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**Sustainable finance and ESG scores:
A portfolio analysis à la Fama and French**

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Dedico questo traguardo alla mia famiglia: a mamma e papà per il loro supporto costante e per esserci sempre stati anche nei momenti di sconforto, a mia sorella, fedele compagna di studi e di vita e ai miei nonni, per essere da sempre i miei sostenitori numero uno.

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Introduction

The environmental events and financial crises which have affected the last decades have led to a new interpretation of development, which should be sustainable and long-term oriented through economic, social, and environmental equilibrium. Sustainable finance, also referred to as “Sustainable and Responsible Investing” (SRI), is a way to contribute to sustainable development, by encouraging public and private investors to allocate their capital to firms committed to having a good impact on the environment and society and to enhancing their corporate governance. Contrary to common thought, sustainable finance has distant roots in time: already between the 18th and 19th century, many began not to invest in tobacco, liquor or gun industries. Sustainable and responsible investments significantly spread between 2012 and 2018, when SRI assets more than doubled. Furthermore, recent surveys reveal that most investors plan to increase their investments in sustainable assets by 2025, also because of the COVID-19 pandemic that made them more aware of environmental and social risks. Faced with the growing demand for SRI investments, many companies have started to adopt Corporate Social Responsibility (CSR) strategies in their operations, or in other words, they go beyond profits and care about the environment and human resources. In addition, companies are becoming more and more sustainable also to meet the commitment made with the Paris Agreement (2015) to reduce greenhouse gas emissions; in this way, they avoid sanctions and do not damage their reputation, which could cause them huge financial losses. As a consequence, various existing and new rating agencies are engaged in evaluating firms not only from the financial point of view, but they assign them rankings based on their environmental and social impact and on the level of their corporate governance, which are better known as Environmental, Social and Governance (ESG) scores. Based on these scores, individual and institutional investors diversify their portfolios, for example, by investing in stocks with high ESG rankings. This is why many asset managers are now offering sustainable funds and indices, which are used as benchmarks for assessing the performance of ESG funds.

The integration of environmental, social and governance factors into investment analysis is the prevailing strategy to sustainable and responsible investing and is the central object of this master thesis. In fact, the aim of the thesis is to build portfolios based on ESG scores and compare the performances of low-rated and high-rated portfolios, by applying

multi-factor models developed by the economists Eugene Fama and Kenneth French. In order to investigate potential abnormal excess returns and differences in the exposure to risk factors, a long-short strategy has been adopted; specifically, a long position is held in high-ranked portfolios and a short position is held in low-ranked portfolios.

In particular, the work is organized into three chapters. In the first chapter, the origins of sustainable and responsible investing are exhibited, with a particular attention to the link between climate change and finance, highlighted by the Paris Agreement. The chapter also analyses the supply side of sustainable finance, starting from the study of the concept of corporate social responsibility and continues with the definition of SRI and the analysis of the evolution of sustainable assets. In this first chapter, the different sustainable and responsible investing strategies are described, as well as the other financial instruments for funding activities with positive environmental or social effects.

The second chapter focuses on the integration of ESG factors into financial analysis, outlining how the ESG financial ecosystem works and the actors involved in it. The chapter also explains the metrics used for evaluating the environmental and social performance of companies and their level of corporate governance, with a reference to the standards and guidelines that can be adopted by firms in order to disclose sustainability reports. Then, three of the most known providers of ESG funds are discussed: BlackRock, PIMCO and JUST Capital; ESG ratings used by agencies for monitoring and assessing the results of companies in the sustainable field are illustrated too, with a particular focus on the ratings methodology used to construct MSCI and S&P ESG indices. The chapter ends with the explanation of the phenomenon of greenwashing, which refers to companies falsely claiming to be sustainable.

The third and final chapter aims to investigate the performance of portfolios of stocks with the lowest E, S, G and total ESG scores and of stocks with the highest scores, with the use of Fama and French multi-factor models. Firstly, the data regarding the ESG rankings and Fama-French risk factors used for the analysis are illustrated, with a particular reference to the Refinitiv ESG scores methodology. Secondly, the chapter examines the methodology used for building low-rated and high-rated portfolios and for evaluating their performance and risk profile. Finally, the empirical results are interpreted and discussed, stressing how the adoption of the Paris Agreement and the recent global COVID-19 pandemic have affected the construction and risk-return profile of ESG portfolios.

Chapter I Overview on sustainable finance

1.1 Origins and evolution of sustainable finance

1.1.1 First steps in sustainable finance

Before defining the concept of sustainable finance, it is opportune to trace its history and the expansion of Sustainable and Responsible Investing (SRI). SRI has its roots in the Religious Society of Friends, commonly known as the Quakers, a religious movement of the mid-1700s settled in North America which condemned slavery and the trade of humans. Later, one of the founders of Methodism, John Wesley, composed a renowned sermon “The use of money”, arguing that it was wrong to gain profits to the detriment of the own and other’s health. He specified not to invest in toxic chemical industries or illegal activities. For a hundred years, sinful companies, such as those operating in tobacco, liquor or gun industries, have been ignored by investors; in those years sustainable and responsible investing was mainly religious driven¹.

During the Prohibition era, from 1919 to 1933, the production and sale of alcoholic beverages was forbidden in the United States, leading to an increased divestment from companies producing alcohol. In this period, the first responsible investment fund was born, the so-called “Pioneer Fund”. This ethically oriented fund was founded in 1928 in Boston by a young journalist, Philip L. Carrett, who decided to exclude stocks related to tobacco, alcohol and gambling sectors (Viscovi and Di Turi, 2017).

However, a big leap in sustainable investing occurred in the 1960s and 1970s, when many pacifist movements condemned all those corporations involved in the war in Vietnam and protested against the apartheid system of racial segregation in South Africa. In the United States, most of the investment funds financed businesses related to the war: in response to this, in 1971 the first modern ethical fund, the “Pax World Fund” was created by two Methodists, Luther Tyson and Jack Corbett, who did not want to invest in firms subsidizing the Vietnam war (Viscovi and Di Turi, 2017). Particularly engaged in the struggle against apartheid was Reverend Doctor Leon Sullivan, who wrote in 1977 a set of accepted rules for morally working in South Africa:

¹ See in this regard LIVINGSTON, A., *What Is Socially Responsible Investing (SRI) – Types & How to Get Started*, MoneyCrashers.com.

1. *«Non-segregation of the races in all eating, comfort, and work facilities»*
2. *«Equal and fair employment practices»*
3. *«Equal pay for all employees doing equal or comparable work»*
4. *«Initiation of and development of training programs for all»*
5. *«Increasing the number of blacks and other non-whites in management and supervisory positions»*
6. *«Improving the quality of life for blacks and other non-whites outside the work environment in such areas as housing, transportation, school, recreation, and health facilities»*
7. *«Working to eliminate laws and customs that impede social, economic, and political justice»*

After the publication of these principles, many companies operating in South Africa, including the largest employer, General Motors, in which Sullivan was a member of the board, decided to exit the country. The divestment from companies in South Africa reached a peak in the 1980s and partly contributed to the end of apartheid (Hill, 2020).

1.1.2 From sustainable development to SRI

After the 1980 the environmental issue emerged, due in part to the environmental disasters which characterized those years: for example, in 1986 the Chernobyl nuclear power plant exploded and in 1989 there was the Exxon Valdez oil spill in Alaska. In response to the environmental concerns, the United Nations (UN) set up the World Commission on Environment and Development (WCED), better known as Brundtland Commission, which published the “Our Common Future” Report in 1987, defining the concept of sustainable development. The Brundtland Report stated: *«sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs»* (World Commission on Environment and Development, 1987). According to this definition, sustainability can be reached only if there is an equilibrium of these three aspects: economic, social and environmental. Economic sustainability refers to producing and consuming without exhausting natural resources; social sustainability concerns the forbiddance of human rights violations, underpayment and child labour; environmental sustainability implies the use of renewable energy, reuse of materials, and land restoration in order to reduce

the risks of climate change, deforestation, extinction of species, water and air pollution and many others. In this context, finance can be used as a means to promote sustainable development, by allocating funding to companies operating in a sustainable manner; it is no longer just a way to maximize profit (Schoemaker and Schramade, 2019).

In this regard, in 1989 investors, corporate executives and activists formed the Coalition of Environmentally Responsible Economies (Ceres) to raise awareness about the impact of companies on the environment and society and to handle the global challenges such as climate change, pollution, waste of natural resources and unfair working conditions (Coalition of Environmentally Responsible Economies).

As Viscovi and Di Turi (2017) highlight, in 1990 the first conference on sustainable and responsible finance took place in the US, originally named “SRI in the Rockies”, with the objective of allocating capital in a more sustainable way. Between the 1980s and 2000s there was the launch of many ethical funds like the Nouvelle Strategies Fund in France (1983), the Friends Provident Stewardship Fund in the UK (1984) and the “Sanpaolo Azionario Internazionale Etico” in Italy (1997). In 1999 the first global SRI stock index, the Dow Jones Sustainability Index (DJSI), was launched, followed by the Sri Ftse4Good stock index introduced by the London Stock Exchange.

In the 2000s sustainable and responsible investing kept growing, supported by several international institutions: in 2005, the then United Nations Secretary-General, Kofi Annan, called for the largest investors in the world and asked them to elaborate some principles for investing their capital in a sustainable and responsible way. The result was the six United Nations Principles for Responsible Investments (UN PRI), which were officially launched at the New York stock exchange in 2006. To date, more than 1,500 investors have joined the initiative and voluntarily work hard to follow these principles.

Table 1. United Nations Principles for Responsible Investments

1	We will incorporate ESG issues into investment analysis and decision-making processes
2	We will be active owners and incorporate ESG issues into our ownership policies and practices
3	We will seek appropriate disclosure on ESG issues by the entities in which we invest
4	We will promote acceptance and implementation of the Principles within the investment industry
5	We will work together to enhance our effectiveness in implementing the Principles
6	We will each report on our activities and progress towards implementing the Principles

Source: PRI Association (2020).

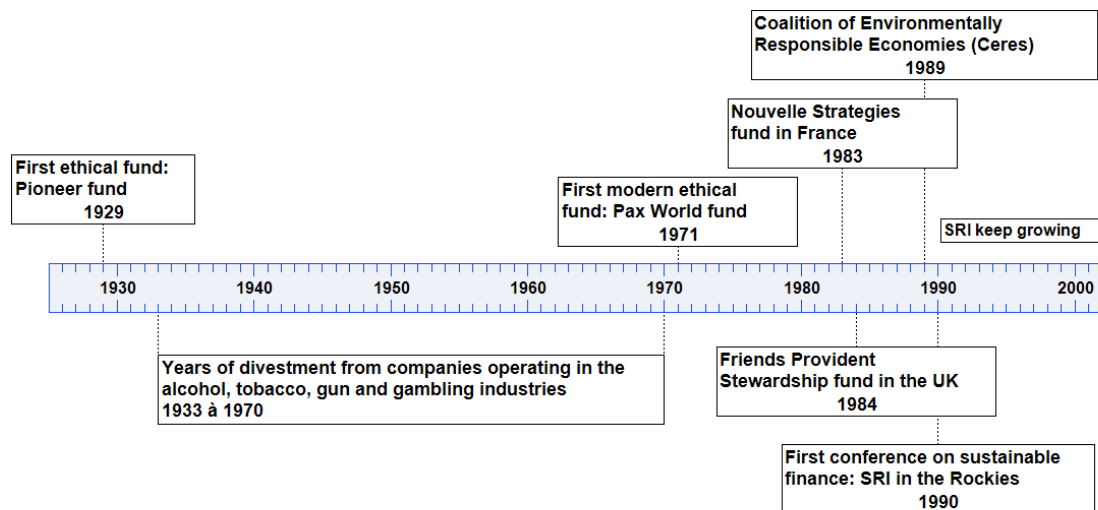
The UN guided the shift towards a sustainable finance also through the development of the 2030 Agenda for Sustainable Development in 2015, which lists 17 Sustainable Development Goals (SDGs):

- *«Goal 1: No poverty»*
- *«Goal 2: Zero hunger»*
- *«Goal 3: Good health and well-being»*
- *«Goal 4: Quality education»*
- *«Goal 5: Gender equality»*
- *«Goal 6: Clean water and sanitation»*
- *«Goal 7: Affordable and clean energy»*
- *«Goal 8: Decent work and economic growth»*
- *«Goal 9: Industry, innovation, and infrastructure»*
- *«Goal 10: Reduced inequality»*
- *«Goal 11: Sustainable cities and communities»*
- *«Goal 12: Responsible consumption and production»*
- *«Goal 13: Climate action»*
- *«Goal 14: Life below water»*
- *«Goal 15: Life on land»*
- *«Goal 16: Peace, justice and strong institutions»*
- *«Goal 17: Partnerships to achieve the goal»*

These goals offer a guidance for moving the society towards a long-term flourishing economy; they offer a universal vision for human progress and environmental defence. (Hill, 2020).

In order to link finance with the need of present and future generations of creating a more sustainable society, the European Commission has released an Action Plan for financing sustainable growth, with the objective of (a) allocating capital to sustainable and responsible investments, (b) of controlling the financial risk which derives from the environmental and social issues, and (c) of promoting the long-term orientation of investments (European Commission, 2018).

Figure 1. Timeline of the most significant events in SRI evolution



Source: Elaboration of the data of Viscovi and Di Turi (2017).

1.2 Climate change and finance

In December of 2015 the Paris Agreement was adopted at the Paris Conference on climate with the objective of contrasting climate change and global warming, in particular, raising awareness about the risks related to the negative impacts of climate change and reinforcing the capacity of societies to address the adverse effects of climate change (European Commission). Around €180 billion a year of extra investments are required to

realize the goals set by the Paris Agreement: for this reason, it is necessary to direct more private capital towards sustainable investment. Drastic changes in the climate and the repercussions on the environment influence the economy and investments too. Finance and climate change are therefore closely linked: natural phenomena such as floods and droughts lead to the increase of prices, with consequences on inflation and interest rates, and cause huge economic losses; in fact, global economic losses due to extreme weather events grew by 86% between 2007 and 2016, and amounted to €110 billion in 2017 (European Commission, 2018). It is clear that climate change entails significant risks for companies and institutions and, consequently, for investors²:

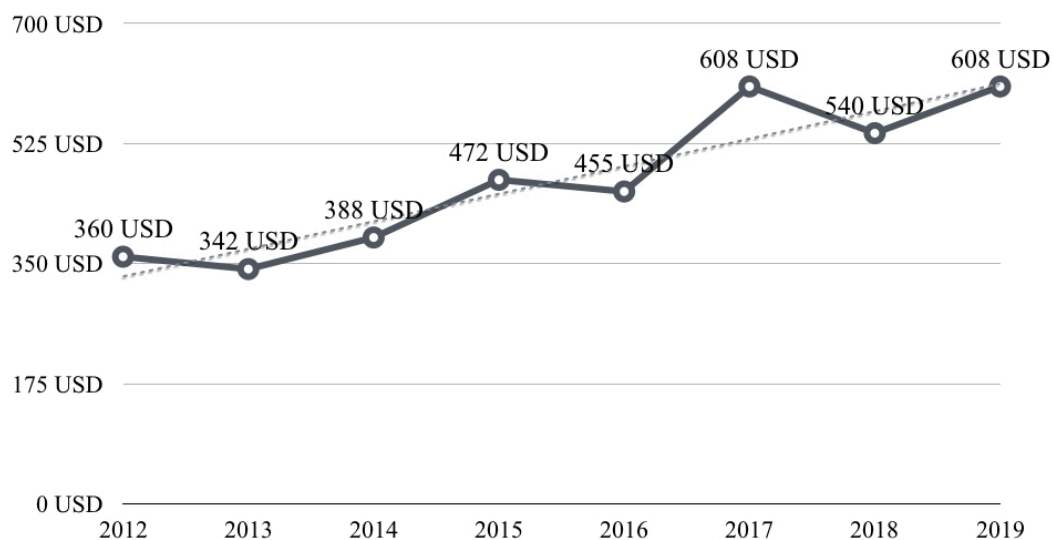
- Global warming, rise of sea levels, melting of glaciers, floods and droughts are detrimental for the companies because they cause damages to facilities, agricultural lands and raw materials. As a consequence, firms may suffer huge economic losses, and shareholders and investors may obtain lower financial returns.
- There are many firms that still do not respect the limits on carbon emissions to achieve the goal of reducing global warming to below 2°C set by the Paris Agreement. These firms may incur large legal costs and can suffer sharp reductions in their value, leading to major financial implications for investors.
- Companies that do not pay much attention to environmental issues damage their reputation. For instance, the oil company British Petroleum destroyed its reputation after the environmental disaster caused in the Gulf of Mexico in 2010; another example is the "Dieselgate" scandal, after which Volkswagen suffered huge losses and harmed its notoriety and respectability.

It is therefore clear that if companies do not become more sensitive to environmental issues, they are likely to suffer significant economic losses because they will have to pay for legal sanctions and stock prices could fall sharply as a result of environmental disasters. Hence, public and private investments should be aligned with the climate goals established by the Paris Agreement, and to this end, The Climate Policy Initiative (2020) estimated \$608-622 billion climate finance flows, with an increase of approximately 6%-8% compared to the average of \$574 billion recorded in 2017/2018. In any case, much

² See in this regard ITALIAN SUSTAINABLE INVESTMENT FORUM (2016), *Finanza sostenibile e cambiamento climatico*.

more investments in climate finance are required to achieve Paris goals: the Climate Policy Initiative (2020) predicted that more than \$1.6-3.8 trillion in new climate investments will be necessary to maintain global warming below 1.5°C by 2050. Unfortunately, the health emergency and the consequent economic crisis caused by the global COVID-19 pandemic will make the achievements of these targets even more difficult.

Graph 1. Climate finance flows in billions of US dollars (2012-2019)



Source: Climate Policy Initiative (2020).

1.3 Corporate social responsibility and sustainable finance

The increase in demand for sustainable and responsible investments and the spread of sustainable financial instruments (such as ethical funds), which have especially affected the 20th century, have also set in motion the supply side and, in particular, companies that have modified their business strategies and financing methods. In front of the growing interest in sustainability, it is increasingly clear the role of businesses as the main driver of sustainable development. As a result, a company should be able to combine economic and financial objectives with the environmental and social ones. However, this is totally different from the Friedman's view on the responsibilities of corporations. The

American economist Friedman (1970) stated that *«the social responsibility of business is to increase its profits»*: corporate executives' main task is to earn as much as possible, complying with the rules and customs of the society; he also added that governments, not firms, should deal with environmental and social issues. The idea that a firm should only maximize the shareholder value has been replaced by the "stakeholder theory" proposed by Freeman in 1984, according to which a firm should create value for all its stakeholders; generally, the stakeholders are suppliers, customers, employees, investors and many others (Freeman and Dmytriyev, 2017). This theory has emerged as a prevailing pattern in "Corporate Social Responsibility" (CSR). The European Commission (2001) defines CSR as *«a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis»*, and adds that *«being socially responsible means not only fulfilling legal expectations, but also going beyond compliance and investing 'more' into human capital, the environment and the relations with stakeholders»*. A company with a sense of social responsibility should internalize the externalities generated and be responsible to shareholders and wider stakeholders.

Sustainable and responsible investors are more interested in firms conducting socially responsible practices and focus on assessing their creditworthiness and risk of default in portfolio management decisions; a firm can achieve real financial benefits if it is incorporated in an ethical stock market index, because these indices are used as benchmarks by investors looking for a good financial performance. The capability of socially responsible companies to well manage social and environmental problems can be a reliable indicator of the quality of corporate administration and control, and thus these firms are more likely to be profitable (European Commission, 2001).

According to Renneboog et al. (2008), business management based on the stakeholder model does not only create value for stakeholders, but also for shareholders. In the short run, investing in companies adopting CSR strategies may generate a low financial performance, but in the long-term, it could lead to larger returns. Companies making investments in projects that create a significant shareholder value, and at the same time, have a positive impact on those having an interest in the company's operations (i.e., stakeholders), may have the chance to obtain higher share prices; as a consequence, companies investing in CSR may be more attractive from a financial perspective.

Nevertheless, it is essential to highlight that there is a casual relationship between CSR and the Net Present Value (NPV): as a matter of fact, in the short-term, a non-socially

responsible company obtain a positive NPV, but in the long run, it may worsen shareholder value because of the potential loss of reputation or expenses for legal proceedings (e.g., litigation costs), that may arise due to the fact that the firm produces negative spill-over effects such as waste of resources or pollution. At the same time, a company investing in CSR may be associated with low financial performance in the short run, because it loses profits to become socially responsible and because of the intense market competition; however, in the long-term, it may achieve a positive NPV by securing itself against the risk of losing good reputation and against legal costs.

Moreover, it is interesting to note that SRI investors have more limited investment opportunities than non-SRI investors, because sustainable and responsible investors screen out companies which do not integrate social and environmental issues in their business. This could result in less portfolio diversification, making the investment underperform (Renneboog et al., 2008). However, Viscovi and Di Turi (2017) conclude that integrating environmental and social factors in asset allocation do not reduce financial performance, help predict and mitigate the risks related to non-financial elements (i.e., environmental risks), and make sustainable investments less volatile over time.

Table 2 shows the investment decision of SRI and conventional funds, underlining that both investing in CSR companies and investing in non-CSR companies can generate positive and negative shareholder value.

Table 2. Summary of the investment decision of SRI and conventional funds

Companies	Positive NPV	Negative NPV
Positive CSR	both SRI and conventional funds invest	only SRI funds with positive screens invest
Negative CSR	only conventional funds invest	neither conventional nor SRI funds invest

Source: Renneboog (2008).

1.4 Definition of sustainable and responsible investing

Finance is commonly seen as an economic discipline that is disconnected from the society and the environment in which it is rooted. However, as described in the previous Paragraph 1.1, over the last few decades finance has been responding to many environmental and social concerns, and a new concept called “sustainable finance” has born, which generally refers to as “Sustainable and Responsible Investing” (SRI). Since sustainable finance lacks a unique commonly accepted definition, the European Sustainable Investment Forum (Eurosif), the European association for the promotion and advancement of sustainable and responsible investment, has coined the following definition in 2016:

«Sustainable and responsible investment (“SRI”) is a long term oriented investment approach which integrates ESG factors in the research, analysis and selection process of securities within an investment portfolio. It combines fundamental analysis and engagement with an evaluation of ESG factors in order to better capture long term returns for investors, and to benefit society by influencing the behaviour of companies» (European Sustainable Investment Forum, 2018).

This definition seems to represent a comprehensive notion at the European level: according to the European Commission, sustainable finance takes Environmental, Social and Governance (ESG) factors into consideration and has a relevant role in the deployment of the capital required for achieving sustainable, and particularly climate, goals.

The Italian Sustainable Investment Forum, member of the Eurosif, shares the definition of SRI mentioned above and agrees on the need of a shared language on sustainable finance. For this reason, it adds the following three essential characteristics to the concept of sustainable and responsible investing³:

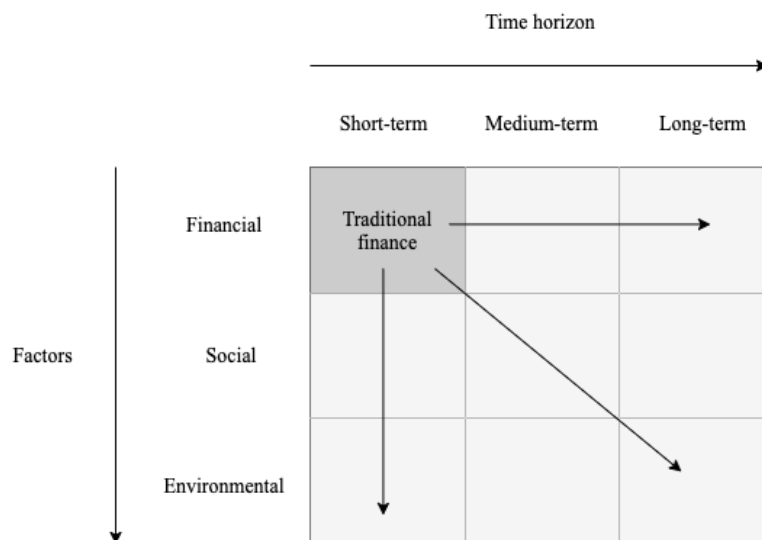
- *«Generation of returns for investors»*
- *«Mid-to-long term time horizon»*
- *«Integration of ESG criteria in asset management»*

As a result, finance pursues profit, but at the same time, cares about the environment, society and corporate governance; finance is no longer just oriented to the creation of

³ See in this regard ITALIAN SUSTAINABLE INVESTMENT FORUM (2019), *The European Union and sustainable finance: impacts and outlook for the Italian market*.

shareholder value within a short-term horizon, but it aims at maximizing value for a wider community within a longer time period. In this way, both shareholders and stakeholders benefit from sustainable finance.

Figure 2. Time horizon and factors in sustainable finance



Source: Schoenmaker and Schramade (2019).

Concerning what has just been stated, Schoenmaker (2017) argues that the economic and financial players should focus on long-term value creation, rather than aspiring to make short-term profits. In this way, finance does not just look at the best risk-reward combinations, but positively influences the three pillars of sustainable development (i.e., economic, social and environmental sustainability). The author identifies four stages of sustainable finance, which show the shifting from a short-termism to a long-termism, and from a shareholder to a stakeholder model:

- Stage 1: *Finance as usual*. This stage refers to the conventional finance, which aims at the portfolio optimization in order to create the greatest shareholder value. What matters is the financial pay off, while the environmental and social issues are not considered at all (Schoenmaker, 2017).
- Stage 2: *Sustainable finance 1.0*. In this stage the objective of finance is still profit maximization, but with a special attention on the environmental and social factors. For this reason, sustainable finance consists in divesting from “sin” stocks or

companies whose products are harmful for the human health (e.g., tobacco, alcohol, gun, gambling firms). However, sinful companies also include those that finance wars or have a negative impact on the environment or society (Schoenmaker, 2017). There were three big “waves” of divestment in the history of SRI: the first was the divestment from American organizations engaged in the armed conflict in Vietnam and companies taking advantage of the regime of the apartheid in South Africa (1960s-1970s); the second “wave” of divestment hit companies dealing with Sudan due to the genocide in the Darfur region; the third “wave” affected firms operating in the fossil energy sector because they were deemed to be responsible for climate change and global warming (Viscovi and Di Turi, 2017).

- Stage 3: *Sustainable finance 2.0*. In this stage, Schoenmaker (2017) argues that finance deals with the internalization of negative externalities related to the environment and society. Investors assign monetary values to these externalities and include them in the calculation of the cost of investment. This approach helps mitigate the risks related, for example, with the bad reputation of the company and creates a value not only for shareholders, but also for stakeholders (e.g., environment, society, suppliers, customers, employees, and so on).
- Stage 4: *Sustainable finance 3.0*. In this last stage, SRI investors decide to invest in sustainable projects, which address environmental, social and governance issues. This is a positive selection of sustainable companies, not a negative screening like in “sustainable finance 1.0”⁴. In this case the firm value is defined in monetary Key Performance Indicators (KPIs), while non-financial KPIs are used to express social and environmental qualities (Schoenmaker and Schramade, 2019).

⁴ A particular reference should also be made to the article ONUNAIWU, E. (2018), *Sustainable finance: from bottom line to triple bottom line*, Medium, 03/04/2018.

