Financial performance of ESG funds: a descriptive study on how their strategies impact invested companies' results.

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1 Abstract

Environmental, Social, and Governance (ESG) investing has emerged as a critical factor in investment decisions, leading to a significant shift in how investments are conducted. The purpose of this study is to investigate how Private Equity and Venture Capital funds are adopting ESG focused strategies in their investment decision process, and how balance sheet and income statement measures of invested companies are affected. The focus then, is: "*Do ESG funds exhibit a higher financial performance compared to non-ESG funds? Which are the main contributions that they bring to companies they invest in?*"

A through literature review has been the starting point to understand how scholars have defined ESG Investing, together with other similar concepts such as Socially Responsible Investing, Impact Investing and UN Principles of Responsible Investing. Furthermore, four key research question have been identified, all connected to the abovementioned main goal of this work. They are centered at understanding which are the main characteristics of ESG funds, in order to depict its peculiarities, pointing out their financial performance compared to non-ESG funds, and at outlining which impact ESG funds have on the companies they invest in.

In order to answer those questions, a statistical and a descriptive analysis have been conducted on a Prequin database. The database provided the authors with the data regarding Private Equity and Venture Capital funds, in particular if they were following ESG principles or not. Orbis has been used instead to access to companies' financial information.

The main results point out that it is not feasible to effectively state that ESG funds outperform non-ESG funds; in particular, when the NET IRR of the funds chosen for the analysis is examined, non-ESG funds show higher values. Notwithstanding ESG funds' lower internal rate of return, there are positive benefits on companies' balance sheet and income statement measures such as Intangible Assets, Total Assets, and Net Income; nonetheless, enterprises benefitting from non-ESG funds' capital exhibit a bigger increase in EBIT levels. Considering these findings, it is clear that ESG funds have a favourable influence and contribute to higher brand value and more resilient businesses.

Keywords: ESG investing, private equity, venture capital, financial performance

2 Abstract in italiano

L'investimento ambientale, sociale e di governance (ESG) è emerso come un fattore critico nelle decisioni di investimento, portando a un significativo cambiamento in come gli investimenti vengono condotti. Lo scopo di questo studio è investigare su come i fondi di private equity e venture capital stanno adottando strategie incentrate sull'ESG nel loro processo decisionale di investimento e su come le misure di bilancio e conto economico delle aziende investite vengono influenzate. L'attenzione è quindi rivolta a: "Gli ESG fund presentano una performance finanziaria superiore rispetto ai fondi non-ESG? Quali sono i principali contributi che apportano alle aziende in cui investono?"

Una revisione della letteratura è stata il punto di partenza per comprendere come gli studiosi hanno definito l'investimento ESG, insieme ad altri concetti simili come l'investimento socialmente responsabile, l'investimento d'impatto e i Principi di investimento responsabile dell'ONU. Inoltre, sono state identificate quattro domande di ricerca chiave, tutte connesse all'obiettivo principale sopra menzionato di questo lavoro. Sono incentrate sulla comprensione delle principali caratteristiche dei fondi ESG, al fine di rappresentare le loro peculiarità, evidenziando la loro performance finanziaria rispetto ai fondi non-ESG e delineando l'impatto che gli ESG fund hanno sulle aziende in cui investono.

Per rispondere a queste domande, è stata condotta un'analisi statistica e descrittiva su un database di Prequin. Il database ha fornito agli autori i dati riguardanti i fondi di private equity e venture capital, in particolare se seguivano o meno i principi ESG. Orbis è stato invece utilizzato per accedere alle informazioni finanziarie delle aziende.

I principali risultati indicano che non è fattibile affermare in modo efficace che gli ESG fund superino i fondi non-ESG; in particolare, quando viene esaminato il NET IRR dei fondi scelti per l'analisi, i fondi non-ESG mostrano valori più elevati. Nonostante il tasso interno di rendimento inferiore degli ESG fund, ci sono benefici positivi sul bilancio e sulle misure del conto economico delle aziende come gli Asset intangibili, gli Asset totali e il Reddito netto; tuttavia, le imprese che beneficiano del capitale dei fondi non-ESG mostrano un aumento maggiore dei livelli di EBIT. Considerando questi risultati, è chiaro che gli ESG fund hanno una influenza favorevole e contribuiscono ad aumentare il valore del brand e la resilienza delle aziende.

Parole chiave: investimenti ESG, private equity, venture capital, performance finanziaria.

3 Executive summary

3.1. Introduction

Environmental, Social, and Governance (ESG) investing has become a critical factor in investment decisions, leading to a significant shift in how investments are conducted and refers to evaluating a company's performance based on environmental, social, and governance factors. Investors are increasingly seeking to align their investments with their values and promote positive social and environmental outcomes, leading to the rise of ESG investing. The Covid-19 pandemic has accelerated the shift towards ESG investing, highlighting the importance of sustainability and resilience, with companies that prioritize ESG factors better positioned to weather the crisis. ESG investing has reshaped the way investments are conducted, with investors now incorporating even more ESG factors into their investment decisions. It has become an important consideration for institutional investors, including pension funds, endowments, and foundations, as well as retail investors. Companies are expected to comply with regulations related to environmental and social impact, and ESG criteria provide a framework for assessing it.

Private equity and venture capital funds have gained significant attention in recent years, with growing interest in understanding how ESG factors play a role in their investment decisions. Both types of funds have the potential to make a significant impact on the companies they invest in, and there is growing interest in understanding how ESG factors play a role in their investment decisions.

Investing in companies that meet ESG criteria is also expected to provide certain financial returns. Several studies have shown that companies that prioritize ESG factors tend to outperform those that do not. Companies that prioritize ESG criteria are also better equipped to manage risks, including reputational risks, and are better positioned to capitalize on opportunities related to sustainability.

3.2. Starting Points

This work expands on a through literature study on the main topics connected to ESG Investing, aiming at summarizing what has been previously defined in past studies. In particular, the main definitions analyzed by the authors are centered at Socially Responsible Investing, that underlines the importance of combining financial returns with social, ethical and environmental issues; UN Principles for Responsible Investing, principles launched to promote best practices and transparency in socially responsible investing, with a focus on environmental, social, and governance (ESG) factors; and Impact Investing, seeking to generate positive impacts, both financial and social.

Another relevant focus of the analysis has been to investigate how Private Equity and Venture Capital funds embrace ESG connected themes, and how much their strategies have shifted towards ESG Investing into the recent years. Furthermore, the authors centered this work at understanding how funds can effectively generate financial and social returns.

The main goal of this thesis is then to understand if "Private Equity and Venture Capital firms that adhere to ESG policies outperform non – ESG funds in terms of financial performance? How do they impact the companies they invest in?".

Main starting points have emerged from the literature review and have been set as the foundation for this work and will be further explored in this work through relevant descriptive and statistical analysis. They are the following:

- ESG investing is "*no longer niche, as it is entering in the mainstream, with more investors recognizing the long-term benefits of investing in sustainable and responsible companies*"

- Institutional investors and companies prioritizing environmental, social and governance factors tend to have better long – term performance, lower risk profiles, and are more attractive to socially responsible investors.

3.3. Research Questions

As previously stated, the purpose of this thesis is to examine the importance of ESG themes in investing, specifically in the context of private equity and venture capital funds. The literature review brought the authors to formulate four main research questions, centred at understanding and evaluating the performance of ESG funds compared to non-ESG funds, as well as the impact of ESG factors on the companies they invest in. Moreover, the main goal has been to provide insights into the potential benefits of ESG investing and the role it can play in promoting sustainable, socially responsible investments.

- RQ1. *Are ESG funds more profitable than non-ESG funds? Do they explicit a higher financial return?*
- RQ2. *Is it possible to state that there is a correlation between the funds_PEESGstatus and other significative variables about the fund itself?*
- RQ3. *Do ESG funds explicit a higher or lower IRR with respect to non – ESG funds?*
- RQ4. *Do ESG funds bring more value to companies than non–ESG funds?*

3.3.1. RQ1

The literature review section of the thesis brought the authors to the attention of ESG Investing and, having access to a Prequin database, it has emerged the possibility to directly analyze and provide insights on funds' profitability, in particular considering Private Equity and Venture Capital firms that adhere to environmental, social and

governance practices. The main objective of this work is indeed to understand whether or not ESG funds are more profitable than non – ESG funds. Different scholars and relevant studies have tried to answer to this question, and the novelty that this work is bringing to the existing literature is a strong answer, result of a relevant study, having access to data from a global network of Private Equity and Venture Capital funds.

The result is made possible by the analysis of different variables that would be further presented and discussed in this work.

3.3.2. RQ2

The main variable analysed in the Prequin database has been "*funds_PEESGstatus*", a categorical variable that is defining whether or not a fund is following environmental, social or governance practices. What had not been much explored by available literature is the attempt of defining which are the main characteristics of ESG funds. The authors have provided it, through a study on the correlation of this variable with other relevant ones such as the asset class, region, funds size and strategies adopted. In this way it has been possible to depict an interesting and defined "image" of what ESG funds are and which are the characteristics that distinguish them.

3.3.3. RQ3

The third question has been a central theme in this work, centred at understanding if ESG funds explicit a higher financial performance than non-ESG funds. The available literature is currently lacking on analysis focused on the Internal Rate of Return (IRR) and the authors have mainly based their result on the assessment of this variable, providing relevant insights on the profitability and financial return of investments. Together with this also measures such as Total value to Paid in Capital has been evaluated and studied to determine the success of the investment.

3.3.4. RQ4

To conclude, the fourth research question has brought interesting insights, filling a research gap for what concerns the connection between Private Equity and Venture Capital funds, and the companies receiving the investments. Indeed, the authors provided the existing literature with relevant information on how these companies are impacted by ESG funds and which are the main differences on both income statement and balance sheet measures with companies receiving funds from non-ESG funds.

3.4. Methodology

3.4.1. Data collection

The Prequin database has been selected for creating a comprehensive database that contains all the relevant deal information, company registries, fund registries, fund features and funds' financial performances. The database has undergone a cleaning process to ensure the consistency of data by removing inconsistencies within it. Then has been adopted a funds perspective by grouping the observations of deals per fund, to enable a more comprehensive, reliable and insightful analysis. This database collected data about 3,185 funds. After conducting all the analysis per funds, it has been merged with financials data of companies invested in by each fund. To do so companies registries have been inserted in Orbis and the accounting data of 62,112 companies, from 2021 to 2011, have been extracted. All companies' data have been joined to the Prequin deals database. Considering investments' deals, to provide a more accurate analysis, accounting data belonging to a period previous the year's deal have been removed. It has instead been decided to consider in the analysis the accounting data from the year's deal until the last available year in the time frame studied, that is 2021. The reason behind this choice is that in this way the improvements and the whole effect after 2 or more deals is directly visible on balance sheet and income statement measures. In this way there is no discontinuity in the positive or negative effect brought by deals (Lööf & Heshmati, 2008). In order to understand funds impact on companies, has been computed the percentage average of each accounting measure year-over-year, then has been reported to each funds the mean of that percentage change considering only companies invested in by each fund. After cleaning this database from data inconsistency and empty values, it was possible to assess the impact of only 853 companies invested.

3.4.2. Analysis methodology

The analysis is composed by 2 main parts: one focused on analyzing the dependence between descriptive and performance features of funds and their ESG status, while the second is dedicated on analyzing the impact that ESG vs non-ESG funds had on companies invested in. This subdivision is dictated by the great difference between the 2-database built. Considering this difference, two different methodologies of analysis have been selected. The first analysis has been conducted by looking at the descriptive statistics of each fund features considering 2 subsets: one with only ESG-funds and one only with non-ESG funds. Then, for each feature, several statistical tests have been conducted in order to assess if there was a statistical prove of non-independence between the feature under analysis and the funds' ESG status. The Chi-Square statistic test has been used to investigate the categorical feature, while for the numerical features, since they revealed to be non-normally distributed after analyzing QQ-plots and carrying out the Shapiro-Wilk test, has been run the Mann-Whitney U test.

Afterward, several Machine Learning classifications algorithms have been run, setting as target variable the funds ESG status, as independent variable funds features. Random Forest Classifier has been selected as the best algorithm to maximize both the accuracy and the computational request to calculate feature importance and SHAP values. It validated the dependence between the funds ESG status and the funds features with an accuracy of 77%. The feature importance and SHAP values built using the Random Forest Classifier, agree on defining which are the most important features explaining the ESG status. Then, considering the limited shape of the database with impacts on companies, the next step has been to analyze descriptive statistics of each impact feature and statistical tests. These tests had the goal to validate statistically which fund impacts on companies invested in are non-independent with fund ESG status. For each feature reveals to be non- normally distributed. So, has been applied the Box-Cox transformation. After this transformation, the Shapiro-Wilk test confirmed that the transformed data are normally distributed. It has been then possible to apply the t-test, which statistically confirmed that the means of the subsamples are not equal, as intuited with descriptive statistics.

3.5. Findings

The results that come from the tests carried out, can be grouped as follow.

3.5.1. Funds features and ESG status relationship

All the statistical tests proved the non-independence between the funds ESG status and each funds feature, as investigated with the descriptive statistics while selecting the most relevant features. These features represent funds' asset class, size, core industries, region focus, strategy, and performances; they allowed to depict ESG and non-ESG funds main traits. ESG funds are mostly Private Equity funds, rather than Venture Capital ones and that is because the former have more power and control on the company invested. Another characteristic is connected to the Fund Size: ESG funds in most of the cases exhibit a larger size, because of their long-term investment focus, the necessity to have a strong reputation and more negotiating power, allowing them to strive for and accomplish greater ESG development. Moreover, it has been found that ESG funds operate mainly in the Energy & Utility or Consumer Discretionary sectors; while non-ESG funds in the Information Technology. ESG funds are more concentrated in Europe while non-ESG in Asia. The strategy adopted by ESG-funds are mainly Balanced and Buyout while non-ESG funds have a growth strategy. Considering funds performances, non-ESG funds reveal to be better in all the metrics analyzed: Net Internal Rate of Return, Total Value to Paid-in Capital, Distributions to Paid-In Capital, Residual Value to Paid-in Capital, and Called (i.e. percentage of GP's promised funds really called and invested). Another key metrics analyzed are the Fund Number Overall and Series. The first indicates how many funds were created by the same GP prior to the present fund, independent of the funds' strategy and it can

be used to gauge a GP's experience. Whereas the second displays how many of the GP's funds followed the identical strategy previous to the fund under scrutiny. It indicates the fund manager's experience with a certain approach. Interesting findings come out by the analysis of these two variables, in fact both reveal that ESG-funds have a higher average of the non-ESG ones. These findings bring out some criticisms from both Kaplan and Schoar (2005) and Phalippou and Gottschalg (2008) studies. The authors reported that is possible to assess a manager's competence level based on the number of funds they have managed and, as a result, the performance of those funds. Instead, has been discovered that while the non-ESG funds have greater performance in all the indicators than non-ESG, they have a lower mean of both Funds Number Overall and Series. These results show that ESG funds, despite a lower performance, usually have a more experienced management. However, it is important to point out that the analysis on funds performances metrics have been carried out on a lower database due to information's lack. This analysis restriction is too wide to consider it as a confutation of the studies analyzed, it ranges from an 80% to 85% database reduction, based on performance metrics took into consideration. In light of this extensive reduction, the performance measures were not used as independent variable for the classifications. Then, the classification algorithms were able to validate how much funds features can explain funds ESG status. The feature importance and the SHAP values reveal to have the same top 3 variables: the primary region focus in Asia, the primary region focus in Europe and the fund size. In fact, the funds with primary region focus in Asia are mainly non-ESG, while the one with the primary region focus in Europe are mainly ESG, and the fund size reveals a good non-discretionary feature to distinguish ESG status.

3.5.2. Funds ESG status implications on companies

The t-tests run on each accounting voices impacted come out with p-values lower that 5%. For each companies accounting voices impacted, the t-tests confirmed a statistical difference between the mean of YoY percentage changes of ESG-funds subset and the mean of non-ESG subset. The research shows that firms invested by ESG funds have a significantly higher growth rate in Intangible Fixed Assets compared to non-ESG funds. This may be due to ESG funds' focus on sustainability and social responsibility, leading to expenditures in areas such as research and development, patents, and brand creation. Additionally, ESG-focused firms are perceived as more trustworthy and socially responsible, contributing to increased brand recognition and customer loyalty. The study suggests that investing in firms through ESG funds may result in higher financial returns due to faster growth in Intangible Fixed Assets, benefiting both investors and society. ESG fund investments resulted in a 126.08% YoY rise in intangible fixed assets for enterprises, while non-ESG funds showed an increase of 99.98%. ESG funds' ability to promote sustainability and social responsibility, results in higher long-term performance and resilience, bringing to higher reputation and customer loyalty. Non-ESG funds may prefer tangible assets, which are simpler to

value and sell, as a more secure investment option for short-term profitability. However, this short-term emphasis may come at the price of long-term sustainability and social responsibility. Companies invested by non-ESG funds had higher growth in cash and cash equivalents (193.86% YoY) compared to ESG funds (161.28% YoY). Those companies are more inclined to focus on long-term value development and financial stability, while non-ESG funds may invest in firms focusing on conventional industries like oil and gas or manufacturing, which can generate more rapid cash flows. Organizations that prioritize ESG policies tend to outperform their rivals in risk management, and innovation, indicating that emphasizing social and governance concerns can provide both short and long-term benefits. However, ESG funds' investments have a more predictable trajectory, due to a lower standard deviation in cash and cash equivalents growth. The difference in cash and cash equivalents growth between ESG and non-ESG funds may also be due to the amount of regulation and control that ESG funds are subject to; ESG funds may be subject to stricter regulations and require larger reserves for potential risks and liabilities, while non-ESG funds may invest in riskier assets. Further research is needed to explore variations in these findings across market segments, locations, and investment methods. Firms invested by ESG funds experience a 17.52% higher average rise in Total Assets compared to those invested by non-ESG funds, suggesting that ESG investment may contribute to greater asset growth and long-term value creation. Companies that prioritize sustainability are better equipped to navigate changing market situations, regulatory environments, and stakeholder expectations, resulting in higher returns and increased market value over time. ESG investment has a favorable impact on equity growth, with companies invested by ESG-funds growing at a pace 11.60% faster than firms invested by non-ESG companies. Such investments attract socially responsible investors, leading to higher valuations and stock prices, resulting in more significant market capitalization and higher shareholder equity. Companies invested in ESG funds have a smaller average rise in revenue from sales and services than those invested in non-ESG funds. Companies emphasizing ESG concerns may prioritize long-term revenue growth by investing in sustainable practices that benefit the world and society, creating a stronger reputation among stakeholders and improving long-term success. Firms invested in non-ESG funds had a higher average gain in EBIT than those invested in ESG funds. Despite the lower profitability of companies invested by ESG-funds, in the long run they could have a much higher profitability leading to a greater average, since the ESG-funds has proved to have a more experienced management.

3.5.3. Conclusions

Overall, this work allows the reader to gather deeper insights about ESG Investing, in particular on important definitions accessed through a thorough literature review. The main topics that have emerged are centered on **what are the main characteristics of ESG funds**, where they are located, and which are the strategies that they mostly adopt in the selection process. Moreover, other relevant insights are related to **their**

profitability, compared to non-ESG funds. Despite many scholars have stated that ESG funds are more profitable than non-ESG ones, the study conducted brought to the opposite conclusion. Through the **analysis of the effects on invested companies** instead, it has been possible to state that ESG funds bring a positive contribution mainly on balance sheet items. ESG Investing has a strong effects on companies, but they are visible in the long run rather than in the short term and are more focused on balance sheet measures. To conclude ESG Investing would have even a stronger role in the future, being a good alternative in promoting in particular social responsibility and the right organization's governance. For everything that regards the Environmental perspective instead, too little has been done so far and the results are not as strong as could be expected. It is crucial that regulators will make consistent changes in the near future and take action to provide the financial ecosystem with a new framework.

4   Introduction

Environmental, Social, and Governance (ESG) factors are increasingly becoming an essential aspect of investment decision-making. The term ESG was first coined in 2005 by the United Nations Global Compact, a voluntary initiative aimed at promoting corporate sustainability; it refers to the three main factors that investors consider when evaluating the sustainability and ethical impact of a company's operations. After this important concept has been introduced into the financial ecosystem, other have emerges, such as Socially responsible investing (SRI) and impact investing, that are two common investment approaches that prioritize ESG factors. SRI involves investing in companies that have a positive social and environmental impact, while impact investing aims to generate social and environmental benefits alongside financial returns. The United Nations Principles of Responsible Investing (UNPRI) is another initiative aimed at promoting responsible investing practices, it is a set of principles that guide investors in integrating ESG factors into their investment decisions. Signatories to the UNPRI commit to incorporating ESG factors into their investment analysis and decision-making processes. This framework is aligned with the 17 Sustainable Development Goals (SDGs), which were adopted by the United Nations General Assembly in 2015. The SDGs aim to address global challenges such as poverty, climate change, and inequality by 2030. Moreover, they also provide a framework for investors to align their investments with sustainable development objectives.

The ESG investment landscape has evolved significantly in recent years, leading investors at recognizing even more the importance of ESG factors in investment decision-making, as they can have a significant impact on a company's long-term financial performance. Those factors include a wide range of issues such as climate change, resource scarcity, labour practices, corporate governance, and more. Companies that prioritize ESG factors in their operations and decision-making processes are believed to be more resilient, sustainable, and better positioned to create long-term value for their shareholders. ESG funds are investment funds that focus on companies that meet certain ESG criteria and they aim to generate positive financial returns while also contributing to environmental and social goals. Those funds have grown significantly in recent years, with assets under management (AUM) in ESG funds reaching $1.7 trillion globally in 2020, according to Morningstar. This growth is expected to continue as more investors seek to align their investments with their values and prioritize sustainability.

The purpose of this thesis is to examine the importance of ESG themes in investing, specifically in the context of private equity and venture capital funds. This thesis will evaluate the performance of ESG funds compared to non-ESG funds, as well as the

impact of ESG factors on the companies they invest in. By analysing the different approaches taken by ESG and non-ESG funds, the goal of this work is to provide insights into the potential benefits of ESG investing and the role it can play in promoting sustainable, socially responsible investments. In particular, the main objective of this thesis is to understand whether or not ESG funds are more profitable than non – ESG funds and thus to answer the following question:

"Private Equity and Venture Capital firms that adhere to ESG policies outperform non – ESG funds in terms of financial performance? How do they impact the companies they invest in?"

To provide a strong and reliable answer, a statistical and descriptive analysis have been performed. The authors had access to a database of Prequin that provided the main source of data needed to study the financial performance of ESG and non – ESG funds. Orbis, a financial database has been instead used to access the data needed to investigate on which are the impact of companies accessing to Private Equity and Venture Capital funds.

The two main starting points are the following:

- ESG investing is "**no longer niche**, as it is entering in the mainstream, with more investors recognizing the long-term benefits of investing in sustainable and responsible companies".

- Institutional investors and companies prioritizing environmental, social and governance factors tend to have **better long – term performance, lower risk profiles, and are more attractive to socially responsible investors**.

4 key research questions have been framed starting from the literature review phase. The first one, the most important, is highly connected to the main goal of this thesis and it has been set by the authors to capture whether or not ESG funds are more profitable than non-ESG funds. The second one instead had the objective to capture which are the main characteristics of ESG funds through the analysis of the *"funds_PEESGstatus"* a categorical variable pointing out whether or not a funds is following ESG practices. The third question has the goal of signaling if ESG funds have a higher IRR than non-ESG funds; to provide a clue of their financial performance also other financial indicator have been analyzed. The fourth question instead wants to capture how the companies accessing ESG funds are performing compared to the ones receiving capital from non-ESG ones. Balance sheet and Income statement measures have been evaluated.

The research questions are the following:

- RQ1. Are ESG funds more profitable than non-ESG funds? Do they explicit a higher financial return?

- RQ2. Is it possible to state that there is a correlation between the funds_PEESGstatus and other significative variables about the fund itself?

