The relationship between corporate social performance and financial performance of European listed companies.

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2 Executive summary

Environmental, social and governance concerns are gaining ground recently and the growing amount of available data enables investors to integrate these issues in their investment strategies. Since a few years, the popularity of these ESG criteria are translated in a growing number of assets under management incorporating ESG criteria in Europe and in the rest of the world. With regard to the growing popularity amongst investors, research analysed the relationship between corporate social performance and financial performance and found a weak but positive relationship between both aspects of the firm.

This thesis will try to contribute to the existing literature by analysing the relationship between CSP and CFP in European companies over the period 2007-2015. In order to perform the analysis, the Thomson-Reuters ASSET-4 database will be used as they provide a complete set of ESG data. The methodology that will be used consists of the repartition of all the stocks with ESG coverage in portfolios on the basis of their ESG score. Thereafter, the relationship will be analysed using least square regression analysis.

The findings of this paper indicates that European markets are rewarding moderate levels of corporate social performance better than low and high levels of ESG. The uncertainty over the ability of firms to combine both projects to improve their societal impact and future growth seems to prevent markets from rewarding top performers. The knowledge of the optimal level of corporate social performance permitted the creation of an investment strategy. From an accounting point of view, this thesis shows that firms with high levels of ESG are able to achieve a return on equity that is three times higher than companies with very low levels of ESG.

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5 Lexique

SRI	Social Responsible Investment
CSR	Corporate Social Responsibility
CSP	Corporate Social Performance
CFP	Corporate Financial Performance
ESG	Environmental, Social & Governance
CAGR	Compounded annual growth rate
VIF	Variance inflation factor
CI	Condition Index
AIC	Akaike Information Criterion
SIC	Schwarz Information Criterion

6 Introduction

The financial world is showing increased interest for investment opportunities in responsible businesses (Eccles, Serafeim & Krzus, 2011). A lot of people, inclusive investors, want to incorporate their social conscience in their daily activities and do not want to be associated with firms that are discriminating when hiring new employees, use animals to perform tests or pollute more than necessary. This growing demand for social responsible practices in business has an impact on various market players :

Firstly, management teams are facing a dilemma about the right use of resources. Should resources be devoted to the improvement of the firm's impact on society or should the available cash be spent on projects creating value for the shareholders? Besides, disclosures about these environmental, social and governance topics are a requirement that can't be omitted anymore without facing the risk that the firm's reputation could be affected (Feldman & Lynch, 1988). In 2011, a large part of the Fortune 1.000 corporations were already disclosing information about their corporate social practices on a regular basis to respond to the growing demand for more transparency in the firm's actions to manage its societal impact (El Ghoul, Guedhami, Kwok & Mishra, 2011).

Secondly, the growing concerns of investors about the environmental, social and governance (ESG) dimension of their investments are translated into a larger number of socially responsible assets under management. According to the 2014 European SRI study published by Eurosif[1], responsible investments can be divided into seven[2] main investment strategies accounting for a total of EUR 9,88 trillion at the end of 2013. This represents 59,91% of the total EUR 16,5 trillion (EFAMA, 2014) assets under management in Europe. In comparison, social responsible investments at the end of 2011 accounted for EUR 6,76 trillion of the EUR 13,9 trillion assets under management in Europe [3] (Social responsible investment grew at a CAGR of 20,89% between end 2011 and end 2013). At the end of 2013, EUR 5,23 trillion were invested using ESG integration. All investment strategies under investigation showed positive CAGR between 2011 and 2013. All numbers with regard to the different strategies are visible in appendix A.

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[1] The full report is available on http://issuu.com/eurosif/docs/eurosif_sri_study_low-res__v1.1_revised_/15?e=0/1400727

[2] Exclusion, Norms-based screening, Best-in-Class selection, Sustainability themed, ESG integration, Engagement and voting & Impact investing.

[3] The 2012 report isavailablle on http://www.eurosif.org/publication/european-sri-study-2012/

When looking at the U.S. market for responsible investments, similar conclusions can be drawn. According to the 2014 report issued by USSIF[4], nearly 18% of the $36,8 trillion under management in the United States at the end of 2014 were invested following responsible investment strategies. SRI accounted for almost 20% of all investments in 2014 while it was only 10% back in 1998 (Hutton & D'Antonio, 1998). ESG criteria are becoming increasingly important in the development of investment strategies. Indeed, ESG based strategies accounted for $4,8[5] trillion of all the assets under management in the United States in 2014.

Thirdly, financial information providers are also taking advantage of the demand for more transparency. Some of the biggest financial information providers have recently set up entire departments to meet the demand of investors and customers for information about how respectful of society companies really are. Examples are the ASSET4 database of Thomson Reuters or the KLD database of Bloomberg.

Lastly, customers are also incorporating the ESG dimension when deciding to buy a product over another because one producer is more respectful of the environment than his competitor or because the firm does not make use of child labour.

In this context, this paper will try to contribute to the existing literature that analysed the relationship between the corporate social performance and their financial performance. This thesis will differ from other papers that analysed the performance of social responsible investment funds that were using responsible investment strategies. To do this multiple portfolios with different levels of ESG performance will be created and their performance will be analysed. This will ensure that all portfolios are created using the same screening methodology and the drawback of analysing fund performance will be addressed. Indeed, different funds are using different screening criteria when investing sustainably. Therefore, the comparison of returns achieved by each of these funds could lead to contradicting results depending on the type of screens used by the fund when selecting stocks. Another point that differentiates this paper from others is the focus on European companies. While the percentage of assets under management invested according to social responsible investment strategies is really large in Europe, existing literature on the subject tends to favour research outside the old continent. A last point has regard to the CSP measurement. The analysis will incorpore all dimensions of ESG (i.e. environmental, social & governance) instead of focusing on one single aspect of corporate social performance as frequently done before.

[4] USSIF: The forum for Sustainable and Responsible Investment
[5] Increase of 77% since 2012.

The following hypothesis will be tested :

The main research question of this thesis is the following : « Are investments in corporate social performance beneficial ?». To structure the analysis, the following division of the main question will be made:

1. Are social responsible companies better investment targets than companies that are not investing in corporate social activities ?
2. Are social responsible companies achieving better accounting-based performances ?

This paper will be organized as follows. Firstly, a review of the existing literature regarding corporate social performance will be made. After reviewing the theoretical aspects of corporate social performance, the data collected in order to test the relationship will be described. Thereafter, the methodology used to process the data will also be discussed. Going forward, the results and the interpretation of the different tests will be summarized. Using everything that was learned about the relationship between CSP and CFP, an investment strategy will be tested to see whether it is possible to make money based on ESG integration. A last part will be dedicated to the conclusion, limitation and recommendation for further research.

7 Literature Review

This section will be dedicated to the enumeration of the literature review. The following subjects will be discussed. First, the theoretical framework in which corporate social responsibility occurs will be described. Then arguments in favour and against corporate social activities will be given. Afterwards a review will be made of past research that tested the relationship between corporate social performance and market return before finishing with past papers that tested the relationship between CSP and accounting-based profitability measures.

7.1 Corporate social responsibility and corporate social performance

The pyramid of corporate social responsibility as depicted by Carroll (1991) draws one of the most complete picture of corporate social responsibility (CSR). CSR encompasses simultaneously 4 types of responsibilities that are economic responsibility, legal responsibility, ethical responsibility and philanthropic responsibility. The idea behind corporate social responsibility is that being profitable while respecting the limits set by the law is not enough. A firm must behave according to the standards set by society but it also has to be involved in the improvement of society in which it is active. There has always been a discussion about whether a firm could justify expenses made to contribute to the well-being of a larger group of stakeholders than the sole shareholders. The European Commission decided, recently, to actively contribute to the debate by releasing a Green paper, called « Promoting an European framework for Corporate Social Responsibility »[6], whereby they acknowledged the usefulness of an open debate about CSR. This Green Paper defined CSR as a concept in which : « Companies have to integrate social, environmental and governance in their business operations and in their interaction with their stakeholders into their activities and in their relationship with stakeholders on a voluntary basis » (European Commission, 2002). The debate about voluntary contribution of companies to the welfare of society was already going on years before this paper was released by the European Commission. Corporate social responsibility is a long-standing debate between two opposing views on the role of a firm. Advocates of corporate social responsibility agree with Freeman's stakeholder[7] approach of a firm.

When it comes down to maximizing the value of the company, a manager should take into account the interest of all stakeholders (Jensen, 2001; Freeman, 1984). Undeniably, all stakeholders

[6] Available on the following link: http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52001DC0366&from=EN

[7] Definition of stakeholder:"those groups without whose support the organization would cease to exist" or "Any group or individual who can affect or is affected by the achievement of the organization's objectives" (Freeman, 1984)

are of intrinsic value and no one can be omitted as some stakeholders could put the viability of the company in danger if their interest would not be dealt well (Dill, 1958). Moreover, Narver (1971) stated that the firm has to adapt itself to the demands arising from all stakeholders in order to maximize the present value of the firm if it wants to ensure its welfare in the long run. Would it fails, then, investors could lose confidence in the ability of the firm to avoid sanctions undermining future financial results. For example, a company that systematically pollutes more than permitted or fails to offer equal chances to men and women could be fined by the government leading to a decrease of the profitability. The European Commission (2002) believes that not only the financial situation of the firm at the micro-economic level is at stake as described by Dill, Freeman and Narver but also the macroeconomic situation of the European Union.

The definition of CSR proposed by Caroll and the view of Freeman on the wide range of stakeholders that should be considered by a firm are in total opposition with Friedman (1970) and other detractors' view on what corporate social responsibility should actually mean to a management team : « 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, 1970). According to Friedman, the last 2 layers[8] of the pyramid of corporate social responsibility as set by Carroll are a waste of resources that are not in line with the mandate given by the shareholders to the managers of companies. Indeed, shareholders are only interested in the maximization of the stock price and will rather be opposed to projects that are not adding value to the company. According to Friedman, only the interests of shareholders should be taken into account, omitting all other stakeholders.

These two opposing views on what it actually means to be socially performing are the real issue of social responsibility. Should a company rather engage in activities that maximize the value to its shareholders and ignore all other stakeholders or should it consider all interests at stake to improve its impact on society?

[8] Ethical and philanthropic responsibilities

7.2 Is corporate social performance creating value ?

Before the in-depth discussion of the existing literature about the relationship between corporate social performance and corporate financial performance, it is important to note that all these studies tried to categorize this relationship in one of the three following categories :

- Positive relationship : Improving the firm's corporate social performance will positively influence the financial performance.
- Negative relationship : Efforts made to improve the firm's social responsibility will lead to a decrease in forthcoming financial performance.
- Neutral relationship : Improvement of the CSP will neither systematically improve or decrease the financial performance.

To explain the sign of the relationship, many arguments in favour of one of them have been exposed over the years. The following section will describe these arguments.

7.3 Evidence supporting a positive relationship

Engaging in activities that aim to increase the firm's corporate social performance is likely to have an indirect positive impact on many stakeholders of the company (Murray and Vogel, 1997). Actually, a good management of stakeholders has proven to have a positive influence on the financial performance measured by return on equity and return on assets (Berman, Wicks & Kotha, 1999). In fact, Hillman and Keim (2001) defined stakeholders as : « Intangible, valuable assets which can be sources of competitive advantages.» Improvement of the relationship with stakeholders will ultimately lead to a competitive advantage in comparison to firms that consider the maximization of shareholder value as the sole objective as defined by Friedman (1970). Therefore, the growing concerns about environmental, social and governance issues are affecting a larger number of people and a better consideration of these issues is likely to satisfy various groups of stakeholders. An example could be the ability of the firm to anticipate future restrictions imposed by government and avoid fines due to the violation of the regulations. Because the firm do not consider the shareholders as the unique stakeholders that matter when maximizing the value of the company, the management team decreases the probability of being fined which will finally contribute to the long-term maximization of the firm's value.

Furthermore, a superior level of corporate social responsibility achieved through higher corporate social performance may improve the image and the reputation of the company towards customers (Andersen & Skjoett-Larsen, 2009; McGuire, Sundgren & Schneeweis, 1988). In the

same idea, management teams should pay attention to all possible associations that could occur in a customer's mind. A good CSR-image could improve the way customers evaluate the firm's products (Brown and Dacin, 1997) and increase the buying intention of people. Additional information, such as provided by corporate social disclosure, is often used when the decision whether to buy or not could not be made on the basis of the pure product's attribute such as value and quality (Feldman & Lynch, 1988). The fact that the makers of a particular product are perceived by customers as socially responsible is becoming a determinant criteria that could favour the acquisition of a product over another (Brønn and Vrioni, 2001 ; Perez, 2009). A good corporate reputation also has an impact on the profitability of a company and more particularly on lasting profitability (Roberts and Dowling, 2002).

An improved reputation could also influence employees' future career moves as working conditions may be better in more responsible companies giving these firms of good repute a competitive advantage in attracting more talented and better skilled workforce (Dowling, 1986). Another benefit associated with the firm's corporate social performance is the increased coverage received by these socially performing companies. Indeed, the time spent by analysts to the analyse of firms is higher for stocks of good repute than the time spent on « sin » companies meaning that more responsible businesses receive more attention from investors and are more often in the highlight than less social performing stocks (Hong and Kacperczyk, 2009).

The funding cost of the firm could also be influenced by the corporate social performance. Firstly, social responsible companies are in a better position to decrease their cost of equity in comparison to peers with lower levels of CSP (El Ghoul et al., 2011). This can be explained by the lower risk associated with stocks that are socially responsible. Secondly, the cost of debt can also be influenced in a positive manner by corporate social performance. Firms that performed better in the corporate social dimension are apparently able to draw funds from the fixed-income market at lower rates. These findings are particularly relevant when long-term debt was considered (Oikonomou, Brooks and Pavelin, 2011). Effects of social performance result in a lower cost of capital which ultimately affects the value of the company in the eyes of potential investors.

CSP's influence on stakeholders is also translated into many other ways : The fact that a company is socially performing could be a sign of superior management as the difficulty to combine market strategies with non-market strategies would prevent firms with less efficient management to engage in corporate social activities (Alexander and Buchholz, 1978 ; Baron, 2003). Moreover, the modern stakeholder theory of Shapiro and Cornell (1987) stated that the true value of a company does not only depend on the explicit claims but also on the implicit claims arising from certain stakeholders. Other benefits could be the improved capacity to deal with future rigorous

rules from government and the greater ability to enter long-term relationships with suppliers and customers who consider the social aspect as very important.

To conclude, corporate performance seems to influence firm performance mainly through higher reputation. It has to be acknowledged that CSP is not the only factor that determines the firm's reputation but a good level of CSP contributes significantly to the improvement of this latter.

7.4 Evidence supporting a negative relationship :

The existing literature, on positive impacts associated with high levels of corporate social responsibility, is very large and was probably not all enumerated in the previous section. On the contrary, evidence about possible disadvantages of being engaged in projets to improve the corporate social responsibility is scarce. Nevertheless, the following has been found:

The most discussed issue about CSP is the uncertainty, about the firm's ability to sustain future growth, created by the costs incurred to improve the company's CSP. The more money spent on CSR, the less money available to engage in value-creating projects. The difficulty with the analysis of possible drawbacks of engaging in corporate social responsibility relies on the measurement of the effective cost of corporate social activities. There are so many different ways to improve a firm's social impact that the associated cost cannot be generalized and is therefore difficult to apprehend.

Nevertheless, Sen and Bhattacharya (2001) stated that even if CSP generally improves the way people perceive a firm, it could also have a disastrous impact. Would the majority of customers believe that CSR initiatives are made at the cost of the future ability to manufacture quality products, sales would be negatively impacted.

7.5 The relationship between corporate social performance and market-based measures

In this section, a summary will be made of the papers that discussed the link between corporate social performance and financial performance. Existing literature was, on the day of today, not able to take a clear position on the question. However, the majority of papers tend to confirm the existence of a positive relationship. Nonetheless, both points of view will be discussed. Due to the lack of research in Europe, this paragraph will be dedicated to the review of scientific research in countries outside Europe.

A first section will summarize the existing evidence on the performance of SRI funds in comparison with conventional funds. On many occasions, the relationship between CSP/CSR and

financial performance has been analysed through the comparison of SRI funds with conventional funds. These studies provided mixed evidence about this relationship. Possible explanation for these mixed results are linked with the way funds set up their investment strategies. It is not likely that two funds have applied exactly the same screening to pick stocks. Two funds, both applying responsible investment practices, could have used totally different screens leading to totally different returns leading to different conclusions with regard to the relationship between corporate social performance and financial performance. This should be kept in mind when comparing the outcome of the different studies.

Geczy, Stambaugh and Levin (2005) computed the cost borne by an investor for investing in a SRI fund. Depending on the pricing model used, the cost of being a responsible investor varied between a few basis points per month and 30 basis points per month. Equivalently, Barnett & Salomon (2006) brought evidence about the existence of a curvilinear relationship (U-shaped relationship) between the number of ethical screens, used to select investment targets, and the associated financial performance. An increase in the number of ethical screens first led to a decrease in financial performance. Thereafter, when the number of screens reached its maximum the financial performance recovered partially. Nevertheless the financial performance achieved by a fund applying the maximum number of screens remained below the return achieved by funds applying no social screening. The U-shaped relationship gave information about what really harms the performance of SRI funds. It is the inability of the fund to position itself as social or not. According to Barnett et al. funds that applied a few social screens, to show some sign of consciousness, underperformed both the social funds and the conventional funds by respectively 0,3% and 0,5% on a monthly risk-adjusted basis. Between 1972 and 2000 the cost of selecting stocks on the basis of social screens was 2.4% yearly after risk-adjustment. Other scientists have analysed the performance of SRI funds and conventional funds and found for example that there was no evidence of significant benefit nor penalty for social screening practices (Humphrey & Lee, 2011) (Bauer & Derwall & Otten, 2006). Others reported that socially responsible mutual funds achieved higher return than conventional funds of the same size (Statman, 2000).

Moreover, the comparison of the return of the Domini Social Index (DSI)[9] with the S&P 500 index for periods between 1990 and 2004 suggested that on average the DSI index outperformed the S&P 500 index by 2,49% on 12-month periods (Statman, 2006).

9 The Domini Social index was defined by Investopedia as : « A market cap weighted stock index of 400 publicly traded companies that have met certain standards of social and environmental excellence. »

In an attempt to settle the discussion Goetz (1997) came up with a new point of view. He stated that the higher performance achieved by SRI funds in comparison to the performance of funds that were investing responsibly is the proof of a negative relationship. According to Goetz, the only reason why SRI-funds outperformed non-SRI funds can be explained by the fact that the once very restricted definition of ethical fund is currently not that binding anymore. Applying social screening strategies does not restrict investors anymore as it once did before.

However, Kempf & Osthoff (2007) rejected Goetz's claim using a straightforward methodology. The comparison between the portfolio composition of a number of SRI funds with non-SRI funds showed that both categories of funds have significantly different investment strategies. By doing so, they refuted the claim of Goetz who explained the improved performance of SRI funds by possible window-dressing techniques.

Next to the analysis of fund performance, other research compared the performance at the firm level. The following paragraphs will be dedicated to a summary of these results :

Despite that a review of individual results of these numerous studies in the field of corporate social performance would be very interesting, the review of recently performed meta-analysis will draw a more robust picture of the relationship CSP-CFP. Indeed, meta-analysis is used to pool the results of many studies together in order to find a dominant trend.

A first meta-analysis performed by Orlitzky (2003) pooled together the results of 52 studies of the last 30 years and provided the following insights : CSP appears to be more correlated with accounting-based performance measure ($r = 0{,}21$) than with market-based indicators ($r = 0{,}07$). A second conclusion is that there seems to be a positive correlation between corporate social performance and financial performance ($r = 0{,}18$) meaning that when the score for social performance went up so did the financial performance of the companies. More recently, Margolis, Elfenbein and Walsh (2007) performed a broader meta-analysis of 167 studies analysing the same relationship. The results confirmed Orlitzky's (2003) research outcome and there seems to be a small but positive impact of CSP on the financial performance of the company (r=0.24).

7.6 The relationship between CSP and accounting-based measures

A first investigation came from Canada where Makni, Bellavance and Francoeur (2009) investigated the relationship between corporate social performance and financial performance in Canadian firms. In the short run there seems to exist a negative relationship between the performance of the companies on the environmental factor and the return on equity. Investing resources in measures aiming to improve the firm's environmental impact is costly and will, in the

short run, put pressure on financial results. The results were almost significant at the 5% level (p = 0,059). Important comment is that this paper only focused on the environmental criteria.

A similar research was conducted in the U.S. where Preston & O'Bannon (1997) investigated the correlation between social and financial performance for large U.S. firms over the period 1982-1992. 2 conclusions were drawn from their research. Firstly, there was no evidence of a negative relationship between social and financial performance. Secondly, financial performance seems to be a driver of social performance meaning that a company will only improve its social posture if slack resources are available.

