Master's Degree in Corporate Finance

Chair of Asset Pricing

Does a company's commitment to ESG factors affects its returns? An empirical analysis of the European Market

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Introduction to the thesis

The objective of this thesis is to understand whether a greater commitment by companies to ESG factors, and therefore to the environment, is a positive driver of their stability and returns. This paper is divided into three chapters.

The first chapter gives a general introduction to the ESG and Sustainable Investing concept and describes the main rating agencies responsible for ESG scores. This first part also contains a description of the evolution of Sustainable Investing over the years and an analysis of public sentiment towards ESGs. It also labels the empirical analysis of the ESG world that were performed previously. The analyses are grouped according to the approach used: Event Study, Portfolio Analysis and Cross-sectional Regression. The last part of the first chapter catalogues the ESG strategies identified by State Street Global Advisors, the third largest asset manager in the world, and describes observations on the performance of ESG strategies, also in the light of the particular moment that the world economy is going through.

The second chapter is the heart of the work and will be structured in two parts, in the first the data are explained, in the second the empirical model. The first part of the second chapter explains the origin of the data: which are the reference companies, which database was taken into account and the reference period. A brief explanation is given about the construction of the ESG scores by Thomson Eikon Reuters. Then the factors used for the implementation of the empirical model and their construction is explained. In the second part of the second chapter there is an explanation of the model itself, i.e. Fame - Macbeth regression, its steps and the objectives it is intended to calculate. In short, a general description of the method is given, which is then carried out in detail in the third chapter of this study. Furthermore, in this part of the work the empirical model is explained, its objective, the variables used and those it aims to calculate.

The third and last chapter explains the results obtained from the various analyses carried out previously. In particular, in the first part the data used (returns and ESG scores) are analysed in depth and some graphs are obtained, which are able to explain the trend of these variables by sector during the selected period. Then the results of the Fama - Macbeth regression and of the multilinear regression of the ESG factor on the Fama - French factors are shown, in order to understand their main characteristics and dependence. The results are accompanied by some comments in which I give my

interpretation. In the second part of the third chapter conclusions are drawn, personal thoughts on the results are expressed and possible explanations are given.

First Chapter

Introduction to the chapter

This first chapter is an introduction to the ESG world, it is used to lay the foundation for the empirical research that will be performed later and is divided into three parts. The first part gives a general introduction to the ESG and Sustainable Investing concept and describes the main rating agencies responsible for ESG scores. This first part also contains a description of the evolution of Sustainable Investing over the years and an analysis of public sentiment towards ESGs. The second part lists and describes the empirical analysis of the ESG world that were performed previously. The analyses are grouped according to the approach used: Event Study, Portfolio Analysis and Cross-sectional Regression. The third part catalogues and defines the ESG strategies identified by State Street Global Advisors, the third largest asset manager in the world, and describes observations on the performance of ESG strategies, also in the light of the particular moment that the world economy is going through.

1.1 Overview on the subject

This first paragraph will give a comprehensive introduction to the ESG concept and Sustainable Investing in general and will list and describe the main agencies responsible for ESG ratings. Then the evolutionary path that has led to Sustainable Investing becoming so popular will be described, and finally the public sentiment towards ESG factors and sustainable investments will be analysed. A definition of ESG materiality will be given.

1.1.1 What is ESG

Over the last few years, investing with a focus on sustainability has become very important and popular. In fact, many investors have decided to invest in sustainability and therefore to opt for a long-term investment over a short-term one. But what gives rise to this attention to sustainability? In the literature it is believed that the beginning of this investors' attitude is attributable to a greater attention to "values - driven

investing"[1] in general. Values - driven investing originates from moral principles and basically consists in not investing in industries without morality, such as arms or tobacco companies. Nowadays these kind of investment strategies are known as Socially Responsible Investing (SRI). A person who is interested in sustainable investing, is an investor who wants to promote business practices that he believes will be aimed to encourage human rights, environmentalism, gender equality and buyers safeguarding.

Socially responsible investors use various strategies to maximize their economic utility and at the same time what is known as a "social good". In this chapter we will discuss briefly some of them to give an idea to the reader, but the topic will be deepened later. One of the most known strategies is called "Negative Screening" and is based on the assumption that non – moral companies are automatically screened out from investment decisions (for example a company that produces tobacco). "Positive Investing" and "Impact Investing" are strategies that aim at investing in firms that are believed to have a positive effect on the environment and on the society. This investment method allows investors to represent their ideals on corporate behavior issues, such as social justice and the environment, through stock screening.

The most popular investing strategy is called "ESG Integration", that plans to integrate environmental, social and governance ("ESG") criteria into the basic analysis of investments. ESG is an established concept in the financial sector as a basis for judging the sustainability of investments. The integration of ESG criteria can improve the risk/return profile of portfolios.

These three ESG factors are essential to assess the sustainability and related risks of an investment position: [2]

- Environmental means more attention to topics such as CO2 emissions and climate change, population growth, biodiversity and food security.
- Social is referred to companies' concerns for human rights, working conditions, child labour and equality.
- Governance is a criterion that mostly covers factors such as the quality and diversity of supervisory boards, executive compensation, shareholders' rights and the elimination of corruption.

[1] Derwall, Koedijk, Ter Horst, "A tale of values – driven and profit – seeking social investors", August 2011
[2] Credit Suisse, "Dai criteri ESG alla filantropia"

Experience shows that ESG criteria are distinctive characteristics of the quality of a company in the long run. Companies that take ESG considerations more seriously are generally better managed, more sustainable and forward-looking. Firms with strong ESG scores are better prepared to deal with crises and perform better than their competitors on average. The integration of ESG standards into investments is aimed at maximizing the long-term return on the portfolio by better managing its exposure to risk.

1.1.2 ESG ratings and factors

As said before, Socially Responsible Investing is expanding fast, and nowadays many investors rely on rating agencies in order to obtain a third-party judgment on the performance of a given company's ESG performance. Several studies have also relied on ESG rating agencies for their empirical analyses and as a consequence these agencies have become increasingly important in investment processes.

It is important to point out at this stage that there is not a unique method to elaborate an Esg vote.

According to a paper of the Mit Sloan School of Management, the most famous and important agencies providing Esg ratings are 5:[3] KLD, Sustainalytics, Video-Eiris, Asset4, and RobecoSAM. The ESG ratings market developed in parallel and in proportion to the focus on Socially Responsible Investing and as a result many ESG rating agencies have been acquired through the years by financial data providers.

The first ESG rating agency was Vigeo Eiris (born in France in the 1980s) and was bought by Moody's in 2019. In the same period Kinder, Lydenberg & Domini (KLD) was born in the US and was bought by MSCI in 2010. For this rating agency the grades go from CCC (the weakest) to AAA (the strongest). In the following decade the Dutch agency Sustainalytics was born, and in 2010 was bought by Morningstar; in the same period, we can see the rise of RobecoSAM (Switzerland), which was bought by S&P Global. Another important player in the field of ESG rating is Asset 4, owned by Refinitiv, available through Datastream. In the case of Asset4, ESG scores are computed and available for all firms and for all historical tax periods of the ESG global

[3] Berg, Koelbel, Rigobon, "Aggregate Confusion: The Divergence of ESG Ratings", MIT Sloan School of Management, 17 May 2020

coverage; so up to year 2002 for about 1,000 businesses (mainly US and European).[4] Asset4 classifies companies with grades from D- (laggards) to A+ (leaders). For my empirical analysis I chose the data provided by Refinitiv and it will be discussed in this paper later.

It is interesting to understand how much and how the scores provided by different agencies differ, and this is possible thanks to the empirical analysis provided by the MIT Sloan School of Management paper. The correlation between the ratings provided by these agencies reaches 54%. For comparison, credit ratings between Moody's and S&P are 99% correlated. This means that investors basically receive different information according to which agency they are referencing.

There are basically three reasons why ESG ratings differ so much among agencies and credit ratings are almost the same. First of all, the concept of ESG performance is ambiguous and freely interpretable, while the concept of risk of default is unique. Furthermore, the collection of financial data has been going on for many years, while the collection of ESG ratings is a trend that has only developed over the last thirty years. And third, it should be pointed out that ESG ratings are financed by investors, while credit ratings are paid by the firms rated.

As a consequence, there is a little probability that ESG performance will be reflected in the prices of stocks and, moreover, this discrepancy undermines companies' ambition to enhance their ESG efficiency because they receive contradictory grades from rating agencies.

Regarding the construction of the ratings, they are elaborated on the basis of public data released by the companies, or on the reports of non-governmental organizations. Starting from this information, the agencies attribute a rating divided into different fields that are usually inspired by the topics that constitute the goals for the sustainable development of the United Nations.

As we said before, ESG scores differ between them, but in practice the rating agencies observe the same aspects in companies. For example, concerning the Environmental pillar, the values observed are emissions, innovation and the re-use of sources. For the Governance score, the most important categories are CSR strategy, structure, compensation and shareholder's rights. The issues involved in the Social score are community, human rights, product quality and diversity.[5]

[4] Refinitiv, "Environmental, Social and Governance Scores from Refinitiv", April 2020
[5] Refinitiv, "Environmental, Social and Governance Scores from Refinitiv", April 2020

1.1.3 Corporate Sustainability trend

This chapter will describe the evolution of the Socially Responsible Investing (SRI), from its origins to the modern days.

It is thought that the trend of socially responsible investing originated in the Quaker community, probably from the 17th century.[6] This stems from the search for a way to invest their savings without infringing their religious convictions (for example, they were absolutely opposed to slaves' trade). To meet the demands of these investors, many fund managers therefore began to eliminate from their larger portfolios the securities that were seen as "sinners". They began to remove, for example, firearms manufacturers, alcohol producers and gambling companies.

In the following years, it was the Methodist method that contributed to the Socially Responsible Investing development. In this context, one of the pillars of this movement is known to be the speech made by John Wesley, named “The use of money”. The author here pointed out the importance of averting investments in firms that could damage workers and the society.

Sustainable investing continued evolving through the political atmosphere of 1960. In particular, in this period the Vietnam War played an important role: investors started avoiding “war profiteering” and they boycotted the firms that provided armaments for the war.[7] 1970 saw the first Earth Day celebration, starting in this way a series of environmental and consumer protection laws that took place in the following decade. In those years the importance of the Socially Responsible Investing movement was recognized, and society understood that it was not just a temporary trend. One of the demonstrations of this assertion is the rise of funds aimed at the integration of social and environmental issues, such as The Pax World Fund and the First Spectrum Fund (1971). In the decade of 1980, after the well-known environmental disasters, the focus of the SRI was the environment and the climate change. This particular attention led to the creation of United States Sustainable Investment Forum (SIF) in 1984, which has become a pillar of sustainable investing over the years.

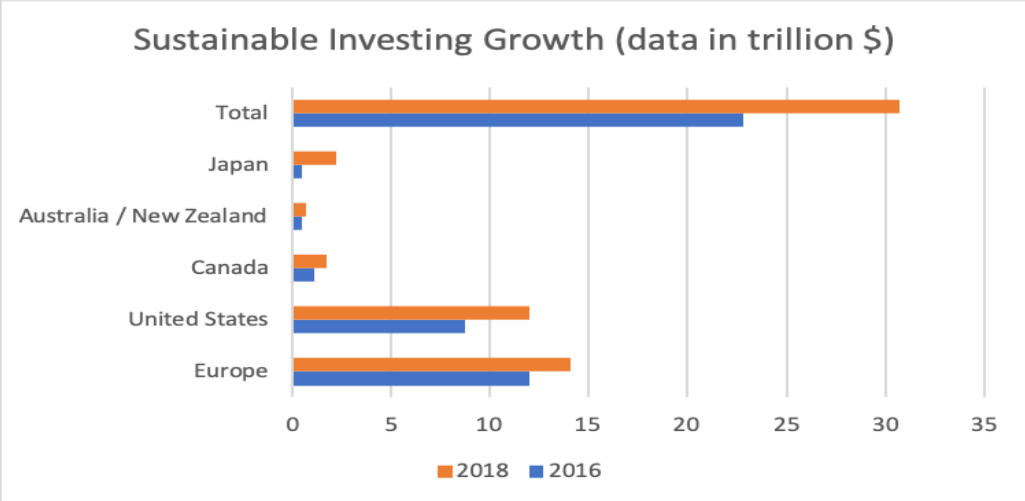
It was during this period that the greater attention to the topic led to the need to set up a rating system concerning corporate sustainability. As explained in the previous

[7] Blaine Townend, “From SRI to ESG: The Origins of Socially Responsible and Sustainable Investing”, Bailard Wealth Management

paragraph, numerous rating agencies were born. In 1989 the "Coalition for Environmentally Responsible EconomieS" (CERES) was born. It is a coalition between environmentalists made by Joan Bavaria with the aim of changing how environmental practices were managed within corporations.

The start of the European Climate Change Programme (ECCP) in 2000 caused the rapid growth of people's attention to topics like climate change and resources' depletion. As a consequence, this contributed to a greater focus not only on Socially Responsible Investing but also on assessing and reporting the corporate sustainability performance. In fact, standing to the 2018 Global Reporting Initiative reports, more than 90% of the biggest firms started to release reports on their sustainability performances.[8]

(1) Sustainable Investing Growth (2016 – 2018)[9]



As we can see here, the market size of Sustainable Investing is growing through the years, with Europe having the largest portion (14,1 T$). It is believed to reach 50 T$ over the next two decades.

1.1.4 Public sentiment about Corporate Sustainability and ESG materiality

In this paragraph I will analyze the public sentiment towards ESG factors and sustainable investments and I will give a definition of ESG materiality.

[8] Global Reporting Initiative
[9] Personal elaboration on data taken from Global Sustainable Investment Alliance

Last year Nn Investment Partners (Nn Ip) in collaboration with PollRight carried out a survey on a group of 290 professional investors from different European Union countries (France, Germany, Italy, Netherlands, Belgium, UK and Scandinavian countries) to understand their vision of sustainable investing. The result obtained explains that 52% of the people interviewed believe that the integration of "Ethical, Social and Governance" factors in the creation of their portfolios costs them returns.[10] The most pessimistic seem to be the Italians (75%), the Germans (80%) and the Dutch (71%), who show a more negative view of the potential return of sustainable investment strategies than the rest of Europe, while French (26%) and Belgian (27%) investors have a much more positive attitude. The study also shows that the "Ethical" factor is dominant in the investment decisions of professional investors. Portfolio diversification requires, however, that investors also consider "Social and Governance" factors, as these criteria can also offer many opportunities.

In this part I will give practical examples of the ESG concept to get a more detailed picture of the topic and to understand how important the integration of these factors is. Afterwards, the concept of ESG materiality will be introduced.

Concerning the "Environmental" concept, problems that are related to the environment could lead to penalties and as a consequence they can get a market capitalization reduction. There are costs that are related to a weak environmental management, and the mining industry could be a good example. It is an industry in which the environmental management has a strong effect, because it is the type of industry that is most exposed to environmental risks. Concerning the "Social" concept, a practical example could be the apparel industry. It is well known that companies involved in scandals in this type of industry have never returned to prior levels. So, it can be said that a management careful to the "social topic" will certainly attract the attention of investors. The "Governance" concept is related to management and control actions of the Board of Directors. All of the problems related to this topic have occurred when the Board assumed improper accounting policies over the years and this has often led to bankruptcy.

So, as we have seen, companies' commitment to managing ESG factors potentially has a great influence on their financial performance. The "ESG materiality" is how each

[10] Survey: "Investor sentiment: responsible investing survey"

of the above factors is relevant to the financial performance, and it is a concept often used in financial empirical studies to demonstrate the importance of these factors.

1.2 Literature Analysis:

In this part of the paper, the analysis preceding my research will be examined. In particular, I want to focus on those that have analyzed the effect of corporate sustainability on financial performance. The analyses will be grouped according to the approach used: Event Study, Portfolio Analysis and Cross-sectional Regression.

1.2.1 Past researches with Event Study Approach and their results

One of the most widely used methods over the years to assess the impact of ESG criteria on financial returns is the event study. It is an empirical approach used to test the impact of a financial event on the enterprise value. The mechanism of this method is well explained by Craig MacKinlay (politician and businessman of the Conservative Party in England) in his article "Event Studies in Economics and Finance": assuming there is rationality in the markets, the consequences of an event will have an instantaneous effect on prices. Therefore, taking into account the prices of securities in a relatively short period of time you can understand the influence of the event in economic terms.[11] In practice, the implementation of this method is as follows: considering a period of time prior to the selected event, this approach calculates what should be the normal stock returns of the companies involved before, during and after the event. Subsequently, these "normal returns" are subtracted from the "actual returns" to receive the "abnormal returns" attributed to the event.

Many studies have been carried out previously using this method, most of them concerned the relationship between environmental events and financial returns. A case in point is Hamilton's 1995 research. This study basically investigates whether the release of information by EPA (Toxic Release Inventory) had a relevant effect on the returns of the companies involved. The results of the research therefore show that the companies involved, which reported emissions, found negative, statistically significant abnormal returns already from the first day of release of the information.[12]

[11] Craig MacKinlay, "Event Studies in Economics and Finance", Journal of Economic Literature, March 1997
[12] James T. Hamilton, "Pollution as news: Media and Stock market reactions to the Toxic Release Inventory data", Journal of Environmental Economics and Management, January 1995

Another relevant research always in this field is that of Konar and Cohen. Experts have come to the conclusion that companies whose price has fallen sharply immediately after the disclosure of information on their releases, have reduced their emissions more than proportionally compared to their comparables. Again, it is clear that markets play an important role because they have the ability to make companies change their attitude towards the environment.[13]

Another study to take into account for the results obtained is that of Reddy and Gordon. The aim of the authors in this case was to understand the influence of sustainability reporting on companies' economic performance. The methodology consists of using the event study approach to identify abnormal returns over a period of one month on a total of 68 publicly traded businesses from the Australian and New Zealand markets. The results of this study indicate that the release of information about the sustainability of a company is statistically significant for the abnormal returns of companies in the Australian market. As for New Zealand firms, the results tell us that only CSR reports were statistically significant in explaining the difference between "normal" and "actual" returns.[14]

The last research I want to consider in this literature review is that of Yan-Leung Cheung. The author in this paper aims to understand the relationship between commitment to corporate governance practices and the evaluation of a company in the market of Hong Kong. The results show that an improvement in corporate governance practices leads to an increase in the evaluation of the business while inadequate use of corporate governance leads to the opposite result. In addition, the effect was more significant for companies listed in the MSCI index.[15]

Although the event study approach is widely used for empirical demonstrations, it has limitations. For example, it may lead to contradictory conclusions or, as McWilliams states in his critical analysis, event studies are insufficient because they give predictions of short-term effects only for shareholders and not for other business

[13] Shameek Konar and Mark A. Cohen, "Information as Regulation: The effect of community right to know laws on toxic emissions", Journal of Environmental Economics and Management, January 1995

[14] Krishna Reddy and Lucus Gordon, "The effect of sustainability reporting on financial performance: an empirical study using listed companies", Journal of Asia Entrepreunership and Sustainability, RossiSmith Academic Publishers, 2010

[15] Yan-Leung Cheung, J. Thomas Connelly, Ping Jiang, Piman Limpaphayom, "Does Corporate Governance predict future performance? Evidence from Hong Kong", 21 March 2011

stakeholders.[16] Moreover, this method finds short-term effects of an event on stock prices, which means that the effects found could fade in the long run. It has also been shown that the results of event studies are also susceptible to minor changes in research planning. For these reasons, many other methods have been used in literature to understand the effects of "sustainability" on companies.

