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Department of Business and Management
Course in Corporate Finance

Master's degree thesis in Business Valuation

**Assessing the impact of ESG scores on the return
and risk profile of European companies during the
Covid-19 global pandemic**

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Academic year: 2021 – 2022

*A mamma e papà,
che mi hanno incoraggiato e sostenuto nello straordinario percorso che mi ha
portato qui oggi.
Grazie per avermi dato la possibilità di studiare in questa bellissima
università,
grazie per avermi supportato anche quando pensavate fossi matto per essere
partito nel mezzo della pandemia,
grazie per avermi dato l'opportunità di fare così tante esperienze,
tutto ciò che sono lo devo a voi*

*A mia sorella,
unica compagna con cui condividere la follia di mamma e papà.
Grazie per essere sempre lì ad ascoltare le mie lamentele e miei dubbi,
grazie per tutti i pangoccioli, fast food, passeggiate e sessioni di videogiochi
notturne che condividiamo*

*ah...quasi dimenticavo, grazie per aver impersonato una (maldestra) 007 per
recuperare i dati perché, altrimenti, non so come avrei scritto questa tesi*

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1. Introduction

The impact a company has on the world while conducting its commercial operations has over time attracted higher interest from various market participants, scholars, and regulatory bodies. To measure this impact 3 categories can be analyzed: environmental, social, and governance. These three components make up the acronym of ESG. The acronym has become a buzzword, constantly present in the media, desired by consumers, and used widely across industries and value chains. Companies have, over the years, become increasingly sustainable to face the demand of their customers, and the pressure posed by activist shareholders and regulatory bodies. Especially when talking about new regulations and economic incentives offered by governmental bodies, the trend is clear: companies should be more sustainable. When examining investing choices, a strong preference for sustainable assets is noticeable. The amount of capital allocated to funds claiming some level of positive impact has grown from representing 22% of total worldwide investments in 2012 to 32% in 2021¹. Furthermore, whenever information is released regarding the level of sustainability of a fund, investors seem to allocate more capital to those that show the most positive ESG performance compared to their less sustainable counterparts. Despite the clear preferences, investors behave irrationally when considering the choice to invest in sustainable assets. The investment choices examined by numerous studies exhibit non-scalability, high impressionability from external, non-economic factors, and a high dependence on the level of emotional connection the person feels to the cause that the investment is supposed to address.

However, the question of whether sustainability has a positive or negative economic effect on the companies implementing it is still not completely answered by the literature. On a conceptual level, the debate of whether a company should follow a shareholder-centric strategy or a stakeholder-centric one has been unfolding since the late 20th century. Supporters of the former theory sustain that the main objective of a company is to maximize its profits. The latter school of thought instead argues that a company operates inside a complex ecosystem having multiple dimensions (e.g., social, environmental) and that its main objective should be the one of having a positive impact on one or more of these dimensions. Empirical results from research

¹ “The Future of Sustainable Investing.” Credit Suisse, October 17, 2022. <https://www.credit-suisse.com/about-us-news/en/articles/news-and-expertise/the-future-of-sustainable-investing-202210.html>.

and asset manager reports have not yet reached a consensus on the issue. The vast majority of those sources however point towards a positive relationship between the high level of sustainability of a firm and economic and financial performance. Economic performance refers to the ability of the firm to either generate higher revenues or decrease its costs. The question in this case is understanding if a company can reach the maximization of profits desired by the proponents of the shareholder theory by engaging in sustainable practices. Financial performance, instead, refers to the ability of the firm to generate abnormal stock returns, and reduce its risk measured by share volatility or both.

The subject becomes even more interesting if a period of economic crisis is considered. Supporters of ESG practices argue that a firm that has largely invested in creating a reputation as being sustainable is perceived better by investors. This positive perception is centered around two factors: risk aversion and loyalty. On one hand, the company is thought of as being more aware of the risks faced and, in general, having lower exposure to risk. Secondly, sustainability generates loyalty from customers and investors, thus generating positive effects on economic and financial performance.

This paper offers readers a comprehensive view of ESG assets from the point of view of investors, regulatory bodies, researchers, asset managers, and the companies themselves. In the following chapters, the Covid-19 crisis will be used as experimental conditions to test whether sustainability has a positive influence on a company's financial performance. While the pandemic had significant economic effects worldwide, the paper will focus its analysis on European companies. This choice is mainly motivated by 2 factors: the European market is the most advanced in terms of sustainability practices and the presence of comparable studies in other geographies. To understand the extent that economic cycles have on the ESG-financial performance relationship, this study will use the same methodology across three time periods: before the crisis, during the market crash, and in the recovery phase.

The paper is divided into 5 parts. The first section introduces the definition of ESG assets, a brief history of sustainable investing, the political environment, and the difference between ESG and CSR.

The second chapter focuses on investors. It captures the motivations behind the preferences of investors, showcases the high degree of irrationality surrounding ESG

investment choices, and provides an explanation for this phenomenon. Finally, it lists the seven investment strategies that can be employed when investing in sustainable assets.

The third part presents the theoretical background supporting a positive relationship between ESG and financial performance focusing on the three main transmission channels identified by literature: cash flow, idiosyncratic risk, and systemic risk.

The fourth chapter provides a review of the available literature regarding ESG-financial performance and ESG-economic performance relationships. Regarding financial performance, literature is collected regarding the influence of ESG on both stock price and volatility. The analysis also considers the impact that the sector in which a company operates has on the relationships as well as the individual impacts of the E, S, and G components. Finally, comparative literature is showcased considering periods of crisis focusing on the 2008 and Covid-19 global crises.

Finally, the last part conducts the analysis of the European landscape in the three periods defined above. Four hypotheses will be tested to examine the relationship between ESG and the two aspects of financial performance across the time periods.

2. An introduction to ESG

2.1 Shareholder theory and stakeholder theory

Sustainable management is tied to the acronym of ESG composed of “environmental”, “social” and “governance” which represent the three pillars companies can focus on to generate positive externalities while conducting their operations. More specifically:

- Environmental issues concern the impact a company’s activities might have on the environment. Examples of such effects are the emission of greenhouse gasses, the use, and disposal of polluting chemicals, and the use of renewable resources or fossil fuels.
- Social issues include a wide range of factors having an impact internally and externally to the company. Examples of factors with an external impact are efforts in the improvement of health or education, and relations with local communities. Examples of factors with an internal impact are the adherence to human rights and the inclusion of labor standards (e.g., exclusion of child labor along the supply chain), talent management, and freedom of association for employees.
- Governance issues concern aspects of the company such as culture, risk profile, or the quality of the management. This factor also includes the firm’s dedication to achieving social and environmental goals. The internal processes and governance policies such as shareholder structure or board and C-level remuneration are also considered. Finally, the efforts towards a fair and transparent measurement and reporting of non-financial effects are also measured.

For a company to adopt a sustainable management style, it means that it is not only focused on maximizing corporate financial performance (CFP) but, at the same time, includes one or more non-financial values such as “Environmentally friendly operations,” “Socially responsible practices,” and “Improvements in corporate governance”.

The shareholder theory of corporate strategy ideated by Milton Friedman states that the primary goal of a company is to maximize its financial performance². Imposing restrictions on corporate strategy to achieve other goals might suggest that corporate profits will have to take a secondary role. The stakeholder theory of corporate strategy elaborated by Dr. F. Edward Freeman in the late 20th century seems to support such a claim by stating that a firm’s success depends on the

² Milton Friedman, The social responsibility of business is to increase its profits, *Corporate Ethics and Corporate Governance* 173–178 (1973)

positive impact it has on its stakeholders (e.g., suppliers, employees, governmental bodies)³. On the other hand, the concept of ESG is based on the coexistence of the two theories rather than the dominance of one over the other⁴.

It is important to stress that the three factors (E, S, and G) are not equally viewed by investors. Samuel M. Hartzmark and Abigail B Sussman from the University of Chicago conducted a study asking 482 participants which characteristics they associated with “sustainability” in business practices. Participants on average listed 2.7 characteristics but there appeared not to be a common agreement among them on what are the elements defining sustainability. While 79% of participants stated they linked the concept of sustainability to actions having a positive environmental impact thus relating to the “E” component of ESG, none of the other two components gained attention from more than 50% of the respondents. The second most popular item associated with sustainability was safety which was mentioned by only 48% of the respondents. Despite the high variability of responses recorded, each of the respondents had an idea of what sustainability for business practices means. Only 2% of the respondents were unaware of what the concept of sustainability might mean for a firm⁵.

³ R. Edward Freeman, *Strategic management: A stakeholder approach* (1984).

⁴ Sungjin Son and Jootae Kim, “Environment, Social, and Governance Performance and Financial Performance with National Pension Fund Investment: Evidence from Korea,” *Frontiers in Psychology* 13 (December 2022), <https://doi.org/10.3389/fpsyg.2022.893535>.

⁵ Hartzmark, Samuel M., and Abigail B. Sussman. “Do Investors Value Sustainability? A Natural Experiment Examining Ranking and Fund Flows.” *SSRN Electronic Journal*, August 9, 2017. <https://doi.org/10.2139/ssrn.3016092>.

2.2 Political Environment

Sustainable finance is now in the spotlight of political and public attention. Business has become in large part the key driver of sustainable human and environmental development. Private markets are not solely focused on maximizing shareholder value and return on investment anymore, but also have incentives to showcase sustainable operations and methods. Topics such as producing and selling products in an environmentally-friendly manner or treating employees with respect and dignity have moved from being simply compliance topics to core strategic priorities. This shift did not occur overnight and was largely catalyzed by the various policies and regulations shaped by the political ecosystem across countries and continents. To describe the framework of sustainability, global resolutions imposed by the United Nations (UN) and initiatives by the European Union (EU) must be addressed.

In 2015, the global investment ecosystem underwent a complete jump start with the launch of the Sustainable Development Goals by the United Nations⁶. In a resolution named “Transforming our world: the 2030 agenda for Sustainable Development”, the UN defines 17 sustainability goals and 169 precise targets to provide member countries with guidance around topics such as education, health, climate change, gender equality, social justice, and energy⁷. While it was highlighted that the formulation of strategies and regulations was up to national governments, this 2030 agenda widely encouraged global collaboration to reach these goals. On a corporate level, the granularity and universality of the 169 goals enabled investors to understand and prioritize the serious challenges within business models. It is essential to stress that while ESG is only a rating system used by companies to rate their sustainability credentials, these have been facilitated by the SDGs as umbrella goals in the wider context of human rights⁸. By bringing a global consensus on pervasive environmental and social matters, the UN has succeeded in justifying the need for ESG considerations. Investors are mapping SDGs to their existing ESG sensitivities and have started directing capital flow toward positive and responsible impact⁹. For instance, the Swedish International Development Cooperation

⁶ “What are the sustainable development goals?: Policy and advocacy. Sightsavers. (2022, October 3). Retrieved February 7, 2023, from https://www.sightsavers.org/policy-and-advocacy/global-goals/?gclid=Cj0KCQiAq5meBhCyARIsAJrtdr7J2KVUtqSymMe-G378lvuelzGioadCGNvbWc62yDxJ3mYk6ITHLeoaArfWEALw_wcB

⁷ “Transforming Our World: The 2030 Agenda for Sustainable Development | Department of Economic and Social Affairs.” United Nations. United Nations. Accessed February 7, 2023. <https://sdgs.un.org/2030agenda>.

⁸ Emerick, Dean. “What Is SDG and ESG? - ESG: The Report.” ESG The Report, January 26, 2023. <https://www.esgthereport.com/what-is-sdg-and-esg/>.

⁹ “ESG to SDGs: Connected Paths to a Sustainable Future.” SustainoMetric. Accessed February 7, 2023. <https://sustainometric.com/esg-to-sdgs-connected-paths-to-a-sustainable-future/>.

Agency, a government agency, has built a partnership of 18 investment companies and institutional investors to explore opportunities and serve as a teaching program regarding SDGs¹⁰.

On a continental level and with reference to the UN 2030 Agenda, the EU published an Action Plan on March 8th, 2018 which reinforces 10 actions regarding sustainability and urges the European Commission to consider it a priority. The plan outlines a sustainable finance strategy that incorporates ESG topics as a measure of financial stability and growth. Some practical examples are the Commission providing ideas for the development of sustainability benchmarks (Action 5) or the integration of sustainability ratings for credit rating agencies (Action 6). The plan goes all the way to imposing Institutional investors and asset managers to incorporate sustainability factors in their investment decision-making (Action 7)¹¹. The EU also launched a serious bid in December of 2019 called the “European Green Deal” to become the world’s first climate-neutral continent by 2050¹². The promise they made was to “provide a roadmap with actions to boost the efficient use of resources by moving to a clean, circular economy and stop climate change, revert biodiversity loss and cut pollution.”¹³ The Union goes so far as to state its ambitions to reduce greenhouse gas emissions by at least 55% by 2030 and achieve climate neutrality by 2050¹⁴. To deliver on these goals, the EU urges investors to take action and consider sustainability standards in their investments.

Switzerland, not being a member state of the European Union, took matters into its own hands by introducing its own set of ESG initiatives. From the 2023 financial year onwards, banks, insurance companies, and listed companies of the SIX Swiss Exchange with more than CHF 20 million in total assets will be obliged to disclose sustainability and corporate governance reports¹⁵. Another worth noting regulation is the Responsible Business initiative,

¹⁰ “A Better World Together.” Sida. Accessed February 7, 2023. <https://www.sida.se/en>.

¹¹ “The European Union's 10 Point Action Plan.” Svarmi. Accessed February 7, 2023. <https://www.svarmi.com/blog/the-european-unions-10-point-action-plan#:~:text=On%207%20March%202018%2C%20the,those%20related%20to%20climate%20change>.

¹² Reeves, E., Caputo, A., Calvo, C., & Muschter, L. (2022, June 27). The ESG opportunity in Europe. Ashurst. Retrieved February 7, 2023, from <https://www.ashurst.com/en/news-and-insights/legal-updates/the-esg-opportunity-in-europe/>

¹³ “Overview of Sustainable Finance.” Finance Europa. Accessed February 7, 2023. https://finance.ec.europa.eu/sustainable-finance/overview-sustainable-finance_en.

¹⁴ “EU Leaders Set More Ambitious Emissions Reductions Target for 2030.” European Climate Foundation, January 31, 2021. <https://europeanclimate.org/stories/eu-leaders-set-more-ambitious-emissions-reductions-target-for-2030/>.

¹⁵ Stevenson, Craig, and Philipp Thaler. “Swiss Sustainability Reporting Requirements.” PwC, 2022. <https://www.pwc.ch/en/insights/sustainability/swiss-sustainability-reporting-requirements.html#:~:text=Swiss%20sustainability%20regulations,->

elected by popular referendum with a majority of 50.7% of the vote¹⁶. This legislation is limited to Swiss companies with activities abroad and sanctions companies engaging in problematic topics of child labor and conflict minerals.

The UN resolution and the country-based initiatives that followed had a substantial positive impact on sustainable investing. Prior to 2015, investors were already screening out sectors that they deemed unethical or misaligned with their personal values such as companies producing controversial weapons, tobacco, or adult entertainment¹⁷. But it is only since the UN resolution that sustainable finance has been made a widely discussed topic. Investors are using the SDGs as a reference point to select their investments and an entire research industry was developed to track companies' ethical behaviors. ESG factors are now widely understood as the expansion of SDGs into the corporate world¹⁸. ESGs can be broadly mapped to SDGs as presented in the graph below. Each of the 17 SDGs can be generally aligned with the unique considerations of ESGs¹⁹.

In%20December%202021&text=From%20the%202023%20financial%20year%20onwards%2C%20public%20companies%2C%20banks%2C,publicly%20on%20non%2Dfinancial%20matters.

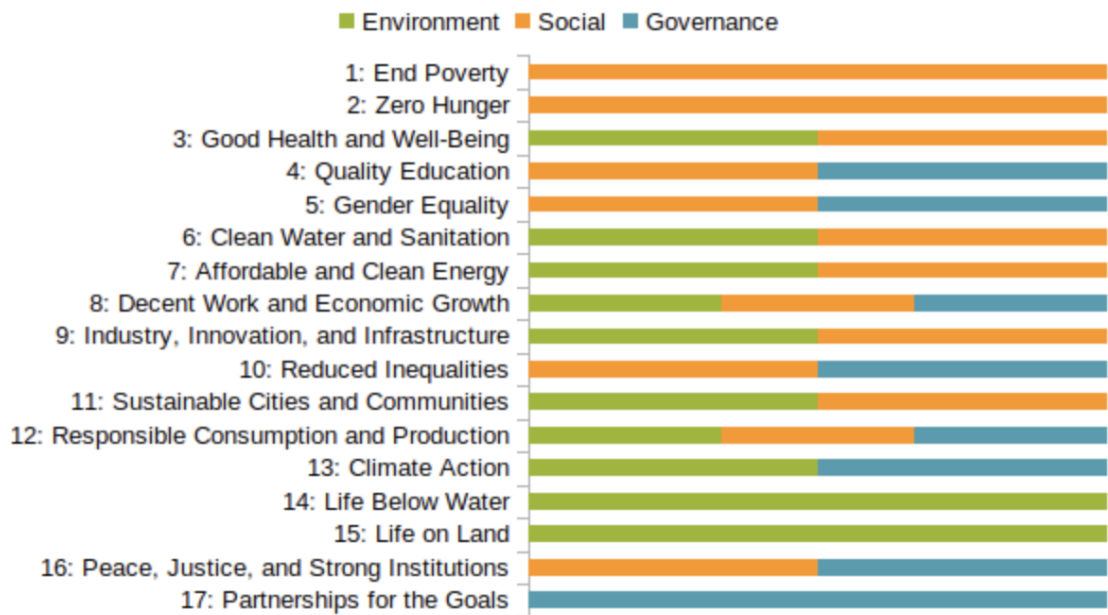
¹⁶ GEISSER, GREGOR, and ALEXANDRE MÜLLER. "The Swiss Responsible Business Initiative (RBI) Discussion and Legal Assessment." Corporate Justice, 2021.