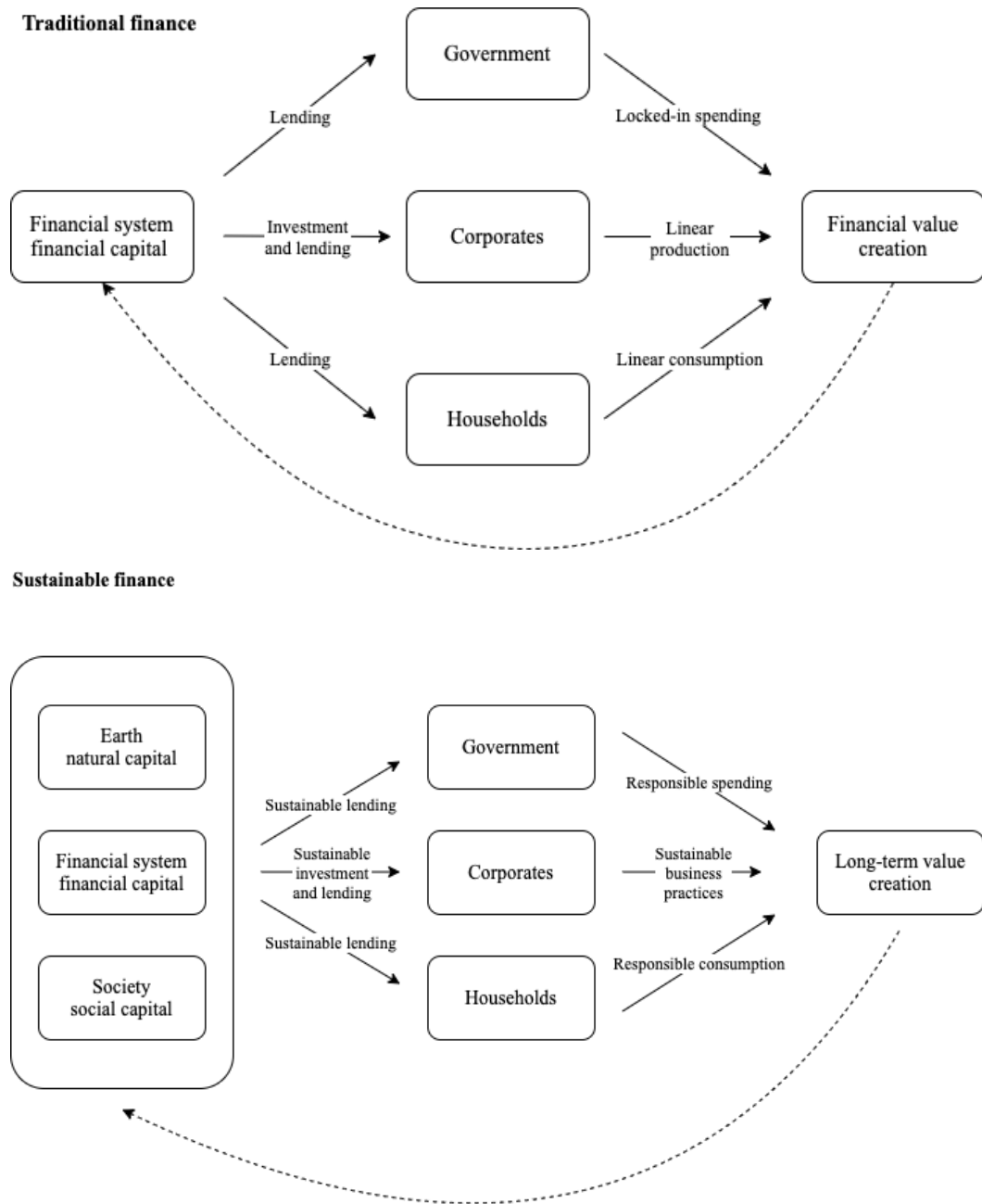
Table 3. Four stages of sustainable finance

Sustainable finance typology	Value created	Ranking of factors	Optimisation	Horizon
Finance-as-usual	Shareholder value	F	Max F	Short term
Sustainable Finance 1.0	Refined shareholder value	$F > S$ and E	Max F subject to S and E	Short term
Sustainable Finance 2.0	Stakeholder value	$T = F + S + E$	Optimise T	Medium term
Sustainable Finance 3.0	Common good value	S and E > F	Optimise S and E subject to F	Long term

Source: Schoenmaker (2017). Note: F= financial value; S= social impact; E= environmental impact; T= total value.

It is easy to understand that the critical difference between traditional and sustainable finance is that the first one generates a “lock-in” or “path dependency” because the players are incapable of altering the path and only enhances the established system, whereas the second one creates a shared, sustainable and responsible regime. In traditional finance, the main goal is the maximization of the firm value and all the actors (i.e., households, government and corporations) are only interested in satisfying their own interests. The financial institutions allocate capital in projects with the best risk-return trade-off. In the conventional system, banks and investment or pension funds lend money to governments and privates and invest in companies, whose production and consumption models are linear: resources are transformed into products, which are consumed and then thrown away. In contrast, sustainable finance aims at long-term value creation, and shifts its attention from financial value to integrated value, which integrates financial, environmental and social value. This new integrated value-based financial system provides funds to governments, firms and households which work towards a more sustainable, circular economy (Schoenmaker and Schramade, 2019; Loorbach et al., 2020).

Figure 3. Value creation from traditional to sustainable finance



Source: Schoenmaker and Schramade (2019).

1.5 Global state of sustainable and responsible investments

In recent years, sustainable and responsible investments have spread significantly across the globe: as the studies of the Global Sustainable Investment Alliance (GSIA) reveal,

from 2012 to 2018 the total sustainable investing assets at the global level have more than doubled. In 2012 SRI assets were \$13.3 trillion, while in 2018 they were \$30.7 trillion. A substantial growth by about 61% is observable between 2012 and 2014, then in the period 2014-2016 the increase in SRI assets has slowed down (+25%), and from 2016 to 2018 sustainable investments have increased by about 34%.

Table 4. Growth of SRI assets by region in billions of US dollars (2016–2018)

	2016	2018
Europe	\$ 12,040	\$ 14,075
United States	\$ 8,723	\$ 11,995
Japan	\$ 474	\$ 2,180
Canada	\$ 1,086	\$ 1,699
Australia/New Zealand	\$ 516	\$ 734
Total	\$ 22,838	\$ 30,683

Source: Global Sustainable Investment Alliance (2019).

The country that has experienced the largest growth between 2016 and 2018 is Japan, whose sustainable investing assets increased by about 307%. But between 2014 and 2016 Japanese SRI assets expanded dramatically by about 6692%. On the contrary, in Europe the SRI assets raised less in the two-year period 2016-2018 (11%). In the other countries, sustainable investing assets keep growing, but at a slower rate compared to 2014-2016 (Global Sustainable Investment Alliance, 2019).

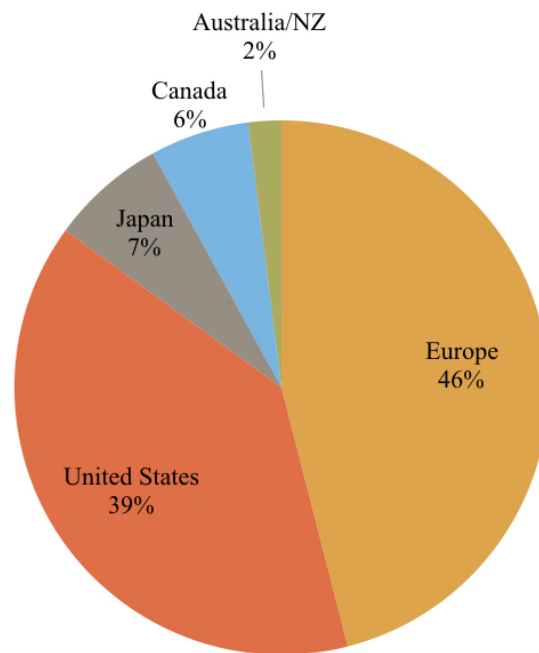
Table 5. Growth of SRI assets by region in billions of local currencies (2014–2018)

	2014	2016	2018	Growth 2014-2016	Growth 2016-2018	Compound Annual Growth Rate (CAGR) 2014-2018
Europe	€ 9,885	€ 11,045	€ 12,306	12%	11%	6%
United States	\$ 6,572	\$ 8,723	\$ 11,995	33%	38%	16%
Canada (in CAD)	\$ 1,011	\$ 1,505	\$ 2,132	49%	42%	21%
Australia/New Zealand (in AUD)	\$ 203	\$ 707	\$ 1,033	248%	46%	50%
Japan	¥ 840	¥57,056	¥231,952	6692%	307%	308%

Source: Global Sustainable Investment Alliance (2019). Note: All 2018 assets are as of 31/12/17, while Japanese assets are as of 31/03/18.

The GSIA (2019) reports that, in most places, the relative amount of SRI assets in total Assets Under Management (AUM) has increased, and in Canada and Australia/New Zealand the majority of total managed assets is composed of sustainable investing assets, respectively 50.6% and 63.2% in 2018. Differently, in Europe the percentage of SRI assets relative to total assets has decreased between 2014 and 2018, from 58.8% to 48.8%, probably due to the fact that the norms on ESG criteria have become more restrictive. Despite this, the largest proportion of sustainable investing assets is still managed by Europe (46% of total SRI assets).

Graph 2. Proportion of global sustainable investing assets by region in % (2018)



Source: Global Sustainable Investment Alliance (2019).

The American investment management corporation BlackRock (2020) states that, between January and September 2020, ESG funds received \$203 billion as a consequence of the fact that the global COVID-19 pandemic has made investors more aware of the instant and short-term impact that environmental or social issues can have and that they have to react as promptly as possible. According to the BlackRock survey, most investors

who already have sustainable and responsible assets will not change their investment approach, while 20% of respondents declared that they will increase their ESG investments, and only 3% said that their sustainable investing decisions will be postponed.

BlackRock (2020) also asked its interviewees the proportion of assets under management they think they will invest responsibly and sustainably by 2025: at the global level, most of respondents answered that by 2025 their SRI assets may double. In 2020, half of American respondents have sustainable investing assets in their portfolios, but in 2025 it is expected that three-quarter of them will invest money in SRI assets; in Asia-Pacific countries, one in three of the interviewees have not yet invested in sustainability but will only become one in ten by 2025. In Europe, Middle East and Africa, 25% of respondents think that three-quarter of their portfolios will be made up of sustainable and responsible investments by 2025.

Before introducing the different sustainable investing strategies, it is appropriate to analyze the asset classes available for sustainable and responsible investments: in 2018 in Europe, the US, Japan and Canada, 51% of the assets were allocated in public equity, 36% in fixed income, 3% in real estate/property, 3% in private equity/venture capital and 7% in other classes such as hedge funds, cash or depository vehicles, commodities and infrastructures (Global Sustainable Investment Alliance, 2019).

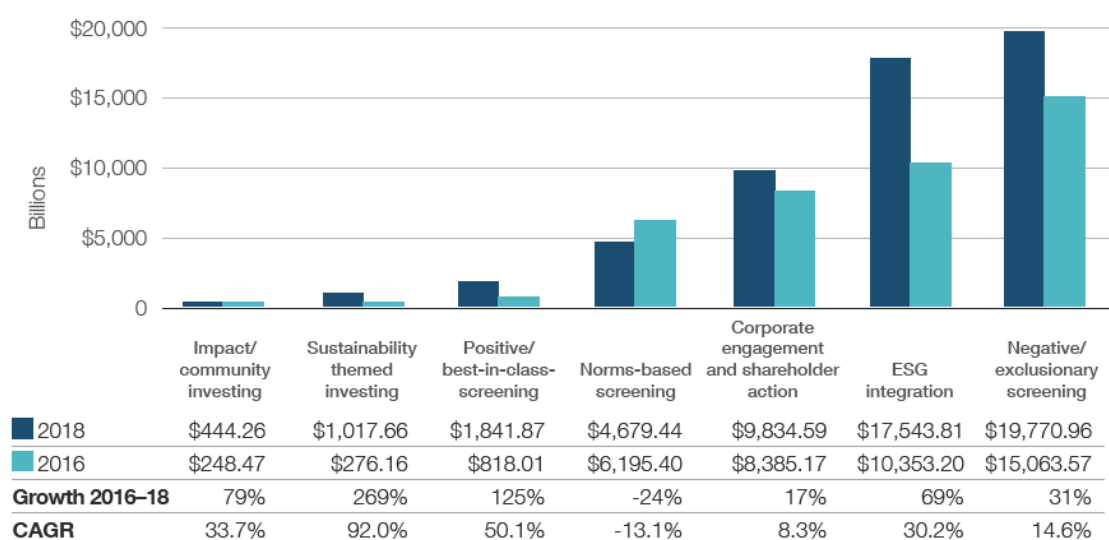
1.6 Sustainable and responsible investing strategies

As stated by the Eurosif (2018), in managing their assets, investment managers can utilize seven different strategies, which integrate sustainable and responsible aspects or ESG standards:

- Sustainability themed investment
- Best-in-Class investment selection
- Norms-based screening
- Exclusion of holdings from investment universe
- Engagement and voting on sustainability matters
- Impact investment
- Integration of ESG factors in financial analysis

As shown in Graph 3, all the SRI strategies have increased exponentially from 2016 to 2018. Even though the asset values of impact investing, sustainability themed investing and Best-in-Class investing are lower than the other investing categories, these three strategies have had a remarkable growth over the period from 2016 to 2018. The norms-based screening is the only strategy that suffered a decline of about 13.1%, probably due to the fact that SRI investors are getting more difficult and are requesting more and more.

Graph 3. Global growth of sustainable investing strategies in US dollars (2016-2018)



Source: Global Sustainable Investment Alliance (2019).

The four stages of sustainable finance described in Paragraph 1.3 can be integrated with different financial instruments: in sustainable finance 1.0, investors adopt the exclusion strategy by avoiding investments in “sin” companies; in sustainable finance 2.0, asset managers begin integrating ESG factors in their investment decisions; in sustainable finance 3.0, impact investing is the favorite strategy.

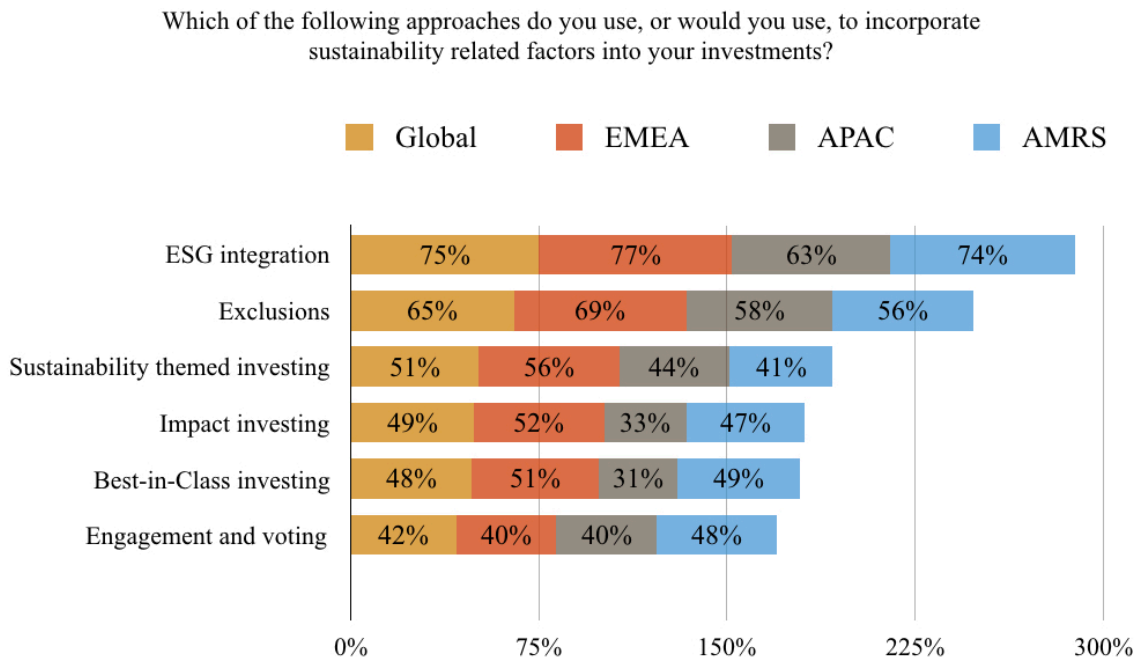
Table 6. Integration of the stages of sustainable finance with SRI strategies

SF typology	Equity	Bonds	Banking	Insurance
SF 1.0	Exclusion			
SF 2.0	ESG integration			
SF 3.0	Impact investing	Green & Social impact bonds	Impact lending; Microfinance	Microinsurance

Source: Schoenmaker and Schramade (2019). Note: SF= sustainable finance.

An interesting survey on the SRI strategies has been carried out by the American investment management corporation BlackRock, between July and September 2020: the interviewees, who have sustainable investment activities in progress or planned, have been asked which investing strategy they adopt or would adopt to incorporate sustainable development in their investments. At the global level, the majority of respondents use or would use the ESG integration strategy, while engagement and voting is the least preferred strategy (see Graph 4).

Graph 4. Comparison of SRI strategies in % (2020)



Source: BlackRock (2020). Note: base size= 395 respondents; norms-based screening strategy is not considered.

1.6.1 Sustainability themed investment

This strategy consists in selecting investment areas that are connected with sustainable development, such as climate change, renewable energy, energy efficiency, sustainable transport, buildings sector, land use/forestry/agriculture, water management, waste management. Following the environmental disasters that are affecting today's society, the main themes are climate change and water: people feel threatened by global warming and scarcity of natural resources and are taking action to reduce the negative impacts of these threats (European Sustainable Investment Forum, 2018).

1.6.2 Best-in-Class investment selection

With this strategy, companies that perform best in a given sector are selected with reference to the ESG factors. Investors choose businesses with the most attractive ESG

scores. It can be applied to any type of sector, even the most controversial ones. *Best-in-universe* and *Best-effort* are other strategies falling within this category (European Sustainable Investment Forum, 2018).

1.6.3 Norms-based screening

This strategy involves the selection of those companies that adhere to internationally accepted conventions and standards concerning environmental protection, human rights, labor and anti-corruption. Generally, international institutions determine the norms on ESG: the most frequently used are the UN Global Compact, International Labor Organization (ILO) Conventions and the OECD Guidelines for Multinational Enterprises (European Sustainable Investment Forum, 2018).

1.6.4 Exclusion of holdings from investment universe

As described in Paragraph 1.1, this strategy of excluding certain companies or sectors from the portfolio or fund dates back to the mid-1700s, when religious movements began divesting from firms which did not follow ethical principles (i.e., firms operating in alcohol, tobacco, gambling, weapons industries). This strategy consists in the negative selection of companies according to particular criteria, which today are weapons, pornography, tobacco, nuclear energy, Genetically Modified Organisms (GMOs), animal testing (European Sustainable Investment Forum, 2018).

1.6.5 Engagement and voting on sustainability matters

Through this strategy, shareholders try to make companies aware of sustainability and social responsibility issues. This can be done by directly dialoguing with the corporate management or through the exercise of the voting rights, submitting any motions in the shareholders' meetings if the dialogue does not take place or does not lead to the expected results (Viscovi and Di Turi, 2017).

1.6.6 Impact investment

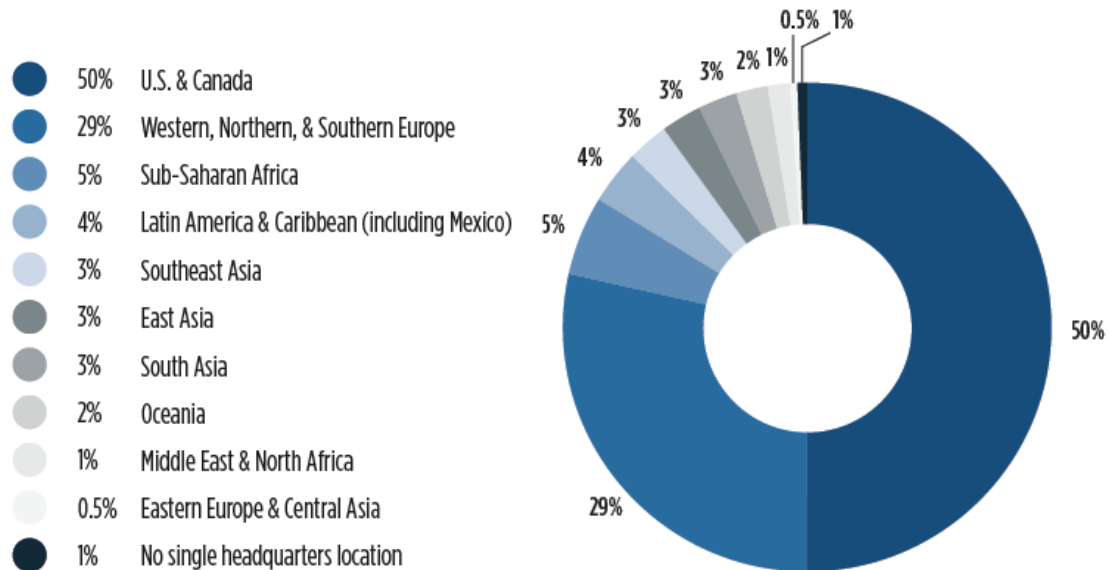
The Global Impact Investing Network (GIIN) defines this strategy as «*investment made with the intention to generate positive, measurable social and environmental impact alongside a financial return*». The four main elements of impact investing are:

- *Intentionality*: there is a real intent to have a positive impact on the society and the environment.
- *Financial return*: there are positive social and environmental effects together with financial rewards.
- *Range of asset classes*: investors can adopt impact investing among different asset classes.
- *Impact measurement*: the social and environmental impact is quantified.

This type of investment can be done by a variety of investors, private or public, with the objective of finding solutions to social and environmental problems. Those include investments in microfinance, social housing, renewable energies, communities (CFA Society Italy, 2018).

Investments based on this strategy have dramatically expanded in recent years: the GIIN (2020) estimates a strong growth of the assets under management of 42.4% in the last year, from \$502 billion to \$715 billion. As can be noted in Graph 5, half investors are situated in the US and Canada (50%) and 29% of investors are located in Europe (excluded Eastern Europe).

Graph 5. Organizations' headquarters location in impact investing market in % of respondents (end of 2019)



Source: Global Impact Investing Network (2020). Note: base size= 1419 organizations; excluded organizations for which headquarters location was unknown.

1.6.7 Integration of ESG factors in financial analysis

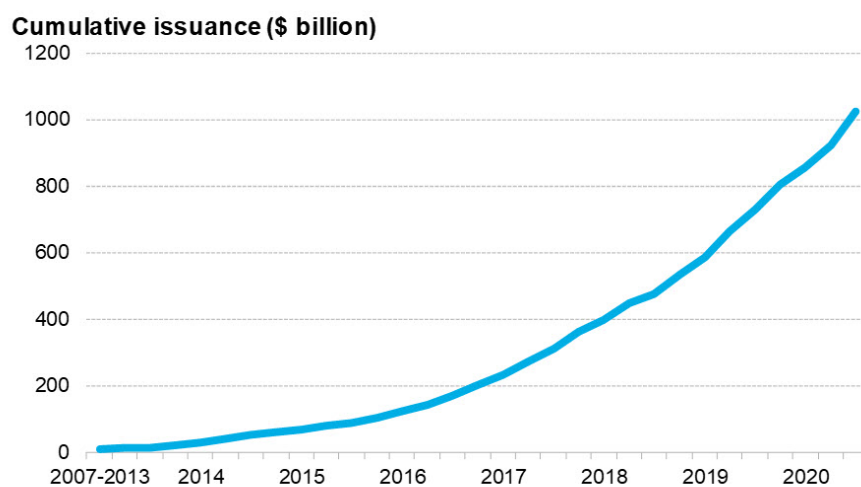
This strategy involves the systematic and explicit inclusion of ESG factors by fund managers in the financial analysis of investments. This strategy is gaining increasing interest because the integration of ESG factors is a way to improve the portfolio risk profile and financial performance (CFA Society Italy, 2018).

1.7 Other financial instruments for financing sustainability

In recent years, there has been the spread of financial instruments capable of efficiently combining financial return and the long-term creation of environmental and social value. Among the fixed-income products there are the *green bonds*, which are «*debt securities associated to the funding of projects that have a beneficial impact on the environment*», for example, «*renewable energies, sustainable waste and water management, the protection of biodiversity and energy efficiency*» (Italian Sustainable Investment Forum,

2019). In response to the environmental concerns, the Climate Awareness Bond, the first green bond, was issued in 2007 by the European Investment Bank (EIB); since then, according to the research company BloombergNEF (BNEF), the green bond market has continuously grown, and in 2020 increased by about 13%, with \$305.3 billion of issuances. Green bonds have incredibly boosted the sustainable debt market, by reaching cumulative \$1 trillion issuances in the third quarter of 2020 (see Graph 6).

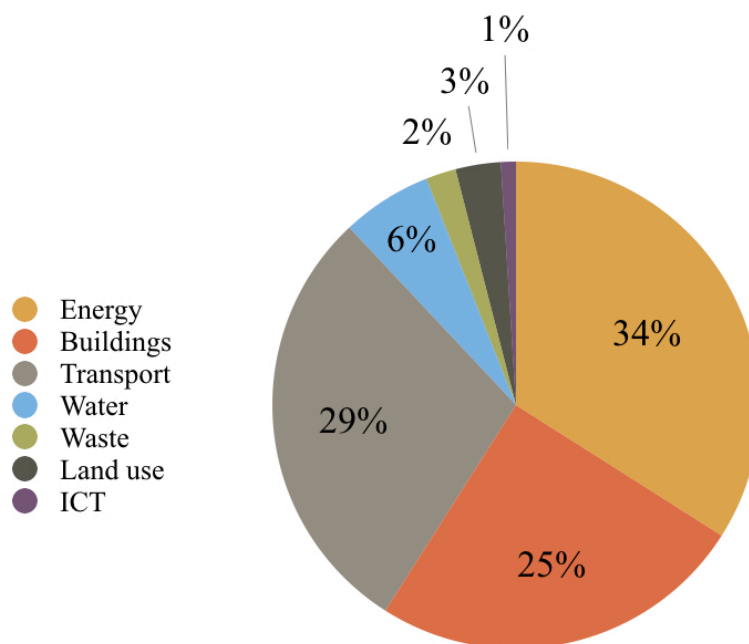
Graph 6. Cumulative green bond issuance by quarter (2007-3Q 2020)



Source: Henze (2020) in BloombergNEF.

The Climate Bonds Initiative, a non-profit organization for driving capital markets towards achieving climate goals, shows that in the first half of 2020 most of returns from green bonds are invested in energy (34%), transport (29%) and buildings (25%). Unfortunately, compared to 2019, in the first half of 2020 all categories suffered a sharp decline of investments. However, investments in transport and renewable energy are less likely to be affected by the global COVID-19 pandemic: usually, projects in large infrastructures receive funds from bodies sponsored by the state that are less exposed to instability.

Graph 7. Use of Proceeds (UoP) in % (H1 2020)



Source: Elaboration of the data of the Climate Bonds Interactive Data Platform.

The current expansion of the global sustainable debt market is driven by *social bonds* too. In the Italian Sustainable Investment Forum (2017) social bonds are defined as debt products deployed with the scope of funding activities with positive social effects. These financial tools are very recent: a consistent growth occurred in 2017, and in 2020 the social bond issuance has raised to \$147.7 billion (BloombergNEF, 2020).

The International Capital Market Association (ICMA) has proposed the “Green Bond Principles” (GBP) and the “Social Bond Principles” (SBP), widespread guidelines for regulating the issuance of green and social bonds. These principles are based on four key aspects⁵:

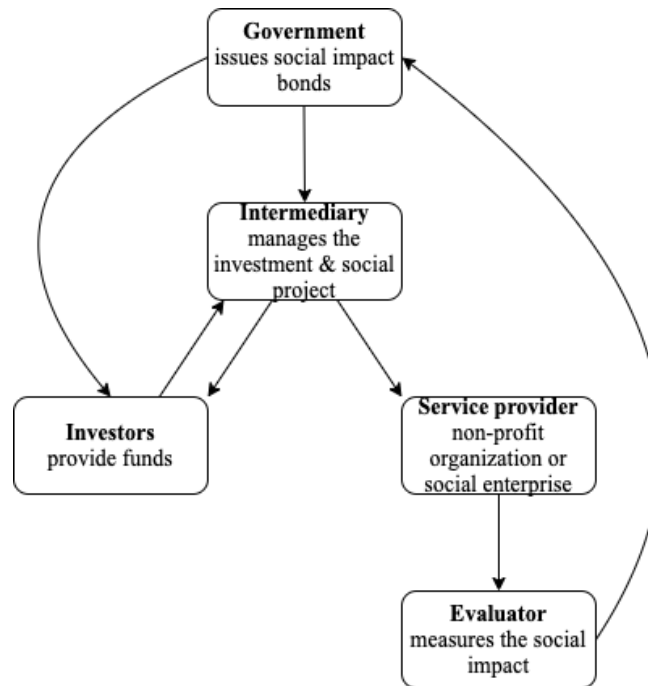
- Proceeds should be direct to investments with beneficial environmental or social outcomes.
- Issuers should specify the goals and criteria of selection and ensure that the project is suitable.