1.2.2 Past researches with Portfolio Analysis Approach and their results

In addition to the event study approach, considering its limitations, another method has been used by many researchers: the Portfolio Analysis approach. Portfolio Analysis is aimed at understanding and estimating the connection between corporate sustainability and economic performance. It is performed creating a series of portfolios and then analyzing their performances or running regressions (which can be cross – sectional or time – series) with other factors of risk.

An example of an analysis of the connection between environmental and economic performance is that of Cohen et al. (1997). The authors in this case consider the S&P 500 companies and build two portfolios, a high polluter and a low polluter portfolio. Then they compare the returns of the high with those of the low, considering as "returns" both market returns and accounting returns. The results of this analysis show that those who invest in companies that perform well with regard to the environment achieve the same, or even better results than investors who choose "environmentally poor" companies. So, the authors came to the conclusion that investors who choose companies that pollute less are not forced to pay a "premium" for their choices.[17] An explanation for these results could lie in the fact that companies are less pollutant precisely because their production system works better and allows them to do so. Or, the companies that pollute less are those that have the possibility to make investments in anti-pollution systems.

Michael Schroder made an important analysis of the trend of the Socially Responsible Investments (SRI) in his research in 2004. In his study he took into account the performance of investment funds and indices from United States, Germany and Switzerland and used Jensen's alpha as a measure of return. The results of his analysis

[16] Abagail McWilliams, Donald Siegel, Siew Hong Teoh, "Issues in the use of event study methodology: a critical analysis of corporate social responsibilities studies", 1 October 1999

[17] Mark A. Cohen, Scott A. Fenn, Shameek Konar, "Environmental and Financial Performance, Are They Related?", May 1997

reveal that a subject who chooses Socially Responsible Investments (SRI) obtains a return similar to one who makes a "normal" investment choice. Only very few funds in the selected sample showed a negative trend.[18]

Another example of the use of this method is the study of Kempf and Osthoff. The authors question whether the use of socially responsible screens by investors could lead to an improvement in performance. Their methodology consists in creating a portfolio based on the ratings provided by KLD Research & Analytics. The strategy is to buy stocks with a high rating and sell stocks with a low score. This approach has resulted in abnormal returns of up to 9%, with peaks when the investor uses a stricter screening methodology.[19]

An important milestone in the analysis of the relationship between sustainability and returns is the paper of Cristiana Manescu. The author, referring to the techniques used by Fama and French, uses the factor mimicking portfolio method. Manescu takes into account data from several US companies, for a period of time ranging from 1992 to 2008. These companies have been grouped according to indicators of growth, size and sustainability, and then monthly returns have been regressed with the use of time – series analysis. The results obtained show that only the "community relations" factor has a favourable impact on stock returns.[20]

Another important contribution is made by the study of Ziegler et al. This paper analyses the relationship between sustainability performance and financial performance of many European companies over a five-year period, from 1996 to 2001. The authors in this case review the shortcomings of the general portfolio model and explain why they prefer to use factor mimicking portfolios (similar to Manescu). For the implementation of this method, portfolios are created based on the level of book-to-market and market capitalizations. The results of this analysis show that average environmental performance has a positive influence on economic performance, while social performance has a negative impact.[21]

[18] Michael Schroder, “The Performance of Socially Responsible Investments”, Centre for European Economic Research (ZEW), June 2004

[19] Alexander Kempf, Peer Osthoff, “The Effect of Socially Responsible Investing on Portfolio Performance”, 23 October 2007

[20] Cristiana Manescu, “Stocks returns in relation to environmental, social and governance performance: Mispricing or compensation for risk?”, 28 March 2011

[21] Andreas Ziegler, Michael Schroder, Klaus Rennings, “The effect of environmental and social performance on the stock performance of European corporations”, 27 February 2007

1.2.3 Past researches with Cross – sectional Regression Analysis and their results

A widely used method in this field is cross – sectional regression. In this type of regression, parameters are considered to be associated for the same period of time or specific moment. It therefore differentiates from time – series regression, in which the parameters are associated with a series of points in time.

Also in this case the study of Cristiana Manescu is particularly important. Following the Fama-Macbeth model, she also performs cross-sectional regressions month by month of monthly returns on the three Fama-French factors, on a momentum factor and on seven ESG aspects. Manescu focuses on limiting the specific effects of the industry caused by specific properties of ESG factors. Precisely for this reason she inserts industry dummy variables to neutralize this effect. In addition, the researcher uses the Garch method to understand the degree of relationship between conditional mean return and conditional variance and therefore Garch-in-mean estimation of the community mimicking portfolio are performed (the only portfolio that has a significative influence on stock returns).[22]

Ziegler also uses this methodology, in fact, thanks to the mimicking portfolio method explained earlier, the researcher calculates the variables that will then be used in the cross – sectional regression of monthly returns on sustainability indicators. As said in the previous paragraph, the multifactor model is used to overcome the Limits of the CAPM and to test different risk factors. So, factor mimicking portfolios are built according to firm's book – to – market and capitalization values. The model is then implemented with time – series regressions on the stock portfolios and used for the confrontation of the values found across the portfolios. In the end the cross – sectional regressions are implemented, and the results show that average environmental performance has a positive influence on economic performance, while social performance has a negative impact.[23]

Another important contribution is made by the work of MacWilliams and Siegel (2000), which demonstrates the weaknesses in the studies done so far on the impact of Corporate Social Responsibility (CSR) on financial performance. This approach therefore studies the influence of CSR on economic performance through the

[22] Cristiana Manescu, “Stocks returns in relation to environmental, social and governance performance: Mispricing or compensation for risk?”, 28 March 2011

[23] Andreas Ziegler, Michael Schroder, Klaus Rennings, “The effect of environmental and social performance on the stock performance of European corporations”, 27 February 2007

regression of the company's performance on social performance and other factors. In the end results show that CSR have an impartial effect on the economic performance.[24]

1.3 ESG Strategies

This paragraph represents the third part of the introductory chapter and will be divided into two sections. The first will list and describe the ESG strategies identified by State Street Global Advisors, the third largest asset manager in the world. The second will describe considerations made on the performance of ESG strategies, also in the light of the particular moment that the world economy is going through.

1.3.1 Strategies overview

There is no common agreement on the number and types of strategies concerning Socially Responsible Investing (SRI). In this paragraph, however, the strategies identified by State Street Global Advisors will be initially listed and described. State Street Global Advisors is the investment unit of the American State Street Corporation. With more than 2500 employees it is the third largest asset manager in the world with about three trillion assets under control. According to what they wrote in the paper "Understanding and Comparing ESG Terminology", the problem today is the use of unclear and undefined language in the ESG world. For this reason, State Street Global Advisors has sought a general consensus in the ESG market by studying the language used by key players such as asset managers, data providers and professors and has finally identified 5 possible strategies:[25]

- Exclusionary Screening
- Positive Screening
- ESG Integration
- Impact Investing

[24] Abagail McWilliams, Donald S. Siegel, "Corporate Social Responsibility and financial performance: Correlation or Misspecification?", May 2000
[25] Rakhi Kumar, Natasha Dayaramani, James D. Rocha, "Understanding & Comparing ESG Terminology, a practical framework for identifying the ESG strategy that is right for you", State Street Global Advisors, 30/09/2019

- Active Ownership

Exclusionary Screening consists in the exclusion from investment of companies that do not respect the moral schemes of those who invest, or that in any case do not respect what is generally considered fair in terms of human rights, environment and corruption. The objective here is to create a connection between the portfolio and the investor's moral beliefs, to control ESG risk and to have a substantial influence in making a company change arguable actions. A practical example could be an investment in funds that categorically rules out firms that produce part of their income from the sale of arms or tobacco.
Positive Screening is a strategy which can be implemented by following three different activities:

- Best in class: consists of opting to invest in a company that is more solid in ESG indicators than its competitors.
- ESG momentum: in this case investors choose firms that improve their ESG indicators more than proportionally compared to similar companies and competitors.
- Thematic investing: the companies chosen here are those that are committed to solving specific problems, such as the rise of temperatures and the respect for human rights.

As well as the Exclusionary Screening strategy mentioned above, Positive Screening aims to mitigate the ESG risk. In addition, this strategy aims to maximize returns and support companies engaged in ethical and moral fields. This strategy therefore awards firms that have a high ESG score and a practical example could be to invest in gas companies that aim to reduce pollution in the environment.
The third strategy identified by State Street Global Advisors is the “ESG Integration”. This approach refers also to ESG data when choosing the companies to invest in and not just conventional financial reporting. As well as the other strategies seen so far, the ESG Integration aims at softening ESG risk and maximizing financial returns. The main difficulty in this case is to be able to find good ESG data, because there are so many of them and so the services of an expert in the field are necessary. What an investor who chooses this kind of strategy needs is definitely a forward-looking

perspective, because it is difficult to quantify and identify over time the consequences of an ESG problem.

Impact investing, on the other hand, is the kind of strategy that aims to have a beneficial social or environmental influence. Usually this type of investment is purpose-specific. The objective of those who invest following an impact investing strategy is to produce a social or environmental benefit that is in line with their moral beliefs. A classic example of this strategy is investing in community funds that benefit communities in need.

The last strategy identified by State Street Global Advisors is called "Active Ownership". This approach consists of getting in relation with companies and be able to vote within them so that behavioral changes in the company and policies can be implemented. The investor in such a strategy intends to substantially influence the company's modus operandi for long-term value generation. In addition, the objectives can be extended to controlling risk, seeking opportunities and encouraging the publication of ESG reports. One consideration to make in this case is that for both having an important ownership stake and entering into a relationship with a company, it is necessary to invest a significant amount of money. An example of an investment following this strategy is certainly a fund in which the asset manager is oriented to Active Ownership.

1.3.2 2020 Considerations

In this paragraph some considerations will be made regarding the integration of ESG strategies into investment decisions and the information will be taken from an interesting article of the Financial Times written by Gillian Tett.[26]

During this new period characterized by the emergence of Covid-19, many assumptions were reversed, and in particular the one that considered that ESG investing brings a smaller return. In practice, in the first half of 2020, the lowest financial moment for covid-19, the S&P 500 ESG Index was 0.6% higher than the standard S&P 500 Index. This is a phenomenon that has not only affected the United States: the emerging markets ESG leaders Index and the Asia ESG leaders Index exceeded their "normal" indices by 0.5% and almost 4% respectively. According to

[26] Gillian Tett, "Why ESG investing make fund managers more money", Financial Times, 9 July 2020

what BlackRock wrote in its new sustainability report, about 90% of the sustainable indices have done better than their unsustainable "relative" indices since the beginning of 2020.[27] Many attribute the reason for this improved performance to crude oil. Many ESG portfolios have very few assets that are against the environment, and that is why when oil prices collapsed, many ESG portfolios were not affected. This, however, is only a partial explanation for the ESG indices' performance. There are two other possible reasons for this. The first concerns the fact that more and more investors are deciding to buy ESG assets and this obviously raises prices. In fact, according to BlackRock, investments in sustainable funds have increased by more than 40% year on year. The second reason is that companies continue to improve supply chain management and corporate governance. In fact, in order to obtain high ESG scores, companies must verify these aspects and correct them if needed, and they also have to provide ESG reports to verify that they are in compliance with the principles set forth by the Sustainability Accounting Standards Board.

[27] BlackRock report, “Sustainable Investing: Resilience amid unceirtainty”, 2020

Second Chapter

Introduction to the chapter

This chapter will be the fundamental part of my thesis. It explains how the data collection has been organized, from monthly returns to ESG scores, and explains the construction of the factors required to perform the empirical section. In the second part an overview of the model used and its implementation are made. There is then a formalization of the model through the drafting of an empirical model, which I then verify in the empirical section using the data I obtained according to the procedure obtained in the first part of the chapter.

2.1 Data Collection

The first part of the second chapter explains the origin of the data: which are the reference companies, which database was taken into account and the reference period. A brief explanation is given about the construction of the ESG scores by Thomson Eikon Reuters. Then the factors used for the implementation of the empirical model and their construction is explained.

2.1.1 Data

As measure for financial performance, the stock return is taken into consideration.
The universe of companies considered for the implementation of this analysis is the group of firms included in the STOXX Europe 600. Since the aim of this thesis is to assess the effect of European companies' commitment to ESG factors on returns, it seemed appropriate to have as starting point an index that could contain a high number of companies from several countries. STOXX Europe 600 is an equity index designed by STOXX Limited and contains 600 of Europe's largest market capitalizations. As mentioned above, there are 600 components in this index from 17 European nations,

representing about 90% of the market capitalization of the European stock market. Among the component countries of the index are Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Switzerland, Sweden and the United Kingdom. Furthermore, the firms listed in this index belong to 10 different sectors including Utilities, Consumer Services, Materials, Oil, Telecommunications and Technology.

The period chosen for the analysis of the data goes from September 2005 to December 2019 (for a total of 173 months), the last year in which many ESG data are available. Such a wide time horizon has been chosen in order to analyze the effects of ESG changes during the various business periods. The period considered includes the two major financial crises that have also affected Europe (2007 and 2011) to see how the effect of ESG parameters varied in times of distress. The option to choose relatively long periods for empirical analysis of this topic is a practice shared by many other scholars such as Ziegler and Manescu.

The variables chosen to represent the performance of the companies are the monthly returns and each data has been downloaded from Thomson Eikon Reuters.

The most important and characteristic variable of this empirical work is the ESG dimension. To represent this aspect, the ESG scores have clearly been chosen. As already explained in the previous chapter, there is a variety of rating agencies that provide ESG scores that are processed according to different schemes and in the form of different outputs. It is precisely for these reasons that many researchers have addressed the issue of the uncertainty and inconsistency of ESG scores, and that is why any analysis of this type requires ESG scores that are robust and therefore able to represent the sustainable performance of the company. Due to the growing interest in sustainability, many companies have started to publish reports on their sustainable performance only in recent years (2012). Among the various rating providers available, Thomson Eikon Reuters was the one I chose for my analysis. This choice is based on the fact that the scores of this rating provider are both transparent and easily accessible and covers the most of European public companies.

About 10 years ago Thomson Reuters purchased ASSET4, one of the first agencies to provide ESG scores to the general public. In this way Thomson Reuters was able to create a rating system based on the principle of Equal Weighted Ratings proposed by ASSET4. Nowaday, Thomson Reuters has one of the world's largest ESG databases with more than 150 employees collecting data continuously. According to this rating

agency's system, there are over 400 ESG score evaluation systems, which are processed manually for each company within Thomson Reuters' ESG system. Each parameter undergoes a careful standardization procedure in order to ensure a possible comparison across the entire range of firms. Data have been available since 2002 for more than a thousand companies in Europe alone.

As mentioned before, Thomson Reuters collects more than 400 ESG variables related to the sustainable performance of companies. From these variables, a group of 178 data points was selected and then grouped into 10 categories. These ten categories are analyzed, and an average is made to form the ESG scores that represent the sustainable performance of the company in point. Regarding the Environmental pillar, the categories analyzed are Resource Use, Emissions and Innovation. Management, Shareholders and CSR Strategy are the categories involved in the Social pillar. While concerning the Governance score, the categories analyzed are Workforce, Human Rights, Community and Product Responsibility.

With regard to the construction of ESG ratings, a score is given to each individual category listed above. At the end the global score is a weighted average between the scores of the various categories. Obviously, the scores of the categories do not all have the same weights within this average, but they vary according to their importance.

Weights taken from the user manual of Thomson Reuters[28]

Pillar	Category	Indicators in Scoring	Weights
Environmental	Resource Use	20	11%
	Emissions	22	12%
	Innovation	19	11%
Social	Workforce	29	16%
	Human Rights	8	4.50%
	Community	14	8%
	Product Responsibility	12	7%
Governance	Management	34	19%
	Shareholders	12	7%
	CSR Strategy	8	4.50%
TOTAL		178	100%

[28] "Thomson Reuters ESG Scores", March 2017

As we can see from this table extracted from the user manual of the ESG section of Thomson Reuters, the categories with a higher weight are those referring to the Environmental pillar (Resource Use, Emissions and Innovation), Workforce and Management.

The scores of each category are calculated according to the percentile rank methodology, and are based on three drivers:

- The number of companies that are worse than the one under examination
- The number of firms that have similar scores compared to the firm under analysis
- The number of companies that show a value in general

So, the score of each category is estimated as follows:

$$score = \frac{n.\ of\ companies\ with\ a\ worst\ value + \frac{n.\ of\ companies\ with\ the\ same\ value\ included\ the\ current\ one}{2}}{n.\ of\ companies\ with\ a\ value}$$

The scores are available as Combined ESG Score, but also in the form of a single pillar score, called Environmental score, Social score and Governance score.

In conclusion, we can figure out how the ESG scores are distributed among companies within the various countries and among the different sectors involved. For this reason, averages have been made and are shown in the following charts.

