
ESG > 75%	-1,03%	1,00	(0,25)	0,17	0,13	0,04	0,92	0,92	74,43
p value	0,34	0,00	0,00	0,00	0,04	0,59			
Low Portfolio									
ESG < 10%	-0,94%	1,14	(0,06)	0,05	0,12	(0,14)	0,80	0,79	17,65
p value	0,67	0,00	0,47	0,58	0,38	0,33			
ESG < 15%	1,65%	1,01	0,01	0,09	0,07	(0,24)	0,84	0,84	19,76
p value	0,34	0,00	0,89	0,17	0,50	0,04			
ESG < 20%	1,07%	1,02	0,04	0,09	0,06	(0,24)	0,87	0,87	21,73
p value	0,50	0,00	0,55	0,14	0,51	0,02			
ESG < 25%	0,68%	1,04	0,05	0,10	0,08	(0,22)	0,87	0,87	23,58
p value	0,67	0,00	0,46	0,10	0,41	0,04			
Long-short portfolio									
ESG - 10%	1,32%	(0,15)	(0,13)	0,12	0,03	0,33	0,11	0,09	-
p value	0,63	0,02	0,22	0,26	0,85	0,07			
ESG - 15%	-1,54%	(0,02)	(0,22)	0,08	0,12	0,31	0,13	0,10	-
p value	0,46	0,71	0,01	0,31	0,31	0,02			
ESG - 20%	-1,53%	(0,02)	(0,27)	0,13	0,10	0,22	0,16	0,14	-
p value	0,41	0,67	0,00	0,06	0,35	0,07			
ESG - 25%	-1,71%	(0,04)	(0,30)	0,07	0,06	0,26	0,20	0,18	-
p value	0,32	0,32	0,00	0,30	0,59	0,03			

Table 82 : Enhanced ESG - Fama-French 5 factors results value weights (15 Y)

2004 E	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	-0,21%	1,05	(0,13)	0,11	0,05	(0,07)	0,96	0,96	47,16
p value	0,81	0,00	0,00	0,00	0,27	0,18			
ESG > 90%	-0,30%	0,94	(0,16)	0,11	0,03	0,28	0,84	0,83	82,80
p value	0,85	0,00	0,01	0,08	0,73	0,01			
ESG > 85%	-2,74%	1,05	(0,21)	0,22	0,05	0,21	0,88	0,88	79,99
p value	0,07	0,00	0,00	0,00	0,60	0,03			
ESG > 80%	-2,06%	1,04	(0,23)	0,18	0,05	0,20	0,90	0,90	77,11
p value	0,13	0,00	0,00	0,00	0,55	0,03			
ESG > 75%	-1,43%	1,03	(0,21)	0,16	0,08	0,12	0,91	0,91	75,05
p value	0,25	0,00	0,00	0,00	0,30	0,16			
Low Portfolio									
ESG < 10%	2,33%	1,01	0,12	0,13	(0,12)	(0,27)	0,89	0,89	2,02
p value	0,12	0,00	0,04	0,02	0,19	0,01			
ESG < 15%	2,04%	1,02	0,09	0,14	(0,11)	(0,29)	0,90	0,90	2,30
p value	0,16	0,00	0,11	0,01	0,18	0,00			
ESG < 20%	2,40%	1,03	0,07	0,14	(0,13)	(0,31)	0,90	0,90	2,90
p value	0,09	0,00	0,22	0,01	0,12	0,00			
ESG < 25%	2,40%	1,04	0,05	0,12	(0,15)	(0,30)	0,91	0,91	3,99
p value	0,08	0,00	0,37	0,02	0,08	0,00			
Long-short portfolio									
ESG - 10%	-2,62%	(0,07)	(0,28)	(0,03)	0,15	0,55	0,26	0,23	-
p value	0,19	0,12	0,00	0,74	0,21	0,00			
ESG - 15%	-4,78%	0,03	(0,30)	0,08	0,16	0,50	0,26	0,24	-
p value	0,01	0,45	0,00	0,24	0,12	0,00			
ESG - 20%	-4,46%	0,01	(0,30)	0,04	0,18	0,50	0,30	0,28	-
p value	0,01	0,75	0,00	0,46	0,06	0,00			
ESG - 25%	-3,83%	(0,01)	(0,26)	0,05	0,22	0,41	0,29	0,27	-
p value	0,01	0,86	0,00	0,43	0,01	0,00			

Table 83 : Enhanced E - Fama-French 5 factors results value weights (15 Y)

2004 S	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	-0,21%	1,05	(0,13)	0,11	0,05	(0,07)	0,96	0,96	58,00
p value	0,81	0,00	0,00	0,00	0,27	0,18			
ESG > 90%	0,19%	1,04	(0,19)	0,08	0,11	0,08	0,86	0,86	86,82
p value	0,90	0,00	0,00	0,20	0,22	0,45			
ESG > 85%	-0,35%	1,04	(0,17)	0,08	0,18	0,07	0,89	0,89	83,83
p value	0,80	0,00	0,00	0,11	0,02	0,45			
ESG > 80%	-0,89%	1,02	(0,21)	0,09	0,11	0,11	0,92	0,92	81,88
p value	0,44	0,00	0,00	0,04	0,11	0,16			
ESG > 75%	-0,46%	1,00	(0,24)	0,10	0,13	0,07	0,94	0,93	79,65
p value	0,64	0,00	0,00	0,01	0,02	0,29			
Low Portfolio									
ESG < 10%	2,51%	0,95	(0,07)	0,05	(0,15)	(0,22)	0,78	0,78	18,96
p value	0,22	0,00	0,35	0,54	0,22	0,10			
ESG < 15%	1,58%	1,02	(0,02)	0,05	(0,03)	(0,22)	0,83	0,82	20,54
p value	0,40	0,00	0,75	0,44	0,81	0,08			
ESG < 20%	2,19%	0,99	0,01	0,05	(0,02)	(0,18)	0,87	0,86	22,60
p value	0,16	0,00	0,84	0,36	0,82	0,09			
ESG < 25%	0,73%	1,02	0,05	0,06	0,04	(0,19)	0,89	0,89	24,81
p value	0,61	0,00	0,35	0,25	0,61	0,05			
Long-short portfolio									
ESG - 10%	-2,32%	0,09	(0,11)	0,03	0,26	0,30	0,06	0,03	-
p value	0,35	0,11	0,23	0,76	0,07	0,07			
ESG - 15%	-1,93%	0,02	(0,15)	0,03	0,21	0,29	0,08	0,05	-
p value	0,38	0,74	0,08	0,74	0,11	0,05			
ESG - 20%	-3,08%	0,03	(0,22)	0,03	0,13	0,28	0,11	0,08	-
p value	0,11	0,51	0,00	0,63	0,25	0,03			
ESG - 25%	-1,19%	(0,03)	(0,29)	0,04	0,09	0,26	0,20	0,17	-
p value	0,48	0,48	0,00	0,55	0,37	0,02			

Table 84 : Enhanced S - Fama-French 5 factors results value weights (15 Y)

2004 G	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	-0,21%	1,05	(0,13)	0,11	0,05	(0,07)	0,96	0,96	57,92
p value	0,81	0,00	0,00	0,00	0,27	0,18			
ESG > 90%	2,50%	0,94	(0,12)	0,20	0,35	(0,16)	0,85	0,84	84,45
p value	0,10	0,00	0,03	0,00	0,00	0,11			
ESG > 85%	2,48%	0,96	(0,14)	0,14	0,26	(0,16)	0,89	0,89	82,91
p value	0,06	0,00	0,01	0,00	0,00	0,06			
ESG > 80%	1,73%	0,98	(0,17)	0,17	0,24	(0,20)	0,91	0,91	81,14
p value	0,14	0,00	0,00	0,00	0,00	0,01			
ESG > 75%	1,68%	0,99	(0,18)	0,15	0,15	(0,13)	0,92	0,92	79,32
p value	0,13	0,00	0,00	0,00	0,02	0,08			
Low Portfolio									
ESG < 10%	-0,56%	1,11	(0,07)	0,09	0,04	(0,03)	0,86	0,86	19,75
p value	0,75	0,00	0,31	0,17	0,67	0,79			
ESG < 15%	-0,80%	1,13	0,01	0,13	0,05	(0,07)	0,87	0,86	22,17
p value	0,65	0,00	0,85	0,06	0,62	0,56			
ESG < 20%	0,36%	1,08	(0,00)	0,11	0,02	(0,01)	0,89	0,89	25,05
p value	0,81	0,00	0,98	0,06	0,79	0,89			
ESG < 25%	1,42%	1,09	(0,03)	0,12	(0,04)	(0,06)	0,90	0,90	28,05
p value	0,32	0,00	0,63	0,03	0,63	0,52			
Long-short portfolio									
ESG - 10%	3,05%	(0,17)	(0,05)	0,11	0,31	(0,13)	0,16	0,13	-
p value	0,18	0,00	0,53	0,22	0,02	0,40			
ESG - 15%	3,28%	(0,17)	(0,15)	0,02	0,21	(0,09)	0,20	0,18	-
p value	0,12	0,00	0,07	0,84	0,10	0,50			
ESG - 20%	1,37%	(0,10)	(0,16)	0,06	0,22	(0,19)	0,17	0,15	-
p value	0,45	0,02	0,02	0,40	0,05	0,12			
ESG - 25%	0,27%	(0,10)	(0,15)	0,03	0,19	(0,07)	0,19	0,16	-
p value	0,87	0,01	0,02	0,63	0,05	0,54			

Table 85 : Enhanced G - Fama-French 5 factors results value weights (15 Y)

2004 ESGC	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	1,71%	1,14	0,35	0,23	0,06	(0,05)	0,93	0,93	37,49
p value	0,20	0,00	0,00	0,00	0,44	0,57			
ESG > 90%	1,49%	1,12	0,18	0,16	0,04	0,04	0,87	0,87	66,34
p value	0,40	0,00	0,01	0,02	0,71	0,74			
ESG > 85%	0,89%	1,11	0,23	0,16	0,09	0,02	0,90	0,89	63,40
p value	0,57	0,00	0,00	0,01	0,32	0,85			
ESG > 80%	1,13%	1,11	0,25	0,18	0,12	0,02	0,90	0,90	60,60
p value	0,47	0,00	0,00	0,00	0,18	0,88			
ESG > 75%	0,94%	1,14	0,23	0,26	0,11	(0,05)	0,91	0,91	58,33
p value	0,54	0,00	0,00	0,00	0,24	0,65			
Low Portfolio									
ESG < 10%	2,58%	1,14	0,43	0,07	0,04	(0,00)	0,86	0,85	14,25
p value	0,21	0,00	0,00	0,40	0,73	0,97			
ESG < 15%	2,82%	1,15	0,40	0,17	0,11	(0,12)	0,88	0,88	16,25
p value	0,13	0,00	0,00	0,02	0,32	0,32			
ESG < 20%	2,79%	1,15	0,42	0,17	0,10	(0,16)	0,90	0,90	17,77
p value	0,09	0,00	0,00	0,01	0,30	0,14			
ESG < 25%	2,63%	1,13	0,41	0,16	0,09	(0,18)	0,91	0,91	19,21
p value	0,09	0,00	0,00	0,01	0,33	0,09			
Long-short portfolio									
ESG - 10%	-1,09%	(0,02)	(0,25)	0,10	(0,00)	0,04	0,08	0,06	-
p value	0,60	0,63	0,00	0,21	0,97	0,75			
ESG - 15%	-1,93%	(0,05)	(0,17)	(0,01)	(0,02)	0,14	0,09	0,06	-
p value	0,26	0,23	0,01	0,84	0,88	0,21			
ESG - 20%	-1,66%	(0,04)	(0,16)	0,01	0,02	0,18	0,10	0,08	-
p value	0,28	0,28	0,01	0,88	0,81	0,08			
ESG - 25%	-1,69%	0,01	(0,18)	0,10	0,02	0,13	0,11	0,09	-
p value	0,22	0,75	0,00	0,06	0,83	0,16			