Waddock & Graves (1997) performed a 2-year analysis of the link and the direction between social performance and financial performance. The results are interesting as there seems to be a positive but not significant relationship between the corporate social performance and the return on equity. When turning the question around they found that there was a positive and significant relationship between the ROE of a company and the CSP in the next year. Their results are similar to other investigations. Again, the availability of slack resources could be a driver of social responsibility. With regard to ROA, there seems to be a positive and significant relationship between the social performance and the return on assets of a company. These results are a proof that there could be a virtuous circle between CSP and CFP but also between CFP and CSP. Indeed, the availability of slack resources enables companies to improve their social responsibility which would lead to the bettering of their financial performance.

Barnett and Salomon (2012) found evidence of a U-shaped relationship between the level of corporate social performance and corporate financial performance measured by accounting-based measures. They concluded that it pays to be good but the firm has to be able to capitalize on their improved stakeholder relationship to take profit from corporate social performance.

8 Data

The data employed to perform this thesis and used to compare social responsible and non-responsible companies were downloaded from different sources. ESG scores used to create the portfolios were retrieved from the Thomson Reuters ASSET-4 database. Data from this source provided information about the performance of a given company with regard to the three dimensions of corporate social performance : Environmental, social and governance. All the information used by Thomson Reuters' analysts to build these ESG score is gathered from publicly available sources. This addresses a selection bias encountered when CSP score is based on a voluntary participation of the companies. Indeed, when participation is voluntary, it is likely to attract mostly firms that are performing well in the investigated subjects.

The Financial information needed to perform the financial and accounting analysis of all companies individually, such as stock price, beta, return on equity and return on assets were collected from S&P Capital IQ and Datastream. Monthly data was used in order to correct as much as possible for infrequent trading of some stocks.

The period under analysis ranged from 2007 to 2015. The period was imposed by the availability of ESG coverage. Thomson Reuters released for the first time their database that covers ESG matters at the end of 2006. The size of the database is increasing year after year what will make future analysis easier and more accurate.

9 Methodology

This section will be dedicated to the methodology used in this thesis. A first part will explain how corporate social performance was measured. The following parts will be separated in two main sections : One will explain the methodology for market performance and the other will be dedicated to accounting-based measures of performance. Distinction was necessary as the methodology applied to both is different. Next to these measures of performance, different statistical tests were performed in this thesis and their methodology will also be described in this section.

9.1 Measurement of social performance

A first step was to make a distinction between socially irresponsible and socially responsible companies. Therefore, all stocks were classified according to their level of ESG performance. ESG performance of the firms was retrieved from the ASSET-4 database of Thomson Reuters. Thomson Reuters provides in-depth data for more than 8000 companies worldwide. 400 metrics such as environmental footprint, waste management, human rights, product responsibility, board structure or compensation policy are available. All these metrics are standardized to enable comparability. Moreover, general scores for every dimension[10] of social responsibility are available and ready to use for investment purposes.

ESG scores, used throughout this thesis to form portfolios, are equal to the arithmetic mean of the environmental, the social and the governance scores retrieved from the ASSET-4 database. Arithmetic average was used in order to give equal weight to every dimension as no evidence was found about the prevalence of one dimension over the other. The classification of stocks into portfolios was made on the basis of this average ESG score.

Companies that did not receive a rating for the three dimensions were removed from the pool of firms. Similarly, companies based outside of Europe were also removed from the sample in order to focus on European companies only. The same procedure was repeated every year between 2006 and 2015.

As shown by Eurosif (2014), ESG implementation is becoming a widely used investment strategy leading to an increasing number of companies covered by ESG specialized rating agencies. In order to take advantage of this growing coverage, the pool of available companies was augmented year after year with newly covered firms. The number of remaining companies varied between 501 at the end of 2006 and 648 at the end of 2014.

[10] Environmental, Social and governance

9.2 Methodology for the market performance

9.2.1 Portfolio construction

From the sample of companies remaining after applying screening for geographic location and availability of ESG information all companies were categorized in 9 portfolios according to their corporate social performance measured through their ESG score. ESG scores released at the end of each year were used for the categorization of stocks the upcoming year. Portfolios were named P1, P2,…,P9. Where portfolio P1 is the one composed of companies with an ESG score between 90% and 100%. P1 can be seen as the most socially responsible portfolio of the nine portfolios. Next to portfolio P1, portfolio P2 consists of firms with an ESG score between 80% and 90% and so on until portfolio P9. Portfolio P9 is the less responsible of all the portfolios. Having a constant and small spread in ESG score for all portfolios ensured homogeneity of ESG profiles inside every one of them. Only very similar firms with regard to social responsibility were pooled together. It is important to note that the larger spread in ESG score for portfolio P9 can be explained by the relative small number of firms having a score between 0% and 10%. Therefore, these companies were pooled together with firms with an ESG score between 10% and 20%, which is also a relative low level of corporate social performance.

The aim of creating 9 portfolios with a decreasing ESG score was to be able to detect whether there exists a linear relationship between corporate social performance and financial performance or if the relationship is more curvilinear as suggested by Barnett & Salomon (2006) who brought evidence of a U-shaped relationship between the return of funds and the screening intensity. Another possibility was enumerated by Mintzberg (1983) who stated that CSP would be rewarded by the market but only until a certain level and therefore there should exist an inverted U-shaped relationship. A last possibility is that there exists no relationship between CSP and CFP. The strategy will also give an idea about what level of ESG enables the highest level of financial return.

9.3 Market performance

The following section will be dedicated to the explanation of the models used to measure financial performance through marked-based measures.

9.3.1 Logarithmic return

The starting point was the computation of the logarithmic return of all the stocks composing the different portfolios. The following formula allowed the computation of logarithmic return for a single stock:

$$Rit = \frac{Ln(Pit)}{Ln(Pit - 1)}$$

Where R_{it} is the logarithmic return computed by dividing the logarithm of the price at date t of stock i by the logarithm of the price at data t-1 of the same stock i.

Going forward, the average return of all equally weighted portfolios was computed by making the sum of the logarithmic returns of all stocks composing the portfolios and dividing the sum by the number of stocks in the portfolio :

$$Rp = \frac{1}{n}\sum_{i=1}^{n} Rit \text{ (A)}$$

9.3.2 Excess return

For every period, the risk-free rate was withdrawn from the return computed in (A) to obtain the excess return.

$$R_{eit} = R_{it} - R_f$$

Where R_{eit} represents the excess return of the portfolio i for period t over the risk-free rate. R_{it} is the return of the portfolio and R_f the risk-free rate of return. The risk-free rate and the market return[11] used in this thesis were gathered from the Kenneth French database[12].

[11] The market return was computed using all stocks for which market data is available. This market return is particularly relevant due to the fact that stocks from the ASSET4-database are from all sectors and from all countries in Europe

[12] Database can be found on: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

9.4 Capital Asset Pricing Model

When investigating the performance of a stock or portfolio, the sole return is not enough. Indeed, two different stocks or portfolios could have exactly the same return but the risk associated with these stocks could be totally different. The capital asset pricing model designed by Sharpe (1964) and Lintner (1965) links return with its associated risk and tells the investor the expected return of a stock or portfolio. The CAPM can be symbolized through the following equation :

$$R_i = R_f + \beta_i(R_M - R_f)$$

The idea behind the capital asset pricing model is that the expected rate of return of a security or portfolio i (R_i) is equal to the risk-free rate (R_f) to which should be added the compensation for the risk associated to the stock or portfolio ($\beta_i(R_M - R_f)$). How riskier the stock, how higher the beta and how higher the return an investor should expect. The expected return computed under the CAPM is a risk-adjusted return as it takes into account the risk taken to generate the return.

Fama and Macbeth (1973) proposed a transformation of the CAPM to enable the analysis of returns through linear regression analysis. The model then becomes:

$$R_{it} - R_{ft} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

Where the excess return of the stock or portfolio i over the risk-free rate for period t can be decomposed in an alpha (intercept) that represents the part of the return that cannot be explained by the following terms. The second term of the equation represents the part of the return explained by the correlation of the security i to the market m. β_i represents the exposure to the systematic or undiversifiable risk of the stock i. A β_i higher than 1 means that the security reacts more heavily than the market while a beta lower than 1 is a sign of the under-reaction of the stock to the market. A beta equal to zero means the stock is totally uncorrelated with movements on the market. The last term of the equation, ε_{it}, is the disturbance or error term which represents the difference between the result of the model and the actual return.

9.4.1.1 Single factor Capital Asset pricing model

« The Capital Asset Pricing model is used to compute the Jensen's alpha, representing the return that cannot be explained by exposure to common risk factors. » (Berger, Crowell, Israel and Kabiller, 2012)

The simplest form of the CAPM is the single factor model. The main assumptions behind the single factor capital asset pricing model are the following : All investors have the same beliefs about the risk/return relationship, they all want to maximize the level of return for a given level of risk (volatility) and there is only one common risk factor driving return (i.e. systematic market risk) (Culp, 2002).

The model can be expressed through the following equation :

$$R_{it} - R_{ft} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

9.4.2 CAPM Multi-factor models

In order to increase the predictive power of the single factor model, additional risk factors should be added. The model then becomes a multi-factor model. Indeed, there exists evidence about patterns, also called anomalies, in stock return that are not explained by the Capital Asset Pricing Model (Fama and French)(1996).

9.4.2.1 Fama & French 3-factor model

A first multi-factor model to be considered was the Fama and French 3-factor model as proposed by Fama & French (1992, 1993). Fama-French found evidence that a part of the return on a stock can be explained by the over-performance of both small stocks over big stocks and value stocks over growth stocks. Between 1984 and 2006 investors that went long in value stocks and short in growth stock would have captured a premium of circa 0,4% by investing in stocks with a high book-to-market value (value stocks). Similarly, a premium of 0,03% could have been achieved by going long in small caps and short in big caps (Fama and French, 2010). Moreover, exposure to the market also accounted for a part of the return common to all stocks. One can consider that the return that was not generated by these factors can be attributed to the strategy implemented by the portfolio manager. The following equation moralizes the Fama and French 3-factor model:

$$R_{it} - R_{ft} = \alpha_i + \beta_1\left(R_{Mt} - R_{ft}\right) + \beta_2(SMB) + \beta_3(HML) + \varepsilon$$

Where :

$R_{it} - R_{ft}$	=	Excess return of the portfolio. Rf is the risk-free rate of return retrieved from the Kenneth French database.
α_i	=	Intercept or alpha, representing the part of the return that cannot be explained by the different coefficients of the model.
$R_{Mt} - R_{ft}$	=	Denotes the excess return of the market portfolio over the risk-free rate.
SMB	=	Premium computed as the difference between small and large capitalization portfolios.
HML	=	Premium based on the difference between high and low book-to-market portfolios.
$\beta_{1,2,...n}$	=	Coefficients representing the exposure of the portfolio to the different factors
ε	=	Error or disturbance term

9.4.2.2 Carhart 4-factor model

The ability of the Fama & French 3-factor model to explain stock return can be improved through the addition of a fourth factor. Indeed, Carhart (1997) proved that a momentum factor (WML) should be added to explain larger part of the return common to all stocks. Jegadeesh and Titman (1993) found that stocks that performed well continued to perform well over the next year and stocks with a bad performance were more likely to remain in a difficult position. Going long in winners and short in losers can thus explain part of the revenues generated by a portfolio.

The adjusted version of the Fama and French 3-factor model becomes :

$$R_{it} - R_{ft} = \alpha_i + \beta_1(R_{Mt} - R_{ft}) + \beta_2(SMB) + \beta_3(HML) + \beta_4(WML) + \varepsilon$$

The model remains the same as before but a fourth factor was added to catch the return explained by the « Winners Minus Losers » factor. The WML factor represents the premium that one could have captured by going long in the previous year's winners and short in the previous year's losers.

9.4.2.3 Fama & French 5-factor model

In an attempt to explain a larger part of the average return, Fama & French (2014) increased the capacity of the 3-factor model by the addition of 2 new factors. The idea of the revisited version of the existing asset pricing model is to take into account the return than can be explained by expected investment and expected profitability.

There is some evidence that book-to-market is not the only component of value and an investor should also pay attention to the gross-to-profit ratio (profitability) of a company as it could be a sign of above-average return. Indeed, some profitable companies generated over average return while having a low book-to-market ratio (Novy-Marx, 2013).

Furthermore, there seems to be a relation between the level of investment of a firm and future returns (Aharoni, Grundy and Zeng, 2013). Profitability is expressed through the RMW factor while investment is expressed through the CMA factor. The former represents the difference between portfolios made of stocks with robust profitability and portfolios of stocks with weak profitability. The latter represents the difference between portfolios made of companies that invest moderately (conservative) and portfolios of companies that invest heavily (aggressive).
The five-factor model can be expressed as follows :

$$R_{it} - R_{ft} = \alpha_i + \beta_1\left(R_{Mt} - R_{ft}\right) + \beta_2(SMB) + \beta_3(HML) + \beta_4(RMW) + \beta_5(CMA) + \varepsilon$$

RMW and CMA factors were added to the 3-factor model to explain a larger part of the revenue.

9.4.2.4 Quality minus Junk factor

More recently, Asness, Frazzini and Pedersen (2013) found that an exposition to portfolios that went long in quality stocks and short in junk stocks could explain part of excess return of a portfolio. This shows that quality could be an extra factor explaining excess return. Moreover, the addition of a quality minus junk (QMJ) factor will give an idea whether the portfolios that were regressed were more exposed to quality or more to junk stocks. A positive coefficient for the QMJ factor indicates that the portfolio is behaving like a portfolio that is tilted towards quality stocks. Would it be the case, then the portfolio is able to profit from the extra return generated by quality stocks. Historical data for the quality minus junk factor were retrieved from the AQR website[13].

[13] Factor can be downloaded here: https://www.aqr.com/library/data-sets/quality-minus-junk-factors-monthly

Quality stocks are described by Asness, Frazzini and Pedersen as stocks that are profitable, safe, growing and have a high-payout. Moreover, these characteristics need to be persistent over time.

The 5-factor model can for example be extended and expressed through the following equation:

$$R_{it} - R_{ft} = \alpha_i + \beta_1\left(R_{Mt} - R_{ft}\right) + \beta_2(SMB) + \beta_3(HML) + \beta_4(RMW) + \beta_5(CMA) + \beta_6(QMJ) + \varepsilon$$

Where QMJ is the factor that represents the return that could have been captured by a portfolio that was long in quality stocks and short in junk stocks. The QMJ factor can also be added to the other models.

9.4.2.5 Crisis of 2008

A final adjustment was necessary to account for the crisis that hit our economy in 2008. Indeed, the financial market suffered heavily during the crisis of 2008. Part of the variation in the stock price during 2008 can be explained by the effects of the crisis and the addition of a dummy variable seems justified. The Carhart 4-factor model then becomes :

$$R_i - R_f = \alpha_i + \beta_1(R_m - R_f) + \beta_2 (SMB) + \beta_3 (HML) + \beta_3 (WML) + \beta_4(QMJ) + \beta_5 (Crisis) + \varepsilon$$

Where crisis is a dummy variable that has a value 1 during 2008 and 0 during the other years.

The quality minus junk factor and the dummy variable were added to respectively the 5-factor model and the 4-factor model as an example. They were also added to other models.

9.5 Performance measures

Next to the analysis of the excess return obtained from the regression analysis, other measures will provide interesting information about the different portfolios. In this sense, the following section will be dedicated to the description of different performance measures that will be used to enable a risk-adjusted comparison of the different portfolios. Risk-adjustment was necessary to avoid drawing conclusions that would be misleading due to the fact that 2 portfolios with similar returns could have a totally different risk exposure. First, the Sharpe ratio will be discussed. Thereafter, the Treynor ratio will be explained.

9.5.1 Sharpe ratio

A first performance measure is the reward to variability ratio or Sharpe ratio. This ratio enables a comparison of the different portfolio on a risk-adjusted basis. Indeed, the Sharpe ratio gives an idea of how much expected return a portfolio provided per unit of standard deviation (Sharpe, 1994). By using the standard deviation as a measure of risk, both systematic and unsystematic risk are considered.

The Sharpe ratio is computed as follows :

$$Sharpe\ ratio = \frac{Rp - Rf}{\sigma p}$$

Where the nominator represents the return of the portfolio adjusted for the risk-free rate. The nominator can also be called the excess return and the denominator represents the standard deviation of the portfolio's excess return.

9.5.2 Treynor ratio

A second performance ratio is the Treynor ratio. The difference with the Sharpe ratio is the measure of risk. Indeed, the Sharpe ratio uses the standard deviation as risk proxy while the Treynor ratio uses the beta of the portfolio. The Beta is a measure of systematic risk representing the risk that cannot be eliminated through diversification.

The Treynor ratio is given by :

$$Treynor\ ratio = \frac{Rp - Rf}{\beta_p}$$

The nominator of the Treynor ratio is the same as for the Sharpe ratio and represents the excess return of the portfolio. The denominator is the risk proxy, in this case the beta of the portfolio.

9.6 Accounting measures

Margolis et al. (2007) stated that CSP generally appears to predict accounting-based return better than market-based return. This stresses the need for including accounting measures to analyse the relationship between corporate social performance and corporate financial performance.

Therefore, the following section will present two of the most used accounting-based measures for the assessment of the profitability. The return on equity and the return on assets both define how well the firm performed financially from an accounting point of view.

The stock categorization for accounting-based analysis was slightly different from for the analysis of market return. All stocks were divided into four groups according to their corporate social performance. The smaller number of groups was necessary due to lack of monthly data for accounting-based measures provided by Capital IQ. Dividing the stocks in four portfolios instead of nine provides more observation for each group resulting in a more accurate regression result. Moreover, fewer groups will probably lead to a better analysis of possible relationship between the level of ESG and firm profitability.

9.6.1 Return on equity and return on assets

While there exists a large number of different measures to account for financial performance, return on equity and return on assets are the most widely used for research purpose according to Rappaport (1999). These measures of profitability are systematically affected by some factors that account for the difference of profitability between the different companies. As follows, return on equity should not be compared without taking into account these different sources of systematic profitability.

A first control variable was used to control for the size of the company. A study performed by Hall & Weiss (1967) brought evidence about the fact that larger companies tend to achieve higher profitability. Indeed, how larger the firm's size, how greater the ability to take profit from economies of scale (Penrose, 1959). The size was measured by the logarithm of the total assets of the company. By using the logarithm, extreme observations have less impact on the results.

A second control variable was highlighted by a study of Tezel & McManus (2003). They stated that financial leverage should be controlled for when analysing accounting-based measures. They have shown that return on equity is influenced by the level of financial leverage represented by the total amount of liabilities over the total amount of assets of the company under investigation. Higher levels of leverage could lead to higher returns due to the fact that more resources are available to engage in value-creating projects (du Toit and De Wet, 2007). Moreover, higher levels of debt leads to lower levels of shareholder equity and thus increase the return on equity. Financial leverage also accounts for the riskiness associated with the company as more leverage means higher risk.

Another factor frequently used to account for the risk related to a company is the beta that represents the systematic risk of a given firm. It was used as third control variable in the regression of accounting-based measures. Riskier companies are likely to engage in riskier projects with higher expected payoff.

A fourth control variable used in this paper is asset turnover, representing the ability of a company to use its assets effectively to create value. A higher ability to use assets efficiently leads to higher firm performances (Kajola, 2010).

The last control variable used is the past performance of the company under investigation as past performances are expected to influence future performances (Bromiley, 1991 ;Ullman, 1985).

The combination of all the previous variables leads to the following model :

$$ROE_{it} \; or \; ROA_{it} = \alpha_i + \beta_1 TA + \beta_2 FL + \beta_3 RISK + \beta_4 TURN + \beta_5 PAST$$

Where ROE and ROA are the dependent variables that will be regressed against the previously mentioned control variables : The TA coefficient represents the total assets of the firm, FL stands for the financial leverage, RISK is the coefficient that represents the company's riskiness, TURN is the asset turnover and PAST is the control variable for the past performances. The β associated with each variable represents the loading of each variable. How larger the coefficient, how more the variable influences the measure of profitability under investigation. α_i represents the ROE or ROA after controlling for the previous variables. Comparison of the different alphas will give an idea of how profitable each group is.

With a view to improving the comparability between the different groups and to allow the comparison of the relative effect of a variable against another, the standardized coefficients were computed and have been added to the results of the different regressions. Standardized coefficients are used to express the effect of the variables on the dependent variable using the same scale. Indeed, standardized coefficients express all coefficients in units of standard deviation and enable comparison between different samples.

9.7 Linear regression model

9.7.1 Hypothesis underlying a regression model:

Gujarati (2004) highlighted the need for testing different hypotheses underlying any regression model. A set of conditions must be fulfilled in order to have linear regression models that estimates the analysed variables correctly. In order to assess the validity of these assumptions, the following tests were performed :

- Tests for the presence of multicollinearity :
  - Analysis of the correlation matrix
  - Assessment of variance inflation factors and condition indexes
- Test for the presence of autocorrelation
  - Breusch-Godfrey test
- Test of the absence of heteroscedasticity
  - Breusch-Pagan test

9.7.1.1 Multicollinearity

Multicollinearity occurs when 2 or more variables, used to control the dependent variable, are strongly correlated. Would multicollinearity be present between different control variables then the coefficients of these variables would not be accurately computed.