Personal elaboration of ESG scores taken from Thomson Eikon Reuters

Country	Total Weighted Score
Spain	68,8
Netherlands	67,1
Portugal	66,7
France	64,5
Germany	64,3
Italy	62,9
UK	62,8
Norway	60,7
Finland	60,7
Sweden	59,9
Austria	58,2
Switzerland	57,3
Denmark	55,7
Belgium	52,9
Poland	52,2
Ireland	48,5

As we can see from this table, once we have obtained the 2019 averages of the companies belonging to the different countries, the countries with a higher ESG score are Spain (68,8), Holland (67,1) and Portugal (66,7), while those with a lower ESG score are Belgium (52,9), Poland (52,2) and Ireland (48,5).

Personal elaboration of ESG scores taken from Thomson Eikon Reuters

Industry	Total Weighted Score
Oil and Gas	69,1
Telecommunications	66,5
Utilities	66,4
Consumer Services	64,6
Basic Materials	62,6
Consumer Goods	62,1
Financials	61,9
Health Care	60,8
Technology	59,1
Industrials	58,5

It is possible to notice from the table shown above, that the industries with higher ESG scores are those that concern Oil and Gas (69,1) and Telecommunications (66,5). While the industries that have obtained lower scores are those regarding Technology (59,1) and Industrials (58,5). The table shows that the companies with the greatest environmental impact are also those with the greatest ESG commitment. This means that they are the companies that are most committed to mitigating the impact they produce. The reasons may be related to lower risk, and a question of image.

2.1.2 Factors

A fundamental step for the implementation of the method used in this thesis is the identification of the so-called "factors". A factor is a stock or asset property, and we assume the exposure to that property as the starting point of the analysis. It has been shown that some of these properties explain the cross-section of risk and return and can be considered systematic.

To explain the construction of the factors used in this thesis, the description of the factors used in the factor model of Fama and French and its extensions could be useful. The currently dominant approach for the specification of factors explaining the expected return of a security, is based on the multifactorial (three-factor) model of Fama and French, as well as its extensions. The CAPM[29] uses only one variable to

[29] Also known as Single Factor Model, it measures the relationship between the stock's expected return and the risk represented by the market. The beta here, measures the risk that the investment in question can bring to the market portfolio.

describe the returns of a portfolio relative to that of the market, the beta. Fama and French demonstrated that this variable does not fully capture all risk factors. This demonstration of Fama and French originates from the concept of Arbitrage Pricing Theory (APT)[30], which was first disclosed in 1976 by Steven Ross. This model assumes that there is no possibility of arbitrage, i.e. the activity that allows investors to generate a source of profit by maintaining a long position in the market where an asset costs less and a short position in the market where an asset costs more. According to this model, the return of securities therefore depends on several factors and is expressed as a linear function of certain risk factors. In equilibrium, securities with the same sensitivity to a given set of factors must therefore necessarily offer the same expected returns.[31]

Fama and French have developed a three-factor model that, in addition to including the beta market factor, takes into account two other variables related to the characteristics of the company: the size of the company and the relationship between book value and market value. This choice stems from the observation that two asset classes tend, on average, to beat market returns as predicted by the Security Market Line:[32] small caps (low capitalization companies) and companies with a high market-to-book ratio (value stocks).

Let us now analyze how they originally created these factors. To find the other factors, Fama and French initially determined the median of NYSE stocks in order to categorize all stocks as "high" or "low". They then divided the US stock population into three groups based on the Book to Market ratio: the low part 30%, the middle 40% (medium), the high part 30%. At this point it is appropriate to explain that securities with a high market value/book value ratio are called "value" assets because their market value depends on the fundamentals present and already priced by the market, while securities with a low market value/book value ratio are considered "growth" assets precisely because their market value depends instead on future cash flow growth expectations.

[30] It is an evolution of the Capital Asset Pricing Model and is based on the correlation between returns and risks of a financial product. In particular, it was designed to get an idea of how sensitive an asset was to changes in certain macroeconomic factors.

[31] "Arbitrage Pricing Theory", corporatefinanceinstitute.com

[32] The Security Market Line is the graphical representation of the Capital Asset Pricing Model.

The construction of the factors for the model used in this thesis is now explained and refers to the technique used by Fama and French in the three-factor model and its extensions.

The first factor to be explained is the Small – Minus – Big factor. It incorporates the so called "size effect", with size intended to be the market capitalization. In few words we can say that this factor states that small firms perform better than large firms in the long run. So, we can think about this factor as the excess return that small market capitalization firms gain versus the large ones in the long run.

We can define the Small – Minus – Big factor as a difference between "Rs" and "Rb" portfolios:

$$SMB = R_S - R_B$$

Where "Rs" and "Rb" respectively represent the average performance of portfolios built on small securities and the average performance of portfolios built on large securities.

$$R_s = {}^1\!/_3\,(R_{SL} + R_{SM} + R_{SH})$$

$$R_B = {}^1\!/_3\,(R_{BL} + R_{BM} + R_{BH})$$

The second factor to be explained is the High – Minus – Low factor. As described before, there is a difference between "value" stocks and "growth" stocks: the firsts come from companies with high book to market ratio, while the others come from companies with low book to market ratio. The fundamental character of this factor lies in the fact that the so-called value stocks perform better than growth stocks.

The High – Minus – Low factor can therefore be constructed as the difference between the "Rh" and "Rl" portfolios:

$$HML = R_H - R_L$$

Where “Rh” and “Rl” respectively represent the average returns of the two groups of securities with high book to market ratio (SH and BH) and the average of the two groups of securities with low book to market ratio (SL and BL).

$$R_H = {}^1\!/_2\,(R_{SH} + R_{BH})$$
$$R_L = {}^1\!/_2\,(R_{SL} + R_{BL})$$

In addition to the list of factors considered so far, it is important to give the description of another factor used in our analysis, the so-called Robust – Minus – Weak factor. The method of calculating the RMW factor is similar to the HML factor, apart from the fact that the breakpoints are based not on Price – to – Book ratio but on Operating Profitability Margin. The larger the operating profit margin, the stronger is the company. Operating Profit Margin is the operating profit divided by total revenues, and is a percentage also known as EBIT Margin. The portfolio that represents this factor is built by taking an average of the returns on the two robust portfolios (the ones with higher Operating Profit Margin) and subtracting the average of the two weak portfolios (the ones with lower Operating Profit Margin).

RMW = ½ (Small High + Big High) – ½ (Small Low + Big Low)

Another important factor used in this analysis is the Conservative - Minus - Aggressive portfolio. In this case the variable taken into consideration is the investment compared to the previous year, i.e. the annual increase in total assets. So, smaller this increase, more Conservative the company we will assume it is. If, on the other hand, the increase is substantial, we will talk about Aggressive companies. This factor is the average return on the two conservative investment portfolios minus the average return on the two aggressive investment portfolios:

CMA = ½ (Small Conservative + Big Conservative) – ½ (Small Aggressive + Big Aggressive)

So, to sum up, in this paragraph it has been explained how the factors necessary to implement the first step of the regression have been found. In particular, the factors in

question are: the market, Small – Minus – Big, High – Minus – Low, Robusts – Minus – Weaks and Conservative – Minus – Aggressive.

2.1.3 Why is ESG a factor for equity returns?

The following part of the paragraph explains the application and construction of the most characteristic factor for our research: the ESG factor.

Moreover, some expectations on the final result are enunciated.

In order to understand if ESG scores could be considered as a factor, I consulted the paper written by Jordan Dekhayser, a member of the Northern Trust Asset Management, that deepens the topic and proposes a detailed vision of this possible factor.[33] To explain this step first of all it is essential to keep in mind the distinction between factor and the characteristic that serves to explain this factor. For example, if I consider the value factor, there are many metrics (price to book, cash flow, etc.) that I can use to describe this factor, and each one will lead to different results. The same goes for the ESG factor: it is unobservable and what you can do is to use a series of metrics to describe it. The metric that is most commonly used to refer to ESGs is ESG score system. One thing that certainly characterizes the ESG dimension, is the multiplicity of opinions about what should be considered within ESG scores, and how things should be weighted within them. In addition, there are numerous rating companies that provide different ESG scores. However, these scores are very important because they are useful metrics for ESG factors.

There are conflicting opinions as to whether ESG can be considered a factor in portfolio construction or not.

In this paragraph we want to give the reader both points of view so that he can have his own opinion on the matter.

For example, "Research Affiliates" researchers, as can be seen from their research, are convinced that ESG cannot be considered as a factor in the common sense of the

[33] Jordan Dekhayser, "Is ESG a factor?", Northern Trust Asset Management, 2018

term.[34] From their point of view, the minimum requirements for a stock characteristic to be considered as a factor are:

a) an in-depth literary background;
b) robust across definitions;
c) robust across countries.

As regards the first point, the traditional factors (value, size and momentum) have been the subject of numerous researches over the years. Instead on ESG there is a lot of discordance: in some works, a negative correlation with returns has emerged, in others a positive correlation.

The problem with the second point concerns the fact that ESG does not have a standard definition, in fact it is used as a broad term for a large group of themes. In addition, it should be noted that there are several rating agencies that each gives different ratings, thus creating confusion for investors.

Research Affiliates has also conducted a linear regression against market return for ESG strategies in Europe and the US. The results obtained show low or negative alpha for the majority of the examined scenarios.

This analysis gave negative results on all three points considered fundamental and led to the conclusion that ESG is not to be considered as a factor, but rather as a "powerful theme". In fact, although ESG has not met any of the three requirements, ESG strategies can still lead to higher returns.

Nicolas Rabener, manager at Factor Research, agrees with Research Affiliates' research that ESG does not have a precise definition and lacks a literary background, but at the same time proposes it as a factor, arguing that "A factor is simply a rules-based framework to stock selection and therefore almost any approach is per definition a factor".[35]

According to Jordan Dekhayser from Northern Trust Asset Management, ESG can be considered as a factor. In short, ESG cannot be considered as a traditional factor on a par with size or quality, precisely because of the relationship it has with other factors. In that regard, the Northern Trust Asset Management carried out an analysis on the MSCI World Index to seek the factor exposures of companies with high ESG ratings,

[34] John West, Ari Polychronopoulos, "Is ESG a factor?", Research Affiliates, July 2020
[35] Nicolas Rabener, "ESG: What's under the hood?", Factor Research, July 2019

the so-called “Leaders”, and companies with low ESG ratings, the so-called “Laggards”.

“ESG factor exposures analysis”[36]

ESG Group	Beta	Book-to-Price	Dividend Yield	Profitability	Residual Volatility	Size
Leaders	0.07	-0.17	0.14	0.12	-0.34	0.35
Laggards	-0.16	0.19	0.10	-0.19	0.01	0.18
Leaders minus Laggards	0.23	-0.36	0.05	0.31	-0.35	0.17

As can be seen from the table above, it emerges that ESG is linked to high profitability, large size, negative book-to-price, superior beta, and little residual volatility, and this correlation seems to be constant over time. So, using ESG as a factor and ESG scores as proxies for that factor is a useful way to find and discover risks and opportunities neglected by standard financial analyses. In addition, in this research it was found that the ideal mixture of factors to be used is ESG and quality, as each factor brings together a different aspect of sustainability, financial and non-financial.

Once we concluded that ESG can be used as a factor, we can describe its construction. By looking at the ESG scores downloaded by Thomson Eikon Reuters, we can immediately classify the securities and see how they are distributed. Companies with higher ESG scores (precisely ninetieth percentile) have been recognized as "Leaders", while companies with lower ESG scores (precisely tenth percentile) have been identified as "Laggards". At this point the factor is constructed by subtracting the "Laggards" from the "Leaders":

$$ESG = LeadersESG - LaggardsESG$$

[36] Jordan Dekhayser, “Is ESG a factor?”, Northern Trust Asset Management, 2018

So, the use of ESG scores as a factor proxy is very useful because it allows investors to have a measurement of what could be the exposure to risk and consider some opportunities that are not involved in the traditional financial analysis.

There is no unequivocal opinion as to whether high ESG performance also results in high financial performance. Reading the studies and research done previously and statements made by the largest investment companies in the market, we were able to get an a priori idea of what could be the real effect of an increased commitment to ESG criteria and therefore what could be the result of our empirical analysis.

It is well known that a company cannot orient its business model towards a sustainable model and cannot become an ESG power in a short time. What is needed is a long-term vision and an investment that can make the company "sustainable" in the long term. Despite this, as a result of my empirical analysis I expect to find at least a non – negative correlation between commitment to ESG criteria and financial returns. According to Fortune, there is always more evidence that companies that perform well in ESG criteria perform better than others. One example would be the S&P 500 companies: in fact, the companies that excelled in ESG criteria outperformed those that failed according to these standards between 2014 and 2018.[37] What makes us even more convinced that the commitment to ESG criteria leads to high financial results is the research carried out by MSCI. Their universe of analysis is 100 companies that had already been analyzed in the past and it has been empirically proven that commitment to ESG criteria has brought a real ROIC advantage over peers among the last 5 years.[38] From our point of view, therefore, there is no reason why a deterioration in performance should appear in the event of higher ESG scores. Although it is true that to achieve high standards of sustainability it is necessary to bear costs, it is also true that once the business is oriented towards a sustainable model, the company may be able to save and allocate these resources to the core business and thus improve performance.

[37] Fortune, “Best stocks 2019: 5 companies that do well while doing good”, 2018

[38] Panos Seretis, Meggin Thwing Eastman, “Enhancing Economic Value With ESG”, MSCI ESG Research Inc, February 2018

2.2 Methodology

This paragraph of the second chapter is used to give an overview of the method used for the empirical model. In the first part we present the model itself, i.e. Fame - Macbeth regression, its steps and the objectives it is intended to calculate. In short, a general description of the method is given, which is then carried out in detail in the third chapter of this study. Then the software used to implement the model, i.e. Stata, is explained. Finally, it is clarified what the results that this model aims to find mean and how they should be interpreted in general.

2.2.1 The Fama – Macbeth Procedure

For the implementation of this empirical analysis, the Fama – Macbeth regression was chosen. This method is used to estimate the parameters in the Asset Pricing models, just like the Capital Asset Pricing Model (CAPM). It is a statistical method to study the relationships between several variables, and unlike portfolio analysis it allows us to control a greater number of variables.

Many empirical theories regarding Asset Pricing, involve the use of so-called "risk factors" to understand returns; the Fama – Macbeth regression is one of them. These factors, as seen in the previous paragraph, can range from more general types (unemployment, inflation) to economic factors (capitalization, performance). This type of regression is therefore useful to understand the connection between such factors and returns. The ultimate goal of this model is to find the premium that comes from exposure to such factors. Particularly in my work, therefore, the main interest is to find the premium that comes from the commitment of the various companies to ESG factors. To this purpose, the ESG factor, explained in the previous paragraph, has been included in the model.

It is possible to identify two steps for the implementation of the Fama - Macbeth regression:[39]

1. The first step consists in identifying the betas. For this purpose, then the dependent variable (in our case the excess returns) are regressed against one or more risk factors (independent variables) just to identify the exposure to such factors. It is important to know that when the dependent variable is a return of a security or an excess return, it is usually not winsored.[40] This step gives origin to a historical time – series of betas that are usefully managed in the second step.

2. The second step is to use the previously obtained beta series to implement cross – sectional regression of returns against the betas. The aim is to find the time – series averages of the periodic cross – sectional regression coefficients and other important statistical results. The result gives then a time series of risk

[39] Turan G. Bali, Robert F. Engle, Scott Murray, “Empirical Asset Pricing, the cross section of stock returns”, John Wiley & Sons Inc, 2016

[40] Winsorization is usually used to avoid that a small contingent of extreme values of independent variables does not have a great influence on the regression.

premium coefficients for each risk factor. Doing so, the purpose is to find whether the average coefficient is statistically different from zero.

It must also be said that the type of cross sectional regression used when running this model must not be a standard ordinary least squared regression. Rather it should be a weighted least squared regression or a logistic regression.

The first stage of this regression therefore gives life to the betas. They are the slope parameters and are also known as factor exposure. They will be useful to figure out the sensitivity of a given portfolio's return to certain factors and to the intercepts.

As a result of the second stage, we obtain the coefficient on the factor exposures found previously and we call them lambdas. These parameters indicate the way in which returns are linked to betas.

At the end of this model, other statistical results such as average, standard error, t - ratios, p - values and R squared are also calculated.

2.2.2 The Empirical Model

The central aim of this thesis is to test if the explanatory power that some ESG concerns have for stock returns is due to mispricing or compensation for risk.

Explanatory power is measured using cross-sectional regression of excess stock returns on ESG scores and four factors known to explain stock returns: beta, size, value, and momentum: the Fama-French three-factor model plus the momentum. The cross-sectional approach is preferred to the portfolio approach of analyzing only the return differential between high and low ESG stock portfolios because of interest in the monotonic effect of ESG concerns on stock returns. Moreover, the use of ex-post returns should supplement Derwall and Verwijmeren (2007), who used measures of ex-ante returns, i.e., implied cost of equity capital.

The test for the effect of ESG concerns is if their estimated effect is statistically indistinguishable from zero as the four-factor model predicts.

The essential question that the cross-section regressions can answer is why average returns vary across assets (Cochrane, 2005). The expected return of an asset should be high if it has large exposure to factors that carry risk premiums, i.e., market risk or

beta, size (market capitalization), book-to-market ratio, or momentum (a simple average of 10 past returns).

The four-factor model estimated here is extended with alternatively with an aggregate ESG variable as:

$$R_{j,t+1} = \gamma_0^{t+1} + \gamma_1^{t+1} Size_{j,t} + \gamma_2^{t+1} BookToMarket_{j,t} + \gamma_3^{t+1} Momentum_{j,t} + \gamma_4^{t+1} \hat{\beta}_{j,t} + \gamma_5^{t+1} ESG_{j,t} + \theta_{j,t+1} \quad (1)$$

Where the excess stock return for firm j in month t+1 ($R_{j,t+1}$) is a function of:

- $\hat{\beta}_{j,t}$, the estimated market risk (beta) of the firm;
- $Size_{j,t}$, the firm's log of market capitalization;
- $BookToMarket_{j,t}$, its book-to-market ratio;
- $Momentum_{j,t}$, the average return over the period t−2 and t−12 months;
- $ESG_{j,t}$, seven individual firm ESG variables or an overall ESG variable;
- an i.i.d. error term, $\theta_{j,t+1}$, with zero mean and constant variance.