Table 86 : Enhanced ESGC - Fama-French 5 factors results equal weights (15 Y)

2004 ESG	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	1,71%	1,14	0,35	0,23	0,06	(0,05)	0,93	0,93	39,93
p value	0,20	0,00	0,00	0,00	0,44	0,57			
ESG > 90%	2,31%	1,07	0,23	0,16	0,23	0,18	0,88	0,88	72,83
p value	0,16	0,00	0,00	0,01	0,02	0,10			
ESG > 85%	1,59%	1,14	0,21	0,21	0,13	0,03	0,88	0,87	69,64
p value	0,37	0,00	0,00	0,00	0,23	0,83			
ESG > 80%	1,80%	1,11	0,20	0,23	0,13	(0,02)	0,90	0,90	66,65
p value	0,24	0,00	0,00	0,00	0,17	0,86			
ESG > 75%	1,30%	1,13	0,21	0,26	0,11	(0,02)	0,91	0,90	63,70
p value	0,40	0,00	0,00	0,00	0,23	0,86			
Low Portfolio									
ESG < 10%	2,28%	1,10	0,42	0,02	0,04	0,04	0,87	0,87	14,20
p value	0,22	0,00	0,00	0,82	0,71	0,74			
ESG < 15%	2,16%	1,15	0,42	0,13	0,17	(0,10)	0,89	0,89	16,13
p value	0,22	0,00	0,00	0,05	0,10	0,40			
ESG < 20%	2,12%	1,14	0,43	0,14	0,14	(0,16)	0,91	0,90	17,67
p value	0,19	0,00	0,00	0,02	0,14	0,14			
ESG < 25%	1,79%	1,14	0,43	0,16	0,17	(0,18)	0,90	0,89	19,13
p value	0,29	0,00	0,00	0,01	0,09	0,11			
Long-short portfolio									
ESG - 10%	0,03%	(0,04)	(0,19)	0,15	0,19	0,13	0,14	0,11	-
p value	0,99	0,41	0,01	0,04	0,09	0,28			
ESG - 15%	-0,58%	(0,01)	(0,21)	0,08	(0,04)	0,12	0,08	0,05	-
p value	0,75	0,83	0,00	0,23	0,68	0,30			
ESG - 20%	-0,32%	(0,03)	(0,22)	0,08	(0,02)	0,14	0,12	0,10	-
p value	0,84	0,42	0,00	0,17	0,85	0,18			
ESG - 25%	-0,49%	(0,01)	(0,22)	0,09	(0,06)	0,16	0,14	0,11	-
p value	0,73	0,75	0,00	0,09	0,45	0,09			

Table 87 : Enhanced ESG - Fama-French 5 factors results equal weights (15 Y)

2004 E	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	1,71%	1,14	0,35	0,23	0,06	(0,05)	0,93	0,93	25,20
p value	0,20	0,00	0,00	0,00	0,44	0,57			
ESG > 90%	1,58%	1,07	0,23	0,15	0,15	0,08	0,87	0,87	73,19
p value	0,36	0,00	0,00	0,02	0,14	0,49			
ESG > 85%	0,58%	1,15	0,21	0,27	0,15	(0,06)	0,90	0,89	68,40
p value	0,73	0,00	0,00	0,00	0,13	0,58			
ESG > 80%	0,55%	1,14	0,27	0,24	0,15	0,01	0,92	0,91	62,36
p value	0,71	0,00	0,00	0,00	0,08	0,90			
ESG > 75%	0,59%	1,16	0,29	0,24	0,17	(0,02)	0,91	0,91	58,96
p value	0,70	0,00	0,00	0,00	0,06	0,83			
Low Portfolio									
ESG < 10%	3,63%	1,09	0,46	0,28	(0,12)	(0,13)	0,92	0,91	1,16
p value	0,02	0,00	0,00	0,00	0,22	0,23			
ESG < 15%	3,59%	1,09	0,45	0,28	(0,12)	(0,13)	0,92	0,91	1,21
p value	0,02	0,00	0,00	0,00	0,22	0,21			
ESG < 20%	3,62%	1,10	0,45	0,28	(0,11)	(0,13)	0,92	0,91	1,36
p value	0,02	0,00	0,00	0,00	0,21	0,19			
ESG < 25%	3,61%	1,10	0,44	0,28	(0,12)	(0,13)	0,92	0,92	1,64
p value	0,02	0,00	0,00	0,00	0,20	0,21			
Long-short portfolio									
ESG - 10%	-2,04%	(0,02)	(0,23)	(0,13)	0,27	0,21	0,26	0,23	-
p value	0,20	0,58	0,00	0,03	0,01	0,05			
ESG - 15%	-3,02%	0,06	(0,24)	(0,01)	0,26	0,07	0,19	0,17	-
p value	0,04	0,08	0,00	0,84	0,00	0,47			
ESG - 20%	-3,07%	0,04	(0,18)	(0,04)	0,27	0,15	0,19	0,17	-
p value	0,02	0,15	0,00	0,44	0,00	0,09			
ESG - 25%	-3,01%	0,06	(0,14)	(0,04)	0,29	0,11	0,17	0,15	-
p value	0,02	0,03	0,00	0,46	0,00	0,20			

Table 88 : Enhanced E - Fama-French 5 factors results equal weights (15 Y)

2004 S	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	1,71%	1,14	0,35	0,23	0,06	(0,05)	0,93	0,93	42,17
p value	0,20	0,00	0,00	0,00	0,44	0,57			
ESG > 90%	0,59%	1,15	0,25	0,01	0,14	0,10	0,88	0,87	79,02
p value	0,74	0,00	0,00	0,92	0,20	0,39			
ESG > 85%	1,11%	1,17	0,23	0,14	0,18	(0,01)	0,89	0,89	74,65
p value	0,51	0,00	0,00	0,03	0,08	0,89			
ESG > 80%	1,65%	1,14	0,23	0,16	0,07	0,07	0,91	0,91	71,94
p value	0,27	0,00	0,00	0,01	0,40	0,51			
ESG > 75%	1,53%	1,14	0,23	0,17	0,07	0,02	0,92	0,92	69,12
p value	0,29	0,00	0,00	0,00	0,40	0,80			
Low Portfolio									
ESG < 10%	3,53%	1,01	0,42	0,02	0,04	(0,05)	0,84	0,84	14,89
p value	0,07	0,00	0,00	0,77	0,75	0,70			
ESG < 15%	3,00%	1,05	0,39	0,07	0,02	(0,01)	0,88	0,87	16,70
p value	0,09	0,00	0,00	0,28	0,82	0,91			
ESG < 20%	2,82%	1,06	0,42	0,09	0,07	(0,04)	0,90	0,89	18,31
p value	0,08	0,00	0,00	0,14	0,47	0,73			
ESG < 25%	2,75%	1,08	0,44	0,14	0,12	(0,01)	0,91	0,91	19,88
p value	0,06	0,00	0,00	0,01	0,17	0,90			
Long-short portfolio									
ESG - 10%	-2,94%	0,13	(0,17)	(0,02)	0,10	0,15	0,05	0,03	-
p value	0,18	0,01	0,04	0,85	0,44	0,30			
ESG - 15%	-1,89%	0,12	(0,16)	0,07	0,15	(0,00)	0,06	0,03	-
p value	0,34	0,01	0,03	0,38	0,19	0,99			
ESG - 20%	-1,17%	0,08	(0,19)	0,07	0,01	0,10	0,07	0,04	-
p value	0,48	0,05	0,00	0,25	0,95	0,36			
ESG - 25%	-1,22%	0,06	(0,20)	0,04	(0,05)	0,04	0,07	0,05	-
p value	0,41	0,09	0,00	0,52	0,59	0,71			

Table 89 : Enhanced S - Fama-French 5 factors results equal weights (15 Y)

2004 G	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	1,71%	1,14	0,35	0,23	0,06	(0,05)	0,93	0,93	48,60
p value	0,20	0,00	0,00	0,00	0,44	0,57			
ESG > 90%	2,17%	1,07	0,34	0,38	0,25	(0,01)	0,88	0,87	80,93
p value	0,23	0,00	0,00	0,00	0,02	0,94			
ESG > 85%	2,17%	1,07	0,34	0,33	0,14	(0,03)	0,89	0,88	78,43
p value	0,20	0,00	0,00	0,00	0,17	0,81			
ESG > 80%	1,52%	1,07	0,34	0,30	0,18	(0,02)	0,90	0,90	75,93
p value	0,32	0,00	0,00	0,00	0,05	0,82			
ESG > 75%	1,00%	1,09	0,32	0,29	0,15	0,03	0,92	0,91	73,73
p value	0,49	0,00	0,00	0,00	0,08	0,79			
Low Portfolio									
ESG < 10%	1,72%	1,21	0,31	0,17	0,03	(0,12)	0,87	0,87	15,28
p value	0,40	0,00	0,00	0,03	0,83	0,37			
ESG < 15%	1,00%	1,22	0,39	0,18	0,09	(0,13)	0,87	0,87	18,25
p value	0,62	0,00	0,00	0,02	0,46	0,33			
ESG < 20%	1,63%	1,19	0,40	0,18	0,07	(0,15)	0,89	0,88	20,54
p value	0,39	0,00	0,00	0,01	0,51	0,24			
ESG < 25%	2,32%	1,17	0,41	0,15	0,04	(0,14)	0,90	0,90	22,76
p value	0,17	0,00	0,00	0,02	0,70	0,22			
Long-short portfolis									
ESG - 10%	0,45%	(0,14)	0,03	0,21	0,22	0,11	0,16	0,14	-
p value	0,82	0,00	0,66	0,00	0,05	0,39			
ESG - 15%	1,17%	(0,15)	(0,05)	0,15	0,05	0,10	0,16	0,13	-
p value	0,50	0,00	0,46	0,03	0,63	0,37			
ESG - 20%	-0,11%	(0,12)	(0,06)	0,12	0,10	0,12	0,20	0,17	-
p value	0,94	0,00	0,29	0,03	0,21	0,19			
ESG - 25%	-1,31%	(0,08)	(0,09)	0,14	0,11	0,16	0,25	0,23	-
p value	0,26	0,00	0,05	0,00	0,10	0,03			

Table 90 : Enhanced G - Fama-French 5 factors results equal weights (15 Y)

H.3. EU results

ESGC EU	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
N	2	173	177	242	301	308	342	372	383	409	426	435	443	459	477	494	566	830	844
Mean	37,40	34,64	36,08	35,73	37,39	37,25	42,69	45,37	48,04	48,93	49,07	50,14	50,19	51,28	53,59	53,68	55,09	51,29	51,41
Std	35,71	15,02	15,77	17,01	17,73	18,86	19,69	19,25	20,16	19,54	19,83	19,26	19,20	19,54	20,38	18,96	18,64	19,72	18,84
ESGCUK	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
N	1	66	71	161	190	194	202	206	218	219	234	238	243	249	313	319	339	395	403
Mean	42,61	37,31	39,12	34,65	35,26	35,77	40,44	42,52	43,66	45,69	44,95	45,48	46,38	46,22	46,14	47,13	46,44	44,93	44,83
Std	-	12,32	14,50	14,96	17,00	16,67	16,85	16,30	17,27	16,71	16,23	16,33	17,09	16,61	18,64	17,88	18,41	19,35	18,34
ESGC	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
N	3	239	248	403	491	502	544	578	601	628	660	673	686	708	790	813	905	1225	1247
Mean	39,13	35,38	36,95	35,30	36,56	36,68	41,85	44,36	46,45	47,80	47,61	48,49	48,84	49,50	50,64	51,11	51,85	49,24	49,29
Std	25,43	14,35	15,45	16,21	17,47	18,04	18,70	18,29	19,26	18,65	18,73	18,40	18,56	18,71	20,03	18,81	19,01	19,82	18,93