- RQ3. Do ESG funds explicit a higher or lower IRR with respect to non – ESG funds?

- RQ4. Do ESG funds bring more value to companies than non–ESG funds?

Overall, this thesis will contribute to the growing body of research on ESG investing, providing valuable insights into the impact of ESG factors on the performance of private equity and venture capital funds, and the companies they invest in. In particular this work would propose a relevant study analysing together the NET IRR of funds and the impact on companies, providing a thorough study having access to information from different geographic areas of the world and thus, helping in addressing gaps in the current literature.

5   The Investment Ecosystem and ESG

The first chapter of this work is focused on introducing the reader to how Sustainability is integrated into the sphere of financial investments. After a thorough literature review of publications and papers, the authors have here reported different definitions of investment approaches that are currently reshaping how financial institutions and retail investors conduct their analysis. Moreover, to connect to the main purpose of this work, that is to investigate how Private Equity and Venture Capital funds are adopting ESG practices to improve their financial performances, the authors focused on these players. After describing how they are composed, there is an introduction to the following section of the thesis, in which it has been analysed which are the market trends in the PE and VC industry and which could be the future outlook for ESG investing.

5.1.   Socially Responsible Investing

The emergence of responsible investing in recent years has presented investors and business organizations with a new set of ethical concerns that must be met (RI). The idea that it is transforming the way in which businesses and asset management organizations deal with decisions is currently one of the most important topics that can be discussed in modern times in relation to investments in general.

The concept of socially responsible investment (SRI) may be traced back to the early 1900s in the United States. At that time, American investors were reluctant to put their money into companies that dealt in illegal substances, such as gambling or tobacco, or that manufactured alcoholic beverages (OECD, 2007, p. 4).

When looking at a variety of articles, it is easy to draw the conclusion that the significance of SRI has been growing steadily since the beginning of the 21st century. According to the Social Investment Forum, in 2006, about one dollar out of every ten dollars managed by professionals in the United States was invested in a way that adhered to the principles of socially responsible investing. Already in 2008, it was thought that responsible investing would have reached a larger and more essential position, and that the number of investors who would embrace this notion would have expanded. However, neither of these predictions came true (Viviers, Bosch, Smit, & Buijs, 2008, p. 15).

According to the Forum of Sustainable and Responsible Investment, socially responsible investing accounted for $6.57 trillion in 2014. This figure represents over one-sixth of all funds managed in the United States of America.

However, what exactly does it mean to engage in socially responsible investing? It is an investing strategy that blends financial return with other social, ethical, and ESG issues, thus linking investor's "social, ethical, ecological, and economic concerns," according to the basic definition (Brzeszczynski and McIntosh, 2014). The Social Investment Forum (SIF) offers a different definition of socially responsible investing. According to this organization, socially responsible investing is defined as "an investment process that considers the social and environmental consequences of investments, both positive and negative, within the context of rigorous financial analysis" (Heal, 2008).

The Social Investing Forum uses the concept of "Integrating personal beliefs and societal issues with investment decisions" to describe SRI rather than the traditional definition (Statman, 2006; Shank et al., 2005).

After that, it is necessary to clarify who exactly constitutes social investors and what exactly their function is. As a result, religious organizations, individuals, non-governmental organizations (NGOs), and businesses can all be considered to be examples of social investors because they all make it a point to invest their money in projects that are designed to meet the requirements of the community as a whole and the requirements of all stakeholders while also meeting the traditional financial goals of the investors (Heal, 2008)

The research that has been done on this topic offers two perspectives that are diametrically opposed to one another about the implications of including moral or ethical considerations in the investment decision-making process. The first point of view claims that socially responsible investors "do good, but not well" because they sacrifice investment success to preserve their principles and, as a result, "do good." Because the quality of investments is not calculated in terms of investment efficiency but in terms of the quality of the investment and, as a result, if the investment follows certain criteria, belongs to a certain industry, and belongs to a certain company, then this view proposes that SRI is a major cause of inefficiencies. This is due to the fact that the quality of investments is not calculated in terms of investment efficiency but in terms of the quality of the investment. And because of this, investors end up with insufficient exposure to some high-performing businesses, like the mining or energy industries, which leads to a mediocre return when compared to a portfolio that is adequately diversified (Gründl et al., 2016). In addition, the screening process for socially responsible investments, which is both extremely labour- intensive and expensive, is seen as another source of inefficiency by proponents of the view presented in the previous paragraph. This may lead to a reduction in returns and profitability for investors in socially responsible funds (UNPRI, 2020).

The second point of view is known as "doing well by doing good," and it asserts that it is reasonable to predict that a firm will do better than a "ordinary" corporation if it integrates ethical ideals into its business strategy. According to Becchetti et al., businesses that adhere to these standards are more appealing to employees who are enthusiastic and productive, and they also have a better chance of attracting cheaper financing from investors who are socially responsible (Becchetti et al., 2012; A behaviour that is socially responsible represents a source of various advantages, both in terms of commercial power and reputation, and in terms of the profit margin, respectively. When companies go this route, the end effect is that their innovative capacity increases, and they become more focused on maximizing shareholder value.

However, information asymmetry is a major factor that impedes the ability of businesses that are committed to articulating the strategic benefit of their SR efforts. This is especially true for businesses that want to avoid appearing to be self-serving by connecting their SR strategy to business objectives (McWilliams et al., 2006).

In conclusion, SRI concepts are rapidly gaining popularity, and investors that incorporate a range of social and environmental screening into their investment process are helping to foster this growth.

The notion of "social responsibility" proposes that the purview of governmental institutions be extended to encompass each and every facet of human endeavour. It would also disprove the notion that steadfast businesspeople believe that the primary objective of corporations is to increase their earnings to the greatest possible extent (Friedman, 2008).

5.2. UN Principles for Responsible Investing (UN PRI)

Back in 2005, the Secretary General, in collaboration with the United Nations Environment Program Finance Initiative (UNEP FI), and the United Nations Global Compact, launched the PRI, which stands for the Principles for Responsible Investments, with the intention of addressing the primary concerns regarding socially responsible investments.

The Principles for Responsible Investments (PRI) are a set of principles that serve as a framework for best practices and potential measures for boosting transparency. These principles place an emphasis on the significance of environmental, social, and governance (ESG) factors that are linked to businesses and institutions. The PRI, in conjunction with its extensive international network of signatories, is responsible for the implementation of the six Principles for Responsible Investment. Its goals are to assist signatories in understanding the financial ramifications of environmental, social, and governance (ESG) issues, as well as to help signatories incorporate environmental, social, and governance (ESG) issues into investment and ownership decisions.

The following is a list of the Six Principles of Responsible Investment:

- Incorporating ESG issues into investment analysis and decision-making process
- Being active owners and incorporating ESG issues into our ownership policies and practices
- Seeking appropriate disclosure on ESG issues by the entities in which we invest
- Promoting acceptance and implementation of the Principles within the investment industry
- Working together to enhance our effectiveness in implementing the Principles
- Reporting on our activities and progress towards implementing the Principles

The PRI is engaged in efforts to improve the long-term aims of its signatories, the financial markets, and economies in which they trade, and eventually the environment and society in its entirety.

The six Principles for Responsible Investment are a collection of criteria for investors to choose from; these guidelines are aspirational in nature and are not required to make a responsible investment. They offer a wide variety of possible activities for incorporating environmental, social, and governance concerns into investment practice. The principles were developed both for and by investors with the goals of fostering more collaboration amongst those who have signed on to them, increasing the rate of innovation among the companies that were considered, as well as their capacity for learning and best practices.

Therefore, the number of signatories keeps growing, reaching over 5000 organizations today (Atkin, 2022), which represents US $121 trillion of asset under management; this is an astonishing result, just considering that as of April 2019, they were only 2372. The Principles for Responsible Investment (PRI) are widely regarded as the most reliable and authoritative source of information on responsible investment practices. They offer primary direction with regard to environmental, social, and governance (ESG) concerns and a significant window of opportunity to encourage collaboration and dedication to responsible investing.

Building a bridge between financial risk, opportunities, and real-world outcomes is the most important component of the PRI strategy, as stated by them. The organization's top priorities for the next three years will be to focus on mitigating climate change, which is the most pressing existential challenge that our society is currently facing, as well as protecting human rights.

To summarize, the PRI is an organization that is governed by investors, with investors, and for investors; this fact serves as the basis for all that has been done since the organization was established. In addition, the aim of the organization is to produce tools, standards, best practices, and frameworks with the purpose of assisting signatories in their efforts to make their investments more environmentally friendly.

5.3. Impact Investing

The governments of the 193 countries who are members of the United Nations came together in September 2015 to create 17 Sustainable Development Goals (SDGs) that must be achieved by the year 2030. These goals are centered on the areas of economics, sustainability, society, and institutions. Because investors are beginning to see the multiple ways in which a company may make a good contribution to these areas, an increasing number of businesses are adopting the Sustainable Development Goals as a framework to map their efforts. Large corporations such as Coca-Cola, Dell, DuPont, General Electric, and Pfizer have already implemented the SDGs into their strategic planning processes.

It is relevant though to briefly describe these goals. No Poverty: End poverty in all its forms everywhere by promoting inclusive economic growth and ensuring equal access to basic resources and services. Zero Hunger: End hunger and malnutrition by promoting sustainable agriculture and improving food security and nutrition. Good Health and Well-being: Ensure access to quality healthcare and promote mental and physical health for all. Quality Education: Ensure inclusive and equitable education for all by providing quality education and training opportunities. Gender Equality: Achieve gender equality and empower all women and girls by promoting equal rights, opportunities, and representation. Clean Water and Sanitation: Ensure access to clean water and sanitation for all by promoting sustainable water management and hygiene practices. Affordable and Clean Energy: Ensure access to affordable, reliable, and sustainable energy for all by promoting renewable energy and energy efficiency. Decent Work and Economic Growth: Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all. Industry, Innovation, and Infrastructure: Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation. Reduced Inequalities: Reduce income inequality and promote social, economic, and political inclusion for all. Sustainable Cities and Communities: Make cities and human settlements inclusive, safe, resilient, and sustainable. Responsible Consumption and Production: Promote sustainable consumption and production patterns and reduce waste and pollution.

Climate Action: Take urgent action to combat climate change and its impacts by reducing greenhouse gas emissions and building resilience to climate-related hazards. Life Below Water: Conserve and sustainably use the oceans, seas, and marine resources for sustainable development. Life On Land: Protect, restore, and promote the sustainable use of terrestrial ecosystems, forests, and biodiversity. Peace, Justice and Strong Institutions: Promote peaceful and inclusive societies, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels. Partnerships for the Goals: Strengthen the means of implementation and revitalize the

global partnership for sustainable development by promoting collaboration and cooperation among governments, businesses, and civil society.

As the deadline draws near, the financial markets have seen a rise in the amount of capital allocations made by asset owners and managers to bridge the funding gap of USD 4.2 trillion that is necessary to achieve these objectives. It is anticipated that only 1.1% of the total assets held by banks and other institutional asset owners will be necessary to close this gap (Hand et al., 2022).

Academics frequently employ the term "impact investing" when referring to the categories of investments. "Investments undertaken with the purpose to achieve positive, measurable social and environmental effect with a financial return," as defined by the Global Impact Investing Network (GIIN). Impact investing is a more proactive approach in organization settings when compared to socially responsible investing (SRI), which has as its primary aim the generation of both social and commercial benefit (JP Morgan and Rockfeller Foundation, 2010). It is also essential to differentiate them in terms of the level of engagement on the part of investors, which is lower in the case of SRI.

In this industry, venture capitalist tactics are employed to give the so-called "impact capital," to invest in a clear set of targets having a clear and defined social mission, and to increase social value. These investments are made to provide the so-called "impact capital" (Geobey et al., 2012; Moore et al., 2012).

In the recent past, there has been a proliferation of investments in the field of impact investing. As a result, to meet the demands of corporate, institutional, and private wealth for effect considerations in investment, all large consulting firms and investment banks now have an impact division. To deepen this theme, the prospect that investors can value beneficial societal externalities in utility in addition to profit is finally being taken seriously by economists. These signals imply that there is a need for socially conscious investing. In a number of different settings, several theoretical models are used to investigate the implications of these non-financial choices (Fama and French, 2007; Hart and Zingales, 2017).

As the impact investing industry continues to grow, its participants are becoming increasingly sophisticated in their approaches to investment performance and decision- making. When it comes to making decisions that aim to maximize both financial and effect performance, impact investors consider a number of factors, one of which is, of course, financial return. Target objectives, liquidity demands, resource capacity, fiduciary obligations, and risk are some of the elements that fall under this category. To make profitable judgments about the distribution of funds and the management of performance, impact investors want data that is both credible and comprehensive. However, there is a lack of sufficient data on the financial performance of impact investments; consequently, impact investors have turned to several sources

to obtain information. They rely mostly on the data that is available to inform their judgments and manage their portfolios to accomplish a wide range of objectives.

In conclusion, to maximize both financial and effect outcomes, impact investors will need to adhere to tight protocols that have been previously established for the disclosure of information and the exchange of data. They will also need to have an advanced comprehension of decision-making in relation to a variety of considerations, such as performance goals, risk, liquidity, fiduciary duty, and the availability of resources.

5.4. ESG Investing

The term "environmental, social, and governance" (ESG) investing refers to a set of guidelines that investors use to evaluate possible investments based on a company's policies on the environment, society, and corporate governance. Individuals' attention has been moved as a result of this to incorporate a more comprehensive and systematized ESG approach in their decision-making process, giving them the opportunity to better understand not only the impact of firms' and organizations' production, but also how they operate and conduct business. This has allowed individuals to make more informed decisions.

The "E" factor focuses specifically on a company's use of natural resources as well as the ways in which its operations, both directly and indirectly through its supply chains, affect the surrounding environment. To phrase it another way, the environmental factor considers a company's environmental transparency, effect, and attempts to limit carbon emissions. These are issues that present genuine risks and opportunities for stakeholders as well as stockholders. If companies fail to assess how the policies they implement and the actions they engage in will have an effect on the surrounding environment, they may put themselves at increased financial risk. Companies run the risk of facing sanctions from governments or regulatory bodies, criminal prosecution, and damage to their reputations if they fail to take the necessary steps to reduce carbon emissions or protect against environmental catastrophes such as oil spills or mining explosions; all these consequences could have a negative impact on shareholder value. As a result of climate change, it is anticipated that there would be an increase in the frequency of natural catastrophes such as hurricanes, floods, heat waves, and wildfires. This will add another level of uncertainty to the complicated framework that is used to evaluate the sustainability of a corporation. Climate risk can have a significant influence on a company's bottom line, and this is especially true for companies that do not adequately prepare themselves for the likely effects of climate change by increasing their investment in innovative energy sources or technologies. Climate change has already begun to influence the long-term creditworthiness of businesses. As a result, this problem is becoming more of a concern and, as a result, a

priority that must be addressed. Possible losses in infrastructure and property have contributed to this effect. According to research conducted by S&P Global (S&P Global, 2019), companies that incorporate environmental objectives into their growth strategies

do not experience a statistically significant performance loss at either the portfolio or individual level, and in some cases, they even outperform their rivals.

The "S" factor, on the other hand, concentrates on how well a company maintains its relationships with its workers, the societies in which it operates, and the political environment; it is worried on how well enterprises manage their relationships outside of the internal scopes of their operations. There are a variety of social issues that might impact the financial performance of businesses, including both immediate and long-term challenges. Labor strikes or customer demonstrations can have a direct influence on a company's profitability. This can be the result of a shortage of skilled workers, a scandal that damages a company's reputation, or all these factors. When organizations take measures to ensure that the products and services, they offer do not present any safety risks and/or limit the susceptibility of their supply networks to geopolitical crises, they typically experience reduced volatility in their businesses. Long-term shifts in customer preferences can be attributed to the complex social processes that underlie events such as surges in online public opinion, strikes, and widespread boycotts of certain businesses. The people who make decisions about the firm can take these into consideration because they are key indicators of the company's potential. A strong connection exists between the letter "S" in ESG and socially responsible investing (SRI). In point of fact, in this sector of the investment industry, SRI investors seek out businesses that support moral and socially conscious ideals such as diversity, inclusiveness, community focus, social justice, and corporate ethics. This is in addition to the fight against discrimination based on race, gender, and sexual orientation.

The letter "G" in ESG refers to the governance aspects of decision-making, which include everything from the formulation of policies by sovereigns to the allocation of rights and duties among various stakeholders in organizations, such as the board of directors, management, shareholders, and stakeholders. The governance aspects of decision-making range from the formulation of policies by sovereigns to the allocation of rights and duties among various stakeholders in organizations. Because governance variables show the laws and regulations that govern nations and firms, investors can screen for good governance practices in the same way that they would screen for environmental and social issues. The core components of corporate governance structures include a corporation's mission, the role and make-up of its board of directors, shareholder rights, and the way the success of the organization is evaluated. A recent study on governance concerns conducted by S&P Global found that firms with inadequate governance are more likely to engage in poor management practices and lose the opportunity to take advantage of future economic opportunities. This was one of the findings of the study. Gender diversity and equity have emerged as two of

the most pressing issues in corporate governance, with many institutional shareholders calling for increased numbers of women to serve on company boards and in executive positions, as well as equal pay and mobility opportunities for women and people of colour. To improve workplace diversity and inclusiveness, an increasing number of companies are putting a greater emphasis on the financial benefits of cultivating inclusive environments. According to the findings of a study, businesses with a greater number of female executives and directors on their boards of directors had better financial performance than businesses with a lower diversity rate.

When talking about ESG Investing in general, businesses utilize ESG criteria to better filter investments and strengthen organizations for a richer and more comprehensive ethically based performance based on company policy. This is done through the usage of ESG Investing. Many participants in the financial ecosystem, including many mutual funds, brokerage firms, and robot-advisors using artificial intelligence solutions, have begun to offer solutions for investing based on environmental, social, and governance factors (ESG) in response to the proliferation of these newly developed methods of evaluating investments. The primary reasons for this adoption have been the growing realization among investors and their audiences of the significance of obeying ESG principles, not only for the purpose of mitigating risk but also for the possibility of outperformance. These guidelines have the potential to save investors' money, particularly in situations where businesses are held accountable for unethical or dangerous practices.

ESG criteria are not only important for companies to identify value creation opportunities and assess risk factors, as was already described in this paragraph, but they are also important for companies to manage their portfolio of investments and thus deliver a higher value exit in terms of both profitability and financial return. This is because ESG criteria help companies manage their portfolio of investments. ESG Investing has increased to more over $30 billions globally as of 2018, showing a 34% increase in less than two years, as stated in a research document published by PWC titled "Pwc Global Private Equity Responsible Investing survey 2021." (GSIR review 2018) On the other hand, it is projected that the global market for impact investing, which is a subset of the investment industry that focuses solely on beneficial outcomes regardless of the size of the financial returns gained, is worth approximately $715 billion. These impressive numbers demonstrate how much work is put into ESG investing, and businesses who are unable to reinvent their investment strategy and adopt a proactive approach toward sustainability may see severe value erosion as a result.

Investors are becoming more demanding, having changed their ethical standards, becoming the number one driver and cause of the massive shift of investing firms toward green finance and ESG Investing in general. This trend is growing at a fast pace, and investors are becoming more demanding as they change their ethical standards. Actually, when compared to 2019, when most of the companies that were

surveyed indicated to use ESG activities as major driver for risk management, approximately 70% of companies today consider it as a value creation and value protection strategy. According to the findings of a study that was carried out by BNP instead, the need for long-term investments' improvement has been the primary driver of ESG integration for more than half of the institutional investors that were interviewed. This is something that can be accomplished through a stronger adoption of sustainability focused strategies. Although fewer than half of the respondents are interested in integrating ESG to improve the image and reputation of their company, just 27% of those interested are driven to do so by altruistic principles.

It should not come as a surprise, then, that ESG topics are showing up more frequently on-board agendas; PWC's survey reveals that 56% of the companies interviewed report that ESG topics are frequently under discussion, whereas in 2019 it was only the 35% of respondents who said that ESG topics were frequently discussed. According to the findings of an alternative survey carried out by Morgan Stanley, more than seventy percent of institutional investors have included environmentally responsible investment criteria into their decision-making process. This number will undoubtedly continue to increase as an increasing number of businesses realign their investment strategies with efforts to decarbonize the economies of the world, build resilience into their supply chains and workforces against pandemics and climate change, create more inclusive workplaces, and acknowledge the significance of sustainability (and purpose) in attracting and retaining talent. The growing movement to tie CEO compensation to environmental, social, and governance (ESG) performance will also bring the board's attention to the foreground. In addition, the same PwC survey found that an increasing number of businesses are reporting their intention to adopt the SDG framework. This is due to the fact that the framework is able to provide a common strategy for achieving favorable societal outcomes, as well as add rigor by establishing 17 overarching goals and 169 targets and is therefore becoming increasingly valuable. It is obvious, however, that Environmental, Social, and Governance (ESG) Investing has the potential to be positioned as one of the most critical levers for transformation, on par with digitalization and the internalization of processes.

However, due to the recent rapid growth of funds that have ESG Investing as their primary investment strategy, there has been a widespread phenomenon of massive advertisement of ESG achievements. Considering the well-known challenges posed by information asymmetries, this has resulted in misalignments between actual and reported financial and ESG return figures.

Many academics and financial players have frequently used the term "Greenwashing" or, more specifically in this instance, "Impact – washing" to refer to the deceptive behavior of firms.

In particular, when discussing environmental, social, and governance (ESG) investing, "greenwashers" are all of those companies that seem to be very transparent and

publish large quantities of ESG data but perform poorly in ESG aspects. This is described by Ellen Pei-yi in her study, which is titled "Greenwashing in environmental, social, and governance disclosures" (Ellen Pei-yi, Greenwashing in environmental, social, and governance disclosures).

Going into a bit more depth, the literature identifies three primary types of greenwashing. The first type is about businesses employing a "greenwashing strategy" (Lyon and Maxwell, 2011; Lyon and Montgomery, 2013; Marquis et al., 2016) to boost company valuation through the manipulation of disclosure. The second type is one that is actively focused on misleading investors, burying unfavourable information, and consequently generating a false picture about how well the company is performing in terms of its impact on the environment. A product-level focus is characteristic of the third type of greenwashing, which is distinguished using eco-label product components, recycled or organic ones, for example, to influence the purchase decisions of customers.

ESG Investing is becoming an increasingly widespread trend and is beginning to permeate the mainstream; despite this, there is room for further development in the field. There are many positive signals being sent out by investors as well as asset managers. One of the most pertinent of these is the Net Zero Asset Managers initiative, which was launched in December 2020 and is an initiative in which asset managers are making commitments to support the goal of reaching net zero greenhouse gas emissions by the year 2050. This initiative had 73 signatories as of 2021, representing $32 trillion in assets under management, which is 36% of the total AUM across the globe (Sciammacco, 2021). In addition, this initiative had 43 new asset managers commit to a net- zero emissions goal. Looking at the figures that were presented, we can see that the number of signatories has more than tripled, reaching 291 now, which has led to $66 trillions in assets being managed. Amazing outcomes for such a worthwhile endeavour; this goes to show how seriously the business and investing community takes environmental, social, and governance (ESG) issues.

Many papers provide a positive view of ESG investing, listing many pros in its adoption, and mostly underlining key advantages, proposing a positive view of this new "forced" trend that is reshaping how both private investors and institutional ones take decisions. Despite all the benefits, ESG still has some barriers in its adoption and according to Perez et al. (2020), ESG is even a distraction, not being desirable by the financial community.

It is clear though looking at financial data that even if the rate of new investments has recently been declining, the growing importance of ESG has been clearly shown in investments. For instance, inflows into sustainable funds increased from $5 billion in 2018 to over $50 billion in 2020—and then to almost $70 billion in 2021. These funds also earned $87 billion in net new money in the first quarter of 2022, and another $33

billion in the second. Global sustainable assets are estimated to be $2.5 trillion by the middle of 2022. This marks a 13.3 percent loss from the end of Q1 2022, which is less than the market's overall 14.6 percent decline during the same time period.