⁵ See in this regard ITALIAN SUSTAINABLE INVESTMENT FORUM (2019), *The European Union and sustainable finance: impacts and outlook for the Italian market*.

- The bond issued should be properly managed (i.e., it should be easily traced by issuers).
- Issuers should frequently inform about the use of the revenues.

Social bonds should not be confused with *social impact bonds*. According to the Italian Sustainable Investment Forum (2017), social impact bonds are not traditional debt securities, but innovative instruments of impact investing for financing projects of public utility, often referred to as “Pay by Result (PbR)” or “Pay for Success” bonds. These unconventional bonds consist in a contract between socially responsible investors and the government: investors get paid by the public administration only after the realization of a real and measurable positive social impact. This investment is made to improve the social outcome, and if the goal is achieved investors will receive the capital invested plus a financial reward based on the improvements obtained; the better the social outcomes obtained, the greater the financial return. The actors involved are governments, investors and service providers. The government issues social impact bonds and investors provide the necessary capital; an intermediary manage the investment and the project which is carried out by a non-profit organization or social enterprise. Eventually, an evaluator measures the social outcome and makes sure that the social project is successful, so that the government can pay investors (Italian Sustainable Investment Forum, 2017). The Italian Sustainable Investment Forum (2017) reports some examples of social impact bonds: the first one was issued in 2010 in the UK to support the reintegration of the prisoners from the Peterborough prison; the first social impact bond funded by the European Union was launched in 2017 in Finland to help about 3,000 refugees integrate into society and enter the labor market.

Figure 4. How social impact bonds work



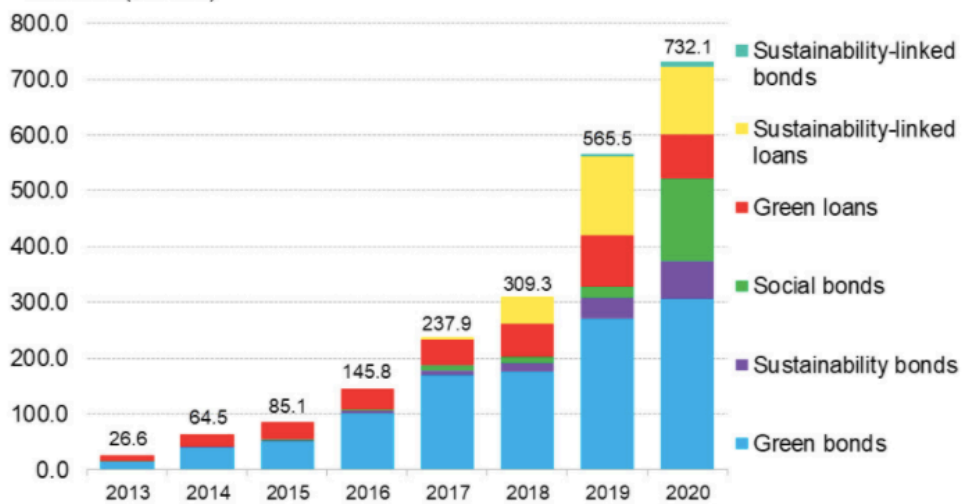
Source: Italian Sustainable Investment Forum (2017); European Sustainable Investment Forum (2018).

To conclude, the sustainable debt market also includes the following categories:

- *Sustainability bonds*, which are debt securities with a positive impact both on the environment and the society. In other words, they are a combination of green and social bonds (Italian Sustainable Investment Forum, 2017).
- *Sustainability-linked bonds*, which are supplementary financial instruments that do not restrict the use of proceeds: the issuers have to set sustainability performance objectives, which are measured through the Sustainability Performance Targets (SPTs), including KPIs. The main difference from sustainability bonds is that in sustainability-linked bonds proceeds are not required to fund green or social projects, they can be used for overall scopes (Loan Market Association).
- *Green and sustainability-linked loans*, which are loan instruments where the borrower is incentivized to reach environmental or sustainable goals (Loan Market Association).

BloombergNEF (2020) reports that sustainability bonds reach \$68.7 billion issuances in 2020, while sustainability-linked and green loans decreased to \$119.5 billion and \$80.3 billion respectively.

Graph 8. Global sustainable debt annual issuance in billions of US dollars (2013-2020)



Source: Henze (2020) in BloombergNEF.

Chapter II ESG criteria

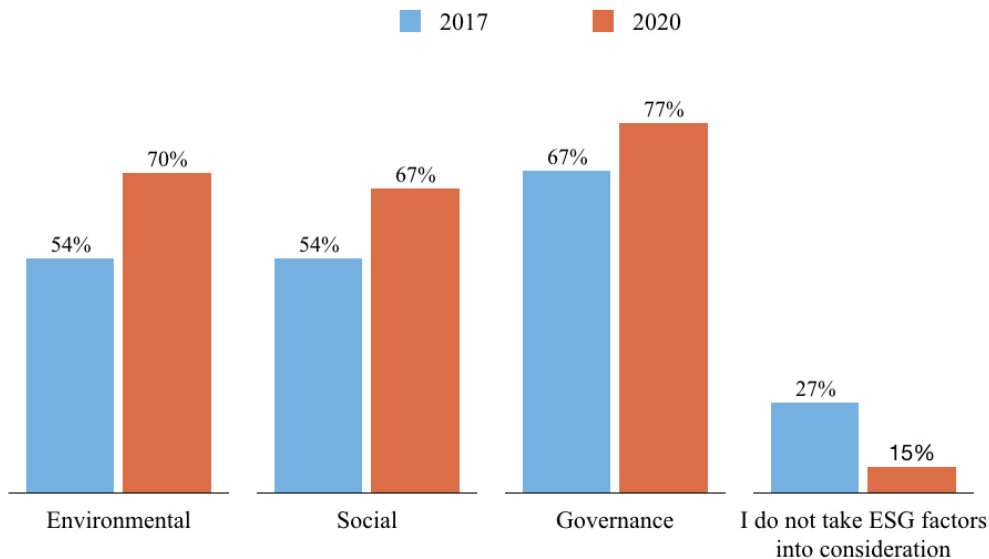
As discussed in Paragraph 1.6.7 the approach of explicitly including environmental, social and governance (ESG) factors into the financial analysis implies focusing on the impact that ESG issues have on the risk-return profile of the investment. ESG integration is an evolution of all the strategies (i.e., positive/negative selection, themed investing, norm-based screening, impact investing, engagement), it does not necessarily constitute an investment method in itself; it could be considered as a unique characteristic of the fundamental analysis⁶.

As exhibited in Paragraph 1.6, the prevailing approach to sustainable and responsible investing is ESG integration, with about 75% of the global respondents declaring that they include or would include ESG factors in their investment analysis (BlackRock, 2020). Similar results have been obtained from the survey of the CFA Institute (2020), which reports that 85% of respondents consider ESG issues in their capital allocation decisions, and the governance factor is the most popular (77%).

⁶ This is the definition of “ESG integration” provided by “Investi Responsabilmente”, a project of the Italian Sustainable Investment Forum.

Graph 9. Comparison of ESG factors in % (2017-2020)

Which, if any, of the following ESG issues do you take into account in your investment analysis or decisions?



Source: CFA Institute (2020). Note: base size=2,800 respondents. The survey was carried out in March 2020.

BlackRock (2020) also asked its interviewees to classify their attention on ESG factors in the future, over the next 3-5 years. For 89% of respondents the priority will be environment, 58% will pay attention to social aspects and 53% will concentrate on governance; as underlined by the BlackRock survey, there will be an increase of the focus on social factors, because of the concern caused by the COVID-19 pandemic. Furthermore, most respondents implement or intend to implement the 13th Sustainable Development Goal of climate action (53%) and the goal number 7 of affordable and clean energy (50%); 37% allocate or will allocate to goal 6 of clean water and sanitation, 32% to goal 3 of good health and well-being and 29% to goal 9 of sustainable cities and communities.

According to the CFA Institute (2020), investment professionals declared that they take ESG factors into account for the following reasons:

- To manage investment risks
- To respond to client demand

- To be consistent with their fiduciary duty
- To have reputational benefits
- To improve financial returns
- To help identify investment opportunities
- To have a proxy of the management quality
- To comply with legislation

Whereas the motivations that lead to ignore ESG criteria are the lack of demand from investors, the scarce knowledge of how to incorporate these factors and not enough information and data.

2.1 Definition of ESG

As already explained, sustainable and responsible investing does not just take risks and rewards into analysis, but also considers extra-financial factors, the so-called “ESG” factors, where “E” stands for environmental, “S” for social and “G” for governance. Investors can adopt an integrated approach in which financial and ESG metrics are combined into the portfolio analysis. The economic and financial actors can measure these factors, but unfortunately, they do not find easy to assign them monetary values.

The environmental factors include eco-efficiency, which means improving a company’s product or service and at the same time reducing the waste of natural resources; environmental impacts; and environmental management, which refers to a firm’s capability of coping with environmental issues. Sustainable and responsible investors should consider environmental risks and focus on those companies that do not have costs like penalties for pollution or fines for non-compliance to government regulation (Fung et al., 2010). In particular, the CFA Institute (2015) lists the following environmental criteria:

- Climate change and carbon emissions
- Air and water pollution
- Biodiversity
- Deforestation
- Energy efficiency
- Waste management

- Water scarcity

As Fung et al. (2010) state, the social criteria look at the violations of social, cultural or citizens' rights. Investors pay attention to companies that respect human rights and labor practices, and that ensure better and healthier work conditions. The contemplation of social factors reduces the risks related to the operations, regulations and reputation of a firm. According to the CFA Institute (2015), the social issues are:

- Customer satisfaction
- Data protection and privacy
- Gender and diversity
- Employee engagement
- Community relations
- Human rights
- Labor standards

Governance, particularly corporate governance, alludes to the standards endorsing how boards of directors and corporate administration work. A good governance meets the interests of the shareholders and improve the value of a company (Fung et al., 2010). In the guide provided by the CFA Institute (2015), governance factors include:

- Board composition
- Audit committee structure
- Bribery and corruption
- Executive compensation
- Lobbying
- Political contributions
- Whistleblower schemes

Some investment decisions are also driven by religious and ethical criteria, because investors may be motivated by moral values. This was particularly evident in the mid-1700s when investors started divesting from "sin" companies operating in an unethical way. Another example is represented by the Italian Church, which monitors its investments to ensure that they are aligned with the respect and promotion of individual

rights and human progress. SRI investors taking religious and ethical criteria into consideration often decide not to allocate their capital to the following sectors⁷:

- Weapons
- Alcohol
- Cigarettes
- Gambling or gaming

In addition, it is important to remember that «*the integration of ESG factors is one way to improve the portfolio risk profile and financial performance*» over the long-term (CFA Society Italy, 2018); this means that short-termism is not suitable for ESG factors because they do not contribute to the short-term value creation, but they have effects on the financial performance over the long-term (CFA Institute, 2015). These factors help in defining the earnings of the firm, rather than determining share or bond prices; they have a time horizon of about 5 years. ESG investing is less likely to create tangible and immediate financial benefits, but it can increase the economic and financial value thanks to the creation of relations with companies (i.e., engagement) and the ability of taking illiquidity advantages, such as benefits arising from investments in private equity and infrastructures (Cambridge Institute for Sustainability Leadership, 2016).

2.2 ESG financial ecosystem

The ESG financial ecosystem is becoming more and more complex due to the increasing number of actors involved, like companies, financial intermediaries and providers, issuers, institutional and individual investors⁸:

- Providers are organizations which evaluate environmental, social and governance factors and assign scores to companies by weighting different quantitative metrics; they include rating and index providers, who offer useful benchmarks for assessing portfolio or fund performance.
- Issuers are public or private entities supplying and distributing equity and debt financial instruments and receiving capital from investors. Nowadays, issuers

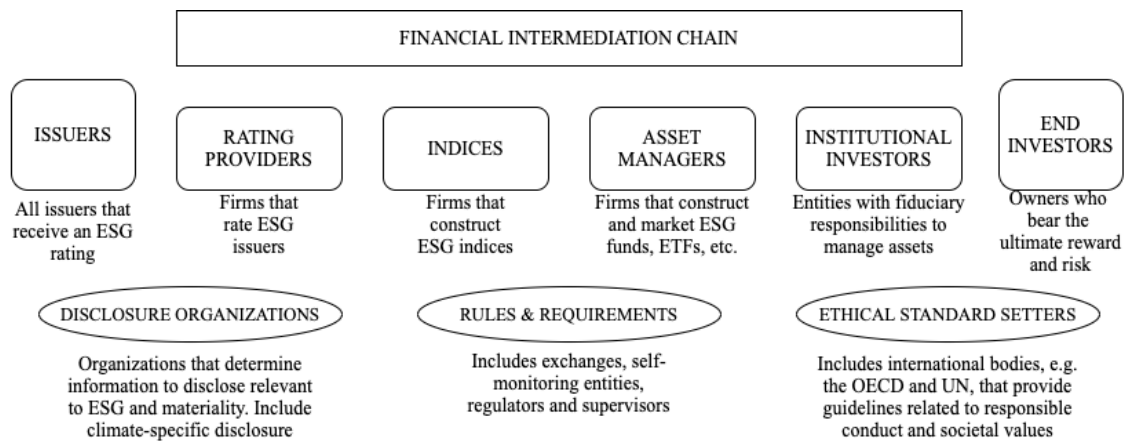
⁷ See in this regard FUNG, H., LAW, S. A. and J. YAU (2010), *Socially responsible investment in a global environment*, Edward Elgar, Cheltenham.

⁸ See in this regard BOFFO, R., AND R. PATALANO (2020), *ESG Investing: Practices, Progress and Challenges*, OECD, Paris.

directly disclose ESG information to asset managers and institutional investors too.

- ESG users include asset managers, who construct portfolios and funds, institutional investors like insurance companies and pension funds, and public authorities including central banks, looking for long-term value creation while contrasting climate change and reducing CO₂ emissions.
- Disclosure bodies and standard setters offer guidelines and frameworks for helping firms in reporting their non-financial performance; moreover, there are other authorities establishing rules and requirements.

Figure 5. ESG financial ecosystem



Source: Boffo and Patalano (2020).

2.3 ESG reporting and metrics

Fund managers and individual investors, which decide to adopt SRI investing strategies, need to analyze the ESG characteristics of firms in order to evaluate ESG performance which complements financial performance. As cited previously, among the major obstacles to the adoption of ESG investment there are the absence of data (because companies often do not disclose ESG information) and the incapacity to include ESG factors into calculations (CFA Institute, 2020). Companies find it difficult to report their ESG performance because of the lack of standardized ESG metrics: sustainability and responsibility reports are not mandatory or regulated and corporate ESG information can

be freely reported by companies, employing any metric for supplying data on their functions and efforts (Fung et al., 2010). This is also confirmed by the survey of BlackRock (2020), which underlines that 53% of respondents find the lacking availability of ESG data as the major challenge to adopting SRI, followed by 33% of respondents declaring that the scarce quality of ESG non-financial reporting is another great barrier to sustainable investing. In addition, 52% of the interviewees argue that it is essential to enhance the adoption of standard ESG measurement and methodology.

Determining the company's ESG performance and then constructing the ESG portfolio require investors to choose the key factors that they prefer the most, and after this, they should elaborate some methods for measuring these qualities and end up evaluating the environmental and social performance of every firm (Hill, 2020). Schoenmaker and Schramade (2019) point out some common metrics in the environmental, social and governance dimensions. According to the authors, carbon emissions are the most utilized metrics on the environmental side; the Greenhouse Gas (GHG) Protocol identifies three different types of CO₂ emissions:

- Direct emissions of a company.
- Indirect emissions caused by the usage of electricity, heat or steam.
- Other indirect emissions deriving from the goods or services a company purchases, produces and sells.

The writers also add a fourth type of carbon emissions that is the emissions that a company may have reduced by taking efforts. Other metrics frequently reported are the consumption of water, the waste of resources and the use of energy.

In the social dimension, Schoenmaker and Schramade (2019) list the following metrics:

- Accident frequency rates
- Social programs
- Employee engagement data
- Attrition rates
- Brand valuations
- Net promoter scores (NPS)

Moreover, Schoenmaker and Schramade (2019) add that «*governance indicators include shareholder structures, board composition, board independence, management compensation, governance committees, voting rights, share classes, and codes of conduct*».

Once companies have identified and measured their Key Performance Indicators (KPIs), they have to disclose a sustainability and responsibility report, containing all the ESG data, so that investors can assess ESG performance of companies. There are several reporting standards and guidelines that companies can refer to:

- *Global Reporting Initiative (GRI)*, which created the Sustainability Reporting Framework (SRF), a global guidance for reporting and disclosing the ESG performance of companies. This framework is an important tool for investors too, because they can use it for having a benchmark for corporate performance and for comparing the achievements of different firms over time (Fung et al., 2010). As stated by the CFA Society Italy (2018), it is estimated that at the global level 80% of the major companies have already adopted the GRI standards. These standards are categorized into economic, environmental and social themes, that are exhibited in Table 7 (Hill, 2020).
- *International Integrated Reporting Council (IIRC)*, which developed the Integrated Reporting Framework (IRF) to assist companies in providing an integrated report to investors, with their financial and non-financial performance. In this report it is possible to find the financial, manufactured, intellectual, human, social and relationship, natural capital of firms. The IIRC also lists some principles and elements to be included in the report (Schoenmaker and Schramade, 2019).
- *Sustainability Accounting Standards Board (SASB)*, which elaborated industry-specific sustainability metrics, focusing on the “materiality” of ESG issues. Most of these metrics can be measured as other financial accounting standards (Hill, 2020).
- *United Nations Global Compact*, which is a global initiative encouraging companies to align their strategies to the UN universal principles related to human rights, labor, environment and anti-corruption (CFA Society Italy, 2018).
- Other services offering standards for reporting ESG performance are: *International Labor Organization (ILO)*, *International Organization for Standardization (ISO)*, *OECD Guidelines for Multinational Enterprises*.

Table 7. GRI's standards for reporting ESG performance

ECONOMIC	Economic Performance Market Presence Indirect Economic Impact Procurement Practices Anti-corruption Anti-competitive Behavior
ENVIRONMENTAL	Materials Energy Water and Effluents Biodiversity Effluents and Waste Environmental Compliance Supplier Environmental Assessments
SOCIAL	Employment Labor/Management Relations Occupational/Health and Safety Training and Education Diversity and Equal Opportunity Non-discrimination Freedom of Association and Collective Bargaining Child Labor Forced or Compulsory Labor Security Practices Rights of Indigenous Peoples Human Rights Assessment Local Communities Supplier Social Assessment Public Policy Customer Health and Safety Marketing and Labeling Customer Privacy Socioeconomic Compliance

Source: Hill (2020).

It is relevant to highlight that many companies write their non-financial reports by themselves, emphasizing some aspects, and are not always honest about the data they disclose; they do not always elaborate sustainability and responsibility reports in a neutral and objective way, giving their own evaluations. In response to this, investors should rely on external services in order to obtain more accurate and truthful ESG data (Hill, 2020; Fung et al., 2010). For instance, *Sustainalytics* assigns a score to companies on each environmental, social and governance issue, which is updated every year. It also offers daily information about events that can negatively affect firms. *Ceres* provides the SEC Sustainability Disclosure Search Tool, which can be utilized for searching yearly corporate non-financial reports. Other examples include *RepRisk ESG Business Intelligence*, a research firm making data on ESG risks available to investors and *JUST Capital*, which evaluates and ranks companies based on the most important factors.

However, most reliable ESG scores are supplied by rating agencies such as MSCI, S&P Global, FTSE Russell and many others (Hill, 2020).

2.4 ESG funds

2.4.1 General outlook on ESG funds

As explained in Chapter 1, from the very beginning, sustainable and responsible finance has found in the mutual fund the main tool through which to implement its strategies. SRI mutual funds are funds investing in financial instruments which respect specific environmental, social and governance requirements (Viscovi and Di Turi, 2017); for this reason, these funds can be referred to using the term “ESG funds”. Like conventional mutual funds, also ESG funds include⁹:

- *Equity (Stock) funds*, which invest in common stocks.
- *Debt (Bond) funds*, which invest in fixed income or debt securities.
- *Balanced funds*, which are hybrid funds investing both in stocks and bonds.
- *Money market funds*, which invest in instruments having a very short time to maturity and high credit quality.

They can be open-ended or close-ended, actively or passively managed. As cited in the project “Investi Responsabilmente” of the Italian Sustainable Investment Forum, ESG ETFs have also become popular in recent years. ESG Exchange Traded Funds (ETFs) are investment funds traded on the stock exchange as common stocks; they replicate indices which are determined by integrating environmental, social and governance criteria in the selection of bonds and equities.

Bioy (2021) in Morningstar reveals that the demand of mutual funds and ETFs has almost doubled in 2020 as compared to 2019, reaching €233 billions of net inflows. Additionally, 505 new sustainable funds have been launched, where 13% of new launches focus on environmental issues and 66% of these are directed toward climate change, due to the increasing regulation and the desire to achieve climate neutrality by 2050.

According to Bioy (2021) in Morningstar, in the fourth quarter of 2020 the best 10 ESG funds in terms of flows were:

⁹ The definitions of the different types of mutual funds derive from Wikipedia, https://en.wikipedia.org/wiki/Mutual_fund

- iShares Global Clean Energy ETF
- Handelsbanken Hållbar Energi
- Pictet-Global Environment Opportunities
- Pictet-Clean Energy
- Nordea 1-Global Climate & Environment
- CSIF-(CH) III Equity World exCH ESG
- BlackRock CCF Dev World ESG Screened Index
- ACS Climate Transition World Equity
- Nordea 1-Emerging Stars Equity
- BGF Sustainable Energy

Seven of these ten funds are climate change-oriented; the best performing funds are related to clean energy, returning between 100% and 200%, due to the increasing demand for alternative energy equipment.

CFA Society Italy (2018) explains that, in selecting the ESG funds to invest in, investors first analyze a wide range of funds with different strategies, ESG definitions and benchmarks. Investors who decide to allocate their capital in sustainable funds often do not only aim at having the best risk-return profile, but have as main goal the integration of environmental, social and governance factors, because they may want to fund projects with a beneficial impact on the environment and society or because the inclusion of ESG criteria is part of their institutional mission. Investors can choose among a wide array of ESG funds based on the SRI strategy used by these funds. Currently, most funds adopt the negative screening approach, by excluding certain companies in the investment decision process, which reflects the interests of many institutional investors; however, many mutual funds now integrate ESG factors in the financial analysis of their investments, regardless of the specific strategy they intend to implement. It is also possible to find funds using a multi-approach which consists in considering different strategies for the security selection process. Once investors have decided the reference strategy, they start analyzing the strategy and the yield structure of the funds in which to make an investment. Investors should have comprehensive ESG data and should understand how the fund manager implements the desired SRI approach; then, they make sure that the fund's investment strategy is compatible with their ESG objectives. Namely, an investor may prefer to allocate its capital in projects with a high social score, thus he or she will not select funds which invest in companies with a low rating in the “S” dimension. Investors often ask the following questions:

- What criteria are used to select the companies to be excluded? (If the fund adopts the negative screening strategy)
- How does the fund manager relate to the companies in which he or she invests? Has he or she voting rights? (If the fund uses the engagement strategy)
- How are the ESG factors integrated?
- What is the impact of ESG factors on returns?
- Is the yield structure consistent with the ESG objectives of the fund?

Like traditional funds, ESG funds also need a reference index, so that investors know if the fund is in line with their investment goal. Most ESG funds make use of general market indices, while others may choose to create their own benchmark. The performance of the fund is compared with the performance of the index, and active fund managers make investment choices in order to exceed the performance of the benchmarks.

2.4.2 BlackRock

One of the largest asset managers in the world is BlackRock, which is extremely committed to sustainable investment. Its CEO, Larry Fink, decided to adopt a long-term investment strategy, stating that BlackRock's clients could benefit from their investments only by generating a long-lasting value for all stakeholders. In order to reach better financial returns, BlackRock integrated sustainable issues in its portfolio construction process. In particular, in 2020 the society made improvements in three main categories¹⁰:

- *Building sustainable portfolios*: managers integrated ESG factors in all their investment strategies; since sustainability risk is investment risk, they reduced this risk in their active portfolios, by divesting from companies with a negative impact on the environment or society (i.e., firms producing thermal coal or related to weapons). They improved the clearness of ESG characteristics, increased the number of KPIs and introduced a new climate risk tool called "Aladdin Climate".
- *Increasing access to sustainable investing*: managers doubled ESG ETFs and collaborated with S&P, FTSE Russell and Markit to create new sustainable indices. They offered more sustainable cash and active strategies and allocated the capital of their clients to projects in renewable energies.

¹⁰ See in this regard BLACROCK (2020), *Our 2020 sustainability actions*.

- *Enhancing sustainability in stewardship*: managers increased their engagement in companies and took voting action in issues related to climate change. They published reports and papers on their activities, results and approaches to ESG issues, and joined different global initiatives.

The investment products offered by BlackRock are mutual funds, ESG ETFs, other investments in shares or bonds, multi-approaches considering different assets (e.g., equities, fixed income, real estate and so on). BlackRock owns the brand iShares, a leading ETF provider with more than 800 Exchange Traded Funds in the world. As mentioned above, iShares Global Clean Energy ETF was the top sustainable fund in terms of flows at the end of 2020. The fund aims at replicating as closely as possible the performance of an index composed of 30 global clean energy companies; its reference index is S&P Global Clean Energy Index. The sustainability characteristics of the fund based on holdings as of 31/12/2020 are the following:

- MSCI ESG Fund Rating (AAA-CCC) of AA
- MSCI ESG Quality Score (0-10) of 7.3

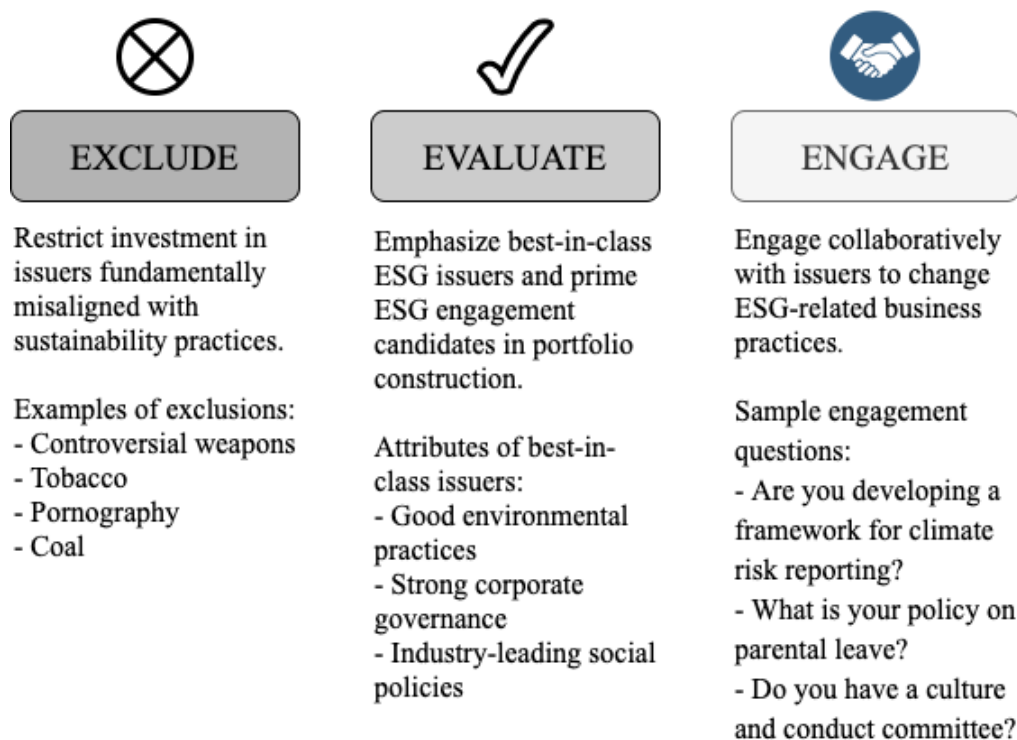
These metrics reveal that the fund invests in firms that are leaders in managing the most significant ESG risks and opportunities¹¹.