Table 91 : ESG Ratings coverage in January of each year (Europe)

Returns EU	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
N	279	2034	2151	2930	3575	3724	4105	4448	4614	4910	5106	5214	5295	5485	5700	5989	7184	10040
Mean	(1,28)	4,20	2,22	4,42	3,46	1,58	(4,52)	4,34	0,88	(2,00)	2,01	2,43	(0,64)	0,13	0,36	2,52	(1,87)	1,95
Std	13,94	10,51	6,68	132,76	7,00	7,60	14,53	16,83	12,00	11,63	12,48	10,71	9,23	10,00	10,02	8,43	9,91	34,28
ReturnsUK	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
N	285	795	1214	2028	2290	2356	2427	2527	2615	2671	2824	2854	2900	3218	3766	3866	4271	4793
Mean	(0,35)	3,26	3,20	1,99	3,89	0,00	(5,85)	5,49	2,02	(0,77)	2,83	2,53	(0,22)	0,28	(0,36)	2,04	(1,66)	2,29
Std	10,69	8,49	8,52	6,70	7,47	8,29	13,97	17,52	10,77	9,63	11,00	9,47	8,29	9,91	11,15	7,52	9,40	10,85
Returns	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
N	564	2829	3365	4958	5865	6080	6532	6975	7229	7581	7930	8068	8195	8703	9466	9855	11455	14833
Mean	(0,81)	3,94	2,57	3,43	3,63	0,97	(5,01)	4,76	1,29	(1,57)	2,30	2,46	(0,49)	0,18	0,08	2,33	(1,79)	2,06
Std	12,40	10,00	7,41	102,15	7,19	7,91	14,34	17,09	11,58	10,98	11,98	10,29	8,91	9,97	10,49	8,09	9,73	28,87

Table 92 : Evolution of Returns for rated firms (Europe)

	RM-RF	SMB	HML	RMW	CMA	Mom
RM-RF	1,0000	(0,1058)	0,4225	(0,4505)	(0,2104)	(0,4723)
SMB	(0,1058)	1,0000	0,0751	0,0674	(0,0417)	0,1427
HML	0,4225	0,0751	1,0000	(0,6595)	0,3662	(0,3282)
RMW	(0,4505)	0,0674	(0,6595)	1,0000	(0,1846)	0,4713
CMA	(0,2104)	(0,0417)	0,3662	(0,1846)	1,0000	0,2226
Mom	(0,4723)	0,1427	(0,3282)	0,4713	0,2226	1,0000

	RM-RF	SMB	HML	RMW	CMA	Mom
RM-RF	1,0000	0,1254	0,0000	0,0000	0,0021	0,0000
SMB	0,1254	1,0000	0,2775	0,3302	0,5469	0,0384
HML	0,0000	0,2775	1,0000	0,0000	0,0000	0,0000
RMW	0,0000	0,3302	0,0000	1,0000	0,0072	0,0000
CMA	0,0021	0,5469	0,0000	0,0072	1,0000	0,0011
Mom	0,0000	0,0384	0,0000	0,0000	0,0011	1,0000

	RM-RF	SMB	HML	RMW	CMA	Mom
VIF	1,6905	1,0964	2,3968	2,1060	1,6119	1,6136

Table 93 : Correlation, p values and VIF for European factors

ESGC	Basic Materials	Consumer Cyclicals	Consumer Non-Cyc.	Energy	Financials	Healthcare	Industrials	Technology	Telecomm. Services	Utilities
Bottom - VIII.2	6,2%	14,7%	7,1%	5,7%	28,4%	5,8%	20,1%	4,8%	4,5%	2,8%
Top - VIII.2	9,1%	18,9%	8,6%	6,7%	22,6%	3,4%	13,9%	3,4%	5,0%	8,4%
Bottom - VIII.3	4,8%	14,9%	7,1%	5,4%	32,3%	5,5%	18,9%	3,1%	5,3%	2,7%
Top - VIII.3	9,3%	18,9%	9,4%	7,3%	22,2%	2,5%	15,0%	3,0%	5,1%	7,4%

Table 94 : Exposition to industries of portfolios (Europe)

	Bottom				Bottom - Enhanced				Top				Top - Enhanced			
	Issued	MC - 25%	MC - Mean	MC - 75%	Issued	MC - 25%	MC - Mean	MC - 75%	Issued	MC - 25%	MC - Mean	MC - 75%	Issued	MC - 25%	MC - Mean	MC - 75%
2004	0,8302	1,05E+09	3,99E+09	3,85E+09	0,8649	1,24E+09	5,76E+09	5,09E+09	1,0727	5,55E+09	3,06E+10	4,99E+10	1,0833	4,62E+09	3,03E+10	4,72E+10
2005	0,9383	1,01E+09	3,19E+09	3,69E+09	1,2167	1,42E+09	5,22E+09	6,84E+09	1,8214	5,61E+09	3,00E+10	4,63E+10	1,5517	3,55E+09	2,96E+10	5,03E+10
2006	1,6596	1,28E+09	3,79E+09	4,87E+09	1,9118	1,57E+09	5,19E+09	6,77E+09	2,2449	1,06E+10	3,80E+10	5,23E+10	2,1846	5,11E+09	3,50E+10	5,25E+10
2007	2,4082	1,67E+09	5,53E+09	6,64E+09	2,7733	2,08E+09	6,45E+09	9,21E+09	3,3762	1,37E+10	4,96E+10	6,56E+10	3,1045	6,53E+09	4,75E+10	6,86E+10
2008	3,1524	1,52E+09	3,98E+09	5,20E+09	3,4000	1,74E+09	4,49E+09	6,27E+09	4,2202	8,57E+09	3,67E+10	4,64E+10	4,0933	4,58E+09	2,82E+10	3,91E+10
2009	3,4561	6,95E+08	2,17E+09	2,87E+09	4,0000	9,19E+08	3,06E+09	4,15E+09	4,9138	3,56E+09	1,56E+10	2,00E+10	4,8659	2,27E+09	1,35E+10	1,56E+10
2010	3,9915	6,89E+08	2,12E+09	2,57E+09	4,7436	9,39E+08	4,32E+09	3,57E+09	6,1405	4,30E+09	1,56E+10	2,29E+10	5,6951	2,65E+09	1,53E+10	2,38E+10
2011	4,7360	9,52E+08	2,99E+09	3,37E+09	5,2558	1,32E+09	9,01E+09	7,26E+09	6,8160	5,00E+09	2,02E+10	2,61E+10	6,4889	3,36E+09	1,86E+10	2,68E+10
2012	4,6589	6,42E+08	2,75E+09	2,57E+09	5,8182	9,82E+08	5,82E+09	3,91E+09	7,7727	3,60E+09	1,64E+10	1,96E+10	7,2062	2,08E+09	1,65E+10	1,96E+10
2013	5,5985	8,87E+08	2,67E+09	3,07E+09	6,4886	1,33E+09	6,10E+09	4,69E+09	8,6567	3,53E+09	1,80E+10	2,61E+10	8,0404	2,94E+09	1,73E+10	2,56E+10
2014	6,0794	1,28E+09	3,87E+09	4,87E+09	7,6596	2,18E+09	1,05E+10	9,75E+09	9,4361	6,59E+09	2,54E+10	3,16E+10	9,0682	5,12E+09	2,55E+10	3,13E+10
2015	5,8676	1,24E+09	3,62E+09	4,30E+09	7,2442	1,73E+09	9,12E+09	9,10E+09	10,1560	6,32E+09	2,16E+10	2,75E+10	9,7766	3,72E+09	2,08E+10	2,80E+10
2016	4,9236	8,33E+08	2,53E+09	2,81E+09	7,4952	1,11E+09	9,73E+09	8,13E+09	11,2722	5,82E+09	2,43E+10	2,98E+10	10,4184	3,51E+09	2,31E+10	3,31E+10
2017	6,1615	1,01E+09	3,15E+09	3,47E+09	8,4561	1,23E+09	1,19E+10	9,61E+09	11,9018	5,93E+09	2,30E+10	2,45E+10	11,3704	3,99E+09	2,33E+10	2,42E+10
2018	4,9189	7,49E+08	2,47E+09	3,25E+09	6,9440	1,07E+09	8,69E+09	5,75E+09	12,3617	5,76E+09	2,22E+10	2,57E+10	10,7600	2,85E+09	2,16E+10	2,25E+10

Table 95 : Biases effect on portfolios (Europe)

Top	ESGC	ESG	E	S	G
100%	0,59%	0,59%	0,60%	0,60%	0,59%
10	0,61%	0,54%	0,55%	0,63%	0,56%
15	0,63%	0,54%	0,56%	0,54%	0,54%
20	0,66%	0,54%	0,54%	0,54%	0,58%
25	0,62%	0,54%	0,55%	0,55%	0,60%
Bottom	ESGC	ESG	E	S	G
100%	0,59%	0,59%	0,59%	0,59%	0,59%
10	0,81%	0,80%	0,58%	0,81%	0,89%
15	0,78%	0,73%	0,58%	0,77%	0,92%
20	0,67%	0,69%	0,61%	0,71%	0,83%
25	0,64%	0,64%	0,63%	0,69%	0,71%

Top	ESGC	ESG	E	S	G
100%	5,75%	5,75%	5,74%	5,75%	5,75%
10	5,98%	5,77%	6,01%	5,66%	5,73%
15	5,90%	5,83%	5,91%	5,65%	5,89%
20	5,76%	5,77%	5,88%	5,69%	5,89%
25	5,75%	5,72%	5,83%	5,69%	5,82%
Bottom	ESGC	ESG	E	S	G
100%	5,75%	5,75%	5,75%	5,75%	5,75%
10	6,24%	6,25%	6,57%	6,29%	6,10%
15	6,09%	6,12%	6,39%	6,47%	6,13%
20	6,04%	5,99%	6,24%	6,29%	6,05%
25	6,00%	6,07%	6,22%	6,13%	5,99%

Table 96 : Mean and standard deviations of EU portfolios

Top	ESGC	ESG	E	S	G
100%	0,59%	0,59%	0,59%	0,59%	0,59%
10	0,62%	0,59%	0,62%	0,61%	0,57%
15	0,63%	0,61%	0,62%	0,65%	0,54%
20	0,63%	0,59%	0,61%	0,62%	0,58%
25	0,65%	0,55%	0,58%	0,57%	0,57%
Bottom	ESGC	ESG	E	S	G
100%	0,59%	0,59%	0,59%	0,59%	0,59%
10	0,63%	0,64%	0,52%	0,77%	0,93%
15	0,47%	0,70%	0,58%	0,64%	0,79%
20	0,53%	0,74%	0,58%	0,64%	0,72%
25	0,63%	0,76%	0,70%	0,71%	0,70%

Top	ESGC	ESG	E	S	G
100%	5,75%	5,75%	5,75%	5,75%	5,75%
10	6,37%	5,79%	5,79%	5,83%	5,61%
15	6,13%	5,84%	5,83%	5,72%	5,60%
20	5,95%	5,81%	5,98%	5,65%	5,76%
25	5,92%	5,77%	5,88%	5,73%	5,84%
Bottom	ESGC	ESG	E	S	G
100%	5,75%	5,75%	5,75%	5,75%	5,75%
10	6,31%	6,28%	6,56%	6,48%	6,10%
15	6,24%	6,12%	6,40%	6,14%	5,94%
20	6,04%	6,03%	6,35%	6,25%	5,93%
25	6,00%	6,08%	6,08%	6,09%	6,00%

Table 97 : Mean and standard deviations of Eu enhanced portfolios

Factors conversions

Another way is to convert the factors in euro and therefore do the analysis from an European point of view (Gluck and Al, 2020). The following formulas give long-short factors:

$$AMB_t^{EUR} = r_{A,t}^{EUR} - r_{B,t}^{EUR} = \left(\frac{A_t^{EUR}}{A_{t-1}^{EUR}} - 1\right) - \left(\frac{B_t^{EUR}}{B_{t-1}^{EUR}} - 1\right)$$

$$= \left(\frac{A_t^{USD} * USDEUR_t}{A_{t-1}^{USD} * USDEUR_{t-1}} - 1\right) - \left(\frac{B_t^{USD} * USDEUR_t}{B_{t-1}^{USD} * USDEUR_{t-1}} - 1\right) =$$

$$= \left(1 + r_{A,t}^{USD}\right)\left(1 + r_t^{USDEUR}\right) - \left(1 + r_{B,t}^{USD}\right)\left(1 + r_t^{USDEUR}\right)$$

$$= \left(1 + r_{i,t}^{USDEUR}\right) * \left(r_{A,t}^{USD} - r_{B,t}^{USD}\right)$$

where AMB is the short long factor A minus B, X_t^{YYY} is the factor X in currency YYY at time t associated to the $r_{X,t}^{YYY}$ return.