¹⁷ "ESG to SDGs: Connected Paths to a Sustainable Future." SustainoMetric. Accessed February 7, 2023. <https://sustainometric.com/esg-to-sdgs-connected-paths-to-a-sustainable-future/>.

¹⁸ "How ESG Relates with UN Sustainable Development Goals." SAFETY4SEA, June 9, 2022. <https://safety4sea.com/cm-how-esg-relates-with-un-sustainable-development-goals/>.

¹⁹ see note 17

Figure 1: A general representation of ESG considerations broadly mapped to the 17 SDGs



Taking pragmatic examples of how establishing ESG measuring has translated into success can help understand the value of these new standards. An example could be the currently trending concept of a circular economy. The most basic principle of this concept is to use waste as a raw material for new products. H&M’s “Let’s close the gap” initiative, started in 2013, collects discarded textiles from customers to restore and sell again²⁰. Customers are rewarded with tokens to be used as discounts in H&M stores. According to Forbes, by 2019, 57% of H&M’s primary materials were sustainable with the target of improving this number to 100% by 2030. Another great practice aligned with the ESGs is to scrutinize and assess companies’ ability to promote positive environments for their entire workforce. A well-known company that is pushing for this target is IKEA²¹. They have created a supplier code-named IWAY to force suppliers to meet certain standards when it comes to humanitarian working conditions. For instance, IWAY evaluates suppliers’ life-work balance, work safety, and core worker rights. By establishing these new rules, IKEA encourages socially positive behaviors and pushes out-of-business suppliers who do not set themselves to achieve these standards.

²⁰ Gençer, G. (2022, December 28). Top 10 sustainability case studies & success stories in 2023. AIMultiple. Retrieved February 7, 2023, from <https://research.aimultiple.com/sustainability-case-studies/#2-ikea-iway-make-business-with-esg-oriented-corporations>

²¹ Ibid.

2.3 The difference between CSR and ESG

In 1953 the American economist Howard Bowen introduced in his publication “Social Responsibilities of the Businessman” the concept of corporate social responsibility (CSR). The concept however only gained popularity in the United States 20 years later²².

CSR can be divided into four broad areas: economic, legal, ethical, and philanthropic responsibilities. While the terms ESG and CSR are often considered synonyms to describe a company’s voluntary set of actions to have a positive impact on the environment or society, there are differences between the two²³.

The main difference to be noticed between CSR and ESG is found in the degree to which both can be quantified. CSR practices are often self-regulated by companies and include a set of qualitative measures that are not easily quantifiable. Furthermore, CSR practices present a large degree of variation across sectors. Despite the large fragmentation in non-financial reporting standards and measures as seen in the following chapters, ESG provides a more measurable approach. These measures take the form of ESG scores or ratings that can be used to add another dimension to evaluate firms’ performance.²⁴

Opinions differ regarding the degree of similarity between ESG and CSR. However, it is generally acknowledged that CSR was a precursor of ESG in the creation of incentives for companies not to look at their strategy and operations solely based on their financial performance²⁵.

²² Writer, S. (2019). A brief history of corporate social responsibility (CSR). Thomasnet® - Product Sourcing and Supplier Discovery Platform - Find North American Manufacturers, Suppliers and Industrial Companies. Retrieved January 18, 2023, from <https://www.thomasnet.com/insights/history-of-corporate-social-responsibility/#:~:text=Although%20responsible%20companies%20had%20already,Social%20Responsibilities%20of%20the%20Businessman>

²³ Khan, Mozaffar, George Serafeim, and Aaron Yoon. “Corporate Sustainability: First Evidence on Materiality.” *The Accounting Review* 91, no. 6 (November 1, 2016): 1697–1724. <https://doi.org/10.2308/accr-51383>.

²⁴ Sean O’Neill on Jul. “What Is the Difference between CSR and ESG?” *The Corporate Governance Institute*, September 27, 2022. <https://www.thecorporategovernanceinstitute.com/insights/lexicon/what-is-the-difference-between-csr-and-esg/#:~:text=CSR%20focuses%20on%20corporate%20volunteering,the%20valuation%20of%20the%20business>

²⁵ “What’s the Difference between CSR and ESG?” *alva*, March 22, 2021. <https://www.alva-group.com/blog/whats-the-difference-between-csr-and-esg/>.

3. The psychology of ESG investing

Having clarified in the previous chapters what ESG is and what is the political and regulatory environment, the following chapter explains the behaviors of investors when they decide to invest in companies having strong ESG profiles. This chapter is divided into six subchapters. The first subchapter is aimed at exploring the reasons that motivate people in investing in sustainable companies. The following two subchapters explore two areas of irrationality investors exhibit when dealing with these kinds of investments. The fourth subchapter “Warm glow as an explanation for investors’ behavior” explains these irrational behaviors. Finally, the last 2 subchapters describe the 7 investment strategies investors adopt when dealing with sustainable assets, their importance measured by assets under management (AUM), and their growth in recent years.

3.1 ESG investing motivations

ESG investing has become increasingly popular in the last decade, especially among retail investors. Retail investors made up only 11% of the total ESG market in 2012 and in 2020 this number has increased to 25%²⁶.

Before analyzing the financial impact of using an ESG strategy, it is interesting to understand what motivates investors to choose ESG assets over non-ESG ones. Chatterji et al. (2009) identified the following four distinct motivations related to the choice of sustainable assets: financial, deontological, consequentialist, and expressive²⁷. The table below describes each one of the motivations:

²⁶ Ferraro, Fabrizio. “Why Do People Invest in ESG Funds? - Santander Asset Management.” SantanderAssetManagement, 2021.

https://www.santanderassetmanagement.com/content/view/7731/file/SAM_%20SUSTAINABLE%20WEALTH%20ACADEMY_WHY%20DO%20PEOPLE%20INVEST%20IN%20ESG.pdf.

²⁷ Chatterji, Aaron, David Levine, and Michael Toffel. “How Well Do Social Ratings Actually Measure Corporate Social Responsibility?” SSRN Electronic Journal, February 20, 2008. <https://doi.org/10.2139/ssrn.993094>.

Table 1: ESG motivations

Motivation	Description
Financial	Investors motivated by financial factors believe that investing in companies conducting more sustainable business practices is a superior investment strategy. This motivation, therefore, leads to the investment in ESG assets without the presence of moral values or interests beyond financial ones.
Deontological	Being motivated by deontological reasons is related to the idea of avoiding generating profits by exploiting unethical behaviors or practices. This investment approach is consistent with the first generation of sustainable investment strategies (e.g., exclusionary screening). Contrary to the Financial rationale described above, deontologically motivated investors choose to invest in sustainable assets due to personal beliefs and values rather than financial returns.
Consequentialist	Consequentialists want to promote the presence of sustainable investments in the market by trying to influence the cost of capital companies to face through funds allocation. More specifically, they believe that by directing their funds to more sustainable companies, they will help them reach lower costs of capital compared to the non-sustainable ones that will receive less funding. Through the use of cheaper funding, the companies adopting sustainable practices will therefore enjoy an advantage thus creating the need for non-sustainable companies to adapt their operations to keep being competitive. This motivation is also subjective and linked to personal beliefs and motivations.
Expressive	Expressive investors adopt a fully value-based investment strategy. Differently from deontologically motivated investors, however, it is closer to more modern sustainable investment strategies (e.g., best-in-class screening). The investor chooses, based on personal beliefs, which industries and/or companies will generate the most positive

	externalities. Once again, the financial returns will represent a secondary motivation in the investor's capital allocation. ²⁸
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3.2 The non-rationality of sustainable investing

Most of the motivations described above present a component of personal interest in the investment in sustainable assets to generate positive externalities. In doing so, however, investors are often described by literature as acting irrationally. The presence of psychological biases and non-rationality in investment decisions has been well documented in a vast variety of studies. The role of emotions in financial decision-making has for example been explored in detail by Kuhnen and Knuston (2011) where they showcase how the role of positive emotions such as overconfidence and excitement can reduce the perception of risk of an asset while negative emotions such as anxiety will have the opposite effect²⁹. Other popular biases such as the home bias influence investors in favoring domestic assets rather than foreign ones due to the unfamiliarity of the latter ones³⁰. Finally, the most popular investment bias is related to the IPOs of glamorous companies where those firms enjoy their shares being overpriced compared to the ones of comparable companies. This effect then usually results in the underperformance of those assets concerning the expected return investors envisioned³¹.

ESG investments are no exception, and the difficulty of interpreting non-monetary aspects leads to higher degrees of non-rationality. Hartzman and Sussman (2019) show how the decision to invest in sustainable assets follows a superficial analysis of the available data. They conduct a study on the performance of over 20,000 mutual funds analyzing whether the presence of a high ESG rating will influence the flow of capital the funds experienced. In 2016, Morningstar published for the first time its proprietary sustainability ratings expressed in a simple, 5 levels rating scale from worst to best performing in terms of ESG. The study shows how the publication of those ratings had a positive impact on the extremely positively ranked funds and a negative impact on the extremely poorly ranked funds. Over a period of 11 months

²⁸ Ibid.

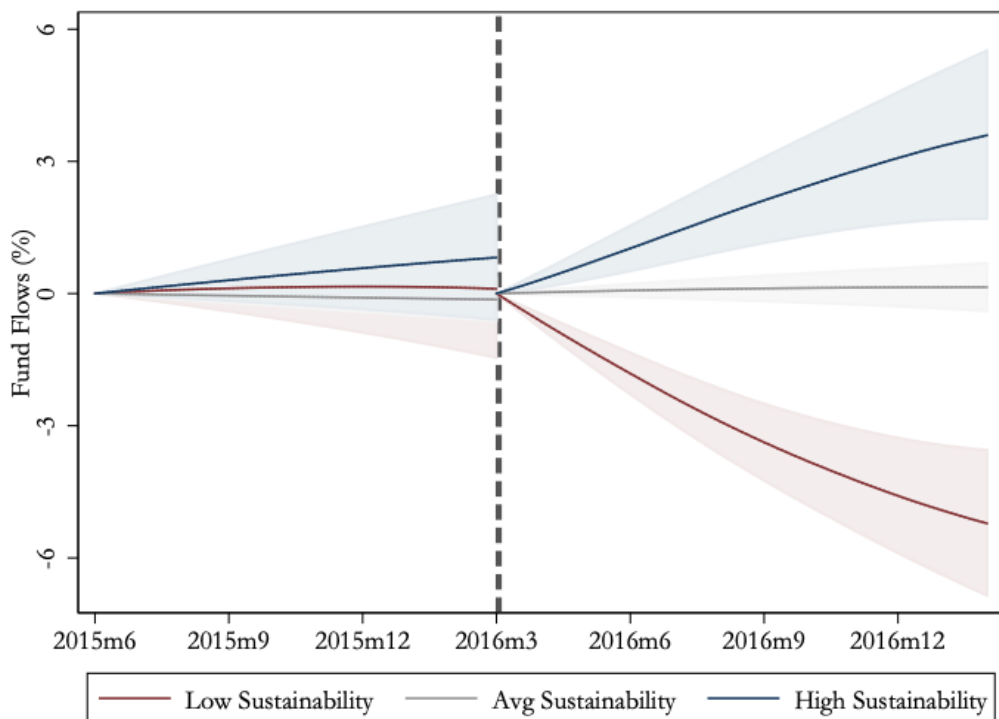
²⁹ Kuhnen, Camelia M., and Brian Knuston. "The Influence of Affect on Beliefs, Preferences, and Financial Decisions." *Journal of Financial and Quantitative Analysis* 46, no. 3 (2011): 605–26. <https://doi.org/10.1017/s0022109011000123>.

³⁰ Wallmeier, Martin, and Christoph Iseli. "Home Bias and Expected Returns: A Structural Approach." *Journal of International Money and Finance* 124 (2022): 102634. <https://doi.org/10.1016/j.jimonfin.2022.102634>.

³¹ MacGregor, Donald G., Paul Slovic, David Dreman, and Michael Berry. "Imagery, Affect, and Financial Judgment." *Journal of Psychology and Financial Markets* 1, no. 2 (June 2000): 104–10. https://doi.org/10.1207/s15327760jpfm0102_2.

after the publication, the highest-ranked funds experienced a 4% increase in fund size corresponding to an amount between 24 and 32 billion dollars attributable to the ESG rating publication. Poorly ranked funds experience a reduction of about 6% in the capital received corresponding to an amount between 12 and 15 billion dollars attributable to the ESG rating publication. Interestingly the funds that were ranked as average in terms of sustainability experienced no impact in terms of the quantity of received funding³². This finding is consistent with another popular biased identified in investment decisions where investors tend to react to extreme information on a much larger scale than they do when facing more moderate scenarios³³. The figure below illustrates the change in capital managed for the funds where the dashed gray line represents the date on which the ESG scoring was published:

Figure 2: change in funding received after publication of ESG scores



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³² HARTZMARK, SAMUEL M., and ABIGAIL B. SUSSMAN. “Do Investors Value Sustainability? A Natural Experiment Examining Ranking and Fund Flows.” *The Journal of Finance* 74, no. 6 (2019): 2789–2837. <https://doi.org/10.1111/jofi.12841>.

³³ Hartzmark, Samuel M. “The Worst, the Best, Ignoring All the Rest: The Rank Effect and Trading Behavior.” *SSRN Electronic Journal*, October 31, 2014. <https://doi.org/10.2139/ssrn.2503987>.

³⁴ *Ibid.*

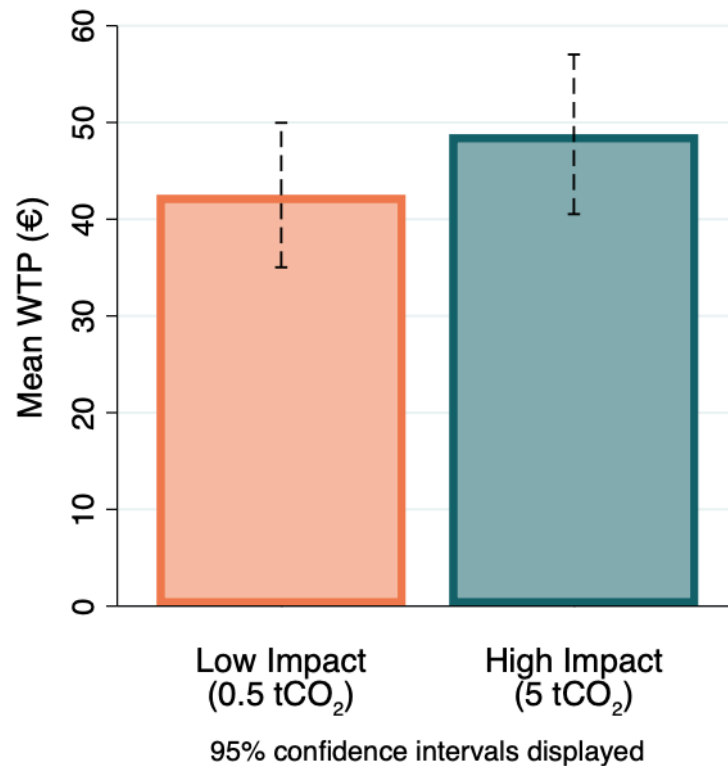
The most important finding of the study is linked to the superficiality to which investors acted based on the information they received. Morningstar published not only the scores based on the rating from 1 to 5 but also the components and individual scores for each of them that led to the rating. The funds within the same ranking received the same treatment from investors despite presenting differences across those individual dimensions meaning that investors did not conduct in-depth research on the ESG profile of the assets and what factors might have led to a specific score.

3.3 The non-scalability of ESG investing

Another factor contributing to the idea that investors' behavior regarding ESG assets is not rational is that the investments to generate positive externalities do not follow a linear behavior. Studies like Humphrey et al (2020) show that people tend to have a preference for allocating more capital to investments having positive effects to charities and less to assets having negative effects on charitable causes. However, there seems to be a non-linear correlation between the magnitude of the positive/negative effect the investment would have, and the capital invested³⁵. Heeb et al. (2022) give more clarity on this phenomenon by conducting an experiment on 527 individuals. In their experiment, investors are divided into two groups and each of these groups can indicate their willingness to pay to acquire one asset. The first group obtains a "low impact" asset while the second group is presented with a "high impact one". The impact is measured by tons of CO2 emissions the investment can reduce. The high-impact investment is presented as saving 10 times the amount of CO2 than the low-impact one. What they find is that while willingness to pay (WTP) for the high-impact asset is higher than the lower one, the results are significantly different. Investors were willing to pay €42,49 for the low-impact asset and €48,78 for the high-impact one as shown in the figure below:

³⁵ Humphrey, Jacquelyn, Shimon Kogan, Jacob Sagi, and Laura Starks. "The Asymmetry in Responsible Investing Preferences," September 2021. <https://doi.org/10.3386/w29288>.

Figure 3: Difference in funds provided for low and high-impact sustainable investments



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To rule out the hypothesis that investors expressed such preferences because they did not understand the impact of the investment, they conducted the same test with professional ESG investors. Those investors being wealthier, more educated, and more knowledgeable about financial markets did not present a different behavior than their less experienced counterparts. The willingness to pay changed to €48,38 for the low-impact asset and €49,64 for the high-impact one³⁷.

3.4 Warm glow as an explanation for investors' behavior

To understand the reasons behind the irrational behavior of ESG investors, it is important to stress that, when individuals adopt sustainable investment strategies, they adopt an emotional rather than calculative approach. When investors act based on their feelings, their utility function and therefore their willingness to pay for the asset is explained by step functions. Investors are motivated more by the subjective emotional connection they feel rather

³⁶ Ibid.

³⁷ Ibid.

than the scope of the asset. Hsee and Rottenstreich (2004) argue that people would invest money to save pandas because of emotional factors such as how much they like pandas, whether or not in the moment of the choice in how much to donate to the cause they can see a picture of a panda and how cute the animal looks in the picture. They also found no difference in the willingness to pay when the number of pandas saved would increase thus showing the absence of scope considerations even when the topic generates a high emotional connection³⁸.