2.4.3 PIMCO

Another large provider of sustainable funds is Pacific Investment Management Company LLC (PIMCO), a fixed income investment management firm, which introduced one of the first sustainable and responsible bond fund in 1991 (Hill, 2020). The corporation became a member of the UN' Global Investors for Sustainable Development (GISD) Alliance, which aims at achieving the UN's Sustainable Development Goals through enduring finance and long-term investment (PIMCO, 2019). In 2017 PIMCO launched the global ESG investment platform to provide fixed income instruments which combine financial performance with a beneficial impact on environment and society (PIMCO, 2017); the firm manages several ESG strategies in the form of mutual funds (see Figure 6), that is i) Exclude, ii) Evaluate, and iii) Engage.

¹¹ All information about iShares Global Clean Energy ETF can be found on www.ishares.com

Figure 6. PIMCO's strategies to build ESG fixed income portfolios



Source: Hill, (2020).

PIMCO implements ESG investing by following this process (Hill, 2020):

- ESG data are collected from third parties and a dedicated ESG team assesses them and makes credit analyses.
- Asset managers and analysts make use of specific ESG tools, such as:
 - o *ESG analytics*, which reports ESG data used by investors to analyze different portfolios.
 - o *ESG COMET (Company Engagement Tool)*, which monitors the engagement and impact of firms.
 - o *ESG METRO (Business Involvement Screen)*, which ensures that the issuers are not related to activities that have to do with guns and so on.
 - o *PARR (PIMCO Analyst Research and Recommendations)*, which checks the credit opinions.

- Once asset managers have all the ESG information they need, they create suitable sustainable and responsible portfolios and funds by using one of the PIMCO's strategies.

PIMCO's ESG mutual funds include¹²:

- *Total Return ESG Fund*, which seeks to maximize the financial reward, while integrating ESG criteria in the security selection.
- *Low Duration ESG Fund*, which invests in short-term securities with a focus on socially responsible firms.
- *ESG Income Fund*, which allocates capital to green, social and sustainability-linked bonds, while maintaining the objective of optimizing income.
- *Climate Bond Fund*, which invests in green bonds and companies committed to reducing the risks of climate change, while delivering a long-term financial value to investors.

The ESG ETFs managed by PIMCO are¹³:

- *RAFI ESG U.S. ETF*, which focuses on companies with environmental, social and governance characteristics and utilizes strong ESG metrics.
- *Enhanced Short Maturity Active ESG Exchange-Traded Fund*, which incorporates the ESG investment approach provided by PIMCO, but aims at obtaining short-term attractive returns.

2.4.4 JUST Capital

Many fund managers, like those just described, offer ESG financial products based on data and scores provided by external services (e.g., MSCI, Morningstar and many others). JUST Capital, founded in 2013, acts differently¹⁴:

- First, it conducts a survey of what factors are considered most important by Americans.
- Second, it makes assessments of US publicly traded companies based on these issues.

¹² See in this regard www.pimco.com

¹³ See in this regard www.pimco.com

¹⁴ See in this regard HILL, J. (2020), *Environmental, Social, and Governance (ESG) investing. A balanced analysis of the theory and practice of a sustainable portfolio*, Elsevier, UK/US.

- Third, by taking these evaluations into account, it ranks these American firms. From its poll, JUST Capital identified 19 issues in 2020, filtered by workers, communities, customers, shareholders, and environment, and assigned a ranking weight to these issues, based on the times the factor is evaluated as the most important (see Table 8).

Table 8. The core issues of JUST business by stakeholder

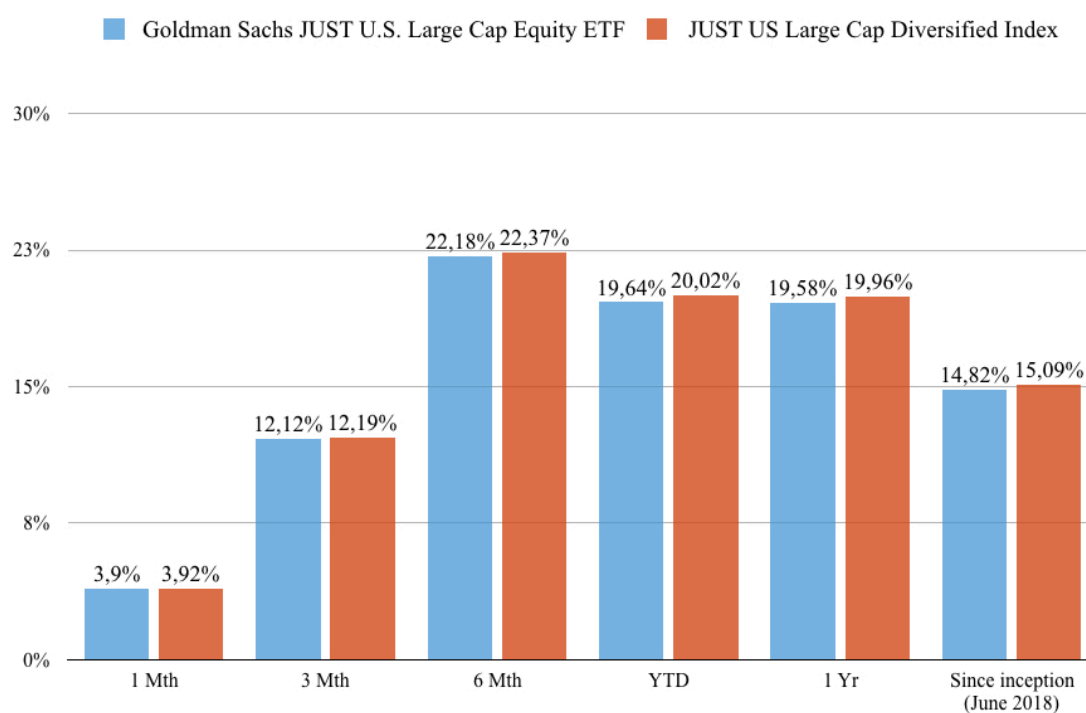
WORKERS		COMMUNITIES		CUSTOMERS		SHAREHOLDERS		ENVIRONMENT	
Issue	Ranking weight	Issue	Ranking weight	Issue	Ranking weight	Issue	Ranking weight	Issue	Ranking weight
Pays a fair, livable wage	9,9%	Upholds human rights standards across the supply chain	9,2%	Protects customer privacy	5,2%	Acts ethically at the leadership level	8,2%	Minimizes pollution	3,3%
Invests in workforce training	8,3%	Creates jobs in the U.S.	7,2%	Treats customers fairly	4,9%	Prioritizes value creation for all stakeholders	4,2%	Helps combat climate change	2,8%
Cultivates a diverse and inclusive workplace	7,7%	Contributes to community development	2,5%	Makes products that do not harm	2,5%	Generates returns for investors	2,3%	Develops and supports sustainable products	2,7%
Protects worker health and safety	7,6%	Supports local communities	1,8%	Communicates transparently	2,1%				
Provides benefits and work-life balance	7,5%								

Source: JUST Capital, <https://justcapital.com/issues/>

Just Capital employed the ranks describing the performance of the US companies on the factors listed in Table 8 in order to construct the JUST US Large Cap Diversified Index (JULCD), which is made up of the top 50% of Russell 1000 firms in every sector, according to JUST Capital's rankings (Hill, 2020). As reported by Hill (2020), the index was launched in 2016 and since then, it has exceeded its reference index: «*from inception through the first quarter of 2019, JULCD returned an annualized 14.9%, 120 basis points better than the Russell 1000 return*». In 2018 Goldman Sachs Asset Management

introduced the Goldman Sachs JUST U.S. Large Cap Equity ETF, an Exchange Traded Fund which invests in American companies having a beneficial effect on the most important issues resulting from the polling of JUST Capital and tries to replicate the JUST US Large Cap Diversified Index (JUST Capital).

Graph 10. Monthly performance in % as of 31/12/2020



Source: Goldman Sachs Asset Management.¹⁵

2.5 ESG indices and ratings

Asset managers and institutional investors wishing to invest in sustainable financial instruments (e.g., ESG portfolios and funds) need sustainability or ESG indices, which summarize the main features of investment products. Sustainability or ESG indices are constructed by incorporating financial criteria, as well as ESG factors; what is different in ESG indices compared to the corresponding traditional indices is the investable

¹⁵ See in this regard <https://www.gsam.com/content/gsam/us/en/individual/products/etf-fund-finder/goldman-sachs-just-u-s--large-cap-equity-etf.html#activeTab=performance>

universe made up of securities that meet certain ESG characteristics. In general, ESG indices are generated by filtering traditional indices based on the sustainability criteria defined by the index provider (Viscovi and Di Turi, 2017; CFA Society Italy, 2018). The sustainability indices have the following functions (CFA Society Italy, 2018):

- Some funds are created by selecting the securities in the portfolio within certain ESG indices.
- ESG indices are used as benchmarks: the performance of an ESG portfolio or fund is compared with the performance of the reference index. The difference in the performance between the chosen investment product and its corresponding benchmark is called “tracking error” (Chen, 2020).
- ESG indices group funds that are similar in terms of asset class, sector or geography.
- When securities in the ESG financial product are similar to those in the ESG reference index, then it is possible to compare the ESG reference index with the equivalent non-ESG index and analyze whether the chosen sustainable tool performs more or less than the corresponding unsustainable tool.

As described by CFA Society Italy (2018), in general, the ESG indices can be divided into two main categories:

- *Market indices*, which group listed companies according to their performance on environmental, social and governance factors.
- *Thematic indices*: which are made up of securities focusing on specific sustainability themes, such as climate change, renewable energies, health and so on.

CFA Society Italy (2018) adds that sustainability indices can be constructed according to three different criteria:

- *Indices by exclusion*, which screen out individual companies or entire sectors which are not consistent with environmental or social principles, such as alcohol, tobacco, weapons, fossil fuels, and many others.
- *Indices by inclusion*, which select the best companies from the point of view of sustainability, regardless of the sector in which they operate; in other words, these indices reward the adoption of best practices of corporate sustainability, without considering the specific activity carried out by the company. For example, even a

firm operating in the fossil fuel sector, if it adopts many ESG principles, can be included in this type of index.

- *Indices by under or overweight*, which assign a higher weight than the starting index to companies with high sustainability ratings, while they assign a lower weight to firms with low sustainability. These indices have the same securities as the equivalent starting index, but different weights based on the sustainability of companies.

The basis on which the ESG indices are built is constituted by the sustainability or ESG ratings, which measure the solidity of a company from the point of view of the environmental, social and governance performance. The ESG ratings are provided by the ESG rating agencies, which are organizations specialized in the collection, processing and analysis of data and information regarding the environmental, social, and governance dimensions of the activity of businesses. However, nowadays, also traditional rating agencies offer sustainability ratings (Viscovi and Di Turi, 2017). As highlighted by CFA Society Italy (2018), rating agencies carry out this activity independently or within index provider firms (see Table 9).

Table 9. Main index and/or rating providers and ESG reference indices

Provider	Indices or families of indices
Calvert	The Calvert Social Index
CRD Analytics	Global Sustainability Index, Cleantech 100, Life Sciences
Domini	Domini 400 Social Index
ECPI	ECPI Indices
FTSE	FTSE4Good Index Series
EthiFinance	Gaia Index
Maplecroft	Climate Innovation Indexes
MSCI	MSCI ESG Indexes and Barclays MSCI (Fixed Income Indices)
Oekom Research	Global Challenges Index
OWW	Responsibility Malaysia SRI Index, Responsibility Singapore SRI Index
RobecoSAM	DJSI
Sustainalytics	Jantzi Social Index, STOXX Global ESG Leaders Indices
Vigeo	ASPI Eurozone, Ethibel Sustainability Index, Euronext Vigeo
Thomson Reuters	Thomson Reuters ndex

Source: CFA Society Italy (2018).

Despite this, Billio et al. (2020) point out that rating agencies have dissimilar rating criteria due to the fact that ESG traits and standards do not have a commonly accepted definition and the information held by the various rating agencies does not coincide with each other. As a result, agencies assess companies' ESG performance differently and strongly disagree with each other. The study conducted by Billio et al. (2020) reveals that the first main difference between raters concerns the sources of data: some rating providers rely on the information disclosed by firms' reports and websites, other rating agencies have personal dialogues with companies or carry out their own surveys. The second main divergence among rating agencies is the number of evaluated criteria: there are some providers that assess about 30 issues, while other raters make evaluations taking more than 100 criteria into consideration. A third major disagreement resides in risk factors, because there are some agencies which do not consider the environmental, social and governance dimensions separately: they put two dimensions together or replace one dimension with a different one. The last observable difference is related to how rating agencies define ESG materiality, that is to say how they define why and how specific issues are relevant for a firm¹⁶.

Billio et al. (2020) analyzed ESG ratings of four companies provided by four distinct agencies: Sustainalytics, RobecoSAM, Refinitiv and MSCI. As exhibited in Table 10, the most obvious example of the disagreement between the raters is observable in the case of Nissan Motor Co., Ltd, which has received a high score by RobecoSAM and Refinitiv, while Sustainalytics and MSCI attribute a very low grade.

Table 10. Example of divergence in ESG ratings

Company	Sustainalytics	RobecoSAM	Refinitiv	MSCI
Nissan Motor Co., Ltd	6	77	72	CCC
Verizon Communications Inc.	91	20	67	BB
Oracle Corp. Jpn	78	8	63	BB
Goodman Group Unt	86	21	58	AA

Source: Billio et al. (2020). Note: The rating scale for Sustainalytics, RobecoSAM and Refinitiv ranges from 0 to 100; for MSCI from CCC to AAA.

¹⁶ See Appendix A for the key differences between ESG rating agencies.

Another study shows that the average percentage of observed agreement is 24%, confirming the strong difference of opinions among rating providers (see Table 11).

Table 11. The percentage of observed agreement among the considered rating agencies

	Sustainalytics	RobecoSAM	Refinitiv	MSCI
Sustainalytics	-			
RobecoSAM	28.22%	-		
Refinitiv	23.74%	20.59%	-	
MSCI	25.36%	19.46%	27.93%	-

Source: Billio et al. (2020).

In the SAFE Working Paper of Billio et al. (2020), it is also emphasized the fact that divergencies in sustainability ratings lead also to a different construction of ESG indices; index providers disagree in the choice of constituents of indices, and this is demonstrated by measuring the overlap coefficient (i.e., agreement rate among the evaluated indexes).

The overlap coefficient is:

- 59% between MSCI and STOXX
- 50% between MSCI and Refinitiv
- 50% between STOXX and Dow Jones
- 49% between MSCI and Dow Jones
- 43% between STOXX and Refinitiv
- 35% between Dow Jones and Refinitiv

The overall agreement rate is 15%¹⁷.

It is clear that the methods used by rating agencies are essentially dissimilar, but investors utilize the resulting scores for the same objective of determining the firms with the best ESG performance. In such manner, the examination of the methodologies adopted by different raters could be useful for identifying the elements that are the basis of the final sustainability ratings (Boffo and Patalano, 2020).

¹⁷ The ESG indices are made up of firms from developed markets with a high ESG performance according to the related provider.

2.5.1 Ratings methodology for building MSCI ESG indices

MSCI is an American provider of financial services, with the headquarter in New York. Thanks to its 50 years of experience, it is a leader in offering its clients the best investment decision tools. In addition to producing financial instruments, MSCI provides investors with data and methodologies for measuring performance and managing risk. It is strongly committed to measuring and integrating environmental, social and governance factors into investment strategies; MSCI ESG Research LLC¹⁸ provides ESG ratings, data and analysis, which are employed to build MSCI ESG indices and other sustainable products and services. MSCI ranks more than 8,500 firms and over 680,000 equity and debt securities globally; MSCI ESG ratings are then utilized by clients for the following activities¹⁹:

- Stock analysis
- Portfolio construction: asset allocation and security selection
- Benchmarking
- Development of ETFs and other index-based products
- Disclosure and reporting for regulators and stakeholders
- Engagement
- Thematic or industry research

MSCI states that «*MSCI ESG Ratings uses a rules-based methodology designed to measure a company's resilience to long-term, industry material environmental, social and governance (ESG) risks*». More than 200 MSCI's ESG analysts adopt a rating-development approach, which briefly consists in:

- *Collecting data*: analysts do not make use of questionnaires, but they gather data from disclosure reports of companies, from government, regulatory and NGO datasets and from over 3,400 media sources.
- *Defining the metrics*: analysts evaluate how firms are exposed to risks and how they managed risks compared to the other companies in the industry; they also check the accuracy of the data.
- *Evaluating*: analysts score and weigh industry-specific issues; they also verify whether the companies in question have been involved in controversies or

¹⁸ MSCI ESG Research LLC is a registered Investment Adviser under the Investment Advisers Act of 1940 and a subsidiary of MSCI.

¹⁹ See in this regard www.msci.com

governance events (i.e., they monitor whether international rules or principles have been violated).

- *Assigning the final ratings*: analysts add scores and weights of key issues together in order to assign the final ESG ratings to companies. Sustainability ratings are then reviewed and monitored.

This approach leads to the creation of company, industry and thematic reports, portfolio analytics, data feeds and indices²⁰.

More precisely, MSCI rates companies by measuring their exposure to and management of key environmental, social and governance risks and opportunities. These risks and opportunities must be material: a risk is material when firms face significant costs related to it, while an opportunity is material when firms can benefit from it. Once identified, the key issues (see Table 12) receive a weight based on their impact on environment and society and the time horizon for the risk or opportunity to materialize: the highest weight is given for a high impact and a short-term timeline (i.e., less than 2 years), while the lowest weight corresponds to a low impact and a long-term timeline (i.e., 5 or more years).

²⁰ See in this regard MSCI (2020), *MSCI ESG Ratings*.

Table 12. MSCI ESG key issue hierarchy

3 PILLARS	10 THEMES	35 ESG KEY ISSUES	
Environmental	Climate Change	Carbon Emissions Product Carbon Footprint	Financing Environmental Impact Climate Change Vulnerability
	Natural Capital	Water Stress Biodiversity & Land Use	Raw Material Sourcing
	Pollution & Waste	Toxic Emissions & Waste Packaging Material & Waste	Electronic Waste
	Environmental Opportunities	Opportunities in Clean Tech Opportunities in Green Building	Opportunities in Renewable Energy
Social	Human Capital	Labor Management Health & Safety	Human Capital Development Supply Chain Labor Standards
	Product Liability	Product Safety & Quality Chemical Safety Financial Product Safety	Privacy & Data Security Responsible Investment Health & Demographic Risk
	Stakeholder Opposition	Controversial Sourcing Community Relations	
	Social Opportunities	Access to Communications Access to Finance	Access to Health Care Opportunities in Nutrition & Health
Governance	Corporate Governance	Ownership & Control Board	Pay Accounting
	Corporate Behavior	Business Ethics Tax Transparency	

Source: MSCI ESG Research (2020).

In addition to assigning weights to each ESG key issue, MSCI scores risk exposure and management on a scale from 0 (poor) to 10 (good): a high level of risk exposure requires a high level of risk management (i.e., if a company face many risks, it needs strategies and practices suitable for managing these risks). Then, also the opportunity exposure and management are scored on a 0-10 scale: if the opportunity is very important to the firm and the company in question is able to capitalize on this opportunity for profit, then a high score will be assigned to the company. Any temporary or structural controversies within the last three years lead to a deduction from the overall score on each key issue. Controversies may arise when products or operations of a firm have a negative impact on the environment or society (MSCI ESG Research, 2020). Companies may receive different scores represented by four distinct colors²¹:

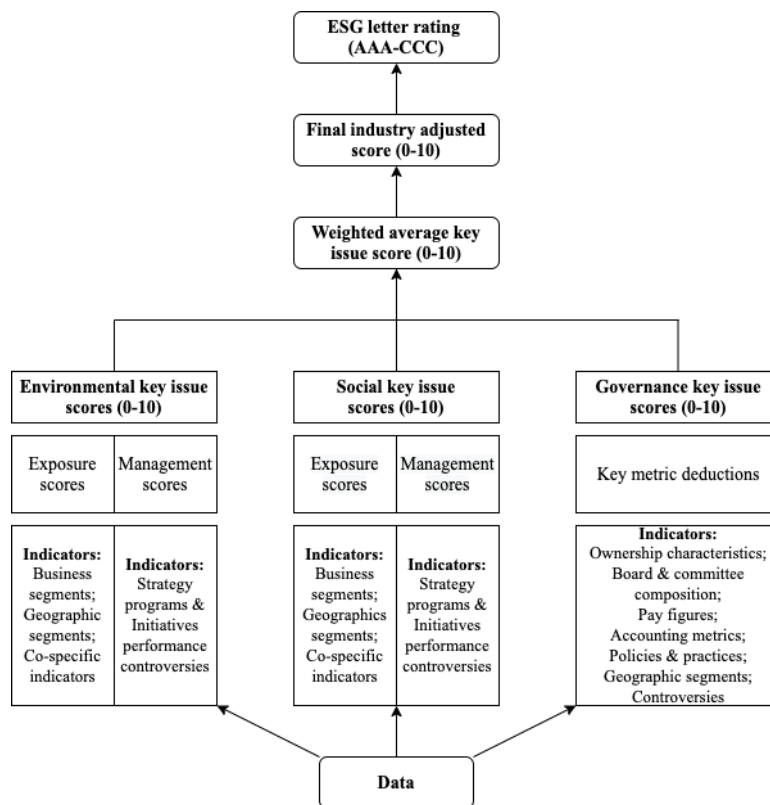
- **Red**, when the firm is involved in one or more *very severe* controversies.
- **Orange**, when the firm is involved in one or more *severe* controversies.
- **Yellow**, when the firm is involved in one or more *severe-to-moderate* controversies.

²¹ See in this regard MSCI ESG Research (2020), *MSCI ESG Controversies*.

- **Green**, when the firm is *not involved* in any controversy.

At the end, in order to assign the final ESG rating, MSCI calculates the weighted average key issue score from environmental, social and governance scores and weights. Then, the weighted average of the ESG pillar scores is adjusted relative to industry peers; the final industry adjusted score coincides with a rating which ranges from leader (AAA, AA), average (A, BBB, BB) to laggard (B, CCC)²².

Figure 7. MSCI hierarchy of ESG scores



Source: MSCI ESG Research (2020).

The ratings described above are used to form most of the MSCI ESG indices; examples of ESG indices constructed using ESG ratings of MSCI include (MSCI ESG Research, 2020):

²² See Appendix B for the MSCI final industry adjusted company scores mapped to letter ratings.

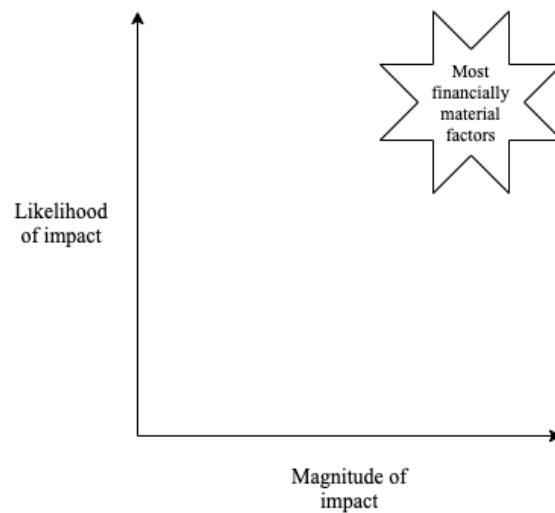
- *MSCI ESG Leaders Indexes*, which employ the Best-in-Class strategy by including firms with the best ESG ratings in each sector.
- *MSCI Focus Indexes*, which aim at giving more relevance to high ESG rated performers.
- *MSCI ESG Universal Indexes*, which improve the exposure to those companies with high ESG ratings and positive environmental, social and governance trends, and, at the same time, they re-weigh firms in a broad and diversified index.
- *MSCI KLD 400 Social Index*, which was born as “Domini 400 Social Index”, the first MSCI ESG index launched in 1990; it selects the best ESG rated companies, while avoiding those firms producing products or performing operations which have a negative impact on the environment and society.

2.5.2 Ratings methodology for building DJSI and S&P ESG indices

The Dow Jones Sustainability Indices (DJSI) are a family of benchmarks born from the partnership between RobecoSAM and S&P Dow Jones Indices, which represent the first global SRI indices, introduced in 1999. These indices are constructed by using the companies’ ratings resulting from the Corporate Sustainability Assessment (CSA), which is an annual evaluation of the ESG performance of over 7,000 firms, founded by the asset manager RobecoSAM. In January 2020, S&P Global acquired RobecoSAM, including the CSA platform, which is now called “S&P Global CSA” (and no more “SAM CSA”) and provides S&P Global ESG scores, which form the basis for the DJSI and many S&P ESG indices. The CSA ranks companies by focusing on sustainability criteria which are important from the financial point of view for the performance of companies and security selection. Most of the largest publicly traded firms in the world take part to the CSA and are assigned a S&P Global ESG score, ranging between 0 and 100. The best rated companies are then included in the DJSI or other S&P ESG indices. The methodology used by the CSA is totally different from the one applied by MSCI; first, the rating scale is different: for MSCI is AAA-CCC, while the S&P Global ESG rating scale is 0-100. Second, MSCI collects data from company disclosures and government and NGO datasets, while the CSA platform collects data from annual surveys. Third, CFA’s analysts group sustainability issues into economic, environmental and social pillars, rather than into environmental, social and governance, as MSCI does.

The CSA starts with the analysis of the financial materiality of economic, environmental and social factors, that is the analysis of the factors that have a long-term impact on the performance, risks and costs of a firm. This analysis is carried out through the financial materiality matrix, which assesses sustainability factors according to the likelihood and magnitude of their impact; factors situated in the top right-hand of the matrix are the most financially material ones and will be used into questionnaires filled by companies, which provide the necessary data for the ESG ratings (S&P Global, 2020).

Figure 8. Financial materiality matrix used by CSA



Source: S&P Global (2020).

After identifying the sustainability factors that are most financially relevant to companies, the world's largest publicly traded firms are asked to reply to a questionnaire, which consists of single questions, whose scores are weighted and add together into a wider area known as criteria. The question score is calculated as follows:

$$\begin{matrix} \text{Number of points received} \\ \text{(between 0 and 100)} \end{matrix} \times \begin{matrix} \text{Question weight} \\ \text{(within the criterion)} \end{matrix} \times \begin{matrix} \text{Criterion weight} \\ \text{(within questionnaire)} \end{matrix} = \begin{matrix} \text{Question} \\ \text{Score} \end{matrix} \quad (2.1)$$

In the same way, each criterion receives a value, and all these values are weighted and summed into three dimensions: economic, environmental and social. At the end, all the dimension scores are assigned a weight and their sum generates the final ESG score. In

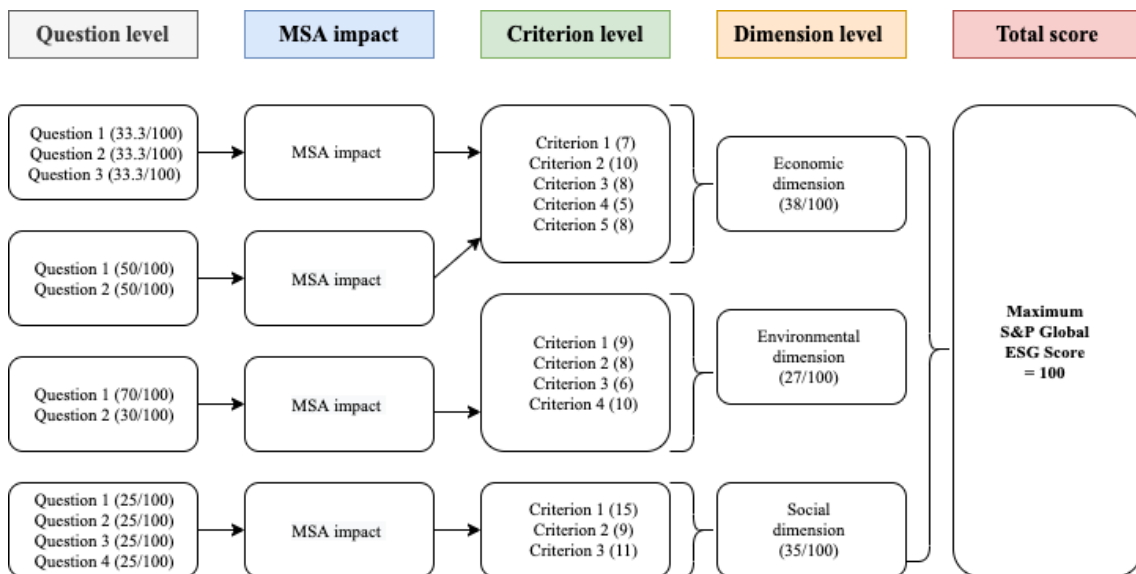
other words, the sum of all the question scores results in the S&P Global ESG score, ranging from 0 to 100. After this, firms within the same sector are classified for identifying those that should be included in the DJSI. The formula for the final score is the following:

$$S\&P\ Global\ ESG\ Score = \sum (Number\ of\ Question\ points\ received \times Question\ weight \times Criterion\ weight) \quad (2.2)$$

In addition, criterion scores can be modified after the Media and Stakeholder Analysis (MSA), which assesses whether a company is involved in a negative event having a significant reputational and financial impact. A MSA case includes corruption, human rights or environmental violations, labor arguments and many others. Once the MSA case has been identified, it is assigned a score according to its impact and the firm’s response to it. The MSA score serves for attributing a coefficient which adjusts the criterion scores based on the negative effect of the MSA case, called “MSA multiplier”; if the negative impact is large, the criterion scores will suffer a sharp reduction (S&P Global, 2020).

$$Criterion\ score\ without\ MSA\ adjustment \times MSA\ multiplier\ calculation = Final\ criterion\ score \quad (2.3)$$

Figure 9. Structure of the CSA methodology



Source: S&P Global (2020). Note: question and criterion weights are pre-defined.