One analysis found that social-related shareholder proposals rose 37 percent in the 2021 proxy season compared with the previous year (Vanderford, 2022).

One of the main complaint has been that "ESG represents an odd and unstable combination of elements, and that attention should be only focused on environmental sustainability" (*ESG Should Be Boiled down to One Simple Measure: Emissions*, 2022).

Others argue that ESG is not feasible because it is too difficult to be implemented by companies; taking the business itself into consideration it must consider many more stakeholders than just focusing on maximizing value for itself and for shareholders. For example, it must consider internal personnel's needs together with customers' ones, suppliers', and environmental issues. In this case there is no optimal choice and for sure the level of complexity at corporate level has increased.

Another key problem is connected to the measurability of aggregate ESG scores, that can provide a clear and stable image of how companies are performing in dealing with environmental, social and governance topics.

Another objection is brought by the paper, and it is about the positive correlations of ESG investing with outperformance. According to the authors, when it exists, it could be explained by other factors and, in any event, are not causative. (Fu, 2021), (Halbritter & Dorfleitner, 2015). On the other side, sustaining the main topic of this work, according to a recent metastudy, most ESG-focused investment funds do outperform the broader market (Whelan et al., 2015). Another interesting point brought by Lucy Perez in the Mckinsey report, is that one of the biggest drivers of ESG is the so called "social license". Social license refers to the perceived level of approval or acceptance of a company's operations, activities, or projects by the local community, stakeholders, and society at large. It represents the level of trust and legitimacy a company has earned and the social and political acceptability of its operations. Companies with a high level of social license are considered to be more sustainable and have a better chance of operating smoothly, gaining access to resources, and avoiding disruptions. Social license is often gained through transparent and responsible corporate practices, community engagement, and demonstration of a commitment to sustainability. This concept is then connected to the companies' ability to face and effectively cope with externalities; according to the same author, if companies cannot demonstrate to address increasing externalities and design their operations and business models to take them into account, there is erosion of "social license". The huge attention towards ESG themes is exactly what pushes companies to address externalities and towards a transition to get more focused on the environment, social factors, and internal factors such as the company's governance.

In conclusion, it is common opinion among authors and scholars that what is mostly needed are improvements coming from a regulation perspective in terms of reporting methods. Anyhow, there is optimism regarding this specific matter, reporting has always been "the product of a long evolution".

5.4.1. ESG Investing Strategies

As we delve further into the research of ESG Investing, it is important to understand the ways in which asset managers are transforming the way they identify and choose investment targets. In this part, the research focus is on the primary topics and trends that are concentrated around the ESG strategies that are implemented by institutional investors.

Scholars have identified three primary elements that are centered on risk and return that are taken into consideration by Responsible Investors. These factors are taken into consideration in the context of Socially Responsible Investing. Factors centered on environmental themes refer to the second sphere, which is focused on urban and industrial pollution, massive exploitation of natural resources, and global warming. The first sphere is about social factors, which include community development, human capital, and working conditions; the second sphere is about factors centered on environmental themes. Instead, the third realm is focused on ethical considerations, such as the use of weapons, the testing of products on animals, alcohol consumption, and gambling. The following chart illustrates the primary approaches that financial market participants take, bearing in mind the primary considerations that play a role in the investment choices made by investors.
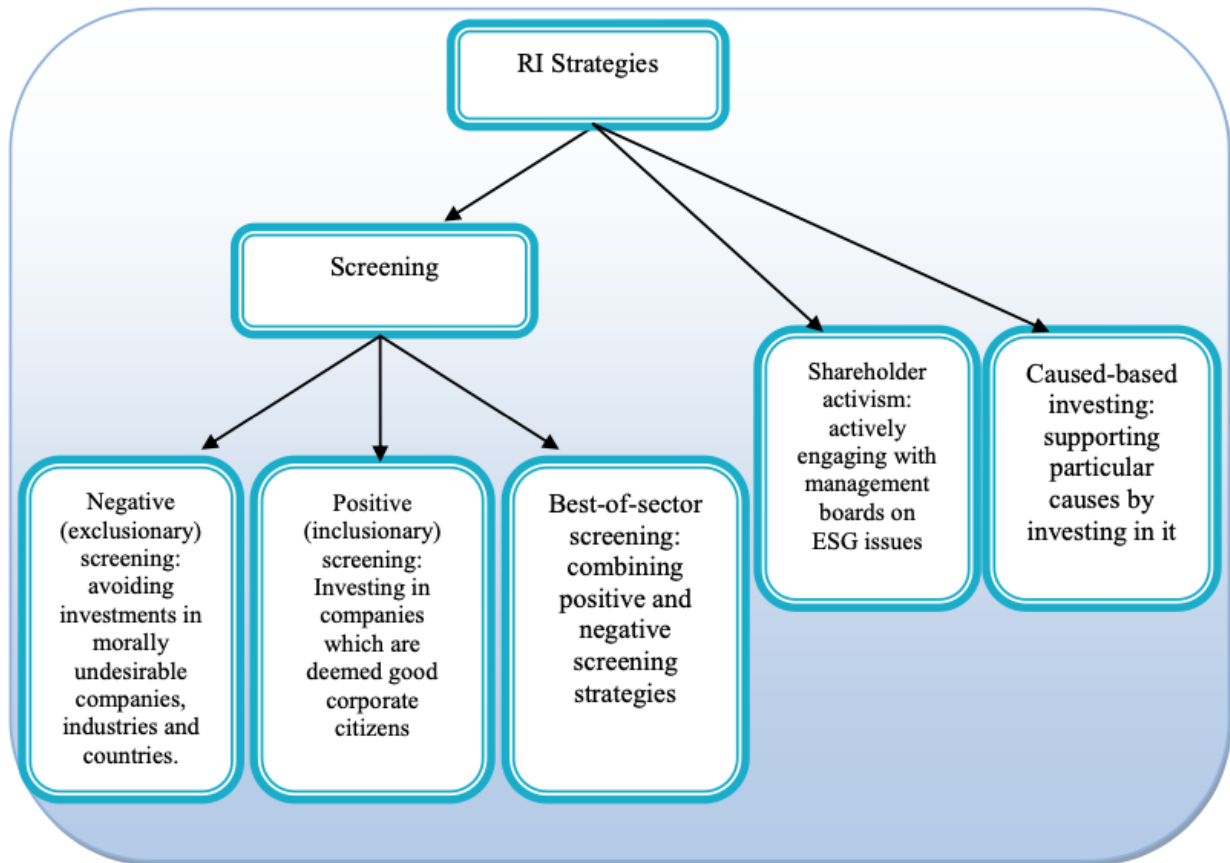
Figure 1 – Primary strategies implemented in Responsible Investing

According to the Sustainable Investment and Finance Initiative (SIF) (Viviers, et al., 2008), investors employ a screening approach to evaluate investment portfolios or choices considering social and environmental aspects. Investors have the option of employing either negative screening, positive screening, or the best-of-sector screening to choose investments in which to put their money. Investors that practice negative screening avoid or reject companies that have poor performance in terms of environmental, social, and governance factors (ESG), as well as unethical firms, industries, or nations (Viviers, et al., 2008). In this scenario, investors decide not to back businesses that the company is pursuing because they believe those businesses violate the investors' own personal convictions. When adopting a negative screening strategy, also known as exclusionary screening, it is extremely important to determine the criteria for exclusion based on a specific goal or target, as stated in an article that was published by Harvard Business School (Cote, 2022). Financial actors frequently choose to avoid corporations whose operations they believe are harmful to people, communities, or the environment. In other instances, their decision is taken to avoid companies based on their religious convictions. Take, for instance, the production and distribution of alcoholic beverages and tobacco products. On the other hand, positive screening, also known as best-in-class screening, is a process in which investors look

at a specific subset of top performing companies from a clearly delineated industry and a set of characteristics to invest in. This type of screening is used to identify potential investments. One way to think of it is as the polar opposite of negative screening. In this situation, however, investors are the ones who pre-determine the relevant criteria for the selection of top performing companies. In the case of positive screening, investors choose companies for themselves on the basis of their expectations that these businesses will generate positive returns and make a positive contribution to society.

Investors that utilize a method known as shareholder advocacy or activism instead have the goal of promoting social values in firms through discourse and active involvement with corporations on a variety of environmental, social, and governance (ESG) issues. They achieve this goal by presenting resolutions, voting on shareholder resolutions, and, on occasion, selling their assets in companies that are irresponsible about social and environmental issues. Typically, the goal of these programs is to put pressure on firms to improve the environmental, social, and governance (ESG) policies and practices they have in place while simultaneously supporting long-term financial performance and increasing shareholder value.

Another tactic utilized by investors is known as community investing or investing in a cause. Investors can send their money to regions or causes that conventional financial institutions consider to be unworthy of support by utilizing this strategy. This can be done to assist in the construction of social infrastructure, or it might be done to provide underprivileged groups with access to equity or fundamental financial services. According to the Small Business Investment Forum (SIF), community investment enables local institutions and organizations to give financial services to persons with low incomes and to provide money for small businesses in the United States and around the world (2008).

Community investing, combined with social screening and shareholder activism in investment decision-making, will be a powerful combination that will help move the sustainability agenda forward. It will be able to satisfy the requirements of places that are currently financially underdeveloped and promote corporate responsibility at the same time. According to the findings of their study, which was published in 2008 by SIF, the combination of the three fundamental SRI techniques helps to cultivate stronger corporate citizenship and social responsibility. Additionally, it helps businesses, their shareholders, and their stakeholders create long-term value for themselves, as well as long-term wealth in the community.

According to the Harvard Business School review, portfolio tilt is another strategy utilized by institutional investors. This method requires the investors to "tilt the percentage of ESG investments in a portfolio to be more than non-ESG investments while maintaining sector weights that match a target index." When compared to the strategies that were just outlined, this one is comparatively low-risk while still

prioritizing environmental, social, and governance (ESG) goals and offering greater industry diversity.

ESG Integration, or Environmental, Social, and Governance Integration, is another strategy that is widely used to effectively pursue sustainability-focused investments. ESG Integration is simply the incorporation of environmental, social, and governance factors into financial analysis by fund managers. On the other hand, when investment managers decide to screen their investments using as the primary "lens" international norms such as those issued by the United Nations, International Labor Organization, Organization for Economic Cooperation and Development (OECD), and non-governmental organizations (NGOs), we refer to this as norms-based screening.

5.5. PE Funds

Private Equity fundraising refers to actions taken by PE firms seeking capital from investors for their funds. Classical categories of investors may be pension funds, insurance companies, endowment funds, high-net- worth individuals and so on. Typically, an investor will invest in a specific fund managed by a firm, becoming a limited partner in the fund rather than an investor in the firm itself. As a result, an investor will only benefit from investments made by the specific fund in which it has invested. The fundraising phase may last several months and managers at times contribute to the overall closed-end volume raised with some personal capital, around 1-5% of total money. For instance, one typical clause might be that managers commitments in the fund will be at least 2% of total commitments obtained.

More in depth, the amount of time that a Private Equity firm spends raising capital varies depending on the level of interest among investors, which is defined by current market conditions and also by the track record of previous funds raised by the firm in question. Firms can spend as little as one- or two-months raising capital when they are able to reach the target that they set for their funds relatively easily, maybe also by gaining commitments from existing investors in their previous funds, or thanks to the fact that strong past performance led to strong levels of investing interest. Other managers may find that fundraising can take considerably longer, and for those of less popular fund types it can take up to two years to raise capital, even though the majority of fund managers will complete fundraising in the range of nine to fifteen months.

Each fund has a target size clearly stated a priori and possibly also a hard cap as a maximum limit of money it can collect (e.g. $7billion with a hard cap of $7.5billion). Once this is established, it is also important to fix a commitment period, that is a time interval (generally around 5 years) starting from a specific date during which fund managers are allowed to call the capital committed and make investments.

Successful PE firms that feel the urge to start new funds to invest additional resources often do so every three or four years. Each fund has a fixed time horizon of around ten

or twelve years, after which the money earned has to be completely distributed back to investors. The most established and well-renowned companies

in this sector may have a track record of ten or more funds issued over a 30-year horizon. Each of these funds necessarily must be created with predetermined and prespecified objectives and strategies, so that future investors have already a clear picture of how their money is going to be spent.

Firstly, different funds may be meant to invest in different geographical areas. By way of example the distributed prospectus may state that two-thirds of the companies targeted in the overall portfolio will be located in Europe, while the remaining one-third will be comprised of companies selectively chosen in North America. The geographical or political region of interest is obviously extremely important, for it ultimately determines the characteristics of the market and of the companies available for takeovers. More conservative investment vehicles target enterprises in mature markets, where the set of risks and of factors of uncertainty are reduced to the minimum, and others instead may focus on emerging economies.

As a second step, a strategical choice has to be made to determine what types of deal the fund is going to pursue. PE funds not only differentiate themselves according to the categories reported above of Buyout, Growth and Venture Capital, but also in terms of specific strategies chosen within each subcategory, and there exist indeed several possible approaches in this respect.

Besides IBOs, LBOs and SBOs that have already been discussed, one particular mention can be given to buy-and-build strategies. These are intended to create value by merging the skills of different companies together relatively quickly, avoiding the time spent to innovate and improve skills separately inside each single entity. Managers have the objective to create value as fast as they are able to in order to finally exit investments at surplus after five or ten years. In the case of buy-and-build, they attempt to do so by adding on top of already owned portfolio companies the expertise obtained from the acquisition of an additional firm considered superior in that area of specialization.

Certainly, the ability to exploit networks and contacts, and the ability to connect companies that would apparently remain in competition or distant one from the other, is the key determinant of success and failure in PE deals and especially for buy-and-build strategies. An explanatory example was the acquisition of the restoration chain Temakinho completed a few years back by PE investors that had already important participations in the food industry. The inclusion of the chain inside the PE portfolio resulted in direct access to food and equipment suppliers, as well as access to clients, and helped the company make operating improvements that are now helping its restaurants to expand and be present in many Italian cities.

5.5.1. The Structure of PE Funds

Limited partnerships are universally recognised globally as the dominant legal vehicle used for structuring Private Equity investments (and private funds in general) as they are well understood by investors and fund managers alike. The characteristics of limited partnerships, such as the ability to limit the liability of investors, their contractual flexibility, and the tax transparent treatment, make them ideal for use as private fund investment vehicles. Whilst by transparency we refer to the fact that the partnership is not treated as a separate entity from its own partners, it is also important to remind the extensive level of privacy that people working under the umbrella of the limited partnership are granted. Accounts are not publicly filed, so that the information that PE managers wish to share with the market can be filtered.

Originally, the problem faced by investors in structuring PE investments was mainly finding a way to group together a few institutions and individuals and to create an entity that would bind them together as investors for a finite period without adding multiple tax charges. The corporation option would create an entity also subject to corporate tax liability at the fund level. A general partnership would create an entity where all the individuals have joint and complete liability on all the obligations of the fund. This would make it impossible to contribute money for silent investors that are not involved in the day-to-day management of the fund.

The fundamental drawback of the traditional general partnership model has always been that all partners are jointly responsible for all the liabilities of the business regardless of their level of actual and real involvement. This automatically becomes a concern for the smallest investors that, even though willing to contribute capital, do not have the time and especially the expertise to manage the operations and the investments of the PE fund. In contrast, a limited partnership affords limited liability protection by statute to such secondary investors which are only contributing capital.

Logically, limited partnerships therefore have to consist of at least one General Partner and at least one Limited Partner. Moreover, alongside the Partnership Agreement which sets down rules, rights and obligations of the different parties involved depending on their role, the Private Equity fund also requires a Management Agreement determining duties and fees for the fund managers.

In most cases, LPs' liability for the fund's debts and obligations is limited exclusively to the amount of their agreed contribution, unless a partner takes actions that could effectively be considered as management of the limited partnership. However, it is not unreasonable for investors to expect to exercise a certain degree of oversight and control over the partnership's activities, in order to safeguard the investments made. This aspect is recognised in limited partnerships legislation and investors are given clear guidance on which activities they may be able to perform without compromising the limited liability status.

On the other hand, GPs are responsible for the management of the partnership and are liable for all debts and obligations incurred while occupying that role. For this reason, the fund sponsors would usually set up general partners as special purpose vehicles to put an upper limit to potential liabilities. Limited partnerships in general do not have legal personality and GPs enter into agreements and hold assets on behalf of the partnership, in their capacity as general managing partners.

The type of legal structure that GPs choose to have also matters in determining incentives and relationships among the parties involved. In some jurisdictions (e.g. Singapore), GPs can either be individuals or corporation, while in other jurisdictions (e.g. Cayman Islands) they can be individuals, corporations but also be structured as partnerships.

This latter option, if chosen, grants even additional flexibility to PE investors and managers. It is the common situation in Private Equity of a two-tier limited partnership structure, where the upper-tier of the complex system is represented by the partnership created by the management team members (which serves as GP to the PE partnership) and the lower-tier by the original PE partnership. The LPs of this upper-tier partnership are the management team members themselves, and the GP is nothing but an entity with legal personality the team itself founded. These two together become the GP of the original PE partnership, managing the fund that will invest in portfolio companies.

The main advantage of this complex system revolves around less tax expenditures for the individual management team members, since the GP of the PE partnership will then be another tax transparent vehicle not subject to corporate income tax on the fees and on carried interest earned. Moreover, a two-tier partnership structure may also allow greater flexibility in providing incentives for individual management team members.

Finally, having the GP as a tax-transparent vehicle may also be more suitable for some LPs wishing to invest in the GP itself (as limited partners of the upper-tier partnership) to earn superior returns by receiving a percentage of the carried interest on top of the standard limited partners profit share of the fund.

5.5.2. European PE regulation

The Alternative Investment Fund Managers Directive (AIFMD or Directive 2011/61/EU) creates a comprehensive regulatory and supervisory framework for the management and marketing of Private Equity, Venture Capital and other Alternative Investment Funds (AIFs) in the European Economic Area. It regulates those managers of investment vehicles that do not fall under the umbrella of the Directive on Undertakings for Collective Investments in Transferable Securities (UCITS). The harmonised European standards for alternative investment fund managers (AIFMs)

aim to enhance the transparency of the activities of AIFMs and the funds they manage towards investors and public authorities. The AIFMD entered into force on the 22 July 2011.

More in detail, the Directive is applicable to EU AIFMs managing AIFs irrespective of their country of domiciliation (both inside and outside the EU), to non-EU AIFMs managing EU AIFs and also to non-EU AIFMs that however market their AIFs in the EU.

The Directive is directly applicable to PE fund managers with Assets Under Management greater than €500 million and enables them to manage and market their funds more easily across the EU through a single internal market passport. Once this passport is obtained, a fund can be marketed in other Member States without lengthy further authorisation from the relevant national competent authorities.

In order to benefit from this access, fund managers need to receive authorisation by their national competent authorities and comply with stringent operational requirements in the field of valuation, capital adequacy, disclosure, investor reporting and remuneration. While fund managers with less than €500 million under management are exempted from the full requirements of the AIFMD, they are still subject to a simplified registration and reporting regime.

A review of the AIFMD framework was presented on 25 November 2021, introducing important changes at the request of the industry. Among them, it is possible to find additional reporting requirements, clarification on the number of individuals who need to be employed by the AIFM, increased role of the European Securities and Markets Authority (ESMA) in oversight of delegation activities and many others. Particularly, modifications to the way fees are supposed to be disclosed are expected. As the development of a common market continues, authorities should also allow depositary services to be located in a Member State different from the one of the fund.

These changes are currently in discussion in the European Parliament. The initial draft was published on 17 May and further amendments were brought forward at the end of June, so that the European Parliament is expected to vote on the text in October. Meanwhile, the Council (formed by Member States representatives) agreed to their amendments to the text in June. Depending on the evolution of negotiations, it may take several months to reach a conclusion and new rules will not enter into force before 2023.

5.5.3. Cyclicality of PE investments

Numerous practitioner accounts over the years have suggested that the Private Equity industry is highly cyclical, with periods of easy financing availability often in response to the success of earlier transactions. These lead to an acceleration of deal volume, to greater use of leverage and to higher valuations, but ultimately more troubled investments appear on the horizon. This cyclicality has been well documented in the

academic literature and is naturally connected to the general state of the macroeconomy in a given period during which the fund is operating.

Some practitioners believe that this cyclicality, albeit present, is intrinsic in the overall economy and does not deserve much attention. In their opinion, the industry is capable of responding promptly to downturns and their data show how Private Equity performed better than the S&P 500 when the market went down for the dot-com bubble, the global crisis and the pandemic (World Economic Forum, 2022). In any case, regression analyses showed the long-term causality and explanatory power existing between the volume of PE deals, economic growth and inflation (Malik & Dhankar, 2017).

Many findings were consistent with anecdotal evidence about poor investments made during the internet bubble, as well as some of the most successful deals being initiated during market busts. During recessions, there will not only be fewer valuable investment opportunities, but those that do exist will have difficulty being financed. Similarly, during boom times, not only will there be more good projects than in bad times, but bad projects will be financed in addition to the good ones. This investment pattern may provide an explanation for the common observation that the private equity investment process is procyclical.

Axelson et al. (2009) analysed the financial structure of PE funds in order to establish the different effects caused by divergent ways of financing deals. Among their results, they find that the level of leverage is mainly driven by a macroeconomic factor like the cost of debt, rather than industry- or firm-specific factors that affect the level of leverage in publicly traded firms. PE firms find it easier to raise debt and produce LBOs in times in which the liquidity level in the economy is high. Although the final rate of return on this increased number of deals depends on the conditions at exit (after several years), the number of deals is inversely linked to the cost of debt. The most recent developments on inflation are pushing the most important central banks to tighten their monetary policy and this change, together with unresolved problems coming from the pandemic period, is likely to slow down LBOs for some time.

In general, if firms completing Buyouts at market peaks employ leverage excessively, we may expect industries with heavy LBO activity to experience more intense subsequent downturns. Moreover, the effects of this overinvestment would be exacerbated if private equity investments drive rivals, not backed by private equity, to aggressively invest and leverage themselves.

Probably, however, this aspect of cyclicality in the PE industry is best expressed by studies that found a relationship between PE funds' performance and the amount of capital flowing into them. Particularly, performance is negatively correlated with capital inflows and funds raised during periods of high capital inflows, which are typically associated with market peaks, perform far worse than their peers.

Kaplan and Schoar (2005) study this relation between past performance and capital flows and argue that fund flows are positively related to past performance and that new partnerships are likely to be established following periods in which the industry has performed especially well. Still, funds and partnerships that are raised in this boom times are less likely to raise follow-on funds, a factor suggesting that these funds perform poorly. A larger fraction of fund flows during these times, therefore, appears to go to funds that have lower performance, rather than top and established funds. The dilution of overall industry performance in periods when many new funds enter is mainly driven by the poor performance of new entrants, while the performance of established funds is less affected.

5.5.4. Evolution and history of PE in Europe

Although the Private Equity market grew significantly faster and more robust in the United States, its roots can be traced as far back as the late 18th century Great Britain. Today it plays a significant role in economic development in Europe as well. The ability of this market to provide firms with the needed financial resources to promote innovation was already visible in the 19th century, when during the industrial revolution entrepreneurs demanded high amounts of capital and the primary providers were wealthy individuals, families or small groups of institutional investors (e.g. groups of banks). The countries mostly affected by this modernisation where Great Britain and Germany.

The lack of uniformity in legal norms and tax features, as well as the great dispersion of investment cultures and traditions across Europe, slowed down the growth of the industry in the continent. Hence the most heard- of PE firms we know today have only emerged relatively recently in Europe compared to the United States, by far the largest and most developed PE market.

For some, two divergent investment models can be found in Europe: the Anglo-Saxon model and the Continental European model. The Anglo-Saxon model is represented by Great Britain primarily, but also by France and the Netherlands. These countries have a highly developed capital market and they are set to finance investment projects with equity capital, which in turn promotes the development of private equity. Germany and Italy, on the other hand, have a traditional approach to economic development of a country consisting mainly of debt securities. Over the last decades, however, there has been a radical change in these countries and increasingly more attention is now being paid to the possibilities offered by the capital market.