A first test to assess the possible presence of multicollinearity was done through the analysis of the correlation matrix. Appendix C1 and C2 contain the different correlation matrices for market-based and accounting-based measures. The correlation matrices for the accounting-based measures (appendix C2) exhibit low values of correlation between the different regressors which is a sign that the models for accounting-based measures are free of multicollinearity. With regard to the market-based measures, a majority of the factors does not seem to be too excessively correlated according to their correlation matrix. Nevertheless, there are some signs of multicollinearity for the quality minus junk factor of Asness et al. (2014). Adding the QMJ factor could in this case lead to inaccurate estimation of the coefficients.

In order to confirm this result, a second assessment of the multicollinearity between the control variables was made through the computation and analysis of the variance inflation factors (VIF) and condition indexes (CI) (Mason, William and Perreault, 1991). Gujarati (2014) recommended the following rule of thumb with regard to the interpretation of the VIF : a VIF close

to 1 means that the variable is free of multicollinearity while a VIF edging to 10 is a sign of multicollinearity. With regard to the condition index, the following rule to thumb can be applied : A conditional index between 10 and 30 is a sign of reasonable multicollinearity while a CI higher than 30 is a sign of severe multicollinearity. Both the variance inflation factors and condition index available in appendix B1 and B2 confirm the result of the correlation matrices. There is no alarming sign of multicollinearity in the regression analysis except for the quality minus junk factor.

9.7.1.2 Autocorrelation

Autocorrelation is defined by Gujarati (2004) as the correlation between the error terms. Least square linear regression assumes that the disturbance in one observation of the sample does not suffer from influences from another observation's disturbance term. The presence of autocorrelation in the models could lead to the underestimation of the variance and the overestimation of both R^2 and t-statistic. Therefore, an assessment of possible autocorrelation was necessary to ensure the validity of the t-statistic and p-value. The Breusch-Godfrey test was performed to test for the presence of autocorrelation in the different samples.
The Breusch-Godfrey test is designed to accept or reject the null hypothesis, where :

H_0 :Absence of autocorrelation
H_1 : Autocorrelation in the sample

A p-value higher than 0,05 means that the test fails to reject the null hypothesis and the sample is free of autocorrelation.

Results of the Breusch-Godfrey tests are available in appendix D1 and D2 According to the results some samples are affected by autocorrelation between the error terms. Measures taken to correct for this autocorrelation will be explained at the end of this section.

9.7.1.3 Heteroscedasticity

Heteroscedasticity can be defined as the case where the dispersion of the observed values is not the same for all observations (i.e. they do not have the same variance). A good regression model should be homoscedastic and thus have equal variance (Gujarati, 2004). Conclusions made on the basis of regression models that are not corrected for heteroscedasticity could be wrong.

The Breusch-Pagan test controls for the presence of heteroscedasticity in the data sample and the following hypothesis are tested:

H_0 : Homoscedasticity

H_1 :Heteroscedasticity

If the obtained p-value is higher than the confidence level (i.e. 5%) than the test fails to reject the null hypothesis and the sample is free of heteroscedasticity and we can conclude that there is homoscedasticity of the residuals.

Appendix E1 and E2 exhibit the results for the Breusch-Pagan tests. Again, some samples are not homoscedastic. As mentioned before, the correction will be explained in the following section.

9.7.2 Implication of the presence of heteroscedasticity and autocorrelation

As presented before, the different regression models for market and accounting performance were tested for multicollinearity, heteroscedasticity and autocorrelation. Results show that the different portfolios are free of multicollinearity between the different regressors meaning that the estimations of the different coefficients are right. Nevertheless the different tests have highlighted the presence of autocorrelation and heteroscedasticity that could undermine the robustness and accuracy of the regression results. In order to avoid drawing conclusions on inaccurate results, corrections were needed.

Therefore, the Newey and West transformation (Gujarati, 2004) that corrects for autocorrelation and heteroscedasticity was performed to adjust the regression results and exhibit more accurate values. Important to note that all the coefficients are presented along with their adjusted t-statistic obtained after applying the Newey and West (1987) correction. Newey and West correction was performed using the statistical tool R.

9.8 Model selection

The following section will be dedicated to the methodology used to compare the different models in order to define which model best fits the research question.

A first way to compare the different models is to have a look at the R-squared values as it gives an indication of the explanatory power of the model (Gujarani, 2004). The R-squared values range from 0 to 1 and how closer the R-squared values are to the upper limit, how better the models are able to explain the variations. Moreover, Theil (1970) highlighted the importance to look at the adjusted-R-squared values instead of the multiple R-squared values. Indeed, to allow a correct comparison of the explanatory power of the different models, the R-squared values should be adjusted for the fact that adding variables to the model automatically increases the R-squared value of the model but also add variance to the forecasted error (Guajari, 2004). By using the adjusted-R-squared values, penalties are added to the R-squared values for the addition of variables to the model improving the comparability.

A second method, particularly efficient to determine the best fitting model, is the Akaike information criterion (AIC)(1973).

The Akaike information criterion gives information about how well the tested models fit the data under consideration. A second insight given by the test is the probability that a given model i is the best fitting model amongst all models considered. The Akaike information criterion also provides information about which variables are useful and which are not. The information provided by the Akaike information criterion can thus be used to increase the predictive power of the model by assessing the added value of new variables. Indeed, the different coefficients estimated through linear regression are more accurately computed due to the omission of useless variables. (Burnham and Anderson, 2004).

A similar test, the Schwarz information criterion (SIC)(1978), was performed to confirm the results of the Akaike information criterion. The way the SIC value is analysed is the same as for the AIC. How lower the SIC value how better the model is fitting the data. A fundamental difference between the two rely on one of the main assumptions of both criterions. The Schwarz criterion considers that the true model is in the set of candidates' model while the Akaike criterion does not make this assumption (Wagenmakers & Farrell, 2004). Therefore, the Schwarz criterion was not performed for the accounting data as it was not likely that the set of variables used to regress the accounting-based measures (i.e. return on equity & return on assets) are the only variables that could be used to control the ROE and ROA.

9.8.1 Akaike Information Criterion

The Akaike information criterion is given by :

$$\text{AIC} = 2k - 2\ln(L) \quad (1)$$

Where k is the number of variables and L the maximized likelihood function of the model under consideration. The computation of the Akaike information criterion was performed using the statistical tool R (also called GNU S).

9.8.2 Schwarz Information Criterion

The Schwarz information criterion is given by :

$$\text{SIC} = -2\ln(L) + \ln(N)k \quad (2)$$

Where L is the maximized likelihood function of the model under consideration and N represents the number of observations. k is the number of variables in the model. As for the Akaike information criterion, the SIC was computed using the statistical tool R.

9.8.3 Comparing the models

A measure used to improve the comparability between different models was proposed by Wagenmakers and Farrell (2004). The computation is twofold. First, the $\Delta_i AIC$ is computed for each model. Then, the Akaike weight or probability to be the best model is computed. The computation of $\Delta_i AIC$ was done through the following formula :

$$\Delta_i AIC = AIC_i - minAIC \quad (3)$$

Where $\Delta_i AIC$ is the difference in AIC with respect to the AIC of the best model. AIC_i was computed according to (1) for model i. The best model is characterized by $\Delta_i AIC = 0$

Going forward, the conditional probabilities or Akaike weights (w_i) are computed for each model using the following formula :

$$w_i = \frac{\exp\left(-\frac{1}{2} * \Delta AIC_i\right)}{\sum_{r=1}^{R} \exp\left(-\frac{1}{2} * \Delta AIC_r\right)} \quad (4)$$

Where w_i is the probability of model i to be the most fitting model of all models under consideration. ΔAIC_i was computed using formula (3) and corresponds to the difference in AIC with respect to the AIC of the best model. The sum of all w_i is equal to 1

Burnham and Anderson (2004) argued that the same procedure can be applied to the Schwarz information criterion. The formulas are slightly modified :

$$\Delta_i SIC = SIC_i - minSIC \quad (5)$$

and

$$w_i = \frac{\exp\left(-\frac{1}{2} * \Delta SIC_i\right)}{\sum_{r=1}^{R} \exp\left(-\frac{1}{2} * \Delta SIC_r\right)} \quad (6)$$

Table 1 - Average Akaike and Schwarz weights

Table 1 provides the Akaike and Schwarz weights computed with formula (4) and (6) for all the models. The weights represent the probability of a given model to be the best model for the analysis of the data. Because 9 portfolios were regressed, the weights from table 1 are the average weight of the 9 portfolios.
The first column gives the model under consideration while the second and the third column gives respectively the Akaike and Schwarz weight

Model	Akaike weight	Schwarz weight
CAPM Single Factor	0,10%	8,82%
FF 3-Factor	0,14%	1,04%
Carhart 4-Factor	23,34%	59,77%
Carhart 4-Factor + crisis	20,17%	19,80%
Carhart 4-Factor +RMW+CMA+crisis	15,18%	3,89%
FF 5-Factor	0,20%	0,41%
FF 5-Factor + crisis	0,13%	0,08%
FF 5-Factor + crisis + QMJ	6,67%	1,94%
Carhart 4-Factor + crisis + QMJ	11,37%	2,62%
All factors	22,71%	1,63%

Table 1 provides the average AIC and SIC weights for each multi-factor model. Both AIC and SIC weights are useful to have a clear insight about which multi-factor model best fits the needs of this thesis.

Appendix F1 and F2 provide the results of all performed tests for all portfolios. From table 1 it is clear that the Schwarz information criterion favours the use of the Carhart's (1997) 4-

factor model as its probability to be the best model is 59,77%. The Carhart 4-factor model improved with the dummy variable, accounting for the 2008 crisis, also have a probability of 19,88% to best fit the needs of this thesis. Nevertheless, adding the dummy variable decreased the probability of being the best model meaning the dummy variable is useless for this purpose. The criterion tends to reject the other models as their weights are very small. These results have to be put in relief as the Schwarz information criterion has a tendency to favour simplistic models (Wagenmackers and Farrell, 2004).

The Akaike criterion slightly confirm the result of the Schwarz information criterion as the Carhart 4-factor model also has the highest probability to be the best fitting model. Nevertheless, the probabilities are much more dispersed over the other available models. Adding variables to the model decreased the predictive power of the model and are by the way useless to assess the returns of the portfolios created using ESG variables. Results of the Akaike information criterion are confirmed by the fact that the Carhart (1997) four-factor model seems to be the standard model used in the assessment of equity portfolios (e.g. Bauer, Derwal and Otten, 2006 ; Hoepner, Rezec and Siegl, 2011; Kempf and Osthoff, 2007 ; Statman and Glushkov, 2009).

The case of « quality minus junk » factor is difficult. When added to the 4-factor model it decreased the probability of this model to be the true model but added to the Fama & French 5-factor model it increased the weight attributed to this model.

The Akaike and the Schwarz information criterion statistically put the Carhart four-factor model forward to be the best model to meet the needs of the research when the aim is to analyse the relationship between corporate social performance and market-based return.

Table 2 - average Akaike weights for ROE and ROA

Table 2 gives the Akaike weights for the regression model with ROE and ROA as dependent variables. The weights were computed according to formula (4) and (6).

Model	Akaike weight	Model	Akaike weight
Past ROA	0,41219%	Past ROE	15,58068%
Addition of size	7,48236%	Addition of size	6,24033%
Addition of Financial leverage	15,33352%	Addition of Financial leverage	5,78659%
Addition of Asset turnover	22,04358%	Addition of Asset turnover	28,88001%
Addition of Beta	54,72835%	Addition of Beta	43,51240%

Table 2 summarizes the different Akaike tests performed for the models used to measure the accounting performance. Appendix G provides more details about all the tests performed.

When considering the models for accounting performance, all the considered variables are efficient in describing the accounting measures. Indeed, the Akaike criterion considers the model with the highest number of variables as the true model.

10 Empirical result

10.1 Market-based measures

10.1.1 Descriptive statistics for market-based measure

Table 3 - descriptive statistics for market performance

Table 3 provides information about the excess return and the market capitalization characterizing each portfolio. Portfolio P1 is the most responsible (highest ESG score) and P9 is the less responsible (lowest ESG score). The market capitalization is given in € million.

Portfolio	P1		P2		P3	
variable	Excess return	Market cap	Excess return	Market cap	Excess return	Market cap
average (monthly)	-0,19%	29.059,89	-0,13%	30.500,16	-0,06%	32.336,42
% of small stock		13,57%		17,86%		27,61%
std dev	6,13%	49.305,53	6,20%	100.312,26	6,42%	125.976,37
Minimum	-16,70%	136,96	-21,39%	129,09	-21,47%	69,42
Maximum	19,05%	413.064,71	19,58%	1.639.365,76	22,59%	1.908.297,91
Median	0,38%	11.431,86	0,40%	7.670,24	0,40%	4.252,08
Kurtosis	4.198538		4.53577		4.942496	
Skewness	-0.1374114		-0.4685344		-0.3893101	
average N Comp	40		130		115	
N Obs	4320		14040		12420	
Portfolio	**P4**		**P5**		**P6**	
variable	Excess return	Market cap	Excess return	Market cap	Excess return	Market cap
average (monthly)	-0,24%	37.538,71	0,19%	50.553,69	0,11%	17.908,87
% of small stock		36,79%		45,88%		49,32%
std dev	6,27%	164.172,18	6,10%	360.403,55	6,10%	134.025,02
Minimum	-20,97%	112,30	-19,75%	15,61	-21,25%	18,18
Maximum	21,18%	1.527.978,54	22,62%	4.517.245,26	25,55%	2.048.564,91
Median	0,05%	4.051,02	0,46%	2.319,71	0,03%	2.033,47
Kurtosis	5.019418		5.095127		6.144055	
Skewness	-0.2783566		-0.2369298		-0.1527331	
average N Comp	82		65		56	
N Obs	8856		7020		6048	
Portfolio	**P7**		**P8**		**P9**	
variable	Excess return	Market cap	Excess return	Market cap	Excess return	Market cap
average (monthly)	-0,25%	29.603,79	-0,55%	17.186,82	-0,46%	19.433,32
% of small stock		55,15%		48,52%		37,56%
std dev	6,28%	130.835,79	6,47%	85.766,62	6,87%	113.785,47
Minimum	-24,31%	10,17	-24,74%	26,24	-23,05%	28,67
Maximum	22,18%	1.198.213,19	24,67%	1.029.305,21	25,20%	1.837.371,45
Median	-0,02%	1.697,94	-0,29%	2.060,44	-0,57%	2.851,51
Kurtosis	5.712956		5.868483		5.688367	
Skewness	-0.367338		-0.3007667		-0.4023633	
average N Comp	45		38		43	
N Obs	4860		4104		4644	

An interesting starting point is the discussion of the descriptive statistics characterizing each portfolio. Table 3 gives information about the excess return and the market capitalization of the 9 portfolios. It also provides information about the four momentums which are the mean, standard deviation, kurtosis and skewness.

Over the period 2007-2015, the average monthly excess return of the nine portfolios ranged between -0,55% (portfolio P8) and 0,19% (portfolio P5) which is equivalent to a yearly excess return of respectively -6,6% and 2,28%. Seven of the nine portfolios achieved negative excess return over the period under consideration. Portfolios P7, P8 and P9, which were the less performing, with regard to corporate performance, showed the lowest excess return of the nine portfolios. Portfolios P1, P2, P3 and P4, which have the highest ESG profiles, performed better but still achieved negative excess return. Only portfolio P5 and P6 were able to have a positive excess return over the period 2007-2015. These portfolios are characterized by a moderate ESG profile. Their ESG score were respectively 60%-50% and 50%-40%. Firms from these two portfolios are showing signs of improvement in their environmental, social and governance policy but still have a long way to go before being labelled as ethic companies. According to these figures, efforts to be socially responsible are rewarded by the market, but doing too much is penalized by the market. These results confirm the existence of an inverted parabolic relationship between corporate social performance and financial performance as mentioned by Mintzberg (1983)

Figure 1 : Cumulative excess return period 2007-2015

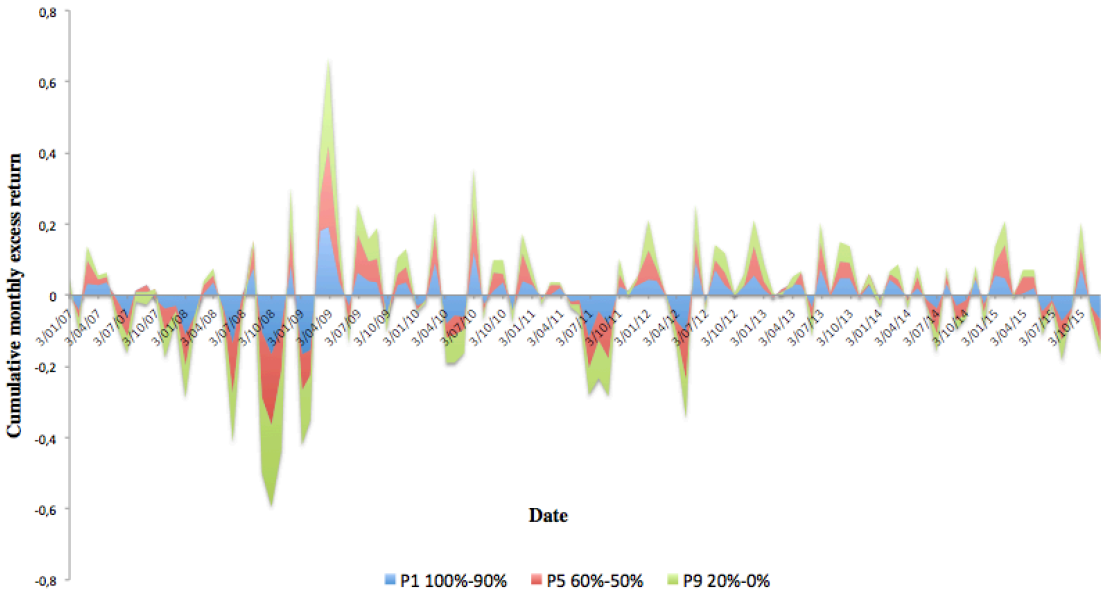


Figure 1 allows a visual comparison between 3 portfolios representing each different ESG profiles. The graph represents the cumulative excess return of the 3 portfolios. The blue space represents the cumulative monthly excess return of the socially performing portfolio P1. The red space represents the moderate portfolio P5 while the green space represents the less socially responsible portfolio P9. These portfolios have an ESG level respectively between 100% and 90%, 60% and 50% and 20% and 0%.

Figure 1 gives a clear idea of the risk associated with each portfolio. The better the corporate social performance, the less volatile the excess return. Indeed, social performance decreases the volatility associated with the portfolio but also decreases the possibility of higher cumulative excess return. According to figure 1, the total cumulative excess return of portfolio P1 never exceeded a cumulative gain and loss of 20% and -20%. On the contrary, portfolio P9 exhibited cumulative excess return that ranged between approximately +60% and -60%.

An analysis of the standard deviation, the square root of the variance (2^e momentum), gives an insight into the total risk associated with each portfolio. The standard deviation represents the volatility caused by systematic and unsystematic risk. Again, portfolios P5 and P6 did better than all the other portfolios and have the lowest standard deviation, respectively 6,10% and 6,10%. Portfolio P9 has the most risk (σ = 6,87) while portfolio P1 has a standard deviation of only 6,13%. This confirms the visual analysis of the cumulative excess return from figure 1. Portfolios P1 and P5 have almost the same standard deviation but still portfolio P1 seems less volatile. It was not able to profit from upwards periods as portfolios P5 but is was more protected in bad periods. This result is in line with Hoepner, Rezec and Siegl (2011) and Godfrey, Merrill and Hansen (2009) who found that ESG performance is a type of insurance against negative events.

The skewness (third moment) and kurtosis (fourth moment) provides useful information about the symmetry and the tail of the return distribution of each portfolio. All portfolios have a negative but small skewness. A symmetric distribution is characterized by a skewness of 0 but in this case, the small value of skewness only gives little evidence of a possible asymmetric distribution. The negative sign associated with the skewness shows that the returns are skewed to the left. The portfolios have a greater probability to exhibit negative surprises than positive surprises. Portfolio P1 is the one that has a skewness the closest to zero while the skewness of portfolio P9 is almost 3 times lower. Therefore, Portfolio P9 has a higher probability to have more severe negative returns than portfolio P1. Portfolio P5 and P6 also exhibited a lower probability of a negative outcome.