As previously discussed, the S&P Global ESG scores of companies resulting from the CSA are used to select the constituents for the Dow Jones Sustainability Indices. The approach applied to build the DJSI is the Best-in-Class, which consists in including in the indices only those firms with the highest ESG scores; hence, the process does not exclude any industry. The constituent selection process works as follows (S&P Dow Jones Indices, 2021):

- *Define the Invited Universe:* the highest capitalization float-adjusted companies, that are included in the S&P Global BMI index, are invited to fill the annual CSA questionnaire.
- *Define the Assessed Universe:* firms from the Invited Universe which receive an S&P Global ESG score resulting from the CSA.
- *Define the Eligible Universe:* companies from the Assessed Universe with an ESG score greater than 45% of the S&P Global ESG score of the highest scoring firm.
- Classify the companies from the Invited Universe, from the ones with the highest ESG scores to the ones with the lowest scores.
- Choose firms that are both in the Eligible Universe and in the top target % of the Invited Universe²³, classified according to the previous point.
- Select the remaining firms in the Eligible Universe that do not exceed 0.6 points from the last chosen company in previous point.
- Select the remaining firms in the Eligible Universe that are already in the DJSI and in the top buffer % of the Invited Universe²⁴.

The family of the DJSI includes global, regional and country benchmarks, as follows: DJSI World, DJSI North America, DJSI Europe, DJSI Asia Pacific, DJSI Emerging Markets, DJSI Korea, DJSI Australia, DJSI Chile and DJSI MILA Pacific Alliance.

It is important to remember that not all the Dow Jones Sustainability Indices are built using the Best-in-Class strategy, but some are constructed by excluding companies operating in controversial sectors such as alcohol, tobacco, weapons, gambling and others (S&P Dow Jones Indices, 2021).

²³ Global indices target= 10%; regional indices target= 20%; country indices target= 30%.

²⁴ Global indices buffer= 15%; regional indices buffer=30%; country indices buffer= 45%.

2.6 The phenomenon of greenwashing

The enthusiasm for sustainable and responsible investing is often dampened by the phenomenon called “greenwashing”. In 1986 the American environmentalist Jay Westerveld coined the term “greenwashing”, which refers to the communication practices and business strategies that lead to the construction of a positive image around the company, in contrast with reality (Cavallito et al., 2017). In other words, greenwashing is «*the act of misleading consumers regarding the environmental practices of a company or the environmental benefits of a product or service*»²⁵ or as stated by the European Commission (2021), the firms’ practice of declaring that they are working more for the environment and society than they actually do. After screening different business websites, the European Commission (2021) found out that in 42% of the cases the declarations of supposed green products were false or misleading. In order to help consumers to determine which products make false environmental declarations, TerraChoice, which was acquired by UL, introduced the Seven Sins of Greenwashing²⁶:

1. *Sin of the hidden trade-off*: a product is claimed to be “green” based only on few characteristics, while ignoring other relevant environmental issues.
2. *Sin of no proof*: a product is declared to be sustainable, but there is no real proof of this (i.e., no available information or third-party certifications).
3. *Sin of vagueness*: a green product is poorly defined, and this misleads consumers.
4. *Sin of worshiping false labels*: a product seems to have the approval of third parties but does not really have.
5. *Sin of irrelevance*: an environmental claim which is really true, but not important to those consumers looking for sustainable products.
6. *Sin of lesser of two evils*: a product is sustainable within its product category, but it has a negative impact within the category as a whole (e.g., organic cigarettes or fuel-efficient sport-utility vehicles).
7. *Sin of fibbing*: a green product that is simply false.

However, many companies perform the act of greenwashing not only for improving their reputation and brand image or attracting customers and employees, but especially for

²⁵ Definition provided by www.ul.com

²⁶ See in this regard <https://www.ul.com/insights/sins-greenwashing>

getting high ESG ratings so as to fall within sustainable indices, which are becoming more and more prevalent; for this reason, as mentioned in Paragraph 2.3, some firms feel they have to adopt and communicate supposed sustainable practices and they “greenwash”. These companies alter their non-financial reports, causing the rating agencies to assign wrong ESG scores (when raters collect data from company disclosures), making it difficult for investors and asset managers to take good investment decisions. Moreover, greenwashing is favored by SRI strategies which do not use strict criteria. This is the case of the strategy of the exclusion of holdings from the investment universe: for instance, excluding firms operating in the tobacco industry from the portfolio is considered a sustainable and responsible investment, but at the same time, this may mean including those companies that do not respect the environment or human rights. Another case is the norms-based screening strategy, which consists in selecting companies that have to comply with international standards which are quite flexible and soft. Thus, the application of these soft criteria in SRI has encouraged the expansion of the phenomenon of greenwashing (Cavallito et al., 2017). In order to reduce greenwashing, Delmas and Burbano (2011) suggested the following solutions:

- Increase the transparency of environmental performance through mandated or voluntary disclosure.
- Facilitate and improve the knowledge about greenwashing through sharing information about greenwashing incidents and reducing regulatory uncertainty.
- Effectively align intra-firm structures, processes and incentives through improving information related to environmental communication decisions, providing ethical leadership and training and aligning employee incentives.

Despite this, greenwashing could be deterred by regulating false environmental declarations, but this is difficult due to the impossibility of measuring and evaluating the degree of greenwashing (Delmas and Burbano, 2011).

Chapter III Empirical analysis: comparison of ESG portfolios

This chapter outlines the data and methodology employed for constructing and evaluating ESG portfolios and shows the empirical results of the analysis. The objective of this research is to compare the performance of portfolios of stocks with low environmental, social and governance scores and the performance of portfolios of stocks with high ESG rankings in order to investigate whether there are significant differences in returns and risk exposure between portfolios. The analysis was carried out by considering the total ESG score and the three dimensions (i.e., E, S and G) separately. I first examined portfolios individually and, in the final part of the study, I analysed a long-short investment strategy.

Stocks were ranked based on the scores they received by the data provider Refinitiv and then, those with low rankings were chosen as constituents for low-rated portfolios, while stocks with high scores were included in high-rated portfolios; all portfolios were rebalanced each year. To analyse the risk-return profile of the portfolios built, factor models of the economists Eugene Fama and Kenneth French were employed. In particular, the excess returns of individually constructed portfolios and long-short portfolios were regressed on the Fama-French three-factor and five-factor models, which help identify whether portfolios generate risk premiums. In addition, Fama-French factor models reveal the exposure of portfolios to size (i.e., market equity), value (i.e., book-to-market equity), profitability and investments (i.e., assets growth) risk factors.

3.1 Data

For the creation of the portfolios, companies included in the S&P 100 index were taken into consideration; this index measures the performance of large market cap firms across different industry groups in the United States. As of 26 February 2021, the number of constituents of the index is 101, but one constituent, Dow Inc., was removed from the list because of the lack of stock market data, since it went public on April 2019; the index constituents with the largest market capitalization and thus, with the greatest index weight are Apple Inc, Microsoft Corp., Amazon.com Inc., Tesla Inc., Alphabet Inc., Facebook Inc., Berkshire Hathaway Inc., Visa Inc., and JP Morgan Chase & Co. These firms belong to the Information Technology, Consumer Discretionary, Communication Services and

Financials sectors, which are the prevailing industries in the index²⁷. A table listing the firms used as constituents for the portfolios is exhibited in Appendix C. The analysis was carried out within the interval of time July 2003-June 2020, but some stocks were listed on the stock exchange at a later stage, thus they have reported share prices at different times during the period analysed.

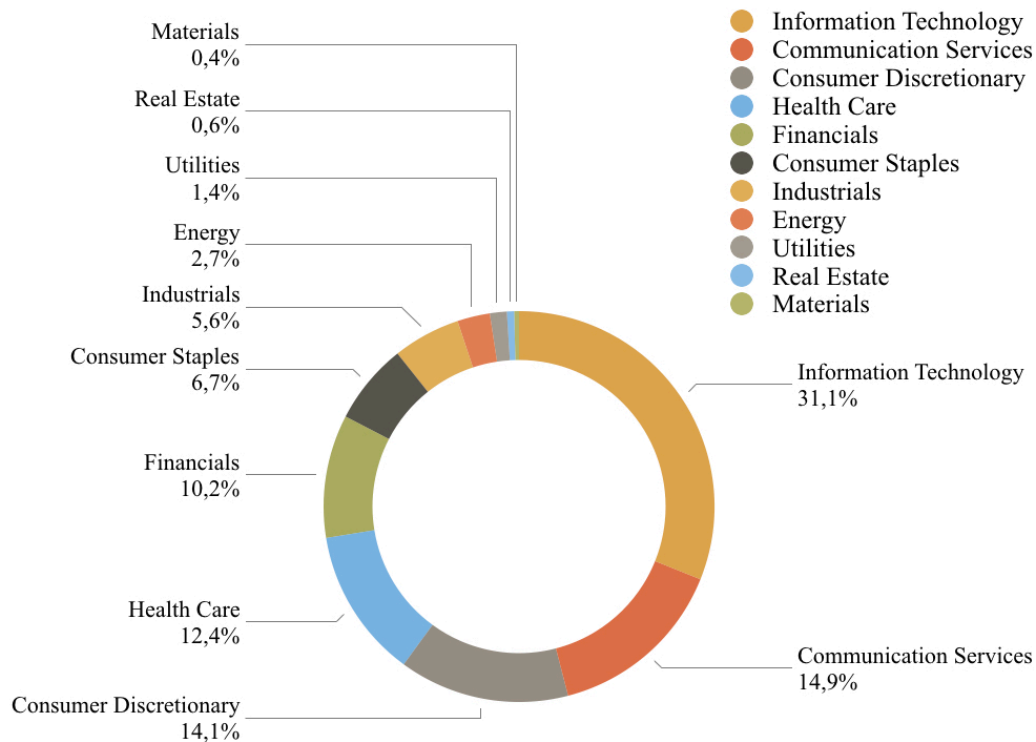
Stock market information and ESG scores for the companies considered in the portfolio construction are provided by Refinitiv, a global provider of financial data and a subsidiary of the London Stock Exchange Group, which acquired the company from Blackstone Group LP and Thomson Reuters in 2021. Refinitiv provides financial technology tools that help its customers in various activities like investing, trading, banking, and many others. One of Refinitiv's financial devices used for this empirical analysis is Eikon, a platform where users can access to data on different asset classes, market data in real time, news and so on. Like other Refinitiv's products, Eikon also offers ESG data and scores for 80% of global market cap²⁸. In Appendix D the Refinitiv's ESG scoring methodology is described.

Furthermore, risk factors used for the study of portfolio performances were downloaded from the web page of Kenneth R. French. Since the firms considered for the portfolio construction have their headquarters in the U.S., I decided to collect the Fama-French North American 5 Factors. In this case, the risk-free rate used for calculating the market risk premium is the U.S. one month Treasury bill rate.

²⁷ See in this regard S&P 100, <https://www.spglobal.com/spdji/en/indices/equity/sp-100/#data>

²⁸ See in this regard www.refinitiv.com

Graph 11. S&P 100 sector breakdown



Source: S&P 100, <https://www.spglobal.com/spdji/en/indices/equity/sp-100/#data>

3.2 Methodology

3.2.1 Portfolio construction

Since the performance analysis of portfolios is carried out using the factor models of Fama and French, the construction of individual and long-short portfolios follows the same logic used by Fama and French for building the risk factors of their models. These factors were built by ranking stocks in a region according to their size (i.e., market capitalization), book-to-market equity (BE/ME), operating profitability, and levels of investment at the end of each June of year t , and by calculating the average return of the value-weighted portfolios formed on size, book-to-market equity, profitability, and

investment from July of year t to June of year $t+1$ ²⁹. In the same way, for this research, at the end of each June of year t , companies in question were sorted in ascending order based on their average environmental, social, governance, ESG scores between July of year $t-1$ and June of year t . Rankings were available from July 2002 to June 2019. After this, I took the bottom and top quintiles, representing the 20% of the companies with the worst scores and the 20% of the companies with the best scores respectively. Firms which did not have all the scores reported during the period under analysis were not considered into the portfolio construction of that period. In this way, portfolios were rebalanced each June of year t , and as a result, the combination of constituents in the portfolios varies. Following the same logic, stocks assigned to a portfolio at the end of June of year t that did not have a reported share price from July of year t to June of year $t+1$ were replaced by other stocks. At the end of this first screening, I obtained two different portfolios for each type of score (i.e., E, S, G, overall ESG):

- portfolios consisting of 20 stocks with the worst scores (i.e., “bottom” portfolios).
- portfolios consisting of 20 stocks with the best scores (i.e., “top” portfolios).

At first, I decided to build equally-weighted portfolios, so I assigned the same weight of 5% to all 20 stocks that form individual portfolios. Then, I calculated the monthly returns of each stock from July 2003 to June 2020, by making the difference of the logarithms of the prices, where as prices I used the total return indices provided by Refinitiv from June 2003 to June 2020. The formula is as follows:

$$r_i = \ln P_t - \ln P_{t-1} = \frac{\ln P_t}{\ln P_{t-1}} \quad (3.1)$$

where

r_i = return of stock $i= 1, 2, \dots, 20$

P_t = price of the stock at time t

P_{t-1} = price of the stock at time $t-1$

Once obtained the monthly stock returns, I calculated the monthly portfolio returns from July of year t to June of year $t+1$, as the weighted average of the monthly returns of the stocks with equal weights, using the following formula:

²⁹ See in this regard Kenneth R. French, <http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/index.html>

$$r_p = \sum_{i=1}^n w_i r_i \tag{3.2}$$

where

r_p = return of the portfolio

w_i = weight assigned to stock $i = 1, 2, \dots, 20$

r_i = return of stock $i = 1, 2, \dots, 20$

For constructing value-weighted portfolios, at the end of each June of year t , I calculated the average market value between July of year $t-1$ and June of year t of the firms chosen as constituents for the various ESG portfolios. As for stock prices, the market value data were available from July 2003 to June 2020, and companies that were listed on the stock exchange after 2003 and that lack therefore a reported market value were replaced by other stocks in the portfolios. The value-weighted portfolios' returns were calculated using the formula 3.2.

In the end, a long-short investment strategy has been adopted, which consists in holding long positions in high-rated portfolios and short positions in low-rated portfolios. The reason behind the adoption of this strategy is that portfolios of high-ranked stocks are expected to outperform portfolios of low-ranked stocks. I constructed equally-weighted and value-weighted long-short portfolios on the basis of E, S, G and total ESG scores by making the difference between top and bottom portfolios.

3.2.2 Portfolio performance: Sharpe ratio and CAPM

Once calculated monthly returns for bottom and top portfolios based on the information from the environmental, social, governance and ESG scores, the analysis was first carried out on the interval of time July 2003-June 2020 and then, the sample was split into two: from July 2003 to December 2015 and from January 2016 to June 2020.

One measure I utilized for comparing the performance of portfolios is the Sharpe ratio, developed by the American economist W. F. Sharpe:

$$\text{Sharpe ratio} = \frac{r_p - r_f}{\sigma_p}$$

(3.3)

where

r_p = return of the portfolio

r_f = risk-free rate

σ_p = standard deviation of the portfolio's excess return

This is a risk-to-reward ratio, where the standard deviation (σ_p) is used as a measure of the risk (i.e., volatility) of the portfolio; it helps identify the investments with the best returns for the level of risk: the portfolio with the greatest Sharpe ratio is the one with the best risk-adjusted-performance (Fernando, 2021).

Another tool used in this analysis to compare the performance of portfolios of stocks performing poorly on ESG issues with the performance of portfolios of firms with the best ESG scores is the Capital Asset Pricing Model (CAPM). The model was developed by the joint work of the researchers H. Markowitz, W. Sharpe, J. Lintner and J. Mossin and explains the relationship between the expected return of an asset and its risk. At the basis of this model there is the distinction between the firm-specific risk of a financial instrument, which can be eliminated through diversification (i.e., by the introduction of other instruments in a portfolio), and the systematic or market risk, which cannot be eliminated and is represented by the coefficient beta (β_i). The risk factor beta describes the exposure of a stock or portfolio to the market portfolio and determines the return of an asset; it is given by the covariance of the returns of a stock with market returns, divided by the variance of market returns (CFA Society Italy, 2018; Body, Kane and Marcus, 2018):

$$\beta_i = \frac{Cov(R_i, R_m)}{\sigma^2(R_m)} \quad (3.4)$$

where

β_i = beta of stock or portfolio $i= 1, 2, \dots$

R_i = return of stock or portfolio $i= 1, 2, \dots$

R_m = market return

Stocks with betas greater than 1 are the riskiest and are said to be “aggressive”, while stocks with betas close to or lower than 1 are less volatile and are known as “defensive”. The formulation of the CAPM is as follows:

$$E(R_i) = R_f + \beta_i(E(R_m) - R_f) \quad (3.5)$$

where

$E(R_i)$ = expected return of stock or portfolio $i= 1, 2, \dots$

R_f = risk-free rate

$E(R_m)$ = expected return of the market portfolio

The above expected return-beta relationship of the CAPM can be represented graphically by the Security Market Line (SML). In equilibrium, stocks should lie on the SML because the CAPM implies that the alpha of stocks (i.e., non-market premium, α_i , which is the abnormal return not explained by the market factor) is zero, meaning that, since markets are efficient, investors cannot beat the market and cannot earn excess returns relative to market returns; the alpha is the difference between fair and actual expected returns, thus if assets are not fairly priced, they will not lie on the SML (Body, Kane and Marcus, 2018; Chen, 2021):

- positive alphas imply underpriced stocks whose expected return will be higher. For this reason, these stocks will lie above the SML.
- negative alphas imply overpriced stocks whose expected return will be lower. For this reason, these stocks will lie below the SML.

3.2.3 Portfolio performance: multi-factor models of Fama and French

Multi-factor models are more appropriate tools for assessing the performance of each portfolio; for this reason, I made use of extensions of the CAPM, the so-called “three-factor” and “five-factor” models developed by Eugene Fama and Kenneth French, which argue that investors have other risk premiums in addition to the market risk premium, that is, they are rewarded for particular risks, incurred in addition to the systematic risk. Specifically, the three-factor model captures the relation between excess returns and three risk factors, namely (Fama and French, 2014; CFA Society Italy, 2018):

- market risk premium, given by the difference between the market return and the risk-free rate of return.
- size, that is to say market capitalization, given by the share price times the number of shares outstanding.
- book-to-market equity, which refers to the book value divided by the market value.

The regression model is as follows:

$$R_i - R_f = \alpha_i + \beta_i(R_m - R_f) + s_iSMB + h_iHML + \varepsilon_i \quad (3.6)$$

where

$R_i - R_f$ = excess return of stock or portfolio $i = 1, 2, \dots$ given by the stock or portfolio return (R_i) minus the risk-free rate (R_f)

α_i = abnormal excess return of stock or portfolio $i = 1, 2, \dots$ over or below the theoretical expected return predicted by the model

$R_m - R_f$ = excess market return given by the market return minus the risk-free rate

SMB = Small Minus Big, the difference between the return on a portfolio of small firms and the return on a portfolio of big firms

HML = High Minus Low, the difference between the return on a portfolio of firms with high BE/ME ratios and the return on a portfolio of firms with low BE/ME ratios

β_i, s_i, h_i = factor exposures of stock or portfolio $i = 1, 2, \dots$ which explain the variations in the excess return

ε_i = disturbance term of stock or portfolio $i = 1, 2, \dots$

The logic behind the model is that small market cap and high BE/ME companies tend to regularly outperform the overall market (CFA Society Italy, 2018).

In order to improve the above regression model, the portfolio excess returns are regressed on the Fama-French five-factor model, which includes two other risk factors, namely profitability and investment:

$$R_i - R_f = \alpha_i + \beta_i(R_m - R_f) + s_iSMB + h_iHML + r_iRMW + c_iCMA + \varepsilon_i \quad (3.7)$$

where

RMW= Robust Minus Weak, the difference between the return on a portfolio of firms with robust profitability and the return on a portfolio of firms with weak profitability

CMA= Conservative Minus Aggressive, the difference between the return on a portfolio of low investment firms and the return on a portfolio of high investment firms

r_i, c_i = factor exposures of stock or portfolio $i= 1, 2, \dots$ which explain the variations in the excess return

With the five-factor model, Fama and French show that an increase in profitability implies an increase in expected returns, while an increase in net assets implies a decrease in the expected value of a stock; in other words, investing in firms with a robust operating profitability and low levels of investment leads to risk premiums for investors (CFA Society Italy, 2018).

Fama-French multi-factor models are relevant in ESG investing because they can be used to capture the ESG risk premium and, in this way, investors can check whether the integration of ESG criteria in portfolio construction represent an opportunity to outperform the broad market.

3.3 Empirical results

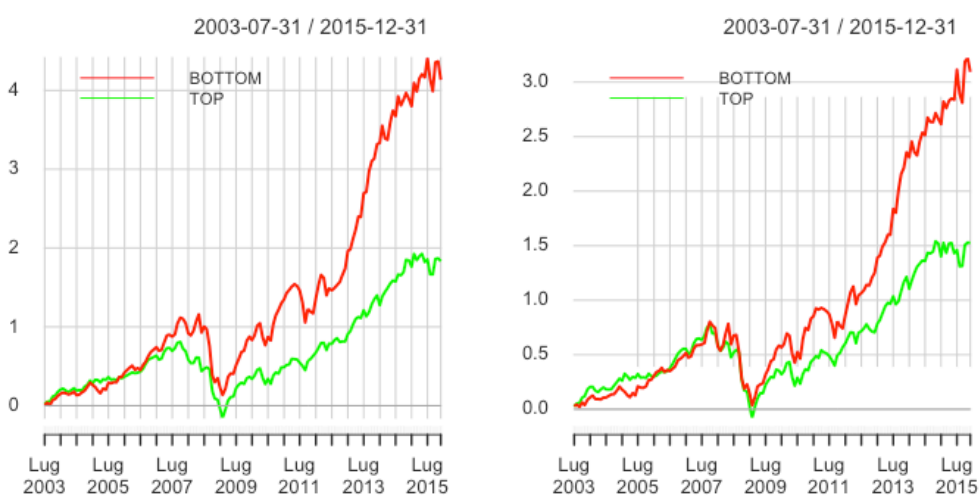
This paragraph illustrates and interprets the outcomes from the empirical analysis. Before moving forward, it is important to remember that portfolios comprising the 20 companies with the lowest scores are called “bottom” portfolios, whereas portfolios formed by the stocks with the highest scores are denoted as “top” portfolios.

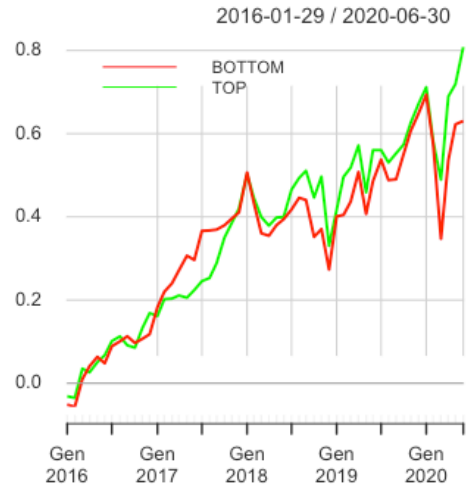
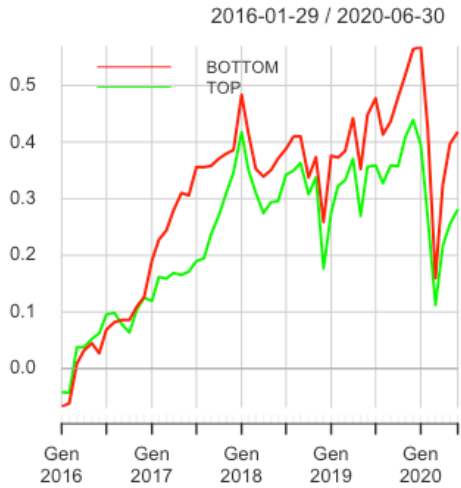
3.3.1 Descriptive statistics of E, S, G and ESG portfolios

To better understand the trend of portfolios, I first obtained the cumulative returns for the equally-weighted and value-weighted portfolios based on the E, S, G and ESG rankings from July 2003 to December 2015, and then, from January 2016 to June 2020. The cumulative returns are calculated as the product of all individual period portfolio returns, using the geometric chaining to accumulate returns. From July 2003 to December 2015 the cumulative returns of the equally-weighted and value-weighted bottom portfolios are

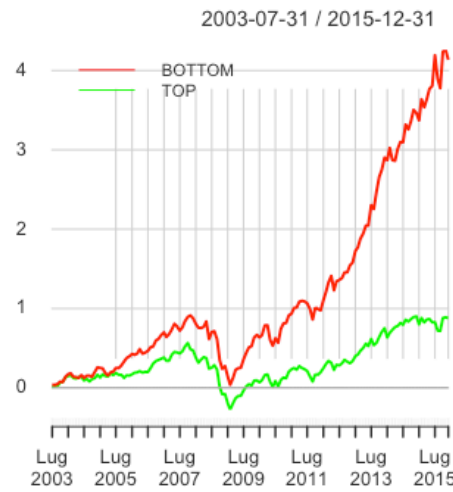
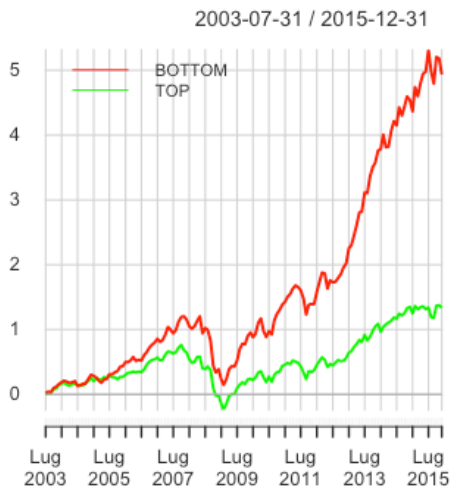
significantly higher than those of top portfolios based on the environmental, social and overall ESG scores, while this is not true for portfolios built on the basis of the G score, where the high-rated portfolio has a higher cumulative return than the low-rated portfolio. Similarly, within the timeframe January 2016-June 2020, the cumulative returns for the equally-weighted and value-weighted bottom portfolios produce higher cumulative returns than top portfolios built according to the E and S scores; on the contrary, low-ranked G portfolios generate lower cumulative returns than high-ranked portfolios, weighted both equally and according to stocks' market value. Differently, the equally-weighted top ESG portfolio has lower cumulative returns, but the value-weighted top ESG portfolio obtains higher cumulative returns.