These characteristics are explained by the “warm glow” model proposed by Ferguson and Flynn (2016). They claim that people’s utility functions are a function of both financial factors and morality. The morality aspect is correlated with the financial considerations of the good action undertaken. That is, the more money people donate to charitable causes, the better they feel afterward. However, the happiness derived does not only depend on how good actions taken are on absolute terms but also in comparison to other choices. The warm glow people experienced depends on the options available to the subjects. When offered the option not only to give but also to steal money from a charity, people who decided to donate to said charity reported being happier than those people who were not offered the option to harm the charity. The better action is compared to others, the stronger the feeling experience. Vice versa, when subjects’ choice was limited only to good actions, the warm glow feeling experienced was lower³⁹.

The warm glow model explains the reason behind the superficiality of the consideration of ESG factors outlined above. Given that the utility derived from sustainable investments is mainly derived from emotions and feelings rather than logical aspects, the abundance of data might be detrimental in creating the warm glow feeling. Providing quantitative information about the investment and even the efficacy of the charitable cause behind it forces investors to think rationally about the investment, thus reducing the role of emotional decision-making. Karlan and Wood (2017) found that small-scale donors are in fact less likely to donate again when quantitative information about the effectiveness of the charity they selected⁴⁰.

³⁸ Hsee, Christopher K., and Yuval Rottenstreich. “Music, Pandas, and Muggers: On the Affective Psychology of Value.” *The Construction of Preference*, 2006, 594–608. <https://doi.org/10.1017/cbo9780511618031.033>.

³⁹ Ferguson, Eamonn, and Niall Flynn. “Moral Relativism as a Disconnect between Behavioural and Experienced Warm Glow.” *Journal of Economic Psychology* 56 (2016): 163–75. <https://doi.org/10.1016/j.joep.2016.06.002>.

⁴⁰ TKarlan, Dean, Sneha Stephen, Keesler Welch, and Jacob Geray. “The Effect of Effectiveness: Donor Response to Aid Effectiveness in a Direct Mail Fundraising Experiment.” *AEA Randomized Controlled Trials*, 2017. <https://doi.org/10.1257/rct.1849-1.0>.

3.5 A description of ESG investment strategies

As outlined above, there are multiple possible reasons behind the choice of investing in sustainable assets. ESG investing can take many forms. While there is a lack of standardization across different strategies and a clear definition of boundaries between them, Eurosif the leading pan-European association focused on promoting Sustainable Finance at the European level, identified 7 ways in which investors can invest in ESG assets:

1. Best in class screening: investments are selected by choosing the best-performing assets based on ESG criteria across categories or classes. Investors following this strategy would define which would be the asset class or category they want to invest in, create or select a model for ESG analysis, and then invest in the assets with the highest performance. This approach is thought of as being a promoter of increased competition between companies in terms of sustainability performance⁴¹.
2. Engagement and voting: this is a long-term strategy aimed at leveraging active ownership through voting shares to influence the behavior of the target firms or their level of non-financial disclosure. The approach is targeted at solving the principal-agent problems caused by the separation of ownership and management that large companies are often subject to.
3. ESG integration: investors following this approach include the financial influence of ESG factors positively and negatively in their analysis of potential investments. This approach also includes the risks that might arise depending on the firm's decision to include ESG considerations in its strategy or operations.
4. Exclusionary screening: this strategy, also called the ethical or value-based approach, is based on the exclusion of individual companies, sectors, or countries from possible investments. The exclusion is based on specific criteria such as in the case of "sectoral exclusion" by eliminating all the companies operating in the "Sin industries" (e.g. weapons, pornography, tobacco).
5. Impact investing: investments are made with the intention to generate a positive social and environmental impact together with financial return. The investments made with such an approach might provide financial returns aligned with the market but in some cases also lower returns are justified thanks to the direct positive impact generated. The clear difference between this category of investments and philanthropic activity is due

⁴¹ Staub-Bisang, Mirjam. Sustainable Investing for Institutional Investors: Risks, Regulations and Strategies. Singapore: Wiley, 2012.

to the presence of financial returns and the ownership of the asset that stays in the hands of the investor.⁴²

6. Norms-based screening: this strategy involves the analysis of the compliance of the investments with international standards and norms influencing ESG factors. Examples of such international standards are the ones set by the United Nations (UN).
7. Sustainability themed: investments carried out with such an approach will be focused on addressing one or multiple issues relating to ESG topics such as environmental issues, climate change, and improvements in social equality. Funds following such a strategy will need to implement fixed transparent investment criteria used to screen investments⁴³. This strategy is often considered riskier but potentially more lucrative due to its higher dependency on recent trends compared to the others⁴⁴.

3.6 ESG investment strategies and their global Assets under management

While all the strategies are aimed at including ESG criteria in the investment decision, investments in each of them, measured by total assets under management (AUM), present large differences. Impact investing is the investment strategy that reported the lowest global assets under management in 2020 amounting to \$352 billion of which 60% were attributable to the US market. The most popular strategy is ESG integration obtaining more than \$25 trillion globally. This strategy became the most popular one only recently overtaking the Exclusionary screening one. The success of this strategy is to be attributed to two main factors: the inclusion of measurable, comparable ESG data in the investment process and the consideration of ESG-related risks that could have an impact on the asset's return potential. Lastly, a surprisingly high amount of funds is invested in Engagement and voting strategies with over 25% of the US boards already tying executive compensation to ESG metrics in 2020⁴⁵.

The figure below presents the global assets under management for the 7 strategies reported in US dollars in 2020.

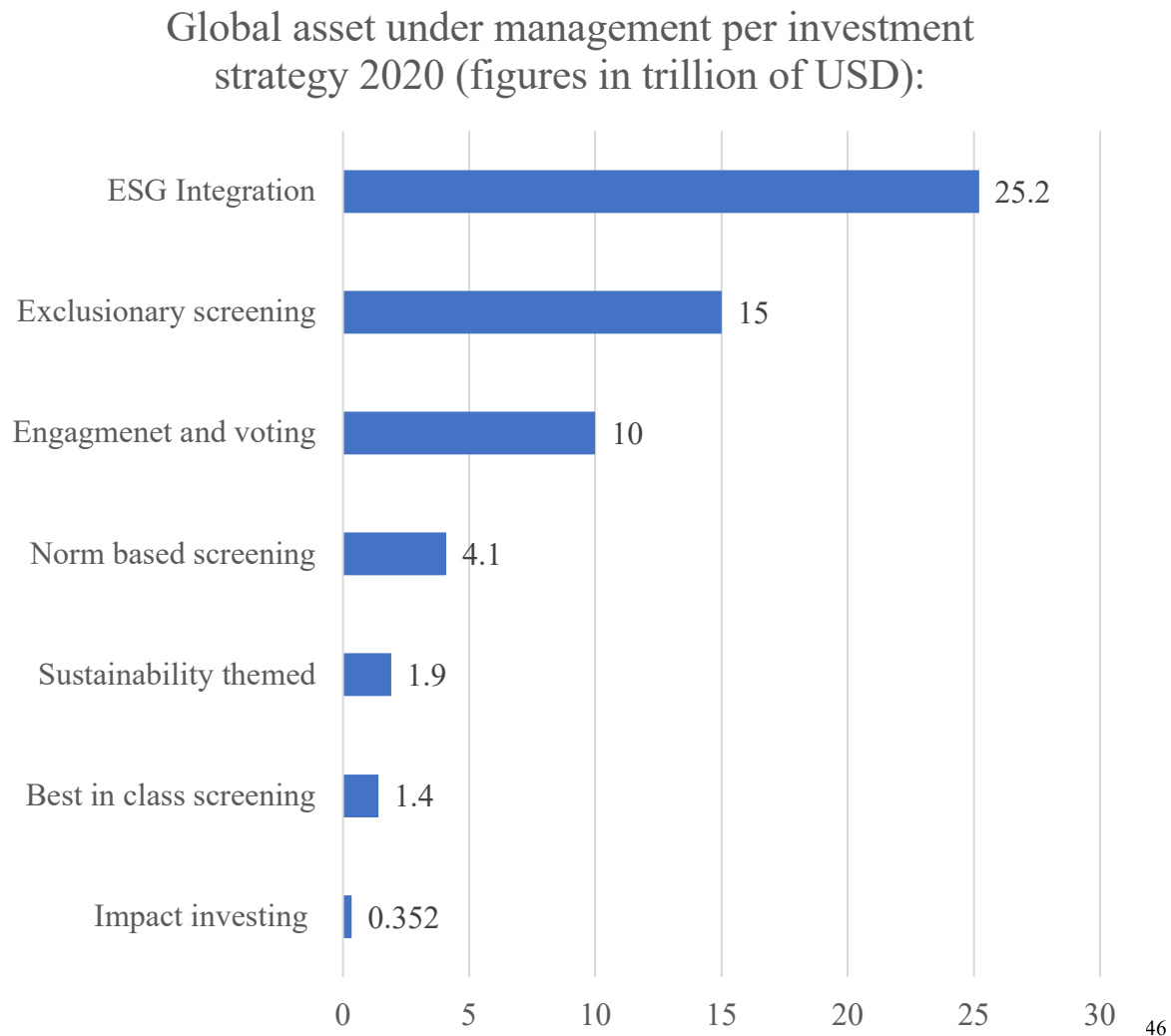
⁴² "What You Need to Know about Impact Investing." The GIIN. Accessed January 18, 2023. <https://thegiin.org/impact-investing/need-to-know/#what-is-impact-investing>.

⁴³ "Responsible Investment Strategies." EUROSIF, November 24, 2021. <https://www.eurosif.org/responsible-investment-strategies/>.

⁴⁴ Staub-Bisang, Mirjam. Sustainable Investing for Institutional Investors: Risks, Regulations and Strategies. Singapore: Wiley, 2012.

⁴⁵ Ross, Jenna. "Sustainable Investing Strategies by Popularity." Advisor Channel, November 4, 2021. <https://advisor.visualcapitalist.com/sustainable-investing-strategies-by-popularity/>.

Figure 4: Comparison between the 7 sustainable investment strategies measured by assets under management in 2020



3.7 ESG investment strategy growth

Not all the strategies emerged in the same period. Exclusionary screening strategies are among the ESG investing approaches that have been around for the longest time. Those investing approaches gained popularity already in the 1960s to address social and political

⁴⁶ “Global Sustainable Investment Review 2020.” GSIA, 2021. <http://www.gsi-alliance.org/>.

issues at the time⁴⁷. Other strategies have been created more recently. Among those strategies, there is impact investing which gained popularity only around 2009⁴⁸.

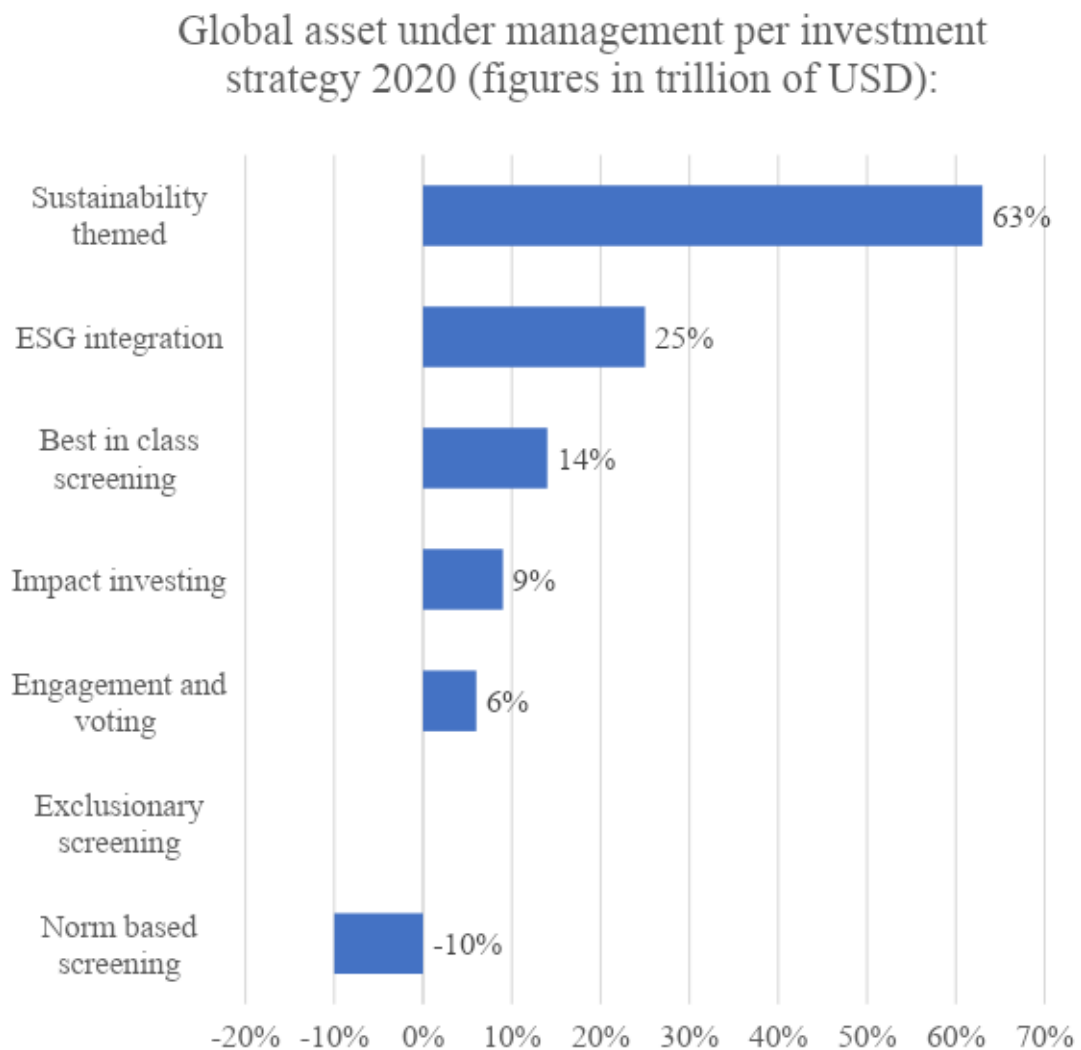
Investor preferences for the investment strategies are captured by looking at the compounded annual growth rate (CAGR) for each of them. These preferences presented over time a high degree of variability and they tend to follow trends in the investment world. An example of this is sustainability-themed strategies which follow the same popularity trend as general-themed investment strategies. In the years between 2015 and 2020, thematic strategies have been growing at a CAGR of 20%⁴⁹. Similarly, sustainability-themed strategies are the ones that registered the highest growth between 2016 and 2020. Most ESG-related strategies registered an increase in the same time frame due to the increasing popularity of ESG investments overall while only norm-based screening registered a global decrease of 10% in assets under management.

⁴⁷ Asmus, CFA, CAIA, Loren. "Understanding ESG Part I: Exclusionary Screening." Understanding ESG Part I: Exclusionary Screening | Canterbury Consulting, January 30, 2020. <https://www.canterburyconsulting.com/blog/understanding-esg-part-i-exclusionary-screening/>.

⁴⁸ Liu, Jess. "ESG Investing Comes of Age." Morningstar, Inc., January 1, 1971. <https://www.morningstar.com/features/esg-investing-history>.

⁴⁹ Wallach, Omri. "How to Invest in Change: A Guide to Thematic Investing." Visual Capitalist, May 19, 2021. <https://www.visualcapitalist.com/sp/how-to-invest-in-change-a-guide-to-thematic-investing/>.

Figure 5: Comparison between the growth of the 7 sustainable investment strategies measured by assets under management in 2020



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⁵⁰ Ross, Jenna. "Sustainable Investing Strategies by Popularity." Advisor Channel, November 4, 2021. <https://advisor.visualcapitalist.com/sustainable-investing-strategies-by-popularity/>.

4. Theoretical background

As outlined in the previous paragraphs, it is clear that investors and regulatory bodies ask for higher levels of sustainability. It is still not clear however if businesses should care about sustainability when pursuing their own interests. To explore the reasons for which ESG initiatives could have a positive impact on firms, this chapter uses the discounted cash flow (DCF) valuation method as the core framework. Four subchapters are presented below. The first one introduces the discounted cash flow framework and the other three provide explanations behind the overperformance of sustainable companies by looking at the cash flow channel, the idiosyncratic risk channel, and the systemic risk channel.

4.1 The discounted cash flow (DCF) valuation method

The demand for sustainable investment opportunities is high and it is growing rapidly. Given this, it is important to understand whether this increasingly high demand is motivated only by personal values or preferences or whether there is an actual theoretical financial reason to invest in sustainable assets.

A company's valuation can be estimated using a variety of different methods. Examples of this are the discounted cash flow method (DCF) or the earnings multiplier. In this section, the discounted cash flow method will be used to analyze the possible reasons behind the influence of ESG factors in a company's valuation. The DCF method calculates a company's value by estimating the cash flows the company will generate in the future and then dividing them using a discount factor to consider the time value of money. The time value of money principle assumes that 1 dollar received today is worth more than a dollar collected tomorrow because money today can be invested and produce interest. If for a certain asset there is a 5% annual interest, it means that a dollar invested today will be worth $1 \cdot (1 + 0,05) = \$1.05$ in one year. For a company's valuation, the annual discount rate is given by the company's weighted average cost of capital (WACC) because it represents the rate of return that is expected by investors when investing in the firm. When valuing a business, future forecasts are generally estimated until year 5 and then a terminal value is used. The rationale behind this is that it is hard to estimate reliably how businesses will perform after 5 years. The most popular way to calculate the terminal value is to use a perpetual growth assumption. It is generally assumed that the company will grow its cash flow at a stable rate year by year. Businesses are in this

case assumed to grow at a reasonable rate indefinitely in the future. A simplified formula for the DCF valuation method is provided below:

$$V = CF_0 + \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \frac{CF_3}{(1+r)^3} + \frac{CF_4}{(1+r)^4} + \frac{CF_5}{(1+r)^5} + TV$$

Where:

V = value of the company

CF = value of the cash flow expected in year

r = WACC of the company

TV = Terminal value

To explain how ESG factors can influence a company's valuation, this section will focus on 3 possible transmission channels described in the literature: the cash flow channel, the idiosyncratic risk channel, the systemic risk channel.