Size and book-to-market ratio are updated monthly, while estimated beta. Beta is estimated for each asset j (j = 1...N) through a time-series regression up to time t of the asset's returns and the market-index return.

Empirical evidence shows that not all ESG concerns are equally relevant to investors or, that there are confounding effects between some of them. So, the focus on the individual ESG concerns in the analysis, also complemented with an aggregate ESG score. As we describe in the previous paragraph, this model (1) was estimated with the Fama-MacBeth procedure, which allows for time-varying coefficients (γ_k^{t+1}, k = 1, 2, 3, 4); infact, we first estimate a time-series regression of individual stock returns on the market-index return in order to obtain beta estimates, and then use these estimates as explanatory variables in the cross-sectional regression (1). The estimated $\hat{\beta}_{j,t}$ in (1) equals the true (unobservable) value plus a measurement error (or sample variance) vj, assumed to be i.i.d. with zero mean and variance σ^2.

Fama and MacBeth (1973) indicate that the mean values of the $\hat{\gamma}_k^{t+1}$ coefficients, which are needed for statistical inference, can be computed as the time series averages of the estimated coefficients, i.e. $\bar{\gamma} = Avg(\hat{\gamma}) = \sum_{t=1}^{T} \hat{\gamma}_k^t / T$.

Then the t-test is the ratio of this mean and the time-series standard error of the estimated coefficient, i.e., its time-series standard deviation ($sd(\hat{\gamma})$) multiplied by the

square root of the time-series length (T), $t(\hat{\gamma}_k) = \sum_{t=1}^{T} \hat{\gamma}_k \Big/ sd(\hat{\gamma}_k)\sqrt{T}$, with k= 0, 1, 2, 3, 4).

Third Chapter

Introduction to the chapter

In this last chapter of my thesis, the results are analysed and conclusions drawn. Precisely in the first part, the results of the Fama - Macbeth regression and the multilinear regression of the ESG factor on the Fama - French factors are presented. Afterwards there is a comment on the results obtained. In the second part, conclusions are drawn, and a personal comment is made.

3.1 Results and comments

3.1.1 Analysis and comments of the data

This paragraph analyses the data used to implement the empirical model. In particular, a detailed analysis of returns and ESG scores is made. As noted, the sample consisted of members of the STOXX Europe 600 index: the initial dataset consisted of an average of 410 firms per year for the 15 years, from 2005 to 2019, with 70,420 firm-year observations that also had industry classification. Summary statistics for the sector economic are presented in next pages.

Sector	Return's mean	Return's Standard Deviation
Automobiles & Parts	1,186518589	7,816059871
Banks	1,093439901	8,418554877
Basic Resources	1,223492758	8,476789258
Chemicals	0,789558041	7,66804342
Construction & Materials	1,061507162	7,171093165
Financial Services	1,180539193	8,774058925
Food & Beverage	0,864473634	7,878715901
Health Care	1,184283503	7,576088312
Industrial Goods & Services	1,103052089	9,254825187
Insurance	1,190554952	9,46220171
Media	1,016455604	9,214144745
Oil & Gas	0,940356021	8,524406033
Personal & Household Goods	1,131281176	8,962054576
Real Estate	1,211448323	9,11565367
Retail	1,149526903	8,249483319
Technology	0,920383334	8,6087856
Telecommunications	0,958902816	9,379352437
Travel & Leisure	1,325573514	8,76346069
Utilities	1,198869754	8,259863002
Total	**1,101538083**	**8,631282783**

The results are summarised in the table above.

The sample firms were classified into sectors.

The sectors analyzed in total are 19: Automobiles & Parts, Banks, Basic Resources, Chemicals, Construction & Materials, Financial Services, Food & Beverage, Health Care, Industrial Goods & Services, Insurance, Media, Oil & Gas, Personal & Household Goods, Real Estate, Retail, Technology, Telecommunications, Travel & Leisure, Utilities.

I have analysed the returns of the various sectors to understand the average over time and the standard deviation.

From the table it is possible to observe that the average returns over the time period considered are between 0.7895 and 1.3256.

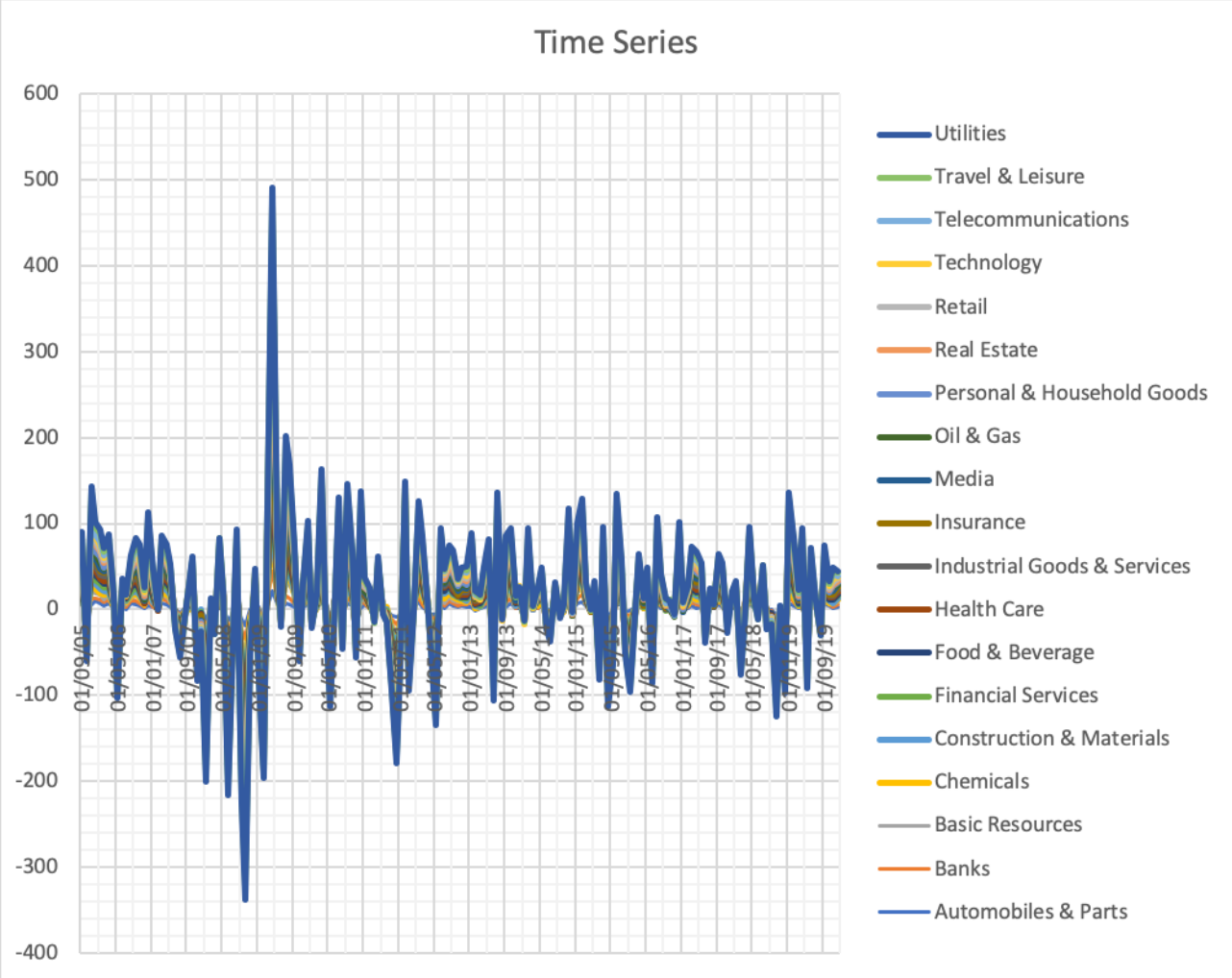
The sectors with the lowest returns are Chemicals and Food & Beverage, while the highest ones correspond to the Travel & Leisure and Real Estate sectors.

As far as the average values are concerned, the deviations standards are high, which suggests that there has been high variability in value over the years. It is enough to think a little, to understand where this variability can come from, which in turn manifests itself in the breaking of trends.

In fact, over the selected period of time there have been several financial crises, which have compromised the performance of many companies.

Therefore, in order to fully understand the behavior of returns over time, and to be able to evaluate all the variations of the various sectors have varied over time was born, it is necessary to made a time series analysis for each sector.

The results are plotted in the Graph in the next page:



As can easily be seen from the graph, the periods of greatest variability are those close to crises. In particular, we can note a great fluctuation around 2008, the year of the subprime crisis that has also resonated in Europe. It also seems that there is one sector that has been most affected by the fluctuations and it seems to be that of Utilities (blue). And it also seems that there have been sectors that have had a flatter performance, such as Banks (orange) and Automobiles (light blue).

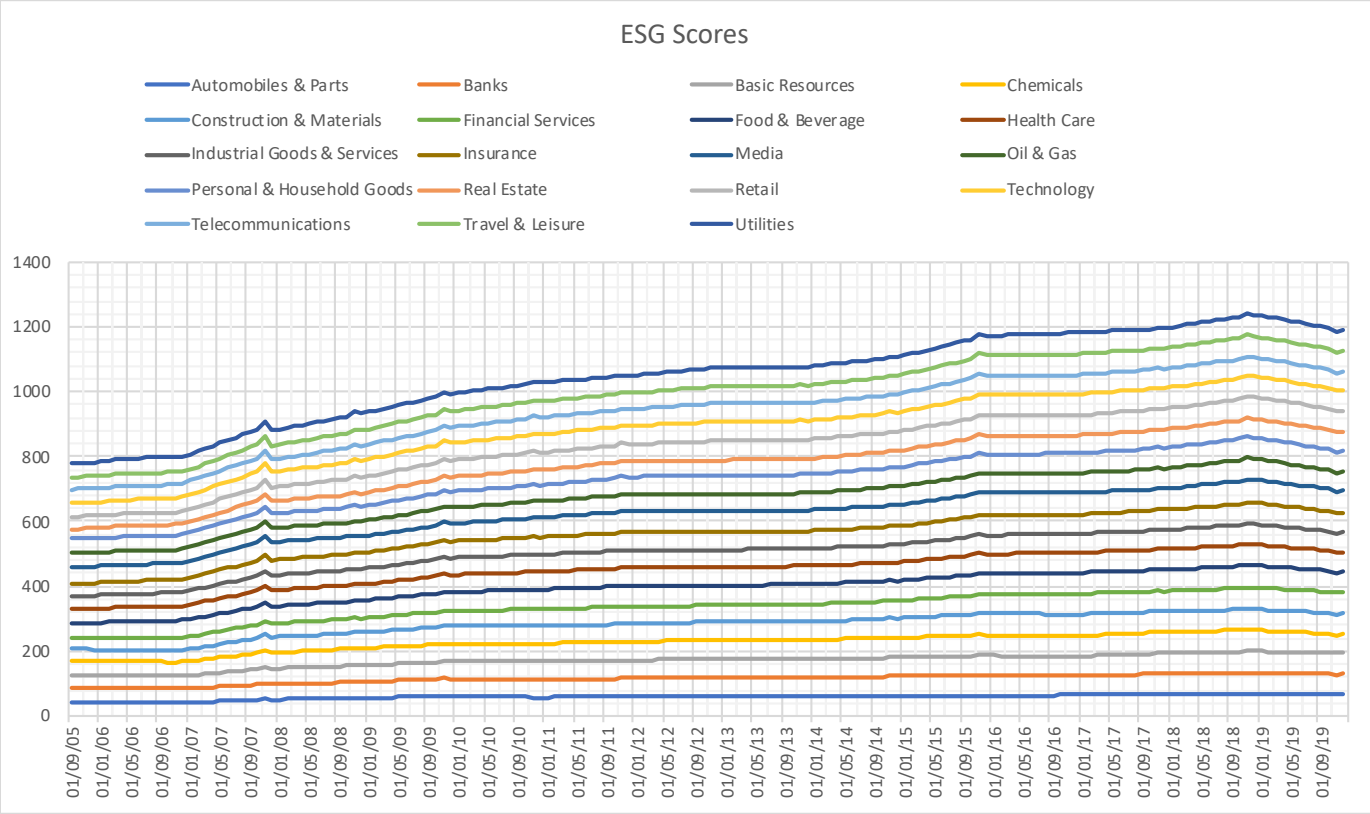
In addition to analysing the trend of returns, it was quite interesting to understand the ESG scores path. So, as for the returns, a table with average and standard deviation was made, to understand what the ESG scores were like within the various sectors.

Sector	ESG mean	ESG Standard Dev.

Automobiles & Parts	59,08461596	14,88976918
Banks	55,36242878	16,52534343
Basic Resources	55,76478522	15,50434263
Chemicals	57,26785467	15,43480853
Construction & Materials	55,10490185	17,97405996
Financial Services	52,48905737	19,22772189
Food & Beverage	60,3749235	14,62762743
Health Care	55,67636506	19,46955013
Industrial Goods & Services	53,12483416	17,78205003
Insurance	54,28505839	18,93785927
Media	61,83976715	15,5906458
Oil & Gas	53,1213443	17,11279026
Personal & Household Goods	54,64476962	19,61396968
Real Estate	47,80970116	17,7010854
Retail	54,66051538	15,7599475
Technology	57,19421594	20,68639975
Telecommunications	52,58051772	15,80654226
Travel & Leisure	53,30718138	19,21437498
Utilities	56,87104709	17,19451316
Total	**54,74332919**	**17,99435006**

From this table we can immediately see which sectors are most committed to ESG factors and which have the lowest scores. The sectors with the highest average ESG scores are "Media", "Food and Beverage" and "Automobiles" with 61.84, 60.37 and 59.08 respectively. The interesting thing is that at the top of the sectors with the most environmentally conscious companies is the automotive sector. Some of the reasons why companies in this sector pay particular attention to ESG factors could be to avoid pollution penalties, for example, or for image-related reasons. An automotive company that presents its image as an environmentally conscious company can only benefit in terms of financial returns. At the bottom of this ranking we have the Oil and Gas, Telecommunications and Financial Services sectors with 53.12, 52.58 and 52.49 respectively.

Also in this area, the deviations standards were quite high, an indication of great variability. For this reason, as in the case of returns, a temporal analysis was also carried out.



As can be seen from this chart, over time there has been a steady increase in ESG scores for most sectors, an indicator that we are moving more and more towards a very specific trend. In fact, this graph confirms that attention to the environment and social issues, in short, to sustainability in general, is an increasingly established trend that is growing year on year. Only the "Banks" and "Basic Resources" sectors, for example, show a rather flat trend.

3.1.2 The software and its use

The Stata software was chosen for the development of this empirical model. It is a statistical software that allows the management and analysis of data and the creation of graphs. The strengthness of this software is the ability to manage large datasets and an ever-increasing ability to manage panel and time - series regression analysis. The syntax used is very simple and intuitive and allows the user to communicate efficiently with Stata and at the same time to do even sophisticated works. Stata is a widely used software for the implementation of regressions like Fama - Macbeth, and in this paragraph, we see how.

First of all, I created a panel in which the observations contained indications regarding both the CUSIP (identification code) of the various stocks (STOXX600, purged of the securities with missing value) and the date (data on a monthly basis from September 2005 to December 2019). The panel thus obtained was analysed with Rolling Windows regressions of the excesses of the returns of the stocks with respect to the ReferenceToMarket, for each stock, thus obtaining the Beta Markets for each date.

For the time intervals used in Rolling Windows I used windows equal to 10 months. In addition to the BetaMarket, I made sure that STATA also provided us with data related to the Beta of the constant, R2, R2-adjusted, SE in order to examine significance and make further analysis.

Once I obtained the BetaMarkets, we added them to the data obtained for BM, Size and Momentum, as well as, of course, the ESG scores and used all these parameters as independent variables to regress, for each date, the values of returns. I have, therefore, obtained the regression coefficients that I then reported in an Excel file and, using the Pivot table, I filtered them so that I could then mediate them and report them as average.

3.1.3 Analysis results and discussion

The Model Equation is:

$$R_{j,t+1} = \gamma_0^{t+1} + \gamma_1^{t+1} Size_{j,t} + \gamma_2^{t+1} BookToMarket_{j,t} + \gamma_3^{t+1} Momentum_{j,t} + \gamma_4^{t+1} \hat{\beta}_{j,t} + \gamma_5^{t+1} ESG_{j,t} + \theta_{j,t+1} \quad (3.1)$$

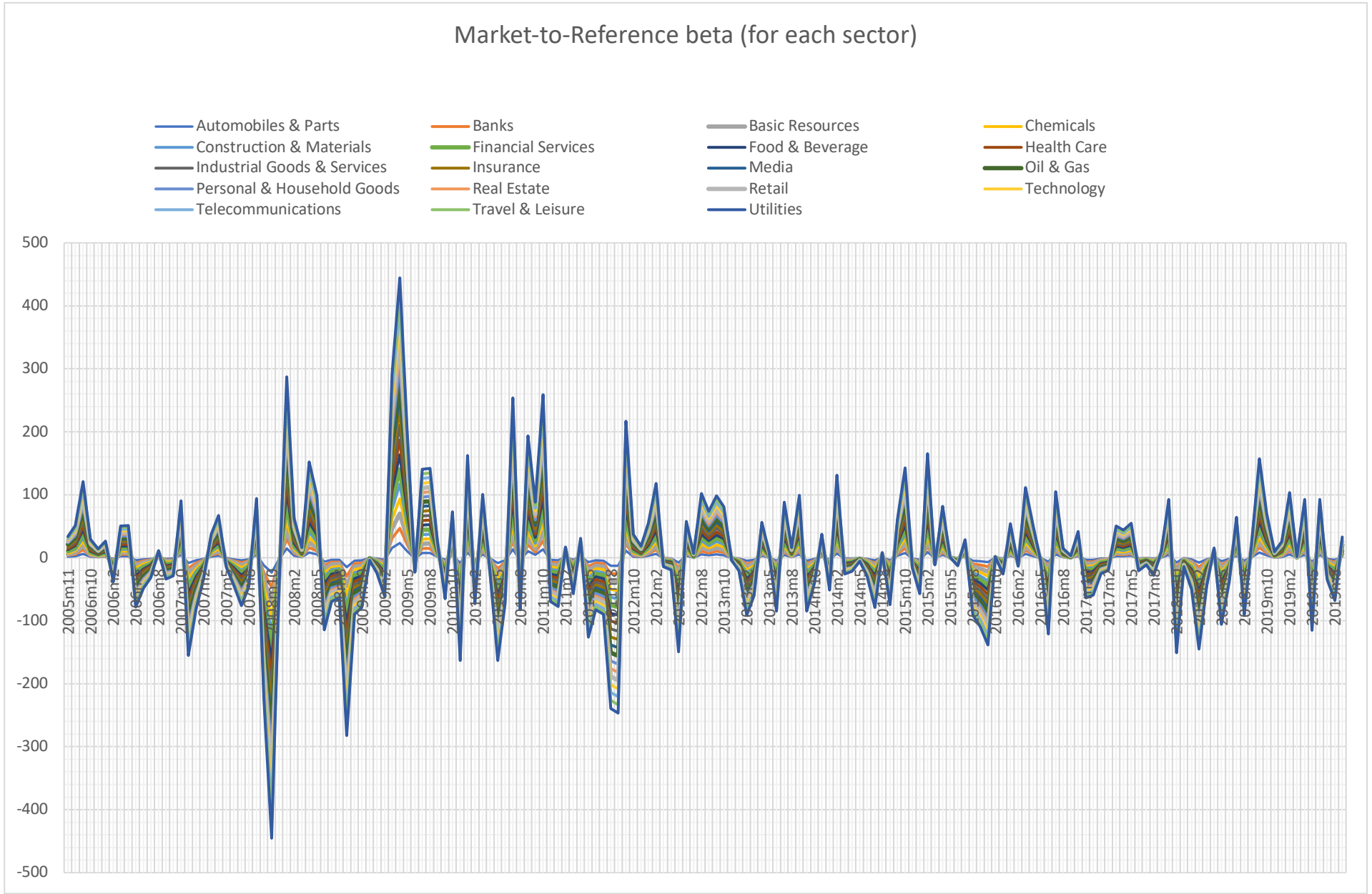
It was estimated using Fama-MacBeth month-by-month cross-sectional regressions, with the ESG score variable computed as described in Chapter 2.