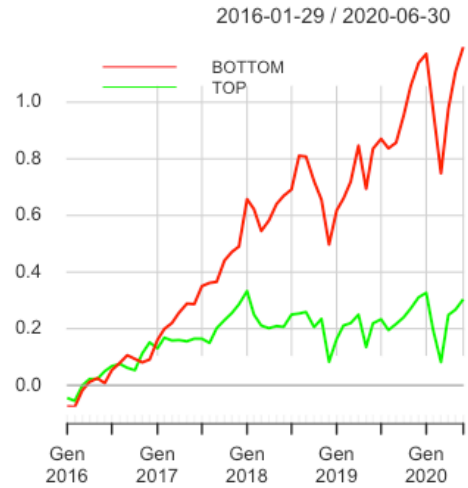
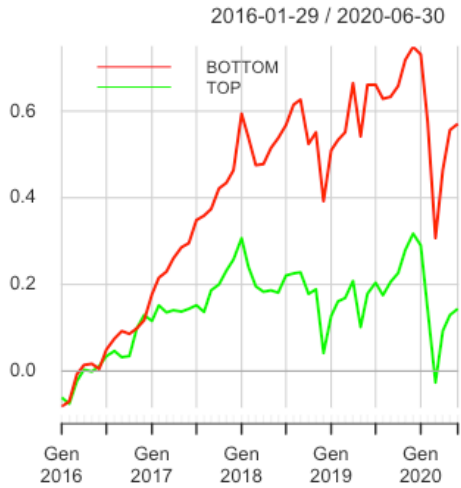
Graph 12. Cumulative returns of equally-weighted and value-weighted portfolios based on ESG score (July 2003-December 2015 and January 2016-June 2020)



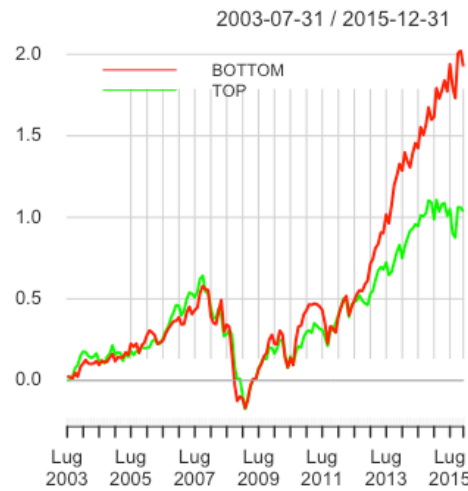


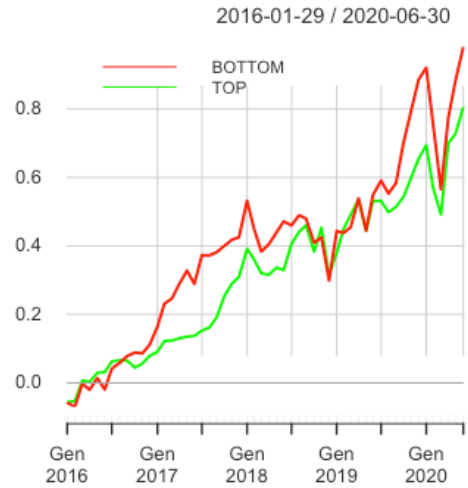
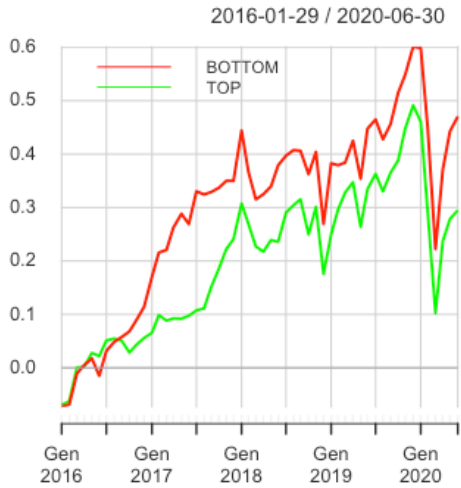
Graph 13. Cumulative returns of equally-weighted and value-weighted portfolios based on E score (July 2003-December 2015 and January 2016-June 2020)



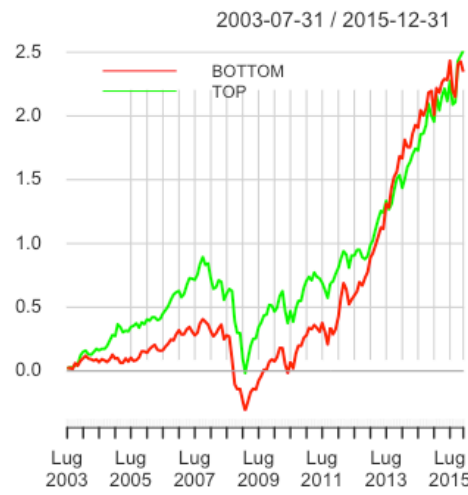
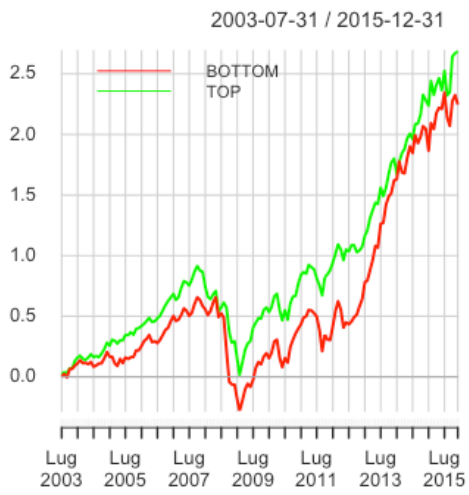


Graph 14. Cumulative returns of equally-weighted and value-weighted portfolios based on S score (July 2003-December 2015 and January 2016-June 2020)





Graph 15. Cumulative returns of equally-weighted and value-weighted portfolios based on G score (July 2003-December 2015 and January 2016-June 2020)



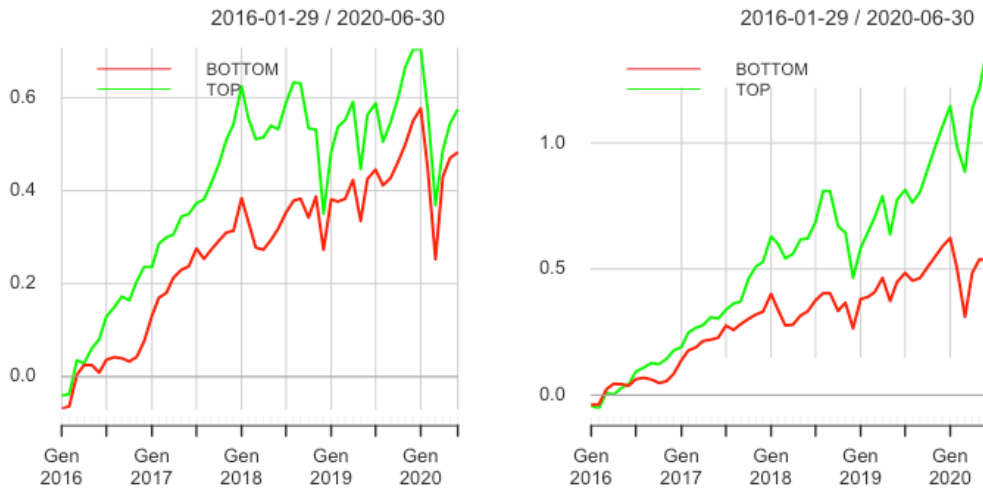


Table 13. Descriptive statistics of value-weighted portfolios

		VALUE-WEIGHTED					
		July 2003-June 2020		July 2003-December 2015		January 2016-June 2020	
		BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP
E score	Mean	1.29%	0.53%	1.19%	0.51%	1.59%	0.59%
	Standard deviation	4.45%	4.29%	4.28%	4.21%	4.94%	4.53%
	Sharpe Ratio	0.2907	0.1244	0.2781	0.1214	0.3211	0.1313
	Min	-16.54%	-18.09%	-16.54%	-18.09%	-11.32%	-12.28%
	Max	12.97%	15.34%	11.02%	11.36%	12.97%	15.34%
S score	Mean	0.97%	0.72%	0.82%	0.55%	1.39%	1.17%
	Standard deviation	4.55%	3.91%	4.45%	3.92%	4.82%	3.88%
	Sharpe Ratio	0.2132	0.1834	0.1839	0.1409	0.2878	0.3024
	Min	-16.27%	-15.57%	-16.27%	-15.57%	-10.78%	-9.53%
	Max	13.44%	13.93%	13.4%	9.99%	13.44%	13.93%
G score	Mean	0.9%	1.13%	0.91%	0.92%	0.88%	1.71%
	Standard deviation	4.44%	4.17%	4.56%	4.04%	4.12%	4.48%
	Sharpe Ratio	0.2038	0.2718	0.2003	0.2285	0.2136	0.3819
	Min	-18.09%	-15.23%	-18.09%	-15.23%	-12.62%	-10.88%
	Max	13.4%	13.37%	11.23%	11.18%	13.4%	13.37%
ESG score	Mean	1.03%	0.82%	1.04%	0.7%	1.01%	1.18%
	Standard deviation	4.37%	3.9%	4.3%	3.85%	4.58%	4.05%
	Sharpe Ratio	0.2361	0.2113	0.241	0.1804	0.2214	0.2925
	Min	-15.94%	-16.5%	-15.94%	-16.5%	-14.54%	-11.11%
	Max	14.01%	13.43%	12.05%	11.16%	14.01%	13.43%

In this section I will focus on the descriptive statistics of value-weighted portfolios, which are exhibited in Table 13, while the equally-weighted portfolios' descriptive statistics can be found in Appendix E. As observable in Table 13, the arithmetic mean of monthly returns is higher for low-ranked portfolios, except for portfolios formed on the basis of the governance score, where bottom portfolios have lower monthly average returns than top portfolios, and for the portfolio based on the overall ESG ranking within the time period January 2016-June 2020, where the high-rated portfolio produces higher mean returns. It is easy to note that higher returns are associated to higher risks; in fact, when

analyzing the standard deviation, low-rated portfolios are more volatile. But this does not hold for G portfolios within the entire sample and between July 2003 and December 2015 and for the portfolio based on the ESG score between January 2016 and June 2020, because the higher returns of top portfolios are related to lower standard deviations. Within the whole sample and between July 2003 and December 2015 the bottom E portfolio is the one with the highest monthly average return and its corresponding top E portfolio has the lowest mean return. However, in the period January 2016-June 2020 the portfolio with the highest monthly average return is the high-ranked one based on the governance score, and the one with the lowest mean return is the top portfolio constructed on the basis of the E ranking. Within the overall sample, the low-ranked S portfolio is the riskiest and the high-ranked ESG portfolios is the least risky. In the interval of time July 2003-December 2015, the bottom G portfolio has the highest standard deviation, while the high-rated portfolio built on the basis of the ESG score is the least volatile. Differently, between January 2016 and June 2020 the bottom portfolio based on the E ranking is the most volatile, while the top portfolio based on the S ranking has the lowest standard deviation. Moreover, it is interesting to observe that the top E portfolio experiences the highest performance, with a return of 15.34%; conversely, the portfolios facing the lowest returns are the high-ranked portfolio based on the environmental score and the low-rated G portfolio (-18.09%).

In order to have a first idea on the performance of the portfolios built, it is useful to look at the Sharpe ratio; in this way, I can measure the amount of reward I get compared to the risk I take in investing in one of the portfolios formed using the information from the environmental, social, governance and ESG score. Within the overall sample and in the timeframe July 2003-December 2015, portfolios including firms with the lowest scores have higher Sharpe ratios, with the only exception of portfolios based on the G ranking because, in this case, high-ranked portfolios perform better per unit of risk incurred. Furthermore, portfolios with the best risk-return profile are those composed of companies with the lowest environmental score. In turn, top E portfolios have the lowest Sharpe ratios. When observing the period January 2016-June 2020, the findings on the Sharpe ratio are almost the opposite of what has been achieved so far: top portfolios are those performing better, with the exception of portfolios based on the environmental score, where the high-rated portfolio has a lower risk-return profile than the bottom one. Here, the portfolio performing better is the high-ranked one based on the G score, with a Sharpe ratio of 38.19%, while the top E portfolio has the lowest ratio of 13.13%.

In general, in the time interval July 2003-December 2015 I can state that low-rated portfolios notably outperform their corresponding high-ranked portfolios. But this does not go for the time span January 2016-June 2020, where high-rated portfolios are those having better risk-return profiles.

3.3.2 Regression results of E, S, G and ESG portfolios

In this paragraph the findings of the regressions carried out using the CAPM, the three-factor and five-factor models of Fama and French are shown. Also in this case, I will analyze only the results of value-weighted portfolios; regression results of equally-weighted portfolios can be observed in Appendix F.

Note that for this empirical analysis a 5% significance level has been used, meaning that if the p-value is lower than 5%, the estimate is significantly different from zero or, in other words, I reject the null hypothesis (H_0) that the true value of the estimate is zero.

The regression results of value-weighted portfolios based on the total ESG score are the first to be exhibited, followed by the findings regarding the regressions on the value-weighted portfolios based on the individual dimensions, E, S and G.

Table 14. Regression results of value-weighted ESG portfolios

ESG score		VALUE-WEIGHTED					
		July 2003-June 2020		July 2003-December 2015		January 2016-June 2020	
		BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP
CAPM	alpha	0.002363	0.001109	0.003016	0.0002909	0.0004956	0.003395
	beta	0.931727***	0.822699***	0.921669***	0.8200855***	0.9585788***	0.826636***
	R-squared	0.8313	0.8119	0.8141	0.8047	0.8768	0.8325
	adj. R-squared	0.8305	0.8109	0.8128	0.8034	0.8745	0.8293
Fama-French 3 factor model	alpha	0.001643	0.0009102	0.002869*	0.0003594	-0.001294	0.001571
	beta	0.999027***	0.9239651***	0.998164***	0.8931526***	1.057528***	0.962176***
	SMB	-0.205603**	-0.4369617***	-0.215734**	-0.4313373***	-0.285036*	-0.403645**
	HML	-0.139020**	0.1570600***	-0.239643***	0.2660102***	-0.024206	0.038420
	R-squared	0.8485	0.8618	0.8383	0.8681	0.8935	0.8668
	adj. R-squared	0.8462	0.8598	0.835	0.8653	0.8871	0.8589
Fama-French 5 factor model	alpha	0.001895	0.0005139	0.003265*	-0.00006057	-0.0009756	0.001174
	beta	0.998499***	0.9534742***	0.993861***	0.9275***	1.0601839***	0.975729***
	SMB	-0.222776***	-0.4351138***	-0.235988**	-0.4288***	-0.3278805*	-0.389764**
	HML	-0.173800*	0.0065179	-0.292331***	0.1143	0.0688318	-0.102427
	RMW	-0.112386	0.0020739	-0.141257	0.0008091	-0.1318699	0.015938
	CMA	0.059447	0.3588409***	0.097576	0.3834***	-0.2149368	0.307233
	R-squared	0.8502	0.8728	0.8418	0.8819	0.8973	0.8727
	adj. R-squared	0.8464	0.8696	0.8363	0.8778	0.8865	0.8595

Note: *** p-value < 0.001; ** p-value < 0.01; * p-value < 0.05.

First, I analyze the regression outcomes regarding the total ESG score (Table 14). With respect to the alpha, only the one of the low-rated portfolio in the timeframe July 2003-December 2015 becomes significant and positive by adding risk factors to the model. This implies that the low-ranked ESG portfolio within this time period tends to have abnormal rates of return above the benchmark return. In the CAPM betas are significant and lower than 1 for all portfolios; this remains true when applying multi-factor models to the whole sample and between July 2003-December 2015, meaning that both bottom and top portfolios move in the same direction as the market; however, in the interval of time January 2016-June 2020 the bottom portfolio becomes riskier than the top portfolio, with a beta greater than 1, while the high-rated portfolio's beta is lower than 1. The SMB risk factor is significant and negative, highlighting the fact that most portfolios' returns depend on big market cap firms.

In the entire sample and between July 2003 and December 2015, the loadings on the HML factor are significant and negative for bottom portfolios and positive for top portfolios, but by adding the five factors, the value factor remains significant only for bottom portfolios, with a negative loading. This is different from the sample January 2016-June 2020, where the HML risk factor is not significantly different from zero. The RMW risk factor is not statistically significant in any portfolio, so the profitability factor does not explain any variations in portfolios' returns. The CMA risk factor is significant and positive only for top portfolios in the entire period assessed and in the time span July 2003-December 2015. In the end, the goodness of fit (adjusted R^2) improves by adding the five factors, ranging from 84% to 89%, which suggests that the five-factor model properly explains the variations in portfolios' returns.

Table 15. Regression results of value-weighted E portfolios

E score		VALUE-WEIGHTED					
		July 2003–June 2020		July 2003–December 2015		January 2016–June 2020	
		BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP
CAPM	alpha	0.005009***	-0.002580*	0.004654**	-0.002248	0.005919	-0.003525
	beta	0.93040***	0.927294***	0.904111***	0.922482***	0.994246***	0.940198***
	R-squared	0.7967	0.8549	0.793	0.8528	0.8093	0.8604
	adj. R-squared	0.7957	0.8541	0.7916	0.8518	0.8056	0.8578
Fama-French 3 factor model	alpha	0.004246**	-0.002387*	0.004599**	-0.002175	0.001963	-0.003057
	beta	1.006480***	0.992776***	0.959044***	0.978020***	1.123508***	1.023346***
	SMB	-0.239541***	-0.328861***	-0.210246**	-0.350491***	-0.338286*	-0.281022*
	HML	-0.136679*	0.234489***	-0.050547	0.251922***	-0.216361*	0.204689*
	R-squared	0.8163	0.8873	0.8033	0.8913	0.8596	0.8812
	adj. R-squared	0.8136	0.8856	0.7992	0.8891	0.8512	0.874
Fama-French 5 factor model	alpha	0.004763***	-0.0027385**	0.005320**	-0.002372*	0.002587	-0.003901
	beta	1.000726***	1.0314372***	0.949843***	1.011592***	1.113542***	1.073787***
	SMB	-0.270716***	-0.3382251***	-0.246190**	-0.360403***	-0.386724*	-0.302152*
	HML	-0.174700*	0.0114871	-0.136719	0.059120	-0.011566	-0.126799
	RMW	-0.202390*	-0.0745329	-0.249894*	-0.086963	-0.124986	-0.156337
	CMA	0.048453	0.5154291***	0.154850	0.465052***	-0.456786	0.703924**
	R-squared	0.8207	0.9077	0.8135	0.9112	0.8697	0.9056
	adj. R-squared	0.8161	0.9054	0.807	0.9081	0.8562	0.8958

Note: *** p-value < 0.001; ** p-value < 0.01; * p-value < 0.05.

Focusing on the environmental pillar (Table 15), within the entire sample and from July 2003 to December 2015, portfolios maintain significant alphas throughout the regressions, which are positive for low-ranked portfolios and negative for high-ranked portfolios. This means that bottom portfolios have positive abnormal returns, while top portfolios have negative abnormal returns which cannot be explained by Fama-French factors. In the period which goes from January 2016 and June 2020, portfolios have all non-significant alphas. In the CAPM all portfolios' betas are significant and lower than 1, so portfolios tend to move with the market. When adding factors to the model, betas become greater than 1, except for bottom portfolios within the whole sample and between July 2003-December 2015, which have significant betas close to 1. Thus, most portfolios are more sensitive to the variations in the returns of the market. The regression results of the three-factor and five-factor models highlight that the SMB risk factor is significant and negative, which means that big market cap firms generate most of the portfolios' returns. When applying the three-factor model, the HML risk factor is significant and positive for high-rated portfolios, which points out that value firms (i.e., firms with a high book-to-market ratio, probably undervalued firms) have a good impact on top portfolios' returns, but low-rated portfolios in the overall sample and between January 2016-June

2020 have significant and negative loadings on the HML factor, indicating that growth firms (i.e., firms with a low book-to-market ratio, probably overvalued firms) with low E scores tend to have risk premiums. However, in the five-factor model the value factor is not significant. The RMW risk factor is only significant and negative for portfolios formed by the 20 stocks with the lowest E scores within the whole sample and within the time period July 2003-December 2015; this implies that these portfolios are biased towards companies with low levels of profitability. The CMA risk factor is significant and positive for high-rated portfolios, so firms with low levels of investment have a greater impact on top portfolios' returns. When looking at the adjusted R², which tells as whether a model fits the current data, it is possible to note that for all portfolios it is high, ranging from about 79% to 95%, and it increases by adding factors to the models; this signifies that the additional variables improve the regression model.

Table 16. Regression results of value-weighted S portfolios

S score		VALUE-WEIGHTED					
		July 2003-June 2020		July 2003-December 2015		January 2016-June 2020	
		BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP
CAPM	alpha	0.001581	0.00001621	0.0006322	-0.001269	0.004231	0.003669
	beta	0.954254***	0.8248***	0.9506201***	0.839463***	0.960309***	0.784720***
	R-squared	0.8029	0.8138	0.8079	0.8156	0.7931	0.8177
	adj. R-squared	0.8019	0.8128	0.8066	0.8143	0.7891	0.8142
Fama-French 3 factor model	alpha	0.0003446	-0.0005583	0.0004092	-0.001252	0.0008833	0.0004175
	beta	1.0581903***	0.9436616***	1.0578168***	0.927521***	1.1146855***	0.9330541***
	SMB	-0.2993659***	-0.4634495***	-0.2847231***	-0.449370***	-0.4329944**	-0.4152994***
	HML	-0.2668207***	0.0427210	-0.3744754***	0.165785**	-0.1012336	-0.1013229
	R-squared	0.8464	0.8669	0.8563	0.8707	0.8371	0.8812
	adj. R-squared	0.8441	0.8649	0.8533	0.868	0.8273	0.8741
Fama-French 5 factor model	alpha	0.0004396	-0.0007803	0.0006617	-0.001557	0.001086	0.00003913
	beta	1.0545326***	0.9702849***	1.0489932***	0.960072***	1.104626***	0.9520***
	SMB	-0.3028091***	-0.4712794***	-0.2937639***	-0.452326***	-0.432755*	-0.4161***
	HML	-0.2551883***	-0.1138643*	-0.3656789***	0.002773	-0.024603	-0.2444*
	RMW	-0.0213250	-0.0603817	-0.0596024	-0.037197	0.019405	-0.03750
	CMA	-0.0321266	0.3602473***	-0.0371840	0.402319***	-0.164381	0.3069
	R-squared	0.8465	0.8792	0.8566	0.8864	0.8382	0.8875
	adj. R-squared	0.8426	0.8761	0.8516	0.8825	0.8214	0.8757

Note: *** p-value < 0.001; ** p-value < 0.01; * p-value < 0.05.

Now my focus moves to the social pillar (Table 16), where alphas of all portfolios are not significantly different from zero, thus there are no abnormal rates of return and variations in returns can be explained entirely by regression models. In the CAPM betas are all significant and lower than 1, so they are less exposed to the market risk, but in multi-

factor models low-rated portfolios have betas greater than 1 and, therefore, are more volatile than the market portfolio. Instead, top portfolios' betas are lower than 1, which means that these portfolios are underexposed to the market. All portfolios in multi-factor models are negatively exposed to the SMB risk factor, which is statistically significant, so, as well as returns of portfolios built on the basis of the E score, also returns of portfolios based on the S ranking are most influenced by large market cap companies. When considering the three-factor model, the loading on the HML risk factor is significant and negative for low-rated portfolios within the entire sample and from July 2003 to December 2015, suggesting that, within these samples, portfolios of stocks with low S scores are more inclined towards growth firms with low BE/ME ratios. However, the HML factor is significant also for the top portfolio within the timeframe July 2003-December 2015, but with a positive loading, which means that this portfolio return is most influenced by value firms. After applying the five-factor model, the HML factor is significant and negative for both bottom and top portfolios in the overall sample, for the low-rated portfolio in the time span July 2003-December 2015 and for the high-rated portfolio between January 2016 and June 2020. The RMW risk factor is not significant for any portfolio in all samples. The CMA risk factor is significant and positive only for high-ranked portfolios in the whole sample and between July 2003 and December 2015, implying that, in these samples, portfolios' returns of high-ranked S stocks are explained by conservative companies, with low levels of investment. Ultimately, the adjusted R^2 is high for all regression models in all samples, especially for multi-factor models, which have, therefore, a high explanatory power.

Table 17. Regression results of value-weighted G portfolios

G score		VALUE-WEIGHTED					
		July 2003–June 2020		July 2003–December 2015		January 2016–June 2020	
		BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP
CAPM	alpha	0.0009813	0.003910**	0.001397	0.002415	-0.00008691	0.008050**
	beta	0.9480452***	0.859795***	0.977633***	0.843411***	0.8763***	0.895658***
	R-squared	0.8304	0.7779	0.8125	0.7736	0.9035	0.798
	adj. R-squared	0.8296	0.7768	0.8112	0.7721	0.9016	0.7941
Fama-French 3 factor model	alpha	0.0005297	0.003253*	0.001315	0.002470	-0.0009622	0.003462
	beta	1.0361971***	0.979035***	1.068358***	0.921263***	0.9816122***	1.041917***
	SMB	-0.3401139***	-0.453437***	-0.356282***	-0.440317***	-0.3251749***	-0.380407**
	HML	0.0211597	0.009608	-0.063607	0.241103***	0.0917360	-0.257593**
	R-squared	0.8527	0.8236	0.8373	0.8301	0.9236	0.8799
	adj. R-squared	0.8505	0.821	0.8339	0.8267	0.919	0.8727
Fama-French 5 factor model	alpha	0.001031	0.002799*	0.002038	0.001730	-0.0008879	0.003642
	beta	1.032928***	1.000398***	1.055510***	0.961684***	0.9901104***	1.022246***
	SMB	-0.372339***	-0.440375***	-0.390030***	-0.423061***	-0.3536798***	-0.354978*
	HML	-0.032174	-0.073739	-0.124817	0.113933	0.1019338	-0.173834
	RMW	-0.210119*	0.078353	-0.232527*	0.101980	-0.1002429	0.111890
	CMA	0.083304	0.214719	0.096173	0.346764**	-0.0320371	-0.170710
	adj. R-squared	0.8579	0.8273	0.8438	0.8399	0.9246	0.882
		0.8543	0.8229	0.8384	0.8343	0.9167	0.8697

Note: *** p-value < 0.001; ** p-value < 0.01; * p-value < 0.05.

From below my attention shifts to the governance pillar (Table 17). With regards to the whole sample, high-rated portfolios show significant and positive alphas, which means that, throughout the entire period analyzed, top G portfolios can earn returns that exceed the broad market. The top portfolio in the CAPM between January 2016 and June 2020 is significant and positive too, but when adding risk factors to the model its alpha become non-significant. When observing portfolios' betas in the CAPM, they are all significant and lower than 1, hence portfolios tend to move in the same direction as the market. However, this does not apply to multi-factor models because in the overall sample and in the timeframe July 2003-December 2015 low-rated portfolios are more likely to amplify market movements (betas > 1), while top portfolios are less volatile than the market portfolio (beta < 1); on the contrary, between January 2016 and June 2020 the beta of the bottom portfolio is close to 1, so this portfolio is less risky than the market, while the top portfolio is more exposed to systematic risk, with a beta greater than 1. As well as for portfolios based on ESG, E and S scores, also for portfolios based on the G score the loading on the SMB factor is significant and negative, highlighting once again that big market cap firms generate most of portfolios' returns. When looking at the HML risk factor, it becomes non-significant in all samples, by adding the profitability and

investment factors to the regression model. Throughout the whole period considered and within the time period that goes from July 2003 to December 2015, low-rated portfolios show significant and negative loadings on the RMW factor, therefore, non-profitable firms with low G rankings in these samples generate risk premiums. Differently, from July 2003 to December 2015 the CMA risk factor is significant and positive only for top portfolios, implying a bias towards conservative firms with low levels of investment. As concerns the adjusted R^2 , it increases by adding factors to the regression model. This is not true for the interval of time going from January 2016 to June 2020, where the adjusted R^2 rises by adding the size and value factors to the model, but compared to the three-factor model it slightly decreases by adding the profitability and investment factors.