The market factor can be obtained by reversing the formula for euro returns and by taking into account the risk free rate:

$$ERM_t^{EUR} = (1 + RM_t^{USD}) * (1 + r_t^{USDEUR}) - 1 - rf_t^{EUR}$$

where RM_t^{USD} is the market return in USD.

Nevertheless, the two approaches have been applied on a euro stock sample and results in similar results.

2004 ESGC	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio - Change in factors									
ESG > 100%	2,20%	1,05	(0,26)	0,30	(0,06)	(0,19)	0,94	0,94	57,49
p value	0,07	0,00	0,00	0,00	0,58	0,04			
ESG > 90%	2,93%	1,03	(0,49)	0,47	(0,13)	(0,20)	0,88	0,87	74,19
p value	0,13	0,00	0,00	0,00	0,46	0,18			
ESG > 85%	3,07%	1,03	(0,46)	0,50	(0,07)	(0,19)	0,90	0,90	72,29
p value	0,07	0,00	0,00	0,00	0,64	0,14			
ESG > 80%	2,70%	1,04	(0,43)	0,43	(0,05)	(0,05)	0,91	0,91	71,09
p value	0,09	0,00	0,00	0,00	0,71	0,66			
ESG > 75%	2,09%	1,04	(0,40)	0,41	(0,02)	0,00	0,92	0,92	69,88
p value	0,16	0,00	0,00	0,00	0,89	0,97			
High Portfolio - Change in returns									
ESG > 100%	1,27%	1,09	(0,25)	0,21	(0,04)	(0,09)	0,96	0,96	57,49
p value	0,29	0,00	0,00	0,01	0,69	0,31			
ESG > 90%	1,77%	1,12	(0,46)	0,34	(0,09)	(0,00)	0,92	0,92	74,19
p value	0,36	0,00	0,00	0,01	0,60	0,99			
ESG > 85%	2,21%	1,09	(0,44)	0,40	(0,05)	(0,05)	0,93	0,93	72,29
p value	0,20	0,00	0,00	0,00	0,76	0,71			
ESG > 80%	1,90%	1,08	(0,42)	0,35	(0,04)	0,05	0,94	0,93	71,09
p value	0,24	0,00	0,00	0,00	0,80	0,69			
ESG > 75%	1,38%	1,07	(0,39)	0,34	(0,01)	0,07	0,94	0,94	69,88
p value	0,35	0,00	0,00	0,00	0,95	0,51			

Table 98 : Comparison of the two ajdustements on European stocks : change in factors or in returns

2004 ESGC	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	0,66%	1,03	(0,22)	0,21	0,03	(0,23)	0,97	0,97	56,96
p value	0,52	0,00	0,00	0,00	0,70	0,00			
ESG > 90%	1,02%	1,04	(0,40)	0,29	0,04	(0,02)	0,93	0,93	73,43
p value	0,52	0,00	0,00	0,01	0,76	0,89			
ESG > 85%	1,15%	1,03	(0,36)	0,31	0,06	(0,03)	0,94	0,94	71,74
p value	0,44	0,00	0,00	0,00	0,65	0,80			
ESG > 80%	1,44%	1,02	(0,34)	0,31	0,09	0,03	0,95	0,95	70,25
p value	0,27	0,00	0,00	0,00	0,42	0,79			
ESG > 75%	0,81%	1,02	(0,33)	0,29	0,11	(0,03)	0,95	0,95	68,84
p value	0,52	0,00	0,00	0,00	0,32	0,76			
Low Portfolio									
ESG < 10%	2,78%	1,05	0,34	0,15	(0,08)	(0,54)	0,90	0,90	17,96
p value	0,16	0,00	0,00	0,24	0,62	0,00			
ESG < 15%	2,36%	1,04	0,38	0,19	(0,07)	(0,50)	0,93	0,93	20,73
p value	0,15	0,00	0,00	0,08	0,63	0,00			
ESG < 20%	0,87%	1,05	0,36	0,16	(0,06)	(0,35)	0,93	0,93	23,32
p value	0,60	0,00	0,00	0,14	0,69	0,00			
ESG < 25%	0,47%	1,06	0,36	0,09	(0,08)	(0,33)	0,94	0,94	25,97
p value	0,75	0,00	0,00	0,33	0,51	0,00			
Long-short portfolio									
ESG - 10%	-1,75%	(0,01)	(0,74)	0,14	0,13	0,53	0,41	0,39	-
p value	0,37	0,72	0,00	0,27	0,46	0,00			
ESG - 15%	-1,21%	(0,01)	(0,73)	0,13	0,13	0,47	0,49	0,48	-
p value	0,45	0,72	0,00	0,22	0,36	0,00			
ESG - 20%	0,57%	(0,03)	(0,71)	0,15	0,15	0,37	0,48	0,47	-
p value	0,71	0,26	0,00	0,12	0,26	0,00			
ESG - 25%	0,34%	(0,04)	(0,68)	0,19	0,19	0,30	0,52	0,50	-
p value	0,80	0,14	0,00	0,03	0,10	0,00			

Table 99 : ESGC - Fama-French 5 factors results value weights (15 Y) – Europe

2004 ESG	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	0,66%	1,03	(0,22)	0,21	0,03	(0,23)	0,97	0,97	66,15
p value	0,52	0,00	0,00	0,00	0,70	0,00			
ESG > 90%	-0,38%	1,05	(0,41)	0,23	0,15	0,08	0,95	0,95	81,10
p value	0,76	0,00	0,00	0,01	0,17	0,41			
ESG > 85%	-0,13%	1,03	(0,41)	0,30	0,13	(0,11)	0,96	0,95	79,44
p value	0,92	0,00	0,00	0,00	0,24	0,24			
ESG > 80%	-0,06%	1,02	(0,39)	0,31	0,14	(0,12)	0,96	0,96	77,80
p value	0,95	0,00	0,00	0,00	0,16	0,13			
ESG > 75%	-0,06%	1,01	(0,37)	0,30	0,13	(0,10)	0,97	0,96	76,54
p value	0,96	0,00	0,00	0,00	0,17	0,20			
Low Portfolio									
ESG < 10%	2,65%	1,06	0,34	0,15	(0,08)	(0,53)	0,90	0,90	17,93
p value	0,18	0,00	0,00	0,22	0,63	0,00			
ESG < 15%	1,68%	1,05	0,38	0,17	(0,07)	(0,45)	0,92	0,92	20,68
p value	0,34	0,00	0,00	0,13	0,66	0,00			
ESG < 20%	1,07%	1,03	0,35	0,20	(0,02)	(0,40)	0,93	0,93	23,14
p value	0,51	0,00	0,00	0,05	0,89	0,00			
ESG < 25%	0,25%	1,06	0,40	0,13	(0,05)	(0,40)	0,94	0,94	25,49
p value	0,87	0,00	0,00	0,16	0,72	0,00			
Long-short portfolio									
ESG - 10%	-3,04%	(0,01)	(0,75)	0,07	0,23	0,61	0,42	0,41	-
p value	0,13	0,78	0,00	0,56	0,17	0,00			
ESG - 15%	-1,81%	(0,02)	(0,79)	0,13	0,19	0,34	0,48	0,47	-
p value	0,27	0,61	0,00	0,22	0,17	0,00			
ESG - 20%	-1,13%	(0,01)	(0,75)	0,11	0,16	0,28	0,50	0,49	-
p value	0,44	0,66	0,00	0,22	0,22	0,01			
ESG - 25%	-0,31%	(0,05)	(0,76)	0,17	0,18	0,30	0,60	0,59	-
p value	0,81	0,05	0,00	0,04	0,11	0,00			

Table 100 : ESG - Fama-French 5 factors results value weights (15 Y) – Europe

2004 E	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	0,71%	1,03	(0,23)	0,20	0,03	(0,22)	0,97	0,97	65,64
p value	0,48	0,00	0,00	0,00	0,72	0,00			
ESG > 90%	0,91%	1,03	(0,41)	0,30	(0,07)	(0,10)	0,94	0,93	83,72
p value	0,55	0,00	0,00	0,00	0,58	0,39			
ESG > 85%	0,59%	1,03	(0,39)	0,28	0,01	(0,09)	0,95	0,95	81,51
p value	0,65	0,00	0,00	0,00	0,92	0,33			
ESG > 80%	0,07%	1,03	(0,38)	0,31	0,09	(0,16)	0,96	0,96	79,64
p value	0,95	0,00	0,00	0,00	0,38	0,06			
ESG > 75%	0,11%	1,03	(0,37)	0,30	0,10	(0,15)	0,97	0,96	78,09
p value	0,92	0,00	0,00	0,00	0,30	0,07			
Low Portfolio									
ESG < 10%	0,16%	1,03	0,25	0,46	(0,02)	(0,68)	0,88	0,88	6,10
p value	0,95	0,00	0,02	0,00	0,92	0,00			
ESG < 15%	0,08%	1,04	0,24	0,40	(0,02)	(0,58)	0,91	0,91	7,91
p value	0,97	0,00	0,01	0,00	0,92	0,00			
ESG < 20%	0,80%	1,04	0,30	0,26	(0,14)	(0,52)	0,92	0,92	9,84
p value	0,65	0,00	0,00	0,02	0,36	0,00			
ESG < 25%	0,94%	1,04	0,25	0,29	(0,08)	(0,58)	0,93	0,93	12,34
p value	0,57	0,00	0,00	0,01	0,58	0,00			
Long-short portfolio									
ESG - 10%	0,75%	(0,00)	(0,66)	(0,16)	(0,06)	0,58	0,30	0,28	-
p value	0,74	0,95	0,00	0,28	0,78	0,00			
ESG - 15%	0,51%	(0,01)	(0,63)	(0,12)	0,03	0,49	0,36	0,34	-
p value	0,78	0,87	0,00	0,31	0,86	0,00			
ESG - 20%	-0,73%	(0,01)	(0,68)	0,05	0,23	0,36	0,45	0,43	-
p value	0,64	0,83	0,00	0,64	0,10	0,00			
ESG - 25%	-0,83%	(0,01)	(0,61)	0,01	0,18	0,44	0,47	0,45	-
p value	0,56	0,83	0,00	0,92	0,15	0,00			