4.2 The cash flow channel

The DCF valuation method uses in its formula the expected future cash flows the company is predicted to generate. There is a positive relationship between the forecasted cash flows and the valuation attributed to the firm. This means that all else being equal, a company with higher expected cash flows over the years will be valued more than a company that is expected to produce less in the future. Gregory et al. (2014) provides an explanation linking a company's ESG efforts to the ability to produce higher cash flows in the future. In the study, it is stated that companies having high ESG performance are more competitive than their peers. This advantage is strongest in the long term as ESG-rated companies are expected to have internal mechanisms and policies in place to force long-term thinking when it comes to developing their strategies. It is also often the case that, to guarantee the long-term success of the firm and minimize principal-agent conflicts moved by short-term thinking of C-level executives, those companies use long-term remuneration incentives for senior management.

McKinsey identifies 5 factors that could explain the higher competitiveness of these firms which are summarized in the table below:

Table 2: The 5 reasons explaining the overperformance of sustainable companies

Factor	Description
Top-line growth	Strong ESG propositions can help companies succeed in current and new markets. When a firm’s activity depends on approval from a government, companies are more likely to receive accesses, approvals, and licenses if they are perceived as being sustainable. A sector where sustainability factors play a crucial role is the mining industry where companies engaging in social initiatives were considered beneficial to the public and obtained approval to extract resources easier than their peers with lower ESG profiles. Finally, cross-industry more than 70 percent of consumers stated that they would be willing to pay a 5 percent premium if the “green” alternatives match the “non-green” ones in terms of performance standards.
Cost reduction	Companies that care about their environmental impact will actively find ways to optimize their resource utilization. Reducing the number of materials used during production, allows companies to cut back raw material costs and other operating expenses. These cost reduction efforts have a tangible impact in improving operating profits that can be as high as 60 percent.
Regulatory and legal interventions	Some industries face strong regulatory pressure from governments (e.g., baking, energy, pharma). Stronger external-value propositions can alleviate the pressure on those companies and achieve higher strategic freedom. It is important for companies operating in such highly regulated industries to minimize the impact of government intervention as it can represent a sizable proportion of the firm’s EBITDA. For the pharmaceutical

	<p>industry, this value varies between 25 and 30 percent, for telecommunication companies it can be as high as 40 to 50 percent, and in the banking sector, which is the one facing the most affected sector, the figure can arrive at 60 percent of their EBITDA.</p>
Increase in productivity	<p>Companies associated with a high ESG proposition can attract and retain high-quality employees and generate a sense of purpose. This perception of real-world impact generates higher job satisfaction which is directly linked to an increase in productivity. Companies that are classified as leaders in the satisfaction of their employees received higher stock valuations between 2.3 and 3.8 percent over a 25-year horizon. Finally, firms having lower overall ESG propositions are expected to be negatively affected in terms of productivity. Examples of factors that can cause this are strikes, workers' slowdowns, and issues with other participants willing to cooperate in the company's value chain.</p>
Optimization of investments and assets	<p>Strong ESG propositions push companies in allocating capital only to the most promising and sustainable opportunities. The focus on sustainability forces companies in thinking about the long-term considerations of each new strategy or investment. Those long-term strategies are generally not chosen by non-sustainable companies because they generally require high levels of initial investments, and the benefits might only be realized after years or even decades. Governments are also getting involved in providing grants and other benefits that help companies that choose to engage in such long-term investments. While in the short term less sustainable, established strategies might produce higher</p>

	<p>profits due to lower investments required, in the long term, less sustainable companies might face more stringent regulations or will have to face outdated, inefficient operations and will be forced to catch up.</p>
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4.3 The idiosyncratic risk channel

Risk is also an important component of the final valuation of the company through the discounted cash flow method. The higher the risk a company is expected to face, the more expensive it will be for the company to acquire sources of capital. The higher those costs, the higher will be the rate of return expected by investors and therefore the discount factor applied for future cash flow. A higher discount factor will negatively affect the company valuation, that is, assuming everything else stays equal, a company facing lower risk will have a higher valuation than its riskier counterparts. The concept of idiosyncratic risk is crucial to understand how sustainable company practices can affect the perceived risk of an investment. Idiosyncratic risk, also referred to as “non-systemic” or “firm-specific” risk is the risk applying only to a specific investment as opposed to systemic risk which is commonly shared across all investments in the same asset class, geography, or sector⁵². Idiosyncratic risk represents approximately 80% of the risk faced by firms in the stock market and, therefore, is an incredibly important aspect to consider when investing⁵³.

According to Giese et al. (2019), there are two main ways in which high ESG efforts can help reduce a company’s idiosyncratic risk: risk control and social capital. Companies that engage in responsible behaviors typically have risk control measures that are above average. Those measures allow them to mitigate risk internally and, in many cases, will extend within their supply chain. The risk of these companies suffering severe incidents such as fraud or corruption is lower. Those events, if materialized, could have dramatic impacts on the firm’s reputation

⁵¹ Henisz, Witold, Tim Koller, and Robin Nuttall. “Five Ways That ESG Creates Value - McKinsey & Company.” McKinsey. Accessed January 19, 2023. <https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/Strategy%20and%20Corporate%20Finance/Our%20Insights/Five%20ways%20that%20ESG%20creates%20value/Five-ways-that-ESG-creates-value.ashx>

⁵² Team, CFI. “Idiosyncratic Risk.” Corporate Finance Institute, December 28, 2022. <https://corporatefinanceinstitute.com/resources/risk-management/idiosyncratic-risk/>.

⁵³ Gaspar, José-Miguel, and Massimo Massa. “Idiosyncratic Volatility and Product Market Competition*.” The Journal of Business 79, no. 6 (November 2006): 3125–52. <https://doi.org/10.1086/505251>.

and therefore valuation. Less frequent events of this kind allow the company as being perceived as less risky and will therefore face lower costs when trying to raise capital⁵⁴. Finally, according to Godfrey et al. 2008, companies that behave ethically build social capital⁵⁵. The concept of social capital can be defined as the relationships of trust among the company's internal and external stakeholders that glue the company together and allow it to operate⁵⁶. Thanks to the social capital these companies can build over the years, when those incidents occur, stakeholders respond in a less negative way than they normally would. Stakeholders tend to behave in a way that punishes bad corporate behavior. This punishment is a function of the gravity of the event experienced and the perceived intentions of the parties involved. Building social capital allows to mitigate the latter factor described and stakeholders will be more likely to attribute negative events to managerial maladroitness rather than actual malevolence.

4.4 The systemic risk channel

The final explanation provided for the overperformance of highly sustainable companies is to be found in the firm's sensitivity to systemic risk. Conversely to the idiosyncratic risk introduced in the chapter above, systemic risk does not consider firm-specific risk faced by a company, but rather the risk that multiple companies share due to factors beyond their direct control⁵⁷. According to Eccles et al. (2014)⁵⁸ companies with strong ESG profiles are less vulnerable to systemic risk. This is attributed to higher overall efficiencies and their level of trustworthiness. Companies that are efficient in terms of energy and commodities that they use for production will be less impacted by a change in price in those production factors. The concept of systemic risk is represented in the capital asset pricing model (CAPM) by the

⁵⁴Giese, Guido, Linda-Eling Lee, Dimitris Melas, Zoltán Nagy, and Laura Nishikawa. "Foundations of ESG Investing: How ESG Affects Equity Valuation, Risk, and Performance." *The Journal of Portfolio Management* 45, no. 5 (2019): 69–83. <https://doi.org/10.3905/jpm.2019.45.5.069>.

⁵⁵ Godfrey, Paul C., Craig B. Merrill, and Jared M. Hansen. "The Relationship between Corporate Social Responsibility and Shareholder Value: An Empirical Test of the Risk Management Hypothesis." *Strategic Management Journal* 30, no. 4 (April 2009): 425–45. <https://doi.org/10.1002/smj.750>.

⁵⁶ Lauricella, Taylor, John Parsons, Bill Schaninger, and Brooke Weddle. "Network Effects: How to Rebuild Social Capital and Improve Corporate Performance." McKinsey & Company. McKinsey & Company, October 24, 2022. <https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/network-effects-how-to-rebuild-social-capital-and-improve-corporate-performance>.

⁵⁷ Chen, James. "What Is Systemic Risk? Definition in Banking, Causes and Examples." Investopedia. Investopedia, December 13, 2022. <https://www.investopedia.com/terms/s/systemic-risk.asp>.

⁵⁸Eccles, Robert G., Ioannis Ioannou, and George Serafeim. "The Impact of Corporate Sustainability on Organizational Processes and Performance." *Management Science* 60, no. 11 (November 6, 2014): 2835–57. <https://doi.org/10.1287/mnsc.2014.1984>.

beta factor (β). The CAPM predicts that the return investors expect from a company is a linear function of the risk profile of the firm measured by the β :

$$ER_i = R_f + \beta_i(ER_m - R_f)$$

Where:

ER_i = Expected return of the investment

R_f = risk-free rate

β_i = beta of the investment

$(ER_m - R_f)$ = market risk premium (the return expected from the market when facing a risk above the market risk rate)

A company facing lower systemic risk will have a lower value of beta and, therefore investors will require lower rates of returns. Because of this, the company will experience lower costs of capital and therefore will enjoy a higher valuation. Finally, a company's low systemic risk can influence the company's valuation also through the size of the investor base. Ghoul et al. (2011) argues that companies having a low ESG rating will enjoy a relatively smaller investor base because of investor preferences and information asymmetry explained below:

- Investor preferences: investors are naturally risk-averse and a low ESG rating is interpreted as a sign of higher risk. Furthermore, those firms would not receive attention from all sustainably conscious investors which, as explored above, has been increasing over the years.
- Information asymmetry: sustainable companies often offer an additional layer of transparency and higher efforts to report accurately the firm's information. Because of this, there is a less severe impact of asymmetric information between the company's management and its investors in particular regarding governance standards and risk management processes⁵⁹.

⁵⁹ El Ghoul, Sadok, Omrane Guedhami, Chuck C.Y. Kwok, and Dev R. Mishra. "Does Corporate Social Responsibility Affect the Cost of Capital?" *Journal of Banking & Finance* 35, no. 9 (February 10, 2011): 2388–2406. <https://doi.org/10.1016/j.jbankfin.2011.02.007>.

5. Literature review

The three explanations provided above have been tested extensively in the literature. The link between a firm's ESG efforts and its financial performance has been a popular research topic in recent years from both researchers from academia and asset managers. The available literature focuses on the relationship between a company's ESG profile and the corresponding stock's risk and return profile. After analyzing more than 1'000 different research reports on the topic, Giese et al (2019)⁶⁰ show how results have been inconclusive. Most of the studies analyzed found a positive correlation between the two variables, however, plenty of studies found no relationship or even a negative one between the two⁶¹. The same variability of results has been showcased by Friede et al (2015) in which 2200 dissertations on the topic have been analyzed. Around 90% of the studies taken into consideration showed a non-negative relationship between ESG ratings and corporate financial performance but only 62% of them found a positive one⁶².

The high variability between the results obtained can be explained by two main factors: the score used to measure ESG results, and the methodologies used especially how different studies control for common factor exposures. Krüger et al. (2015) defines a "measurement error" that has to be taken into consideration when collecting results from different studies. This measurement error is caused by the qualitative nature of ESG measures. ESG indexes and scoring providers use their metrics to evaluate ESG performance which then results in meaningful differences between the results obtained⁶³. Furthermore, providers and researchers use different parameters and methods of analysis to evaluate and include those factors often resulting in the different relative importance of the individual ESG characteristics⁶⁴.

The following section aims at collecting recent studies and provides an answer to the following 4 topics: the relationship between ESG efforts and stock return (subchapter 5.1), the

⁶⁰ Giese, Guido, Linda-Eling Lee, Dimitris Melas, Zoltán Nagy, and Laura Nishikawa. "Foundations of ESG Investing: How ESG Affects Equity Valuation, Risk, and Performance." *The Journal of Portfolio Management* 45, no. 5 (2019): 69–83. <https://doi.org/10.3905/jpm.2019.45.5.069>.

⁶¹ Ibid.

⁶² Friede, Gunnar, Timo Busch, and Alexander Bassen. "ESG and Financial Performance: Aggregated Evidence from More than 2000 Empirical Studies." *Journal of Sustainable Finance & Investment* 5, no. 4 (December 15, 2015): 210–33. <https://doi.org/10.1080/20430795.2015.1118917>.

⁶³ Krüger, Philipp. "Corporate Goodness and Shareholder Wealth." *Journal of Financial Economics* 115, no. 2 (February 2015): 304–29. <https://doi.org/10.1016/j.jfineco.2014.09.008>.

⁶⁴ Berg, Florian, Julian F Kölbl, and Roberto Rigobon. "Aggregate Confusion: The Divergence of ESG Ratings." *Review of Finance* 26, no. 6 (November 23, 2022): 1315–44. <https://doi.org/10.1093/rof/rfac033>.

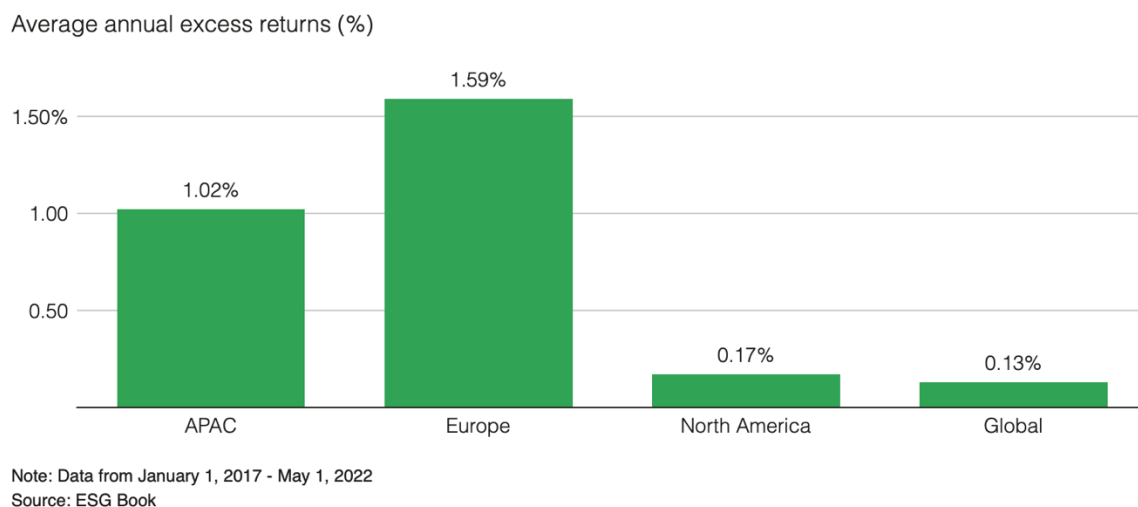
relationship between ESG variables and stock risk (subchapter 5.2), and how those results are affected in a period of global crisis by looking at examples from the 2008 financial crisis and the more recent Covid-19 pandemic (subchapter 5.3).

5.1 The impact of ESG on financial and economic returns

5.1.1 The relationship between ESG efforts and stock returns

Reuters conducted global research comparing the returns of companies that are high performers in terms of ESG parameters, referred to as ESG leaders with a market benchmark January 2017 through April 2022. They show positive excess returns for ESG leaders, but the magnitude of the difference varies across regions. Europe appears to be the region where ESG leaders enjoyed the highest excess returns: 1.59%⁶⁵. The figure below provides a visualization of the results of the study:

Figure 6: Excessive returns generated by ESG leaders across geographies

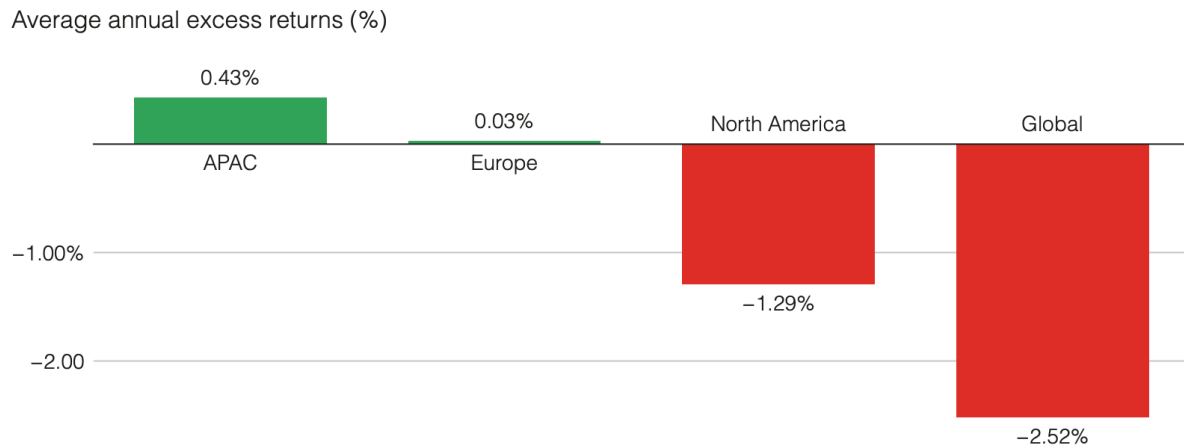


As presented in the first section of this paper, investors do not consider environmental, social, and governance issues equally. When considering the factors individually, meaningful differences can be noticed in the excess returns companies experience. While the governance factor showed positive excess returns across all the regions considered, social positive

⁶⁵ Jessop, Simon, and Cole Horton. "Positive ESG Performance Improves Returns Globally, Research Shows." Reuters. Thomson Reuters, July 28, 2022. <https://www.reuters.com/business/sustainable-business/positive-esg-performance-improves-returns-globally-research-shows-2022-07-28/>.

portfolios presented lower returns compared to the benchmark both globally and in North America as shown below:

Figure 7: Excessive returns generated by social positive portfolios across geographies



Note: Data from January 1, 2017 - May 1, 2022
Source: ESG Book

Interestingly environmental positive portfolios presented positive excess returns in APAC, Europe and North America but not globally where they experienced lower returns by 0.82%.