The single currency in Europe created more integrated pan-European debt and equity markets and a more competitive corporate environment, which also helped to significantly foster for the first time the Private Equity industry (European Central Bank, 2005). The boom in high-technology industries initially drove the

growth of this market in the late 1990s, thereby financing and nurturing a significant number of European companies at an early stage of their development. Following the decline in stock prices in 2000 and 2001, activity in the European market for PE declined dramatically. The numbers remained relatively high from a historical perspective and funds raised by firms stabilised at a fairly high level of around €27 billion per year between 2002 and 2004.

In the late 1990s and in the years 2000 and 2001, in addition, PE funds consistently raised more money than they were able or willing to invest. Year after year, the figure for total fundraising com surpassed the figure for total investments (Harris et al., 2015).This created a sort of overhang of money raised but not yet invested, only partly due to the worsening of macroeconomic conditions at the turn of the millennium. This situation changed in the period from 2002 to 2004 as investments increased and continued to surpass funds raised.

Starting from the readjustment of stock market prices, there was a move towards less risky investments. In fact, Buyouts in mature industries became dominant. The importance of these deals may have been driven by the restructuring efforts made by European companies in those years, which in many cases have led to the sale of non-core businesses. While Buyouts had a share of around 60% of the market in 2001, this figure was already up to around 80% in 2003 (Jenkinson, 2006). Apart from Great Britain, the countries experiencing the highest share of the market in the Euro area where France, Germany, Italy and Spain (European Central Bank, 2005).

The amount of funds raised by PE houses right before the global financial crises reached a record €112.3 billion in 2006, up from €71.8 billion the year before (Dantas Machado & Raade, 2008). Around 75% of the total funds raised, or €84.3 billion, was earmarked for Buyout investment. The share of venture capital in fundraising was €17.5 billion, or 15.5% of total funds raised, including €5.9 billion for early-stage venture capital investment. The successful fundraising was probably led by investor interest in Buyout funds, even though the relative share of venture capital in fundraising also increased. Low interest rates combined with the easy credit conditions that prevailed until the global market crash helped create an ideal environment for LBOs in 2006 and contributed to the consequent strong supply of funds for investment. The favourable fundraising environment was further reinforced by institutional investors' increasingly positive attitude towards the asset class arising from the attractive returns generated.

Not by chance, funds whose vintage year (namely, year of inception) was 2001, 2002 or 2003 had a pooled IRR of around 20%. These funds had the opportunity to exploit equity market expansions and to borrow at very low interest rates. Conversely, funds established around the outbreak of the crisis had negative pooled IRRs as low as -25% (Di Carlo, 2010). The crash also contracted the amount of funds raised by Private

Equity firms. In 2012, the figure was as low as €24.6 billion and it started to crawl back up only in 2013, when it doubled to €53.6 billion.

After a few years of constant expansion, the record year for fundraising was 2019, right before the pandemic. A total of 578 PE funds were in the position to collect €114 billion, the highest amount of the decade. The biggest share as expected went to Buyout activity (€79 billion), followed by VC (€15 billion) and Growth Capital (€9 billion). While the figure for Growth is in line with the average of previous years and actually saw a decline with respect to 2018, Venture Capital recorded the seventh consecutive year of expansion and a 17% increase compared to 2018 (Invest Europe, 2020)[7].

For what concerns the source of the funding, pension funds provided 29% of funds raised, followed by fund-of-funds and other asset managers (19%) and family offices and private individuals (13%). North America accounted for the highest proportion of fundraising (28%), followed by France and Benelux (26%) (Invest Europe, 2020).

The total equity amount invested in European companies increased by more than 20% year-on-year to €104 billion in 2019 and this was the highest level of investment ever recorded. A total of 7,902 companies received investment, 8% above the average for the previous five years, 84% of which were SMEs.

The pandemic not surprisingly slowed down the market as much as it slowed down the overall economy. Total fundraising in Europe during 2020 reached €101bn, a 12% decrease from 2019. The figure however is at least in line with the level observed in 2018 (€103bn) and 2017 (€97bn) and remains largely above the yearly amounts raised by the industry since 2009. Despite the lower volume of money collected the number of funds raising resources increased to a record of 672. The Buyout category had €62 billion, Venture Capital €16 billion and Growth Capital €15 billion (Invest Europe, 2021)[8].

The type of institutional investors and their relative involvement remained the same. Pension funds provided again 29% of funds raised, followed by fund-of-funds (20%) and family offices and private individuals (13%). The geography was also the same, with North America that accounted for the highest proportion of fundraising (26%), followed again by France and Benelux (24%).

Finally, the total equity amount invested in European companies decreased to €88bn in 2020. A total of 8,163 companies received investment, 85% of which were SMEs (Invest Europe, 2021).

But as the pandemic hit hard a lot of crucial sectors in the economy at a global level, Private Equity markets were able to bounce back relatively quickly and to restart the process of growth that had characterised the second decade of the millennium. Total fundraising in Europe during 2021 reached €118 billion, 7% above 2020's figure and the highest level ever recorded. A total of 841 funds raised capital during the year, the highest number of funds ever recorded (Invest Europe, 2022)[9]. Buyouts amounted to

€71 billion raised (for a total of 181 funds), compared to €20 billion for Growth Capital and to €18 billion for Venture Capital.

This time, fund-of-funds and other asset managers were the top investor category with 23% of the funds raised, followed by pension funds at 20% and families and individuals at 15%. The geographical sourcing of these funds also changed, maybe due to the pandemic, with France and Benelux with the highest proportion of fundraising (31%) followed by North America (19%). Considering a division of the funds raised in 2021 by region of management, France and Benelux are for the first time ahead with 36.4% of the money raised compared to the UK and Ireland that together account for 35.3%. This is a significant change, as historically the Anglo-Saxon part of Europe hosted the largest share of funds' management (in 2019, the figure was 65%). Subsequently, the most significant region is the Nordics (24.2%), followed by the DACH area (12.1%) and Southern Europe (8%) (Invest Europe, 2022).

The total equity amount invested in European companies in 2021 is €138 billion and far exceeds levels recorded in any year. It represents an increase of around 50% from 2020. A total of 8,895 companies received investment, 84% of which were SMEs. Overall, investments of European PE firms amounted to 0.76% of European GDP.

The latest figures show that investments by number of companies were concentrated in four sectors: ICT (37%), consumer goods and services (17%), biotech and healthcare (15%), and business products and services (13%). ICT received almost €43 billion of investments and combined with the category of consumer goods and services accounted for more than 50% of investments by amount.

Not surprisingly, Buyouts were the largest deals both in numbers and in volume. Among the €138 billion invested in European companies, Buyouts take out the 57.3%. Particularly, €28.6 billion of the Buyout deals constituted transactions above €300 million, €16.2 billion were transactions between €150 and €300 million, €28.9 billion were mid-market transactions between €15 and €150 million and the remaining €5.2 billion were small transactions below €15 million.

Divestments at cost in 2021 arrived at €41 billion, roughly 60% higher than the year before. This is a significant increase, and above the average of the five previous years. A total of 3,720 European companies were exited during the year. Of the €41 billion, €29.4 billion were divested at cost by Buyout deals.

41% of divested Buyouts ended up being SBOs as the companies were sold to other Private Equity firms. 28% were instead trade sales to strategic buyers. Other significant categories were management/owner buyback and repayment of preference shares/loans, both of which had values around 10% of divestments.

5.5.5. Future outlook for Private Equity

While we enter into 2023, inflation is increasing hastily and is causing serious troubles to the purchasing power in our economy. Governments and central banks are taking painful actions to counteract, but the results will not be visible until 2023. The numbers of inflation for some countries are as high as in the 1980s and come after a decade of (basically) zero interest rates and low growth. As of August, prices in the Eurozone are growing year-on-year at 8.9%. In countries like Spain and the Netherlands inflation is above 10%, while in Germany is at 7.5% and in France at 6.1%. A radical change, to which all the economy and the PE industry need to adapt.

The rise in short-term interest rates, and more importantly, the sharp increase in market expectations of further tightening, has been the primary driver of recent market turmoil. The corresponding increase in discount rates has led to a fundamental repricing of valuations and a sharp rotation away from stocks with relatively high implied growth rates into stocks with relatively low implied growth rates.

Venture capital is particularly susceptible to this repricing given its high degree of exposure to young companies that will require significant growth to reach profitability as well as the surge in valuations over the past few years (Aker, 2022)10. Assets that gain most of their value from expected future revenue and growth in earnings are more sensitive to increases in discount rates, given that cash flows will be realized well into the future. LBOs instead consist of more mature companies with relatively strong and stable earnings and thus lower valuations. From this point of view, this makes them less sensitive to rising rates.

Nevertheless, it must also be born in mind that, among the sources of value creation in PE deals, multiple expansion (at valuation) has been the largest driver of success. According to Bain & Company (2022), in the years 2010-2015 multiple expansion caused 48% of the increase in value for portfolio companies and this figure jumped to 56% in the years 2016-2021. The remaining shares are revenue growth (38%) and margin expansion (6%). The trend is therefore becoming even more pronounced in recent years. This is not to say that GPs are becoming less adept to improving portfolio companies' performance, but certainly the trend will not be easily turned around. This exposure is something that must be taken into consideration to make sensible investment decisions.

If the market is correct, moreover, and short-term rates do indeed increase significantly by the end of the year, this would result in the average interest coverage ratio for recent Buyout deals falling accordingly, assuming EBITDA remains unchanged. The higher borrowing costs entail that PE companies have to cover increasing interest payments and for future deals this means that leverage, which has magnified positive returns in recent years, will need to come down.

For what concerns the war in Ukraine, it is not yet clear how this is impacting the Private Equity industry. After half a year of engagement, the conflict does not seem to be ending any time soon. Considering the issue from a geographical point of view, the area of Central and Eastern Europe accounted in 2021 for only around €1 billion of the overall volume of Buyout deals. The AIF market is therefore not yet developed, at least not as much as in Western Europe and in the United States. PE firms operating in the area have shifted their destinations as soon as the conflict outbroke and very few new funds will be opened hereafter. The overall impact is likely to be limited.

A final aspect to be considered pertains to ESG and reporting standards of related issues. With the recent regulatory requirements, PE firms are taking actions to disclose relevant data and more and more LPs are indeed requesting this type of information before providing capital. 93% of LPs claim to be susceptible to ESG and may refuse to fund investments if these pose ESG concerns (Hugh, 2022). The opportunity for PE firms stems from their active involvement as shareholders in portfolio companies. By actively engaging alongside management teams, they can decide to create value and be considered responsible for a positive impact on ESG factors in portfolio companies invested. The threat is however being liable if no or negative changes take place.

5.6. Venture Capital

Typically, venture capital funds are constituted as limited partnerships, with the general partner directing the fund's investments and the limited partners supplying funding. The fund's limited partners, who might include institutional investors, family offices, high-net-worth individuals, and even businesses, pledge a set amount of cash and become passive investors (Gompers & Lerner, 2001). The general partner is in charge of generating funds, seeking investment opportunities, and overseeing the fund's investments. Throughout the fund's existence, which is typically 10 years, committed capital, or the cash promised by limited partners during the course of the fund, plays a critical role as the means by which investing activities are properly carried out. The general partner is paid a management fee, which is normally 2% of committed capital, as well as a carried interest, which is a proportion of the fund's profits. The carried interest rate is normally 20%, although it might fluctuate based on the performance of the fund (Kaplan & Strömberg, 2009). Carry interest and management fees are two important components of venture capital firms. Carried interest is the portion of earnings received by venture capitalists from successful investments. This pay structure encourages venture investors to identify and assist start-ups with high potential returns. Management fees, on the other hand, are collected to cover the operational costs of running the venture capital fund, such as wages, rent, and other expenditures. These fees are generally 1% to 2% of the fund's total capital. Management fees are also used by venture capital firms to engage

qualified experts to run and advise their portfolio companies. According to a National Venture Capital Association (NVCA) report, carried interest and management fees accounted for 16.8% and 1.4%, respectively, of total capital committed to venture capital firms in 2020. (NVCA, 2021). These fees are critical to the operation of the venture capital business and are required for investors to be adequately compensated for the risks they assume in sponsoring start-ups.

Lowering the maximum size of General Partners' (GPs') participation in venture capital funds can help align GPs' interests with those of Limited Partners (LPs). GPs often receive a share of the fund's profits, independent of the fund's overall performance. This pay structure may result in an incentive mismatch between GPs and LPs, as GPs may prefer larger, riskier assets that have the potential to generate higher returns but also offer greater risks to the whole fund. According to a Harvard Business School research, decreasing the maximum amount of GP investments might help minimize this mismatch of incentives and encourage GPs to focus on investments that yield consistent long-term returns (Lerner, 2020). According to the study, funds with smaller maximum investment amounts outperformed those with greater maximum investment levels, implying that smaller investments might lead to a more diversified portfolio and more wise investing decisions. Reducing the maximum amount of investments can also promote trust and transparency between the two sides, resulting in a more collaborative and productive partnership by aligning the incentives of GPs with those of LPs.

An Investment Memorandum (IM) must be written to effectively manage the relationship between Limited Partners and General Partners. It functions as a complete start-up handbook, offering specific information on the company's business plan, management team, financials, and development prospects. Venture capitalists use the IM to assess a start-potential up's and make an educated investment choice; it is also an important tool for start-ups to explain their vision and strategy to potential investors. The IM should be a clear and concise document that highlights the key strengths of the start-up and identifies potential risks and challenges, according to a report by the British Private Equity and Venture Capital Association (BVCA). It should also include a thorough examination of the market and competitors, as well as the regulatory and legal framework in which the start-up works. The IM is essential in the venture capital market since it facilitates effective communication between investors and start-ups. It helps investors to assess prospective investment possibilities and make educated decisions based on extensive and trustworthy data. The IM provides a platform for start-ups to display their capabilities and potential, as well as receive the cash they require to expand and flourish. The investment memorandum (IM) comprises governance terms that clarify the relationship between the start-up and the venture capitalist, in addition to giving specific information about the start-business up's strategy and financials. These sections cover board membership, voting rights, and decision-making procedures, and are intended to harmonize the interests of all

stakeholders. According to a National Venture Capital Association (NVCA) research, governance clauses are a vital aspect of the investment process since they give clarity and openness regarding both parties' duties and obligations (NVCA, 2019). The paper also emphasizes the necessity of matching incentives between the start-up and the venture investor to ensure that both sides are working toward the same goals. Governance measures are especially crucial in the venture capital business, where the dangers and uncertainties of early-stage financing can result in conflicts of interest between the start-up and the venture capitalist. The IM can help to alleviate these conflicts and offer a framework for productive collaboration and value generation by setting defined norms and procedures for decision-making and governance.

Fundraising for venture capital funds may be difficult and time-consuming, requiring a track record of successful investments as well as strong connections with limited partners. Fund managers may meet with potential investors for months or even years, outlining their investment strategy and track record. Before contributing cash to the fund, limited partners may also do rigorous due diligence on the fund manager's investment team, track record, and investing procedure (Gompers & Lerner, 2001). This phase is known as the investment or committed period, and it typically lasts 5 years; after this period, the fund will no longer explore for other intriguing investments, but will instead focus on the pool of start-ups picked and will only make follow-on investments in the current portfolio maintained.

The reputation of General Partners (GPs) in the venture capital business is important to their success. To recruit Limited Partners (LPs) and secure investments in their funds, venture capitalists rely significantly on their reputation. A solid reputation may also assist GPs in gaining access to high-quality deal flow, negotiating better terms with start-ups, and establishing trust with portfolio firms. From the standpoint of game theory, reputation may be viewed as a solution to the "hostage dilemma" in the venture capital business. When a GP has a motive to behave in its own self-interest, even if it is not in the best interests of the LPs, the hostage dilemma occurs. A general partner, for example, may be motivated to prioritize its personal reward over the fund's long-term success. GPs, on the other hand, may demonstrate their credibility and dedication to the interests of LPs by developing a good reputation for honesty, openness, and performance. This reduces the possibility of GPs holding LPs "hostage" and encourages more cooperative conduct between the two parties. According to research, reputation is a crucial factor of success in the venture capital market. According to a University of Chicago Booth School of Management study, GPs with excellent reputations are more likely to attract high-quality ventures, acquire larger investments, and deliver greater returns for their limited partners (Gompers et al., 2018). The study also discovered that Physicians' reputation can function as a barrier to opportunistic conduct since they are more likely to incur reputational repercussions for unethical or self-interested activity.

The venture capital business has experienced a trend toward larger and more specialized funds in recent years. Big funds may have the benefit of being able to invest larger quantities of cash into portfolio firms, possibly yielding higher returns, but they may also have difficulties in discovering and delivering on large-scale investments (Gompers & Lerner, 2016). Specialty funds may concentrate on certain industries or areas, giving them a competitive advantage in locating investment opportunities and producing value for portfolio firms (Gompers & Lerner, 2001).

5.6.1. The Investing Phase in Venture Capital

The managing phase of venture capital refers to the continuing activity of supervising and assisting the fund's portfolio firms. This stage is crucial for optimizing investment value and executing a successful exit plan. During this phase, General Partners (GPs) collaborate closely with portfolio company management teams to give direction, resources, and strategic counsel. According to research, competent portfolio company management may have a considerable impact on the performance of a venture capital fund. According to a research conducted by the Ewing Marion Kauffman Foundation, firms that had excellent support and advice from their investors were more likely to have successful exits, such as initial public offerings (IPOs) and acquisitions (Hellmann & Puri, 2002). The study also discovered that investors who gave active management support were more likely to obtain significant investment returns. GPs must establish excellent connections with their portfolio firms and understand their specific requirements and difficulties in order to properly manage their portfolios. This necessitates constant communication and coordination between general partners and portfolio firms, as well as a thorough grasp of the sectors and marketplaces in which they operate. Furthermore, GPs must be prepared to make unpleasant decisions, such as removing management teams or reorganizing operations, when necessary. This necessitates a thorough awareness of the legal and financial consequences of such acts, as well as the capacity to collaborate with other stakeholders such as Limited Partners (LPs) and other investors.

Mentoring is important in the venture capital management phase because it allows general partners to engage directly with portfolio company management teams to assist them accomplish their goals and overcome problems. Coaching entails offering advice, resources, and assistance to portfolio firms in order to help them manage the challenges of the startup ecosystem and achieve success. Coaching has been demonstrated in studies to have a major influence on the success of venture capital investments. According to a Harvard Business Review research, firms that got coaching from their investors were more likely to accomplish successful exits, such as IPOs or acquisitions, than those that did not (Gompers et al., 2010). According to the study, mentoring was more beneficial than merely providing funds since it allowed investors to create closer ties with portfolio firms and better understand their needs and issues. Additionally, coaching can assist general practitioners in focusing on

developing winners rather than merely identifying winners. Creating winners entails working directly with portfolio firms to help them expand their businesses, establish great teams, and manage the startup landscape's hurdles. In contrast, picking winners entails merely identifying the most promising firms and giving them with funding. GPs may earn greater returns on their investments and deeper connections with portfolio firms by focusing on producing winners. This necessitates a long-term mindset as well as a commitment to assisting portfolio firms throughout their growth and development.

The function of venture capital (VC) in creating value to portfolio firms has received substantial scholarly attention. VC investors are commonly seen as giving not just financial assistance but also strategic advice, industry experience, and access to networks and resources. These donations are sometimes referred to as "smart money" since they offer value beyond the dollars contributed. Increased exposure and legitimacy may also assist VC-backed enterprises, attracting additional investors and consumers. According to several studies, VC-backed firms outperform non-VC-backed counterparts in terms of revenue growth, profitability, and the chance of going public or being acquired (Gompers & Lerner, 2004). According to one research, VC-backed firms outperformed their non-VC-backed rivals in terms of survivability, patent success, and innovation (Gompers, Kovner, Lerner, & Scharfstein, 2010). Another study showed that VC-backed firms grew faster in terms of employment, sales, and assets than non-VC-backed enterprises (Hellmann & Puri, 2002). Some research, however, have questioned the real value that VC investors provide, arguing that VC-backed businesses were just more appealing to investors in the first place (Gompers, 1996). According to some academics, the favourable performance of VC-backed firms may be attributable to selection bias, in which only the most promising startups obtain VC capital (Da Rin et al., 2006). Finally, the value provided by venture capital may be determined by factors such as the stage of the firm, the industry, and the caliber of the VC investors. Early-stage firms, for example, may benefit more from the advice and experience offered by VC investors, but later-stage companies may require less participation and more access to funding. The sector may also have an impact on the value delivered by VC investors, with some businesses need more specialized experience or resources. Furthermore, the caliber of the VC investors themselves may be important, with experienced and well-connected investors likely to deliver greater value than novice or less-connected investors.

5.6.2. Regulation of Venture Capital in Europe

Venture capital funds are subject to a range of regulations in Europe. These regulations are designed to protect investors and maintain the stability of the financial sector. The Alternative Investment Fund Managers Directive, or AIFMD, came into effect in 2013 and applies to all managers of alternative investment funds, including those managing venture capital funds. The directive creates requirements for fund managers in terms

of risk management, transparency, and reporting, in addition to establishing regulations for the marketing and distribution of funds (European Securities and Markets Authority, 2017). The Alternative Investment Fund Managers Directive (AIFMD) also establishes a legislative framework for fund passporting between EU member states. This paves the way for fund managers to market and distribute their money throughout the EU (European Securities and Markets Authority, 2017).

Aside from the Alternative Investment Fund Managers Directive (AIFM), venture capital funds in Europe may be subject to national laws and guidelines established by regulatory authorities such as the Financial Conduct Authority in the United Kingdom or the Autorité des marchés financiers in France. These authorities are examples of national regulatory authorities. These regulations could include restrictions on investments, conflicts of interest, or obligations for more transparency (European Private Equity and Venture Capital Association, 2021).

The objective of Europe's regulations governing venture capital funds is to achieve a balance between the protection of investors and the promotion of investment and expansion in innovative businesses. According to Günther et al. (2016), regulation may result in increased expenditures and administrative responsibilities for fund managers; however, it may also help to develop trust and confidence in the company, which may be to the benefit of both fund managers and investors.

5.7. Trends in Sustainable Investments

According to the research that was presented in the paragraph that came before this one, global sustainable investments reached $35.3 trillion in the five major markets (Europe, the United States of America, Canada, Australasia, and Japan) in the year 2020. This represents a 55% increase using 2016 as the base year. Even though the growth over the past two years (2018–2020) has only been 15%, the trends being observed here are quite intriguing. This is the case even if the growth over the past two years has only been 15%. The COVID–19 pandemic has, without a doubt, posed a significant obstacle for sustainable related investments; however, it has also posed a significant opportunity for this important sector. Governments, and particularly Europe, have allotted massive amounts of funds, with the intention of reshaping environmentally friendly technologies and more generally moving towards a greener transition.