Table 101 : E - Fama-French 5 factors results value weights (15 Y) – Europe

2004 S	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 90%	0,55%	1,03	(0,43)	0,18	0,22	(0,02)	0,95	0,95	86,12
p value	0,67	0,00	0,00	0,03	0,05	0,79			
ESG > 85%	-0,25%	1,03	(0,43)	0,19	0,15	(0,04)	0,96	0,96	83,88
p value	0,83	0,00	0,00	0,01	0,12	0,66			
ESG > 80%	-0,17%	1,02	(0,42)	0,27	0,17	(0,10)	0,96	0,96	81,81
p value	0,88	0,00	0,00	0,00	0,07	0,21			
ESG > 75%	-0,01%	1,01	(0,38)	0,28	0,15	(0,13)	0,96	0,96	80,46
p value	1,00	0,00	0,00	0,00	0,12	0,09			
Low Portfolio									
ESG < 10%	2,41%	1,07	0,27	0,23	(0,01)	(0,36)	0,90	0,90	17,22
p value	0,23	0,00	0,00	0,07	0,96	0,01			
ESG < 15%	1,56%	1,10	0,37	0,22	0,01	(0,55)	0,92	0,92	19,31
p value	0,40	0,00	0,00	0,06	0,96	0,00			
ESG < 20%	0,82%	1,09	0,38	0,18	0,00	(0,43)	0,93	0,93	21,54
p value	0,62	0,00	0,00	0,09	0,99	0,00			
ESG < 25%	0,67%	1,08	0,34	0,15	0,02	(0,42)	0,94	0,94	24,24
p value	0,67	0,00	0,00	0,13	0,87	0,00			
Long-short portfolio									
ESG - 100%	0,01%	(0,00)	0,00	(0,00)	(0,00)	0,00	0,22	0,19	-
p value	0,17	0,80	0,11	0,00	0,08	0,00			
ESG - 10%	-1,86%	(0,04)	(0,70)	(0,05)	0,23	0,34	0,36	0,35	-
p value	0,34	0,34	0,00	0,71	0,19	0,02			
ESG - 15%	-1,81%	(0,07)	(0,80)	(0,03)	0,15	0,51	0,51	0,50	-
p value	0,30	0,03	0,00	0,78	0,34	0,00			
ESG - 20%	-0,99%	(0,08)	(0,80)	0,10	0,17	0,32	0,55	0,54	-
p value	0,50	0,01	0,00	0,31	0,18	0,00			
ESG - 25%	-0,67%	(0,06)	(0,72)	0,13	0,12	0,29	0,51	0,49	-
p value	0,64	0,02	0,00	0,16	0,32	0,01			

Table 102 : S - Fama-French 5 factors results value weights (15 Y) – Europe

2004 G	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	0,66%	1,03	(0,22)	0,21	0,03	(0,23)	0,97	0,97	64,76
p value	0,52	0,00	0,00	0,00	0,70	0,00			
ESG > 90%	-0,06%	1,02	(0,33)	0,26	0,13	0,01	0,95	0,95	86,60
p value	0,96	0,00	0,00	0,00	0,25	0,90			
ESG > 85%	0,11%	1,03	(0,36)	0,29	0,06	(0,10)	0,95	0,95	84,37
p value	0,93	0,00	0,00	0,00	0,59	0,28			
ESG > 80%	0,45%	1,04	(0,35)	0,28	0,06	(0,11)	0,96	0,96	82,66
p value	0,72	0,00	0,00	0,00	0,56	0,24			
ESG > 75%	0,72%	1,03	(0,34)	0,28	0,09	(0,13)	0,96	0,96	81,17
p value	0,55	0,00	0,00	0,00	0,42	0,16			
Low Portfolio									
ESG < 10%	5,06%	1,03	0,10	0,03	(0,24)	(0,69)	0,90	0,90	18,25
p value	0,01	0,00	0,24	0,84	0,16	0,00			
ESG < 15%	4,74%	1,06	0,14	0,03	(0,17)	(0,59)	0,92	0,92	20,70
p value	0,01	0,00	0,08	0,80	0,26	0,00			
ESG < 20%	4,20%	1,04	0,15	0,02	(0,27)	(0,57)	0,93	0,93	23,03
p value	0,01	0,00	0,04	0,86	0,05	0,00			
ESG < 25%	2,63%	1,05	0,17	0,03	(0,27)	(0,42)	0,94	0,93	25,82
p value	0,09	0,00	0,02	0,77	0,04	0,00			
Long-short portfolio									
ESG - 10%	-5,12%	(0,00)	(0,43)	0,24	0,37	0,70	0,31	0,29	-
p value	0,01	0,94	0,00	0,07	0,04	0,00			
ESG - 15%	-4,63%	(0,03)	(0,50)	0,26	0,23	0,49	0,37	0,35	-
p value	0,01	0,44	0,00	0,02	0,12	0,00			
ESG - 20%	-3,75%	(0,00)	(0,50)	0,26	0,33	0,46	0,41	0,39	-
p value	0,01	0,87	0,00	0,01	0,01	0,00			
ESG - 25%	-1,91%	(0,02)	(0,51)	0,25	0,35	0,29	0,38	0,36	-
p value	0,19	0,49	0,00	0,01	0,01	0,01			

Table 103 : G - Fama-French 5 factors results value weights (15 Y) – Europe

2004 ESGC	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	2,16%	1,04	0,33	0,40	0,02	(0,34)	0,96	0,96	46,35
p value	0,09	0,00	0,00	0,00	0,88	0,00			
ESG > 90%	1,42%	1,06	(0,13)	0,46	0,06	(0,05)	0,94	0,94	72,77
p value	0,34	0,00	0,05	0,00	0,66	0,63			
ESG > 85%	1,96%	1,05	(0,08)	0,38	0,02	(0,02)	0,94	0,94	70,64
p value	0,18	0,00	0,20	0,00	0,89	0,85			
ESG > 80%	2,42%	1,04	(0,08)	0,35	(0,01)	(0,06)	0,95	0,95	68,81
p value	0,08	0,00	0,22	0,00	0,91	0,56			
ESG > 75%	2,06%	1,04	(0,05)	0,40	0,08	(0,05)	0,95	0,95	67,09
p value	0,11	0,00	0,36	0,00	0,51	0,61			
Low Portfolio									
ESG < 10%	4,43%	1,05	0,65	0,46	(0,08)	(0,50)	0,93	0,93	16,89
p value	0,01	0,00	0,00	0,00	0,61	0,00			
ESG < 15%	3,27%	1,03	0,65	0,49	(0,05)	(0,50)	0,95	0,94	19,66
p value	0,03	0,00	0,00	0,00	0,72	0,00			
ESG < 20%	2,49%	1,03	0,61	0,48	0,00	(0,53)	0,95	0,94	22,02
p value	0,10	0,00	0,00	0,00	1,00	0,00			
ESG < 25%	2,14%	1,05	0,60	0,41	0,02	(0,48)	0,95	0,95	24,10
p value	0,13	0,00	0,00	0,00	0,90	0,00			
Long-short portfolio									
ESG - 10%	-3,00%	0,00	(0,78)	0,01	0,13	0,45	0,51	0,49	-
p value	0,06	0,96	0,00	0,95	0,33	0,00			
ESG - 15%	-1,32%	0,02	(0,73)	(0,11)	0,06	0,48	0,54	0,53	-
p value	0,35	0,45	0,00	0,22	0,60	0,00			
ESG - 20%	-0,07%	0,01	(0,69)	(0,12)	(0,01)	0,47	0,58	0,56	-
p value	0,96	0,78	0,00	0,12	0,90	0,00			
ESG - 25%	-0,09%	(0,01)	(0,66)	(0,00)	0,06	0,43	0,60	0,59	-
p value	0,94	0,67	0,00	0,98	0,54	0,00			

Table 104 : ESGC - Fama-French 5 factors results equally weights (15 Y) – Europe

2004 ESG	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	2,16%	1,04	0,33	0,40	0,02	(0,34)	0,96	0,96	48,62
p value	0,09	0,00	0,00	0,00	0,88	0,00			
ESG > 90%	1,46%	1,07	(0,23)	0,44	0,08	(0,00)	0,95	0,95	79,43
p value	0,28	0,00	0,00	0,00	0,51	1,00			
ESG > 85%	1,85%	1,04	(0,21)	0,49	0,05	(0,15)	0,95	0,95	76,69
p value	0,18	0,00	0,00	0,00	0,69	0,15			
ESG > 80%	1,75%	1,05	(0,16)	0,43	0,02	(0,10)	0,95	0,95	74,45
p value	0,19	0,00	0,01	0,00	0,84	0,29			
ESG > 75%	1,67%	1,04	(0,11)	0,39	0,01	(0,08)	0,95	0,95	72,47
p value	0,20	0,00	0,07	0,00	0,90	0,42			
Low Portfolio									
ESG < 10%	4,21%	1,05	0,66	0,48	(0,06)	(0,48)	0,93	0,93	16,87
p value	0,02	0,00	0,00	0,00	0,68	0,00			
ESG < 15%	3,25%	1,03	0,65	0,48	(0,07)	(0,50)	0,95	0,95	19,70
p value	0,03	0,00	0,00	0,00	0,59	0,00			
ESG < 20%	2,64%	1,03	0,61	0,48	(0,00)	(0,54)	0,95	0,95	22,05
p value	0,08	0,00	0,00	0,00	1,00	0,00			
ESG < 25%	2,10%	1,04	0,61	0,40	0,01	(0,50)	0,95	0,95	24,11
p value	0,14	0,00	0,00	0,00	0,91	0,00			
Long-short portfolio									
ESG - 10%	-2,75%	0,01	(0,89)	(0,05)	0,14	0,48	0,53	0,52	-
p value	0,10	0,66	0,00	0,66	0,34	0,00			
ESG - 15%	-1,39%	0,01	(0,87)	0,00	0,12	0,36	0,59	0,58	-
p value	0,32	0,62	0,00	0,97	0,33	0,00			
ESG - 20%	-0,90%	0,01	(0,77)	(0,04)	0,02	0,44	0,62	0,61	-
p value	0,46	0,56	0,00	0,59	0,83	0,00			
ESG - 25%	-0,43%	(0,01)	(0,72)	(0,01)	0,00	0,43	0,66	0,65	-
p value	0,69	0,66	0,00	0,89	1,00	0,00			