With regard to the kurtosis, table 3 suggests that how more a portfolio is efficient with respect to social responsibility, how closer its kurtosis is to the kurtosis of a normal distribution (i.e. kurtosis of 3). Higher kurtosis means a higher frequency of extreme outcomes. The combination of skewness and kurtosis shows that portfolio P9 is associated with more risk as it has a larger probability of having extreme negative outcomes.

Another interesting point is the relationship between corporate social performance and market capitalization. According to table 3 socially responsible portfolios exhibited a higher average market capitalization than non-sustainable portfolios. Furthermore, the percentage of small-capitalization stocks in the total number of stocks present for each portfolio seems to be inversely related to the ESG score. Portfolio P1 is made of 13,57% of small capitalization and this percentage reached 55,15% for portfolio P7. The less sustainable portfolios, P8 and P9, are also composed of respectively 48,52% and 37,56% of companies with small market capitalization which is still much more than portfolio P1. Social performance seems to more pronounced in companies with a higher market capitalization.

10.1.2 CAPM Single factor model

Table 4 - CAPM single factor model

Table 4 provides the result the least following least square regression for the 9 portfolios :

$$R_{it} - R_{ft} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

The alpha (intercept) computed with the least square regression is a monthly alpha. The last row of table 4 provides the yearly alpha .

CAPM single factor									
Portfolio Europe 2007-2015	P1	P2	P3	P4	P5	P6	P7	P8	P9
Social perform	100%-90%	90%-80%	80%-70%	70%-60%	60%-50%	50%-40%	40%-30%	30%-20%	20%-0%
Intercept	-0.0037891	-0.0032506	-0.0027222	-0.0044375	-0.00010809	-0.00088403	-0.0045868	-0.0076378	-0.006840
t-statistic	(-1.3012)	(-1.2876)	(-1.0091)	(-1.7635).	(-0.0429)	(-0.2854)	(-1.5221)	(-2.2786)*	(-2.0329)*
rmrf	0.8064332	0.8436703	0.8791950	0.8506911	0.84799762	0.83676227	0.863963	0.8860858	0.958512
t-statistic	(8.8451)***	(10.8550)***	(9.5884)***	(10.4073)***	(14.1296)***	(11.8056)***	(10.8220)***	(10.7425)***	(9.0745)***
Adjusted R^2	0.6405	0.6852	0.6939	0.6818	0.7143	0.6961	0.6997	0.6931	0.7195
yearly alpha	-4,55%	-3,90%	-3,27%	-5,33%	-0,13%	-1,06%	-5,50%	-9,17%	-8,21%
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				Newey-West corrected					

Table 4 presents the results from the CAPM single factor model. Mean excess returns of the portfolios are only controlled for market risk and give an idea of the risk related to every single portfolio.

None of the nine portfolios exhibited a positive alpha but the best performing portfolios were the moderate portfolios P5 and P6. The social responsible portfolios P1 and P2 also outperformed the less responsible portfolios P8 and P9. Indeed, the intercepts given by the regression are respectively -4,55% and -3,9% yearly for portfolios P1 and P2 and -9,17% and -8,21% for portfolios P8 and P9. Nevertheless no portfolio has a statistically significant alpha at the 0,1% level and consequently results have to be taken with caution.

The beta of portfolio P1 was 0,81 while the beta of P9 was 0,96. The beta of all the other portfolios were between 0,83 and 0,88. All the betas are statistically significant. These results show that the social responsible portfolio is less sensitive to movement on the market than the less responsible portfolio which is more sensitive to market fluctuations. Notwithstanding, all the portfolios have betas lower than 1 because of the diversification achieved by the portfolio construction and no one overreacts to shocks in the market.

10.1.3 Performance measures

Table 5 - Sharpe & Treynor ratio

Table 5 provides the Sharpe and Treynor ratio for the nine portfolios. Both ratios were computed from monthly return but were transformed to yearly ratios by multiplying the monthly ratio by $\sqrt{12}$.

Performance measure									
Portfolio	P1	P2	P3	P4	P5	P6	P7	P8	P9
standard deviation of excess return	6,13%	6,20%	6,42%	6,27%	6,10%	6,10%	6,28%	6,47%	6,87%
portfolio mean excess return	-0,19%	-0,13%	-0,06%	-0,24%	0,19%	0,11%	-0,25%	-0,55%	-0,46%
beta (from capm 4 factor)	0,6097	0,7207	0,7358	0,7126	0,7396	0,6975	0,7307	0,7160	0,7959
Sharpe ratio	-0,031	-0,020	-0,010	-0,039	0,031	0,018	-0,041	-0,086	-0,067
Annualized Sharpe ratio	-0,106	-0,070	-0,035	-0,134	0,108	0,062	-0,140	-0,297	-0,230
Treynor ratio	-0,00309	-0,00174	-0,00088	-0,00341	0,00256	0,00157	-0,00348	-0,00774	-0,00575
Annualized Treynor ratio	-0,01070	-0,00604	-0,00303	-0,01180	0,00888	0,00543	-0,01207	-0,02682	-0,01990

Table 5 provides information about traditional performance measures. The advantage of these measures is that they enable a more accurate comparison as they express portfolio performance per unit of a chosen unit of risk.

The first performance measure under consideration is the Sharpe ratio which presents the portfolio excess return per unit of total risk or standard deviation. Portfolio P1, the socially performing portfolio, exhibited an annualized Sharpe ratio of -0,106 while the less socially performing portfolio P9 only has an annualized Sharpe ratio of -0,203. According to the results the moderate portfolios did better and have a positive annualized Sharpe ratio of 0,108 for portfolio P5 and 0,062 for portfolio P6.

The second performance measure is the Treynor ratio that expresses the mean excess return per unit of beta. The difference with the previous ratio is that only market risk or systematic risk is taken into consideration. Portfolio P1 has a yearly Treynor ratio of -0,0107 against -0,01990 for portfolio P9. Only portfolios P5 and P6 have a positive Treynor ratio. Again, the moderate portfolios outperformed all other portfolios.

10.1.4 Fama & French 3-factor model

Table 6 - Fama & French 3-factor model

Table 6 provides the results of the following regression

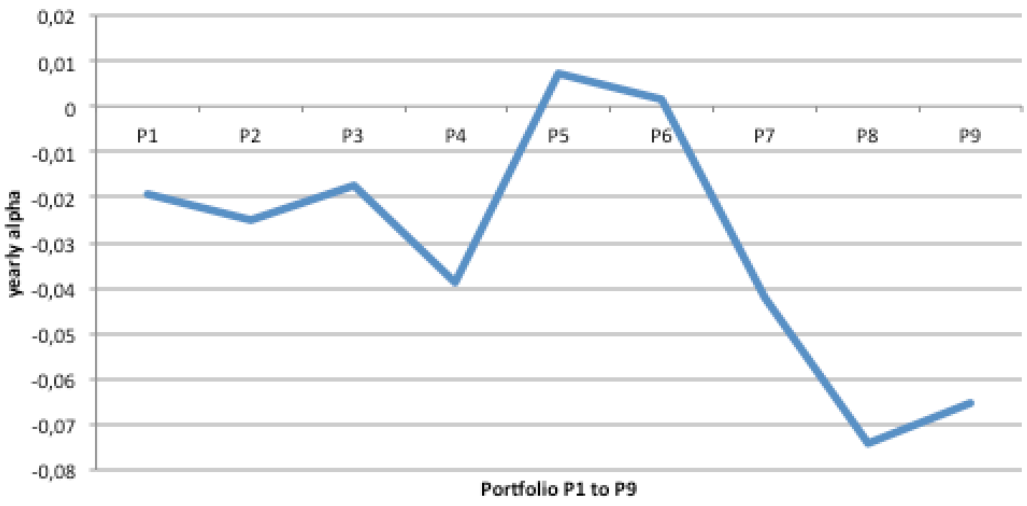
$$R_{it} - R_{ft} = \alpha_i + \beta_1(R_{Mt} - R_{ft}) + \beta_2(SMB) + \beta_3(HML) + \varepsilon$$

The alpha (intercept) computed with the least square regression is a monthly alpha. The last row of table 6 provides the yearly alpha.

CAPM 3 factor model									
Europe 2007-2015	P1	P2	P3	P4	P5	P6	P7	P8	P9
ESG score rai	100%-90%	90%-80%	80%-70%	70%-60%	60%-50%	50%-40%	40%-30%	30%-20%	20%-0%
Intercept	-0.001604	-0.002075	-0.001460	-0.003217	0.0005883	0.0001268	-0.003499	(-0.006180)	-0.005462
t-statistics	(-0.5539)	(-0.7391)	(-0.5166)	(-1.1745)	(0.2395)	(0.0423)	(-1.1154)	(-1.8722).	(-1.6083)
Rm-Rf	0.679061	0.773242	0.801556	0.773792	0.7993590	0.7684149	0.787083	0.789377	0.869043
t-statistics	(9.8609)***	(9.1242)***	(9.6377)***	(10.4050)***	(13.0020)***	(12.1558)***	(8.6102)***	(9.0605)***	(8.9595)***
SMB	-0.596407	-0.215956	-0.119444	-0.014570	0.2531130	0.2435657	0.446100	0.247131	0.129529
t-statistics	(-3.8903)***	(-1.6176)	(-0.8203)	(-0.1093)	(2.4663)*	(1.7091).	(3.3790)**	(1.5702)	(0.9221)
HML	0.499995	0.289143	0.331963	0.340360	0.2445026	0.3310868	0.391597	0.457613	0.412311
t-statistics	(2.6851)**	(1.5822)	(1.6263)	(1.8491).	(1.4979)	(1.6497)	(2.4080)*	(2.9255)**	(2.1453)*
Adjusted R^2	0.7033	0.6937	0.7006	0.6876	0.7216	0.7076	0.7284	0.7119	0.7294
Yearly alpha	-1,92%	-2,49%	-1,75%	-3,86%	0,71%	0,15%	-4,20%	-7,42%	-6,55%
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1			Newey-West corrected						

Once controlled for value and size, the Fama and French 3-factor model enables the following conclusions: Portfolio P1 to P3, the ESG performing portfolios with and ESG score above 70%, all have a negative yearly alpha between -1,75% and -2,49%. Nevertheless, the socially performing portfolios over-performed the socially non-performing portfolios as can be seen in table 6. Indeed, portfolio 1 has a yearly alpha of -1,92% while portfolio 9 has a yearly alpha of -6,55%. The moderate portfolios 5 and 6 seems to have outperformed all the other portfolios as their yearly alphas are respectively 0,71% and 0,15%. Portfolio P4, on the limit between the moderate and good ESG performing portfolios, has an alpha of -3,86% yearly. These results are statistically insignificant and should be treated carefully but seems to confirm the existence of an inverted U-shaped relationship as illustrated by Figure 2.

Figure 2 - Illustration of the inverted U-shaped curve



Portfolio 1 was less risky than all the other portfolios with a market beta of 0,68 while portfolio 9 was the riskiest one with a beta 0,87. Confirming that socially performing portfolios are performing better and with less risk than portfolio made of socially irresponsible companies. The moderate portfolios P5 and P6 achieved higher returns than portfolio P9 with less associated risk but they were both more risky than the socially performing portfolios P1.

Another interesting finding is that socially responsible portfolios (P1 to P4) were more exposed to large caps while the less socially performing portfolios (P5 to P9) have a positive exposure to SMB meaning they are behaving like portfolios that are tilted towards small capitalization and have thus small stock exposure. Nevertheless only portfolio P1 has a statistically significant exposure to the SMB factor.

The Fama and French 3-factor model explained a large part of the price variation of the different portfolios. Indeed, the R-squared value of the different portfolios varied between 68,76% and 72,94% meaning that more than 68% of the price variations could be explained by the three factors model recommended by Fama and French.

10.1.5 Carhart 4-factor model

Table 7 - Carhart 4-factor model

Table 7 provides the results of the following regression

$$R_{it} - R_{ft} = \alpha_i + \beta_1(R_{Mt} - R_{ft}) + \beta_2(SMB) + \beta_3(HML) + \beta_4(WML) + \varepsilon$$

The alpha (intercept) computed with the least square regression is a monthly alpha. The last row of table 7 provides the yearly alpha.

CAPM 4 factor model										
Portfolio	Europe 2007-2015	P1	P2	P3	P4	P5	P6	P7	P8	P9
Carhart 4-Factor model		100%-90%	90%-80%	80%-70%	70%-60%	60%-50%	50%-40%	40%-30%	30%-20%	20%-0%
(Intercept)		0.0008497	-0.0002173	0.0008663	-0.001054	0.002702	0.002636	-0.001505	-0.003585	-0.002875
	t-statistics	(0.2966)	(-0.0855)	(0.3297)	(-0.4287)	(1.2284)	(0.9853)	(-0.5857)	(-1.3030)	(-0.9106)
rmrf		0.6096655	0.7206990	0.7357501	0.712599	0.739585	0.697456	0.730677	0.715998	0.795883
	t-statistics	(10.9955)***	(9.2591)***	(10.0265)***	(9.6322)***	(16.2704)***	(12.6178)***	(9.3693)***	(10.3860)***	(8.8605)***
smb		-0.6655584	-0.2683146	-0.1850184	-0.075548	0.193549	0.172856	0.389892	0.174011	0.056626
	t-statistics	(-4.0516)***	(-1.9251).	(-1.0861)	(-0.5727)	(1.7218).	(1.2533)	(2.9204)**	(1.3227)	(0.3920)
hml		0.2431995	0.0947091	0.0884513	0.113919	0.023313	0.068508	0.182869	0.186080	0.141586
	t-statistics	(1.3733)	(0.5262)	(0.4568)	(0.6100)	(0.1626)	(0.3788)	(1.1505)	(1.1676)	(0.8478)
wml		-0.3734945	-0.2827933	-0.3541749	-0.329346	-0.321708	-0.381906	-0.303583	-0.394930	-0.393754
	t-statistics	(-4.1378)***	(-3.3069)**	(-3.8187)***	(-3.4661)***	(-3.9043)***	(-3.7566)***	(-3.6729)***	(-4.3043)***	(-5.6345)***
R^2		0.7456	0.716	0.7347	0.7181	0.7526	0.7524	0.7541	0.7543	0.7666
Yearly alpha		1,020%	-0,261%	1,040%	-1,265%	3,242%	3,163%	-1,806%	-4,302%	-3,450%
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				Newey-West corrected						

The extension of the Fama and French 3-factor model to the Carhart (1997) 4-factor model permitted the investigation of the momentum factor that considers that previous winners will outperform previous losers. The addition of new factors caused the coefficients of the other factors to change. According to the Akaike information criterion and the Schwarz information criterion, the Carhart 4-factor model best fit the need for this thesis as its probability to be the best fitting model

is the highest. According to the Akaike information criterion, the addition of the momentum factor was particularly relevant as the probability of the model to be the best model increased from 0,14% for the 3-factor model to 23,34% for the 4-factor model. Moreover, the Carhart 4-factor model yielded a higher adjusted R-squared than the three-and five-factor model. According tot the adjusted R-squared value the Carhart 4-factor model explained up to 76,66% of the return variations. Now all portfolios have an adjusted R-squared higher than 70%.

The intercept or Jensen's alpha presents the return after that the excess return was regressed for systematic return factors. As the alpha represents the part of the return that could not be explained by the different factors, it represents the part of the revenue that was generated by the strategy of the portfolio. Portfolios P5 and P6 achieved a yearly alpha of respectively 3,24% and 3,163%. Portfolios P7, P8 and P9 fiercely underperformed portfolios P5 and P6 with negative alpha down to -4,30% for portfolio P8. The more socially responsible portfolios all exhibited a yearly alpha close to 0%. These figures seems to confirm the idea of a reversed U-shaped curvilinear relationship in fund returns proposed by Mintzberg (1983). Indeed, socially performing portfolios outperformed ESG non-performing portfolios while the portfolios with an average ESG score outperformed both categories.

Statistically significant conclusion can be drawn with regard to the market beta as they are all significant at the 0,1% level. As in the previous models, the socially responsible portfolio has a lower market beta than portfolio P9 made of firms with a low ESG score. The difference of 0.1862 between portfolio P1 and P9 is a significant proof that socially performing firms have less risk associated than firms that do not take into account the societal aspect when doing business. Results with regard to the beta of portfolios P1 and P9 confirm previous findings of Alexander & Buchholz (1978) and Orlinzky & Benjamin (2001). For the portfolios P2 to P8 there was not a conducting line in the level of market beta.

With regard to the exposure to the SMB factor, socially responsible portfolios have a greater exposure to large caps while non-responsible portfolios have an exposure to small capitalization. Portfolios P1 to P4 have a negative exposure to large capitalization while portfolios P5 to P9 all have an exposure to small capitalization. Only the result of portfolio P1 was statistically significant (t-stat=-4,0516). Thereby, robust conclusion can't be drawn for the SMB exposure.

All portfolios have a small exposure to value as the coefficient for all portfolios is small but positive. Again, none of the coefficients were statistically significant as the t-statistic is very low.

An interesting fact is that all portfolios have a negative coefficient for the momentum factor. Moreover all the results were significant at the 0,1% level. A negative coefficient for the WML factor is a sign that all portfolios have an exposure to past losers. This result is consistent with the

positive exposure to value as there exists evidence of a negative correlation between value and momentum (Asness, Moskowitz and Pedersen, 2013).

10.1.6 Addition of extra factors

The addition of the dummy variable that accounts for the 2008 crisis was not relevant according to the Akaike information criterion. Indeed, the addition of the crisis factor slightly decreased the probability of the Carhart 4-factor model to be the best fitting model. Nonetheless, the adjusted R-squared value improved for some portfolios.

Similarly, adding the factors accounting for investment (CMA), profitability (RMW) and quality (QMJ) yielded the same result and will not be discussed here. Nevertheless, results for the regressions including these factors are available in exhibit G1 to G6.

10.2 Accounting measures

Before performing the analysis of the different accounting-based measures, a discussion of the different trends characterizing the different ESG groups will be made.

Table 8 - Trends per ESG category

Table 8 provides information about the trends characterizing the different ESG groups. The first column represents the starting group of the sample. The second column enumerates the possible movements a company can make between the different ESG categories. The following columns present the percentage of companies that makes the movement mentioned in column 2.

Starting group	Movement in the next 3 years	2006	2007	2008	2009	2010	2011	AVERAGE
HIGH	STAY	72,41%	79,53%	85,34%	82,48%	78,31%	72,73%	78,47%
	GO DOWN	27,59%	20,47%	14,14%	17,52%	21,69%	22,55%	20,66%
MIDHIGH	STAY	27,39%	34,12%	36,70%	47,28%	58,71%	57,99%	43,70%
	GO UP	53,50%	55,88%	55,32%	41,85%	25,87%	24,66%	42,85%
	DO DOWN	19,11%	10,00%	7,98%	10,87%	14,93%	12,79%	12,61%
MIDLOW	STAY	24,29%	26,67%	28,78%	28,24%	42,98%	39,84%	31,80%
	GO UP	61,43%	64,44%	62,59%	64,12%	44,63%	44,72%	56,99%
	GO DOWN	11,43%	8,89%	8,63%	7,63%	12,40%	8,94%	9,65%
LOW	STAY	30,51%	38,60%	46,03%	43,08%	63,33%	58,82%	46,73%
	GO UP	69,49%	61,40%	53,97%	56,92%	36,67%	33,82%	52,05%

Table 8 presents the movement of companies between the four groups. For example, a stock starting in the « High » group has two possible movements. It can remain in the « High » group for the next three years or it can lower its corporate social performance and go down to one of the three following groups with a lower level of ESG: « MidHigh », « MidLow » or « Low ». The ESG score range of these different groups is respectively 75%-50%, 50%-25% and lower than 25%. The following trends can be deducted from table 8 :

1. Companies in the « High » group have a higher tendency, in comparison with firms in other categories, to remain for the next three years in the same group. On average 78,47% of the firms remained in the « High » category while the percentage of companies that remained for at least three years in one of the three other groups for at least three years is much lower : 43,70% for « MidHigh », 31,8% for « MidLow » and 46,73% for « Low ».
2. The percentage of firms that managed to increase their score in order to reach a higher category is much higher than the percentage companies lowering their score. The « MidHigh » And « MidLow » groups have a tendency to improve their ESG profile of respectively 42,85% and 56,99% against a tendency to go down of respectively 12,61% and 9,65%. A majority of companies preferred to improve their corporate social performance than to lower it.
3. The general tendency characterizing all groups is the improvement of the corporate social performance in the short run.

Before discussing the results of the regression analysis with ROA and ROE as dependent variables, the descriptive statistics of table 9 will be analysed. Thereafter, the results for the accounting measures ROE and ROA will be discussed in a way that takes into account the Dupont identity. First, the ROA will provide a look at how efficient the firm are using their assets to generate income. Afterwards, the return on equity will be investigated to take into account the leverage multiplier. Due to the use of leverage, the return on equity is expected to be higher than the return on assets.

It should be noticed that the standardized coefficient has been added in order to enables a comparison between different groups.