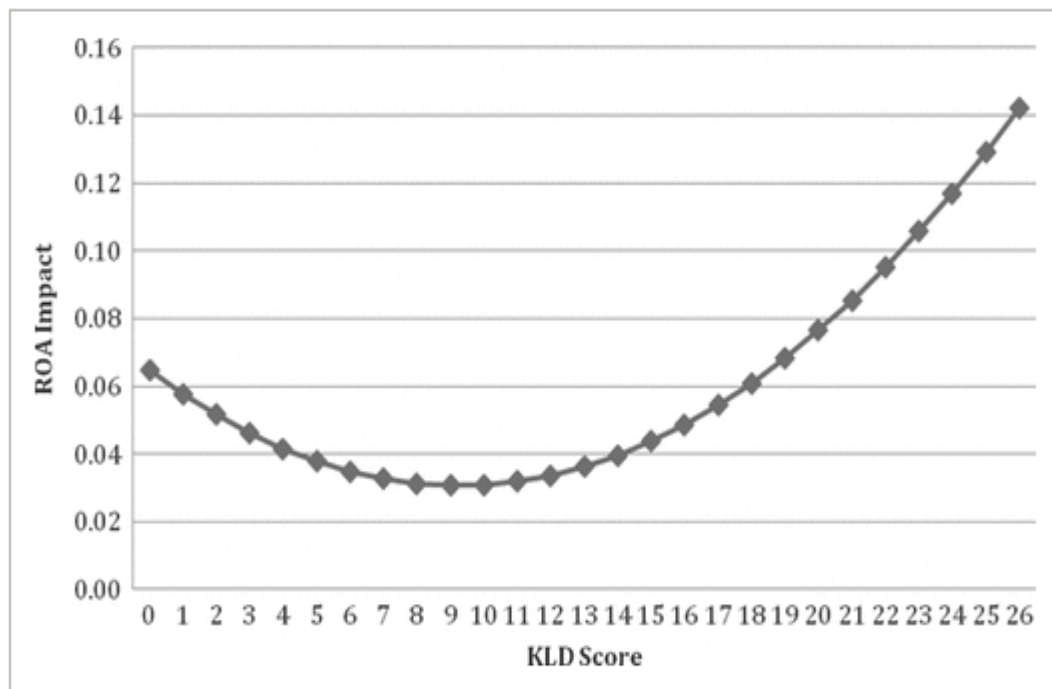
La Torre et al. (2020) analyze 46 companies included in the Eurostoxx50. By performing a linear analysis, they show how the effect of ESG ratings on stock financial performance is weak or absent in the majority of cases. Only 7 companies in the sample considered show a positive response to ESG factors. They attribute this finding to the sectors in which those companies operate (energy and utilities)⁶⁶. While the study considers the same market analyzed by this paper and uses similar research methodologies, it differs substantially in the control variables used. La Torre et al. (2020) use macroeconomic variables such as the changes in the Euribor rate, inflation, and unemployment rather than traditional financial figures as implemented in the analysis presented in the next chapters.

⁶⁶ La Torre, Mario, Fabiomassimo Mango, Arturo Cafaro, and Sabrina Leo. “Does the ESG Index Affect Stock Return? Evidence from the eurostoxx50.” *Sustainability* 12, no. 16 (July 7, 2020): 6387. <https://doi.org/10.3390/su12166387>.

5.1.2 The relationship between firm performance and ESG

The benefits companies can expect from operating in an ESG-positive manner do not exhibit a linear relationship. Barnett and Salomon (2012) have studied the relationship between return on assets (ROA) and ESG efforts measured by their KLD score across 1'214 firms. They argue that the relationship between the two variables follows a U-shaped pattern. This indicates that companies that fall below average or that are leaders in terms of ESG efforts have higher ROA compared to firms that ranked as average in the ESG dimension as shown by the picture below.

Figure 8: The relationship between ESG efforts and returns on assets (ROA)



They argue that engaging in socially responsible practices is costly for firms and that the benefits only occur when the company is able to capitalize on better relationships with its stakeholders. Companies that rank average in terms of ESG efforts bear the cost of applying some ESG-positive initiatives but do not receive substantial benefits to consider those efforts profitable. The firms that are below average do not receive any benefits but, at the same time, do not sustain the high costs necessary for those activities. When firms engage in a high number of socially responsible practices, the benefits exceed the associated costs. Those benefits are not due to a higher reach in the number of clients or by charging higher prices but rather have

to be found in increased efficiencies in the production of social responsibility and in lower operating costs⁶⁷.

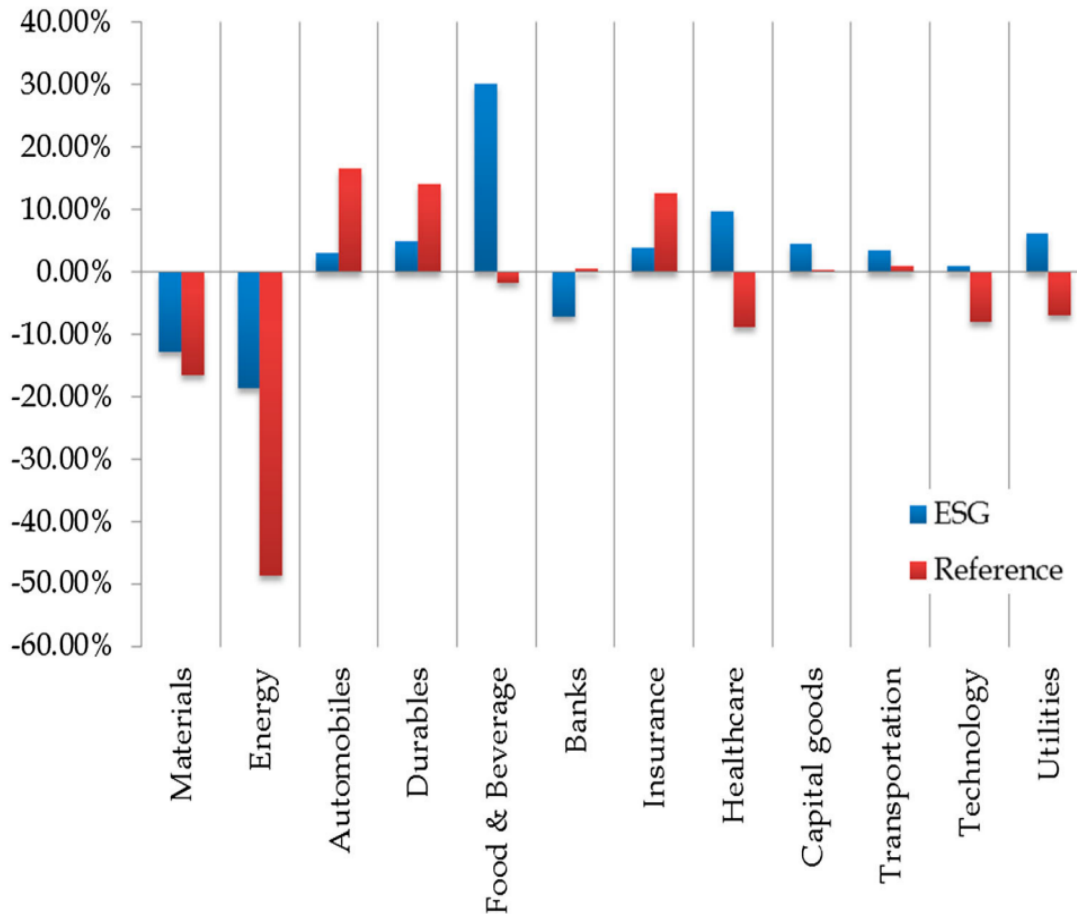
5.1.3 Industry effect in the relationship between ESG and stock performance

The effect of ESG factors on a stock's return highly depends on the industry considered. Kumar et al. (2016) considers 12 industries and while they find that 67% of them show a positive relationship between the two factors, the strength of this relationship varies greatly ranging from 2,25% to 31,84%.⁶⁸ The industries experiencing the highest advantages by incorporating ESG factors in their strategy and operations are energy, food&beverage, and healthcare. However, some industries such as automobiles, banking, durables, and insurance show a negative relationship between the two factors. The picture below summarizes the results of the study across the 12 industries analyzed:

⁶⁷ Barnett, Michael L., and Robert M. Salomon. "Does It Pay to Be Really Good? Addressing the Shape of the Relationship between Social and Financial Performance." *Strategic Management Journal* 33, no. 11 (2012): 1304–20. <https://doi.org/10.1002/smj.1980>.

⁶⁸ Ashwin Kumar, N. C., Camille Smith, Leila Badis, Nan Wang, Paz Ambrosy, and Rodrigo Tavares. "ESG Factors and Risk-Adjusted Performance: A New Quantitative Model." *Journal of Sustainable Finance & Investment* 6, no. 4 (October 4, 2016): 292–300. <https://doi.org/10.1080/20430795.2016.1234909>.

Figure 9: Comparison between the annual return of ESG-positive and reference portfolios across sectors



5.2 The relationship between ESG efforts and stock risk

The idea that by including ESG factors in the company’s decision making it is possible to reduce the risk faced by the company has also been a popular topic of discussion among researchers and asset managers. The main hypothesis tested by the literature is that firms engaging in positive ESG/CSR practices will experience a reduction in idiosyncratic risk.

Godfrey et al. (2005) defined positive CSR as representing “insurance-like protection” for companies thanks to the reduction in the financial risk they face⁶⁹. Mishra and Modi (2012) compared 192 firms and 1’728 observations over a period of 10 years to analyze whether

⁶⁹ Godfrey, Paul C. “The Relationship between Corporate Philanthropy and Shareholder Wealth: A Risk Management Perspective.” *Academy of Management Review* 30, no. 4 (October 1, 2005): 777–98. <https://doi.org/10.5465/amr.2005.18378878>.

positive (negative) CSR profiles would be associated with a reduction (increase) in idiosyncratic risk. Their results confirmed the hypothesis thus finding a significant relationship between the two variables when the company does not present high leverage ratios⁷⁰. Sassen et al. (2016) found consistent and robust results aligned to the ones highlighted above by applying a similar methodology as the one used by this paper applying it to the STOXX600 European companies in the years from 2002 to 2014. They attribute this finding to the improved relationship with stakeholders the firm experiences when focusing on ESG factors. More specifically, high corporate social performance (CSP) leads to the firm meeting the needs of multiple stakeholders which motivates them in being more loyal to the company and therefore mitigate stock risk in several ways (e.g., customer/supplier loyalty, lower investor overreaction to negative news)⁷¹.

The possibility of mitigating risk by engaging in positive CSP becomes increasingly important when considering the asymmetry of the stock return distribution. While it is often hypothesized that stock returns follow a normal, bell-shaped distribution, it is not often the case empirically. Chen et al. (2001) concluded that companies that are larger, with higher trading volumes and experiencing positive returns for a consecutive period of 36 months present a well-defined negative skewness in their stock returns. The negative skewness distribution of returns indicates that, when a firm presents the characteristics highlighted above, the probability of the company's stock experiencing positive returns is higher than the probability of the company's stock price being negatively affected in the future⁷². Firms that do not exhibit the characteristics highlighted above can, therefore, use the opportunity to mitigate those added risks by engaging in ESG-positive behaviors⁷³.

⁷⁰ Mishra, Saurabh, and Sachin B. Modi. "Positive and Negative Corporate Social Responsibility, Financial Leverage, and Idiosyncratic Risk." *Journal of Business Ethics* 117, no. 2 (October 28, 2012): 431–48. <https://doi.org/10.1007/s10551-012-1526-9>.

⁷¹ Sassen, Remmer, Anne-Kathrin Hinze, and Inga Hardeck. "Impact of ESG Factors on Firm Risk in Europe." *Journal of Business Economics* 86, no. 8 (April 23, 2016): 867–904. <https://doi.org/10.1007/s11573-016-0819-3>.

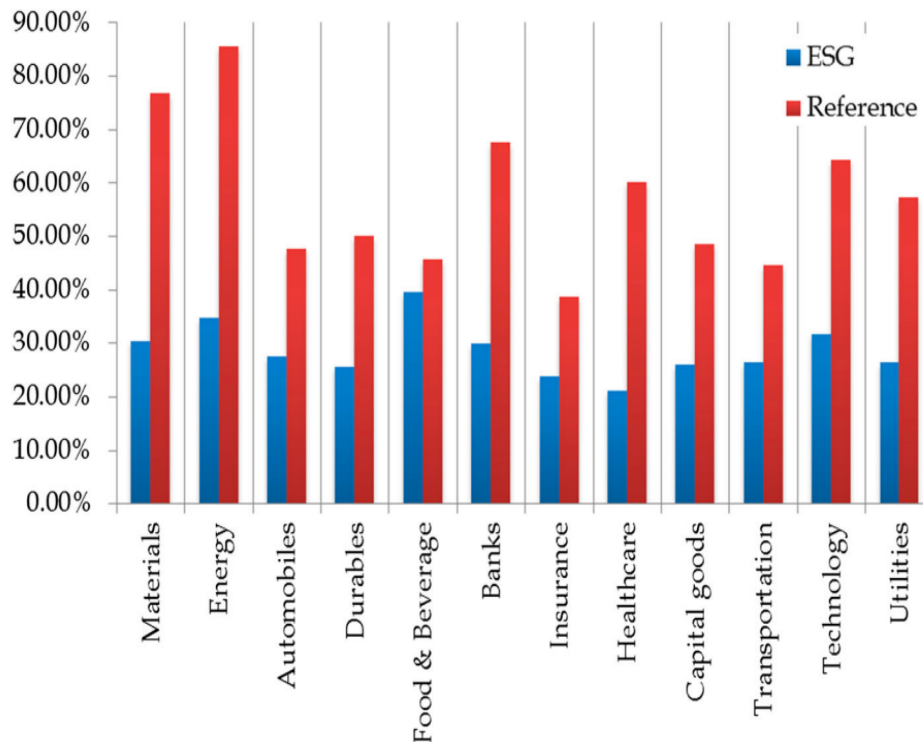
⁷² Chen, Joseph, Harrison Hong, and Jeremy C Stein. "Forecasting Crashes: Trading Volume, Past Returns, and Conditional Skewness in Stock Prices." *Journal of Financial Economics* 61, no. 3 (July 13, 2001): 345–81. [https://doi.org/10.1016/s0304-405x\(01\)00066-6](https://doi.org/10.1016/s0304-405x(01)00066-6).

⁷³ Zhou, Dongyi, and Rui Zhou. "ESG Performance and Stock Price Volatility in Public Health Crisis: Evidence from Covid-19 Pandemic." *International Journal of Environmental Research and Public Health* 19, no. 1 (December 25, 2021): 202. <https://doi.org/10.3390/ijerph19010202>.

5.2.1 Industry effect in the relationship between ESG and stock risk

The effect of ESG factors on a stock's risk also depends on the industry considered. Kumar et al. (2016) in the study mentioned previously investigated the issue across 12 industries and while all of them show a positive relationship between the two factors with an average of 28,78% reduction in annualized volatility, the strength of this relationship varies greatly.⁷⁴ The industry experiencing the highest advantages by incorporating ESG factors in their strategy and operations is energy which experiences a decrease in the volatility of 50,75%. The picture below summarizes the results of the study across the 12 industries analyzed:

Figure 10: Comparison between the annual volatility of ESG-positive and reference portfolios across sectors



⁷⁴ Ashwin Kumar, N. C., Camille Smith, Leïla Badis, Nan Wang, Paz Ambrosy, and Rodrigo Tavares. "ESG Factors and Risk-Adjusted Performance: A New Quantitative Model." *Journal of Sustainable Finance & Investment* 6, no. 4 (October 4, 2016): 292–300. <https://doi.org/10.1080/20430795.2016.1234909>.

Furthermore, Liu and Zhu (2016) highlight how in many data-focused studies there is the risk of correlation mining. When a financial model is trained in a dataset it might overfit to the data used and therefore be non-useful when used in a different dataset⁷⁵.

5.2.2 Tail risk

Tail risk is defined as the return of the stock reducing by three or more standard deviations⁷⁶. All companies are exposed to some extent to such a risk. However, the investment in achieving good company ESG practices has also been proven in reducing tail risk and, conversely, companies ranking as lower than average in ESG factors were exposed to higher tail risk. Ilhan et al. (2020) examine the tail risk faced by companies due to the uncertainty in the political and legal framework surrounding environmental issues. If stringent climate regulations are set by political institutions, companies having sub-optimal levels of sustainability will be highly affected, causing a sharp reduction in their stock price. According to their results, a one standard deviation reduction in the firm's carbon intensity can reduce tail risk by 10%⁷⁷.

5.3 Performance of ESG-positive assets in times of crises

Given the presence of a lower risk associated with socially responsible companies, it is interesting to understand whether this characteristic is present also in periods in which the markets face high stress. The 9/11 terrorist attacks, the economic crisis of 2009, or the more recent Covid-19 pandemic are all examples of events that can trigger devastating economic consequences on a global scale. Those events are associated with the concept of systemic risk. While firms can not directly reduce this risk, as seen above, they can mitigate the magnitude to which their own business will respond to such a risk. In particular, Benabou and Tirole (2010) state that companies with good ESG practices face lower systemic risk exposures, are more resilient, and can recover faster from a crisis⁷⁸.

⁷⁵ Harvey, Campbell R., Yan Liu, and Heqing Zhu. "... And the Cross-Section of Expected Returns." *Review of Financial Studies* 29, no. 1 (2015): 5–68. <https://doi.org/10.1093/rfs/hhv059>.