Table 105 : ESG - Fama-French 5 factors results equally weights (15 Y) – Europe

2004 E	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	2,19%	1,04	0,29	0,37	0,00	(0,32)	0,96	0,95	47,70
p value	0,09	0,00	0,00	0,00	0,98	0,00			
ESG > 90%	2,80%	1,07	(0,13)	0,42	(0,24)	(0,14)	0,95	0,94	83,16
p value	0,07	0,00	0,06	0,00	0,07	0,20			
ESG > 85%	2,31%	1,06	(0,11)	0,43	(0,05)	(0,04)	0,95	0,95	80,49
p value	0,09	0,00	0,08	0,00	0,65	0,67			
ESG > 80%	1,45%	1,06	(0,08)	0,47	0,01	(0,11)	0,96	0,96	78,32
p value	0,27	0,00	0,15	0,00	0,91	0,24			
ESG > 75%	1,66%	1,05	(0,04)	0,46	0,04	(0,13)	0,96	0,96	76,07
p value	0,20	0,00	0,53	0,00	0,73	0,16			
Low Portfolio									
ESG < 10%	1,29%	1,05	0,55	0,71	0,02	(0,56)	0,93	0,93	4,10
p value	0,48	0,00	0,00	0,00	0,88	0,00			
ESG < 15%	1,22%	1,04	0,55	0,59	(0,02)	(0,49)	0,94	0,94	6,24
p value	0,45	0,00	0,00	0,00	0,88	0,00			
ESG < 20%	2,15%	1,04	0,62	0,51	(0,04)	(0,49)	0,95	0,95	8,35
p value	0,15	0,00	0,00	0,00	0,74	0,00			
ESG < 25%	2,30%	1,03	0,59	0,51	(0,01)	(0,60)	0,95	0,95	10,48
p value	0,12	0,00	0,00	0,00	0,91	0,00			
Long-short portfolio									
ESG - 10%	1,51%	0,02	(0,69)	(0,29)	(0,26)	0,41	0,44	0,42	-
p value	0,34	0,48	0,00	0,01	0,06	0,00			
ESG - 15%	1,09%	0,02	(0,66)	(0,16)	(0,03)	0,45	0,51	0,50	-
p value	0,41	0,44	0,00	0,07	0,78	0,00			
ESG - 20%	-0,70%	0,02	(0,71)	(0,04)	0,06	0,38	0,60	0,58	-
p value	0,55	0,38	0,00	0,60	0,57	0,00			
ESG - 25%	-0,65%	0,02	(0,63)	(0,05)	0,05	0,46	0,60	0,59	-
p value	0,55	0,39	0,00	0,50	0,58	0,00			

Table 106 : E - Fama-French 5 factors results equally weights (15 Y) – Europe

2004 S	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	2,20%	1,04	0,33	0,39	0,01	(0,34)	0,96	0,96	49,51
p value	0,09	0,00	0,00	0,00	0,94	0,00			
ESG > 90%	2,02%	1,03	(0,20)	0,36	0,12	0,09	0,95	0,95	84,39
p value	0,12	0,00	0,00	0,00	0,27	0,31			
ESG > 85%	1,61%	1,03	(0,15)	0,34	0,02	0,03	0,96	0,95	81,96
p value	0,20	0,00	0,01	0,00	0,84	0,73			
ESG > 80%	1,49%	1,03	(0,12)	0,41	0,08	(0,04)	0,96	0,95	79,55
p value	0,24	0,00	0,03	0,00	0,45	0,66			
ESG > 75%	1,72%	1,04	(0,05)	0,40	0,09	(0,05)	0,96	0,95	77,43
p value	0,18	0,00	0,43	0,00	0,40	0,56			
Low Portfolio									
ESG < 10%	4,53%	1,06	0,56	0,53	0,03	(0,46)	0,93	0,93	14,97
p value	0,01	0,00	0,00	0,00	0,84	0,00			
ESG < 15%	4,00%	1,06	0,65	0,47	0,02	(0,55)	0,94	0,94	17,90
p value	0,01	0,00	0,00	0,00	0,86	0,00			
ESG < 20%	2,69%	1,05	0,66	0,45	0,06	(0,43)	0,95	0,95	20,28
p value	0,07	0,00	0,00	0,00	0,63	0,00			
ESG < 25%	2,36%	1,04	0,64	0,41	0,02	(0,44)	0,95	0,95	22,42
p value	0,09	0,00	0,00	0,00	0,85	0,00			
Long-short portfolio									
ESG - 10%	-2,51%	(0,03)	(0,76)	(0,16)	0,09	0,55	0,53	0,52	-
p value	0,12	0,35	0,00	0,11	0,50	0,00			
ESG - 15%	-2,39%	(0,03)	(0,80)	(0,13)	(0,00)	0,58	0,59	0,58	-
p value	0,10	0,35	0,00	0,16	0,99	0,00			
ESG - 20%	-1,21%	(0,02)	(0,79)	(0,04)	0,02	0,39	0,62	0,61	-
p value	0,33	0,42	0,00	0,63	0,84	0,00			
ESG - 25%	-0,64%	0,00	(0,68)	(0,00)	0,07	0,39	0,60	0,58	-
p value	0,58	1,00	0,00	0,95	0,48	0,00			

Table 107 : S - Fama-French 5 factors results equally weights (15 Y) – Europe

2004 G	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	2,17%	1,04	0,33	0,40	0,01	(0,34)	0,96	0,96	50,40
p value	0,09	0,00	0,00	0,00	0,90	0,00			
ESG > 90%	0,68%	1,03	(0,04)	0,35	(0,07)	(0,27)	0,94	0,94	83,03
p value	0,65	0,00	0,57	0,00	0,57	0,02			
ESG > 85%	1,12%	1,04	(0,01)	0,35	(0,09)	(0,24)	0,95	0,94	80,02
p value	0,44	0,00	0,86	0,00	0,45	0,02			
ESG > 80%	2,06%	1,04	0,02	0,34	(0,08)	(0,26)	0,95	0,95	77,56
p value	0,14	0,00	0,78	0,00	0,52	0,01			
ESG > 75%	2,54%	1,04	0,07	0,32	(0,05)	(0,26)	0,96	0,95	75,38
p value	0,05	0,00	0,26	0,00	0,66	0,01			
Low Portfolio									
ESG < 10%	1,67%	1,03	0,50	0,35	(0,02)	(0,44)	0,93	0,93	16,62
p value	0,31	0,00	0,00	0,00	0,89	0,00			
ESG < 15%	2,06%	1,05	0,49	0,32	(0,11)	(0,45)	0,94	0,94	19,33
p value	0,18	0,00	0,00	0,00	0,40	0,00			
ESG < 20%	2,21%	1,03	0,50	0,40	(0,08)	(0,52)	0,94	0,94	21,89
p value	0,14	0,00	0,00	0,00	0,55	0,00			
ESG < 25%	1,75%	1,04	0,53	0,39	(0,06)	(0,44)	0,95	0,94	24,19
p value	0,24	0,00	0,00	0,00	0,66	0,00			
Long-short portfolio									
ESG - 10%	-0,99%	(0,00)	(0,54)	(0,00)	(0,06)	0,18	0,32	0,30	-
p value	0,51	0,87	0,00	0,96	0,67	0,10			
ESG - 15%	-0,94%	(0,00)	(0,50)	0,03	0,02	0,21	0,38	0,36	-
p value	0,45	0,95	0,00	0,68	0,88	0,02			
ESG - 20%	-0,14%	0,01	(0,48)	(0,06)	0,00	0,27	0,41	0,39	-
p value	0,90	0,64	0,00	0,42	0,99	0,00			
ESG - 25%	0,79%	(0,00)	(0,47)	(0,07)	0,01	0,19	0,40	0,38	-
p value	0,48	0,99	0,00	0,34	0,94	0,02			

Table 108 : G - Fama-French 5 factors results equally weights (15 Y) – Europe

2004 ESGC	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	0,66%	1,03	(0,22)	0,21	0,03	(0,23)	0,97	0,97	56,95
p value	0,52	0,00	0,00	0,00	0,71	0,00			
ESG > 90%	0,48%	1,08	(0,40)	0,34	0,12	(0,08)	0,90	0,89	75,60
p value	0,82	0,00	0,00	0,01	0,51	0,60			
ESG > 85%	0,97%	1,07	(0,40)	0,28	0,04	0,01	0,92	0,92	74,54
p value	0,57	0,00	0,00	0,01	0,79	0,95			
ESG > 80%	1,14%	1,04	(0,37)	0,29	0,06	(0,01)	0,93	0,93	73,03
p value	0,46	0,00	0,00	0,00	0,68	0,91			
ESG > 75%	1,46%	1,02	(0,35)	0,34	0,06	(0,06)	0,94	0,93	71,72
p value	0,33	0,00	0,00	0,00	0,63	0,56			
Low Portfolio									
ESG < 10%	0,68%	1,06	0,25	0,21	(0,07)	(0,47)	0,89	0,89	21,27
p value	0,75	0,00	0,01	0,12	0,68	0,00			
ESG < 15%	-0,23%	1,04	0,29	0,13	(0,31)	(0,52)	0,91	0,91	26,15
p value	0,90	0,00	0,00	0,30	0,06	0,00			
ESG < 20%	1,43%	0,99	0,14	0,16	(0,37)	(0,51)	0,91	0,91	30,48
p value	0,44	0,00	0,09	0,17	0,02	0,00			
ESG < 25%	1,01%	1,02	0,11	0,25	(0,05)	(0,39)	0,92	0,91	33,40
p value	0,57	0,00	0,16	0,03	0,76	0,00			
Long-short portfolio									
ESG - 10%	-0,20%	0,03	(0,65)	0,13	0,19	0,39	0,27	0,25	-
p value	0,93	0,53	0,00	0,36	0,33	0,02			
ESG - 15%	1,20%	0,03	(0,68)	0,15	0,34	0,53	0,38	0,37	-
p value	0,54	0,46	0,00	0,22	0,04	0,00			
ESG - 20%	-0,29%	0,05	(0,51)	0,12	0,43	0,50	0,35	0,33	-
p value	0,87	0,13	0,00	0,26	0,00	0,00			
ESG - 25%	0,45%	0,00	(0,46)	0,10	0,11	0,33	0,27	0,25	-
p value	0,78	0,89	0,00	0,37	0,44	0,01			

Table 109 : Enhanced ESGC - Fama-French 5 factors results value weights (15 Y) – Europe

2004 ESG	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	0,66%	1,03	(0,22)	0,21	0,03	(0,23)	0,97	0,97	66,14
p value	0,52	0,00	0,00	0,00	0,71	0,00			
ESG > 90%	0,57%	1,06	(0,41)	0,02	0,02	0,06	0,92	0,92	83,40
p value	0,72	0,00	0,00	0,87	0,86	0,63			
ESG > 85%	0,71%	1,06	(0,39)	0,14	0,07	0,02	0,94	0,94	82,22
p value	0,62	0,00	0,00	0,11	0,56	0,86			
ESG > 80%	0,29%	1,05	(0,41)	0,20	0,11	0,06	0,95	0,95	81,14
p value	0,82	0,00	0,00	0,02	0,34	0,54			
ESG > 75%	-0,23%	1,04	(0,41)	0,25	0,15	0,02	0,96	0,96	80,04
p value	0,85	0,00	0,00	0,00	0,14	0,81			
Low Portfolio									
ESG < 10%	0,92%	1,05	0,26	0,13	(0,12)	(0,49)	0,88	0,87	19,97
p value	0,68	0,00	0,01	0,38	0,53	0,00			
ESG < 15%	1,90%	1,03	0,36	0,11	(0,17)	(0,53)	0,91	0,91	23,23
p value	0,31	0,00	0,00	0,36	0,30	0,00			
ESG < 20%	2,46%	1,02	0,39	0,10	(0,20)	(0,52)	0,92	0,92	26,48
p value	0,14	0,00	0,00	0,34	0,18	0,00			
ESG < 25%	2,20%	1,06	0,31	0,07	(0,10)	(0,48)	0,92	0,92	29,69
p value	0,20	0,00	0,00	0,52	0,48	0,00			
Long-short portfolio									
ESG - 10%	-0,34%	0,01	(0,67)	(0,11)	0,15	0,55	0,27	0,25	-
p value	0,89	0,85	0,00	0,49	0,49	0,00			
ESG - 15%	-1,20%	0,03	(0,75)	0,04	0,24	0,55	0,41	0,40	-
p value	0,54	0,49	0,00	0,77	0,15	0,00			
ESG - 20%	-2,17%	0,03	(0,79)	0,10	0,31	0,57	0,52	0,51	-
p value	0,19	0,39	0,00	0,36	0,03	0,00			
ESG - 25%	-2,43%	(0,02)	(0,72)	0,18	0,26	0,50	0,49	0,48	-
p value	0,13	0,54	0,00	0,08	0,07	0,00			