Table 9 - Descriptive statistics for accounting-based measures

This table presents the descriptive statistics for different metrics. The return on assets and return on equity are presented in their raw form before they were controlled for different control variables.

Variable \ Group	High		Midhigh		Midlow		Low	
	Average	Median	Average	Median	Average	Median	Average	Median
ROE	20,42%	11,70%	20,75%	13,32%	23,36%	14,01805	13,12%	11,90%
ROA	4,61%	4,07%	5,73%	4,70%	6,75%	4,92%	5,27%	3,35%
Total assets*	151.427	13.720	202.040	4.993	94.142	2.686	61.517	3.954
Net income*	1.763	401	6.500	151	5.765	108	1.300	157
Number of employees	51.918	25.224	31.774	10.197	17.088	5.541	14.259	4.433
EPS	1,37	0,74	5,53	0,74	5,52	0,54	- 1,05	1,05
Effective tax rate	30,29%	25,64%	32,23%	25,95%	29,88%	26,09%	28,59%	22,67%
Long term debt*	128.061	8.265	142.392	3.288	54.462	1.544	48.797	2.544
Total Debt	27.022	2.859	33.261	1.128	13.743	616	8.236	804
Capex*	566,58	24,00	2.275,76	9,60	- 1.090,30	3,49	1.250,44	8,63
Capex as % of sales	0,79%	0,50%	1,09%	0,45%	3,66%	0,36%	-3,84%	0,54%
Revenue*	39.132	8.306	55.923	3.030	22.701	1.386	9.170	1.574
NOPLAT*	2.690	584	7.437	247	4.096	147	330	181

** In million €*

Table 9 shows that the return on equity was the lowest for the less responsible companies. The descriptive statistics also bring evidence about the fact that corporate social performance was more pronounced in companies of larger size when size was measured by total assets and total employees. The probable explanation is that corporate social responsibility is more developed in bigger companies with more financial resources.

Moreover, the investigation of the other accounting variable also shows that capital expenditure measured as a percentage of total sales is the highest for the « Midhigh » and « Midlow » groups and negative for the « Low » group. This could confirm the trends described in table 8. Indeed, companies from these « Midhigh » and « Midlow » groups have a high tendency to improve their ESG profile which means their capital expenditures are likely to be more important.

10.2.1 Return on assets

Table 10 - Regression result with ROA as dependent variable

Table 10 shows the result of the following regression :

$$ROA_{it} = \alpha_i + \beta_1 TA + \beta_2 FL + \beta_3 RISK + \beta_4 TURN + \beta_5 PAST$$

Where the intercept represents the return on assets after controlling for the following variables : TA= total assets, FL= financial leverage, RISK= beta , TURN=Asset turnover and PAST= previous year return on assets. Standardized coefficients were added to improve the comparison between the different coefficients.

Regression result accounting performance				
Portfolio	**High**	**MidHigh**	**MidLow**	**Low**
Dependent variable: ROA				
Intercept	0.01144984	-0.072306	-0.0112514	0.03404
t-statistic	(3.1976)**	(-0.5122)	(-0.8920)	(3.2648)**
Total asset	-0.0010474	-0.052056	0.0009942	-0.007799
Standardized coefficient	-0.02239590	-0.039953	0.0083975	-0.09175935
t-statistic	(-1.6256)	(-2.0332)*	(0.4138)	(-2.5438)*
Financial leverage	-0.00149636	0.270170	0.0078182	0.009746
Standardized coefficient	-0.00724402	0.044394	0.0235146	0.04253975
t-statistic	(-0.6341)	(1.2697)	(1.4298)	(0.9244)
Turnover	0.00304427	0.072562	0.0056769	0.0077076
Standardized coefficient	0.04412407	0.043501	0.0373211	0.00672425
t-statistic	(3.8112)***	(2.1190)*	(2.5648)*	(0.5741)
Beta	-0.0034644	0.083324	-0.00519125	-0.002083
Standardized coefficient	-0.03517100	0.030636	-0.0218424	-0.01347391
t-statistic	(-2.4650)*	(0.7318)	(-1.5527)	(-0.6194)
Past	0.8630942	0.866215	1.01650267	0.774
Standardized coefficient	0.87598177	0.536396	0.9162766	0.81365819
t-statistic	(39.1826)***	(2.3824)*	(14.5897)***	(14.7814)***
R^2	0.8397	0.3067	0.8653	0.6981
Adjusted R^2	0.8393	0.3047	0.8646	0.6953
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1			Newey West corrected	

Table 10 provides the results from the regression analysis with return on assets as dependent variable. Return on assets gives information on how efficiently a firm uses its assets to generate profits. A high return on assets can only be achieved if the projects are profitable and asset efficiency is optimal within the company. The level of ROA put in perspective of the ESG performance should give an interesting insight into how activities, aiming to increase the firm's corporate social responsibility, are impacting the profitability.

According to the figures from table 10, firms from the « high » group were penalized on their return on assets for being socially responsible. Indeed, the intercept of the low ESG companies was higher than the intercept of the other groups. The intercepts of the « High » and the « Low » group were respectively 1,14% and 3,4%. Companies in the phase towards a more socially responsible status (« MidHigh » and « MidLow ») were negatively impacted and even have a negative return on assets. These results are confirming the claims of Friedman (1970) who stated

that CSP is only possible when resources are devoted to projects that are not creating value for shareholders. The « Low » group of firms only wasted a minimum of money on projects aiming to improve the firm's societal impact. All resources are expected to have been used for the creation of value to shareholders as recommended by Friedman (1970). The three other groups were spending resources and assets in order to improve the firm's impact on society. Indeed, the « MidHigh » and « MidLow » groups are investing to be more socially responsible while the « High » group is composed of companies that are investing to keep their status of socially performing companies. Again, the results were not significative enough to draw robust conclusions.

Size and ROA were negatively related in three of the four groups. The « high » group was less impacted by the size than the « low » group as can be seen from the standardized coefficients. Nevertheless, the results were statistically not significant.

The asset's operational efficiency expressed through the « turnover » factor provides information about the relationship between the ROA and the asset's efficiency to generate sales. According to the regression result the relationship is positive for all groups. Standardized coefficients show that the asset's efficiency to generate sales increased together with the firm's level of ESG.

With regard to the influence of past performance on the current profitability, all results were positively related with current profitability and were significant at the 0,1% level for 3 of the 4 groups.

10.2.2 Return on equity

Table 11 - Regression result with ROE as dependent variable

Table 11 shows the result of the following regression :

$$ROE_{it} = \alpha_i + \beta_1 TA + \beta_2 FL + \beta_3 RISK + \beta_4 TURN + \beta_5 PAST$$

Where the intercept represents the return on equity after controlling for the same variables as for the regression result of table 10. Again, standardized coefficients were added to improve the comparison between the different coefficients.

Regression result accounting performance				
Portfolio	**High**	**MidHigh**	**MidLow**	**Low**
Dependent variable: ROE				
Intercept	0.11268	-0.07231	0.032046	0.0335864
t-statistic	(2.1092)*	(-0.5122)	(0.3137)	(1.1945)
Total asset	-0.0453	-0.05206	-0.056047	0.0038759
standardized coefficient	-0.069435	-0.039953	-0.0748089	0.01346112
t-statistic	(-2.3494)*	(-2.0332)*	(-2.0532)*	(0.4492)
Financial leverage	0.43453	0.27017	0.219233	-0.0106498
standardized coefficient	0.143128	0.044394	0.0746630	-0.01107381
t-statistic	(2.9853)**	(1.2697)	(1.3235)	(-0.2516)
Turnover	0.06758	0.07256	0.229322	0.0001798
standardized coefficient	0.070098	0.043501	0.2359330	0.00512127
t-statistic	(3.0166)**	(2.1190)*	(2.7647)**	(0.4041)
Beta	-0.1592	0.08332	0.002632	-0.0227655
standardized coefficient	-0.116550	0.030636	0.0017532	-0.04364184
t-statistic	(-2.9386)**	(0.7318)	(0.0556)	(-0.9210)
Past	0.30221	0.86621	0.189787	0.7175261
standardized coefficient	0.420782	0.536396	0.3342355	0.72580502
t-statistic	(2.1348)*	(2.3824)*	(1.9413).	(9.7175)***
R^2	0.2511	0.3067	0.2106	0.5348
Adjusted R^2	0.2493	0.3047	0.2068	0.5304
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1			Newey west corrected	

The regression of the return on equity enabled a sound analysis of the relationship between ROE and factors driving profitability. Moreover the standardized coefficients allow the comparison of the different drivers of profitability between the groups. As said before, the ROE provides investors with information about how well their investment is generating income. In comparison with the ROA, the effects of leverage is added to the equation.

Adjusted R-squared ranged from 20,68% to 53,04% meaning that at least 20,68% of the variation in ROE was explained by the regression model.

Companies with high levels of ESG outperformed all companies with an ESG score lower than 75%. The ROE, after controlling for the different factors, was respectively 11,27% for the best ESG performing companies against 3,36% for the « low » group which have an ESG score lower than 25%. The groups « MidHigh » and « MidLow » achieved an adjusted return on equity lower than the « Low » group. These two groups can be qualified as transitory groups. As discussed before (see table 8), the firms composing these groups have a tendency to improve their ESG level

in order to be reclassified, in the short run, into groups with higher ESG reputation. The expenses incurred to do so are likely to impact the net income leading to lower levels of return on equity. Furthermore, the descriptive statistics of table 9 shows that the part of revenue dedicated to capital expenditure was the largest for these two transitory groups. Companies that reached a level of corporate social performance that is close to the highest attainable level (i.e. an ESG score higher than 75%) were apparently able to achieve a return on equity equal to 3 times the ROE of the « low » group. This result is similar to previous research performed by Eccles et al. (2012) and Margolis and Walsh (2003, 2007). Corporate social performance seems to be a driver of the firm's profitability. Possible explanation will be given in the section dedicated to the interpretation of results. Important to notice that none of the results were statistically significant at the 0,1% level. Only the intercept of the « High » group was statistically significant at the 1% level.

The ROE formula states that return on equity is equal to net income divided by shareholder equity. Therefore, engaging in projects that aim to improve the firm's social performance is likely to reduce the net income. According to the three trends deduced from table 8, the « MidHigh » and « MidLow » groups are the one that are expected to invest the most to be labelled as corporate social performing companies. This was confirmed by the percentage of sales dedicated to capital expenditure available in table 9. According to existing literature, how higher the level of CSP, how bigger the positive impact on the firm's reputation. Therefore, we can assume that once engaged in projects to improve their societal impact, firms out of the « MidHigh » and « MidLow » categories, are likely to continue these investments in the future in order to benefit from the effects of having a higher ESG level.

In a meanwhile, companies in the « High » group are reaching their maximum potential with regard to social performance and extra expenses incurred to further improve the ESG level would be useless. Once the maximum ESG level achieved, it is likely that these firms are in a position to capitalize on their past efforts and are able to profit from the advantages associated with the label of socially responsible firm. These advantages are likely to push the ROE to higher levels as can be observed from table 11.

Financial leverage and ROE were positively related for all groups except the « Low » group. Standardized coefficients for financial leverage reveal the relative impacts of financial leverage on the different groups. Companies were more positively impacted by financial leverage when the ESG score was increasing. This confirms the point of Oikonomou (2011) who proved that socially responsible firms are able to decrease the cost of debt leading to more favourable indebtedness conditions. Using debt will benefit the return on equity as the cost of debt is likely to be lower than

the return generated. Nevertheless, only the group « High » was significantly exposed to financial leverage (t-stat= 2,9853). Another interesting point can be deducted from the comparison between the regression result with ROE as dependent variable and the regression result with ROA as dependent variable. While the « High », group in the regression of the ROA, was negatively impacted by the financial leverage, it is largely positively impacted when the regression was made with the ROE as dependent variable. This can be explained by the fact that ROE incorporates the leverage multiplier in comparison to the ROA and also because the leverage occurs at more favourable conditions for the « High » group due to the positive impact of high levels of corporate social performances.

As for the ROA, all groups were positively impacted by past performance. Good performance in the previous year was a driver of current profitability.

Turnover, that represents the number of sales generated per unit of assets, is also a factor that positively impacted all portfolios. Every increase of Turnover by 1 unit would lead to a higher ROE in all the groups. Socially performing companies are able to use their assets in a more efficient way than socially irresponsible companies.

With regard to the size of the company, expressed as the logarithm of total assets, all groups suffer when the size increases except the « low » group. Once again, only the coefficient for the « high » group was statistically significant. The fact that only the « low » group was positively impacted by the size factor is not a surprise at all. Looking at the descriptive statistics of table 9 brings some interesting insight. CSP performing companies are many times larger than businesses from the « Low » group. It is widely recognized that the relation between return on equity and size should be positive as a growing business is able to profit from economies of scales. Nevertheless, too large firms could also suffer from their too important size.

11 Long-short strategy using ESG screening

This section will be dedicated to the creation of a long/short strategy based on the knowledge acquired throughout this thesis with regard to the market performance of corporate social performing European companies. First the investment strategy will be explained and afterwards the results will be discussed.

11.1 Strategy

Starting from the results of this paper, moderate levels of corporate social performance seems to be the best rewarded by the market. Companies with low and high levels of CSP are, according to the results of the Carhart (1997) 4-factor model, penalized by the market. The first for being socially irresponsible and the latter for being too socially responsible. Different funds were created to analyse the difference in return between investors who were able to detect the optimal level of CSP and the investors who were not able and simply invest in the stocks with the highest levels of CSP. Based on this information, the following strategy was set up:

The funds created were all using the same long-short strategy in which they systematically took short positions in the stocks from portfolio P9[14] and long positions in stocks with a moderate or a good ESG profiles. A total of four funds were created. Two of them took long positions in the stocks of firms with the best ESG level [15] and the two others took long positions in the stocks of companies with a moderate ESG level[16]. The funds were named respectively ESG BEST, ESG BEST 2, ESG MODERATE and ESG MODERATE 2.

Every year, the funds took short positions by selling €100 of each of the stocks from portfolio P9. The revenues from the short positions (i.e. € 4200 at the beginning of 2007) were all used to take long positions in all the stocks from the portfolio used in the strategy (i.e. P1, P2, P5 or P6). The amount of money invested in the long positions was limited to the proceeds from the short positions and the strategy did not allow the addition of cash. Therefore, the portfolios can be categorized as self-financing. Moreover, the proceeds from the short positions were invested equally over all long positions no matter the stock price of the stocks underlying the long position. At the end of every year all positions were closed and the whole strategy was repeated every year until the end of 2015. The cash earned after closing all positions was put aside and was not used in

[14] i.e. the portfolio with the less socially responsible stocks that achieves generally weaker financial performance according to the results of the multi-factor models
[15] i.e. stocks from portfolios P1 and P2
[16] i.e. stocks from portfolios P6 and P5

the next year. The sum of the amounts earned or lost at the end of every year represents the payoff of the strategy. It is important to note that transaction costs were not taken into consideration and will decrease the performance of the funds if they were added. Furthermore, the money earned was not invested at the risk-free rate and was just put aside.

11.2 Results

Figure 3 - Cumulative excess return from long-short strategy

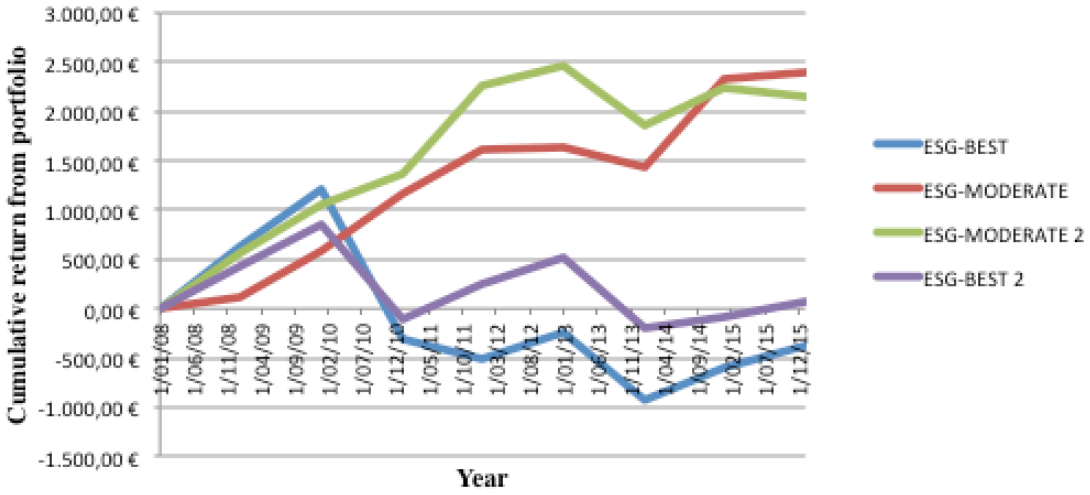


Figure 3 gives a visual representation of the cumulative return of each strategy while table 12 gives a more detailed view on the return year by year. As can be seen, the two funds that achieved the highest cumulative return are the ones that took long positions in moderate corporate social performing stocks confirming the existence of an inverted U-shaped relationship between stock return and ESG performance. According to table 12, the ESG MODERATE fund was able to end 8 of the 9 periods with a positive payoff while the strategy that invested in the best of the class stocks only ended with 5 positive payoffs and a negative balance at the end of the investment period. Moreover, moderate funds have the highest minimum excess return meaning that the downside risk of these funds is less than for the other funds analysed. The use of a long-short strategy also limited the minimum excess return in comparison to the portfolios (P1 to P9) individually. According to the descriptive statistics of the 9 portfolios provided in table 3, the excess return of the portfolios reached minimum returns ranging between -16,7% and -24,74% in a single month. The long-short strategy limited this downside risk to -4,11% for the moderate fund and -7,68% for the best fund.

These results highlight the importance of identifying the optimal level of CSP fixed by the market when using ESG criteria to create investment strategies.

Table 12 - Long/short strategy return and descriptive statistics

Fund	ESG LEVEL			Return							
		Date	3/01/07	3/01/08	5/01/09	4/01/10	4/01/11	3/01/12	3/01/13	6/01/14	5/01/15	4/01/16
ESG-BEST	90%-100%	Return		622,21 €	599,39 €	-1.538,60 €	-203,93 €	278,69 €	-685,27 €	320,11 €	228,16 €	-264,88 €
		Cumulated return	0,00 €	622,21 €	1.221,60 €	-317,00 €	-520,93 €	-242,24 €	-927,51 €	-607,41 €	-379,25 €	-644,12 €
ESG-BEST 2	80%-90%	Return		434,37 €	412,75 €	-944,69 €	347,78 €	269,00 €	-718,83 €	122,89 €	138,31 €	22,61 €
		Cumulated return	0,00 €	434,37 €	847,12 €	-97,57 €	250,21 €	519,21 €	-199,62 €	-76,73 €	61,58 €	84,18 €
ESG-MODERATE	40%-50%	Return		117,71 €	466,51 €	580,31 €	441,23 €	27,71 €	-189,91 €	878,79 €	70,18 €	254,56 €
		Cumulated return	0,00 €	117,71 €	584,22 €	1.164,52 €	1.605,76 €	1.633,46 €	1.443,55 €	2.322,34 €	2.392,52 €	2.647,08 €
ESG-MODERATE 2	50%-60%	Return		563,37 €	488,82 €	310,06 €	910,84 €	200,30 €	-620,99 €	387,78 €	-95,25 €	208,75 €
		Cumulated return	0,00 €	563,37 €	1.052,19 €	1.362,25 €	2.273,09 €	2.473,40 €	1.852,41 €	2.240,18 €	2.144,93 €	2.353,69 €

Fund	Descriptive statistics			
	Max. Ex. Return	Min. Ex. return	Mean Ex. return	Median Ex. return
ESG-BEST	9,18%	-7,68%	0,11%	-0,29%
ESG-BEST 2	7,70%	-5,99%	0,21%	0,20%
ESG-MODERATE	6,99%	-4,64%	0,56%	0,68%
ESG-MODERATE 2	8,42%	-4,11%	0,59%	0,44%

Table 13 - Regression results fund performance

Table 13 provides the result of the following regression model:

$$R_{it} - R_{ft} = \alpha_i + \beta_1(R_{Mt} - R_{ft}) + \beta_2(SMB) + \beta_3(HML) + \beta_4(WML) + \beta_5(crisis) + \varepsilon$$

The table provides the result of the regression analysis for the 4 funds that were created using a long-short strategy. The regression analysis was performed on the monthly return of each fund.