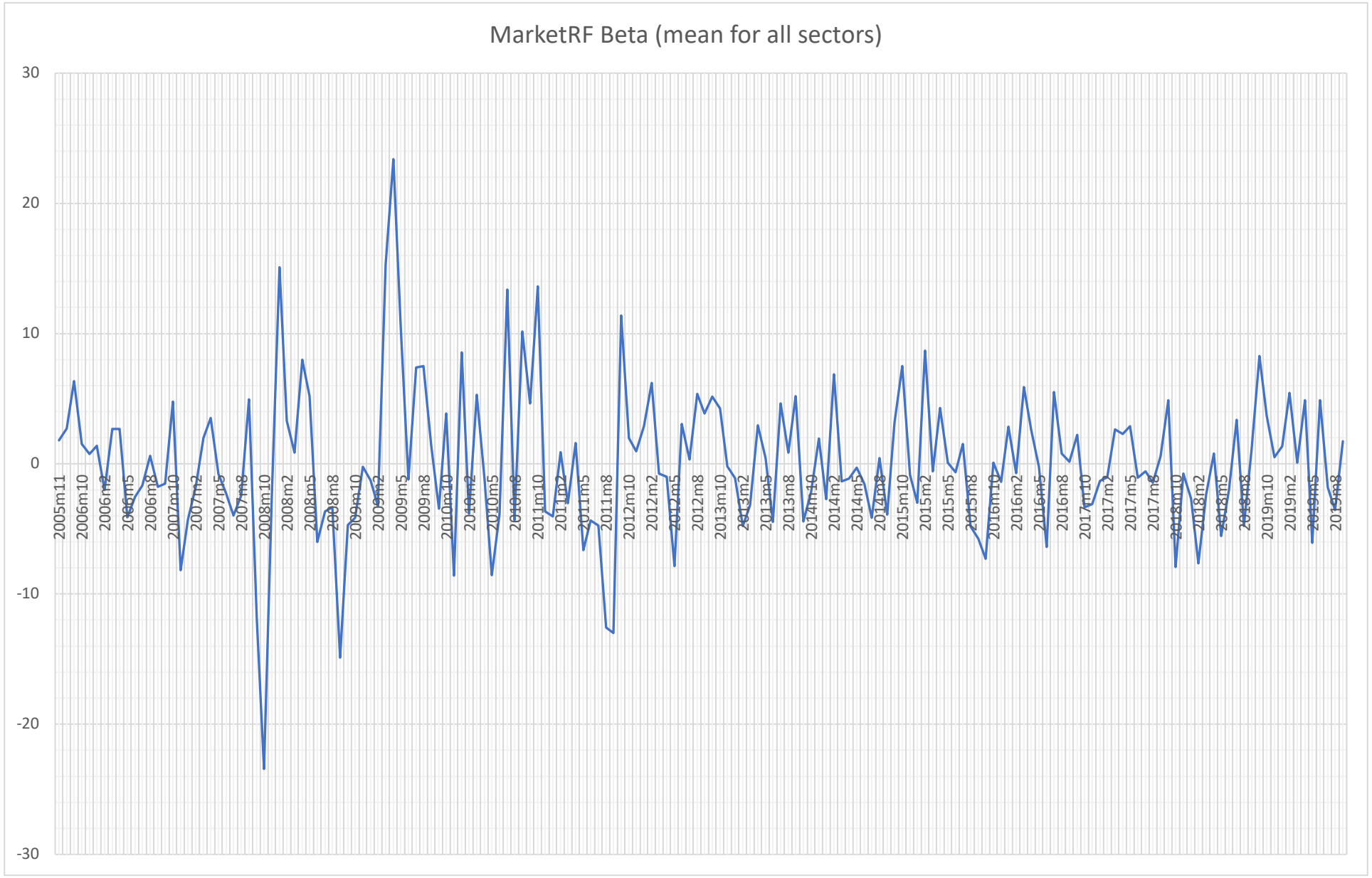
For the second Stage of calculation procedure the results are reported in the following table, grouped by sectors:

Sectors	beta_MktRF	beta_Size	beta_b_BM	betai_b_Momentum	beta_ESG	beta_constante
Automobiles & Parts	0.12377098	-3.60142E-06	0.010444714	0.223604488	-0.002866601	0.806282206
Banks	0.120223105	-3.55094E-06	0.010436258	0.223982152	-0.00291491	0.806995045
Basic Resources	0.125738341	-3.69255E-06	0.010396296	0.223396805	-0.002847957	0.812604807
Chemicals	0.123789565	-3.62385E-06	0.010418449	0.223953313	-0.002890101	0.805553418
Construction & Materials	0.127657955	-3.71098E-06	0.010352262	0.222820957	-0.002848553	0.815750922
Financial Services	0.127126456	-3.62046E-06	0.010360752	0.223091662	-0.002922399	0.819272136
Food & Beverage	0.125875572	-3.69387E-06	0.010393148	0.223355638	-0.002847999	0.812829718
Health Care	0.128249429	-3.65415E-06	0.010427707	0.223149049	-0.002824022	0.808674486
Industrial Goods & Services	0.124800622	-3.65838E-06	0.010402075	0.223310796	-0.002857054	0.810964999
Insurance	0.124095722	-3.58028E-06	0.010456661	0.224003872	-0.002887502	0.803568213
Media	0.125161779	-3.68701E-06	0.010409522	0.223569762	-0.002847777	0.81165986
Oil & Gas	0.124500033	-3.57557E-06	0.010457501	0.224169463	-0.002897536	0.802689976
Personal & Household Goods	0.126720447	-3.66294E-06	0.010364968	0.223137513	-0.002894314	0.810804345
Real Estate	0.124339252	-3.64325E-06	0.010462111	0.223516857	-0.002863592	0.809468491
Retail	0.126135313	-3.68866E-06	0.010404142	0.223112895	-0.002869265	0.814680673
Technology	0.132331811	-3.61318E-06	0.010448885	0.223567827	-0.002922109	0.809128602
Telecommunications	0.115800102	-3.37675E-06	0.010634302	0.225211248	-0.00290361	0.786865057
Travel & Leisure	0.114234725	-3.49866E-06	0.010394292	0.220834078	-0.002806878	0.805042972
Utilities	0.121579379	-3.58677E-06	0.010464602	0.223484483	-0.002953372	0.807204765
Total Means	**0.124831139**	**-3.62506E-06**	**0.010422687**	**0.223438409**	**-0.002877212**	**0.80905069**

The last row reports the mean value which can be used as final results.

The plots reported in the figure on the next pages, refer to the trend of beta factors over time, month by month.


Market-to-Reference beta (for each sector)
Automobiles & Parts
Banks
Basic Resources
Chemicals
Construction & Materials
Financial Services
Food & Beverage
Health Care
Industrial Goods & Services
Insurance
Media
Oil & Gas
Personal & Household Goods
Real Estate
Retail
Technology
Telecommunications
Travel & Leisure
Utilities
500
400
300
200
100
0
-100
-200
-300
-400
-500


MarketRF Beta (mean for all sectors)
30
20
10
0
-10
-20
-30
2005m11
2006m10
2006m2
2006m5
2006m8
2007m10
2007m2
2007m5
2007m8
2008m10
2008m2
2008m5
2008m8
2009m10
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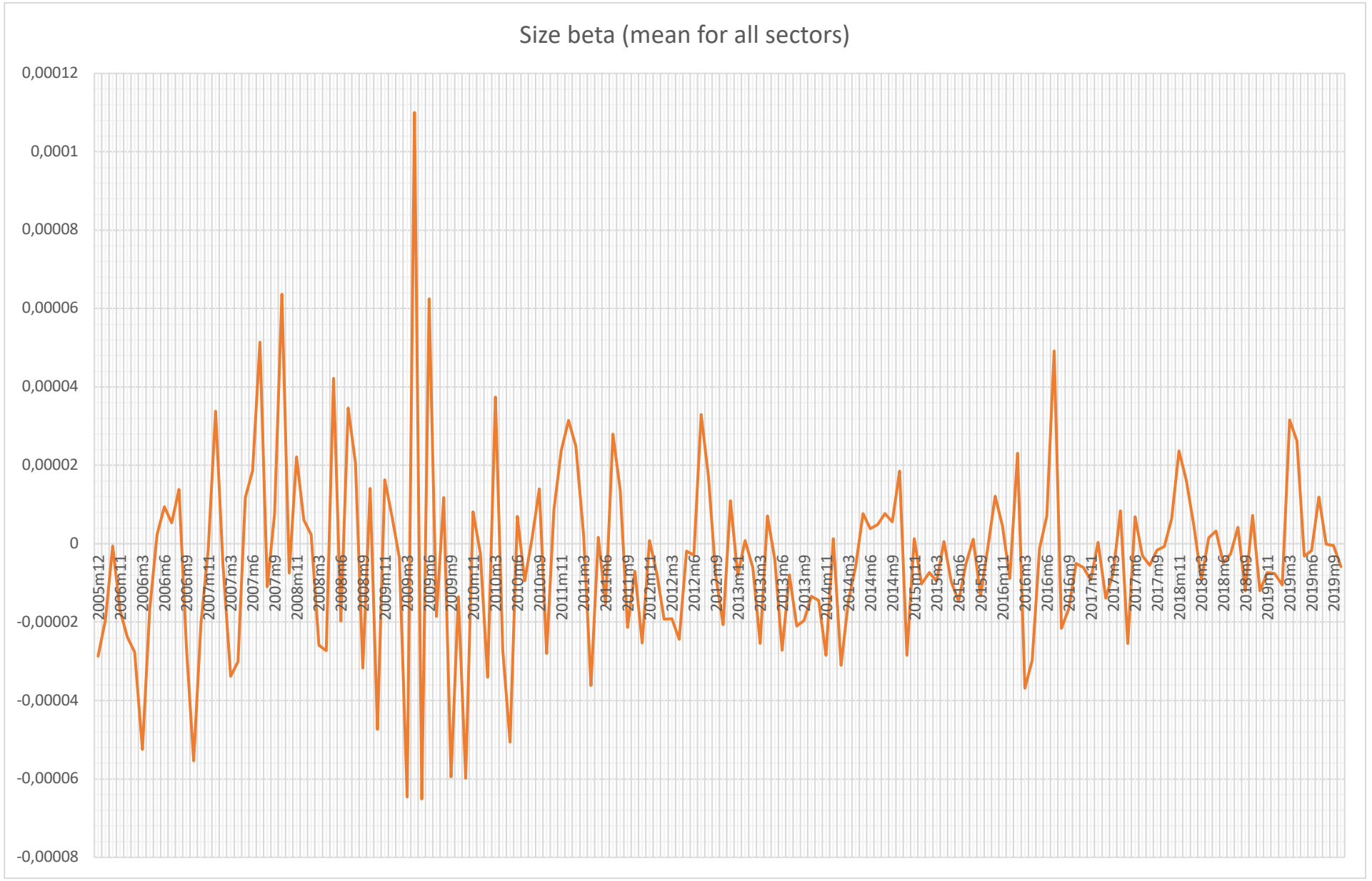
2019m2
2019m5
2019m8


Size beta (mean for all sectors)
0,00012
0,0001
0,00008
0,00006
0,00004
0,00002
0
-0,00002
-0,00004
-0,00006
-0,00008
2005m12
2006m11
2006m3
2006m6
2006m9
2007m11
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2019m11
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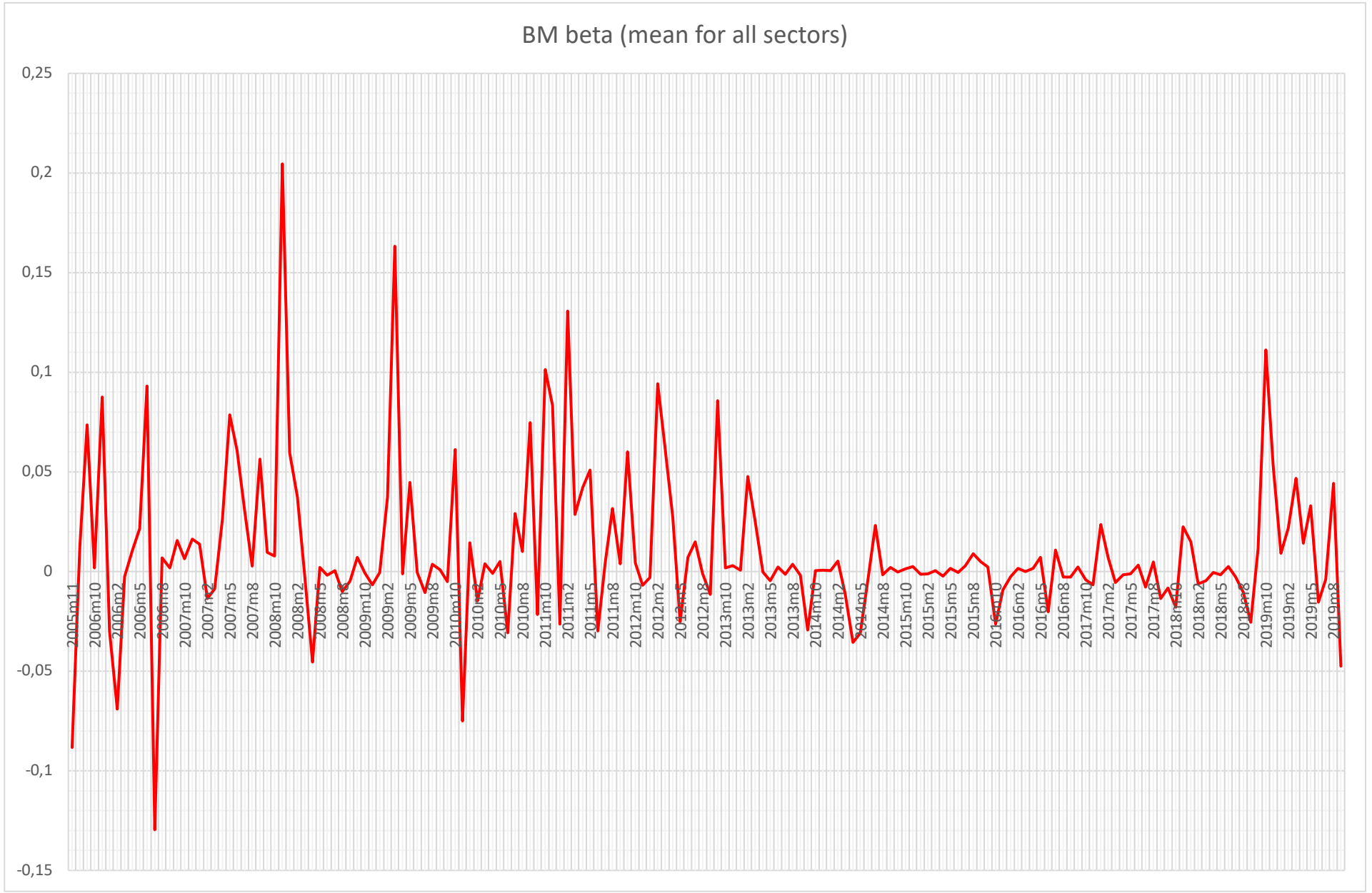
2019m9