⁷⁶ Hayes, Adam, and SAMANTHA SILBERSTEIN. "Understanding Tail Risk and the Odds of Portfolio Losses." Investopedia. Investopedia, October 16, 2022. <https://www.investopedia.com/terms/t/tailrisk.asp>.

⁷⁷ Ilhan, Emirhan, Zacharias Sautner, and Grigory Vilkov. "Carbon Tail Risk." *The Review of Financial Studies* 34, no. 3 (2020): 1540–71. <https://doi.org/10.1093/rfs/hhaa071>.

⁷⁸ BĀNABOU, ROLAND, and JEAN TIROLE. "Individual and Corporate Social Responsibility." *Economica* 77, no. 305 (December 22, 2010): 1–19. <https://doi.org/10.1111/j.1468-0335.2009.00843.x>.

5.3.1 The 2008 global financial crisis and the period before Covid-19

Evidence of the impact of ESG characteristics during a crisis can be found in Lins et al. (2017) which examines 1'673 firms in the years between 2006 and 2009 to test the response of those firms to the financial crisis and what role was played by sustainable company practices. They state that during the crisis, firms with high CSR ratings were able to outperform low-rated CSR companies by on average 4% in terms of stock returns, after controlling for various risk factors and characteristics. Specifically, they found that companies with higher CSR ratings experienced higher profitability, sales growth, and higher employee productivity. Those results were also present in a lower magnitude in the same companies during the recovery period right after the crisis. The explanation they provide for this phenomenon is that, in periods of crisis, trust in corporations at large is eroded and companies showcasing higher levels of social practices signal higher levels of trustworthiness. They argue this phenomenon is visible in periods of crises compared to normal ones because, in a normal period, the current stock price of a company reflects all the risk factors and information available⁷⁹.

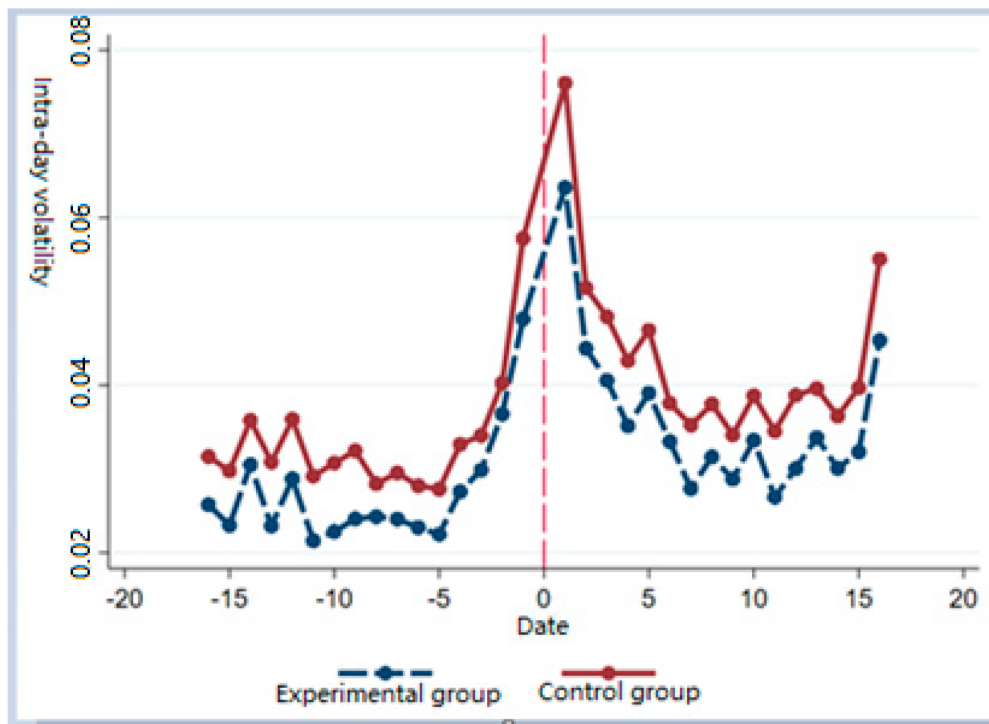
5.3.2 The Covid-19 Crisis

Consistent results were found recently during the Covid-19 crisis. Zhou and Zhou (2022) analyzed 531 companies in China over all trading days between December 2019 and March 2020. They divide the companies into quartiles depending on their ESG score to create a high-performance ESG group and a control group to study the evolution of their stocks' volatility and their resilience during the crisis period. They employ in their study a similar methodology, explained, explanatory and control variables as provided by this paper. What they found is that the volatility of listed companies increased sharply during the Covid-19 crisis and that companies that had excellent ESG performance showed stronger resilience and the ability to recover faster from the impact of the crisis. They found that strong ESG practices act as a cushion for a company in times of crisis by stabilizing stock prices. The picture below summarizes their finding by comparing the change in volatility over time of the control group

⁷⁹ LINS, KARL V., HENRI SERVAES, and ANE TAMAYO. "Social Capital, Trust, and Firm Performance: The Value of Corporate Social Responsibility during the Financial Crisis." *The Journal of Finance* 72, no. 4 (March 9, 2017): 1785–1824. <https://doi.org/10.1111/jofi.12505>.

(represented by the red line) with the high ESG performance one (represented by the blue line)⁸⁰.

Figure 11: Comparison between the annual volatility of ESG-positive and reference portfolios during the Covid-19 pandemic



Comparable results in the Chinese market are also to be found in Li et al. (2022)⁸¹ in the same period and in Xu et al. (2022) which extends the findings to companies experiencing stock price crashes in the period from 2010 to 2019⁸². This positive influence of ESG factors is found also when considering the European market during the same time period. Engelhardt et al. (2021) applies to the European market a similar methodology to the Chinese studies and

⁸⁰Zhou, Dongyi, and Rui Zhou. “ESG Performance and Stock Price Volatility in Public Health Crisis: Evidence from Covid-19 Pandemic.” *International Journal of Environmental Research and Public Health* 19, no. 1 (December 25, 2021): 202. <https://doi.org/10.3390/ijerph19010202>.

⁸¹ Li, Zengfu, Liuhua Feng, Zheng Pan, and Hafiz M. Sohail. “ESG Performance and Stock Prices: Evidence from the COVID-19 Outbreak in China.” *Humanities and Social Sciences Communications* 9, no. 1 (July 18, 2022). <https://doi.org/10.1057/s41599-022-01259-5>.

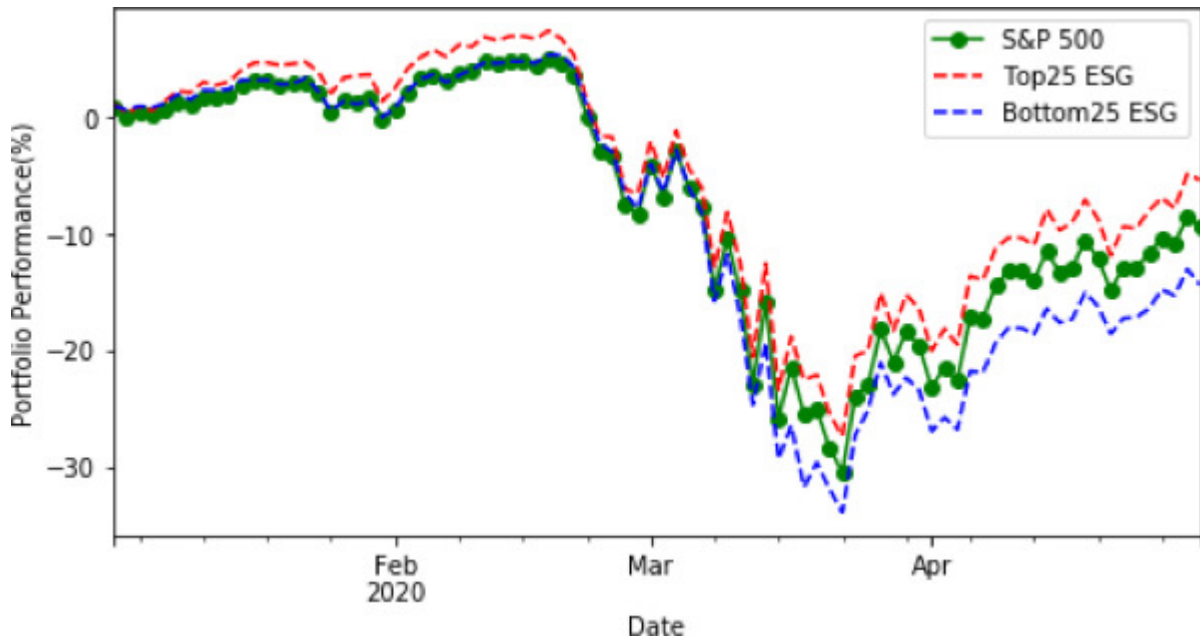
⁸² Xu, Nengrui, Jing Liu, and Huan Dou. “Environmental, Social, and Governance Information Disclosure and Stock Price Crash Risk: Evidence from Chinese Listed Companies.” *Frontiers in Psychology* 13 (September 20, 2022). <https://doi.org/10.3389/fpsyg.2022.977369>.

to the one proposed by this paper while using different control variables. They find that companies having high ESG scores showed at least 3.83% higher returns and 0.17% lower idiosyncratic volatility compared to the ones ranked below average in terms of sustainable practices. Furthermore, they find that the importance and significance of those results are higher when they analyze “low-trust countries”. They define with this expression countries that exhibit poorer security regulations and in which lower standards in terms of disclosure are enforced⁸³. Another example of a study conducted in the European market during the global pandemic is given by Cardillo et al. (2022) which considers a sample of 1’204 European firms to analyze the impact of the announcement of the pandemic-related statistics (e.g., the number of deaths, count of infected) on stock prices and volatilities. They find that good sustainability-related practices combined with healthy financial metrics (e.g., sufficiently high cash holding ratio) provide a degree of protection and help in mitigating the exposure to systemic risk leading to an overperformance of ESG leaders⁸⁴. Albuquerque et al. (2020) provides an explanation for this phenomenon. The study, conducted on American companies, concludes that when a company presents a higher performance in ESG metrics, it creates a sense of loyalty from its customers and investors. This loyalty, when compounded with high advertising efforts, led to substantial overperformance both in terms of stock return and volatility compared to a benchmark, especially during the collapse period of the pandemic crisis. This overperformance is not only seen in terms of investors’ perception of the firm but it is also clearly visible by looking at internal company metrics. More specifically, they found that despite the large reduction in sales during the first quarter of 2020, the operating profit margin increased for sustainable companies. The picture below shows graphically the comparison between the performance of the S&P500 and two portfolios constructed respectively with the highest and lowest rated companies in terms of ESG during the first quarter of 2020:

⁸³ Engelhardt, Nils, Jens Ekkenga, and Peter Posch. “ESG Ratings and Stock Performance during the COVID-19 Crisis.” *Sustainability* 13, no. 13 (June 25, 2021): 7133. <https://doi.org/10.3390/su13137133>.

⁸⁴ Cardillo, Giovanni, Ennio Bendinelli, and Giuseppe Torluccio. “Covid-19, ESG Investing, and the Resilience of More Sustainable Stocks: Evidence from European Firms.” *Business Strategy and the Environment* 32, no. 1 (June 8, 2022): 602–23. <https://doi.org/10.1002/bse.3163>.

Figure 12: Comparison between the return of top and bottom quartile portfolios in terms of ESG and the S&P 500 during the Covid-19 pandemic



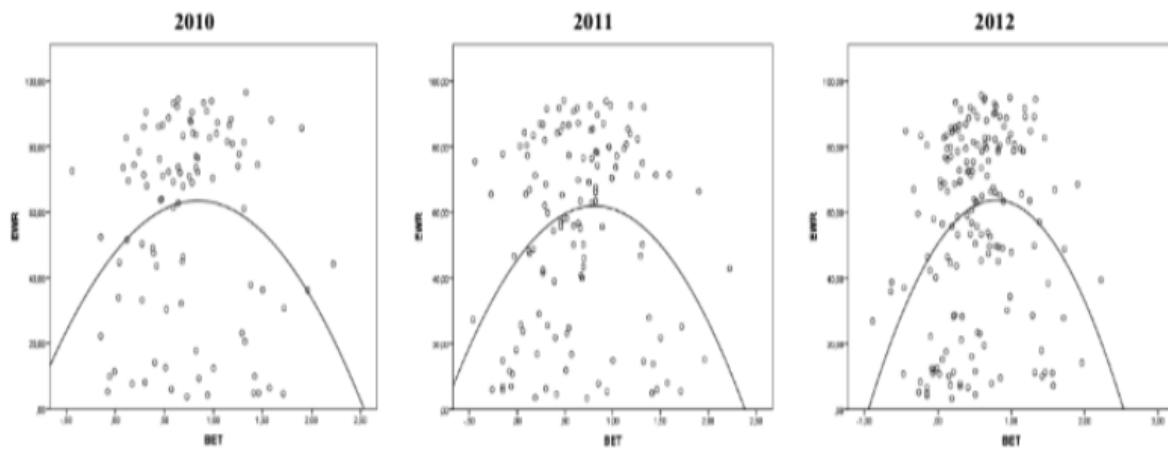
85

5.3.3 The shape of the relationship between systemic risk and ESG

Similarly to the relationship between the reduction in systemic risk that firms can expect from engaging in ESG activities is not linear but rather presents a U-shaped behavior. Garcia et al. (2017) show that companies with the highest and lowest systemic risk present poorer ESG performance while firms having a systemic risk similar to the portfolio of market assets have the best ESG performance. The picture below summarizes the findings of Garcia et. al (2017) between the years 2010 and 2012. On the x-axis the authors measure the idiosyncratic risk a firm is exposed to and on the y-axis the ESG score of the company.

⁸⁵ Díaz, Violeta, Denada Ibrushi, and Jialin Zhao. "Reconsidering Systematic Factors during the COVID-19 Pandemic – the Rising Importance of ESG." *Finance Research Letters* 38 (January 22, 2021): 101870. <https://doi.org/10.1016/j.frl.2020.101870>.

Figure 13: The U-shaped relationship between a company's ESG score and the exposure to idiosyncratic risk



5.3.4 Industry considerations and individual impact of E, S, and G during the Covid-19 crisis

As examined in the previous chapters, the interest of investors in the singular ESG components differs substantially. It is therefore to be expected that companies experience different levels of benefits depending on their investment in the respective categories. Those differences are also directly related to industry factors. What this means is that each individual component of ESG can lead to a different impact depending on the industry considered. Diaz et al. (2021) analyzed the US market constructing portfolios of top quartile and bottom quartile companies in terms of ESG scores and compared their performance. They then constructed similar portfolios but considered each of the ESG components individually. By analyzing their results, it appears that during the Covid-19 crisis, the environmental component affected all sectors except Consumer staples and Energy. The social component had a significant effect on Communications, Industrial goods, Technology, Financial Industry, Real Estate, and Consumer Discretionary. Finally, the Governance factor appeared significant in all industries except Financial, Real Estate, and Communications. Despite having a statistically significant effect, the Governance component had a mild impact on the industries it influenced. The

positive influence of ESG factors during the Covid-19 pandemic has been mostly driven by environmental and social factors⁸⁶.

⁸⁶ Ibid.

6. Empirical research

Finally, this section explores the link between ESG scores and the performance of companies in the European landscape both in terms of return and risk in the different periods before, during, and right after the main movements in the market caused by the Covid-19 pandemic. The Covid-19 period has been chosen for the analysis because, as seen above, the importance of ESG factors becomes increasingly important in times of crisis and the pandemic represents a perfect scenario to test this hypothesis in recent times. Europe has been chosen as the geography to be analyzed as it is considered the leader in ESG practices as highlighted by Ho et al. (2012) and Sassen et al. (2016). As shown in the section above, several studies analyze the topic only during the beginning of the Covid-19 pandemic (Engelhardt et al. (2021), Cardillo et al. (2022)), in different geographies (Li et al. (2022), Xu et al. (2022)) or by using as control variables macroeconomic factors (La Torre et al. (2020)). There is however no study that analyzes the issue using traditional financial metrics as control variables in Europe before and after the Covid-19 pandemic in Europe. This paper is aimed at filling this gap in the literature and provides insights into how companies reacted to the crisis period depending on their level of sustainability.

This section will be divided into seven parts: hypothesis definition, data source, variables selection, descriptive statistics, regression results, robustness test, and interpretation of results. The first part will define the four hypotheses that will be tested in this section. The second part describes the source used to collect the data and some general information regarding the data collected. The third part presents the variables used in the analysis. This part will be divided into three subparts each describing: the dependent variables, the core explanatory variable, and the control variables. In the fourth part, the data is examined by looking at simple measures such as: mean, variance, minimum value, maximum value, and correlation between the variables. The fifth part provides the results of the regression used to test the hypotheses. In the sixth part, two sets of robustness tests are performed to validate the results obtained. Finally, an interpretation of the results is provided in the last subsection of this chapter.

6.1 Hypothesis definition

This paper tests four hypotheses. Two hypotheses focus on the link between ESG scores and stock returns. The other two focus on the relationship between ESG scores and stock volatility. Each relationship is tested twice: during the market crash due to the Covid-19 pandemic and then again afterward. The six hypotheses are formulated below:

H1: There is no relationship between a firm's ESG score and stock price during the market crash induced by the Covid-19 pandemic

H2: There is no relationship between a firm's ESG score and stock price during the recovery phase after the market crash induced by the Covid-19 pandemic

H3: There is no relationship between a firm's ESG score and stock volatility during the market crash induced by the Covid-19 pandemic

H4: There is no relationship between a firm's ESG score and stock volatility during the recovery phase after the market crash induced by the Covid-19 pandemic

6.2 Data source

This paper uses data from 537 European companies before, during and after the market crash due to the Covid-19 pandemic. The companies chosen are the ones listed on the main European stock exchanges and included in the main stock indices (e.g., DAXS40, FTSEMIB, CAC40, IBEX 35). The data is collected yearly, and the reference period of the study starts in 2017 and ends in 2022 totaling 5 years of observations. Thus, the data includes 2'356 observations. The data has been polished to eliminate all the observations for which at least one of the data points is missing. The final dataset after the polishing includes 1'988 observations. For each of those observations, 7 variables are collected: annualized stock return, 360-day volatility, ESG score, Tobin's Q ratio, last reported company sales, cash ratio, and financial leverage. All the data has been collected using the Bloomberg Data Terminal.