Table 110 : Enhanced ESG - Fama-French 5 factors results value weights (15 Y) – Europe

2004 E	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	0,66%	1,03	(0,22)	0,21	0,03	(0,23)	0,97	0,97	64,00
p value	0,52	0,00	0,00	0,00	0,71	0,00			
ESG > 90%	1,00%	1,02	(0,39)	0,24	0,07	0,13	0,92	0,91	87,39
p value	0,55	0,00	0,00	0,03	0,62	0,30			
ESG > 85%	2,16%	1,00	(0,41)	0,24	(0,13)	(0,01)	0,93	0,93	84,87
p value	0,15	0,00	0,00	0,01	0,32	0,94			
ESG > 80%	1,57%	1,02	(0,38)	0,32	(0,07)	(0,11)	0,94	0,94	83,26
p value	0,29	0,00	0,00	0,00	0,60	0,32			
ESG > 75%	0,78%	1,02	(0,36)	0,32	0,02	(0,09)	0,95	0,95	81,71
p value	0,56	0,00	0,00	0,00	0,86	0,38			
Low Portfolio									
ESG < 10%	-0,90%	1,04	0,20	0,58	0,06	(0,54)	0,91	0,90	7,32
p value	0,66	0,00	0,03	0,00	0,74	0,00			
ESG < 15%	0,03%	1,03	0,23	0,50	0,02	(0,57)	0,91	0,91	10,09
p value	0,99	0,00	0,01	0,00	0,88	0,00			
ESG < 20%	0,58%	1,04	0,16	0,37	(0,10)	(0,58)	0,93	0,92	13,69
p value	0,74	0,00	0,04	0,00	0,52	0,00			
ESG < 25%	1,97%	1,02	0,16	0,22	(0,07)	(0,64)	0,92	0,92	18,05
p value	0,25	0,00	0,04	0,04	0,65	0,00			
Long-short portfolio									
ESG - 10%	1,90%	(0,02)	(0,59)	(0,34)	0,01	0,67	0,33	0,31	-
p value	0,41	0,62	0,00	0,02	0,94	0,00			
ESG - 15%	2,13%	(0,03)	(0,64)	(0,25)	(0,16)	0,56	0,34	0,33	-
p value	0,30	0,51	0,00	0,06	0,38	0,00			
ESG - 20%	0,99%	(0,02)	(0,54)	(0,05)	0,03	0,47	0,36	0,34	-
p value	0,55	0,57	0,00	0,63	0,82	0,00			
ESG - 25%	-1,19%	0,00	(0,52)	0,09	0,09	0,55	0,38	0,37	-
p value	0,47	0,97	0,00	0,38	0,54	0,00			

Table 111 : Enhanced E - Fama-French 5 factors results value weights (15 Y) – Europe

2004 S	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	0,66%	1,03	(0,22)	0,21	0,03	(0,23)	0,97	0,97	67,32
p value	0,52	0,00	0,00	0,00	0,71	0,00			
ESG > 90%	1,20%	1,06	(0,49)	(0,01)	(0,04)	0,07	0,92	0,91	88,98
p value	0,49	0,00	0,00	0,94	0,77	0,57			
ESG > 85%	1,11%	1,05	(0,47)	0,07	0,12	0,03	0,94	0,93	87,14
p value	0,45	0,00	0,00	0,44	0,34	0,75			
ESG > 80%	0,44%	1,03	(0,41)	0,18	0,20	(0,02)	0,95	0,95	85,65
p value	0,73	0,00	0,00	0,03	0,07	0,84			
ESG > 75%	0,07%	1,03	(0,42)	0,22	0,17	(0,09)	0,96	0,96	84,34
p value	0,95	0,00	0,00	0,00	0,10	0,30			
Low Portfolio									
ESG < 10%	2,14%	1,10	0,17	0,15	(0,08)	(0,48)	0,89	0,89	19,74
p value	0,32	0,00	0,08	0,29	0,69	0,00			
ESG < 15%	-0,69%	1,10	0,20	0,10	0,21	(0,32)	0,90	0,90	23,55
p value	0,73	0,00	0,03	0,41	0,22	0,03			
ESG < 20%	-0,30%	1,10	0,29	0,05	0,07	(0,47)	0,90	0,90	27,08
p value	0,88	0,00	0,00	0,69	0,66	0,00			
ESG < 25%	0,49%	1,09	0,17	0,09	0,17	(0,48)	0,92	0,92	29,77
p value	0,78	0,00	0,03	0,43	0,26	0,00			
Long-short portfolio									
ESG - 10%	-0,95%	(0,04)	(0,66)	(0,16)	0,03	0,55	0,29	0,27	-
p value	0,70	0,36	0,00	0,31	0,88	0,00			
ESG - 15%	1,80%	(0,05)	(0,67)	(0,03)	(0,09)	0,36	0,29	0,27	-
p value	0,40	0,25	0,00	0,82	0,64	0,02			
ESG - 20%	0,74%	(0,07)	(0,71)	0,13	0,13	0,45	0,40	0,38	-
p value	0,70	0,06	0,00	0,29	0,44	0,00			
ESG - 25%	-0,41%	(0,05)	(0,59)	0,14	0,01	0,38	0,37	0,36	-
p value	0,81	0,10	0,00	0,22	0,97	0,00			

Table 112 : Enhanced S - Fama-French 5 factors results value weights (15 Y) – Europe

2004 G	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	0,66%	1,03	(0,22)	0,21	0,03	(0,23)	0,97	0,97	64,74
p value	0,52	0,00	0,00	0,00	0,71	0,00			
ESG > 90%	-0,41%	0,99	(0,28)	0,29	0,28	(0,06)	0,92	0,92	89,21
p value	0,80	0,00	0,00	0,00	0,04	0,63			
ESG > 85%	-0,50%	1,01	(0,30)	0,26	0,19	0,05	0,95	0,95	87,25
p value	0,70	0,00	0,00	0,00	0,09	0,63			
ESG > 80%	0,25%	1,02	(0,31)	0,27	0,11	(0,07)	0,95	0,95	85,68
p value	0,85	0,00	0,00	0,00	0,31	0,46			
ESG > 75%	0,30%	1,03	(0,33)	0,29	0,09	(0,10)	0,96	0,96	84,12
p value	0,80	0,00	0,00	0,00	0,42	0,26			
Low Portfolio									
ESG < 10%	4,83%	1,04	0,11	0,08	(0,10)	(0,64)	0,90	0,90	19,66
p value	0,01	0,00	0,21	0,51	0,55	0,00			
ESG < 15%	3,91%	1,02	0,12	0,01	(0,26)	(0,51)	0,91	0,90	21,95
p value	0,03	0,00	0,16	0,90	0,10	0,00			
ESG < 20%	3,18%	1,03	0,07	(0,02)	(0,31)	(0,47)	0,92	0,91	26,11
p value	0,07	0,00	0,35	0,89	0,04	0,00			
ESG < 25%	2,91%	1,04	0,04	0,01	(0,28)	(0,53)	0,93	0,93	28,51
p value	0,07	0,00	0,62	0,91	0,04	0,00			
Long-short portfolio									
ESG - 10%	-5,24%	(0,04)	(0,39)	0,21	0,39	0,58	0,23	0,21	-
p value	0,02	0,34	0,00	0,15	0,05	0,00			
ESG - 15%	-4,41%	(0,01)	(0,42)	0,24	0,46	0,56	0,28	0,26	-
p value	0,02	0,87	0,00	0,05	0,01	0,00			
ESG - 20%	-2,93%	(0,00)	(0,39)	0,28	0,42	0,40	0,26	0,24	-
p value	0,10	0,94	0,00	0,01	0,01	0,00			
ESG - 25%	-2,61%	(0,01)	(0,37)	0,28	0,37	0,43	0,32	0,30	-
p value	0,09	0,78	0,00	0,01	0,01	0,00			

Table 113 : Enhanced G - Fama-French 5 factors results value weights (15 Y) – Europe

2004 ESGC	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	2,17%	1,04	0,33	0,40	0,01	(0,34)	0,96	0,96	46,29
p value	0,09	0,00	0,00	0,00	0,91	0,00			
ESG > 90%	2,15%	1,10	(0,09)	0,54	0,21	0,02	0,92	0,92	73,50
p value	0,24	0,00	0,26	0,00	0,18	0,88			
ESG > 85%	2,42%	1,09	(0,05)	0,53	0,17	(0,05)	0,94	0,94	71,52
p value	0,13	0,00	0,45	0,00	0,23	0,66			
ESG > 80%	2,13%	1,05	0,01	0,47	0,12	(0,03)	0,94	0,94	69,65
p value	0,15	0,00	0,84	0,00	0,34	0,75			
ESG > 75%	2,27%	1,04	0,04	0,47	0,10	(0,06)	0,94	0,94	67,77
p value	0,12	0,00	0,56	0,00	0,43	0,54			
Low Portfolio									
ESG < 10%	2,45%	1,03	0,48	0,40	(0,12)	(0,52)	0,93	0,93	16,00
p value	0,14	0,00	0,00	0,00	0,42	0,00			
ESG < 15%	2,50%	1,04	0,51	0,41	(0,10)	(0,57)	0,94	0,93	19,13
p value	0,13	0,00	0,00	0,00	0,47	0,00			
ESG < 20%	2,86%	1,03	0,52	0,37	(0,12)	(0,49)	0,94	0,94	21,64
p value	0,06	0,00	0,00	0,00	0,36	0,00			
ESG < 25%	2,97%	1,04	0,53	0,38	(0,09)	(0,42)	0,95	0,95	23,67
p value	0,04	0,00	0,00	0,00	0,49	0,00			
Long-short portfolio									
ESG - 10%	-0,30%	0,06	(0,57)	0,14	0,33	0,54	0,36	0,35	-
p value	0,87	0,08	0,00	0,24	0,04	0,00			
ESG - 15%	-0,07%	0,05	(0,57)	0,12	0,27	0,52	0,43	0,42	-
p value	0,96	0,11	0,00	0,24	0,04	0,00			
ESG - 20%	-0,73%	0,02	(0,50)	0,11	0,24	0,45	0,48	0,46	-
p value	0,55	0,40	0,00	0,18	0,02	0,00			
ESG - 25%	-0,70%	0,00	(0,49)	0,09	0,19	0,35	0,46	0,44	-
p value	0,55	0,83	0,00	0,22	0,07	0,00			

Table 114 : Enhanced ESGC - Fama-French 5 factors results equal weights (15 Y) – Europe