Carhart 4 factor model + 2008 dummy variable					
Fund		ESG BEST	ESG BEST 2	ESG MODERATE	ESG MODERATE 2
Carhart 4-factor model		Long P1 Short P9	Long P2 Short P9	Long P5 Short P9	Long P6 Short P9
(Intercept)		0,0005651	0,00015344	0,0034609	0,0025389
	t-statistics	(0,234)	(0,0797)	(2,0352)*	(1,1396)
rmrf		-0,1541623	-0,04370168	-0,0272732	0,0028845
	t-statistics	(-3,242)**	(-1,2198)	(-0,6583)	(0,0878)
smb		-0,7278839	-0,32846980	0,1402316	0,1658612
	t-statistics	(-6,645)***	(-4,2336)***	(1,7159).	(1,7013)
hml		0,0703337	-0,08725204	-0,1822421	-0,1782782
	t-statistics	(0,585)	(-0,9664)	(-1,8385).	(-1,6117)
wml		0,0546459	0,11567915	-0,0387500	0,1034865
	t-statistics	(0,869)	(1,6121)	(-0,4900)	(1,7086)
crisis		0,0096961	0,00981687	0,0166020	0,0170408)
	t-statistics	(1,300)	(0,9930)	(2,6816)**	(1,6562)
R^2		0,3895	0,2256	0,08705	0,1526
Yearly alpha		0,678%	0,184%	4,153%	3,047%
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				Newey-West corrected	

According to the Akaike information criterion tests available in appendix H, the Carhart (1997) 4-factor model extended with the dummy variable for the 2008 crisis was the best fitting model to regress the returns of the 4 funds. Therefore, Table 13 presents the results of the regression analysis of the Carhart 4-factor model improved with the dummy variable of 2008. The funds that took long positions in moderate ESG companies and short positions in the weakest ESG companies achieved a yearly alpha of 4,153% and 3,047%. Moreover, the alpha of the ESG MODERATE fund was significant at the 5% confidence level. The returns achieved by both moderate funds were

larger than the returns of both “ESG BEST” and “ESG BEST 2” funds. This proves that firms with moderate levels of ESG are better investment targets than firms with high levels of ESG.

With regard to market exposure, the beta of the four portfolios were all close to zero meaning that the returns of the funds were almost independent of the return on the market.

The funds investing in the best ESG stocks both have a negative exposure to the SMB factor meaning they were more tilted towards large caps while the moderate funds were more tilted towards small-capitalization stocks. The exposure to the SMB factor is in line with the descriptive statistics of table 3 that shows that ESG performance was positively correlated with the size of the firms measured through market capitalization.

With regard to the WML factor, 3 of the 4 funds were positively exposed to past winners. Only the “ESG MODERATE” fund was slightly tilted towards past losers. None of the coefficients for WML were statistically significant and conclusions regarding exposure to the WML factor should be taken with caution.

12 Interpretation of the results

The aim of becoming a social performing company can only be fulfilled at the expense of value creation (Friedman, 1970). Indeed, the resources devoted by managers to increase the social performance of their firm are not anymore available to engage in projects that will add directly value to the company. How more resources spent on social activities, how more uncertainty about the firm's ability to sustain growth in the future and the capacity to generate cash flows. According to the efficient market hypothesis, any social disclosure will lead to the stock price to adjust to the newly available information. The uncertainty about future cash flows and the ability to sustain future growth will decrease the value of the firm in the eyes of investors who do not consider social responsibility as a part of the business of a firm (Friedman, 1970) (Damodaran, 2007).

The methodology employed in this thesis, consisting of the repartition of all the stocks in different portfolios depending on their level of environmental, social and governance, highlights a very interesting fact in contradiction with Friedman's opinion on CSR. It is nor the portfolio with the highest corporate social performance, nor the one with the lowest level of social performance that achieved the highest level of risk-adjusted return. Indeed, portfolio P5 and P6, defined as the moderate ESG portfolios exhibit the highest risk-adjusted return. Results of the Carhart (1997) 4-factor model prove that these portfolios, with an ESG score between 40% and 60% outperformed all the other portfolios over the period 2007-2015. One should interpret these results with enough caution as no intercept was statistically significant. This seems to confirm McWilliams and Siegel's (2001) idea of an optimal/ideal level of CSP and the existence of an inverted U-shaped relation between CSP and CFP as proposed by Mintzberg (1983). At a certain level of CSP, the benefits of being socially performing, which are, a higher reputation, increased buying intention, lower cost of equity and lower cost of debt exceed, in the eyes of investors, the costs incurred to implement social responsible practices. At a moderate level of ESG performance[17] the thoughts of Porter and van der Linde (1985) seems to be confirmed. Indeed for these two portfolios investors believe that the benefits of behaving responsibly are greater than the costs incurred to do so and behind this optimal level, the disadvantages of CSR in the context of a firm's economic purposes are still creating fear for investors. The results for return on equity should be a proof to investors that firms benefit from having high levels of ESG.

This optimal level of CSP for market investments should evolve over time as more and more investors will become aware of the benefits associated with corporate social responsibility leading investors to fear less the uncertainty around corporate social performance. This should lead to an

[17] portfolios P5 and P6

increased demand for ESG performing stocks and let the price of these stocks increase. Therefore, the optimal level of CSP should move over time towards higher levels of CSP.

13 Conclusion

The aim of this thesis was to bring evidence of a positive or negative relationship between corporate social performance and financial performance in Europe. Extended literature on this subject already exists. Unfortunately, only a few have a specific focus on Europe despite the fact that European investors are showing increasing interest in social performance when composing their portfolio of investments. Can investors expect higher returns while investing in corporate social responsible companies or should they expect to be penalized ? Can a company increase its profitability by improving its social posture or is social reputation development a pure waste of resources as advocated by Friedman (1970)? The identification of a possible relationship was made through the analysis of accounting- and market-based measures. Results were put in perspective of previous research and theoretical frameworks such as Freeman's stakeholder theory (1984) or Friedman's agency theory (1970). In reality the truth appears to be somewhere in the middle of these two opposing theories. The fact that CSP practices is costly can't be denied. In a first stage, shareholders' money is invested in corporate social activities that will not directly create value to shareholders which correspond to Friedman's claim. Nevertheless, the impact of these activities should not be neglected and are confirming Freeman's stakeholder theory that states that shareholders are not the only important stakeholder for the company and favouring other groups of stakeholders also creates value.

Existing literature was not able to find a compromise on the effect of corporate social performance. Nor the market reaction to social posture nor the effect of CSP on firm's profitability was clearly established. This thesis contributes to the movement that believes that the positive effects of corporate social performance exceed the costs related to these practices. Results offered in this paper suggest that attention towards the claims of other stakeholders than only the shareholders has a positive impact on the performance of the firm. While the return on assets is negatively impacted by corporate social activities, return on equity is benefiting from higher levels of CSP confirming the findings of Margolis (2007), Orlitzky (2003) and Waddock & Graves (1997). Return on equity is nothing more than the return on assets times the leverage multiplier. Consequently, the large increase of ROE in comparison with ROA can be attributed to the effect of leverage. ESG performing companies are able to take advantage of improved condition to access debt. This confirms the claim of Oikonomou (2011) with respect to the access to more favourable financing solutions.

Lower levels of return on assets also tend to confirm that corporate social responsibility can't be achieved without a cost. Also, the benefits of achieving high levels of CSP/ESG tends to exceed the cost related to it once the leverage is taken into consideration.

This paper confirms the existence of a U-shaped relationship between accounting-based measures and corporate social performance. The firms with moderate levels of CSP are the ones with the lowest accounting-based performances while the socially top performers are the firms with the highest levels of return on equity.

The results of this paper also partly confirm the existence of a virtuous circle as proposed by Waddock et al. While some pretend that the availability of slack resources is the reason behind CSP, this study confirms the other part of the virtuous circle by showing that CSP also improve the return and profitability of companies.

As mentioned before, a large part of the existing literature supports a slightly positive reaction of the market to good levels of corporate social performance. Results with regard to market performance are confirming the existence of an inverted U-shaped relation between ESG score and expected return. Interpretation of this inverted U-shape is twofold : Firstly, investors are tempted to penalize companies with too high levels of ESG. A more than probable explanation is the fear of investors relative to the uncertainty about the firm's future growth and the future ability to produce cash-flows. Secondly, investors seem to prefer investments in companies with an average level of CSP over totally irresponsible firms. These results suggest that investors are aware of the large range of benefits associated to CSP but still fear the uncertainty arising from corporate social responsible practices. This paper brings evidence that investor's fear is not justified as CSP seems to lead to higher levels of return on equity.

To conclude, depending on whether accounting measure of profitability or market return is analysed the results are slightly different but both are in the same direction (i.e. a positive relationship). With respect to accounting measure of profitability, the results suggest that how higher the level of CSP, the higher the benefits to the firm are. The conclusions are different when looking at the expected return. Excess return regressed using the Carhart (1997) 4- factor model suggests that a moderate level of social performance is the most rewarded by the market and outperforms all other portfolios created on the basis of ESG score.

13.1 Implications

According to the results and conclusions drawn in this thesis two main implications arise. One has regard to investors while the other concerns the firms' managers.

The company's positive societal impact is likely to improve the firm's reputation and access to debt. Better condition to access resources should not be neglected and the results of this paper should encourage managers to put efforts to improve the way their company is impacting the society. Moreover, the market seems to become familiar with environmental, social and governance aspect of management and seems to reward, up to a point, good ESG behaviour. Investors should consider all the advantages related to CSP-performance before penalizing a firm for the sole reason that the company's resources are not used to create value directly. Nevertheless, investors should be aware that the market still fears the uncertainty associated with high levels of corporate social performance and that the highest return will be achieved by investing in moderate ESG stocks as proved by the long-short strategy created in section 11 of this paper. Moreover, corporate social responsible companies are likely to achieve much higher levels of return on equity.

13.2 limitations

A first limitation encountered while doing this paper is the small number of companies covered by ESG analysts. The sample of European companies varies between 533 and 693 stocks while the entire market for European stocks is much larger. The fact that all the portfolios were built from the ESG covered stocks reduces the power of diversification. This will always be an issue to socially responsible investors until the whole market is covered by ESG analysts.

ESG investment is becoming a widely used strategy but it remains a recent phenomenon. Therefore the strategy used to build the different portfolios and the long-short investment strategy could only be tested on a limited period of time.

Another limitation is the limited significance of the regression results. Even if the results presented in this paper are in line with previous research, the fact that analysed intercepts are statistically not significant reduces the robustness of the results and the interpretations of these results..

A last limitation was highlighted by Chatterji, Levine & Toffel (2008) who analysed the reliability of ESG scores. They bring evidence that rating agencies fail to use publicly available information in an optimal way and have by the way still a great job to do in order to improve the accuracy of their judgement.

13.3 Further research

Future improvements are related to the limitations encountered while writing this thesis. Results based on longer periods of times and based on larger samples could be interesting to study. Moreover, the concerns with regard to environmental issues and human rights are increasing and will be much more present in future decades. Therefore, it could be of great interest to study how the relationship between corporate social performance and financial performance evolve together with the growing concerns.

In order to present more robust results with regard to corporate social performance, crosschecking of the ESG score could be an interesting improvement. The difficulty remains in the access of those databases. Example of a possible database that could be used to crosscheck the level of corporate social responsibility is the KLD Social ratings database of Bloomberg.

A last interesting research point for further research would be the more in depth decomposition of the Dupont identity to better understand the strengths and weaknesses related to ESG-performing companies. This paper provides evidence of an improved use of leverage. Nevertheless, further decomposition of the Dupont identity would provide additional information about for example the firms' profit margin.

14 References

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15 Appendix

15.1 Appendix A : Social Responsible investment market in Europe

Figures about SRI

Total AuM in Europe per strategy in M€	2011	2013	CAGR
exclusion	3.584.498,00 €	6.853.954,00 €	38,28%
Norms-based screening	2.132.394,00 €	3.633.794,00 €	30,54%
Best-in-Class selection	283.081,00 €	353.555,00 €	11,76%
Sustainability themed	48.046,00 €	58.961,00 €	10,78%
ESG integration	3.164.066,00 €	5.232.120,00 €	28,59%
Engagement and voting	1.762.687,00 €	3.275.930,00 €	36,33%
Impact investing	8.750,00 €	20.269,00 €	52,20%
Total after correction for double counting	6.763.347,00 €	9.884.966,00 €	20,89%
Total AuM in Europe	13.900.000,00 €	16.800.000,00 €	9,94%
% AuM devoted to responsible investment	48,66%	58,84%	

15.2 Appendix B1 : Test of multicollinearity for market-based performance portfolios

Portfolios P1 to P9

Model	CAPM single factor		Fama French 3-factor		Carhart 4-factor		Carhart 4-factor + crisis	
Factor								
	VIF	*CI*	*VIF*	*CI*	*VIF*	*CI*	*VIF*	*CI*
Intercept		1.000		1.000		1.000		1.000
MKRF		1.040	1.486156	1.247	1.595848	1.422	1.818.515	1.297
SMB			1.009077	1.283	1.021000	1.437	1.056.187	1.461
HML			1.489738	1.959	1.722332	2.102	1.801.416	1.682
WML					1.521788	2.261	1.523.131	2.188
crisis							1.188.905	2.609
RMW								
CMA								
QMJ								

Model	FF 5-factor		FF 5-factor + crisis		FF-5 factor+crisis+QMJ		All factors	
Factor								
	VIF	CI	VIF	CI	VIF	CI	VIF	CI
Intercept		1.000		1.000		1.000		1.000
MKRF	2.092876	1.315	2.206925	1.168	2.969178	1.358	3.143196	1.460
SMB	1.171626	1.441	1.194876	1.433	1.366445	1.669	1.422390	1.787
HML	3.811048	1.548	3.814268	1.526	5.134554	1.779	5.179375	1.916
RMW	2.826127	2.843	2.832476	2.058	3.326652	2.369	3.411788	2.358
CMA	1.617630	3.785	1.677527	2.931	2.025217	3.431	2.091738	2.962
crisis			1.236906	3.814	1.237562	4.405	1.242241	3.755
QMJ					6.743006	5.905	8.879839	5.006
WML							2.322662	6.992

15.3 Appendix B2 : Test of multicollinearity for accounting-based performance portfolios

ROA

Portfolio	HIGH		MIDHIGH		MIDLOW		LOW	
Factor								
	VIF	*CI*	*VIF*	*CI*	*VIF*	*CI*	*VIF*	*CI*
intercept		1.000		1.000		1.000		1.000
Total Asset	1.472362	2.991	1.234049	2.187	1.378784	2.620	1.113838	2.015
Financial leve	1.182624	4.373	1.109824	3.430	1.049046	3.931	1.072095	2.537
Turnover	1.411414	7.038	1.148822	5.964	1.296265	5.019	1.002158	4.513
Beta	1.190926	11.170	1.068413	9.274	1.065308	6.944	1.015174	6.284
Past ROA	1.353458	20.220	1.063323	15.246	1.285102	15.734	1.089830	14.359

ROE

Model	HIGH		MIDHIGH		MIDLOW		LOW	
Factor								
	VIF	*CI*	*VIF*	*CI*	*VIF*	*CI*	*VIF*	*CI*
intercept		1.000		1.000		1.000		1.000
Total Asset	1.472362	2.991	1.234049	2.187	1.366616	2.155	1.188827	2.008
Financial leve	1.182624	4.373	1.109824	3.430	1.159664	3.250	1.181560	2.396
Turnover	1.411414	7.038	1.148822	5.964	1.176170	5.421	1.001360	4.804
Beta	1.190926	11.170	1.068413	9.274	1.059569	8.269	1.023786	7.078
Past ROA	1.353458	20.220	1.063323	15.246	1.022687	14.565	1.012040	13.866

15.4 Appendix C1 : Correlation matrix for market performance factors

Correlation matrix market performance factors

factor	MKTRF	SMB	HML	RMW	CMA	WML	QMJ	crisis
MKTRF	1							
SMB	-0.0757	1						
HML	0.5714	-0.0901	1					
RMW	-0.4190	-0.0845	-0.7859	1				
CMA	-0.2479	-0.2316	0.2814	-0.2482	1			
WML	-0.4851	-0.0329	-0.5363	0.4361	0.2104	1		
QMJ	-0.7495	-0.1712	-0.7690	0.7162	0.1592	0.7149	1	
crisis	-0.2886	-0.1636	0.0080	-0.0275	0.3592	0.1109	0.2035	1

15.5 Appendix C2 : Correlation matrices for accounting performances

Correlation matrix ROE Portfolio LOW

	Size	Financial Leverage	Turnover	Beta	Past ROE
Size	1				
Financial Lev	0.3899	1			
Turnover	-0.0075	0.0091	1		
Beta	0.1059	0.0739	-0.0292	1	
Past ROE	-0.0341	0.0030	0.0200	-0.1030	1

Correlation matrix ROE Portfolio MIDLOW

	Size	Financial Leverage	Turnover	Beta	Past ROE
Size	1				
Financial Lev	0.3514	1			
Turnover	-0.3637	-0.0497	1		
Beta	0.2259	0.0968	-0.1450	1	
Past ROE	-0.0787	0.0605	0.1145	-0.0184	1

Correlation matrix ROE Portfolio MIDHIGH

	Size	Financial Leverage	Turnover	Beta	Past ROE
Size	1				
Financial Lev	0.2631	1			
Turnover	-0.3333	-0.0577	1		
Beta	0.1808	0.1740	-0.0881	1	
Past ROE	-0.1319	0.0631	0.1763	-0.1264	1

Correlation matrix ROE Portfolio HIGH

	Size	Financial Leverage	Turnover	Beta	Past ROE
Size	1				
Financial Lev	0.4172	1			
Turnover	-0.4785	-0.2234	1		
Beta	0.2480	0.2350	-0.1918	1	
Past ROE	-0.1031	0.0928	0.1334	-0.1427	1

Correlation matrix ROA Portfolio LOW

	Size	Financial Leverage	Turnover	Beta	Past ROE
Size	1				
Financial Lev	0.2257	1			
Turnover	-0.0092	0.0144	1		
Beta	0.1014	0.0333	-0.0292	1	
Past ROE	-0.2496	-0.1782	0.0315	-0.0861	1

Correlation matrix ROA Portfolio MIDLOW

	Size	Financial Leverage	Turnover	Beta	Past ROE
Size	1				
Financial Lev	0.1709	1			
Turnover	-0.3800	0.0500	1		
Beta	0.2303	0.0135	-0.1505	1	
Past ROE	-0.3853504	0.0030	0.3898	-0.0567	1

Correlation matrix ROA Portfolio MIDHIGH

	Size	Financial Leverage	Turnover	Beta	Past ROE
Size	1				
Financial Lev	0.2631	1			
Turnover	-0.3333	-0.0577	1		
Beta	0.1808	0.1740	-0.0881	1	
Past ROE	-0.1319	0.0631	0.1763	-0.1264	1

Correlation matrix ROA Portfolio HIGH

	Size	Financial Leverage	Turnover	Beta	Past ROE
Size	1				
Financial Lev	0.3294	1			
Turnover	-0.4889	-0.1589	1		
Beta	0.2566	0.1837	-0.2011	1	
Past ROE	-0.3052	-0.2934	0.3615	-0.3682	1

15.6 Appendix D1 : Test of autocorrelation for market based performance portfolios

Breusch Godfrey test

Single factor CAPM	Portfolio	BG test(chi^2)	df	p-value	Free of autocorrelation?
	P1	1.0274	1	0.3108	YES
	P2	4.2473	1	0.03931	NO
	P3	2.6048	1	0.1065	YES
	P4	3.1648	1	0.07524	YES
	P5	2.7192	1	0.09915	YES
	P6	0.080944	1	0.776	YES
	P7	1.301	1	0.254	YES
	P8	0.12206	1	0.7268	YES
	P9	2.31	1	0.1285	YES

Breusch Godfrey test

FF 3-factor	Portfolio	BG test(chi^2)	df	p-value	Free of autocorrelation?
	P1	0.064995	1	0.7988	YES
	P2	2.1344	1	0.144	YES
	P3	1.7575	1	0.1849	YES
	P4	1.8168	1	0.1777	YES
	P5	3.0272	1	0.08188	YES
	P6	0.085475	1	0.77	YES
	P7	3.0181	1	0.08234	YES
	P8	0.0017758	1	0.9664	YES
	P9	0.9324	1	0.3342	YES

Breusch Godfrey test

Carhart 4-factor	Portfolio	BG test(chi^2)	df	p-value	Free of autocorrelation?
	P1	0.64408	1	0.4222	YES
	P2	3.2637	1	0.07083	YES
	P3	2.8894	1	0.08916	YES
	P4	3.2348	1	0.07209	YES
	P5	5.3106	1	0.0212	NO
	P6	1.0372	1	0.3085	YES
	P7	4.2359	1	0.03958	NO
	P8	0.77349	1	0.3791	YES
	P9	2.5139	1	0.1128	YES

Breusch Godfrey test

FF 5-factor	Portfolio	BG test(chi^2)	df	p-value	Free of autocorrelation?
	P1	0.055555,	1	0.8137	YES
	P2	24224	1	0.1196	YES
	P3	16392	1	0.2004	YES
	P4	1.9487,	1	0.1627	YES
	P5	2.4861,	1	0.1149	YES
	P6	0.31662,	1	0.5736	YES
	P7	3.6737,	1	0.05528	YES
	P8	0.36049,	1	0.5482	YES
	P9	2.0176,	1	0.1555	YES