In order to draw overall conclusions, I focus on the regression results obtained from the five-factor model, which has a greater explanatory power and properly justifies the variations in portfolios' returns. In the sample covering the period July 2003-December 2015, bottom E and ESG portfolios earn returns that exceed the whole market, while only the top E portfolio underperforms the market portfolio. With regards to betas, between July 2003 and December 2015 high-rated E portfolios are riskier than low-rated ones and, on the contrary, bottom S and G portfolios are more volatile than top portfolios. Both low-ranked and high-ranked ESG portfolios move in the same direction as the market.

In the sample which goes from January 2016 to June 2020, no portfolio generates abnormal excess returns. In this timeframe, bottom portfolios tend to have a greater risk profile than top portfolios, with the exception of G portfolios, where the high-rated portfolio is more volatile than the low-rated one. In all intervals of time analyzed, low-rated and high-rated portfolios are skewed towards big-market cap firms. Growth stocks with low book-to-market ratios have a moderate impact on returns of bottom portfolios based on the S and ESG scores during the time period July 2003-December 2015 and on the top S portfolio from January 2016 to June 2020. Low-rated E and G portfolios' returns in the sample July 2003-December 2015 are influenced by non-profitable companies. Ultimately, top E portfolios in each sample and high-ranked S, G and ESG portfolios between July 2003 and December 2015 have a bias towards conservative firms, with low levels of investment.

3.3.3 Long-short strategy

In this paragraph the empirical results of the long-short strategy are shown in order to check whether exist significant differences in the performances of low-rated and high-rated portfolios. Also in this case, only the findings of value-weighted long-short portfolios will be examined, while the descriptive statistics and regression results of equally-weighted long-short portfolios can be found in Appendix G and H respectively. After the discussion of the descriptive statistics, regression results of long-short ESG portfolios are presented, followed by those of long-short portfolios based on the E, S and G scores.

In order to investigate the significant differences in the performance of bottom and top portfolios, I focused on the alpha resulting from the regressions. The alpha represents the potential abnormal excess return which can be generated by a portfolio of stocks over or below the expected return predicted by the model, which is the return earned for the risk assumed. In this case, since long-short portfolios are built by doing the difference between top and bottom portfolios, if the alpha is positive and statistically significant, then most of the portfolio return comes from the top portfolio; on the contrary, if the alpha is negative and significant, then the bottom portfolio is the major contributor to the portfolio return. If the alpha is not significantly different from zero, then the bottom and top portfolios are indifferent.

Table 18. Descriptive statistics of value-weighted long-short portfolios

		LONG-SHORT STRATEGY VALUE-WEIGHTED		
		July 2003-June 2020	July 2003-December 2015	January 2016-June 2020
E score	Mean	-0.76%	-0.68%	-0.99%
	Standard deviation	2.47%	2.22%	3.06%
	Sharpe Ratio	-0.3082	-0.3049	-0.3241
	Min	-8.17%	-7.92%	-8.17%
	Max	6.74%	6.11%	6.74%
S score	Mean	-0.25%	-0.27%	-0.21%
	Standard deviation	2.65%	2.61%	2.77%
	Sharpe Ratio	-0.0953	-0.1019	-0.0774
	Min	-8.85%	-8.85%	-6.19%
	Max	10.51%	10.51%	6.54%
G score	Mean	0.23%	0.01%	0.83%
	Standard deviation	2.56%	2.59%	2.38%
	Sharpe Ratio	0.0889	0.0039	0.3488
	Min	-7.22%	-7.22%	-3.95%
	Max	12.99%	12.99%	7.68%
ESG score	Mean	-0.21%	-0.34%	0.17%
	Standard deviation	2.48%	2.4%	2.69%
	Sharpe Ratio	-0.0832	-0.1428	0.0634
	Min	-6.42%	-6.34%	-6.42%
	Max	8.69%	7.73%	8.69%

As can be observed in Table 18, the descriptive statistics of long-short E, S, G and ESG portfolios are consistent with those of portfolios individually constructed using the information from E, S, G and overall ESG scores; actually, since mean returns of high-rated E, S and ESG portfolios are lower than low-rated E, S and ESG portfolios throughout the entire sample and from July 2003 to December 2015, monthly average returns of long-short E, S and ESG portfolios in these samples are negative. On the contrary, in the same samples, mean returns of top G portfolios are higher than those of bottom G portfolios, hence long-short G portfolios have positive monthly average returns. Furthermore, generally, the long-short portfolio that enjoys the highest return is the one based on the governance score, whereas the long-short portfolio experiencing the lowest return is the one built according to the social ranking. In the whole sample, as well as between July 2003 and December 2015, only the long-short G portfolio has a positive Sharpe ratio, suggesting that it would be better to hold a long position in bottom E, S and ESG portfolios and a short position in top E, S and ESG portfolios. When considering the timeframe January 2016-June 2020, long-short E and S portfolios have negative mean returns because bottom E and S portfolios have higher monthly average returns than top E and S portfolios; contrariwise, long-short G and ESG portfolios have positive mean returns given that, in this sample, high-rated G and ESG portfolios experience higher returns than low-rated G and ESG portfolios. Sharpe ratios are negative for long-short E

and S portfolios and positive for long-short G and ESG portfolios. This confirms that a long strategy for high-ranked G and ESG portfolios and a short strategy for low-ranked G and ESG portfolios are recommendable, while a long position should be hold in bottom E and S portfolios and a short position should be hold in top E and S portfolios.

Table 19. Regression results of value-weighted long-short ESG portfolios

ESG score		LONG-SHORT STRATEGY VALUE-WEIGHTED		
		July 2003-June 2020	July 2003-December 2015	January 2016-June 2020
CAPM	alpha	-0.002302	-0.003788	0.001891
	beta	-0.106599**	-0.099379*	-0.129003
	R-squared	0.03387	0.0307	0.04619
	adj. R-squared	0.02909	0.02415	0.02785
Fama-French 3 factor model	alpha	-0.001785	-0.003575*	0.001897
	beta	-0.073131	-0.102435*	-0.094956
	SMB	-0.228510**	-0.214680*	-0.111163
	HML	0.293301***	0.500149***	0.062614
	R-squared	0.1275	0.2328	0.05331
	adj. R-squared	0.1144	0.217	-0.003488
Fama-French 5 factor model	alpha	-0.002441	-0.004395*	0.001177
	beta	-0.042399	-0.063099	-0.084469
	SMB	-0.209563*	-0.192100*	-0.052802
	HML	0.173734	0.397199***	-0.172451
	RMW	0.113734	0.140213	0.153415
	CMA	0.308303*	0.295201	0.525283
	R-squared	0.1489	0.2547	0.09948
	adj. R-squared	0.1274	0.2289	0.005674

Note: *** p-value < 0.001; ** p-value < 0.01; * p-value < 0.05.

Now my attention shifts to the regression results of long-short portfolios. Table 19 shows the regression findings of long-short portfolios built on the basis of the total ESG score. Significant and negative alphas are observable only in multi-factor models during the time interval July 2003-December 2015; this is in line with the results of the regressions on value-weighted ESG portfolios within the same period because bottom portfolios generate significant and positive abnormal returns. It is possible to conclude that, from July 2003 to December 2015, the low-rated ESG portfolio contributes most to the performance of the long-short portfolio, whereas, from January 2016 to June 2020 there are no abnormal returns characterizing the performance of stocks with low and high ESG scores. With respect to the market risk factor, only the beta in the sample July 2003-December 2015 remains significant and negative in the three-factor model. However, the

results suggest no significant differences in the volatility between bottom and top ESG portfolios. The SMB risk factor is significant and negative in multi-factor models of the whole sample and of the sample July 2003-December 2015. This can also be noted in individually constructed value-weighted ESG portfolios within the same samples. Therefore, long-short ESG portfolios have a bias towards big market cap companies, both with low and high ESG rankings. The significance of the HML factor is maintained in multi-factor models only by the long-short portfolio of the sample July 2003-December 2015, with a positive loading. This means that, in this sample, value firms have risk premiums; however, this is not consistent with the value-weighted ESG portfolio in the same sample, because only the bottom portfolio have a significant but negative exposure to the value risk factor. Since value-weighted top ESG portfolios and long-short ESG portfolios in the total sample and between July 2003 and December 2015 show significant and positive loadings on the CMA factor, the long-short portfolios' returns in these samples are most affected by companies with low levels of investment and high ESG scores. It is interesting to observe that there are no significant differences in the exposure to risk factors between low-ranked and high-ranked ESG portfolios from January 2016 to June 2020.

Table 20. Regression results of value-weighted long-short E portfolios

		LONG-SHORT STRATEGY VALUE-WEIGHTED		
E score		July 2003-June 2020	July 2003-December 2015	January 2016-June 2020
CAPM	alpha	-0.0086374***	-0.007966***	-0.010452*
	beta	-0.0006809	0.020575	-0.051108
	R-squared	0.000001396	0.001533	0.005569
	adj. R-squared	-0.004949	-0.005213	-0.01356
Fama-French 3 factor model	alpha	-0.007685***	-0.007840***	-0.005987
	beta	-0.011773	0.021552	-0.099767
	SMB	-0.086470	-0.139321	0.064710
	HML	0.368389***	0.296964***	0.421038**
	R-squared	0.1232	0.08658	0.1999
	adj. R-squared	0.11	0.06781	0.1519
Fama-French 5 factor model	alpha	-0.008561***	-0.008761***	-0.007461
	beta	0.033337	0.064997	-0.039770
	SMB	-0.064734	-0.113504	0.093654
	HML	0.179603*	0.186424	-0.116425
	RMW	0.127132	0.161079	-0.025744
	CMA	0.475885***	0.319612*	1.163824**
	R-squared	0.1719	0.1173	0.3442
	adj. R-squared	0.151	0.08661	0.2759

Note: *** p-value < 0.001; ** p-value < 0.01; * p-value < 0.05.

When focusing on the regression results of long-short E portfolios (Table 20), it is possible to note that within the entire period analyzed and in the sample July 2003-December 2015 alphas are significant and negative for all models, suggesting that bottom E portfolios generate abnormal returns compared to top E portfolios. During the time span January 2016-June 2020, only in the CAPM the alpha is significant and negative, but by adding risk factors to the model it becomes non-significant, so there are no abnormal returns which differentiate the performance of the two portfolios. In the three-factor model the HML factor is significant and positive: since the loading on the value factor is significant and positive for top E portfolios, long-short E portfolios are skewed towards value firms with high environmental scores. However, in the five-factor model the HML risk factor remains significant and positive only when considering the entire sample from July 2003 to June 2020. The CMA risk factor is significant and positive and the same can be observed for value-weighted high-rated E portfolios, confirming that conservative companies with high E rankings generate risk premiums.

Table 21. Regression results of value-weighted long-short S portfolios

		LONG-SHORT STRATEGY VALUE-WEIGHTED		
S score		July 2003-June 2020	July 2003-December 2015	January 2016-June 2020
CAPM	alpha	-0.002613	-0.002964	-0.001569
	beta	-0.127000**	-0.108953*	-0.172649*
	R-squared	0.0424	0.03123	0.07811
	adj. R-squared	0.03766	0.02469	0.06038
Fama-French 3 factor model	alpha	-0.001955	-0.002727	-0.0014334
	beta	-0.112598*	-0.127720*	-0.1812357
	SMB	-0.161234	-0.163724	0.0251407
	HML	0.306763***	0.534756***	-0.0001014
	R-squared	0.1215	0.2152	0.07842
adj. R-squared	0.1084	0.1991	0.02313	
Fama-French 5 factor model	alpha	-0.002280	-0.003288	-0.002021
	beta	-0.081622	-0.085673	-0.152678
	SMB	-0.165696	-0.157853	0.025740
	HML	0.134740	0.359037**	-0.221037
	RMW	-0.039782	0.020553	-0.051294
	CMA	0.401283**	0.448913**	0.474391
	R-squared	0.1533	0.256	0.1077
adj. R-squared	0.1319	0.2302	0.01474	

Note: *** p-value < 0.001; ** p-value < 0.01; * p-value < 0.05.

By reference to long-short S portfolios (Table 21), there are no differences in performance between low-ranked and high-ranked S portfolios as evidenced by alphas which are not

significantly different from zero. In the CAPM betas are significant and negative, supporting the findings of individually constructed S portfolios, which point out that bottom portfolios are more volatile than top portfolios. Betas are still significant and negative in the three-factor model throughout the entire period considered and between July 2003 and December 2015, but in the five-factor model betas are all non-significant, highlighting that there are no differences in the exposure to the market risk between bottom and top S portfolios. The loading on the HML factor remains significant and positive only during the period July 2003 and December 2015, which means that the long-short S portfolio in this sample is biased towards value stocks with high book-to-market ratios. Given that value-weighted top S portfolios and long-short S portfolios within the whole sample and from July 2003 to December 2015 have a significant positive exposure to the CMA risk factor, high-rated S portfolios with low levels of investment tend to have risk premiums.

Table 22. Regression results of value-weighted long-short G portfolios

G score		LONG-SHORT STRATEGY VALUE-WEIGHTED		
		July 2003-June 2020	July 2003-December 2015	January 2016-June 2020
CAPM	alpha	0.001880	-0.00004467	0.007129*
	beta	-0.085821*	-0.1320**	0.022345
	R-squared	0.0208	0.04683	0.001757
	adj. R-squared	0.01595	0.04039	-0.01744
Fama-French 3 factor model	alpha	0.001671	0.00008946	0.003456
	beta	-0.055231	-0.1445**	0.060700
	SMB	-0.110474	-0.08311	-0.047786
	HML	-0.014330	0.2992**	-0.349341**
	R-squared	0.02879	0.105	0.2205
adj. R-squared	0.01422	0.08663	0.1737	
Fama-French 5 factor model	alpha	0.0007083	-0.001377	0.003556
	beta	-0.0299040	-0.090579	0.032121
	SMB	-0.0652608	-0.032321	0.007782
	HML	-0.0481495	0.229334	-0.276960
	RMW	0.2877464*	0.332655*	0.217741
	CMA	0.1403243	0.260001	-0.135558
	adj. R-squared	0.05403	0.1409	0.2342
adj. R-squared	0.03014	0.111	0.1545	

Note: *** p-value < 0.001; ** p-value < 0.01; * p-value < 0.05.

In Table 22 the outcomes of the regression on the long-short G portfolios are exhibited. Only the long-short portfolio's alpha in the CAPM of the sample covering the period January 2016-June 2020 is significant and positive, suggesting that the top portfolio

generates excess returns compared to the market because, in the previous results, the value-weighted high-rated G portfolio's alpha in the same sample is significant and positive. However, when adding risk factors to the model in all samples, the performance of bottom and top portfolios remains indifferent. Betas in the CAPM of the whole sample and of the sample July 2003-December 2015, and the beta of the three-factor model within the period July 2003-December 2015 are significant and negative, given that the value-weighted low-ranked G portfolio is more exposed to systematic risk than the high-ranked G portfolio. Despite this, betas become non-significant when applying the five-factor model, thus there are no significant differences in the exposure to market risk between bottom and top portfolios. In the three-factor model, from July 2003 to December 2015 the HML factor is significant and positive, but from January 2016 to June 2020 it is significant and negative; this is in line with the findings of value-weighted G portfolios because, in the sample July 2003-December 2015, the top portfolio is tilted towards value firms with high BE/ME ratios, while between January 2016 and June 2020 the top portfolio is biased towards growth firms with low BE/ME ratios. By the way, when applying the five-factor model the loadings on the HML factor are non-significant. The RMW factor is significant and positive within the whole sample and from July 2003 to December 2015, hence the returns of long-short G portfolios in these samples are most influenced by profitable firms with high governance scores; this is not consistent with the results of value-weighted G portfolios because the RMW factor is significant only for bottom portfolios, but with a negative loading.

3.4 Discussion of empirical results

To get a general overview of the risk-return profile of the portfolios obtained, I focus my attention on the outcomes of the Fama-French five-factor model regressions. In this way, it is possible to highlight that long-short portfolios differ considerably between the sample July 2003-December 2015 and the sample January 2016-June 2020.

Specifically, from July 2003 to December 2015 long-short E and ESG portfolios have significant negative abnormal returns, which signifies that bottom E and ESG portfolios generate most of these portfolios' returns. In this case, holding a long position in bottom portfolios and a short position in top portfolios is preferable. Moreover, the long-short ESG portfolio is skewed towards big market cap firms, both with low and high ESG scores; some differences between low-rated and high-rated portfolios can be noted: most

of risk premiums of S and ESG portfolios may be generated by value firms with high scores; then, profitable high-rated G stocks and conservative companies with high E and S scores may influence portfolios' returns. In each sample analysed, there are no differences in the exposure to systematic risk between low-rated and high-rated portfolios. It is interesting to note that, from January 2016 to June 2020, low-ranked and high-ranked portfolios show no significant differences in performance and in the exposure to risk factors. This could be explained by the adoption of the Paris Agreement in 2015: most companies had to align to the goal of the Paris Agreement of reducing greenhouse gas emissions, thus they may have taken actions to improve their environmental and social impact, increasing their ESG scores. As a consequence, firms performing well that had low ESG rankings before 2015, after 2016 received higher scores and continued to generate positive financial returns.

Additionally, some Information Technology (IT) firms such as Amazon.com Inc., Apple Inc. and Microsoft Corp, which weigh heavily on portfolios' returns, were first included in low-ranked portfolios and after 2016 they become part of high-ranked portfolios.

Interestingly, the portfolios of stocks with the highest governance scores have the best risk-return profile throughout the whole period under analysis. This is due to the fact that good corporate governance can create higher value for both shareholders and stakeholders. Particularly, good governance helps the board of directors and shareholders to make effective decisions which can boost financial rewards; it improves firm reputation and as a consequence, helps to attract investors. Furthermore, companies with a good corporate governance are more likely to emerge from recessions and thus enhance investor confidence (Félicité, 2019).

In the end, when looking at the performance of bottom and top portfolios at the outbreak of COVID-19 pandemic, high-rated portfolios were more resilient than low-rated ones, which after the first lockdown in 2020 suffered huge losses. This may be attributable to the fact that companies that are engaged in environmental protection, safety and health may respond promptly to crisis and may be more agile in creating solutions that avoid any harm to economies.

Conclusion

In the light of what has been discussed in the previous chapter, the objective of the thesis to analyze the performance between low-rated and high-rated E, S, G and ESG portfolios is now clear. This empirical analysis has sought to verify what is stated in the current literature on sustainable and responsible investing: especially on medium-long term horizons, SRI can guarantee satisfactory performance as traditional investing and reduces the riskiness of an investment because it is based on broader information which helps identify risks and prevent potential losses (Viscovi and Di Turi, 2017).

In order to achieve the goal of the thesis, companies included in the S&P 100 index were considered and ranked in ascending order. Then, for each score, “bottom” portfolios, made up of the 20 stocks with the lowest rankings, and “top” portfolios, which include the 20 stocks with the highest rankings were constructed and rebalanced each year over the period July 2003-June 2020. The analysis of the performance was carried out on individually constructed portfolios and, in the final part of the study, on long-short portfolios, which were built by holding a long position in high-rated stocks and a short position in low-rated stocks. Both equally-weighted and value-weighted portfolios were assessed first by looking at the descriptive statistics, in particular the Sharpe ratio, which gives an idea about the risk-return profile of portfolios and then, by applying the CAPM, the Fama-French three-factor and five-factor models, which help investigate whether there are significant differences in the excess returns and risk exposure between top and bottom portfolios. The findings of the empirical analysis reveal that portfolios of stocks performing poorly on E and total ESG scores generate statistically significant higher returns in the timeframe July 2003-December 2015, which can be due to the higher risk associated to low scores; in the interval of time January 2016-June 2020 there are no significant differences in the performance between low-ranked and high-ranked portfolios. However, when analysing Sharpe ratios, after 2016 top portfolios, excluding the one based on the environmental score, show better risk-reward combinations. This could be due to the fact that the Paris Conference on climate in 2015 pushed many companies to change their way of operating with the goal of becoming more sustainable. The control for risk factors leads to non-significant differences in the exposure to market risk; despite this, standard deviations are higher for bottom portfolios, suggesting that firms strongly committed to respecting the environment and improving social policies and corporate governance can mitigate risks more efficiently. This may be attributable to

the better preparation of sustainable and responsible firms in facing economic and financial crisis and to the fact that companies which pay attention to sustainable issues are less likely to incur legal costs or damage their reputation. In fact, from empirical results, it is possible to note that portfolios of stocks with the highest scores suffered lower financial losses at the surge of the global COVID-19 pandemic. When considering Fama-French risk factors, it is observable that all portfolios have a bias towards large market cap firms, but this may be due to the fact that firms included in the index used for this analysis have a big market capitalization. Differences in the exposure to risk factors can only be seen within the sample covering the period July 2003-December 2015.

To sum up, although during the time span July 2003-December 2015 it would be preferable to adopt a long strategy for low-rated stocks and a short strategy for high-rated stocks, after 2016 top portfolios do not significantly differ in terms of performance from bottom portfolios. This confirms what stressed by Visconti and Di Turi (2017): the integration of ESG factors in investments does not penalize returns and decreases the investment volatility by increasing the probability of avoiding or reducing losses.

One limitation of this research is that not all companies in the database were listed on the stock exchange from 2003 and thus, they were not assigned a ranking because they did not disclose or report information about their environmental and social performance and level of corporate governance; for this reason, they were considered in the portfolio construction at a later point, limiting the choice of the portfolio constituents in certain years.

It is also appropriate to underline that the sample is restricted to American big market cap companies, therefore, in order to enrich the conclusions of this research, the same analysis should be carried out on other samples, for instance, on small market cap firms and on companies whose headquarters are located in Europe and Asia.

As pointed out by Billio et al. (2020), rating agencies disagree on ESG criteria and assign different, or even opposite, scores to the same firms. This implies that, with the use of scores from agencies other than Refinitiv, the choice of portfolio constituents may vary substantially. For this reason, future studies should address portfolios of stocks based on ESG ratings from different agencies, in order to make comparisons among the various ESG scores providers.

Appendix

Appendix A.

Billio et al. (2020) offer this overview on the differences in the ESG factors assessed by the major rating agencies.

	MSCI	VIGEO-EIRIS	REFINITIV	SUSTAINALYTICS	ISS OEKOM	ROBECOSAM	ECPI	BLOOMBERG	FTSE RUSSELL
RATING SCORE	CCC to AAA	- to ++	D- to A+ and 0 to 100	0 to 100	D- to A+	0 to 100	F to EEE	0 to 100	0 to 5
HISTORY	1990	1983	2002	1992	1985	1995	1997	2008	2001
HEADQUARTER	New York, United States	Paris, France	Toronto, Canada	Amsterdam, Netherlands	Munich, Germany	Zurich, Switzerland	Milan, Italy	New York, United States	London, United Kingdom
SOURCES	Company disclosure, 1600+ Media sources, 100+ specialized dataset	Company disclosure, Recommendation, Conventions	Company websites, Company reports, NGO Websites, Media and news, Stock Exchange filings	Public disclosure, Media and news, NGO reports	Publicly available information, Interview with stakeholders, information on company policies and practices, company direct contact	Survey approach	Company reports, Media and news, Regulatory data, Bloomberg and Thomson Reuters, University networks	Company reports, Publicly available information, Company direct contact	Publicly available information, Company direct contact, Other sources (governments and NGOs)
N. CRITERIA	37	38	178	155	100	74	80/86	120	300
MAIN RISK FACTORS	<p>Environmental</p> <ul style="list-style-type: none"> Climate Change, Natural Resources Pollution And Waste Management Environmental Opportunities Social Product Liability Human Capital Stakeholder Needs Social Opportunities Governance Corporate Behavior Corporate Governance 	<ul style="list-style-type: none"> Human Resources, Human Rights Environment Business Behavior Community Involvement Corporate Governance 	<p>Environmental</p> <ul style="list-style-type: none"> Resource Use, Emission, Innovation Social Workforce, Human Rights, Community, Product Responsibility Governance Management, Shareholders, CSR Strategy 	<ul style="list-style-type: none"> Industry-Specific indicators, Factors Change According To The Industrial Group To Which A Company Belongs 	<p>Environment</p> <ul style="list-style-type: none"> Climate Change Strategy, Efficiency, Energy Mgmt, Env. Impact of Product, Env. Mgmt, Water Risk And Impact Social Equal Opportunities, Freedom of Association, Health And Safety, Human Rights, Product Responsibility, Social Impact of Product, Supply Chain Mgmt, Taxes Governance Business Ethics, Compliance, Independence of The Board, Remuneration, Shareholder Democracy and Structure 	<ul style="list-style-type: none"> About 21 Industry-Specific Indicators, Three Main Dimensions: Economic (38/100), Environmental (27/100), Social (35/100) 	<p>Environmental</p> <ul style="list-style-type: none"> Product Production Process Social & Governance Employees, And Human Capital Community Relations Markets Corporate Governance & Shareholder 	<p>Environmental</p> <ul style="list-style-type: none"> Carbon Emissions, Climate Change Effect, Pollution, Waste Disposal, Renewable Energy, Resource Depletion Social Supply Chain, Political Contributions, Discrimination, Diversity, Community Relations, Human Rights, Governance Cumulative Voting, Executive Compensation, Shareholders' Rights, Takeover Defense, Staggered Boards, Independent Directors 	<p>Environmental</p> <ul style="list-style-type: none"> Biodiversity, Climate Change, Pollution & Resources, Water Security, Supply Chain Social Labor standards, Human Rights & Community, Health & Safety, Customer Responsibility, Supply Chain Governance Tax Transparency, Risk Management, Corporate Governance, Anti-Comption
MATERIALITY AND WEIGHTING	Proprietary Definition. Analysis on material risks and opportunities for all the GICS sub-sectors	Proprietary Definition. Based on principles developed by International Bodies.	Proprietary Definition. Standard weighting for all the categories Environmental = 34%, Social 35.5%, Governance= 30.5%	Proprietary Definition of Materiality - subindustry level. Assessment of the potentially material issues in the future	Proprietary Definition. Selection and weighting of 5 key issues per sector and 800 detailed industry-specific Criteria	Proprietary Definition. Disclosure of criteria and weighting of the 61 industries analyzed	Proprietary Definition developed by International Bodies (eg. UN Global Compact Initiative and UN PRI)	Proprietary Definition. Based on principles developed by International Bodies (eg. GRI, CDP, SASM for three industries, FSB Task Force on Climate-related Financial Disclosures)	Proprietary Definition. Ratings are calculated using an Exposure-weighted average. Alignment with the UN Sustainable Development Goals (SDGs)

Appendix B.

This table maps the MSCI final industry adjusted company scores to letter ratings, which ranges from leader (highest scores) to laggard (lowest scores) (MSCI ESG Research, 2020).

Letter Rating	Leader/Laggard	Final industry-adjusted company score
AAA	Leader	8.571 - 10.0
AA	Leader	7.143 - 8.571
A	Average	5.714 - 7.143
BBB	Average	4.286 - 5.714
BB	Average	2.857 - 4.286
B	Laggard	1.429 - 2.857
CCC	Laggard	0.0 - 1.429

Appendix C.

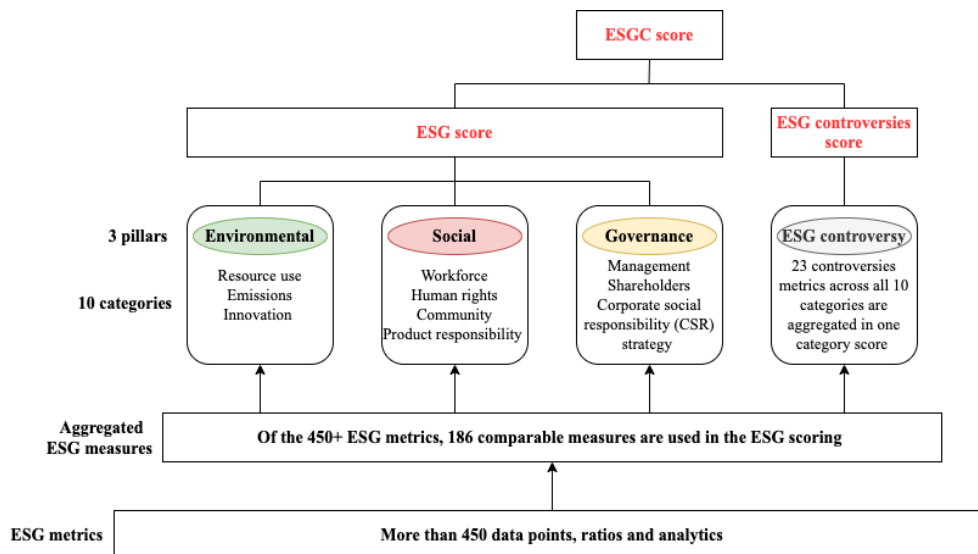
This table lists the constituents of S&P 100 index considered for the portfolio construction; note that Dow Inc. was removed from the list. Data were collected from Refinitiv.