2004 ESG	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	2,17%	1,04	0,33	0,40	0,01	(0,34)	0,96	0,96	48,55
p value	0,09	0,00	0,00	0,00	0,91	0,00			
ESG > 90%	2,83%	1,09	(0,20)	0,23	(0,07)	0,09	0,93	0,93	79,50
p value	0,08	0,00	0,01	0,03	0,62	0,45			
ESG > 85%	3,84%	1,08	(0,16)	0,39	0,02	(0,04)	0,94	0,94	77,34
p value	0,01	0,00	0,02	0,00	0,86	0,74			
ESG > 80%	3,26%	1,06	(0,09)	0,46	0,12	(0,01)	0,95	0,95	75,31
p value	0,02	0,00	0,14	0,00	0,33	0,95			
ESG > 75%	2,13%	1,05	(0,05)	0,45	0,08	(0,02)	0,95	0,95	73,17
p value	0,12	0,00	0,47	0,00	0,49	0,87			
Low Portfolio									
ESG < 10%	2,26%	1,03	0,47	0,39	(0,13)	(0,53)	0,93	0,93	15,87
p value	0,18	0,00	0,00	0,00	0,36	0,00			
ESG < 15%	2,86%	1,04	0,53	0,40	(0,11)	(0,57)	0,94	0,93	18,68
p value	0,08	0,00	0,00	0,00	0,44	0,00			
ESG < 20%	3,36%	1,04	0,55	0,35	(0,12)	(0,48)	0,94	0,94	20,99
p value	0,03	0,00	0,00	0,00	0,36	0,00			
ESG < 25%	3,50%	1,04	0,55	0,35	(0,11)	(0,45)	0,95	0,95	23,08
p value	0,02	0,00	0,00	0,00	0,38	0,00			
Long-short portfolio									
ESG - 10%	0,57%	0,06	(0,67)	(0,17)	0,06	0,62	0,39	0,37	-
p value	0,76	0,09	0,00	0,17	0,70	0,00			
ESG - 15%	0,98%	0,04	(0,69)	(0,01)	0,13	0,53	0,47	0,45	-
p value	0,54	0,20	0,00	0,90	0,33	0,00			
ESG - 20%	-0,09%	0,03	(0,64)	0,12	0,24	0,47	0,52	0,50	-
p value	0,95	0,32	0,00	0,18	0,05	0,00			
ESG - 25%	-1,37%	0,01	(0,60)	0,10	0,19	0,43	0,51	0,50	-
p value	0,28	0,58	0,00	0,22	0,08	0,00			

Table 115 : Enhanced ESG - Fama-French 5 factors results equal weights (15 Y) – Europe

2004 E	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	2,16%	1,04	0,33	0,40	0,01	(0,34)	0,96	0,96	43,27
p value	0,09	0,00	0,00	0,00	0,92	0,00			
ESG > 90%	3,59%	1,07	(0,05)	0,40	(0,06)	(0,00)	0,94	0,94	84,59
p value	0,02	0,00	0,47	0,00	0,63	0,98			
ESG > 85%	3,66%	1,05	(0,04)	0,42	(0,13)	0,01	0,96	0,95	81,51
p value	0,01	0,00	0,51	0,00	0,26	0,88			
ESG > 80%	2,98%	1,06	0,05	0,47	(0,06)	(0,06)	0,95	0,95	78,82
p value	0,04	0,00	0,47	0,00	0,61	0,53			
ESG > 75%	2,74%	1,05	0,08	0,47	0,01	(0,05)	0,95	0,95	76,55
p value	0,04	0,00	0,20	0,00	0,92	0,63			
Low Portfolio									
ESG < 10%	0,73%	1,09	0,54	0,65	(0,01)	(0,40)	0,92	0,91	4,10
p value	0,72	0,00	0,00	0,00	0,98	0,01			
ESG < 15%	1,27%	1,06	0,55	0,65	0,05	(0,48)	0,93	0,92	5,93
p value	0,49	0,00	0,00	0,00	0,77	0,00			
ESG < 20%	1,72%	1,06	0,52	0,52	(0,09)	(0,50)	0,94	0,94	7,89
p value	0,29	0,00	0,00	0,00	0,51	0,00			
ESG < 25%	2,50%	1,03	0,51	0,46	(0,08)	(0,52)	0,95	0,95	10,13
p value	0,09	0,00	0,00	0,00	0,55	0,00			
Long-short portfolio									
ESG - 10%	2,86%	(0,01)	(0,59)	(0,25)	(0,06)	0,39	0,34	0,32	-
p value	0,12	0,69	0,00	0,03	0,71	0,00			
ESG - 15%	2,39%	(0,01)	(0,59)	(0,22)	(0,18)	0,50	0,41	0,39	-
p value	0,14	0,74	0,00	0,03	0,21	0,00			
ESG - 20%	1,26%	0,00	(0,47)	(0,05)	0,03	0,44	0,39	0,37	-
p value	0,36	0,96	0,00	0,53	0,78	0,00			
ESG - 25%	0,23%	0,02	(0,43)	0,01	0,09	0,47	0,43	0,42	-
p value	0,85	0,34	0,00	0,86	0,39	0,00			

Table 116 : Enhanced E - Fama-French 5 factors results equal weights (15 Y) – Europe

2004 S	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	2,16%	1,04	0,33	0,40	0,01	(0,34)	0,96	0,96	49,43
p value	0,09	0,00	0,00	0,00	0,92	0,00			
ESG > 90%	2,45%	1,05	(0,15)	0,41	0,11	0,18	0,93	0,93	84,77
p value	0,12	0,00	0,04	0,00	0,41	0,11			
ESG > 85%	1,72%	1,05	(0,08)	0,38	0,20	0,10	0,94	0,94	82,03
p value	0,24	0,00	0,23	0,00	0,13	0,36			
ESG > 80%	1,86%	1,05	(0,01)	0,39	0,18	0,12	0,95	0,94	79,52
p value	0,18	0,00	0,88	0,00	0,13	0,23			
ESG > 75%	1,84%	1,04	0,04	0,41	0,13	0,04	0,95	0,95	77,58
p value	0,18	0,00	0,55	0,00	0,27	0,71			
Low Portfolio									
ESG < 10%	3,77%	1,05	0,41	0,51	(0,07)	(0,40)	0,92	0,92	14,00
p value	0,05	0,00	0,00	0,00	0,65	0,00			
ESG < 15%	3,47%	1,05	0,51	0,52	0,05	(0,46)	0,93	0,93	16,81
p value	0,05	0,00	0,00	0,00	0,74	0,00			
ESG < 20%	3,35%	1,06	0,54	0,43	0,01	(0,53)	0,94	0,94	19,60
p value	0,04	0,00	0,00	0,00	0,97	0,00			
ESG < 25%	3,52%	1,05	0,51	0,38	0,01	(0,49)	0,95	0,95	21,91
p value	0,02	0,00	0,00	0,00	0,92	0,00			
Long-short portfolio									
ESG - 10%	-1,32%	(0,00)	(0,56)	(0,10)	0,19	0,59	0,34	0,33	-
p value	0,49	0,91	0,00	0,40	0,26	0,00			
ESG - 15%	-1,75%	(0,01)	(0,59)	(0,14)	0,15	0,56	0,42	0,40	-
p value	0,30	0,83	0,00	0,21	0,32	0,00			
ESG - 20%	-1,50%	(0,01)	(0,55)	(0,04)	0,18	0,65	0,48	0,46	-
p value	0,31	0,76	0,00	0,66	0,17	0,00			
ESG - 25%	-1,68%	(0,02)	(0,47)	0,03	0,12	0,52	0,48	0,46	-
p value	0,18	0,52	0,00	0,69	0,28	0,00			

Table 117 : Enhanced S - Fama-French 5 factors results equal weights (15 Y) – Europe

2004 G	a	RM-RF	SMB	HML	RMW	CMA	R2	AdjR2	ESG
High Portfolio									
ESG > 100%	2,17%	1,04	0,33	0,40	0,01	(0,34)	0,96	0,96	50,32
p value	0,09	0,00	0,00	0,00	0,91	0,00			
ESG > 90%	0,95%	1,03	0,12	0,26	0,04	(0,23)	0,92	0,91	83,14
p value	0,59	0,00	0,15	0,02	0,77	0,08			
ESG > 85%	1,29%	1,01	0,14	0,31	(0,02)	(0,22)	0,94	0,94	80,56
p value	0,38	0,00	0,04	0,00	0,87	0,04			
ESG > 80%	1,51%	1,03	0,18	0,37	0,00	(0,27)	0,94	0,94	78,12
p value	0,30	0,00	0,01	0,00	0,97	0,01			
ESG > 75%	2,04%	1,04	0,19	0,39	0,02	(0,28)	0,95	0,95	75,84
p value	0,15	0,00	0,00	0,00	0,90	0,01			
Low Portfolio									
ESG < 10%	1,41%	1,04	0,44	0,37	0,08	(0,39)	0,93	0,93	16,40
p value	0,40	0,00	0,00	0,00	0,60	0,00			
ESG < 15%	1,71%	1,04	0,44	0,30	(0,06)	(0,36)	0,94	0,94	18,74
p value	0,27	0,00	0,00	0,00	0,66	0,00			
ESG < 20%	2,07%	1,03	0,42	0,27	(0,21)	(0,39)	0,94	0,94	21,33
p value	0,17	0,00	0,00	0,01	0,11	0,00			
ESG < 25%	1,88%	1,03	0,42	0,33	(0,15)	(0,48)	0,95	0,95	23,39
p value	0,19	0,00	0,00	0,00	0,23	0,00			
Long-short portfolio									
ESG - 10%	-0,47%	(0,00)	(0,33)	(0,11)	(0,03)	0,16	0,11	0,09	-
p value	0,80	0,92	0,00	0,34	0,84	0,23			
ESG - 15%	-0,42%	(0,02)	(0,30)	0,01	0,04	0,14	0,16	0,13	-
p value	0,77	0,41	0,00	0,94	0,76	0,18			
ESG - 20%	-0,56%	(0,00)	(0,24)	0,10	0,21	0,12	0,16	0,13	-
p value	0,66	0,94	0,00	0,19	0,05	0,20			
ESG - 25%	0,16%	0,01	(0,22)	0,06	0,17	0,20	0,19	0,17	-
p value	0,89	0,72	0,00	0,42	0,08	0,01			

Table 118 : Enhanced G - Fama-French 5 factors results equal weights (15 Y) - Europe

I. Conclusion

XII - List of figures

XIII - List of tables

XIV – Executive summary

Sustainable finance has gained strength in the financial community during the last years as shown by growing assets (GSIA, 2018), growing flows (Hale, 2019) and growing investors' concerns (Schroders, 2019). A centerpiece of sustainable finance is the sustainability assessment of firms in order to identify sustainable companies. ESG ratings are an easily understandable way to perform this assessment and became popular during the last years.

However, ESG ratings suffer from many drawbacks. Some studies reported a lack of consensus between agencies (Chatterji et al., 2015, Dorfleitner et al., 2015 and Berg et al., 2019). Other studies have found biases such as the political influence (Di Giuli and Kostovetsky, 2014), the location (Baldini et al., 2018) and the size (Drempetic et al., 2019). Furthermore, there is currently a lack of regulation. In fact, ratings are mainly derived from non-audited and self-reported information (Financial Times, 2020e).

This thesis aims at studying the reliability of ratings through three complementary research questions. The first research question showed that, despite an overall agreement on the SRI definition, ESG rating is a relative concept specific to each agency as reflected by different methodologies and purposes. This indicates a possible complementary effect between agencies. The second research question confirmed a size and a location effect and provided indications of a learning effect. Build upon the result of the second research question, the third research question has shown that portfolios of high and low ESG ratings are neither associated with overperformance nor with underperformance. Besides, this question has shown that ESG ratings could not reproduce findings on specific pillar components (such as employees and customer satisfaction).

Taking together, results have implications for ESG agencies, investors and firms. First, the reliability of agencies is questioned by the results of the second and third research questions. However, the consolidation trends and the introduction of regulation may push for more consensus between agencies. Investors should select their rating agencies carefully due to the lack of consensus and be aware that potential biases could lead to exposure to certain risk factors. Firms should take into account these growing sustainable concerns which could reduce the cost of capital if they are well integrated. Besides, firms may have to comply with stricter non-financial reporting rules in the coming years. Overall, this thesis raises concerns about the reliability of ratings and pointed out that they should be used carefully.

Keywords: Sustainable finance, ESG ratings, Panel regressions, Multi-factor models.