The total amount of sustainable assets under management has increased during this time period to reach $98.4 trillion dollars. This represents 35.9% of the total amount of assets under management in the markets that were examined and a growth of 2.5 percentage points in comparison to the most recent time period that was investigated.
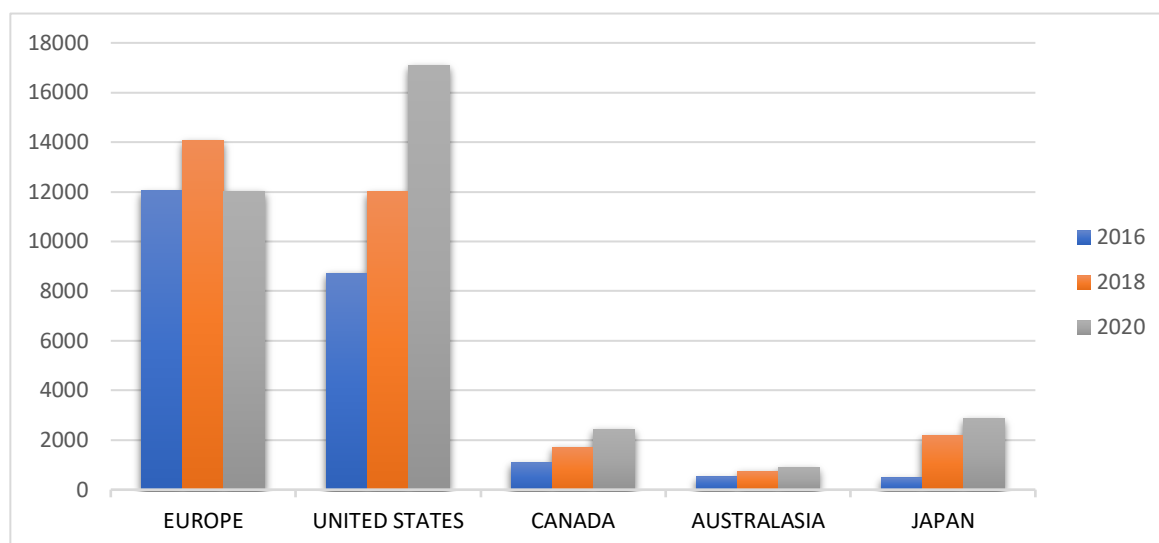
Figure 2 - Total amount of sustainable Assets Under Management in the years 2020, 2018 and 2016, per country (Numbers are expressed in millions)

The amount of money invested in different areas of sustainability-related topics is displayed by region in the following graph, which covers the years 2016 through 2020. The United States grew by 42%, following Canada and placing second overall, followed by Japan registering a 38% increase. Canada, with a 48% growth in sustainable assets managed, represents the region with the highest increase over the period. The United States grew by 42%, following Canada and placing second overall. This region, which has long represented the number one driver for sustainability investments, has seen a 13% fall. The primary cause of this decline is a revision that European authorities made to how they interpret what is meant by the term "Sustainable Investment." However, considering that new definitions have just been included into legislation in the European Union as a part of the European Sustainable Finance Action Plan, this outcome is not very noteworthy.

In relation to this, documents (ESMA, 2018) that have been made public by the European Securities Market Association (ESMA) give with the three primary aspects of their strategy on sustainable finance. Greenwashing is made feasible by the rapid expansion of the market and the increased demand for environmentally, socially, and governance-related investments, as was mentioned in the paragraph that came before this one. The first goal of the program is to combat greenwashing and promote transparency. Greenwashing is an issue that is multifaceted and diversified, and it has the potential to have a detrimental impact on investors that are interested in making sustainable investments. It is possible for it to take many various shapes, and there may be many different reasons for it. The protection of investors is the top priority for the European Union (EU), and the extent to which this priority will be met will largely be determined by how thoroughly regulators will be able to investigate this problem, identifying its essential components, tackling it with coordinated action across a wide

variety of industries, and coming up with general remedies applicable across the EU. The European Securities and Markets Authority (ESMA) has made significant progress toward understanding and analyzing the hazards of "greenwashing" in connection to sustainability claims and the regulation of sustainable finance plans. These

actions were important. ESMA and national competent authorities (NCAs) need to develop new abilities outside of their traditional areas of concentration due to the increasing significance of sustainable finance. This is the second point of the European sustainability program, and it focuses on building NCAs and ESMA's capacities. In order to comprehend and resolve the supervisory consequences of new laws and novel market practices, ESMA and NCAs need to be able to comprehend and resolve the supervisory consequences of new laws and novel market practices.

Instead, the third point focuses on the monitoring, measuring, and analyzing of ESG markets and risks; in order to protect investors and maintain the stability of the financial markets, it is essential to be aware of new trends, dangers, and vulnerabilities. ESMA will make use of its data-analysis skills in order to support its own supervisory work as well as the work of the NCAs, as well as to encourage a convergent strategy among the NCAs.

This new set of aims might help explain, at least in part, why the European market is in a state of constant and rapid transition, going through new legislative definitions as it relates to sustainable products and strategies.
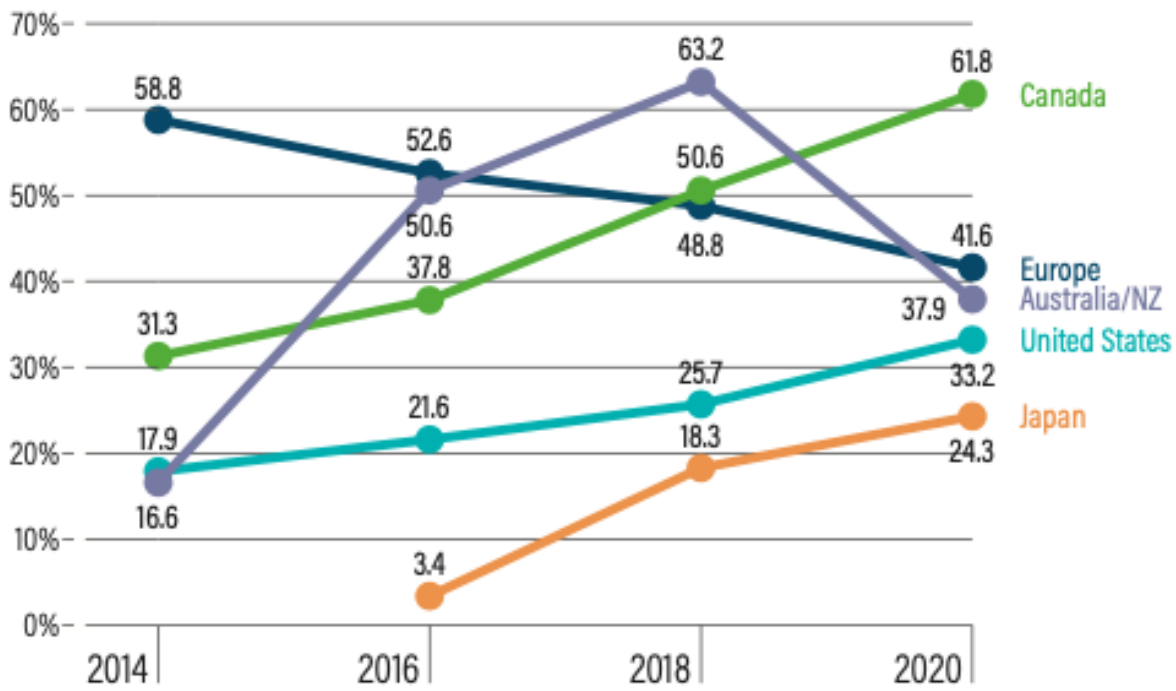
Figure 3 – Percentage weight of ESG investment over total investment per region

REGION	2014	2016	2018	2020
Europe*	58.8%	52.6%	48.8%	41.6%
United States	17.9%	21.6%	25.7%	33.2%
Canada	31.3%	37.8%	50.6%	61.8%
Australasia*	16.6%	50.6%	63.2%	37.9%
Japan		3.4%	18.3%	24.3%

Figure 4 – Yearly distribution percentages of ESG investment over the main regions.

Instead, it is possible to illustrate the impact of assets managed through sustainable investing in comparison to total managed assets in the regions of interest by referring to these two graphs. Following a crescent-shaped pattern throughout the analyzed time period (2014–2020), Canada will be the region in which the highest percentage, almost 62%, is reached by the year 2020. This number translates the efforts made by this country to innovate and provide its contribution toward a transition of their investments that is focused on sustainability. In contrast, both Europe and Australasia had a downward trend; both areas have witnessed major shifts in everything that pertains to the criteria of sustainable financial products. In both instances, regulators took an active part in revising the sustainability rules for the definition of financial products; however, in the sole instance of Australasia, another revision has been imposed by the home central bank, relative on the definition of the overall market size.
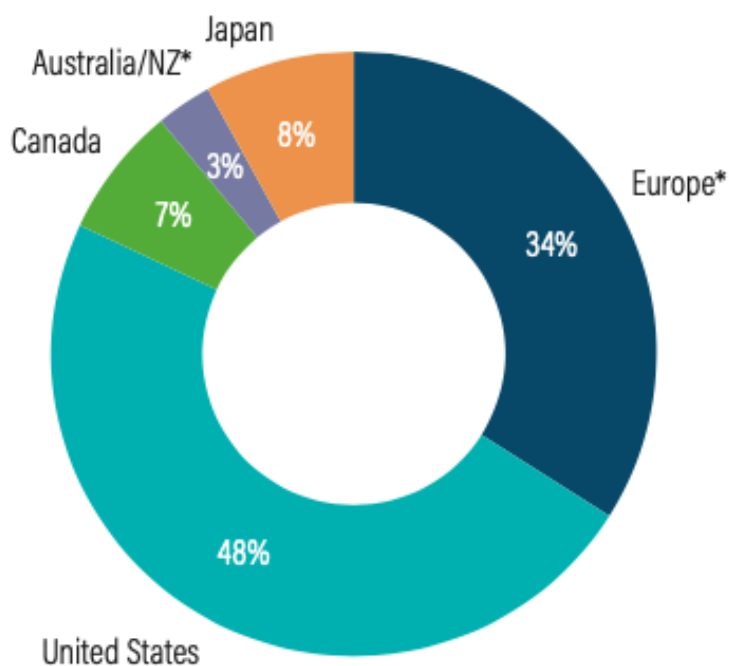
Figure 5 – Percentage distribution of ESG investment in the world

This interesting graph instead, depicts the proportion of global sustainable investing assets by region as of 2020. It is important though to underline that Europe and United States alone count for more than the 80% of sustainable assets under management, data that translates the effort of the two regions in contributing for cleaner technologies and investments in general. Another important fact behind this results is the fact that as of 2020 United States are the first contributor to sustainable assets, having surpassed Europe, that has always been the main actor in this type of investments. Nevertheless, Europe and Unites States depicts this astonishing result, it is important to remind the fact that they have bigger and more developed financial markets if compared to the other regions analysed.

ESG integration is the method of sustainable investment that has been reported as being used the most frequently across the board. It has a total of $25,2 trillion in assets under management and uses a strategy called "ESG integration." The second most common strategy for sustainable investments is known as negative or exclusionary screening, which accounts for $15.9 trillion, and corporate participation or shareholder action, which accounts for $10.5 trillion. This finding is in contrast to one that was made in 2018, when it was shown that negative/exclusionary screening was the sustainable investment approach that was utilized the most. This shift toward ESG integration was notably noticeable in Japan, where it replaced shareholder activism and business engagement as the most preferred approach of achieving sustainable investment returns. The data on European sustainable investing strategies included in this year's report are extrapolated from historical data gleaned from earlier rounds of this research. This is necessary because there are no data available for the year 2020 at the strategy level. All of the key areas' reports are suggesting that more and more investment companies are combining their tactics rather than relying solely on one of them. During the period in question, there was a discernible uptick in activity regarding corporate involvement, investments with a focus on sustainability, and ESG integration. However, since 2016, there has been a tendency toward norms-based screening, positive screening, and screening that combines both negative and positive results. All of these trends have witnessed more unpredictability.

The figure illustrates how the prevalence of sustainable investing approaches varies throughout different regions of the world. These differences can be attributed to a wide range of factors, some of which are unique to certain geographic areas.

For example, Australasia does not track corporate interaction as a separate strategy and instead aggregates positive, negative, and norms-based screening into a single bucket; as a result, the region's assets can only be used to four of the seven methods shown in Figure 8. The United States does not keep track of norms-based screening and instead only counts the portion of corporate involvement assets that is used to submit shareholder resolutions on environmental, social, and governance (ESG) issues in order to obtain an overall total of sustainable investing assets.

Despite this, there are still some noteworthy regional differences that we can see. When compared to Japan's 8% share of the worldwide sustainable investing assets, Japan's

contribution to the global assets dedicated to corporate involvement and shareholder action (at 17%) is significantly bigger than its contribution to the global assets dedicated to sustainable investing (at 8). The United States of America holds a bigger share of the world's assets in terms of sustainable investing, impact or community investing, positive or best-in- class investing, and ESG integration.

Using a number of different approaches to sustainable investing allows investors to incorporate sustainability-related risks and opportunities into their investment processes, as was previously said. As a consequence of this, the way of segmenting these strategies might not correctly reflect the global trends that the industry of sustainable investing is currently dealing with.

Historically speaking, the majority of assets that were screened using norm-based and negative or excluding criteria were located in Europe. Because the recent European Union Sustainable Finance Disclosure Regulation lays out requirements for investment managers to include sustainability risks in their investments, negative or exclusionary screening, norms-based screening, and ESG integration are now expected practices for all financial products in the region. This is due to the fact that the Sustainable Finance Disclosure Regulation was recently passed.

According to a web post that was written and published by Morgan Stanley during the Covid 19 Pandemic in the year 2020, sustainable funds performed better than standard peer funds. During a time of extreme financial turmoil caused by a global crisis that saw most of the largest and most important economies on the verge of a global recession, ESG – portfolios performed better than those that are not focusing on environmental, social, and governance themes, according to an analysis of the performance of more than 3000 asset management firms based in the United States.
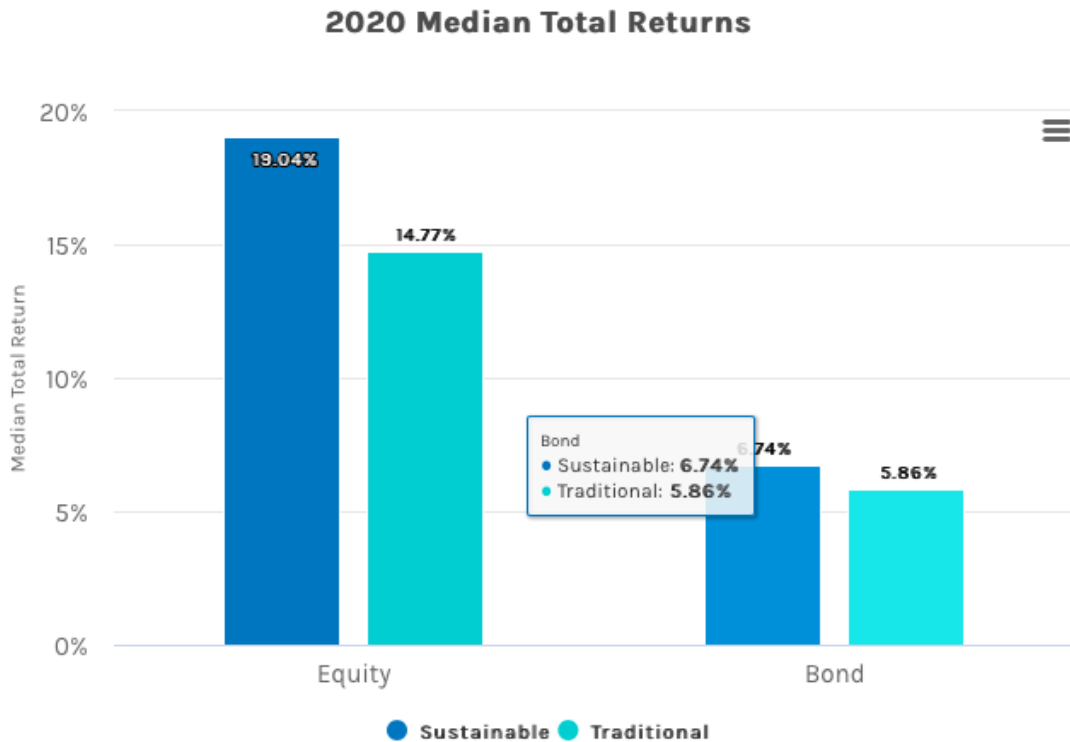
Figure 6 – Median Total Return in Equity and Bond considering Sustainable vs Traditional investments

In the equity cluster, ESG financial products have outperformed by 4.3 percentage points, while in the bond's one they have only outperformed by 0.9 percentage points. As can be seen from this graph, the median of total returns for sustainable products is higher in both Equities and Bonds. This is something that can be observed. Another stronger result that confirms this analysis is that sustainable related financial assets, both in equities and bonds, have performed better in terms of standard deviation; specifically, the former have performed 3.1% better than the latter, while the latter have performed 0.4% better than the former. These numbers highlight the fact that in a very specific period of time, when financial markets were initially characterized by high volatility and uncertainty and then they ended in a growing trend, ESG portfolios depicted great results in terms of performance and standard deviation, ultimately becoming the most balanced financial assets in terms of risk and return. This is evidenced by the fact that ESG portfolios depicted great results in terms of performance and standard deviation.

These financial results are bolstered even further by the following statement made by Audrey Choi, the chief executive officer of Morgan Stanley: "Sustainable investments have continued to perform well throughout 2020, further dispelling the myth that investors who include sustainability considerations in their portfolios face a financial trade-off." Consequently, very important signs are coming from the financial markets. For instance, the United States exhibited a 42% increase from 2018 in the assets adopting a sustainable investing strategy, which makes sustainability-focused

financial assets more and more interesting from the point of view of asset management. Astonishing outcomes have also been recorded from the investors' perspective; in fact, more than a half of retailers have migrated from both a risk & result theme and a social on, and either own ESG investment solutions or are considering purchasing them. In addition, regulators are demanding a higher level of transparency in the disclosure of information to the public that is related to sustainability. This is done in order to overcome problems associated with information asymmetry and to provide investors with data that is more reliable for the purpose of measuring ESG risks and opportunities.

In conclusion, the fundamental competitive advantage of sustainable funds lies in their capacity to reduce risk, an aspect that is essential during times of crisis. As a result, sustainable funds are an excellent product both financially and ethically, and this is why they are referred to as "green" funds.

5.8. The Role of Regulation

In recent years, ESG investing has been increasingly popular due to the fact that investors are increasingly desirous of aligning their portfolios with their ideals and encouraging environmentally friendly, socially responsible, and governance-friendly results. This tendency may be attributed to a number of different factors, such as a greater awareness of the risks posed by climate change and other sustainability challenges, as well as an acceptance of the potential for ESG factors to drive long-term value creation. A spate of new laws and standards that aim to increase openness and accountability in the environmental, social, and governance (ESG) sector have been enacted by regulators all over the world in an effort to support the expansion of ESG investing. In Europe, for instance, the EU's Sustainable Finance Action Plan is comprised of a variety of initiatives that are aimed at encouraging sustainable investment. These initiatives include the creation of an EU-wide taxonomy of sustainable economic activity and the implementation of a framework for sustainable finance disclosures. In a similar manner, the United States Securities and Exchange Commission (SEC) has taken actions to strengthen its focus on environmental, social, and governance (ESG) issues. One of these actions was the formation of a Climate and ESG Task Force, which is charged with identifying potential misconduct related to ESG issues and improving the agency's ability to identify and pursue ESG-related violations. In addition to developments in law, the proliferation of environmental, social, and governance (ESG) investments has been supported by the development of new tools and frameworks with the goal of promoting more openness and accountability in the ESG sphere. For example, the Task Force on Climate-related Financial Disclosures (TCFD) has developed a framework that is widely used for climate-related financial disclosures. In addition, the Global Reporting Initiative (GRI) has developed a set of criteria for sustainability reporting. Both of these initiatives have been undertaken by numerous organizations. Overall, the rise of ESG investing is

being driven by a number of different factors, some of which include an increased demand from investors for sustainable investment options, an increased awareness of the risks posed by sustainability challenges, and the implementation of new regulations and frameworks aimed at promoting greater transparency and accountability in the ESG space. It is projected that there would be an increase in the number of legislative and market measures aimed at bolstering sustainable investment and producing environmentally, socially, and governance-friendly results as the trend toward ESG investing continues.

6 Data frame analysis

We gathered information on the environmental, social, and governance (ESG) condition of around 3185 funds and sought to determine the characteristics that most typically characterise a fund. The features we considered included the fund's ID (fundid), the asset class (assetclass), the fund's size in millions of USD (fundsizeusdmn), the fund's size binned into low, medium, and high categories (fundsizeusdmn cat), the fund's core industry (fundcoreindustries), the geographic area of focus (primaryregionfocus), the type of strategy used (strategy), the internal rate of return (Netirr) (Fundpeesgstatus).

In the context of an explanation, the variable of interest is a fund's environmental, social, and governance (ESG) focus. The goal of this research is to determine the influence of an ESG focus on fund performance. To put it another way, the question is whether funds that prioritize environmental, social, and governance problems (ESG = 1) outperform those that do not (ESG = 0). As previously stated, 36.7% of the funds in our sample include environmental, social, and governance concerns into their investment strategy.

Of of the funds examined, 2016 were found to do not adhere to ESG standards, while 1169 follow them.

6.1. Assetclass

This characteristic permits the categorization of funds into three distinct categories: multi, venture capital (VC), and private equity (PE). Due to the fact that there are only six funds in the multi category, the two observations will be eliminated during data processing, and no different dummy variable will be generated. As a result, two dummy variables were created and used in the investigation. Despite the expectation that venture capital funds would outperform other types of private equity funds, such as leveraged buyout funds, asset class management is essential (Kaplan & Schoar, 2005).

Private equity funds represent just 25.15 percent of all sample funds. It is simple to discern the asset classes of funds that adhere to ESG regulations from those that do not. 63.30% of the database consists of funds without the ESG classification, whereas 36.70% consists of funds having the designation. Nevertheless, if we restrict the funds to those having Private Equity as an Asset Class, the percentage of those with the ESG label improves to 52.31 percent, while the percentage of those without it decreases to 47.69 percent. The fraction of venture capital funds that adhere to ESG criteria

principles falls to 31.29%, while the proportion that does not rises to 68.71%.