Breusch Godfrey test

FF 3-factor +QMJ	Portfolio	BG test(chi^2)	df	p-value	Free of autocorrelation?
	P1	1.0587	1	0.3035	YES
	P2	3.7715	1	0.05213	YES
	P3	3.5765	1	0.0586	YES
	P4	3.9174	1	0.04779	NO
	P5	5.7919	1	0.0161	NO
	P6	0.80605	1	0.3693	YES
	P7	6.2804	1	0.01221	NO
	P8	0.20276	1	0.6525	YES
	P9	1.7346	1	0.1878	YES

Breusch Godfrey test

Carhart 4 factor +QMJ	Portfolio	BG test(chi^2)	df	p-value	Free of autocorrelation?
	P1	1.0617	1	0.3028	YES
	P2	3.828	1	0.0504	YES
	P3	3.5516	1	0.05949	YES
	P4	3.8989	1	0.04832	NO
	P5	6.305	1	0.01204	NO
	P6	1.3048	1	0.2533	YES
	P7	5.722	1	0.01675	NO
	P8	0.85482	1	0.3552	YES
	P9	2.615	1	0.1059	YES

Breusch Godfrey test

FF 5-factor +QMJ	Portfolio	BG test(chi^2)	df	p-value	Free of autocorrelation?
	P1	1.2578	1	0.2621	YES
	P2	3.4945	1	0.06157	YES
	P3	3.1797	1	0.07456	YES
	P4	3.7308	1	0.05342	YES
	P5	4.5008	1	0.03388	NO
	P6	0.80927	1	0.3683	YES
	P7	6.3042	1	0.01205	NO
	P8	0.78258	1	0.3764	YES
	P9	2.0245	1	0.1548	YES

15.7 Appendix D2 : Test of autocorrelation for accounting-based measures

Breusch-Godfrey Test

ROE	Portfolio	BG test(chi^2)	df	p-value	Free of autocorrelation?
	HIGH	0.19946	1	0.6552	YES
	MIDHIGH	0.10236	1	0.749	YES
	MIDLOW	0.41622	1	0.5188	YES
	LOW	3.214	1	0.07301	YES

Breusch-Godfrey Test

ROA	Portfolio	BG test(chi^2)	df	p-value	Free of autocorrelation?
	HIGH	9.3525	1	0.002227	NO
	MIDHIGH	0.10236	1	0.749	YES
	MIDLOW	5.3714	1	0.02047	NO
	LOW	0.52513	1	0.4687	YES

15.8 Appendix E1 : Test of heteroscedasticity for market-based performance portfolios

Breusch Pagan heteroscedasticity test

Single factor CAPM	BP(chi^2)	df	p-value	heteroscedasticity
P1	0.38961	1	0.5325	NO
P2	0.00073889	1	0.9783	NO
P3	0.45474	1	0.5001	NO
P4	13926	1	0.238	NO
P5	0.89865	1	0.3431	NO
P6	21849	1	0.1394	NO
P7	0.93779	1	0.3328	NO
P8	0.092033	1	0.7616	NO
P9	0.99409	1	0.3187	NO

Breusch Pagan heteroscedasticity test

Fama French 3 factor model	BP(chi^2)	df	p-value	heteroscedasticity
P1	0.5033	3	0.9182	NO
P2	0.1263	3	0.7379	NO
P3	0.3082	3	0.9585	NO
P4	0.24578	3	0.9699	NO
P5	0.40851	3	0.9385	NO
P6	0.88401	3	0.8293	NO
P7	0.25503	3	0.9683	NO
P8	1.061	3	0.7865	NO
P9	1.0631	3	0.786	NO

Breusch Pagan heteroscedasticity test

Four Factor model	BP(chi^2)	df	p-value	eteroscedasticity
P1	6.0829	4	0.193	NO
P2	4.4417	4	0.3495	NO
P3	4.5008	4	0.3424	NO
P4	2.0537	4	0.7259	NO
P5	1.8199	4	0.7688	NO
P6	10.468	4	0.03325	YES
P7	2.6581	4	0.6166	NO
P8	6.8813	4	0.1423	NO
P9	5.7611	4	0.2177	NO

Breusch Pagan heteroscedasticity test

Five Factor model	BP(chi^2)	df	p-value	eteroscedasticity
P1	4.5161	5	0.4777	NO
P2	3.4221	5	0.6352	NO
P3	1.0647	5	0.9572	NO
P4	1.6703	5	0.8926	NO
P5	0.32759	5	0.9971	NO
P6	1.9616	5	0.8544	NO
P7	1.4369	5	0.9202	NO
P8	5.2394	5	0.3874	NO
P9	4.4097	5	0.4921	NO

Breusch Pagan heteroscedasticity test

Five factor + crisis	BP(chi^2)	df	p-value	heteroscedasticity
P1	9.5874	6	0.1431	NO
P2	1.9005	6	0.004156	YES
P3	1.6825	6	0.009949	YES
P4	2.2464	6	0.0009972	YES
P5	9.6653	6	0.1395	NO
P6	9.0096	6	0.173	NO
P7	8.4907	6	0.2043	NO
P8	9.7575	6	0.1352	NO
P9	1.4206	6	0.02742	YES

Breusch Pagan heteroscedasticity test

Five factor+ crisis +QMJ	BP(chi^2)	df	p-value	heteroscedasticity
P1	15.725	7	0.02775	YES
P2	26.716	7	0.0003749	YES
P3	25.144	7	0.0007153	YES
P4	26.367	7	0.000433	YES
P5	18.773	7	0.008928	YES
P6	24.124	7	0.001084	YES
P7	13.886	7	0.05325	NO
P8	17.242	7	0.0159	YES
P9	20.307	7	0.004943	YES

Breusch Pagan heteroscedasticity test

Four factor + crisis	BP(chi^2)	df	p-value	heteroscedasticity
P1	8.2227	5	0.1444	NO
P2	16.995	5	0.00451	YES
P3	13.607	5	0.01831	YES
P4	17.621	5	0.00346	YES
P5	8.3877	5	0.1361	NO
P6	13.199	5	0.02158	YES
P7	5.8367	5	0.3224	NO
P8	7.893	5	0.1622	NO
P9	1.4509	5	0.01268	YES

Breusch Pagan heteroscedasticity test

Four factor +crisis + QMJ	BP(chi^2)	df	p-value	heteroscedasticity
P1	12.267	6	0.05627	NO
P2	18.632	6	0.004833	YES
P3	16.185	6	0.0128	YES
P4	18.772	6	0.004567	YES
P5	11.182	6	0.08292	NO
P6	17.338	6	0.008119	YES
P7	7.4325	6	0.2827	NO
P8	12.875	6	0.04507	YES
P9	14.638	6	0.02327	YES

15.9 Appendix E2 : Test of heteroscedasticity for accounting-based portfolios

Breusch Pagan heteroscedasticity test

ROE as dependent variable	BP(chi^2)	df	p-value	heteroscedasticity
Highest	169,2	5	2,2e-16	YES
Midhigh	144,76	5	2,2e-16	YES
Midlow	104,23	5	2,2e-16	YES
Low	27,563	5	4,431e-05	YES

Breusch Pagan heteroscedasticity test

ROA as dependent variable	BP(chi^2)	df	p-value	heteroscedasticity
Highest	119,87	5	2,2e-16	YES
Midhigh	144,76	5	2,2e-16	YES
Midlow	121,07	5	2,2e-16	YES
Low	23,802	5	0,0002369	YES

15.10 Appendix F1 : Akaike & Schwarz information criterion for market-based portfolios

Akaike Information Criterion (AIC) portfolio 100-90

Model	df	AIC	ΔAIC	Akaike weight	SIC	ΔSIC	Schwarz weight
CAPM Single Factor	1	-402,2484	34,59	0,00%	-394,20	26,39	0,00%
FF 3-Factor	3	-421,0378	15,80	0,01%	-407,63	12,96	0,11%
Carhart 4-Factor	4	-436,683	0,15	28,34%	-420,59	0,00	74,80%
Carhart 4-Factor + crisis	5	-436,8348	0,00	30,58%	-418,06	2,53	21,11%
Carhart 4-Factor +RMW+CMA+crisis	6	-434,2029	2,63	8,20%	-410,06	10,53	0,39%
FF 5-Factor	5	-419,9741	16,86	0,01%	-401,20	19,39	0,00%
FF 5-Factor + crisis	6	-419,3762	17,46	0,00%	-397,92	22,67	0,00%
FF 5-Factor + crisis + QMJ	7	-429,0166	7,82	0,61%	-404,88	15,71	0,03%
Carhart 4-Factor + crisis + QMJ	6	-435,8569	0,98	18,75%	-414,40	6,19	3,39%
All factors	8	-435,1984	1,64	13,49%	-408,38	12,21	0,17%

Akaike Information Criterion (AIC) portfolio 90-80

Model	df	AIC	ΔAIC	Akaike weight	SIC	ΔSIC	Schwarz weight
CAPM Single Factor	1	-414,0331	8,20	0,51%	-405,99	0,15	39,94%
FF 3-Factor	3	-415,0213	7,21	0,84%	-401,61	4,53	4,48%
Carhart 4-Factor	4	-422,2299	0,00	30,82%	-406,14	0,00	43,06%
Carhart 4-Factor + crisis	5	-422,071	0,16	28,46%	-403,30	2,84	10,40%
Carhart 4-Factor +RMW+CMA+crisis	6	-419,8191	2,41	9,23%	-395,68	10,46	0,23%
FF 5-Factor	5	-414,7995	7,43	0,75%	-396,02	10,11	0,27%
FF 5-Factor + crisis	6	-413,9446	8,29	0,49%	-392,49	13,65	0,05%
FF 5-Factor + crisis + QMJ	7	-418,622	3,61	5,07%	-394,48	11,65	0,13%
Carhart 4-Factor + crisis + QMJ	6	-420,7121	1,52	14,43%	-399,26	6,88	1,38%
All factors	8	-419,8534	2,38	9,39%	-393,03	13,11	0,06%

Akaike Information Criterion (AIC) portfolio 80-70

Model	df	AIC	ΔAIC	Akaike weight	SIC	ΔSIC	Schwarz weight
CAPM Single Factor	1	-409,4927	12,52	0,07%	-401,45	4,48	8,32%
FF 3-Factor	3	-409,9266	12,09	0,09%	-396,52	9,41	0,71%
Carhart 4-Factor	4	-422,0142	0,00	36,25%	-405,92	0,00	77,92%
Carhart 4-Factor + crisis	5	-420,8876	1,13	20,64%	-402,11	3,81	11,60%
Carhart 4-Factor +RMW+CMA+crisis	6	-418,9343	3,08	7,77%	-394,80	11,13	0,30%
FF 5-Factor	5	-410,4227	11,59	0,11%	-391,65	14,27	0,06%
FF 5-Factor + crisis	6	-408,7985	13,22	0,05%	-387,34	18,58	0,01%
FF 5-Factor + crisis + QMJ	7	-417,4915	4,52	3,78%	-393,35	12,57	0,15%
Carhart 4-Factor + crisis + QMJ	6	-420,2226	1,79	14,80%	-396,71	9,21	0,78%
All factors	8	-420,4339	1,58	16,45%	-393,61	12,31	0,17%

Akaike Information Criterion (AIC) portfolio 70-60

Model	df	AIC	ΔAIC	Akaike weight	SIC	ΔSIC	Schwarz weight
CAPM Single Factor	1	-410,5541	10,17	0,26%	-402,51	2,12	22,46%
FF 3-Factor	3	-410,5726	10,15	0,27%	-397,16	7,47	1,55%
Carhart 4-Factor	4	-420,7199	0,00	42,62%	-404,63	0,00	64,81%
Carhart 4-Factor + crisis	5	-419,6222	1,10	24,62%	-400,85	3,78	9,79%
Carhart 4-Factor +RMW+CMA+crisis	6	-417,742	2,98	9,61%	-391,43	13,20	0,09%
FF 5-Factor	5	-410,2069	10,51	0,22%	-387,22	17,41	0,01%
FF 5-Factor + crisis	6	-408,6783	12,04	0,10%	-387,22	17,41	0,01%
FF 5-Factor + crisis + QMJ	7	-414,4291	6,29	1,83%	-390,29	14,34	0,05%
Carhart 4-Factor + crisis + QMJ	6	-418,0464	2,67	11,20%	-396,59	8,04	1,16%
All factors	8	-417,6687	3,05	9,27%	-390,85	13,78	0,07%

Akaike Information Criterion (AIC) portfolio 60-50

Model	df	AIC	ΔAIC	Akaike weight	SIC	ΔSIC	Schwarz weight
CAPM Single Factor	1	-427,8108	12,99	0,05%	-419,76	4,60	7,78%
FF 3-Factor	3	-428,6553	12,14	0,07%	-415,24	9,12	0,81%
Carhart 4-Factor	4	-440,4617	0,34	26,26%	-424,37	0,00	77,78%
Carhart 4-Factor + crisis	5	-439,0447	1,75	12,93%	-420,27	4,10	10,02%
Carhart 4-Factor +RMW+CMA+crisis	6	-438,5179	2,28	9,94%	-414,38	9,99	0,53%
FF 5-Factor	5	-430,6146	10,18	0,19%	-411,84	12,53	0,15%
FF 5-Factor + crisis	6	-428,7811	12,02	0,08%	-407,32	17,04	0,02%
FF 5-Factor + crisis + QMJ	7	-438,4585	2,34	9,65%	-414,32	10,05	0,51%
Carhart 4-Factor + crisis + QMJ	6	-438,4774	2,32	9,74%	-417,02	7,35	1,97%
All factors	8	-440,7994	0,00	31,10%	-413,98	10,39	0,43%

Akaike Information Criterion (AIC) portfolio 50-40

Model	df	AIC	ΔAIC	Akaike weight	SIC	ΔSIC	Schwarz weight
CAPM Single Factor	1	-421,2764	19,22	0,00%	-413,23	11,17	0,31%
FF 3-Factor	3	-423,5064	16,99	0,01%	-410,10	14,31	0,06%
Carhart 4-Factor	4	-440,4965	0,00	39,07%	-424,40	0,00	83,06%
Carhart 4-Factor + crisis	5	-439,5584	0,94	24,44%	-420,78	3,62	13,59%
Carhart 4-Factor +RMW+CMA+crisis	6	-437,6068	2,89	9,21%	-413,47	10,94	0,35%
FF 5-Factor	5	-426,9669	13,53	0,05%	-408,19	16,21	0,03%
FF 5-Factor + crisis	6	-425,2813	15,22	0,02%	-403,82	20,58	0,00%
FF 5-Factor + crisis + QMJ	7	-432,4384	8,06	0,70%	-408,30	16,10	0,03%
Carhart 4-Factor + crisis + QMJ	6	-438,831	1,67	16,99%	-417,37	7,03	2,47%
All factors	8	-437,6717	2,82	9,52%	-410,85	13,55	0,09%

Akaike Information Criterion (AIC) portfolio 40-30

Model	df	AIC	ΔAIC	Akaike weight	SIC	ΔSIC	Schwarz weight
CAPM Single Factor	1	-416,216	24,83	0,00%	-408,17	10,62	0,27%
FF 3-Factor	3	-425,0918	15,95	0,02%	-411,68	7,10	1,58%
Carhart 4-Factor	4	-434,8788	6,16	2,42%	-418,79	0,00	55,06%
Carhart 4-Factor + crisis	5	-435,1694	5,87	2,80%	-416,39	2,39	16,65%
Carhart 4-Factor +RMW+CMA+crisis	6	-437,0663	3,98	7,22%	-412,93	5,86	2,94%
FF 5-Factor	5	-429,4436	11,60	0,16%	-410,67	8,12	0,95%
FF 5-Factor + crisis	6	-428,7046	12,34	0,11%	-407,25	11,54	0,17%
FF 5-Factor + crisis + QMJ	7	-440,0626	0,98	32,28%	-415,92	2,86	13,16%
Carhart 4-Factor + crisis + QMJ	6	-434,7827	6,26	2,30%	-413,33	5,46	3,59%
All factors	8	-441,0428	0,00	52,70%	-414,22	4,56	5,62%

Akaike Information Criterion (AIC) portfolio 30-20

Model	df	AIC	ΔAIC	Akaike weight	SIC	ΔSIC	Schwarz weight
CAPM Single Factor	1	-407,3754	28,60	0,00%	-399,33	13,08	0,06%
FF 3-Factor	3	-412,266	23,71	0,00%	-398,86	13,56	0,04%
Carhart 4-Factor	4	-428,5044	7,47	1,13%	-412,41	0,00	38,74%
Carhart 4-Factor + crisis	5	-429,7964	6,18	2,16%	-411,02	1,39	19,33%
Carhart 4-Factor +RMW+CMA+crisis	6	-435,7462	0,23	42,31%	-411,61	0,80	25,91%
FF 5-Factor	5	-425,3825	10,59	0,24%	-406,61	5,80	2,13%
FF 5-Factor + crisis	6	-424,6567	11,32	0,17%	-403,20	9,21	0,39%
FF 5-Factor + crisis + QMJ	7	-431,669	4,31	5,51%	-407,53	4,88	3,37%
Carhart 4-Factor + crisis + QMJ	6	-428,3312	7,64	1,04%	-406,87	5,54	2,43%
All factors	8	-435,975	0,00	47,44%	-409,15	3,26	7,60%

Akaike Information Criterion (AIC) portfolio 20-0

Model	df	AIC	ΔAIC	Akaike weight	SIC	ΔSIC	Schwarz weight
CAPM Single Factor	1	-404,1187	21,77	0,00%	-396,07	11,04	0,26%
FF 3-Factor	3	-406,0539	19,83	0,00%	-392,64	14,47	0,05%
Carhart 4-Factor	4	-421,0769	4,81	3,16%	-404,98	2,13	22,70%
Carhart 4-Factor + crisis	5	-425,884	0,00	34,95%	-407,11	0,00	65,69%
Carhart 4-Factor +RMW+CMA+crisis	6	-425,7748	0,11	33,09%	-401,64	5,47	4,26%
FF 5-Factor	5	-412,1864	13,70	0,04%	-393,41	13,70	0,07%
FF 5-Factor + crisis	6	-414,3294	11,55	0,11%	-392,87	14,24	0,05%
FF 5-Factor + crisis + QMJ	7	-417,6428	8,24	0,57%	393,50	800,61	0,00%
Carhart 4-Factor + crisis + QMJ	6	-423,9129	1,97	13,04%	-402,46	4,65	6,41%
All factors	8	-424,1991	1,68	15,05%	-397,38	9,73	0,51%

15.11 Appendix F2 : Akaike information criterion for accounting-based portfolios

Akaike Information criterion (AIC): ROA HIGH

Model	df	AIC	ΔAIC	Akaike weight
Past ROA	1	-11050,46	50,25	0,00000%
Addition of size	2	-11075,06	25,65	0,00027%
Addition of Financial leverage	3	-11073,49	27,22	0,00012%
Addition of Asset turnover	4	-11089,41	11,3	0,35052%
Addition of Beta	5	-11100,71	0	99,64909%

Akaike Information criterion (AIC): ROA MIDHIGH

Model	df	AIC	ΔAIC	Akaike weight
Past ROA	1	4824,665	7,216	1,17904%
Addition of size	2	4823,424	5,975	2,19285%
Addition of Financial leverage	3	4819,704	2,255	14,08627%
Addition of Asset turnover	4	4817,665	0,216	39,04445%
Addition of Beta	5	4817,449	0	43,49739%

Akaike Information criterion (AIC): ROA MIDLOW

Model	df	AIC	ΔAIC	Akaike weight
Past ROA	1	-4019,421	11,035	0,27320%
Addition of size	2	-4017,456	13	0,10228%
Addition of Financial leverage	3	-4021,359	9,097	0,71996%
Addition of Asset turnover	4	-4028,876	1,58	30,87491%
Addition of Beta	5	-4030,456	0	68,02966%

Akaike Information criterion (AIC): ROA LOW

Model	df	AIC	ΔAIC	Akaike weight
Past ROA	1	-1992,949	10,934	0,19653%
Addition of size	2	-2002,841	1,042	27,63404%
Addition of Financial leverage	3	-2003,883	0	46,52773%
Addition of Asset turnover	4	-2001,973	1,91	17,90443%
Addition of Beta	5	-2000,295	3,588	7,73727%

Akaike Information criterion (AIC): ROE HIGH

Model	df	AIC	ΔAIC	Akaike weight
Past ROE	1	2923,653	78,78	0,00000%
Addition of size	2	2913,746	68,873	0,00000%
Addition of Financial leverage	3	2885,908	41,035	0,00000%
Addition of Asset turnover	4	2875,377	30,504	0,00002%
Addition of Beta	5	2844,873	0	99,99998%