BM beta (mean for all sectors)
0,25
0,2
0,15
0,1
0,05
0
-0,05
-0,1
-0,15
2005m11
2006m10
2006m2
2006m5
2006m8
2007m10
2007m2
2007m5
2007m8
2008m10
2008m2
2008m5
2008m8
2009m10
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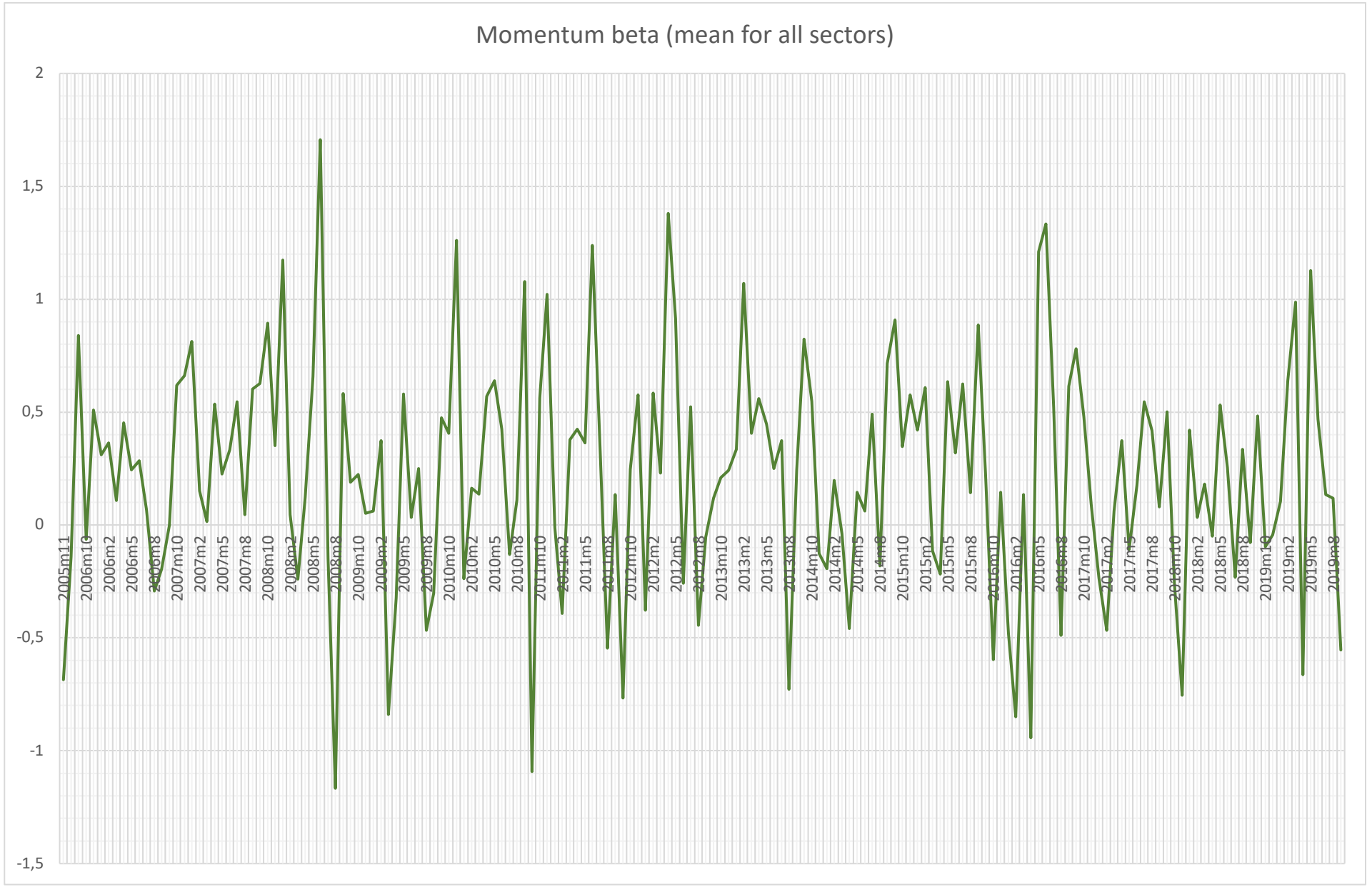
2019m2
2019m5
2019m8


Momentum beta (mean for all sectors)
2
1,5
1
0,5
0
-0,5
-1
-1,5
2005m11
2006m10
2006m2
2006m5
2006m8
2007m10
2007m2
2007m5
2007m8
2008m10
2008m2
2008m5
2008m8
2009m10
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2016m5
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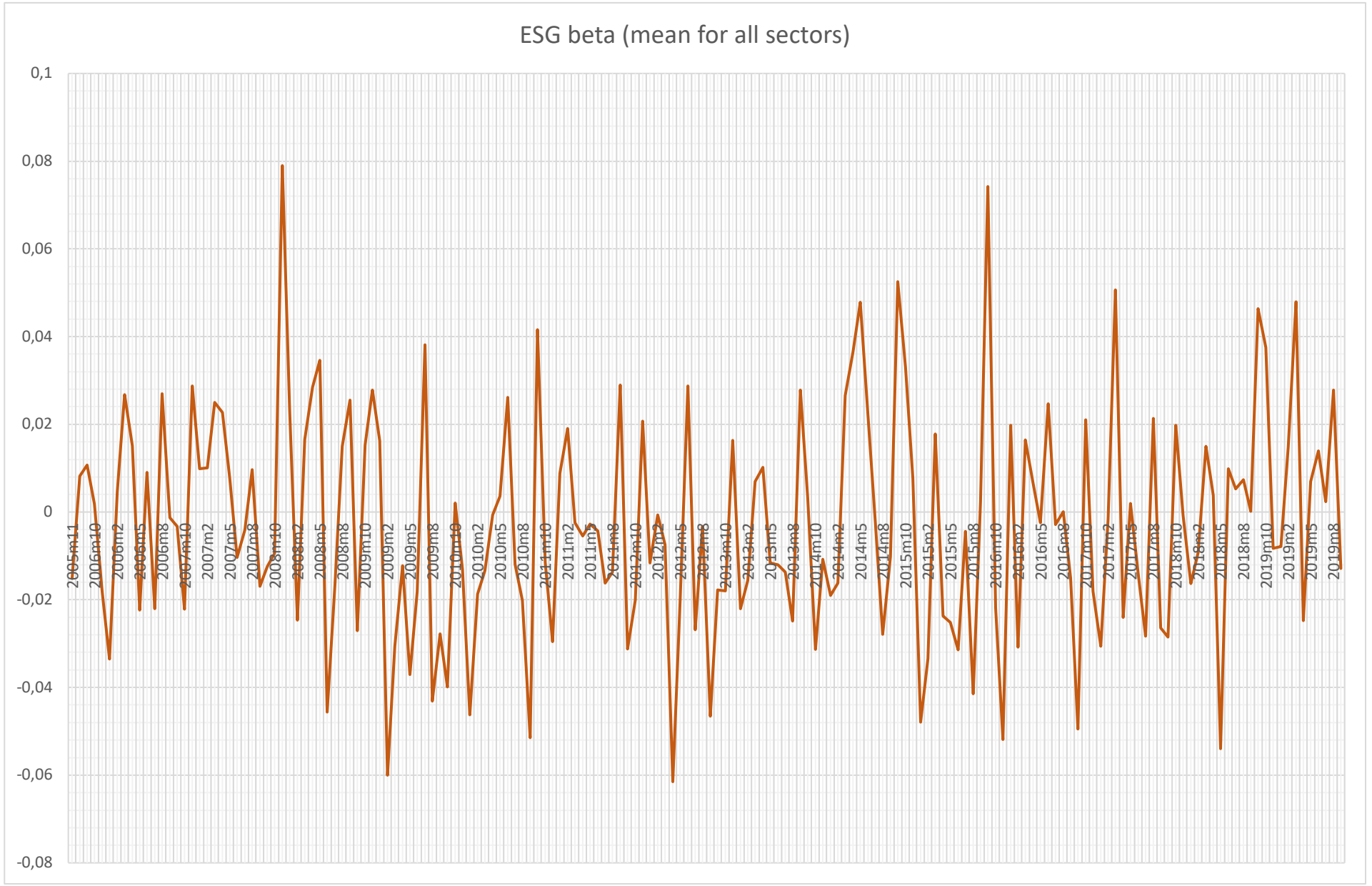
2019m10
2019m2
2019m5
2019m8


ESG beta (mean for all sectors)
0,1
0,08
0,06
0,04
0,02
0
-0,02
-0,04
-0,06
-0,08
2005m11
2006m10
2006m2
2006m5
2006m8
2007m10
2007m2
2007m5
2007m8
2008m10
2008m2
2008m5
2008m8
2009m10
2009m2
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2016m8
2017m10
2017m2
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2018m2
2018m5
2018m8
2019m10
2019m2
2019m5
2019m8

The average values of the coefficients are shown in the summary table below

	(1) ReturnRF	(2) ReturnRF	(3) ReturnRF	(4) ReturnRF	(5) ReturnRF	(6) ReturnRF
Size	-0.00000650*					-0.00000362*
	(0.00000258)					(0.00000169)
MktRF		0.648***				0.12483***
		(0.0599)				(0.0156)
BM			0.0109*			0.0104227**
			(0.00461)			(0.00371)
MoM				0.110*		0.0972*
				(0.0516)		(0.0513)
ESG					-0.00521*	-0.00243*
					(0.00243)	(0.00135)
_cons	1.108**	0.170*	0.972**	0.648*	1.279**	0.80905*
	(0.377)	(0.0706)	(0.361)	(0.311)	(0.387)	(0.388)
N	69640	70134	70119	70134	69857	69362
adj. R^2						0.0460

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In the table above, the first columns show the results obtained by performing linear regressions of the return beta with each characteristic considered individually while the last column shows the coefficients relating to the multilinear regression considering the characteristics taken all simultaneously.

The coefficient obtained represents the risk premium of the considered characteristic. The comparison between the coefficients of the simple regressions and those of the multilinear does not reserve big surprises: the coefficients keep their sign and their degree of significance. In some cases their value also changes slightly, while in others the variations in module are more relevant, such as the ESG which goes from -0.00521 to -0.00243.

Over the entire period analyzed, the variables explained the cross-section of returns in an appreciable way, although market-to reference and book-to-market with a higher level of significance than size, momentum and ESG. Furthermore, as expected, the book-to-market and momentum have had positive effects on the returns of the shares, the magnitudes of each, or the risk premiums.

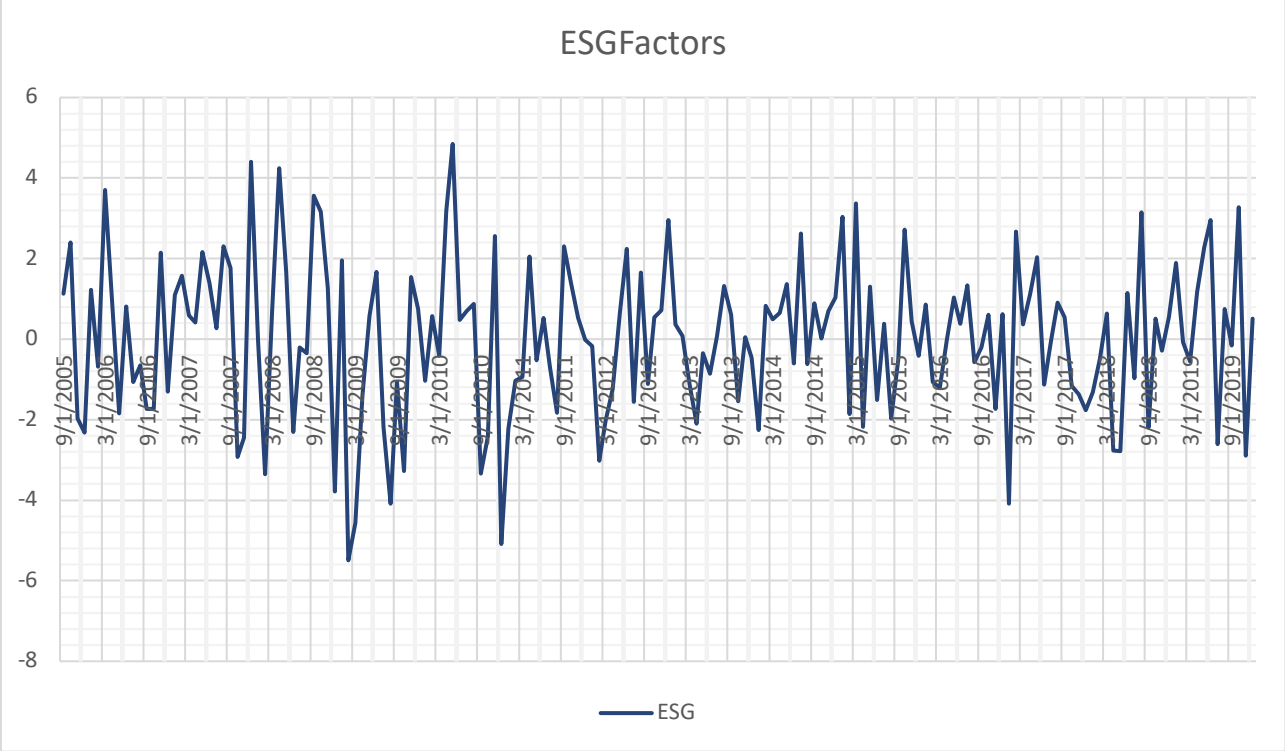
A negative and significant risk premium was obtained for the ESG characteristic, therefore a high ESG score is considered a hedge by investors, which makes the company less risky.

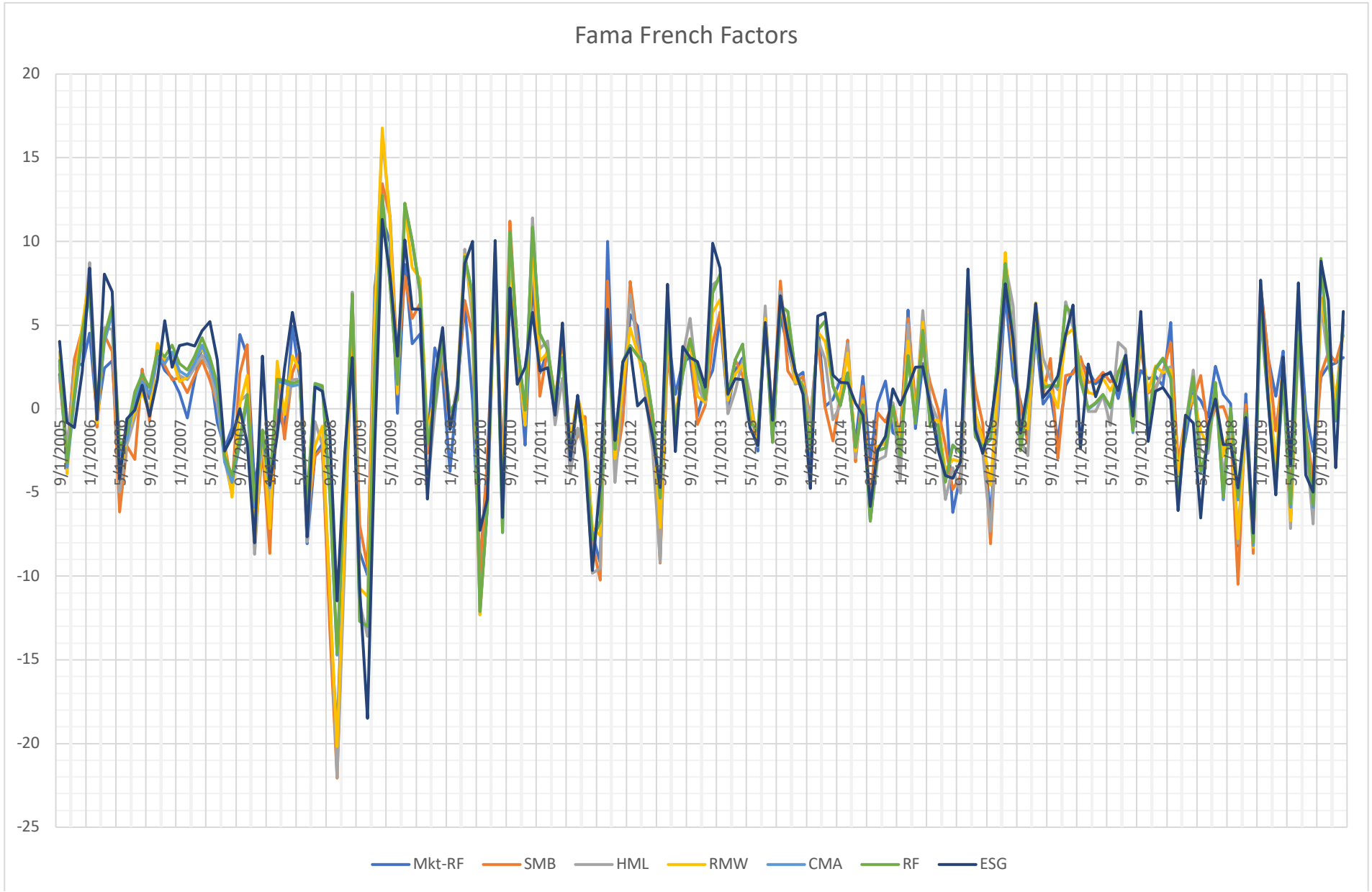
3.1.4 Multilinear regression analysis of the ESG factor

In order to further deepen my research, I have analysed in depth the factor obtained from the ESG scores. This factor, as explained in detail in the second chapter, has been constructed using the long - short technique, thus taking into consideration the most performing companies from a sustainable point of view and those with less performance.

This analysis was made by regressing the ESG factor on the Fama – French factors (also found and explained in detail in the second chapter), in order to identify the presence of a significant alpha and to understand its variability, i.e. whether it is an independent factor or not.

I propose below the graphical results of the ESG factor regressions on the Fama – French factors:




Fama French Factors
20
15
10
5
0
-5
-10
-15
-20
-25
9/1/2005
1/1/2006
5/1/2006
9/1/2006
1/1/2007
5/1/2007
9/1/2007
1/1/2008
5/1/2008
9/1/2008
1/1/2009
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5/1/2017
9/1/2017
1/1/2018
5/1/2018
9/1/2018
1/1/2019
5/1/2019
9/1/2019
Mkt-RF
SMB
HML
RMW
CMA
RF
ESG

Factors	Mean	Standard Deviation
Mkt-RF	0.597790698	4.360056113
SMB	-0.033023256	1.391954515
HML	-0.092616279	1.731027929
RMW	0.305116279	1.050733126
CMA	0.039244186	1.354765494
RF	0.100348837	0.137108408
ESG	0.013703788	1.908451624

The table above shows some statistics of the factors considered.