Venture Capital
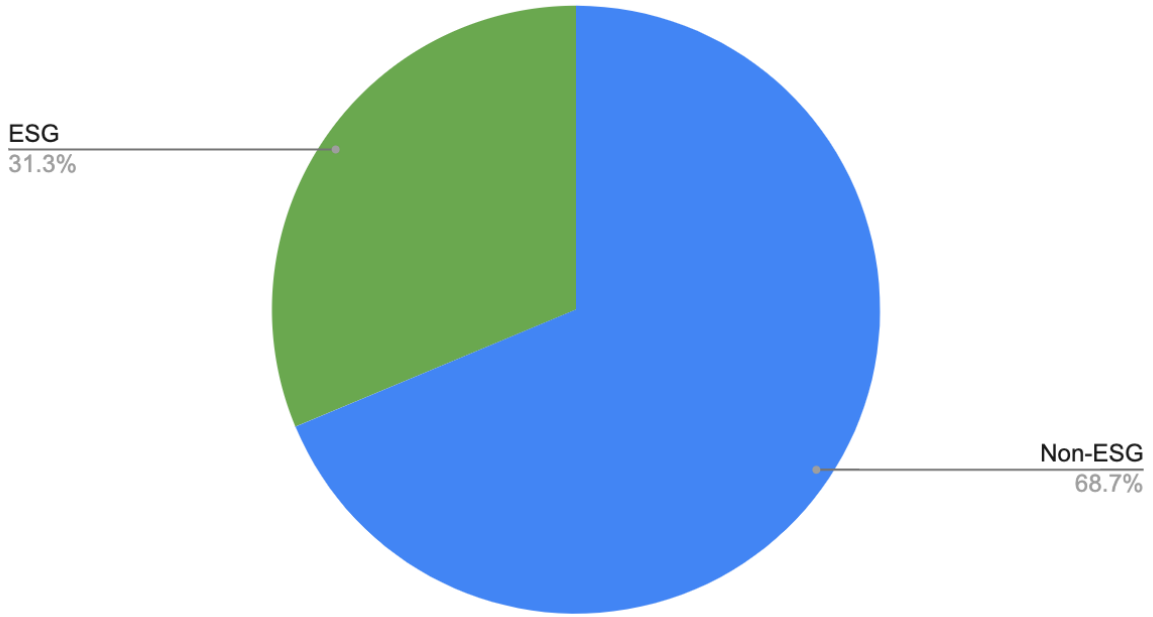
Figure 7 - Percentages of ESG vs Non-ESG Venture Capital Funds

Private Equity
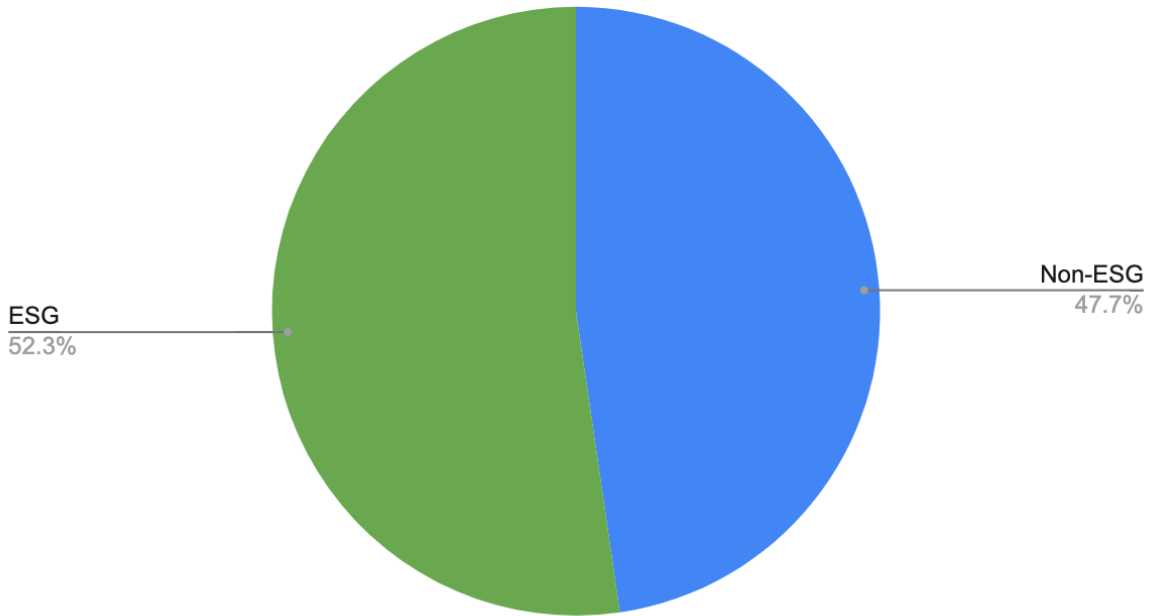
Figure 8 - Percentages of ESG vs Non-ESG Private Equity Funds
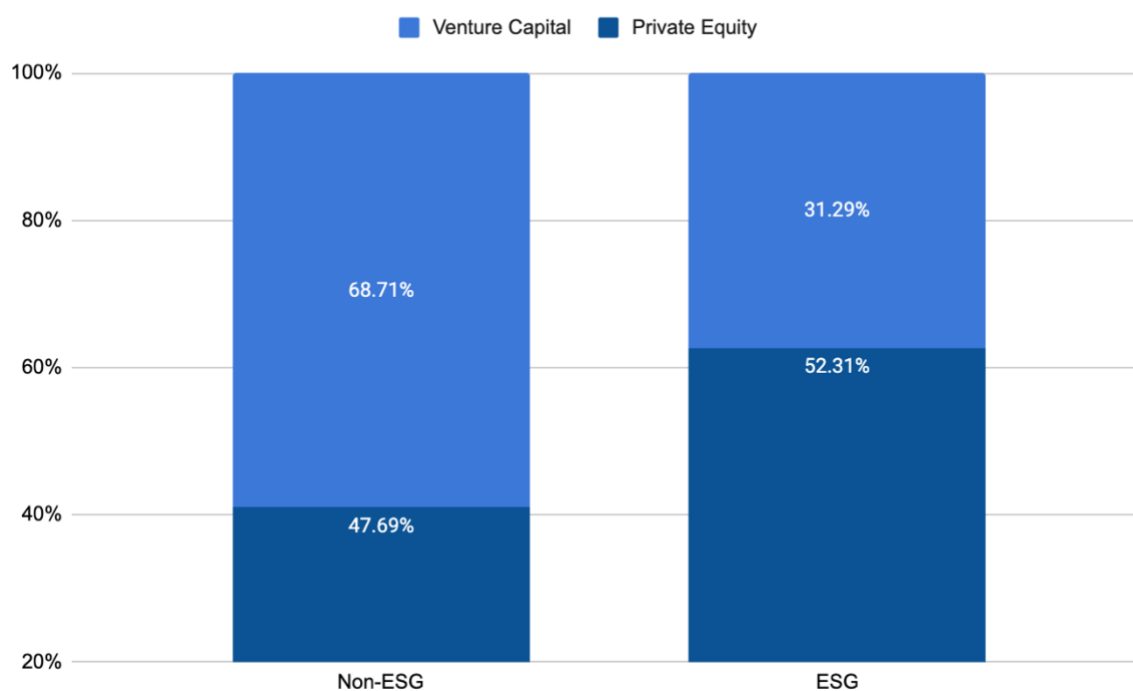
Figure 9 - Asset Class percentages based on the ESG status.

It is clear that there is a strong effect between the two characteristics (Assetclass and Fundpeesgstatus). We also statistically evaluated it using the Chi-Square Test of Independence.

A Chi-Square Test of Independence is a statistical tool used to test if two categorical variables have a significant relationship. On the premise that the two variables are independent, this test is used to examine if the observed frequencies of particular occurrences or characteristics deviate significantly from the predicted frequencies. To do a chi-squared test of independence, organize the data into a contingency table, which is a table that provides the frequency or count of observations within each combination of the two categorical variables. The predicted frequency of each combination of the two variables is then calculated on the assumption that the variables are independent. The difference between the observed and predicted frequencies is then squared and divided by the expected frequency, with the resulting values averaged over all combinations of the two variables.

If the two variables are truly independent, then the p-value can be calculated by comparing the resulting statistic (the chi-squared statistic) to a critical value from a chi-squared distribution, which is the probability of observing a chi-squared statistic as large as or larger than the one observed. A statistically significant discrepancy between the observed and expected frequencies allows one to reject the null hypothesis of independence between the two variables if the p-value is less than a predetermined threshold (usually 0.05). If the p-value is larger than this threshold, it

is not possible to reject the null hypothesis since the difference between the observed and expected frequencies is not statistically significant.

Thus, we came up with our alternative and null hypotheses. These are some of them: That the two categories under investigation are unrelated is the "Null Hypothesis" (H0). An alternative hypothesis (H1) holds that the two categories being compared are dependent on one another.

We calculated a value of 0.05, which means there is a 5% possibility that we incorrectly assumed independence between the two variables.

By producing a P-value of 3.51E-26, which is substantially less than the previously established value, the experiment led to the rejection of the Null Hypothesis and statistical confidence that the two variables are dependent on each other. Using statistical analysis, we show that the ESG status of a fund is reliant on the asset classes in which it invests.

The public at large is aware that private equity firms are the ones that rescue floundering companies by investing in them and helping them to restructure their finances. Possible financial and operational strategies include reducing costs, increasing productivity, and introducing new products. Similar to how private equity firms seek for underperforming or undervalued companies, many ESG (environmental, social, and governance) investments target such enterprises. Private equity companies invest in businesses that are struggling financially or operationally and may benefit from the firm's expertise and resources. Yet, venture capital organizations want to put their money into companies that either have a high potential for development or have shown rapid expansion in the past. These firms are known to put money into startups and other businesses in the seed and early stage of development. They may also put money into companies that have achieved profitability and are looking to grow. VCs may be less interested in supporting ESG enterprises since they may need more time and money to reach these development stages (Boyarchenko, 2021). Yet, VC companies with a focus on impact investing or sustainability may be more open to backing ESG businesses (Drei et al., 2019).

6.1.1. Why PE are better than VC funds in addressing ESG values

Because of their longer investment horizon, private equity companies may be more focused on Environmental, Social, and Governance (ESG) aspects than venture capital organizations. Private equity firms often keep their assets for a number of years, giving them greater time to handle any ESG concerns that may occur inside portfolio companies. They can collaborate with company management to execute changes, assess progress, and report on outcomes.

Another reason is the degree to which private equity firms have influence over their portfolio companies. Private equity firms frequently possess major shares in portfolio businesses and sit on the board of directors, giving them greater influence over the

company's operations and decision-making. This allows them to adopt ESG-related changes and track their success, which is not always the case with venture capital organizations more readily.

Reputation and risk management are also important considerations I n private equity firms' emphasis on ESG. Private equity firms face greater reputational risk than venture capital firms since they frequently purchase and run long-standing businesses. As a result, they are more likely to be aware of, and held accountable for, any ESG concerns that have emerged in the past. Private equity businesses can minimize reputational concerns and manage investment risks by incorporating ESG principles. Furthermore, institutional investors and private equity firm limited partners are increasingly advocating for the integration of ESG factors into investment choices. This is motivating private equity companies to prioritize ESG because they want to connect their investment strategies with their clients' expectations and fulfill the new criteria of responsible investing.

Finally, ESG issues might influence a private equity firm's exit plan. Businesses with a good ESG track record may be more appealing to potential purchasers because they have superior corporate governance, social, and environmental standards, which can result in a higher valuation.

Venture capital firms, on the other hand, have a shorter investment horizon and less influence over portfolio businesses, which may make it more difficult for them to handle ESG concerns. Furthermore, VCs tend to be more focused on the technological or product innovation of the companies they invest in, and ESG issues may not be as pressing as they are for PE firms. This is changing, however, as venture capital firms acknowledge the importance of ESG in the long-term performance of their portfolio companies and the dangers that might emerge from failing to address it.

6.2. Fund size

While analyzing investment funds, it is critical to consider a number of factors that have the ability to impact the fund's performance as well as its risk profile. The fund's size is an important factor to examine since it can have a significant impact on the fund's ability to generate returns and manage risk.

According to the conclusions of this inquiry, the average amount of funds considered was $294 million dollars. When looking only at funds that do not meet environmental, social, and governance (ESG) regulations, the average size was revealed to be substantially smaller, coming in at 229 million dollars. This demonstrates that, on average, funds that do not conform to ESG guidelines are smaller in size than the whole population of funds considered.

On the other hand, it was determined that the average size of ESG-compliant funds is substantially greater, at 402 million dollars. This shows that, on average, funds that

comply to ESG guidelines are larger in size when compared to the whole population of funds considered.

These findings are noteworthy for a variety of reasons, including the possibility that there is a link between the size of a fund and whether or not it complies to ESG criteria. Larger funds may have more resources and infrastructure in place to embrace and comply to ESG standards, whereas smaller funds may have more challenges owing to their relative lack of resources and infrastructure. Further research may be necessary to understand the relationship between fund size and ESG criteria, as well as how this relationship may effect the fund's performance and risk profile.

The fund sizes in this research were classified as small, medium, and large in order to better understand the link between fund size and environmental, social, and governance (ESG) factors. The small category contained the lowest 33% of the money, the big category had the greatest 33%, and the middle category contained the remaining funds.

Because funds within each size category can be compared, this technique allows for a more in-depth evaluation of the link between fund size and ESG criteria. By categorizing fund sizes into these three groups, it is possible to more precisely study the link between fund size and ESG criteria and identify any patterns or trends.

After this examination of fund sizes, it appears that the basic idea that there may be a link between fund size and ESG criteria is validated. ESG-compliant funds, in particular, have a higher share of big and medium funds and a much lower number of small funds. This finding lends credence to the assumption that larger funds are more likely to have the resources and infrastructure required to adopt and adhere to ESG standards, whereas smaller funds may face more challenges. According to the graph below, companies that adhere to the ESG criteria have a higher representation of big and medium funds.
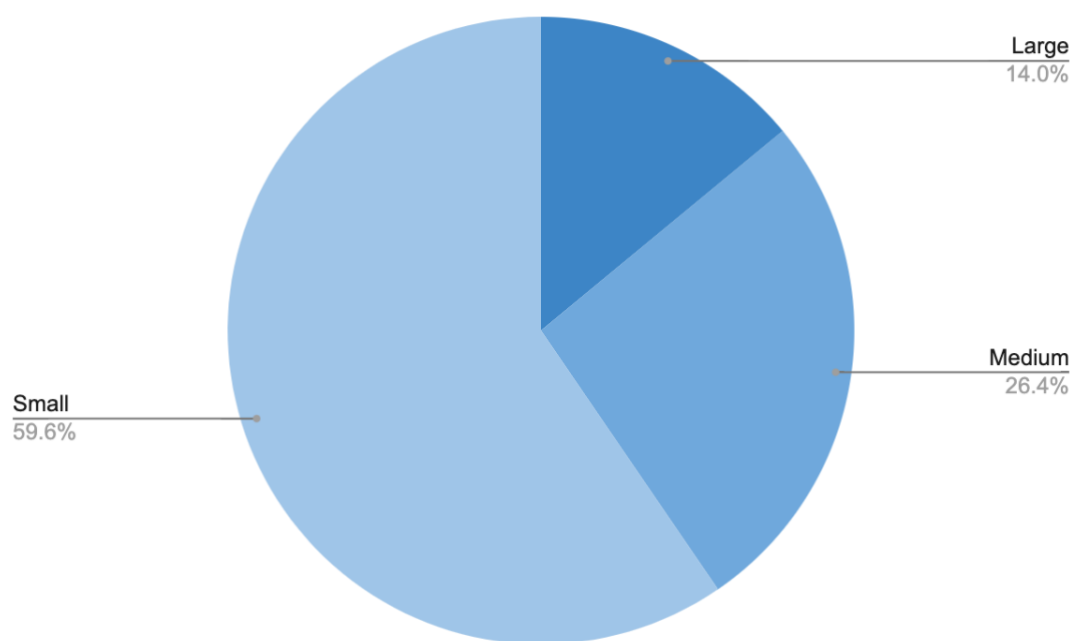
Figure 10 - Percentage distribution of funds by size categories
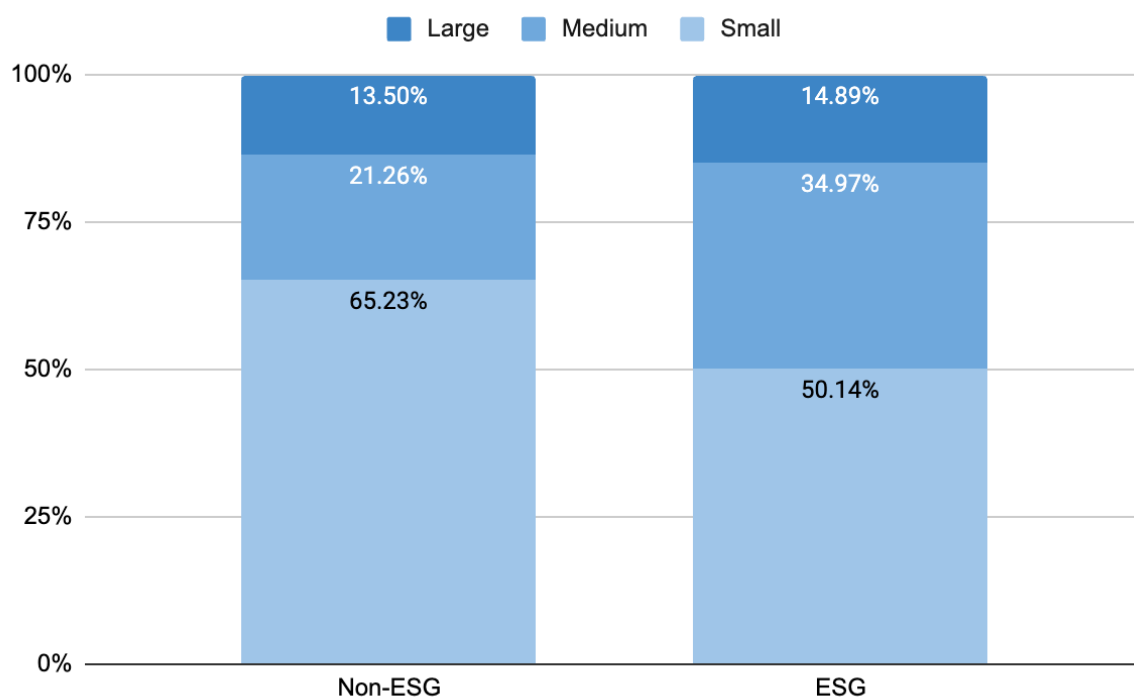
Figure 11 - Asset Class percentages based on the ESG status.

Before doing statistical tests to investigate the differences seen so far, it is necessary to apply the logarithmic transformation to the sample.

As a standard step in getting ready data for statistical analysis, logarithmic transformation is often performed. In order to stabilize the data and apply uniform standards, it is often used to numerical variables. Later in this work, we shall discuss

the significance of using the logarithmic transformation before beginning any statistical study.

One of the most important reasons to employ a logarithmic transformation is to normalize the data. When the data displays skewness, a term referring to a non-symmetrical distribution of values, this is of the utmost importance. Skewness has a major effect on statistical test outcomes because it modifies central statistics including the mean, median, and standard deviation. Skewness may also impact the data's natural direction. The logarithmic transformation may be used to generate a more normal-looking distribution and thereby minimize the skewness of the data.

Another rationale for using logarithmic processing is the reduction of data variation. Distance from the mean as measured by the variance is a statistical measure. Homoscedastic data, in which all of the data have the same degree of variation, is essential for statistical analysis. It's possible that the logarithmic transformation might help stabilize variance by minimizing the effect of outlying data points. For this purpose, we take the logarithm of the relevant variable.

To illustrate why the logarithmic transformation is useful, we may use the following example. Let's pretend we have access to a database listing the heights of a representative cross-section of the population. The heights are listed in inches, and the distribution is highly skewed, with just a small number of people being extraordinarily tall and the vast majority being of average height. The results of a t-test comparing the means of two groups of heights may be affected by the data's skewness and extreme values. Yet the logarithmic function may be used to the data in order to make the distribution less skewed and the variance more stable, both of which should lead to more trustworthy statistical inferences.

To sum up, the logarithmic transformation is an essential part of the preliminary processing of statistical data. If you want your statistical tests to be more precise and trustworthy, normalizing the data and reducing the variance is a good place to start. This is why the logarithmic transformation of numerical variables is recommended prior to their use in statistical analysis.

After applying it to our dataset and modeling the distributions of the two subgroups characterized by the funds' ESG status, it seems that they are regularly distributed.

6.2.1. Normality Test to run Independence Test

In order to thoroughly investigate the connection between the fund size of ESG-funds and non-ESG-funds, it is crucial to determine if these two samples are independent of one another. Statistical tests of independence, such the t-test, are often employed for this purpose. Nonetheless, the basic concept of normality must be verified before doing these tests.

When shown graphically, normally distributed data looks like a bell-shaped curve. Several statistical tests, including those used to test for independence, require that the data be regularly distributed in order to provide reliable results. To check whether the

assumption holds for both ESG and non-ESG fund size data, a normalcy test must be run.

Visual methods like the Q-Q plot and numerical methods like the Shapiro-Wilk test are only two examples of how normalcy may be examined. It is safe to run the independence test when it has been shown that the data follows a normal distribution.

To check whether the data on ESG and non-ESG fund sizes were normally distributed, we first generated quantile-quantile (QQ) plots in Python. The quantiles of a sample may be visually compared to the quantiles of a normal distribution using a QQ plot. By looking at the QQ plot, we may see whether our sample data follows the normal distribution's expected trend. There was considerable uncertainty regarding the sample distribution, but the QQ plot of non-ESG fund fund sizes seemed to reflect the theoretical distribution. Contrary to what was shown in the QQ plot of ESG fund sizes.
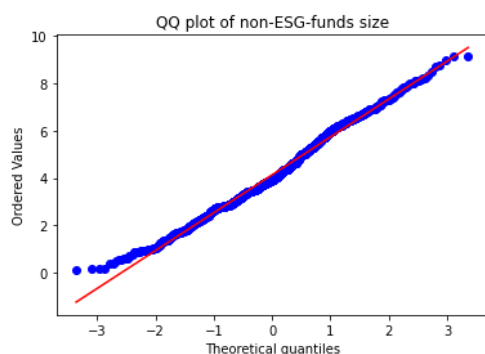
Figure 12 - QQ plot of non-ESG fund size
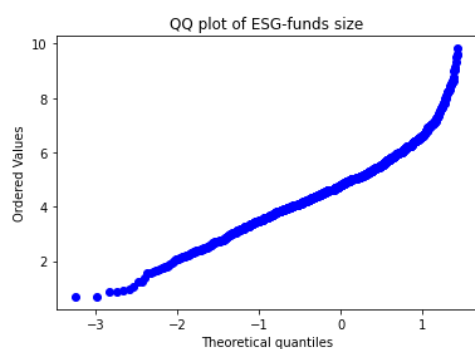
Figure 13 - QQ plot of ESG fund size

The Shapiro-Wilk test was performed to statistically confirm their normality and check their adherence to a normal distribution.
The normal sample test is a statistical technique for checking whether a data set was taken from a normally distributed population. The normality of the population distribution is one way to check whether this is the case. In 1965, Samuel Shapiro and Martin Wilk gave the first iteration of the test, which they named after themselves.

The significance of the test is based on a comparison between the sample mean and variance and the theoretical mean and variance of a normal distribution. The sample mean and standard deviation are compared. The W statistic, which measures how far the sample data is from having a normal distribution, is the one that is calculated specifically for this test. The dispersion of the sample data from a normal distribution is what this statistic measures. This statistic is calculated by first comparing the data being analyzed to a normal distribution. If the data follows a normal distribution, a small W statistic is reassuring. In contrast, an outsized W statistic suggests that the data do not adhere to a normal distribution.

The sample data must be normalized beforehand such that it has a mean of zero and a standard deviation of one before the test can begin. In such case, the test may be considered finished. To calculate this, take the sum of all values in the sample and deduct the sample mean from that number. Divide the result by the standard deviation of the sample to obtain your answer.

The W statistic is then determined by the test by the use of the following formula:

Equation 1 - W statistic of Shapiro-Wilk test

$$W = \frac{(\sum_{i=1}^{n} a_i \, x_i^2)^2}{\sum_{i=1}^{n} x_i^2 \, \sum_{i=1}^{n} (x_i - \bar{x})^2}$$

where x_i are the normalized sample data and a_i are the coefficients that vary with sample size and normal distribution shape.

When the W statistic has been generated, it is compared to a threshold value that has been culled from an exhaustive database of such thresholds. The normality hypothesis is upheld if the estimated value of the W statistic is less than the critical value.

If the expected value of the W statistic is larger than the critical value, then the data are not normally distributed.

The data are likely not regularly distributed because of this finding. The null hypothesis that the sample is picked at random from the whole population might be rejected if the p-value of the test is less than the set threshold of significance.

Our analysis of the Shapiro-Wilk test results showed that the fund size of ESG funds had a test statistic of 0.99 and a p-value of 0.00, whereas the fund size of non-ESG funds had a test statistic of 0.99 and a p-value of 0.00. These results indicate that the samples were likely not selected at random from the target demographics. Both p-values are less than 0.05, and the test statistics are favorable, therefore this seems to be the case (both greater than 0.9). Hence, it is possible to reject the normalcy hypothesis for both samples. Visual inspection of the QQ plots corroborated this finding, showing that the

distributions of ESG-fund sizes deviated significantly from the anticipated normal distribution, while they confirmed worries about non-normal distributions for non-ESG funds. Due to the non-normal distribution of the data, non-parametric tests may be more suitable than parametric ones, such as the t-test.

A t-test comparing the sizes of ESG and non-ESG funds was not possible since the data did not follow the assumptions of normality, as shown by the results of the Shapiro-Wilk test. When comparing the means of two samples that follow the same distributional assumption, the t-test is often used as a common parametric statistical test. Nevertheless, the Shapiro-Wilk test results demonstrated that none of the two samples in this research fulfilled the t-assumption test's of normally distributed data. As both samples' test statistics and p-values were larger than the critical values and thresholds, it's possible that the null hypothesis of normality may be rejected for both samples.

A nonparametric statistical test was used to compare the sizes of ESG and non-ESG funds since the data did not follow a normal distribution.