Akaike Information criterion (AIC): ROE MIDHIGH

Model	df	AIC	ΔAIC	Akaike weight
Past ROE	1	4824,665	7,216	1,17904%
Addition of size	2	4823,424	5,975	2,19285%
Addition of Financial leverage	3	4819,704	2,255	14,08627%
Addition of Asset turnover	4	4817,665	0,216	39,04445%
Addition of Beta	5	4817,449	0	43,49739%

Akaike Information criterion (AIC): ROE MIDLOW

Model	df	AIC	ΔAIC	Akaike weight
Past ROE	1	1890,338	86,624	0,00000%
Addition of size	2	1870,974	67,26	0,00000%
Addition of Financial leverage	3	1863,376	59,662	0,00000%
Addition of Asset turnover	4	1803,714	0	73,06652%
Addition of Beta	5	1805,71	1,996	26,93348%

Akaike Information criterion (AIC): ROE LOW

Model	df	AIC	ΔAIC	Akaike weight
Past ROE	1	-440,7412	0	61,14369%
Addition of size	2	-438,7655	1,9757	22,76847%
Addition of Financial leverage	3	-436,9225	3,8187	9,06007%
Addition of Asset turnover	4	-434,9676	5,7736	3,40903%
Addition of Beta	5	-435,087	5,6542	3,61874%

15.12 Appendix G1 : Regression results Carhart 4-factor + dummy variable for 2008

Carhart 4 factor model + 2008 dummy variable

Portfolio Europe 2007-2015	P1	P2	P3	P4	P5	P6	P7	P8	P9
CAPM 4 fact	100%-90%	90%-80%	80%-70%	70%-60%	60%-50%	50%-40%	40%-30%	30%-20%	20%-0%
(Intercept)	0.0027147	0.0016285	0.0021418	0.00025018	0.0036590	0.0039260	0.00043464	-0.0011958	0.00065222
t-statistics	(0.9585)	(0.6934)	(0.7895)	(-0.1204)	(1.5657)	(1.2661)	(0.1305)	(-0.4403)	(0.2103)
rmrf	0.5767030	0.6880752	0.7132074	0.68955025	0.7226651	0.6746476	0.69639418	0.6737652	0.73353387
t-statistics	(16.0260)***	(10.6126)***	(11.0579)***	(11.4854)***	(15.7979)***	(20.4977)***	(8.7612)***	(9.4007)***	(9.5837)***
smb	-0.7051621	-0.3075114	-0.2121030	-0.10324054	0.1732200	0.1454522	0.34870155	0.1232687	0.01828474
t-statistics	(-6.6763)***	(-2.1027)*	(-1.3502)	(-0.8211)	(1.4801)	(0.9351)	(2.6449)**	(1.3182)	(0.1360)
hml	0.2931202	0.1441169	0.1225915	0.14882522	0.0489386	0.1030513	0.23478980	0.2500407	0.23601239
t-statistics	(3.1169)**	(0.9343)	(0.7625)	(0.9716)	(0.4290)	(0.6930)	(1.6630).	(1.8361).	(1.4481)
wml	-0.3697953	-0.2791322	-0.3516451	-0.32675927	-0.3198088	-0.3793464	-0.29973525	-0.3901902	-0.38675675
t-statistics	(-4.3930)***	(-3.0976)**	(-3.6820)***	(-3.2270)**	(-3.3859)**	(-3.0039)**	(-4.1184)***	(-3.5936)***	(-6.8201)***
2008 crisis	-0.0147717	-0.0146200	-0.0101022	-0.01032890	-0.0075826	-0.0102215	-0.01536349	-0.0189263	-0.02794106
t-statistics	(-3.4041)***	(-2.3278)*	(-1.4240)	(-1.5878)	(-1.4421)	(-1.6641).	(-2.1068)*	(-2.0982)*	(-3.4721)***
R^2	0.7482	0.718	0.7342	0.7177	0.7515	0.7524	0.7569	0.7593	0.7787
Yearly alpha	3,26%	1,95%	2,57%	0,30%	4,39%	4,71%	0,52%	-1,43%	0,78%

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' **Newey-West corrected**

15.13 Appendix G2 : Regression result Carhart 4-factor + dummy + QMJ

Carhart 4 factor model + QMJ + 2008 dummy variable									
Portfolio Europe 2007-2015	P1	P2	P3	P4	P5	P6	P7	P8	P9
CAPM 4 fact	100%-90%	90%-80%	80%-70%	70%-60%	60%-50%	50%-40%	40%-30%	30%-20%	20%-0%
(Intercept)	0,0044075	0,0030652	0,0042231	0,0014329	0,0056408	0,0057901	0,0025749	7,0678E-05	0,0009521
t-statistics	(1,7279).	(0,9239)	(1,1030)	(0,4592)	(2,2840)*	(1,6856).	(0,6562)	(0,0258)	(0,240)
rmrf	0,5288861	0,6474912	0,6544152	0,6561420	0,6666815	0,6219923	0,6359360	0,63799	0,7250637
t-statistics	(21,3079)***	(7,4647)***	(7,2064)***	(7,1041)***	(10,8275)***	(13,3554)***	(5,7015)***	(10,6095)***	(8,378)***
smb	-0,7905694	-0,3799997	-0,3171136	-0,1629121	0,0732258	0,0514030	0,2407151	0,059369	-0,0334137
t-statistics	(-6,1117)***	(-1,9655).	(-1,7303).	(-1,0620)	(0,6011)	(0,2557)	(1,4669)	(0,5785)	(-0,181)
hml	0,1597298	0,0309037	-0,0414155	0,0556294	-0,1072336	-0,0438361	0,0661351	0,15024	0,2123838
t-statistics	(1,1947)	(0,1250)	(-0,1658)	(0,2403)	(-0,6378)	(-0,2089)	(0,3761)	(0,7666)	(0,935)
wml	-0,3147066	-0,2323764	-0,2839121	-0,2882705	-0,2553115	-0,3186836	-0,2300828	-0,34897	-0,3769984
t-statistics	(-5,4411)***	(-2,1205)*	(-2,4264)*	(-2,2470)*	(-2,7651)**	(-2,6998)**	(-2,3242)*	(-4.1764)***	(-3,445)***
qmj	-29,5757705	-25,1020232	-36,3642024	-20,6636947	-34,6270463	-32,5683852	-37,3946881	-22,128	-5,2390090
t-statistics	(-1,8746).	(-0,9119)	(-1,2748)	(-0,7136)	(-1,6149)	(-1,4309)	(-1,5240)	(-1,2307)	(-0,164)
2008 crisis	-0,0140683	-0,0140230	-0,0092374	-0,0098374	-0,0067591	-0,0094469	-0,0144741	-0,0184	-0,0278165
t-statistics	(-3,3084)**	(-2,3464)*	(-1,4772)	(-1,6650).	(-1,3170)	(-1,5951)	(-2,0547)*	(-2,0701)*	(2,546)*
R^2	0,7481	0,7169	0,7349	0,716	0,7524	0,7529	0,7581	0,7582	0,7766
Yearly alpha	5,29%	3,68%	5,07%	1,72%	6,77%	6,95%	3,09%	0,08%	1,14%
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				Newey-West corrected					

15.14 Appendix G3 : Regression result Fama & French 5-factor model

Fama & French 5 factor model										
Portfolio	Europe 2007-2015	P1	P2	P3	P4	P5	P6	P7	P8	P9
CAPM 5 factor		100%-90%	90%-80%	80%-70%	70%-60%	60%-50%	50%-40%	40%-30%	30%-20%	20%-0%
(Intercept)		-0.001681	-0.002427	-0.001691	-0.003807	-7,377E-06	0.001151	-0.004821	-0.006338	-0.005141
		(-0.4788)	(-0.7460)	(-0.4986)	(-1.1544)	(-0.0025)	(0.3322)	(-1.3991)	(-1.8206).	(-1.4524)
rmrf		0.620282	0.708709	0.727120	0.713134	0,7267	0.664711	0.711532	0.645878	0.747909
		(8.4164)***	(7.9028)***	(7.5874)***	(7.3120)***	(9.8983)***	(9.7732)***	(7.3139)***	(9.0987)***	(9.1281)***
smb		-0.621579	-0.234535	-0.146820	-0.023283	0,2389	0.159902	0.455131	0.184672	0.061415
		(-3.3812)**	(-1.5953)	(-0.9089)	(-0.1746)	(1.9510).	(1.0631)	(3.3779)**	(1.1642)	(0.4248)
hml		0.800923	0.654640	0.730498	0.717833	0,6824	0.709843	0.938833	1188372	0.969524
		(2.1706)*	(2.4120)*	(2.5153)*	(2.5350)*	(2.2349)*	(1.9160).	(3.7385)***	(3.9040)***	(2.7458)**
rmw		0.312051	0.414628	0.430968	0.459327	0,5207	0.238369	0.730240	0.753809	0.513940
		(1.0680)	(1.5730)	(1.6673).	(1.8244)	(1.6225)	(0.8493)	(3.1302)**	(1.8724).	(1.6597)
cma		-0.372218	-0.404047	-0.469076	-0.375333	-0,4518	-0.676664	-0.457378	-0.909213	-0.775339
		(-0.9142)	(-1.8387).	(-1.7540).	(-1.3603).	(-1.8505).	(-2.1543)*	(-1.8905).	(-3.7960)***	(-2.5804)*
Adjusted R^2		0.7056	0.6984	0.7072	0.692	0.7314	0.7218	0.7436	0.7493	0.7488
yearly alpha		-2,02%	-2,91%	-2,03%	-4,57%	-0,01%	1,38%	-5,79%	-7,61%	-6,17%
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				Newey-West corrected						

15.15 Appendix G4 : Regression result Fama & French 5-factor +QMJ

Fama & French 5 factor model + QMJ									
Portfolio Europe 2007-2015	P1	P2	P3	P4	P5	P6	P7	P8	P9
CAPM 5 factor	100%-90%	90%-80%	80%-70%	70%-60%	60%-50%	50%-40%	40%-30%	30%-20%	20%-0%
(Intercept)	0,002913	0,0011866	0,0029256	0,00015725	0,0043736	0,0051228	-0,00013101	-0,0023671	-0,0018772
	(0,8306)	(0,3617)	(0,8321)	(0,0476)	(1,5957)	(1,3783)	(-0,0419)	(-0,7337)	(-0,4705)
rmrf	0,47020	0,5906448	0,57630	0,58362	0,5835208	0,5349538	0,55829	0,5161553	0,6412913
	(5,5248)***	(5,0760)***	(4,4239)	(4,4825)***	(6,2940)***	(5,6108)***	(4,5510)***	(6,8253)***	(5,1978)***
smb	-0,83669	-0,4037582	-0,36299	-0,20892	0,0337599	-0,0260811	0, 23549	-0,0012615	-0,0914008
	(-4,0538)***	(-2,3386)*	(-2,2112)	(-1,2611)	(0,2365)	(-0,1502)	(1,4674)	(-0,0067)	(-0,5663)
hml	0,30398	0,2637081	0,23111	0,28898	0,2084598	0,2801939	0,43143	0,7588376	0,6164961
	(0,911)	(0,8302)	(0,7410)	(0,9476)	(0,6875)	(0,8422)	(1,9803).	(2,4232)*	(1,6766).
rmw	0,79995	0,7984466	0,92126	0,88037	0,9859801	0,6602000	1,2284	1,1755283	0,8605444
	(2,5562)*	(2,7079)**	(3,0393)	(3,1636)**	(2,7342)**	(2,0147)*	(4,5692)***	(2,5599)*	(2,5617)*
cma	0,043961	-0,0766515	-0,050854	-0,016182	-0,0549043	-0,3168432	-0,032443	-0,5494884	-0,4796867
	(0,1776)	(-0,3338)	(-0,2157)	(-0,0756)	(-0,2689)	(-1,3962)	(-0,1550)	(-2,4048)*	(-1,6643).
qmj	-103,01	-81,0386254	-103,52	-88,899	-98,2436193	-89,0645740	-105,18	-89,0408357	-73,1813509
	(-2,4206)*	(-2,1650)*	(-2,6282)	(-2,1849)*	(-2,5588)*	(-2,1572)*	(-3,8357)***	(-2,3104)*	(-2,0091)*
Adjusted R^2	0,7332	0,7138	0,7323	0,7106	0,7566	0,742	0,7713	0,7672	0,7585
yearly alpha	3,50%	1,42%	3,51%	0,19%	5,25%	6,15%	-0,16%	-2,84%	-2,25%
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1			Newey-West corrected						

15.16 Appendix G5 : Regression result Fama & French 5-factor + QMJ + 2008 dummy variable

Fama & French 5 factor model + QMJ + 2008 dummy variable									
Portfolio Europe 2007-2015	P1	P2	P3	P4	P5	P6	P7	P8	P9
CAPM 5 fact	100%-90%	90%-80%	80%-70%	70%-60%	60%-50%	50%-40%	40%-30%	30%-20%	20%-0%
(Intercept)	0,0043468	0,0025284	0,0036572	0,0010035	0,0047831	0,0057415	0,001160	-0,0010272	0,00076732
	(1,8376).	(0,8707)	(1,1548)	(0,4732)	(1,9427).	(1,6981).	(0,312)	(-0,2696)	(0,1962)
rmrf	0,45224	0,5738394	0,56714	0,5730188	0,5783925	0,5272060	0,5421	0,4993738	0,60817
	(8,8386)***	(7,4591)***	(8,7655)***	(9,5249)***	(9,8300)***	(9,1653)***	(6,607)***	(9,3331)***	(10,710)***
smb	-0,86112	-0,4266176	-0,37545	-0,2233367	0,0267841	-0,0366200	0,2135	-0,0240885	-0,13645
	(-4,7356)***	(-2,4265)*	(-2,5664)*	(-1,6638).	(0,2178)	(-0,1958)	(1,269)	(-0,1406)	(-1,2477)
hml	0,31593	0,2748973	0,23722	0,2960411	0,2118743	0,2853525	0,4422	0,7700109	0,63855
	(1,4740)	(1,0563)	(0,9278)	(1,2133)	(0,9921)	(1,1903)	(1,613)	(2,8588)**	(2,0111)*
rmw	0,77781	0,7777274	0,90997	0,8673057	0,9796574	0,6506478	1,208	1,1548385	0,81971
	(5,0867)***	(3,7164)***	(5,5195)***	(4,1614)***	(3,0861)**	(1,8641).	(3,407)***	(3,2898)**	(3,6462)***
cma	0,097589	-0,0264636	-0,023489	0,0154721	-0,0395890	-0,2937050	0,01583	-0,4993717	-0,38077
	(0,7800)	(-0,1566)	(-0,1185)	(0,0866)	(-0,2316)	(-1,9626).	(0,057)	(-2,8930)**	(-2,6488)**
qmj	-102,23	-80,3015724	-103,12	-88,4338911	-98,0187012	-88,7247703	-104,5	-88,3048299	-71,729
	(-2,6807)**	(-2,7688)**	(-3,5513)***	(-3,1713)**	(-3,1355)**	(-1,9763).	(-3,628)***	(-2,3249)*	(-3,9433)***
Crisis	-0,012202	-0,0114192	-0,0062263	-0,0072022	-0,0034847	-0,0052646	-0,01098	-0,0114030	-0,022506
	(-2,0034)*	(-1,8717).	(-1,0940)	(-1,4457)	(-0,6493)	(-0,8544)	(-1,069)	(-1,3601)	(-2,9534)**
Adjusted R^2	0,7339	0,7139	0,7304	0,7089	0,7544	0,7401	0,7716	0,7675	0,7653
yearly alpha	5,22%	3,03%	4,39%	1,20%	5,74%	6,89%	1,39%	-1,23%	0,92%
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1			Newey-West corrected						

15.17 Appendix G6 : Regression result all factors

CAPM all factors									
Portfolio Europe 2007-2015	P1	P2	P3	P4	P5	P6	P7	P8	P9
CAPM 5 fact	100%-90%	90%-80%	80%-70%	70%-60%	60%-50%	50%-40%	40%-30%	30%-20%	20%-0%
(Intercept)	0,0033693	0,0018765	0,0028498	0,00016098	0,0040955	0,0048348	0,00059225	-0,0018785	-0,00028546
	(1,0300)	(0,5336)	(0,7024)	(0,0518)	(1,5392)	(1,3526)	(0,1680)	(-0,4878)	(-0,0673)
rmrf	0,5087174	0,6115061	0,6137827	0,62170	0,6181168	0,5795847	0,57490	0,5485587	0,66899
	(9,9286)***	(6,2431)***	(5,6614)***	(5,8611)***	(9,5493)***	(10,4814)***	(5,4434)***	(9,2105)***	(6,4779)***
smb	-0,7643370	-0,3620671	-0,2955182	-0,13992	0,0948607	0,0531429	0,26967	0,0602012	-0,032220
	(-4,1719)***	(-1,9037).	(-1,6953).	(-0,9352)	(0,7585)	(0,2759)	(2,0702)*	(0,3588)	(-0,2407)
hml	0,2431013	0,2263192	0,1770604	0,23326	0,1606425	0,2178005	0,39993	0,7065778	0,56011
	(0,9401)	(0,8270)	(0,7083)	(0,9307)	(0,6698)	(0,7823)	(1,8974).	(2,8791)**	(1,6285)
rmw	0,6164861	0,6701258	0,7767221	0,72825	0,8661781	0,5010188	1,1149	1,0143330	0,64596
	(4,6304)***	(3,6904)***	(4,9521)***	(3,6989)***	(3,6149)***	(1,9344).	(6,0283)***	(3,8106)***	(2,9839)**
cma	0,2408593	0,0690944	0,0948426	0,13896	0,0611888	-0,1608236	0,098970	-0,3745926	-0,22647
	(1,8192).	(0,4045)	(0,4308)	(0,8373)	(0,3978)	(-1,0844)	(0,5658)	(-2.7324)**	(-1,0278)
qmj	-56,1500919	-49,5693258	-65,0618928	-48,718	-65,6077083	-45,9890053	-77,733	-48,1748313	-22,104
	(-1,9694).	(-1,5742)	(-2,0631)	(-1,5288)	(-2,9644)**	(-1,5264)	(-3,1186)**	(-1,6894).	(-0,6243)
Crisis	-0,0139977	-0,0126170	-0,0077096	-0,0087501	-0,0047479	-0,0069303	-0,012025	-0,0129671	-0,024440
	(-2,3073)*	(-2,3267)*	(-1,5019)	(-1,8415).	(-1,0080)	(-1,2557)	(-2,0414)*	(-1,5564)	(-3,4810)***
wml	-0,2981305	-0,1988459	-0,2462357	-0,25697	-0,2097078	-0,2765118	-0,17301	-0,2596518	-0,32109
	(-5,6960)***	(-1,7965).	(-2,0240)*	(-2,0306)*	(-2,6052)*	(-2,4990)*	(-2,1146)*	(-2,9287)**	(-4,0849)***
Adjusted R^2	0,7508	0,7195	0,7399	0,7198	0,7617	0,7544	0,7756	0,7785	0,781
yearly alpha	4,04%	2,25%	3,42%	0,19%	4,91%	5,80%	0,71%	-2,25%	-0,34%
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				Newey-West corrected					

15.18 Appendix H : Average AIC weight for fund performance regression

Average AIC weight fund performance	
CAPM single factor	4,15%
FF 3-factor	6,78%
Carhart 4-factor	8,90%
Carhart 4-factor+crisis	21,76%
Carhart 4-factor +QMJ	5,57%
Carhart 4-factor +QMJ +crisis	20,87%
FF 5-factor	8,14%
FF 5-factor +QMJ	4,45%
FF 5-factor+crisis	8,42%
FF 5-factor + QMJ +crisis	5,59%
All factors	5,37%

Executive summary

Environmental, social and governance concerns are gaining ground recently and the growing amount of available data enables investors to integrate these issues in their investment strategies. Since a few years, the popularity of these ESG criteria are translated in a growing number of assets under management incorporating ESG criteria in Europe and in the rest of the world. With regard to the growing popularity amongst investors, research analysed the relationship between corporate social performance and financial performance and found a weak but positive relationship between both aspects of the firm.

This thesis will try to contribute to the existing literature by analysing the relationship between CSP and CFP in European companies over the period 2007-2015. In order to perform the analysis, the Thomson-Reuters ASSET-4 database will be used as they provide a complete set of ESG data. The methodology that will be used consists of the repartition of all the stocks with ESG coverage in portfolios on the basis of their ESG score. Thereafter, the relationship will be analysed using least square regression analysis.

The findings of this paper indicates that European markets are rewarding moderate levels of corporate social performance better than low and high levels of ESG. The uncertainty over the ability of firms to combine both projects to improve their societal impact and future growth seems to prevent markets from rewarding top performers. The knowledge of the optimal level of corporate social performance permitted the creation of an investment strategy. From an accounting point of view, this thesis shows that firms with high levels of ESG are able to achieve a return on equity that is three times higher than companies with very low levels of ESG.