6.3 Variables selection

This paper investigates the influence of ESG positive behavior and a firm's yearly return and risk measured by 360-day volatility. Therefore, the paper employs two explained variables, one core explanatory variable, and four control variables.

6.3.1 Explained variables: stock price and volatility

The first explained variable is the annual return on common equity the company experienced during the year considered. The return is computed as follows:

$$\text{Annual stock return} = \frac{P_{end} - P_{beg}}{P_{beg}}$$

where:

P_{beg} = price of the stock at the beginning of the year

P_{end} = price of the stock at the end of the year

The second explained variable is stock risk measured by the 360-day share volatility. A share's volatility is the statistical measure of the dispersion of returns during a certain period which in this case is 360 days. Volatility is computed using the following formula:

$$Vol_i = \sqrt{\frac{\sum_{t=1}^N \left[\left(R_i - \frac{\sum_{t=1}^N R_i}{N} \right)^2 \right]}{N - 1}}$$

where:

$$R_i = \frac{P_i}{P_{i,t-1}} - 1$$

P_i = closing price of stock i

N = window period [360 days]

6.3.2 Main explanatory variable: ESG score

Bloomberg provides on its platform a wide variety of ESG data both from external sources (e.g., Morgan Stanley Capital International [MSCI], Standard & Poor's [S&P] Global and Sustainalytics) and from its proprietary scores. The score selected for the analysis is the RobecoSAM sustainability score. The score is based on the SAM*Corporate Sustainability Assessment (CSA) which evaluates the sustainable practices of more than 4'700 companies worldwide on an annual basis. The score ranges from 1 (worst) to 100 (best). The score is one of the most widely followed metrics in terms of sustainability thanks to the extensive experience of RobecoSAM. Since its founding date in 1995, the company has focused exclusively on providing several services and data to asset managers exclusively on the topic of sustainable investing. The division of RobecoSAM providing the SAM*Corporate Sustainability Assessment (CSA) was then acquired in 2019 by S&P Global⁸⁷.

6.3.3 Control variables

This paper employs four variables to control for firm-specific factors that could influence the stock price and volatility of a company. A description of each of the variables used and the rationale for the inclusion in the analysis is presented in the table below.

Table 3: The four control variables used in the analysis

Control variable	Description and rationale
Company sales	<p>Variable description: this variable presents the last reported company sales in millions of euros. The variable is used as a proxy of company size and is included in the model in a logarithmic fashion as employed by comparable literature.</p> <p>Rationale for inclusion: The size of a company is an</p>

⁸⁷ Global, S. P. (2019, November 21). S&P Global to acquire the ESG ratings business from Robecosam. S&P Global to Acquire the ESG Ratings Business from RobecoSAM. Retrieved February 4, 2023, from <https://www.prnewswire.com/news-releases/sp-global-to-acquire-the-esg-ratings-business-from-robecosam-300962951.html>

	<p>important factor to consider when analyzing stock price fluctuations during crisis periods. This is because large, established companies are perceived as being more stable and as better equipped to respond to macroeconomic shocks than their smaller counterparts.</p>
<p>Tobin's Q</p>	<p>Variable description: Tobin's Q is a ratio created to measure whether a company is overvalued or undervalued. To assess that, it compares the market value of the company with the book value of its assets measured by their replacement cost. Tobin's Q is computed as follows:</p> $Tobin's\ Q = \frac{Equity\ market\ value}{Equity\ book\ value}$ <p>A firm having Tobin's Q equal to 1 is therefore fairly priced according to the ratio. If the ratio is higher than 1, the company is considered overvalued while, if Tobin's Q is lower than 1, the company is considered undervalued.</p> <p>Rationale for inclusion: As presented above, Tobin's Q allows to identify companies that are over or undervalued compared to the value of their assets. Companies that are perceived as being undervalued will attract more attention from investors compared to their counterparts perceived as overvalued. The perception of the "fair value" of a company will influence the decision to purchase a stock and will therefore influence the stock price⁸⁸.</p>

⁸⁸ Hayes, A., Drury, A., & Jaspersen, H. D. (2022, November 15). Q ratio or Tobin's q: Definition, formula, uses, and examples. Investopedia. Retrieved January 21, 2023, from <https://www.investopedia.com/terms/q/qratio.asp>

Cash ratio	<p>Variable description: The Cash ratio is used as a measure of a company’s liquidity. Its objective is to determine whether the company is able to repay its short-term obligations using its available cash or equivalents. With equivalents is intended financial assets that are easily marketable, that is, securities which can be sold quickly and without incurring in substantial transaction costs (e.g., treasury bonds). It is calculated as follows:</p> $\text{Cash ratio} = \frac{\text{cash} + \text{cash equivalents}}{\text{current liabilities}}$ <p>A cash ratio equal or higher than 1 means that the company has more cash and equivalents available than the value of its current liabilities.</p> <p>Rationale for inclusion: Companies having higher amounts of cash or easily tradable assets are perceived as being more secure, especially in times of crisis. This is because they are able to face unexpected expenses without the need of liquidating their long-term assets⁸⁹.</p>
Financial leverage	<p>Variable description: the variable captures the level of financial leverage of the firm as per the latest reported data. It is computed using the following formula:</p> $\text{Financial leverage} = \frac{\text{average annual total liabilities}}{\text{average annual total assets}} \times 100$

⁸⁹ Cardillo, Giovanni, Ennio Bendinelli, and Giuseppe Torluccio. “Covid-19, ESG Investing, and the Resilience of More Sustainable Stocks: Evidence from European Firms.” *Business Strategy and the Environment* 32, no. 1 (June 8, 2022): 602–23. <https://doi.org/10.1002/bse.3163>.

	<p>Rationale for inclusion: companies that show high levels of financial leverage, are exposed periodically to large interest payments. In a time of crisis, the revenue-generating activities of the company could be impacted. Therefore, the company could face a higher risk of not being able to repay those interests and becoming insolvent. During a crisis period, companies that show lower levels of financial leverage are therefore perceived as less risky⁹⁰.</p>
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6.4 Econometric model

As presented above, this paper will test whether ESG scores have an impact on two explained variables: stock price and volatility. To test this hypothesis, two ordinary least squares analyses (OLS) are conducted using the ESG score as the explanatory variable and the four control variables introduced above. The OLS methodology is a widespread technique used to estimate the coefficient of linear regression. To do so, it minimizes the sum of squared errors between the predicted values by the model and the actual ones. A generic OLS regression model with p explanatory variables has the following form:

$$Y = \beta_0 + \sum_{j=1..p} \beta_j X_j + \varepsilon$$

where:

Y = explained variable

β_0 = intercept of the model

β_j = the coefficient of explanatory variable j (where j is between 1 and p)

X_j = the explanatory variable j (where j is between 1 and p)

ε = the error term

⁹⁰ Varghese, Richard, and Sharjil Haque. "The COVID-19 Impact on Corporate Leverage and Financial Fragility." IMF Working Papers 2021, no. 265 (November 5, 2021): 1. <https://doi.org/10.5089/9781589064126.001>.

The first regression model presented by this paper uses stock price as an explained variable. This model is employed to test for the first two hypotheses described above (H1 and H2) and is constructed in the following way:

$$\text{RETURN_COM_EQY} = \beta_0 + \beta_1 * \text{ROBECOSAM_TOTAL_STBLY_RANK} + \beta_2 * \text{TOBIN_Q_RATIO} + \beta_3 * \ln(\text{SALES_REV_TURN}) + \beta_4 * \text{CASH_RATIO} + \beta_5 * \text{FNCL_LVRG} + \varepsilon$$

where:

RETURN_COM_EQY = last monthly stock price

β_0 = intercept of the model

β_j = coefficient of explanatory variable j (where j is between 1 and 5)

ROBECOSAM_TOTAL_STBLY_RANK = RobecoSAM sustainability score

TOBIN_Q_RATIO = Tobin's Q ratio of the firm in the reference year

$\ln(\text{SALES_REV_TURN})$ = natural logarithm of last reported company sales

CASH_RATIO = cash ratio computed using the last reported company data

FNCL_LVRG = financial leverage computed using the last reported data

ε = the error term

The second regression model presented by this paper uses stock volatility as an explained variable. This model is employed to test for the last two hypotheses described above (H3 and H4) and is constructed in the following way:

$$\text{VOLATILITY_360D} = \beta_0 + \beta_1 * \text{ROBECOSAM_TOTAL_STBLY_RANK} + \beta_2 * \text{TOBIN_Q_RATIO} + \beta_3 * \ln(\text{SALES_REV_TURN}) + \beta_4 * \text{CASH_RATIO} + \beta_5 * \text{FNCL_LVRG} + \varepsilon$$

where:

VOLATILITY_360D = 360-day stock volatility

β_0 = intercept of the model

β_j = coefficient of explanatory variable j (where j is between 1 and 5)

ROBECOSAM_TOTAL_STBLY_RANK = RobecoSAM sustainability score

TOBIN_Q_RATIO = Tobin's Q ratio of the firm in the reference year

$\ln(\text{SALES_REV_TURN})$ = natural logarithm of last reported company sales

CASH_RATIO = cash ratio computed using the last reported company data

FNCL_LVRG = financial leverage computed using the last reported data

ε = the error term

As outlined above, both models will therefore be applied three times: before the market crash, during the market crash and, lastly, after the crash. The period considered as before the market crash includes the years from 2017 to 2019, the market crash period includes the year 2020, and the after crash period is considered to be 2021. The choice of these periods is motivated by looking at the movements of the ENEUROPE500 index as can be seen below:

Figure 14: Returns of the EN EUROPE500 from May 2019 to September 2021



As shown above, it is noticeable that the European stock market did experience a significant macroeconomic shock in the first months of 2020 to fully recover in 2021. This is why 2020 was chosen as the “crisis year” and 2021 as the post-crisis one. This paper uses 859 observations between the years of 2017 to 2019, 488 in 2020, and 641 in 2021. The differences in the number of observations used per year are due to the data cleansing process that eliminated all the entries for which Bloomberg offered no data on one or more of the variables collected.

6.5 Descriptive statistics

The table below provides a look at the sample data used in the analysis and the robustness tests. The data is presented in terms of mean, standard deviation, minimum value, and maximum value:

Table 4: Descriptive statistics

Variable	Variable Code	Mean value	Standard deviation	Minimum value	Maximum Value
Yearly stock return	RETURN_COM_EQY	16.26	47.63	-240.02	697.15
360 days volatility	VOLATILITY_360D	37.09	17.08	13.68	210.53
ESG score	ROBECOSAM_TOTAL_STBLY_RANK	41.60	30.43	0	100
Tobin's Q	TOBIN_Q_RATIO	2.22	1.80	0.48	18.73
Company sales	SALES_REV_TURN	8.43	1.32	3.53	12.44
Cash and equivalents balance	CASH_RATIO	0.75	1.16	0	10.94
Financial leverage	FNCL_LVRG	3.93	6.81	1	90.30

Finally, the correlation matrix provided below provides information regarding the correlation between all the variables used in the study.

Table 5: Correlation matrix

	VOLATILITY_360D	TOBIN_Q_RATIO	SALES_REV_TURN	FNCL_LVRG	ROBECOSAM_TOTAL_STBLY_RANK	CASH_RATIO	RETURN_COM_EQY
VOLATILITY_360D	1.000000	0.082587	-0.191996	0.098700	-0.219747	0.091962	-0.113745
TOBIN_Q_RATIO	0.082587	1.000000	-0.418663	-0.067351	-0.174779	0.382849	0.167062
SALES_REV_TURN	-0.191996	-0.418663	1.000000	0.080406	0.487617	-0.446058	-0.000540
FNCL_LVRG	0.098700	-0.067351	0.080406	1.000000	0.065150	-0.119635	0.435790
L_TOTAL_STBLY_RANK	-0.219747	-0.174779	0.487617	0.065150	1.000000	-0.147182	-0.002792
CASH_RATIO	0.091962	0.382849	-0.446058	-0.119635	-0.147182	1.000000	-0.028515
RETURN_COM_EQY	-0.113745	0.167062	-0.000540	0.435790	-0.002792	-0.028515	1.000000

As shown above, none of the correlations of variables is higher than 49% indicating that there is no threat of dealing with multicollinearity when performing the analyses presented below.

6.6 Regression results

This section will be divided into four parts each testing one of the four hypotheses described above. In order to establish the existence of a relationship between the explanatory and the explained variables, the hypotheses have to be rejected by proving that the coefficient for the ESG variable is statistically significant. Furthermore, to prove that high ESG scores have a positive effect on firms the coefficient will have to be positive for H1 and H2 and negative for H3 and H4. That is, to be beneficial, high ESG scores should contribute positively to a stock's price and help decrease the share volatility.

6.6.1 Regression results for hypothesis one

This section provides the result to test for hypothesis one as formulated below:

H1: There is no relationship between a firm's ESG score and stock price during the market crash induced by the Covid-19 pandemic

It, therefore, uses stock return as the explained variable during 2020. The table below provides the results of the regression analysis:

Table 6: regression results for hypothesis one

	coef	std err	t	P> t	[0.025	0.975]
Intercept	-45.5628	16.921	-2.693	0.007	-78.810	-12.315
ROBECOSAM_TOTAL_STBLY_RANK	-0.0708	0.069	-1.028	0.305	-0.206	0.065
TOBIN_Q_RATIO	7.5867	1.197	6.336	0.000	5.234	9.940
SALES_REV_TURN	3.9232	1.977	1.985	0.048	0.039	7.807
CASH_RATIO	-1.5927	1.732	-0.920	0.358	-4.995	1.810
FNCL_LVRG	3.1864	0.266	11.984	0.000	2.664	3.709

As shown in the table above, the coefficient for the ESG score is negative and statistically non-significant indicating that there exists no relationship between the stock returns of European public companies and their ESG scores when the market is affected by a major macroeconomic shock. Hypothesis 2 can, therefore, not be rejected.

6.6.2 Regression results for hypothesis two

This section provides the result to test for hypothesis two as formulated below:

H2: There is no relationship between a firm's ESG score and stock price during the recovery phase after the market crash induced by the Covid-19 pandemic

It, therefore, uses stock return as the explained variable during 2021. The table below provides the results of the regression analysis:

Table 7: regression results for hypothesis two

	coef	std err	t	P> t	[0.025	0.975]
Intercept	-6.8859	14.958	-0.460	0.645	-36.259	22.488
ROBECOSAM_TOTAL_STBLY_RANK	-0.1157	0.073	-1.591	0.112	-0.258	0.027
TOBIN_Q_RATIO	3.3089	0.944	3.505	0.000	1.455	5.163
SALES_REV_TURN	1.4464	1.707	0.848	0.397	-1.905	4.798
CASH_RATIO	-0.6642	1.902	-0.349	0.727	-4.400	3.072
FNCL_LVRG	3.4169	0.245	13.941	0.000	2.936	3.898

As shown in the table above, the coefficient for the ESG score is negative and statistically non-significant indicating that there exists no relationship between stock returns of European public companies and their ESG scores in the period right after the market is affected by a major macroeconomic shock. Hypothesis 3 can, therefore, not be rejected.

6.6.3 Regression results for hypothesis three

This section provides the result to test for hypothesis three as formulated below:

H3: There is no relationship between a firm's ESG score and stock volatility during the market crash induced by the Covid-19 pandemic

It, therefore, uses the 360-day volatility as the explained variable during 2020. The table below provides the results of the regression analysis:

Table 8: regression results for hypothesis three

	coef	std err	t	P> t	[0.025	0.975]
Intercept	75.6990	7.955	9.516	0.000	60.068	91.330
ROBECOSAM_TOTAL_STBLY_RANK	-0.2050	0.032	-6.331	0.000	-0.269	-0.141
TOBIN_Q_RATIO	-1.7753	0.563	-3.153	0.002	-2.881	-0.669
SALES_REV_TURN	-2.4154	0.929	-2.599	0.010	-4.242	-0.589
CASH_RATIO	-0.4773	0.814	-0.586	0.558	-2.077	1.122
FNCL_LVRG	0.5179	0.125	4.143	0.000	0.272	0.764

As shown in the table above, the coefficient for the ESG score is negative and statistically significant at the 1% confidence level indicating that there exists a negative relationship between the stock volatility of European listed companies and their ESG scores when the stock market is affected by a major macroeconomic shock. Hypothesis 5 can, therefore, be rejected.

6.6.4 Regression results for hypothesis four

This section provides the result to test for hypothesis four as formulated below:

H4: There is no relationship between a firm's ESG score and stock volatility during the recovery phase after the market crash induced by the Covid-19 pandemic

It, therefore, uses the 360-day volatility as the explained variable during the period during 2021. The table below provides the results of the regression analysis:

Table 9: regression results for hypothesis four

	coef	std err	t	P> t	[0.025	0.975]
Intercept	49.6146	5.378	9.225	0.000	39.053	60.176
ROBECOSAM_TOTAL_STBLY_RANK	-0.1379	0.026	-5.279	0.000	-0.189	-0.087
TOBIN_Q_RATIO	0.8592	0.339	2.531	0.012	0.193	1.526
SALES_REV_TURN	-1.1019	0.614	-1.796	0.073	-2.307	0.103
CASH_RATIO	-0.5986	0.684	-0.875	0.382	-1.942	0.745
FNCL_LVRG	0.2632	0.088	2.987	0.003	0.090	0.436

As shown in the table above, the coefficient for the ESG score is negative and statistically significant at the 1% confidence level indicating that there exists a negative

relationship between the stock volatility of European listed companies and their ESG scores after the stock market is affected by a major macroeconomic shock. Hypothesis 6 can, therefore, be rejected.