6.2.2. Independence Test

Among nonparametric tests, the Mann-Whitney U test is often used to compare the means of two separate samples. The crucial parameters for the sample size and the level of significance are used in conjunction with the calculated U test statistic to reach this conclusion. If the estimated U is smaller than the crucial value, we may reject the null hypothesis that the two samples have the same mean. Our statistical analysis using the Mann-Whitney U test produced a test statistic of 745984.5 and a p-value of 2.77e-25. These results indicate that ESG funds and non-ESG funds have statistically distinct fund sizes.

The descriptive statistics reveal a significant disparity between the two variables' means. The t-test findings, which indicated a p-value very close to zero, lend credence to the existence of this distinction. This indicates a high degree of statistical significance between the samples, and it is extremely improbable that the observed difference in means happened by coincidence. A strong correlation between the two samples is further supported by these results. This would indicate that there is a meaningful difference between the two populations being studied and that the means of the two variables are different.

This is a big deal since it proves that the difference between the two elements being studied is real and not coincidental. This finding shows that there is a distinction between the two variables, which accounts for the discrepancy. To learn more about this discrepancy and its possible connections to other features or circumstances, it may be important to do more research.

For additional proof that ESG-funds and non-ESG-funds have independent fund sizes, a chi-squared test of independence was run using the categorical variable built using the percentile technique, as was stated at the outset of this variable's presentation.

The chi-squared test of independence produced a p-value of 5.25e-17, with a chi-squared statistic of 74.97 and two degrees of freedom. The very low p-value (less than 0.05) indicates a statistically significant correlation between fund size and ESG status, as well as a significant difference in the percentage of ESG to non-ESG funds across the three groups. In contrast, the chi-squared test of independence is a statistical test of association that does not reveal anything about the nature or strength of the relationship between the two variables being tested.

6.2.3. Results

ESG funds are larger than non-ESG funds, according to the Mann-Whitney U test and the chi-squared test of independence. This finding may come as a surprise to some shareholders, given ESG investment has often been linked to less massive but more ethical businesses. Yet, there are a variety of factors that might have led to this result.

One counterargument is that it usually takes more money to make ESG investments work. For example, businesses with a strong commitment to reducing their environmental impact may need to invest in costly new equipment or processes. Spending more time and money on stakeholder engagement and reporting may be a burden for businesses that place a premium on social and governance responsibility. So, ESG funds may need to be larger so that they can continue to support these types of investments.

Overall, the results of these two research demonstrate a sizable gap between ESG and non-ESG funds. Chi-squared test of independence shows correlation between fund size and ESG status, whereas Mann-Whitney U test shows statistically significant difference between the medians of the two groups. These results demonstrate that ESG investors choose larger fund sizes as a means of underpinning their investments.

Furthermore, multiple studies have shown that a fund's size is correlated with the amount of attention it pays to ESG issues. It has been shown that bigger funds are more likely to have ESG-focused strategies and to devote a greater percentage of their portfolios to ESG investments than smaller funds (Zaccone & Pedrini, 2020). Larger funds may more easily devote resources to ESG concerns and carry out ESG due diligence and engagement efforts, such as employing bigger research and analytical teams. This may provide them with the knowledge and expertise necessary to identify ESG risks and opportunities in emerging businesses. Larger funds may also have a better reputation in the sector, which might help them network with other influential people to promote ESG-related reform. When it comes to promoting ESG principles and encouraging broader adoption, larger funds, for instance, may already have ties with key industry players including suppliers, customers, and regulatory bodies.

Furthermore, pension funds and endowments, which are examples of institutional investors, have longer investment horizons and are therefore more likely to participate in ESG-focused funds. Institutional investors manage larger asset pools and may provide capital to larger funds that prioritize environmental, social, and governance (ESG) objectives. In addition, bigger funds may be able to exert more pressure and influence on their portfolio companies, encouraging them to prioritize ESG development. This might strengthen their assets and ensure their continued sustainability over time. The increasing demand for ESG investments from institutional investors like pension funds and endowments, which are typically larger and have a longer investment horizon, is the primary driver of the correlation between fund size and ESG integration.

It is important to note, however, that the relationship between fund size and ESG concentration may be nuanced and highly variable depending on variables such as the private equity industry, the fund's location and jurisdiction, and the goals and principles of the fund's management.

Not only do bigger funds have challenges in implementing ESG strategies at scale, but they also face challenges in incorporating ESG concerns within portfolio businesses and ensuring that ESG goals are matched throughout the whole portfolio. Yet, smaller private equity and venture capital companies may not have the resources or experience to properly incorporate ESG factors into their investing processes, while potentially having better flexibility and a higher emphasis on ESG issues. While there is a correlation between the size of a fund and the importance it places on environmental, social, and governance (ESG) concerns, this connection is nuanced and highly context-dependent.

In conclusion, environmental, social, and governance (ESG) concerns are gaining importance for private equity and venture capital firms of all sizes, and each firm has to find its own method to incorporate ESG principles in a manner that is consistent with its values and investment aims.

6.3. Fund Core Industries

It is essential to take into account the variable showing the industries in which each fund works while conducting an analysis of investment funds. Information about the fund's risk profile and possible return may be gleaned from this variable, which provides an overview of the companies and sectors in which the fund is invested.

A fund with a lot of exposure to the IT industry, for instance, would have a different risk profile and return potential than one with holdings in more traditional sectors like utilities or healthcare. Investors can better assess the risks and possible returns of a fund if they have knowledge of the sectors in which the fund operates.

It's not enough to just look at the industries in which a fund invests; it's also important to examine the specific companies that make up those sectors. This may aid in providing a more in-depth understanding of the fund's holdings and how they may be affected by monetary policy, regulatory shifts, and market tendencies.

The variable identifying the sectors in which each fund operates is crucial when comparing investment funds, as it provides an overview of the types of companies and industries in which the fund is engaged and may help direct investment choices.
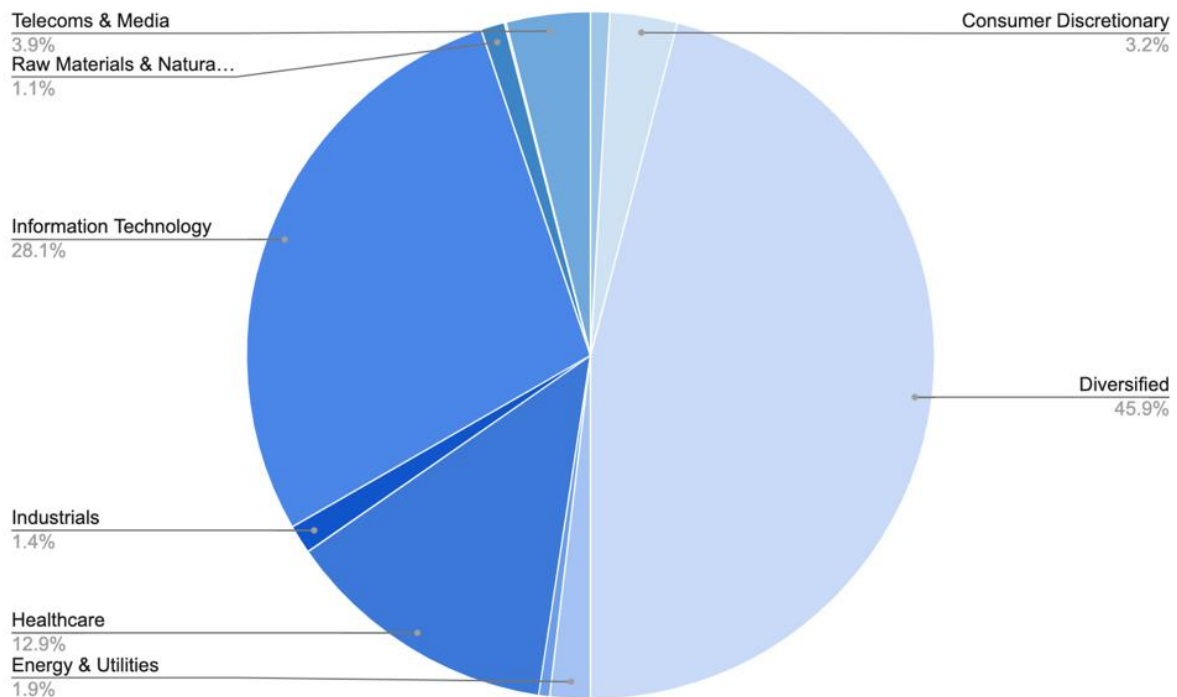
Figure 14 - Percentage distribution of funds industries in the data frame

The sample evaluated is made up of only four key industries: Diversified, Information Technology, Healthcare, and Telecoms & Media, which account for 45.93%, 28.15%, 12.93%, and 3.95% of the total. In light of this, it was decided to group together the dummy variables that are not statistically significant. Increasing the proportion of the statistical sample covered to 96.02%, all the dummy variables representing the remaining percentage (i.e. 3.98%) have been binned in one dummy variable: Industrials, Raw Materials & Natural Resources, Business Services, Financial & Insurance Services, and Real Estate. Binning is a preprocessing approach in data science that includes grouping together low-frequency variables to minimize the number of categories in a categorical variable.

Just four major sectors were included in the evaluation sample: the Diversified sector (44.93%), the IT sector (28.15%), the Healthcare sector (12.93%), and the Telecoms &

Media sector (3.95%). The insignificant dummy variables were thus grouped together for analysis. To ensure that as much of the statistical sample as possible is represented, we have combined the following dummy variables into a single one: Industrials, Raw Materials & Natural Resources, Business Services, Financial & Insurance Services, and Real Estate (totaling 3.98 percent). The practice of binning is a preprocessing method in data science that involves clustering together infrequent variables to reduce the total number of categories in a given variable. Binning, or categorizing variables, is a method of data preparation that may be helpful for a number of reasons.

To begin, binning may aid in the simplification of data by cutting down on the number of inspection categories. When working with large and complicated datasets, this may aid in analysis and visualization.

Second, machine learning algorithms may do better with less noise and fewer outliers if low-frequency variables are grouped together. By integrating low frequency variables, we may improve the model's overall accuracy and reliability while mitigating the impact of skewed or anomalous individual data.

By simplifying the amount of inputs, or variables, in a model, binning may improve its interpretability. Finding the most important aspects driving the model's predictions is difficult when dealing with a huge number of variables. By reducing the number of groups into which variables may be placed, it becomes clearer which attributes most affect the model's performance.

Overall, binning is a helpful data preparation approach that may increase both the data quality and the final model's performance. When dealing with large and complicated datasets, this approach has the potential to simplify things, dampen the effect of noise and outliers, and enhance interpretability.
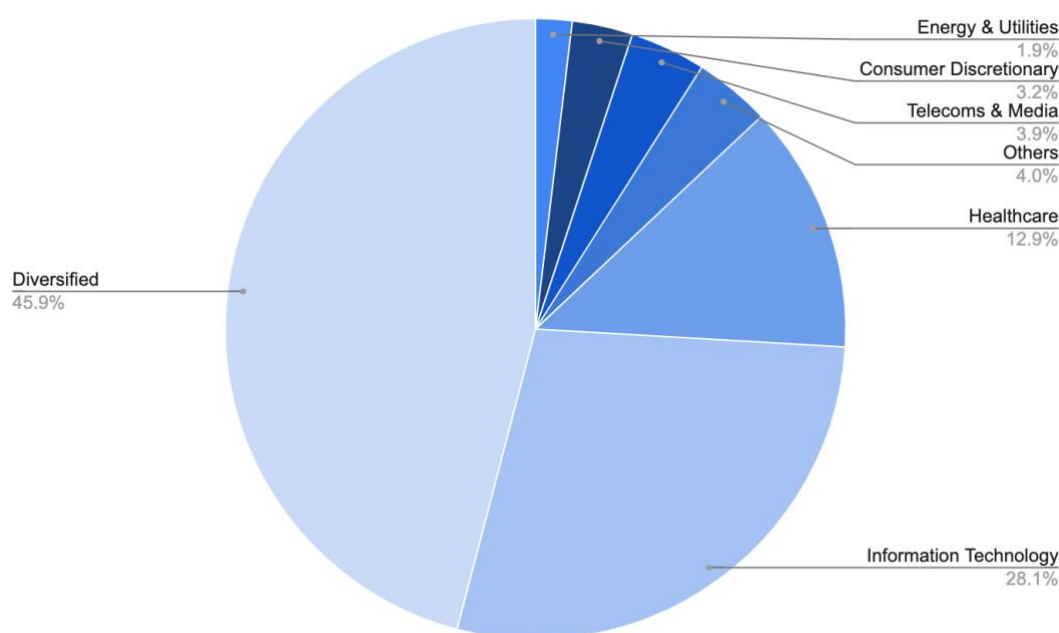
Figure 15 - Percentage distribution of funds industries in the data frame after cleaning the sample

It allowed for a more accurate depiction of the dominant economic sectors at the investigated firms:

Each sector has its own histogram, against which the funds' ESG performance was measured. The goal was to learn more about how environmental, social, and governance (ESG) standards affect the fund business. The chart that emerges compares the proportion of funds that adhere to ESG rules with the number that do not for each sector.

It is evident that some industries differ from the typical distribution displayed in the "Total" column, which shows the total distribution of funds' ESG rating. For instance, it seems that a larger share of investments in the Diversified, Healthcare, IT, and Telecoms & Media sectors have a normal distribution. Yet, in the Energy & Utilities industry, a far larger share of funds are considered ESG.

These numbers suggest that a fund's propensity to adhere to ESG principles may be affected by the sector in which it operates. Certain sectors may naturally be more aligned with ESG principles, while the adoption of ESG criteria within a sector may be affected by reasons other than the sector itself.
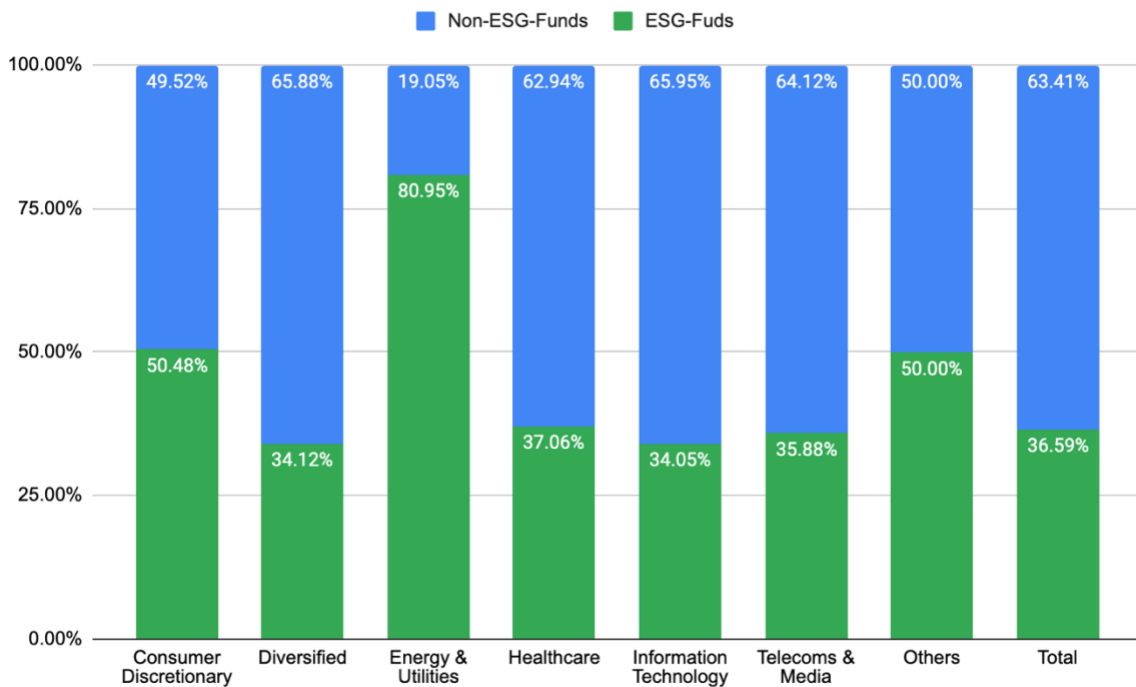
Figure 16 - Percentage distribution of ESG status per Fund Core Industry

To assess also statistically the dependence between the ESG status and the funds core industries, has been conducted the Chi-Square Test of Independence, as in the previous variables. It led to the following results:

Table 1 - p-values per Funds Core Industries

Funds core industries	p-value
Diversified	0.37%
Information Technology	4.45%
Healthcare	87.11%
Others	0.12%
Telecoms & Media	83.98%
Consumer Discretionary	0.29%
Energy & Utilities	0.00%

These findings provide statistical confirmation of prior intuitions, resulting to the rejection of the null hypothesis and so establishing the dependency with the ESG status of the following values: Diversified, Information Technology, others, Consumer Discretionary, and Energy & Utilities. This resulted in a rejection of the alternative hypothesis and the conclusion that there is no correlation between ESG status and the performance of funds in the healthcare or communications and media sectors.

To make it easier to isolate the genuine influence of each predictor on the response and reduce the standard errors of the estimates, we omitted from the data set used to develop the classification model any variables whose significance depends on the ESG status. To improve the classification model substantially without compromising generality, a crucial feature selection was performed in this way.
Using this feature selection process leads to a more stable model that is less sensitive to variations in the input data. This improves model generalization while decreasing the risk of overfitting.

6.3.1. Comments on the results

Renewable energy, healthcare, technology, consumer products, finance, and diversity are just a few of the many industries that ESG funds invest in. Standards for environmental, social, and governance (ESG) performance evaluation vary by sector.

For instance, in the Renewable Energy sector, a company's worth may be determined by how much it aids in the switch to clean energy and how much it does to battle climate change. Companies in the healthcare sector may be graded on how they

respond to ethical challenges and how they impact global health. By investing in ESG funds, individuals and organizations may show their support for businesses that put an emphasis on environmental, social, and governance performance, ultimately helping to create a more sustainable and responsible global economy. You should think about your investment objectives, your comfort level with risk, and the ESG fund's track record while making a decision.

Following the results, the study would zero in on the information technology, energy and utilities, diversified, and consumer discretionary sectors.

The Consumer Discretionary industry is crucial in the context of Sustainable investing. Non-essential but highly sought-after consumer products and services are produced and sold by the companies in this sector. The retail sector is part of the broader Consumer Discretionary industry and includes both traditional brick-and-mortar shops and e-commerce sites offering things like clothing, gadgets, and home furnishings. The Media and Entertainment industry is another example; it includes production and distribution companies for many types of media including movies, TV shows, records, and video games. The last economic segment includes hotels, resorts, and amusement parks, among other providers of leisure and tourism-related services and experiences. Sustainable and accountable operations and supply chain management are a priority for ESG investors in the Consumer Discretionary sector. Businesses that do things like reduce waste and emissions, promote diversity and inclusion in the workplace, and buy from environmentally and socially responsible suppliers are more likely to attract ESG investors. Environmental, Social, and Governance (ESG) results for the Consumer Discretionary business segment of Elen Stokes. ESG investment enables investors to support companies that emphasize environmental, social, and governance performance while simultaneously participating in the expansion of the Consumer Discretionary sector, which is essential to the global economy.

Instead, the Diverse Industry is made up of companies from a wide variety of fields, giving it a fertile ground for ESG investment. For instance, conglomerate holding companies may operate in several industries and sell many different types of products. In the context of ESG investing, a diversified company's environmental, social, and governance performance across all of its activities and sectors may be assessed. This is a rare opportunity for ESG investors to get exposure to businesses across a wide range of sectors that are committed to ethical and environmentally sound practices. Consider the environmental impact, labor standards, and corporate governance practices of a company that operates in many sectors, such as renewable energy, healthcare, and consumer items. "Corporate Social Responsibility and Financial Performance in the Diversified Industry: An Exploratory Study," by Kim Martin. Diverse companies provide ESG investors a chance to spread their risk across different sectors while also showing their support for businesses that are committed to ethics and the environment. It's important to stress that ESG investment in a diversified sector calls

for careful scrutiny and investigation of each company and industry to ascertain their long-term viability. ESG investors may reduce their overall risk and increase their exposure to the benefits of ESG investing by spreading their money out over a number of different companies and sectors.

In addition, the IT industry has gained prominence as an area of focus for ESG investors in recent years. ESG considerations such as data privacy, ethical use of artificial intelligence, and responsible material sourcing are becoming more important for investors in this sector as the industry's impact on the environment and society grows. "The Link Between Environmental, Social, and Governance (ESG) Performance and Financial Performance in the IT Industry," by Minjae Lee. Companies that focus on environmental and social governance (ESG) concerns are often seen as having an advantage in the IT industry, as customers and investors are becoming more aware of the impact that technological products and services may have on the world. Good ESG practices also help businesses attract and keep workers, who are increasingly looking for companies that reflect their own morals and ethics ("Sustainable Investing in the Information Technology Industry: A Review of Literature" by Stefan Ambec).

Investor returns on IT companies may also be significantly impacted by ESG concerns. Businesses that place a premium on data protection, for instance, may gain an edge in a sector where privacy concerns are on the rise, and businesses that are forthright about their ESG practices are more likely to earn the confidence and devotion of their customers and the investors who fund them.

There is growing evidence that IT companies with strong ESG practices enjoy more financial success than their competitors. Thus, many investors are include ESG considerations in their industry investment plans.

Last but not least, the Energy & Utilities industry is one of the most essential ones for ESG investment. Given the company's size, environmental, social, and governance (ESG) considerations like carbon emissions and renewable energy are particularly important in this field. Many financiers seek for companies that provide social and environmental good with financial success. An organization's long-term financial performance in the Energy & Utilities sector may be significantly impacted by its approach to environmental, social, and governance (ESG) concerns including carbon reduction programs, investments in renewable energy, and water management techniques. Environmental, Social, and Governance (ESG) Problems' Impact on Energy and Utilities Firm Financial Performance by James K. Gwartney.

Moreover, the Energy & Utilities industry is highly regulated, and ESG concerns may factor into the regulatory environment for these businesses. Companies may be incentivized to adopt more sustainable practices via carbon emissions and renewable energy legislation, or they may be penalized for not meeting certain environmental and social requirements. There is growing evidence that Energy & Utilities firms with strong ESG strategies enjoy more financial performance than their peers. This has led

many investors to include environmental, social, and governance (ESG) considerations into their sector allocation decisions (" A Literature Analysis on Sustainable Investment in the Energy and Utilities Sector "Ambec, Stefan).

As can be seen in the above graph and confirmed by the Chi-square test, there is a significant trend in the studied database: more Energy & Utilities funds embrace ESG principles than the total number of funds operating in this economic sector. Eighty-one point nine five percent of those funds are in a positive pe ESG state, which is in line with statistics from the broader economic climate. This industry has been the focus of several studies that highlight the sector's positive impact on the shift to the adoption of ESG policies, particularly the "Environmental" component of the practices used. The Energy and Utilities industry is the one most people think of when they hear "environmental," especially when talking about renewable energy. But, many companies in this field continue to use harmful technology and generate power from non-renewable sources like gas, petrol, and carbon, all of which have a negative impact on the planet. To demonstrate this, in their 2020 study "ESG Investing: Environmental Pillar Scoring and Reporting," the OECD compared the relative size of companies operating in the Energy & Utilities, Basic Materials, and Industrial sectors with and without a commitment to ESG principles. There has been an increased trend in all three areas in recent years, although non-ESG enterprises still outweigh ESG ones. Even if there are some extremes, this may be because fewer businesses were removed from other sectors, increasing the overall weight of the index in the sectors under investigation, and the companies that were eliminated were not the worst polluters in the index. Another discouraging finding comes from looking at CO_2 emissions: the ESG indices tend to have higher emissions than the non-ESG ones. This sends a strong message, especially to retail investors who may not have the expertise to do in-depth research and fully understand whether or not companies are considering the environment in their day-to-day activities. In addition to environmental and economic considerations, the article notes that ESG also takes into account social and governance factors, with greater emphasis placed on the latter two when selecting companies from which to compile ESG indices.

Recent studies imply that carbon-focused benchmarks may face similar issues in terms of openness, consistency, and comparability, which may explain why the usage of climate-related standards remains relatively low.