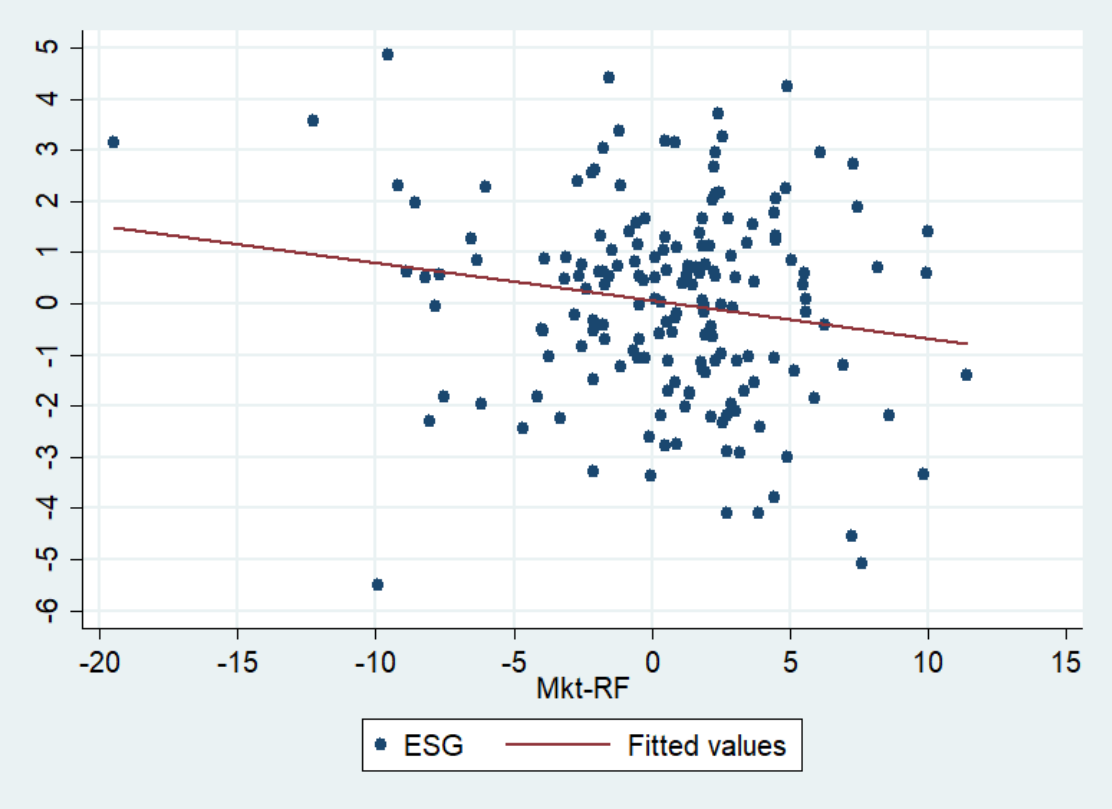
The trend of the ESG factor shows that it is not affected by the financial crisis as shown by other factors and this seems to be in line with the negative premium risk found for the characteristic based on the ESG score in the previous paragraph.

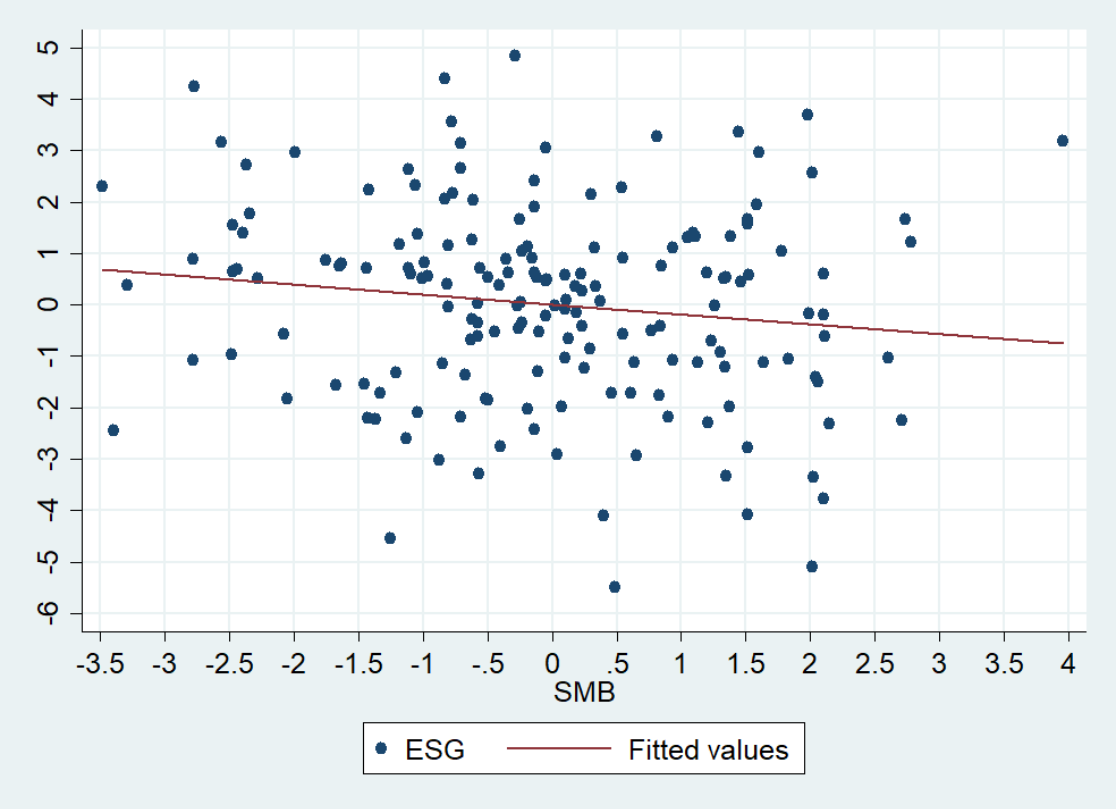
We can examine the relationship of the ESG factor with the other factors by analyzing the correlation matrix between them.

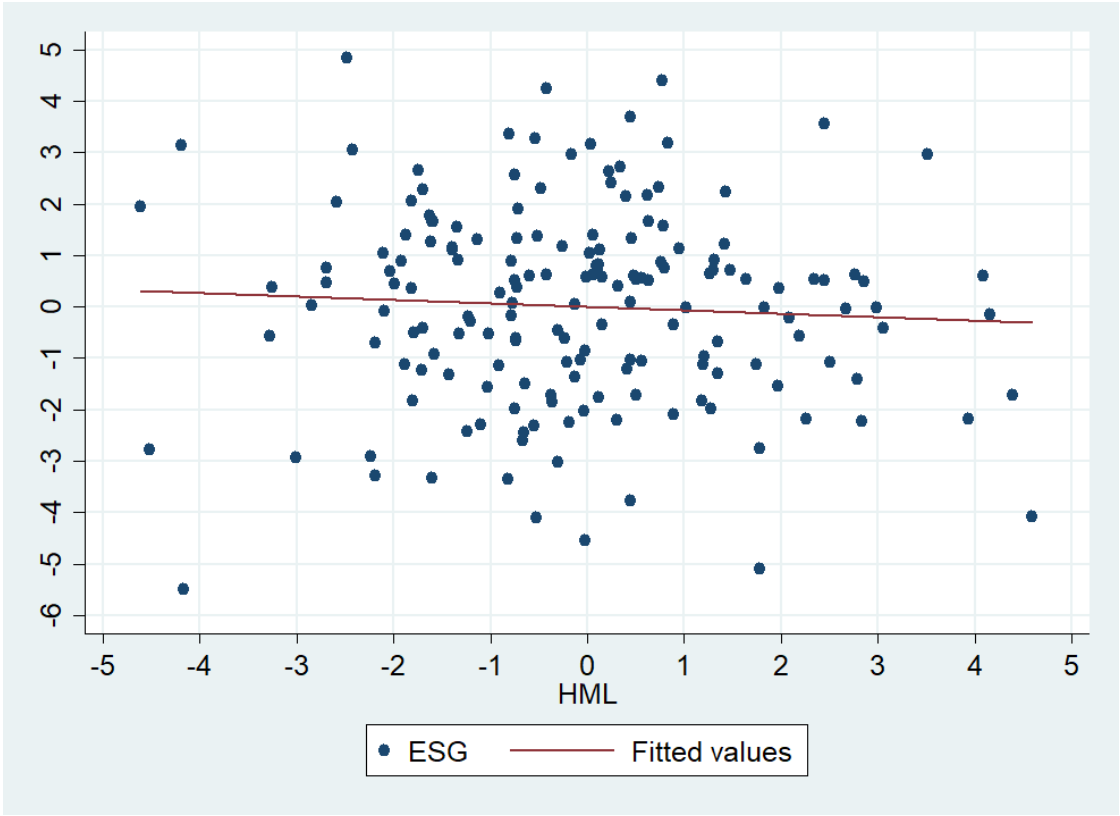
. Correlation Matrix

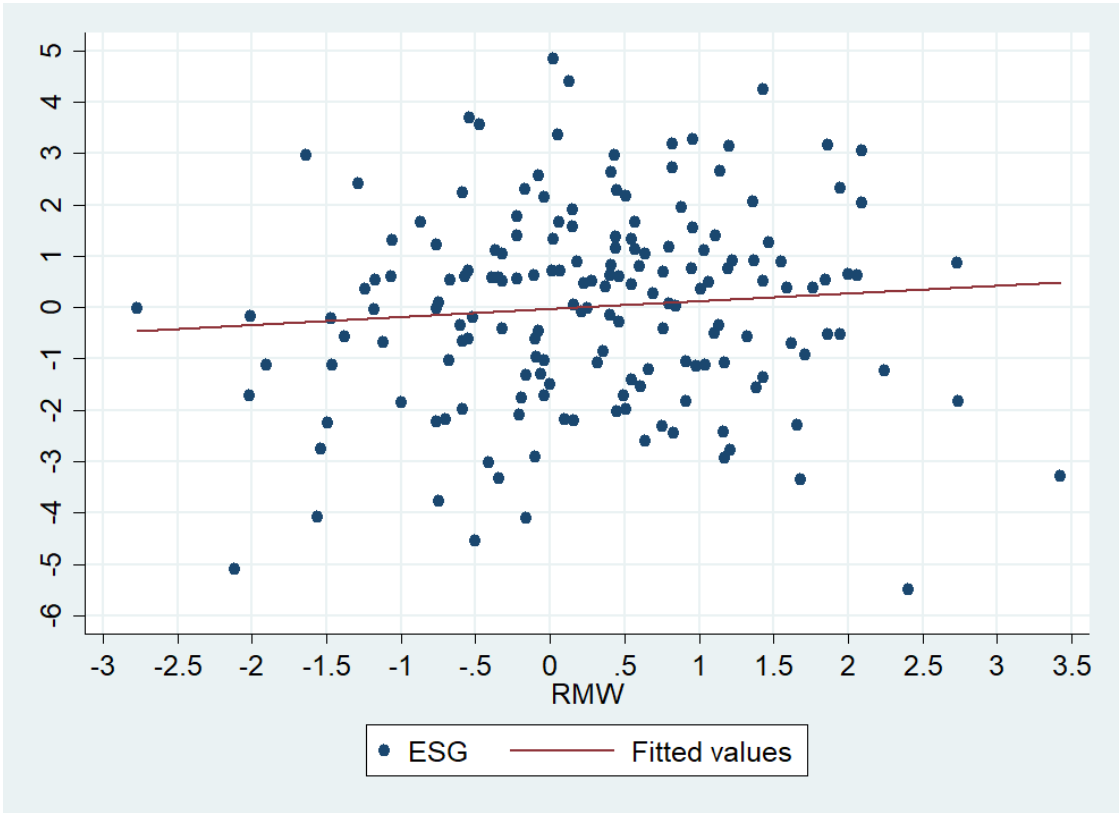
```
             |      CMA      RMW      HML      SMB    MktRF
-------------+---------------------------------------------
         CMA |   1.0000
             |
             |
         RMW |  -0.1663   1.0000
             |   0.0000
             |
         HML |   0.4749  -0.5241   1.0000
             |   0.0000   0.0000
             |
         SMB |  -0.1595  -0.2512   0.0285   1.0000
             |   0.0000   0.0000   0.0000
             |
       MktRF |  -0.4151  -0.3397   0.1568   0.1010   1.0000
             |   0.0000   0.0000   0.0000   0.0000
             |
```

The correlation matrix shows a good correlation of the ESG factor with all the other factors. A proof of this is given by the scatter plots shown in the figures on pages and following.


-6 -5 -4 -3 -2 -1 0 1 2 3 4 5
-20 -15 -10 -5 0 5 10 15
Mkt-RF
ESG
Fitted values


-6 -5 -4 -3 -2 -1 0 1 2 3 4 5
-3.5 -3 -2.5 -2 -1.5 -1 -.5 0 .5 1 1.5 2 2.5 3 3.5 4
SMB
ESG
Fitted values


5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-5
-4
-3
-2
-1
0
1
2
3
4
5
HML
ESG
Fitted values


5
4
3
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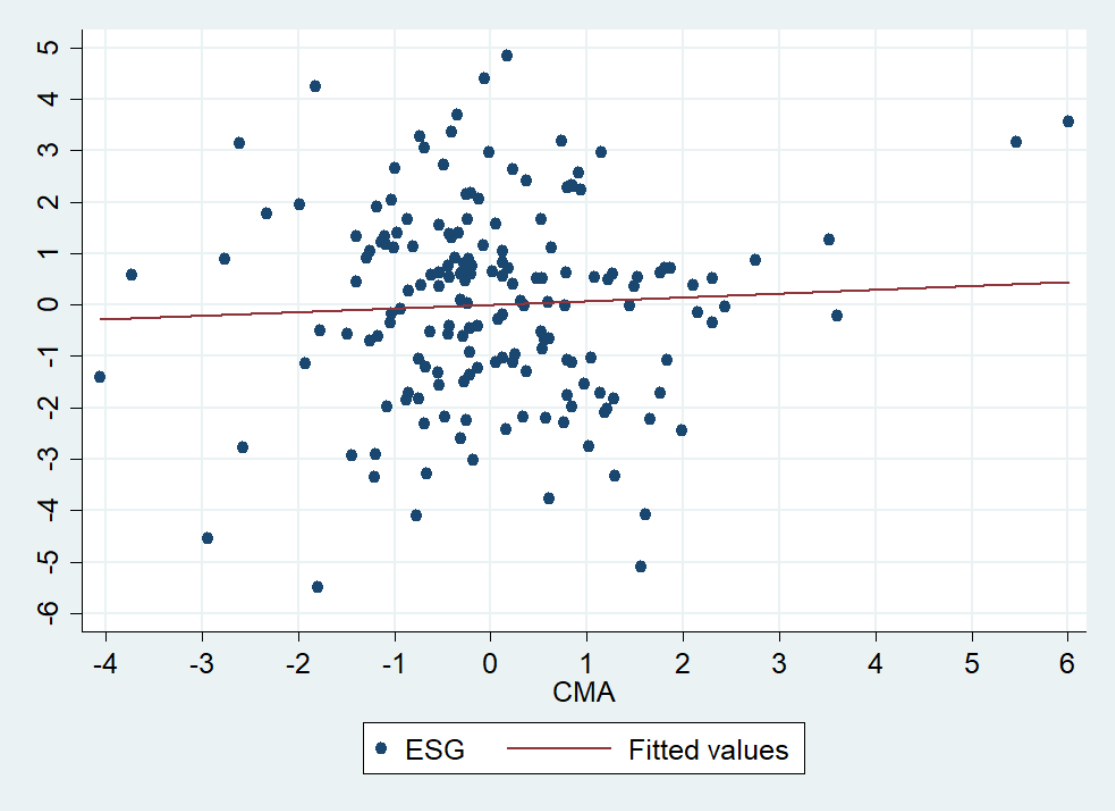
1
0
-1
-2
-3
-4
-5
-6
-3
-2.5
-2
-1.5
-1
-.5
0
.5
1
1.5
2
2.5
3
3.5
RMW
ESG
Fitted values



At this point, we can try to perform a multiple linear regression using the ESG factor as the dependent variable, intended as the return of the long-short portfolio obtained from the sorting with respect to the ESG Score, and as independent variables the factors used in the Fama model -French.

Find the relationship between the ESG factor and the Fama-French factors to see if they are independent or if the factors have any influence in determining the ESG factor, and then explain the variability.

The results obtained from the regression all show a real dependence of the ESG factor on each of the Fama-French factors as the regression coefficients are all highly significant.

Also, as expected, they are all negative, meaning that as they increase ESG decreases and vice versa.

Among all the most influential factor seems to be SMB with a coefficient equal to Beta_SMB =-0.185

It is interesting to note that the fact that the alpha intercept is significant indicates that the ESG factor has a risk premium that survives after trying to explain it with Fama-French factors: in this case alpha value is 0,0654.

	(1)
	ESG
MktRF	-0.0756***
	(0.00246)
SMB	-0.185***
	(0.00632)
HML	-0.0329***
	(0.00497)
RMW	-0.0500***
	(0.00845)
CMA	-0.0455***
	(0.00780)
_cons	0.0654***
	(0.00790)
N	70134
adj. R^2	0.046

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

3.2 Conclusions

As we have repeated many times within this thesis, the ESG is a phenomenon that especially since recent years has become a real trend.

The question at the heart of this paper therefore arises from the possible economic implications that the ESG factor may have for a company. It is therefore investigated whether there is a "market reward" due to a greater commitment to ESG factors. In order to find answers, this document analyses the impact of ESG ratings on the economic and financial performance of European enterprises from September 2015 to December 2019 (for a total of 173 months). In order to have a fairly precise idea of the trend of this phenomenon on the European market, a rather large sample of data was chosen: the STOXX Europe 600 (which was then reduced to 410 companies due to missing data.) With regard to financial data, Thomson Eikon Reuters was chosen as the database, both for its transparency and its simplicity. In this way it was possible to download both the monthly financial returns of the companies in question and the ESG scores, a key variable within this work. To carry out this thesis empirically, a type of regression very common to these types of work has been used: Fama-Macbeth regression. As software, the use of Stata, which is simple and intuitive concerning statistical operations, has been preferred.

As I said earlier in this thesis, what I expected was a positive outcome, in the sense that I expected that a greater commitment to ESG factors would lead companies to higher, or at least more stable, financial outcomes. In fact, this is the result achieved.