Name	RIC	Name	RIC	Name	RIC
3M Co	MMM	Costco Wholesale Corp	COST.O	Morgan Stanley	MS
Abbott Laboratories	ABT	CVS Health Corp	CVS	Netflix Inc	NFLX.O
Abbvie Inc	ABBV.K	Danaher Corp	DHR	Nextera Energy Inc	NEE
Accenture PLC	ACN	Duke Energy Corp	DUK	Nike Inc	NKE
Adobe Inc	ADBE.O	Dupont De Nemours Inc	DD	NVIDIA Corp	NVDA.O
Allstate Corp	ALL	Eli Lilly and Co	LLY	Oracle Corp	ORCL.K
Alphabet Inc	GOOG.O	Emerson Electric Co	EMR	PayPal Holdings Inc	PYPL.O
Alphabet Inc	GOOGL.O	Exelon Corp	EXC.O	PepsiCo Inc	PEP.O
Altria Group Inc	MO	Exxon Mobil Corp	XOM	Pfizer Inc	PFE
Amazon.com Inc	AMZN.O	Facebook Inc	FB.O	Philip Morris International Inc	PM
American Express Co	AXP	FedEx Corp	FDX	Procter & Gamble Co	PG
American International Group Inc	AIG	Ford Motor Co	F	Qualcomm Inc	QCOM.O
American Tower Corp	AMT	General Dynamics Corp	GD	Raytheon Technologies Corp	RTX
Amgen Inc	AMGN.O	General Electric Co	GE	Salesforce.Com Inc	CRM
Apple Inc	AAPL.O	General Motors Co	GM	Schlumberger NV	SLB
AT&T Inc	T	Gilead Sciences Inc	GILD.O	Simon Property Group Inc	SPG
Bank of America Corp	BAC	Goldman Sachs Group Inc	GS	Southern Co	SO
Bank of New York Mellon Corp	BK	Home Depot Inc	HD	Starbucks Corp	SBUX.O
Berkshire Hathaway Inc	BRKb	Honeywell International Inc	HON	Target Corp	TGT
Biogen Inc	BIIB.O	Intel Corp	INTC.O	Tesla Inc	TSLA.O
BlackRock Inc	BLK	International Business Machines Corp	IBM	Texas Instruments Inc	TXN.O
Boeing Co	BA	Johnson & Johnson	JNJ	Thermo Fisher Scientific Inc	TMO
Booking Holdings Inc	BKNG.O	JPMorgan Chase & Co	JPM	U.S. Bancorp	USB
Bristol-Myers Squibb Co	BMJ	Kinder Morgan Inc	KMI	Union Pacific Corp	UNP
Capital One Financial Corp	COF	Kraft Heinz Co	KHC.O	United Parcel Service Inc	UPS
Caterpillar Inc	CAT	Lockheed Martin Corp	LMT	UnitedHealth Group Inc	UNH
Charter Communications Inc	CHTR.O	Lowe's Companies Inc	LOW	Verizon Communications Inc	VZ
Chevron Corp	CVX	Mastercard Inc	MA	Visa Inc	V
Cisco Systems Inc	CSCO.O	Medonald's Corp	MCD	Walgreens Boots Alliance Inc	WBA.O
Citigroup Inc	C	Medtronic PLC	MDT	Walmart Inc	WMT
Coca-Cola Co	KO	Merck & Co Inc	MRK	Walt Disney Co	DIS
Colgate-Palmolive Co	CL	MetLife Inc	MET	Wells Fargo & Co	WFC
Comcast Corp	CMCSA.O	Microsoft Corp	MSFT.O		
ConocoPhillips	COP	Mondelez International Inc	MDLZ.O		

Appendix D.

In this section Refinitiv’s ESG scoring methodology is illustrated. Refinitiv provides an ESG score, which measures the ESG performance of companies relative to the sector (for environmental and social pillars) and to the country of incorporation (for the governance category), and an ESG combined (ESGC) score, which is determined by deducting a score related to any controversies that involve the company being analysed. Around 9,000 companies receive ESG ratings of Refinitiv and the time series data used for calculating the scores go back to 2002. Refinitiv’s 150 analysts collect data from annual reports, news sources, CSR reports, stock exchange filings, NGO websites and company websites, and update them continuously. There are more than 450 measures, of which a subset of 186 of the most material and comparable is grouped into 10 categories which form the three pillars: environmental, social and governance. Then, the scores and weights of these three pillars are used for the final ESG score (Refinitiv, 2021).

Figure 10. Refinitiv’s ESG scoring methodology



Source: Refinitiv (2021).

Refinitiv’s ESG scoring methodology is as follows³⁰:

³⁰ See in this regard REFINITIV (2021), *Environmental, social and governance (ESG) scores from Refinitiv*.

- *Calculate category scores*: qualitative data are treated as Boolean questions, which are answered “yes” or “no” according to the polarity of the measures, denoting whether a higher value is positive or negative; then, these answers are converted to numeric values. For example, it is positive for a company to have low carbon emissions, then it will receive a value of 1 (see Table 13). Quantitative data are assigned a percentile rank score, only if they are relevant for all firms and are reported by companies. The category scores calculation is the following:

$$Score = \frac{n. \text{ of firms with a worse value} + \frac{n. \text{ of firms with the same value included in the current one}}{2}}{n. \text{ of firms with a value}}$$

Table 23. Conversion of Boolean data to numeric values

	Default values	
Positive	Yes= 1	No/Null= 0
Negative	Yess/Null= 0	No= 1

Source: Refinitiv (2021).

- *Calculate category weights*: the weights for the 10 categories are calculated using the magnitude (materiality) matrix to properly assess the importance of ESG themes covered in each category. The matrix is derived as follows:

$$Category \text{ weight of an industry} = \frac{Magnitude \text{ weight of a category}}{Sum \text{ of magnitudes of all categories}}$$

- *Calculate pillar scores*: the scores for the three pillars (i.e., environmental, social and governance) are measured by doing the relative sum of the category weights.
- *Calculate overall ESG score*: the three pillar scores are aggregated based on the weights of the 10 categories.
- *Calculate controversies scores*: the controversies scores are measured according to 23 ESG metrics; the default value for these controversies topics is 0, but it becomes 1 if the company is involved in severe ESG controversies. Then, the count of controversies is multiplied by the severity weight and the final

controversies score is calculated using the percentile formula (but only for firms with controversies, otherwise firms with no controversies receive a score of 100%). It is important to remember that the benchmark for controversies scores is the industry group.

Table 24. Severity weights based on the market cap

Global benchmark	Cap class	Severity rate
>=10 billion	Large	0.33
>=2 billion	Mid	0.67
<2 billion	Small	1


Source: Refinitiv (2021).

- *Calculate ESG combined (ESGC) score:* when the controversies score is lower than the ESG score, then the ESGC score is given by the average of the controversies score and ESG score. On the contrary, when the controversies score is higher than the ESG score, then ESGC score is equal to the ESG score.

ESG scores are expressed in percentiles, that are converted to letter grades, ranging from A+ (excellent ESG performance) to D- (poor ESG performance).

Table 25. Refinitiv’s conversion from ESG percentile scores to letter grades

Score range	Grade
0 to 25 First quartile	D
> 25 to 50 Second quartile	B
> 50 to 75 Third quartile	C
> 75 to 100 Fourth quartile	A



ESG laggards

ESG leaders

Source: Refinitiv (2021).

Appendix E.

This table illustrates the descriptive statistics of equally-weighted portfolios within the period July 2003-June 2020.

		EQUALLY-WEIGHTED					
		July 2003-June 2020		July 2003-December 2015		January 2016-June 2020	
		BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP
E score	Mean	1.21%	0.59%	1.31%	0.67%	0.96%	0.36%
	Standard deviation	4.73%	4.6%	4.67%	4.56%	4.94%	4.74%
	Sharpe Ratio	0.2569	0.1283	0.2797	0.1473	0.1952	0.0765
	Min	-21.1%	-20.31%	-21.1%	-20.31%	-17.08%	-14.77%
	Max	12.14%	13.3%	12.14%	13.3%	12.04%	12.25%
S score	Mean	1.00%	0.65%	1.07%	0.68%	0.82%	0.58%
	Standard deviation	4.56%	4.27%	4.56%	4.21%	4.6%	4.45%
	Sharpe Ratio	0.2201	0.153	0.2344	0.1611	0.1788	0.1303
	Min	-18.43%	-19.52%	-18.43%	-19.52%	-15.77%	-14.77%
	Max	13.27%	12.25%	13.27%	12.08%	12.2%	12.25%
G score	Mean	0.9%	0.95%	0.92%	0.95%	0.82%	0.95%
	Standard deviation	4.92%	3.99%	5.14%	3.82%	4.3%	4.47%
	Sharpe Ratio	0.1824	0.2374	0.1798	0.2481	0.1915	0.2116
	Min	-20.96%	-13.11%	-20.96%	-12.67%	-13.62%	-13.11%
	Max	14.12%	10.06%	11.94%	10.06%	14.12%	9.76%
ESG score	Mean	1.09%	0.72%	1.21%	0.78%	0.77%	0.55%
	Standard deviation	4.71%	4.16%	4.64%	4.12%	4.93%	4.3%
	Sharpe Ratio	0.2317	0.1735	0.26	0.1899	0.1566	0.1286
	Min	-20.69%	-18.81%	-20.69%	-18.81%	-18.72%	-12.36%
	Max	14.25%	12.85%	12.1%	12.85%	14.25%	9.42%

Appendix F.

The following tables exhibit the regression results of individually constructed equally-weighted portfolios, starting from those based on the total ESG score and followed by portfolios based on the three dimensions, E, S and G within the period July 2003-June 2020.

		EQUALLY-WEIGHTED					
ESG score		July 2003-June 2020		July 2003-December 2015		January 2016-June 2020	
		BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP
CAPM	alpha	0.002299	-0.0005189	0.004077**	0.0006208	-0.002719	-0.003729*
	beta	1.021715***	0.9041210	1.013357***	0.9003225***	1.047829***	0.917009***
	R-squared	0.8603	0.8608	0.8486	0.8454	0.9021	0.9072
	adj. R-squared	0.8596	0.8601	0.8476	0.8444	0.9003	0.9055
Fama-French 3 factor model	alpha	0.002127	-0.0003025	0.003984**	0.0006876	-0.002652	-0.003227
	beta	1.034025***	0.9643542***	1.037474***	0.9540778***	1.114805***	0.995166***
	SMB	-0.031786	-0.3081899***	-0.018078	-0.3349318***	-0.219834	-0.265457**
	HML	-0.042144	0.2320176***	-0.185267*	0.2343655***	0.129475	0.199474**
	R-squared	0.861	0.8924	0.8554	0.8814	0.9107	0.9285
	adj. R-squared	0.859	0.8907	0.8524	0.879	0.9054	0.9242
Fama-French 5 factor model	alpha	0.002428	-0.0008847	0.004745**	0.00007661	-0.002398	-0.003519
	beta	1.027025***	0.9987365***	1.014918***	0.9961***	1.095656***	0.994193***
	SMB	-0.046773	-0.2976075***	-0.047888	-0.3262***	-0.204146	-0.229455*
	HML	-0.038241	0.0750444	-0.186867*	0.06916	0.235019	0.111629
	RMW	-0.095857	0.0576688	-0.199795	0.04100	0.082062	0.108471
	CMA	-0.029215	0.3857070***	-0.046138	0.4275***	-0.220935	0.201356
	R-squared	0.8618	0.9032	0.8588	0.8958	0.9129	0.932
	adj. R-squared	0.8583	0.9008	0.8539	0.8922	0.9038	0.9249

		EQUALLY-WEIGHTED					
E score		July 2003-June 2020		July 2003-December 2015		January 2016-June 2020	
		BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP
CAPM	alpha	0.003567**	-0.002673*	0.005131**	-0.001309	-0.0008634	-0.006488**
	beta	1.017305***	1.016365***	1.004540***	1.019902***	1.0536444***	1.011825***
	R-squared	0.8455	0.8926	0.8234	0.8893	0.9115	0.91
	adj. R-squared	0.8448	0.8921	0.8222	0.8885	0.9098	0.9082
Fama-French 3 factor model	alpha	0.003429*	-0.0021509*	0.005098**	-0.001220	-0.001789	-0.004602**
	beta	1.032185***	1.0485436***	1.016459***	1.049206***	1.125922***	1.068746***
	SMB	-0.048492	-0.2233723***	-0.022086	-0.239787***	-0.216227	-0.225329*
	HML	-0.022024	0.2925178***	-0.062667	0.253438***	0.025807	0.318779***
	R-squared	0.8462	0.9193	0.8243	0.911	0.918	0.9462
	adj. R-squared	0.8438	0.9181	0.8206	0.9092	0.9131	0.9429
Fama-French 5 factor model	alpha	0.004116*	-0.0024022*	0.006203***	-0.001465	-0.001215	-0.004996**
	beta	1.017385***	1.0748394***	0.987872***	1.076863***	1.112182***	1.100145***
	SMB	-0.083588	-0.2288642***	-0.068020	-0.243124***	-0.250088*	-0.253633**
	HML	-0.021230	0.1427611**	-0.094016	0.111969	0.220997	0.152550
	RMW	-0.225015*	-0.0449440	-0.310947**	-0.037448	-0.074787	-0.142204
	CMA	-0.048657	0.3471986***	0.001070	0.347855***	-0.430980*	0.346686*
	R-squared	0.8504	0.9273	0.8329	0.9199	0.9264	0.9522
	adj. R-squared	0.8466	0.9255	0.8271	0.9171	0.9187	0.9473

		EQUALLY-WEIGHTED					
S score		July 2003-June 2020		July 2003-December 2015		January 2016-June 2020	
		BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP
CAPM	alpha	0.001792	-0.001426	0.002938	-0.0005827	-0.001399	-0.003822*
	beta	0.972660***	0.932565***	0.979913***	0.9237673***	0.958275***	0.956890***
	R-squared	0.8298	0.8726	0.8194	0.8533	0.8657	0.9253
	adj. R-squared	0.829	0.872	0.8182	0.8523	0.8631	0.9239
Fama-French 3 factor model	alpha	0.001326	-0.001399	0.002775	-0.000549	-0.001644	-0.003904*
	beta	1.007004***	0.993323***	1.030701***	0.980031***	1.050739***	1.029786***
	SMB	-0.090680	-0.283249***	-0.073149	-0.311627***	-0.296389*	-0.236006*
	HML	-0.111818*	0.154744	-0.313074***	0.159769**	0.140220	0.123252*
	R-squared	0.8357	0.893	0.8407	0.8786	0.881	0.9364
	adj. R-squared	0.8332	0.8914	0.8374	0.8761	0.8739	0.9325
Fama-French 5 factor model	alpha	0.001676	-0.0019108	0.003531*	-0.001078	-0.001600	-0.004148*
	beta	0.997226***	1.0247558***	1.003357***	1.018200***	1.052594***	1.030496***
	SMB	-0.106582	-0.2750374***	-0.099645	-0.305152***	-0.305836*	-0.209551*
	HML	-0.095367	0.0080366	-0.280346**	0.004374	0.150984	0.047747
	RMW	-0.100911	0.0431291	-0.173939	0.026770	-0.031433	0.077059
	CMA	-0.060140	0.3582439***	-0.126337	0.399152***	-0.026467	0.171471
	R-squared	0.8367	0.9019	0.8437	0.8908	0.8811	0.9385
	adj. R-squared	0.8326	0.8995	0.8382	0.887	0.8688	0.932

G score		EQUALLY-WEIGHTED					
		July 2003-June 2020		July 2003-December 2015		January 2016-June 2020	
		BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP
CAPM	alpha	0.0001682	0.002006	0.0006321	0.002730*	-0.0009461	-0.0001376
	beta	1.0475794***	0.866927***	1.1044553***	0.832552***	0.9085437***	0.9540499***
	R-squared	0.8278	0.8611	0.8201	0.8434	0.892	0.9092
	adj. R-squared	0.8269	0.8605	0.8189	0.8423	0.8899	0.9075
Fama-French 3 factor model	alpha	-0.00003819	0.0019326	0.0005905	0.002747*	-0.001480	-0.0002673
	beta	1.103***	0.9324312***	1.1533428***	0.901247***	1.004302***	1.0059957***
	SMB	-0.2248**	-0.2905224***	-0.1944748*	-0.353742***	-0.301053**	-0.1666761
	HML	0.04532	0.1241966**	-0.0288009	0.136323*	0.113255	0.0796790
	R-squared	0.8356	0.8832	0.8259	0.8796	0.9086	0.9144
	adj. R-squared	0.8331	0.8815	0.8223	0.8772	0.9031	0.9092
Fama-French 5 factor model	alpha	0.000812	0.0013590	0.001777	0.002051	-0.001473	-0.00008087
	beta	1.084418***	0.9644801***	1.116879***	0.947960***	1.014501***	0.9882***
	SMB	-0.268105***	-0.2784974***	-0.240128**	-0.343037***	-0.325781**	-0.1463
	HML	0.047843	-0.0173990	-0.022263	-0.043859	0.100387	0.1627
	RMW	-0.277330**	0.0679182	-0.305015*	0.052445	-0.092214	0.09351
	CMA	-0.063657	0.3512263***	-0.093119	0.468197***	0.018813	-0.1709
	R-squared	0.8415	0.8931	0.8323	0.8997	0.9092	0.9162
	adj. R-squared	0.8375	0.8904	0.8265	0.8962	0.8997	0.9075

Appendix G.

This table shows the descriptive statistics of equally-weighted long-short portfolios within the period July 2003-June 2020.

		LONG-SHORT STRATEGY		
		EQUALLY-WEIGHTED		
		July 2003-June 2020	July 2003-December 2015	January 2016-June 2020
E score	Mean	-0.62%	-0.63%	-0.6%
	Standard deviation	2.27%	2.31%	2.17%
	Sharpe Ratio	-0.2749	-0.2737	-0.2764
	Min	-6.81%	-6.81%	-6.57%
	Max	5.87%	5.87%	4.99%
S score	Mean	-0.35%	-0.39%	-0.24%
	Standard deviation	2.46%	2.63%	1.92%
	Sharpe Ratio	-0.1432	-0.1488	-0.1266
	Min	-7.66%	-7.66%	-4.12%
	Max	12.13%	12.13%	3.95%
G score	Mean	0.05%	0.02%	0.12%
	Standard deviation	2.67%	2.85%	2.08%
	Sharpe Ratio	0.0187	0.0083	0.0585
	Min	-7.47%	-7.47%	-5.48%
	Max	15.93%	15.93%	4.04%
ESG score	Mean	-0.37%	-0.42%	-0.22%
	Standard deviation	2.44%	2.51%	2.24%
	Sharpe Ratio	-0.1515	-0.1688	-0.0976
	Min	-6.33%	-6.33%	-6.25%
	Max	9.56%	9.56%	6.36%

Appendix H.

The following tables present the regression results of equally-weighted long-short portfolios, starting from those based on the total ESG score and followed by portfolios based on the three dimensions, E, S and G within the period July 2003-June 2020.

LONG-SHORT STRATEGY
EQUALLY-WEIGHTED

ESG score		July 2003-June 2020	July 2003-December 2015	January 2016-June 2020
CAPM	alpha	-0.003866*	-0.004520*	-0.002018
	beta	-0.115164**	-0.110830*	-0.127880
	R-squared	0.04079	0.03459	0.06558
	adj. R-squared	0.03604	0.02807	0.04761
Fama-French 3 factor model	alpha	-0.003482*	-0.004362*	-0.001542
	beta	-0.067740	-0.080820	-0.119243
	SMB	-0.273554**	-0.315930**	-0.038178
	HML	0.271383***	0.414128***	0.069987
	R-squared	0.1381	0.1961	0.07345
	adj. R-squared	0.1252	0.1796	0.01785
Fama-French 5 factor model	alpha	-0.004373**	-0.005738**	-0.002095
	beta	-0.025662	-0.015576	-0.101477
	SMB	-0.248059**	-0.277578**	-0.016228
	HML	0.106701	0.246611*	-0.124582
	RMW	0.152800	0.238940	0.032017
	CMA	0.423831**	0.483050**	0.425405
	R-squared	0.1796	0.2503	0.1109
	adj. R-squared	0.1589	0.2242	0.01833

LONG-SHORT STRATEGY
EQUALLY-WEIGHTED

E score		July 2003-June 2020	July 2003-December 2015	January 2016-June 2020
CAPM	alpha	-0.007289***	-0.007504***	-0.006633*
	beta	0.001488	0.017566	-0.038879
	R-squared	0.000007845	0.001022	0.006449
	adj. R-squared	-0.004943	-0.005728	-0.01266
Fama-French 3 factor model	alpha	-0.006632***	-0.007383***	-0.003780
	beta	0.018290	0.035323	-0.056781
	SMB	-0.172031*	-0.216778*	-0.001657
	HML	0.311763***	0.310600***	0.292960**
	R-squared	0.1112	0.1021	0.1792
	adj. R-squared	0.09792	0.08362	0.13
Fama-French 5 factor model	alpha	-0.007578***	-0.008737***	-0.004754
	beta	0.060081	0.092239	-0.012052
	SMB	-0.142502	-0.174394	0.005536
	HML	0.157407	0.196570	-0.069639
	RMW	0.179345	0.271647*	-0.061810
	CMA	0.404765**	0.356195*	0.780780**
	R-squared	0.1575	0.1468	0.3083
	adj. R-squared	0.1362	0.1172	0.2362

LONG-SHORT STRATEGY				
EQUALLY-WEIGHTED				
S score		July 2003-June 2020	July 2003-December 2015	January 2016-June 2020
CAPM	alpha	-0.004267*	-0.004584*	-0.003431
	beta	-0.037666	-0.053942	0.001555
	R-squared	0.00431	0.007502	0.00001324
	adj. R-squared	-0.0006189	0.0007958	-0.01922
Fama-French 3 factor model	alpha	-0.003778*	-0.004390*	-0.003228
	beta	-0.011750	-0.048094	-0.020558
	SMB	-0.189719*	-0.237555*	0.067829
	HML	0.263783***	0.467339***	-0.016980
	R-squared	0.07872	0.1613	0.004083
	adj. R-squared	0.0649	0.1441	-0.05567
Fama-French 5 factor model	alpha	-0.004647**	-0.005679**	-0.003522
	beta	0.030156	0.018090	-0.022112
	SMB	-0.165680	-0.204797*	0.105366
	HML	0.096819	0.275305*	-0.104429
	RMW	0.143315	0.198857	0.114099
	CMA	0.427293**	0.534899**	0.201052
	R-squared	0.1197	0.2178	0.022
	adj. R-squared	0.09749	0.1906	-0.07988

LONG-SHORT STRATEGY				
EQUALLY-WEIGHTED				
G score		July 2003-June 2020	July 2003-December 2015	January 2016-June 2020
CAPM	alpha	0.0007897	0.001035	-0.0001995
	beta	-0.1782230***	-0.269699***	0.0484459
	R-squared	0.08201	0.1598	0.01075
	adj. R-squared	0.07746	0.1541	-0.008276
Fama-French 3 factor model	alpha	0.0009185	0.001090	0.000245
	beta	-0.1685992***	-0.249519***	0.002089
	SMB	-0.0628391	-0.158343	0.141823
	HML	0.0761015	0.159619	-0.033588
	R-squared	0.08764	0.1829	0.02564
	adj. R-squared	0.07395	0.1661	-0.03283
Fama-French 5 factor model	alpha	-0.0005129	-0.0007956	0.0004186
	beta	-0.1173120*	-0.1656715**	-0.0263506
	SMB	-0.0076171	-0.1021997	0.1885644
	HML	-0.0718258	-0.0310114	0.0610982
	RMW	0.3445226**	0.3556077*	0.1913305
	CMA	0.4237920**	0.5707255**	-0.1865739
	R-squared	0.1424	0.2487	0.04342
	adj. R-squared	0.1208	0.2226	-0.05622

Appendix I.

This section includes the calculation code in RStudio for computing the portfolios' descriptive statistics and for carrying out the regressions on the portfolios built.

```
##INDIVIDUALLY CONSTRUCTED PORTFOLIOS
```

```
library(readxl)
```

```
library(PerformanceAnalytics)
```

```
ESG <- read_excel("portfolios monthly.xlsx", sheet = 8,col_types = c("date", "numeric", "numeric"))
```

```

bottom <- xts(ESG[,2],order.by = ESG$TIMEFRAME)
top <- xts(ESG[,3],order.by = ESG$TIMEFRAME)

#GRAPHS
chart.CumReturns(cbind(bottom,top),wealth.index = F,geometric = T, leg
end.loc = "topleft", colorset = c("red","green"))

#DESCRIPTIVE STATISTICS
table.AnnualizedReturns(bottom)

table.Stats(bottom)

SharpeRatio(bottom)

table.AnnualizedReturns(top)

table.Stats(top)

SharpeRatio(top)

#REGRESSION
factors <- read_excel("Monthly North America 5 Factors.xlsx",col_types
= c("date","numeric","numeric","numeric","numeric","numeric","numeric"
))
ff <- xts(factors[,-1],order.by = factors$TIMEFRAME)

#Bottom portfolio
ffbottom <- cbind(ff,bottom)
mktrf <- ffbottom[,1]
smb <- ffbottom[,2]
hml <- ffbottom[,3]
rmw <- ffbottom[,4]
cma <- ffbottom[,5]
rf <- ffbottom[,6]
p <- ffbottom[,7]
excessreturns=p-rf
fit=lm(excessreturns ~ mktrf)
summary(fit)

```

```

fit2=lm(excessreturns ~ mktrf+smb+hml)
summary(fit2)

fit3=lm(excessreturns ~ mktrf+smb+hml+rmw+cma)
summary(fit3)

#Top portfolio
fftop <- cbind(ff,top)
mktrf <- fftop[,1]
smb <- fftop[,2]
hml <- fftop[,3]
rmw <- fftop[,4]
cma <- fftop[,5]
rf <- fftop[,6]
p <- fftop[,7]
excessreturns=p-rf
fit=lm(excessreturns ~ mktrf)
summary(fit)

fit2=lm(excessreturns ~ mktrf+smb+hml)
summary(fit2)

fit3=lm(excessreturns ~ mktrf+smb+hml+rmw+cma)
summary(fit3)

###LONG-SHORT STRATEGY
longshort <- top-bottom

#GRAPHS
chart.CumReturns(cbind(bottom,top,longshort),wealth.index = F,geometric = T, colorset = c("red","green","blue"))

addLegend(legend.loc = "topleft",legend.names = c("BOTTOM","TOP","LONG SHORT"),col = c("red","green","blue"),lty=1, cex=0.8)

#DESCRIPTIVE STATISTICS
table.AnnualizedReturns(longshort)

table.Stats(longshort)

```

```
SharpeRatio(longshort)
```

```
#REGRESSION
```

```
fflongshort <- cbind(ff, longshort)
```

```
mktrf <- fflongshort[,1]
```

```
smb <- fflongshort[,2]
```

```
hml <- fflongshort[,3]
```

```
rmw <- fflongshort[,4]
```

```
cma <- fflongshort[,5]
```

```
rf <- fflongshort[,6]
```

```
p <- fflongshort[,7]
```

```
excessreturns=p-rf
```

```
fit=lm(excessreturns ~ mktrf)
```

```
summary(fit)
```

```
fit2=lm(excessreturns ~ mktrf+smb+hml)
```

```
summary(fit2)
```

```
fit3=lm(excessreturns ~ mktrf+smb+hml+rmw+cma)
```

```
summary(fit3)
```

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