6.7 Robustness tests:

In this section, two sets of robustness tests are conducted to validate the empirical results found above. The first set of robustness tests changes the time of observation for the analysis. The same methodology and variables are applied looking at the period right before the Covid-19 stock market crash. The second set of tests instead changes the model used by analyzing the results for the best and worst companies in terms of ESG performance.

6.7.1 Change in the time period considered

To test for the consistency of results across periods, the same methodology presented above is used considering the period between 2017 and 2019. The following regression results serve as a robustness test for H1 and H2:

Table 10: regression results for time-sensitive robustness tests for H1 and H2

	coef	std err	t	P> t	[0.025	0.975]
Intercept	-25.4432	10.648	-2.389	0.017	-46.343	-4.543
ROBECOSAM_TOTAL_STBLY_RANK	-0.0035	0.045	-0.078	0.938	-0.092	0.085
TOBIN_Q_RATIO	9.0484	0.991	9.128	0.000	7.103	10.994
SALES_REV_TURN	1.6934	1.210	1.400	0.162	-0.681	4.067
CASH_RATIO	-1.6023	1.203	-1.331	0.183	-3.964	0.760
FNCL_LVRG	2.7648	0.211	13.078	0.000	2.350	3.180

As shown in the table above, the coefficient for the ESG score is, again, negative and statistically non-significant. Thus, the results are comparable to the ones indicated in the analysis for H1 and H2.

The following regression results serve as a robustness test for H3 and H4:

Table 11: regression results for time-sensitive robustness tests for H3 and H4

	coef	std err	t	P> t	[0.025	0.975]
Intercept	36.2255	3.137	11.546	0.000	30.067	42.384
ROBECOSAM_TOTAL_STBLY_RANK	-0.1199	0.013	-9.026	0.000	-0.146	-0.094
TOBIN_Q_RATIO	-0.3160	0.292	-1.082	0.280	-0.889	0.257
SALES_REV_TURN	-0.3056	0.356	-0.858	0.391	-1.005	0.394
CASH_RATIO	0.7503	0.355	2.116	0.035	0.054	1.446
FNCL_LVRG	0.0922	0.062	1.481	0.139	-0.030	0.214

As shown in the table above, the coefficient for the ESG score is, again, negative and statistically significant at the 1% confidence level. Thus, the results are comparable to the ones indicated in the analysis for H3 and H4.

6.7.2 Change in the model employed

To check for consistency of results with changes in methods employed, a robustness test is conducted by creating two dummy variables. The first dummy variable identifies the companies that can be considered top performers in terms of ESG by assuming the value of 1 if the company belongs to the top quartile and 0 otherwise. The second dummy variable identifies the companies that can be considered as worst performers in terms of ESG by assuming the value of 1 if the company belongs to the bottom quartile and 0 otherwise. The top and bottom quartiles are computed as follows:

A company is included in the top quartile if its ESG score is higher than the threshold score:

$$\text{top quartile threshold score} = \mu + Z\sigma = 62$$

where:

$$\mu = \text{mean ESG score} = 41.6$$

$$Z = \text{z-score for the top quartile} = 0.675$$

$$\sigma = \text{standard deviation of ESG scores} = 30.43$$

A company is included in the bottom quartile if its ESG score is lower than the threshold score:

$$\text{top quartile threshold score} = \mu - Z\sigma = 21$$

where:

$$\mu = \text{mean ESG score} = 41.6$$

$$Z = \text{z-score for the top quartile} = 0.675$$

$$\sigma = \text{standard deviation of ESG scores} = 30.43$$

6.7.2.1 Testing for the robustness of the results of H1

The following regression results test for the robustness of H1 by using as dependent variable stock returns and as the main explanatory variable first the dummy identifying the best ESG performers and then the dummy identifying the worst ones:

Table 12: model change robustness test for H1 top ESG performers

	coef	std err	t	P> t	[0.025	0.975]
Intercept	-44.3551	17.066	-2.599	0.010	-77.888	-10.823
TOP_QUARTILE	-2.8511	4.378	-0.651	0.515	-11.453	5.751
TOBIN_Q_RATIO	7.5841	1.200	6.323	0.000	5.227	9.941
SALES_REV_TURN	3.5246	1.927	1.829	0.068	-0.262	7.311
CASH_RATIO	-1.6302	1.737	-0.939	0.348	-5.042	1.782
FNCL_LVRG	3.1867	0.266	11.972	0.000	2.664	3.710

Table 13: model change robustness test for H1 worst ESG performers

	coef	std err	t	P> t	[0.025	0.975]
Intercept	-45.6045	17.303	-2.636	0.009	-79.604	-11.606
BOTTOM_QUARTILE	3.1987	4.088	0.783	0.434	-4.833	11.231
TOBIN_Q_RATIO	7.6062	1.198	6.351	0.000	5.253	9.959
SALES_REV_TURN	3.4525	1.859	1.857	0.064	-0.201	7.106
CASH_RATIO	-1.6970	1.727	-0.983	0.326	-5.090	1.696
FNCL_LVRG	3.1801	0.266	11.958	0.000	2.658	3.703

As shown in the tables above, the coefficient for the ESG score is, again, statistically non-significant. Thus, the results are comparable to the ones indicated in the analysis for H1.

6.7.2.2 Testing for the robustness of the results of H2

The following regression results test for the robustness of H2 by using as the dependent variable stock returns and as the main explanatory variable first the dummy identifying the best ESG performers and then the dummy identifying the worst ones:

Table 14: model change robustness test for H2 top ESG performers

	coef	std err	t	P> t	[0.025	0.975]
Intercept	-7.4069	15.344	-0.483	0.629	-37.538	22.724
TOP_QUARTILE	-3.8239	4.154	-0.921	0.358	-11.980	4.333
TOBIN_Q_RATIO	3.3389	0.946	3.530	0.000	1.482	5.196
SALES_REV_TURN	0.9805	1.699	0.577	0.564	-2.355	4.316
CASH_RATIO	-0.7026	1.911	-0.368	0.713	-4.455	3.049
FNCL_LVRG	3.4093	0.245	13.895	0.000	2.927	3.891

Table 15: model change robustness test for H2 worst ESG performers

	coef	std err	t	P> t	[0.025	0.975]
Intercept	-4.7257	15.121	-0.313	0.755	-34.418	24.967
BOTTOM_QUARTILE	1.5267	4.977	0.307	0.759	-8.247	11.301
TOBIN_Q_RATIO	3.3896	0.945	3.589	0.000	1.535	5.244
SALES_REV_TURN	0.4725	1.596	0.296	0.767	-2.662	3.607
CASH_RATIO	-0.9182	1.903	-0.483	0.630	-4.655	2.818
FNCL_LVRG	3.4084	0.246	13.883	0.000	2.926	3.891

As shown in the tables above, the coefficient for the ESG score is, again, statistically non-significant. Thus, the results are comparable to the ones indicated in the analysis for H2.

6.7.2.3 Testing for the robustness of the results of H3

The following regression results test for the robustness of H3 by using as the dependent variable yearly stock volatility and as the main explanatory variable first the dummy identifying the best ESG performers and then the dummy identifying the worst ones:

Table 16: model change robustness test for H3 best ESG performers

	coef	std err	t	P> t	[0.025	0.975]
Intercept	77.2213	8.149	9.476	0.000	61.209	93.234
TOP_QUARTILE	-10.1242	2.090	-4.843	0.000	-14.232	-6.017
TOBIN_Q_RATIO	-1.8123	0.573	-3.164	0.002	-2.938	-0.687
SALES_REV_TURN	-3.2675	0.920	-3.551	0.000	-5.076	-1.459
CASH_RATIO	-0.5010	0.829	-0.604	0.546	-2.130	1.128
FNCL_LVRG	0.5231	0.127	4.115	0.000	0.273	0.773

Table 17: model change robustness test for H3 worst ESG performers

	coef	std err	t	P> t	[0.025	0.975]
Intercept	74.6639	8.242	9.059	0.000	58.468	90.859
BOTTOM_QUARTILE	9.9508	1.947	5.110	0.000	6.125	13.777
TOBIN_Q_RATIO	-1.7238	0.571	-3.021	0.003	-2.845	-0.603
SALES_REV_TURN	-3.6955	0.886	-4.172	0.000	-5.436	-1.955
CASH_RATIO	-0.7658	0.822	-0.931	0.352	-2.382	0.850
FNCL_LVRG	0.4998	0.127	3.945	0.000	0.251	0.749

As shown in the first table, the coefficient for the ESG score is, again, negative and statistically significant at the 1% confidence level for the analysis including ESG top performers. As shown in the second table, the coefficient for the ESG score is positive and statistically significant at the 1% confidence level for the analysis including ESG worst performers. Thus, the results are comparable to the ones indicated in the analysis for H3 as top ESG performers enjoy a reduction in their yearly stock volatility. In contrast, the worst ESG performers suffer from increased yearly stock volatility.

6.7.2.4 Testing for the robustness of the results of H4

The following regression results test for the robustness of H4 by using as the dependent variable yearly stock volatility and as the main explanatory variable first the dummy identifying the best ESG performers and then the dummy identifying the worst ones:

Table 18: model change robustness test for H4 best ESG performers

	coef	std err	t	P> t	[0.025	0.975]
Intercept	47.9183	5.567	8.608	0.000	36.987	58.849
TOP_QUARTILE	-5.7263	1.507	-3.800	0.000	-8.685	-2.767
TOBIN_Q_RATIO	0.8771	0.343	2.556	0.011	0.203	1.551
SALES_REV_TURN	-1.4801	0.616	-2.402	0.017	-2.690	-0.270
CASH_RATIO	-0.5868	0.693	-0.847	0.398	-1.948	0.774
FNCL_LVRG	0.2543	0.089	2.857	0.004	0.079	0.429

Table 19: model change robustness test for H4 worst ESG performers

	coef	std err	t	P> t	[0.025	0.975]
Intercept	48.0100	5.428	8.845	0.000	37.351	58.669
BOTTOM_QUARTILE	9.3667	1.787	5.242	0.000	5.858	12.875
TOBIN_Q_RATIO	0.9159	0.339	2.701	0.007	0.250	1.582
SALES_REV_TURN	-1.8960	0.573	-3.309	0.001	-3.021	-0.771
CASH_RATIO	-1.0332	0.683	-1.513	0.131	-2.374	0.308
FNCL_LVRG	0.2504	0.088	2.841	0.005	0.077	0.423

As shown in the first table, the coefficient for the ESG score is, again, negative and statistically significant at the 1% confidence level for the analysis including ESG top performers. As shown in the second table, the coefficient for the ESG score is positive and statistically significant at the 1% confidence level for the analysis including ESG worst performers. Thus, the results are comparable to the ones indicated in the analysis for H4 as top ESG performers enjoy a reduction in their yearly stock volatility. In contrast, the worst ESG performers suffer from increased yearly stock volatility.

6.8 Interpretation of results

The aim of the research presented above is to understand whether a company's sustainable practices can act as a shield in times of crisis and during the recovery phase following right after. The results obtained while testing for Hypothesis one (H1) and Hypothesis two (H2) highlight a non-statically significant relationship between a company's ESG score and annual stock returns. This indicates that during the Covid-19 market crash and in the recovery phase, the stock performance of European companies was not affected negatively or positively by the ESG profile of the firm. This result is contradicting most of the literature analyzed above. As presented in chapter 5.1 of this elaborate, most of the comparable

studies conducted during the beginning of the global pandemic found a positive relationship between the two variables.

This difference in the results obtained can be explained by three main reasons: a difference in control variables used, the use of a dataset of companies to conduct the study, and, most importantly, a difference in the ESG score used to measure corporate sustainability. This paper employs a similar methodology to other comparable studies presented in the literature review section. However, some differences can be found in the control variables used. La Torre et al. (2020)⁹¹ for example controls for macroeconomic variables rather than firm-specific indicators. Engelhardt et al. (2021)⁹² employs similar variables to control for firm-specific characteristics but extend the analysis by controlling for industry and country effects. Furthermore, some firm characteristics can be estimated by using different measures. For example, to control for a company's size, this paper considers company sales while other studies use market capitalization or net profits. Changes in the model used to test for the same hypothesis can significantly affect the results obtained. The second potential reason for the divergence of results can be found in the use of different datasets to test the hypotheses. The companies considered in this paper are European as it is the most advanced region in terms of ESG. The companies considered are however only the ones listed on the main stock exchanges (e.g., Germany, Spain, Italy, Switzerland) while those listed on smaller stock exchanges (e.g., Poland, Romania, Croatia) are excluded from the analysis. As outlined above, the impact of ESG factors depends on the geography considered. In Engelhardt et al. (2021)⁹³ the countries that produced the most pronounced effects were the countries labeled as "low-trust". These countries were not included in the analysis proposed by this paper. Furthermore, there are important differences in the frequency of the data collected. While this study collects yearly data, other papers often use monthly or even daily data such as in the case of Zhou and Zhou (2022)⁹⁴. Finally, the difference in the results obtained can be attributed to the use of different ESG scores. Depending on the score selected, the level of corporate sustainability attributed can vary significantly. This difference can be explained by the way in which those scores are computed. Due to the lack of standards in the measurement of ESG performance, each ESG score provider can decide how to evaluate each of the components of ESG and which would be their relative weight in the overall score assigned to the company. As explained by Krüger

⁹¹ See note 66

⁹² See note 83

⁹³ *Ibid*

⁹⁴ See note 80

et al. (2015)⁹⁵ there is a substantial “measurement error” that has to be taken into account when reading studies on the topic.

The results obtained are similar to the ones shown by comparable literature when considering stock volatility. Both during the Covid-19 market crash and, in the year, after it, sustainable companies experienced a reduction in their stock volatility. In particular, the results obtained while testing for Hypothesis three (H3) indicate that for each additional point scored in the S&P SAM*Corporate Sustainability Assessment (CSA), companies experienced on average a reduction in their stock yearly volatility of 0.20 during the market crash. The results obtained while testing for Hypothesis four (H4) showcase a reduction of volatility equal to 0.14 during the recovery period for each additional point in the S&P SAM*Corporate Sustainability Assessment (CSA) score. Furthermore, as shown in the regressions used as robustness tests, a 0.12 volatility reduction per additional ESG score point has also been experienced by the same companies in the period before the market crash. Finally, companies in the top quartile in terms of sustainability enjoyed on average a reduction in their stocks’ volatility of 10.12 and 5.73 during the market crash and recovery period respectively. European firms belonging to the worst quartile in terms of ESG on average experienced an increase in stock volatility of 9.95 and 9.36 in the same periods. Given the results obtained, it is clear that sustainable companies experienced tangible advantages compared to their counterparts when considering stock volatility.

⁹⁵ See note 63

7. Conclusion

The question of whether a company's sustainable efforts have a tangible impact on the firm's stock financial performance has been discussed by scholars and asset managers worldwide. Sustainability has become a factor too big to ignore for any investor. The percentage of assets managed with sustainability in mind increased from representing 22% of total worldwide investments in 2012 to 32% in 2021.

Companies are subject to an increasing amount of pressure to become more sustainable from regulatory bodies. The United Nations is, in fact, promoting higher sustainability standards through the launch of the 17 Sustainable Development Goals (SDGs) which have been followed by a series of continental and nation-specific regulations companies have to respect. Investors have also been requesting companies to reach higher ESG standards. ESG investors present a high degree of irrationality and motivations which have more in common with emotional decision making rather than the maximization of financial performance. Despite that, they clearly tend to allocate their capital to companies that excel in the sustainability dimension.

This paper contributes to the literature on the topic by being the only one currently available considering European companies not only during the market crash due to the Covid-19 global pandemic, the largest market crash since the 2008 financial crisis, but also in the recovery phase.

To investigate the impact of ESG on annualized stock return and volatility, 537 companies listed on the main European stock exchanges are analyzed. The ESG score employed for the analysis is the S&P Global Corporate Sustainability Assessment (CSA). In all the periods considered, the sustainability component has a substantial effect on the volatility of European stocks. The impact of sustainability is most pronounced during the market crash, and, in all the time horizons analyzed, sustainable companies are rewarded with lower yearly stock volatility while their least sustainable counterparts suffer from higher fluctuations in their prices. The results of this paper highlight how, on average, for each additional point on the S&P ESG score, European firms experienced a reduction of 0.20 in volatility during the market crash and 0.14 in the recovery phase. The results are in line with the ones found in most of the comparable literature. Empirical results provided by other studies analyzing the 2008 financial crisis and the Covid-19 global pandemic clearly show an overperformance of ESG-positive companies in terms of stock volatility compared to market benchmarks across geographies.

The ESG score however has no impact on the annual return of the firms considered. The coefficient attributed to the sustainability metric is non-significant across all the periods analyzed. This result contradicts most of the literature available on the topic which identifies a significant, positive relationship between the variables. This divergence can be motivated by different factors such as the difference in the model used for the analysis, the dataset considered, and, most importantly, the choice of ESG score used for the analysis. Given the lack of standardization in the calculation of those scores, the results obtained can vary substantially leading to the absence of consensus among researchers.

Given the short duration of the market crash due to the Covid-19 global pandemic which lasted only one year, future literature should expand the analysis to consider longer periods of macroeconomic uncertainty such as the one the world is experiencing since the beginning of 2022. Furthermore, it would be interesting to combine the research models that analyze the topic by employing traditional company financials as control variables with the models employing macroeconomic variables to potentially control for most of the variables that could influence stock performance.

Hopefully, thanks to the results obtained by this paper and most of the comparable literature available, the pressure from investors and regulatory bodies will not be the only factor pushing for higher corporate involvement in ESG. Being sustainable doesn't only have a positive impact on the environment, society, or a firm's stakeholders but provides companies with significant value-creation opportunities.

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