What emerges from this analysis is the presence of a negative risk premium for the ESG factor, which means that a greater commitment to ESG elements shows the company to be safer than others. From an investor's perspective, therefore, a company with a high ESG score will be seen as a hedge, therefore less risky and able to offer more stable returns, independent of the economic cycle. This result is in accordance with numerous other researches carried out by industry experts and companies involved in the ESG environment.

If a rational explanation for this phenomenon is sought, it is possible to try to analyse the allocation of financial resources within a company. How easy it is to think, a company cannot orient its business model towards a sustainable model and cannot become an ESG power in a short time. What is needed is a long-term vision and an investment that can make the company "sustainable" in the long term.

So maybe in the short term an economic loss is acceptable from this point of view: resources have been used and the result of this investment will be in the long term. But once the company in question is established in sustainability, it will be able to use its resources in the complete functioning of its business. So, in the end, although it is true that to achieve high standards of sustainability it is necessary to bear costs, it is also true that once the business is oriented towards a sustainable model, the company may be able to save and allocate these resources to the core business and thus improve performance.

So, at the end of this analysis we can conclude that sustainability and commitment to the ESG can be seen as a real value. But why has sustainability become a value? In a world that is becoming aware of climate change and with governments committed to building new regulatory frameworks, sustainability allows us to look at the medium to long term with less risk. Activities with a strong environmental impact, for example, may be penalised by the approval of stricter regulations. Or face sanctions if their standards are not adequate. From this point of view, therefore, they are riskier. Social" sustainability brings advantages in terms of reputation, but also protects employees, customers and shareholders from possible causes. In addition to these elements, there are two relatively recent innovations that will support the growth of sustainable investments. The first is greater availability of data, thanks to technology that can collect and analyse it.

Today it is possible to quantify the environmental and social impacts of an investment. And, as a result, to assess the impact of ESG factors more accurately, just as one does with purely financial factors. The second novelty concerns new consumption and investment habits. In an article in 2017, the Economist called the millennials the "Sri generation". A generation more attentive to environmental and social sustainability both when buying and investing. Millennials today are more than thirty years old, with an increasing share of investments coming from their portfolios. And they want them to be sustainable.

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Summary:

An overview

The objective of this thesis is to understand whether a greater commitment by companies to ESG factors, and therefore to the environment, is a positive driver of their stability and returns.

Over the last few years, investing with a focus on sustainability has become very important and popular. In fact, many investors have decided to invest in sustainability and therefore to opt for a long-term investment over a short-term one. But what gives rise to this attention to sustainability? In the literature it is believed that the beginning of this investors' attitude is attributable to a greater attention to "values - driven investing"[41] in general. Values - driven investing originates from moral principles and basically consists in not investing in industries without morality, such as arms or tobacco companies. Nowadays these kind of investment strategies are known as Socially Responsible Investing (SRI). A person who is interested in sustainable investing, is an investor who wants to promote business practices that he believes will be aimed to encourage human rights, environmentalism, gender equality and buyers safeguarding.

The most popular investing strategy in this field is called “ESG Integration”, that plans to integrate environmental, social and governance ("ESG") criteria into the basic analysis of investments. ESG is an established concept in the financial sector as a basis for judging the sustainability of investments. The integration of ESG criteria can improve the risk/return profile of portfolios.

These three ESG factors are essential to assess the sustainability and related risks of an investment position: [42]

- Environmental means more attention to topics such as CO2 emissions and climate change, population growth, biodiversity and food security.
- Social is referred to companies' concerns for human rights, working conditions, child labour and equality.

[41] Derwall, Koedijk, Ter Horst, “A tale of values – driven and profit – seeking social investors”, August 2011
[42] Credit Suisse, “Dai criteri ESG alla filantropia”

- Governance is a criterion that mostly covers factors such as the quality and diversity of supervisory boards, executive compensation, shareholders' rights and the elimination of corruption.

Nowadays many investors rely on rating agencies in order to obtain a third-party judgment on the performance of a given company's ESG performance. It is important to point out at this stage that there is not a unique method to elaborate an Esg vote.
According to a paper of the Mit Sloan School of Management, the most famous and important agencies providing Esg ratings are 5:[43] KLD, Sustainalytics, Video-Eiris, Asset4, and RobecoSAM.

Literature's review

One of the most widely used methods over the years to assess the impact of ESG criteria on financial returns is the event study. It is an empirical approach used to test the impact of a financial event on the enterprise value. Examples are the papers of Hamilton, Konar & Cohen, Reddy & Gordon and Yan-Leung Cheung. In addition to the event study approach, considering its limitations, another method has been used by many researchers: the Portfolio Analysis approach. Portfolio Analysis is aimed at understanding and estimating the connection between corporate sustainability and economic performance. It is performed creating a series of portfolios and then analyzing their performances or running regressions (which can be cross – sectional or time – series) with other factors of risk. Examples are the papers of Cohen et al. (1997), Schroder, Kempf & Osthoff, Cristiana Manescu and Ziegler. Another widely used method in this field is cross – sectional regression. In this type of regression, parameters are considered to be associated for the same period of time or specific moment. It therefore differentiates from time – series regression, in which the parameters are associated with a series of points in time. An important contribution is made by the work of MacWilliams & Siegel (2000).
There is no common agreement on the number and types of strategies concerning Socially Responsible Investing (SRI). For this reason, State Street Global Advisors has sought a general consensus in the ESG market by studying the language used by

[43] Berg, Koelbel, Rigobon, "Aggregate Confusion: The Divergence of ESG Ratings", MIT Sloan School of Management, 17 May 2020

key players such as asset managers, data providers and professors and has finally identified 5 possible strategies:[44]

- Exclusionary Screening
- Positive Screening
- ESG Integration
- Impact Investing
- Active Ownership

2020 considerations

During this new period characterized by the emergence of Covid-19, many assumptions were reversed, and in particular the one that considered that ESG investing brings a smaller return. In practice, in the first half of 2020, the lowest financial moment for covid-19, the S&P 500 ESG Index was 0.6% higher than the standard S&P 500 Index. This is a phenomenon that has not only affected the United States: the emerging markets ESG leaders Index and the Asia ESG leaders Index exceeded their "normal" indices by 0.5% and almost 4% respectively. According to what BlackRock wrote in its new sustainability report, about 90% of the sustainable indices have done better than their unsustainable "relative" indices since the beginning of 2020.

The data

As measure for financial performance, the stock return is taken into consideration.

The universe of companies considered for the implementation of this analysis is the group of firms included in the STOXX Europe 600. Since the aim of this thesis is to assess the effect of European companies' commitment to ESG factors on returns, it seemed appropriate to have as starting point an index that could contain a high number of companies from several countries. The period chosen for the analysis of the data goes from September 2005 to December 2019 (for a total of 173 months), the last year in which many ESG data are available. Such a wide time horizon has been chosen in order to analyze the effects of ESG changes during the various business periods. The period considered includes the two major financial crises that have also affected

[44] Rakhi Kumar, Natasha Dayaramani, James D. Rocha, “Understanding & Comparing ESG Terminology, a practical framework for identifying the ESG strategy that is right for you”, State Street Global Advisors, 30/09/2019

Europe (2007 and 2011) to see how the effect of ESG parameters varied in times of distress. The variables chosen to represent the performance of the companies are the monthly returns and each data has been downloaded from Thomson Eikon Reuters. The most important and characteristic variable of this empirical work is the ESG dimension. To represent this aspect, the ESG scores have clearly been chosen. Thomson Reuters collects more than 400 ESG variables related to the sustainable performance of companies. From these variables, a group of 178 data points was selected and then grouped into 10 categories. These ten categories are analyzed, and an average is made to form the ESG scores that represent the sustainable performance of the company in point. Regarding the Environmental pillar, the categories analyzed are Resource Use, Emissions and Innovation. Management, Shareholders and CSR Strategy are the categories involved in the Social pillar. While concerning the Governance score, the categories analyzed are Workforce, Human Rights, Community and Product Responsibility. The scores are available as Combined ESG Score, but also in the form of a single pillar score, called Environmental score, Social score and Governance score.

The factors

A fundamental step for the implementation of the method used in this thesis is the identification of the so-called "factors". To explain the construction of the factors used in this thesis, the description of the factors used in the factor model of Fama and French and its extensions could be useful.

The first factor to be explained is the Small – Minus – Big factor. It incorporates the so called “size effect”, with size intended to be the market capitalization. In few words we can say that this factor states that small firms perform better than large firms in the long run. So, we can think about this factor as the excess return that small market capitalization firms gain versus the large ones in the long run.

We can define the Small – Minus – Big factor as a difference between “Rs” and “Rb” portfolios:

$$SMB = R_S - R_B$$

Where “Rs” and “Rb” respectively represent the average performance of portfolios built on small securities and the average performance of portfolios built on large securities.

$$R_s = {}^1\!/_3\,(R_{SL} + R_{SM} + R_{SH})$$

$$R_B = {}^1\!/_3\,(R_{BL} + R_{BM} + R_{BH})$$

The second factor to be explained is the High – Minus – Low factor. As described before, there is a difference between “value” stocks and “growth” stocks: the firsts come from companies with high book to market ratio, while the others come from companies with low book to market ratio. The fundamental character of this factor lies in the fact that the so-called value stocks perform better than growth stocks.
The High – Minus – Low factor can therefore be constructed as the difference between the "Rh" and "Rl" portfolios:

$$HML = R_H - R_L$$

Where “Rh” and “Rl” respectively represent the average returns of the two groups of securities with high book to market ratio (SH and BH) and the average of the two groups of securities with low book to market ratio (SL and BL).

$$R_H = {}^1\!/_2\,(R_{SH} + R_{BH})$$

$$R_L = {}^1\!/_2\,(R_{SL} + R_{BL})$$

In addition to the list of factors considered so far, it is important to give the description of another factor used in our analysis, the so-called Robust – Minus – Weak factor. The method of calculating the RMW factor is similar to the HML factor, apart from the fact that the breakpoints are based not on Price – to – Book ratio but on Operating Profitability Margin. The larger the operating profit margin, the stronger is the company. Operating Profit Margin is the operating profit divided by total revenues, and is a percentage also known as EBIT Margin. The portfolio that represents this factor is built by taking an average of the returns on the two robust portfolios (the ones

with higher Operating Profit Margin) and subtracting the average of the two weak portfolios (the ones with lower Operating Profit Margin).

$$RMW = ½ (Small\ High + Big\ High) – ½ (Small\ Low + Big\ Low)$$

Another important factor used in this analysis is the Conservative - Minus - Aggressive portfolio. In this case the variable taken into consideration is the investment compared to the previous year, i.e. the annual increase in total assets. So, smaller this increase, more Conservative the company we will assume it is. If, on the other hand, the increase is substantial, we will talk about Aggressive companies. This factor is the average return on the two conservative investment portfolios minus the average return on the two aggressive investment portfolios:

$$CMA = ½ (Small\ Conservative + Big\ Conservative) – ½ (Small\ Aggressive + Big\ Aggressive)$$

By looking at the ESG scores downloaded by Thomson Eikon Reuters, we can immediately classify the securities and see how they are distributed. Companies with higher ESG scores (precisely ninetieth percentile) have been recognized as "Leaders", while companies with lower ESG scores (precisely tenth percentile) have been identified as "Laggards". At this point the factor is constructed by subtracting the "Laggards" from the "Leaders":

$$ESG = LeadersESG – LaggardsESG$$

The software and its use

The Stata software was chosen for the development of this empirical model. It is a statistical software that allows the management and analysis of data and the creation of graphs. Stata is a widely used software for the implementation of regressions like Fama - Macbeth, and in this paragraph, we see how.

First of all, I created a panel in which the observations contained indications regarding both the CUSIP (identification code) of the various stocks (STOXX600, purged of the securities with missing value) and the date (data on a monthly basis from September 2005 to December 2019). The panel thus obtained was analysed with Rolling Windows

regressions of the excesses of the returns of the stocks with respect to the ReferenceToMarket, for each stock, thus obtaining the Beta Markets for each date.

For the time intervals used in Rolling Windows I used windows equal to 10 months. In addition to the BetaMarket, I made sure that STATA also provided us with data related to the Beta of the constant, R2, R2-adjusted, SE in order to examine significance and make further analysis.

Once I obtained the BetaMarkets, we added them to the data obtained for BM, Size and Momentum, as well as, of course, the ESG scores and used all these parameters as independent variables to regress, for each date, the values of returns. I have, therefore, obtained the regression coefficients that I then reported in an Excel file and, using the Pivot table, I filtered them so that I could then mediate them and report them as average.

The Fama – Macbeth regression and the results

The Model Equation is:

$$R_{j,t+1} = \gamma_0^{t+1} + \gamma_1^{t+1} Size_{j,t} + \gamma_2^{t+1} BookToMarket_{j,t} + \gamma_3^{t+1} Momentum_{j,t} + \gamma_4^{t+1} \hat{\beta}_{j,t} + \gamma_5^{t+1} ESG_{j,t} + \theta_{j,t+1} \quad (3.1)$$

It was estimated using Fama-MacBeth month-by-month cross-sectional regressions, with the ESG score variable computed as described before.

The average values of the coefficients are shown in the summary table below

	(1) ReturnRF	(2) ReturnRF	(3) ReturnRF	(4) ReturnRF	(5) ReturnRF	(6) ReturnRF
Size	-0.00000650*					-0.00000362*
	(0.00000258)					(0.00000169)
MktRF		0.648***				0.12483***
		(0.0599)				(0.0156)
BM			0.0109*			0.0104227**
			(0.00461)			(0.00371)
MoM				0.110*		0.0972*
				(0.0516)		(0.0513)
ESG					-0.00521*	-0.00243*
					(0.00243)	(0.00135)
_cons	1.108**	0.170*	0.972**	0.648*	1.279**	0.80905*
	(0.377)	(0.0706)	(0.361)	(0.311)	(0.387)	(0.388)
N	69640	70134	70119	70134	69857	69362
adj. R^2						0.0460

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In the table above, the first columns show the results obtained by performing linear regressions of the return beta with each characteristic considered individually while the last column shows the coefficients relating to the multilinear regression considering the characteristics taken all simultaneously.

The coefficient obtained represents the risk premium of the considered characteristic. The comparison between the coefficients of the simple regressions and those of the multilinear does not reserve big surprises: the coefficients keep their sign and their degree of significance. In some cases, their value also changes slightly, while in others the variations in module are more relevant, such as the ESG which goes from -0.00521 to -0.00243.

Over the entire period analyzed, the variables explained the cross-section of returns in an appreciable way, although market-to reference and book-to-market with a higher level of significance than size, momentum and ESG. Furthermore, as expected, the book-to-market and momentum have had positive effects on the returns of the shares, the magnitudes of each, or the risk premiums.

A negative and significant risk premium was obtained for the ESG characteristic, therefore a high ESG score is considered a hedge by investors, which makes the company less risky.

Multilinear regression of the ESG factor on the Fama – French factors

In order to further deepen my research, I have analysed in depth the factor obtained from the ESG scores. This analysis was made by regressing the ESG factor on the Fama – French factors, in order to identify the presence of a significant alpha and to understand its variability, i.e. whether it is an independent factor or not.

Factors	Mean	Standard Deviation
Mkt-RF	0.597790698	4.360056113
SMB	-0.033023256	1.391954515
HML	-0.092616279	1.731027929
RMW	0.305116279	1.050733126
CMA	0.039244186	1.354765494
RF	0.100348837	0.137108408
ESG	0.013703788	1.908451624

The table above shows some statistics of the factors considered.

The trend of the ESG factor shows that it is not affected by the financial crisis as shown by other factors and this seems to be in line with the negative premium risk found for the characteristic based on the ESG score in the previous paragraph.

The results obtained from the regression all show a real dependence of the ESG factor on each of the Fama-French factors as the regression coefficients are all highly significant.

Also, as expected, they are all negative, meaning that as they increase ESG decreases and vice versa.

Among all the most influential factor seems to be SMB with a coefficient equal to Beta_SMB =-0.185

It is interesting to note that the fact that the alpha intercept is significant indicates that the ESG factor has a risk premium that survives after trying to explain it with Fama-French factors: in this case alpha value is 0,0654.

Conclusions

What I expected was a positive outcome, in the sense that I expected that a greater commitment to ESG factors would lead companies to higher, or at least more stable, financial outcomes. In fact, this is the result achieved.

What emerges from this analysis is the presence of a negative risk premium for the ESG factor, which means that a greater commitment to ESG elements shows the company to be safer than others. From an investor's perspective, therefore, a company with a high ESG score will be seen as a hedge, therefore less risky and able to offer more stable returns, independent of the economic cycle. This result is in accordance with numerous other researches carried out by industry experts and companies involved in the ESG environment.

If a rational explanation for this phenomenon is sought, it is possible to try to analyse the allocation of financial resources within a company. How easy it is to think, a company cannot orient its business model towards a sustainable model and cannot become an ESG power in a short time. What is needed is a long-term vision and an investment that can make the company "sustainable" in the long term.

So maybe in the short term an economic loss is acceptable from this point of view: resources have been used and the result of this investment will be in the long term. But

once the company in question is established in sustainability, it will be able to use its resources in the complete functioning of its business. So, in the end, although it is true that to achieve high standards of sustainability it is necessary to bear costs, it is also true that once the business is oriented towards a sustainable model, the company may be able to save and allocate these resources to the core business and thus improve performance.

So, at the end of this analysis we can conclude that sustainability and commitment to the ESG can be seen as a real value. But why has sustainability become a value? In a world that is becoming aware of climate change and with governments committed to building new regulatory frameworks, sustainability allows us to look at the medium to long term with less risk. Activities with a strong environmental impact, for example, may be penalised by the approval of stricter regulations. Or face sanctions if their standards are not adequate. From this point of view, therefore, they are riskier. Social" sustainability brings advantages in terms of reputation, but also protects employees, customers and shareholders from possible causes. In addition to these elements, there are two relatively recent innovations that will support the growth of sustainable investments. The first is greater availability of data, thanks to technology that can collect and analyse it.

Today it is possible to quantify the environmental and social impacts of an investment. And, as a result, to assess the impact of ESG factors more accurately, just as one does with purely financial factors. The second novelty concerns new consumption and investment habits. In an article in 2017, the Economist called the millennials the "Sri generation". A generation more attentive to environmental and social sustainability both when buying and investing. Millennials today are more than thirty years old, with an increasing share of investments coming from their portfolios. And they want them to be sustainable.