Table 2 - CO2 emissions over industries and major market indexes

Index	MSCI World	MSCI ESG Screened	MSCI ESG leaders	MSCI World	MSCI ESG Screened	MSCI ESG Leaders	MSCI World	MSCI ESG Screened	MSCI ESG Leaders
Industries	Aggregate CO2 Emissions (mln)			Average CO2 Emissions (mln)			Weighted CO2 Emissions (mln)		
Basic Materials	1 178	1 220	487	14	11	6.9	0.606	0.566	0.498
Energy	904	736	334	15	12	7.6	1.8	1.7	0.622
Industrials	433	619	233	2.3	2.4	1.6	281 772	272 991	0.311
Utilities	1 823	402	848	31	10	21	1.3	0.327	1.21

Note: The data is in millions. The weighted methodology analyses CO2 emissions weighted by market capitalisation of companies before and after the ESG application
Source: MSCI, Refinitiv, OECD calculations

6.4.   Primary Region Focus

This variable indicates in which the primary region in which the funds took into consideration operate.
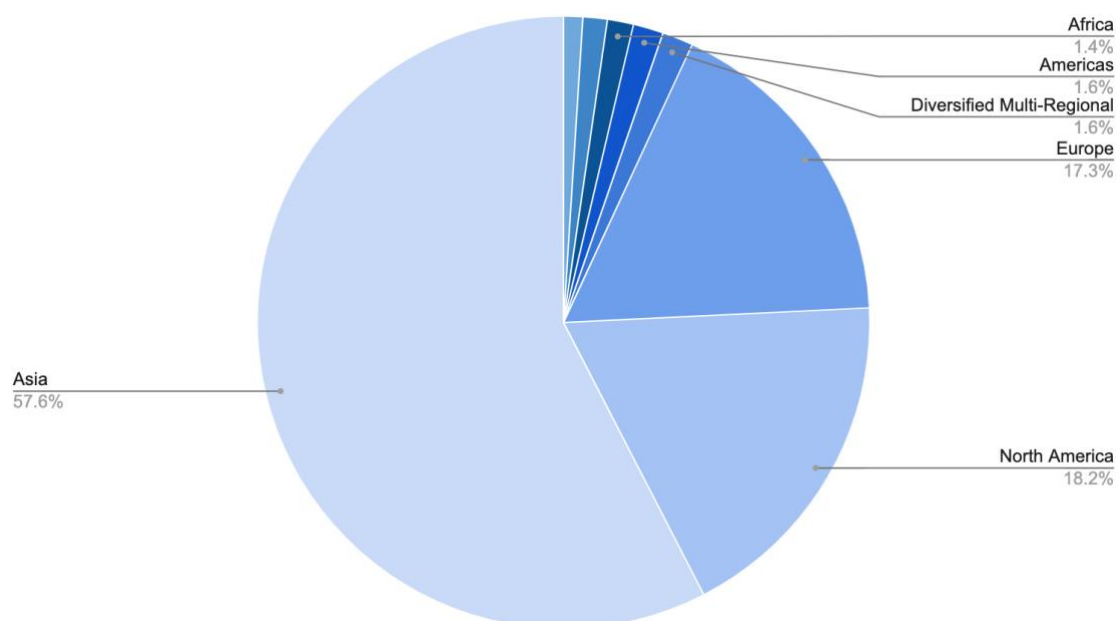
Figure 17 - Percentage distribution of funds Primary Region Focus

Table 3 – Absolute and Percentage frequencies per Funds Primary Region Focus

Funds primary region focus	Absolute frequency	Percentage frequency
Asia	1834	57.58%
North America	579	18.18%
Europe	552	17.33%
Diversified Multi-Regional	52	1.63%
Americas	51	1.60%
Africa	44	1.38%
Middle East & Israel	41	1.29%
Australasia	32	1.00%

The information gathered pertains to 93.09% of the funds that operate in Asia, North America, and Europe. Hence, using the same technique used for the previous variable, the dummy variable that has no statistical significance (i.e. Americas, Africa, Middle East, and Israel Australasia) has been binned into a variable called "Other," which indicates the activeness of founds in these regions.

Exploring in depth and introducing the ESG status for each key region of emphasis results in a well-articulated global picture. In instance, 83.15% of funds operating in Asia do not accept ESG status, but 71.18% of funds with a regional concentration in Europe do.
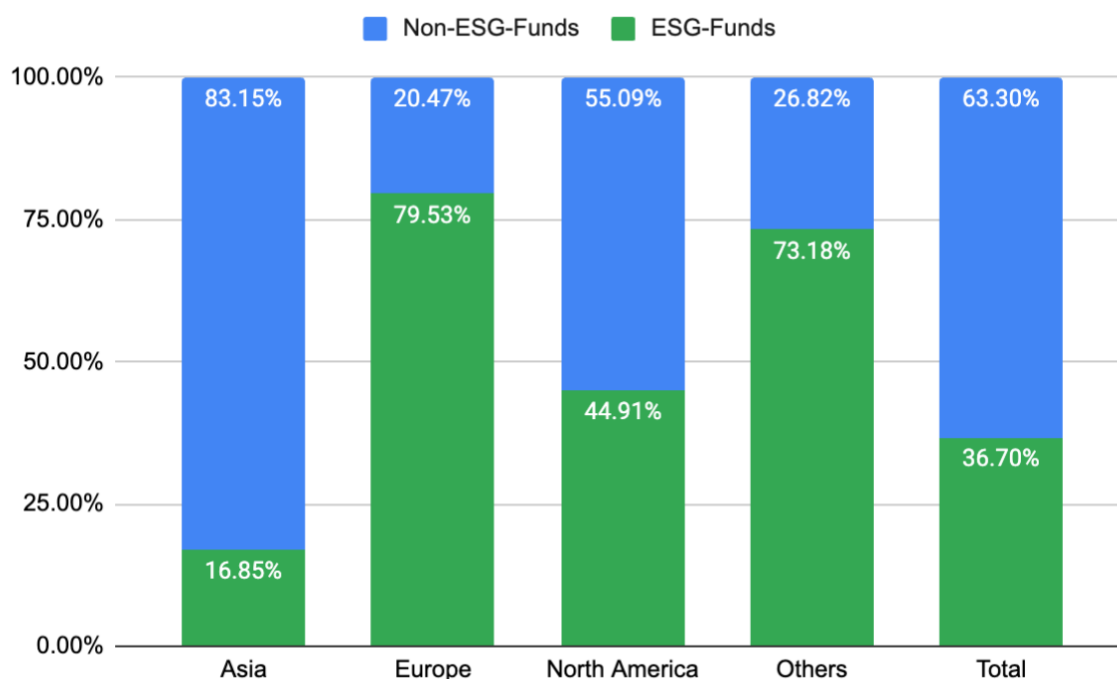
Figure 18 - Percentage distribution of Funds ESG status per Primary Region Focus

It is essential to compare the ESG investment climates of Asia and Europe, two regions with very different economic structures. Increased investor understanding of the financial impact of ESG risks and opportunities, as well as increased demand for investment products that correspond with personal values and views, are two of the most important factors driving development in ESG investing in Europe. Furthermore noteworthy is the fact that European regulators have been actively encouraging companies to adopt ESG reporting standards and principles like the EU's Non-Financial Reporting Regulation. There is widespread agreement that environmental, social, and governance (ESG) factors may have a significant role in determining short- and long-term financial performance and in fostering long-term economic development.

There will be more pressure on businesses to improve their ESG performance and disclosure as a result of the widespread adoption of ESG practices in the European financial ecosystem. Additionally, new investment products and services will be developed that take ESG factors into account, and there will be a greater alignment between investment decisions and societal goals like lowering carbon emissions and increasing social equality. The increasing importance of environmental, social, and governance considerations in making financial decisions has led to a more stable and ethical market. In Europe, ESG investments will increase dramatically by 2020. By 2020, sustainable investment assets in Europe are expected to reach over €14.8 trillion, making up more than half of all professionally managed assets in the region, as

reported by the Global Sustainable Investing Alliance (GSIA). Double-digit expansion rates were seen in the areas of ESG integration, exclusion, and impact investing in Europe over the past few years, as reported by the same survey. Nonetheless, the data shows that Asia's ESG investing ecosystem is less mature than that of other regions, but it is exhibiting promising growth. This is because governments and businesses in the area have access to substantial investment capital. Sustainable investment assets in Asia are expected to reach $1.3 trillion by 2020, representing for 5 percent of total professionally managed assets in the region, according to the GSIA. The report found that ESG integration and exclusion were the two most common investment strategies in Asia, with a growing interest in impact investing. As education, regulation, and opportunities for ESG investments expand in Asia, this trend is expected to continue. China's recognition of the need to solve environmental and social concerns including climate change and economic injustice is one of the key drivers of growth in ESG investing on this continent. One major factor is the rise in accessibility of environmental, social, and governance (ESG) data and information, as well as the creation and distribution of ESG investment products and services for the benefit of both institutional and individual investors. Pressure from Western countries to establish rules for less polluting company operations and the adoption of ESG legislation and standards in certain countries may be a driving force toward Sustainable investing. Thus, there is a great deal of pressure on Asian businesses to improve their ESG performance and transparency in order to foster the development of a more sustainable financial system with more congruence between investment choices and social goals.

As a direct consequence, ESG investing is helping to create new investment possibilities in Asia and encouraging responsible and sustainable economic development by channeling capital towards more ecologically and socially responsible businesses.

Funds that operate in North America fall between between these two extremes, with the average percentage of funds adhering to ESG criteria being 44.91%.

Increased investor demand and regulatory improvements have led to a meteoric rise in ESG investing in the United States in recent years. In 2021, sustainable and responsible investment accounted for over 30 percent of professionally managed assets in the United States, a market estimated at roughly $17.1 trillion. The growth of environmentally, socially, and politically responsible (ESR) investment in the United States may be attributed to a number of causes, including policy changes, investor interest, and market supply and demand. The interest of asset managers and investors in ESG topics has led to a rise in the number of ETFs and mutual funds that concentrate on these areas in the United States. More than twice as many ESG exchange-traded funds (ETFs) and mutual funds (MFs) were offered to US investors in 2020 than there had been in 2019. As more is learned about environmental issues, more laws are passed, and more possibilities present themselves economically, this trend is expected

to continue in the years ahead. Despite the impressive growth of ESG investing in the United States, there is still a ways to go before it achieves universal maturity and acceptance. Nonetheless, data shows that ESG investing will grow in popularity and importance in the USA over the next years.

The current attractiveness and success of the US market may be attributed largely to three factors, all of which have contributed to the shift toward ESG investment. Investors are increasingly interested in ESG investing products and services as a means of bringing their holdings into harmony with their own beliefs and ideals. The second factor has been connected to government initiatives; for example, the United States government has passed regulations promoting corporate transparency and accountability to help promote the growth of ESG investing. Finally, the variety of ESG-focused investment products, such as exchange-traded funds and mutual funds, has increased greatly in recent years, making it easier for investors to invest in ESG.

As the popularity of ESG investing develops, companies are starting to live up to the principles of environmental protection, social responsibility, and good corporate governance that it promotes. Better sustainability practices and a stronger focus on long-term wealth growth are the results of this. This is related to the growing movement toward making financial decisions that are in line with one's own values and views; investors that engage in ESG investing are better able to do so.

ESG investing has been shown to provide large returns, resulting in superior investment outcomes, and this has been made possible by the aforementioned aspects and trends.

73.18 percent of funds adhere to the ESG criteria, putting them close to the best of funds operating in the eurozone, as shown by the representation of the regions given in the variable others. As a matter of fact, we discover that the vast majority of individuals in Africa, the Americas, Australasia, and Diversified Multi-Regional adhere to ESG norms. Those in the Middle East and Israel are the only ones who do not follow these norms.

Funds Primary Region Focus	Non-ESG Funds	ESG-Funds
Africa	2.27%	97.73%
Americas	27.45%	72.55%
Australasia	6.25%	93.75%
Diversified Multi-Regional	26.92%	73.08%
Middle East & Israel	68.29%	31.71%

Figure 19 – Percentage distribution of ESG status per Primary Region Focus within the "Others" category

To provide additional statistical evidence of this connection between funds' ESG status and their major target location, the Chi-Square Test of Independence was performed, which provides p-values that reject the Null Hypothesis, with all p-values being close to 0.

Therefore, the purpose of this paragraph has been to identify the geographical areas of the globe where ESG investing is more established, and hence the geographical focus. It has emerged that Europe is the most developed, and it undoubtedly follows market trends; in fact, this region was the first to introduce and implement sustainability focused policies, as well as a more comprehensive program of initiatives centered on teaching retailers and organizations on the importance of first moving towards a greener way of conducting business operations, and thus directly connecting to the implementation of ESG investing. North America is in second position, while Asia, a rapidly growing continent, is far behind.

6.5. Strategy

In comparison to the asset class variable, this variable makes it possible to conduct a more in-depth analysis of the various investment approaches. After the data processing step has been finished, the strategy variable will be made up of fifteen distinct strategy types, as reported below.

Funds strategy	Absolute frequency	Percentage frequency
Venture (General)	1633	51.24%
Growth	628	19.71%

Early Stage	369	11.58%
Expansion / Late Stage	143	4.49%
Early Stage: Seed	121	3.80%
Early Stage: Start-up	114	3.58%
Balanced	77	2.42%
Buyout	56	1.76%
Fund of Funds	25	0.78%
Co-Investment	8	0.25%
Hybrid	5	0.16%
Direct Secondaries	4	0.13%
Co-Investment Multi-Manager	2	0.06%
Secondaries	1	0.03%
Special Situations	1	0.03%

Figure 20 – Absolute and Percentage frequencies per Strategies

The variable being discussed contains a breakdown of investment techniques employed by funds that focus on early-stage businesses, such as the values: "Early Stage: Seed" and "Early Stage: Start-up". This degree of information, however, makes the categorization model more complicated and difficult to grasp. As a result, these tactics are combined under the umbrella term "Early Stage." There are further seven values with a low frequency of less than 1%, accounting for 1.44 percent of the variable. Additional values include Fund of Funds, Co-Investment, and others.

Such binning activities resulted in various enhancements to the previously stated categorization model, as well as a much better image of the database studied.
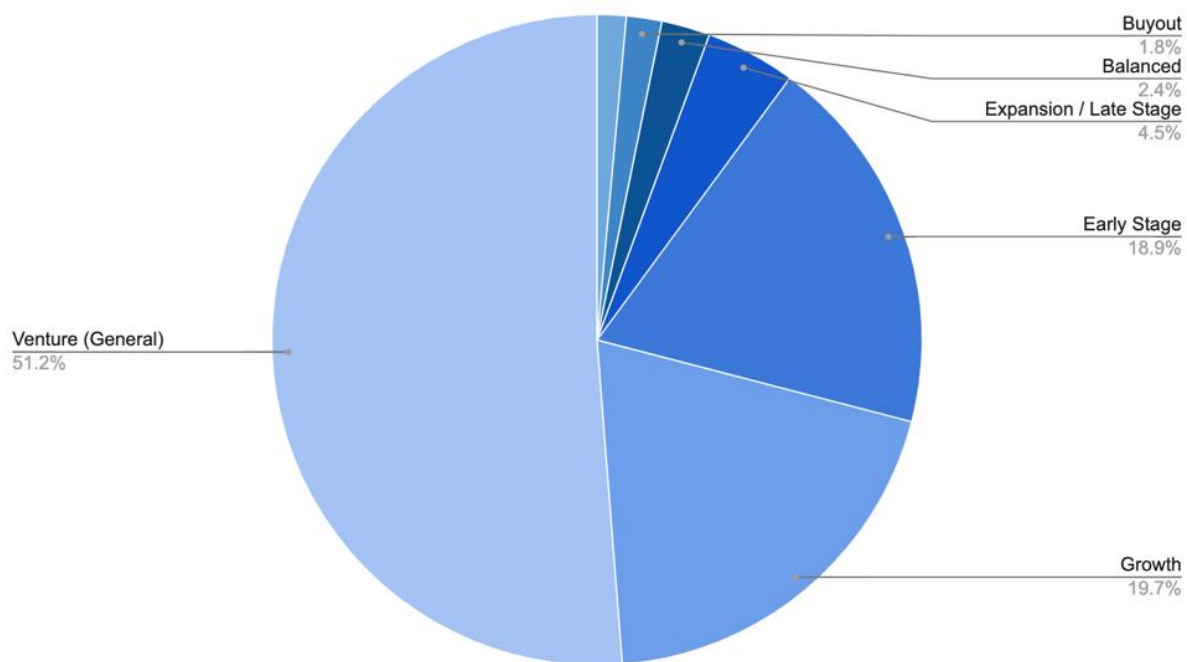
Figure 21 - Percentage distributions of Funds Strategies after data cleaning

Table 4 - Absolute and Percentage frequencies per Strategies after data cleaning

Funds strategy	Absolute frequency	Percentage frequency
Venture (General)	1632	51.24%
Growth	628	19.72%
Early Stage	603	18.93%
Expansion / Late Stage	143	4.49%
Balanced	77	2.42%
Buyout	56	1.76%
Others	46	1.44%

Distributions of ESG status for the dummy variables produced by the Strategy variable indicate that they are not normally distributed (which is represented by the "Total"

histogram). The share of ESG funds is greatest for the "Balanced" dummy variable and lowest for the "Venture (General)" dummy variable.

The Chi-Squared Test of Independence was also conducted to provide more statistical evidence on the reliance that exists between the variable ESG and the dummy variables. These data were shown for each dummy variable, and the p-values were very near to zero, indicating that the null hypothesis should be rejected.
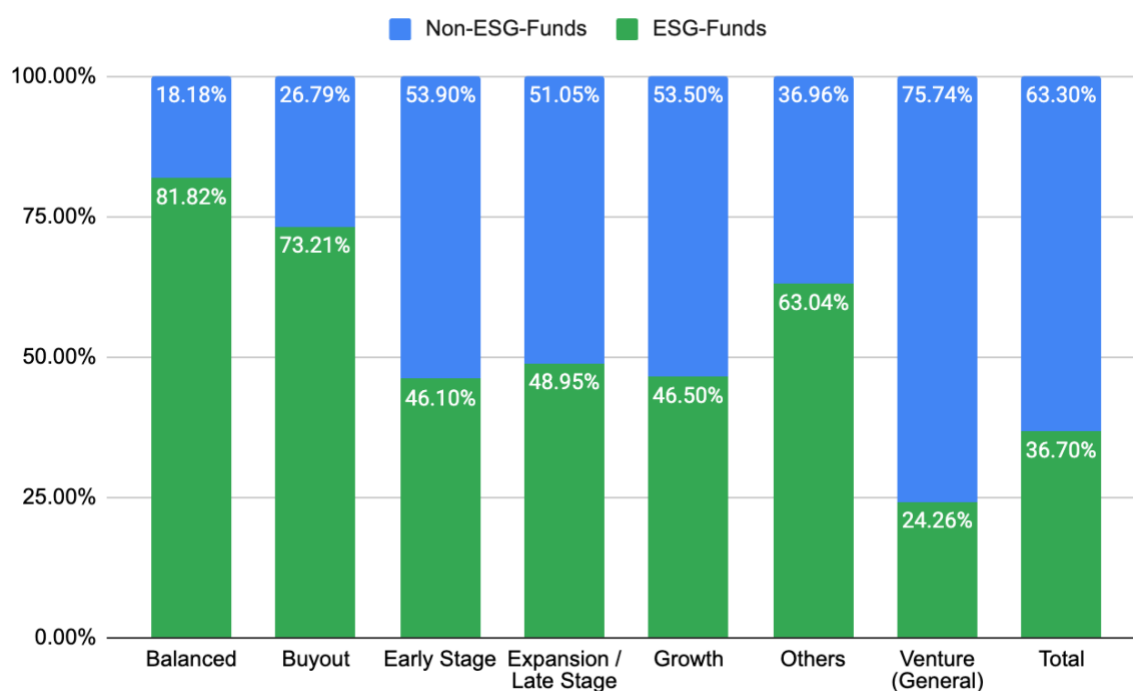
Figure 22 - Percentage distribution of Funds ESG status per Funds Strategies

6.5.1. Comments on Strategies

In private equity and venture capital, the specific investment strategy adopted by a firm can also influence its approach to ESG investing. Referring to the different investment strategies analyzed in this work, here is how ESG considerations can be integrated into various private equity and venture capital investment strategies:

1. Buyout: Invests in established companies, often with the intention of improving operations and/or financials; in this case investments often involves the use of leverage. ESG considerations can be integrated into the due diligence process, and ESG-related issues can be addressed as part of the post-investment value creation plan.

2. Venture: This strategy main objective is to provide capital to new or growing businesses with perceived long-term growth potential. Early-stage companies may require more hands-on ESG support, such as guidance on establishing sustainable

business practices. Investors can also seek out startups that have a strong ESG focus and mission.

3. Growth: In this case private equity or venture capital funds typically take significant minority positions in companies without the use of leverage. In most of the cases the target companies are profitable, but still maturing; the investee companies have significant scope for growth and the investor has the opportunity to earn important returns exploiting synergies and economies of scale or scope. Investment horizons are mid-to-long term, similar to those seen with buyout funds. In growth stage investments, ESG considerations can be integrated into the evaluation of a company's growth prospects, such as its ability to attract and retain employees and its reputation with customers.

4. Early stage: The main responsibility of funds in this specific stage is to support a non-commercial company's product development and marketing. Investors can seek out early-stage companies that have a strong focus on ESG issues and look for ways to support the development of these practices.

5. Expansion: Funds here invest in companies towards the end of the venture stage cycle providing capital injections for expansion into a position of stable profit streams. Typical with venture capital deals, expansion/late-stage funds take short - to mid - term, minority positions. When making expansion-stage investments, investors can consider a company's track record on ESG issues and look for opportunities to improve its performance in these areas.

6. Balanced: A balanced investment strategy can involve a mix of buyout, growth, and venture investments, and thus the target companies are at all stages of development, from early stage to buyout, with a focus on companies that have a strong track record on ESG issues and a commitment to sustainability.

After describing the main strategies adopted by the funds analyzing it is interesting to better describe what these strategies are, why private equity and venture capital funds use them and further investigate how these strategies are so important for ESG investing. The focus will be brought on analyzing the Buyout, the Balanced and Expansion/Late-Stage strategies which gave a major contribution to the study.

6.5.1.1. Balanced Strategy

The purpose of the balanced strategy in private equity and venture capital is to maximize profits while avoiding risk, and it is characterized by a portfolio approach that tries to strike a balance between high-risk and high-reward investments. A balanced approach in venture capital "seeks to invest in a combination of early-stage and later-stage firms, as well as a mix of growth and buyout prospects to create a

balance of risk and profit," as stated by the National Venture Capital Association (NVCA).

Like the balanced strategy in public markets, the balanced strategy in private equity "seeks to achieve a balance between higher risk/higher reward early stage investments and lower risk/lower reward buyout investments," as stated by the European Private Equity and Venture Capital Association (EVCA).

The portfolio may reap the benefits of both early-stage investments' high return potential and later-stage buyout deals' lower risk profile via diversification. In addition to providing a wider range of investment options and experiences, this strategy may expose investors to companies at various phases of development and growth.

Private equity and venture capital businesses may reap several advantages from incorporating ESG (environmental, social, and governance) issues into a well-rounded strategy. It has been found that "ESG considerations are becoming increasingly important in private equity as they can play a critical role in improving the long-term sustainability and performance of portfolio companies," as stated in a report by the European Private Equity and Venture Capital Association (EVCA) (EVCA, 2021). The National Venture Capital Association (NVCA) agrees, saying that "integrating ESG factors into investment strategies may assist venture capital firms find and invest in businesses with good ESG practices, which can contribute to long-term financial success and stability" (NVCA, 2021). Incorporating ESG factors into a well-rounded plan may assist encourage sustainable business practices and social responsibility while also improving long-term financial success. "Impact investors attempt to invest in businesses, organizations, and funds with the purpose of generating verifiable social and environmental effect alongside a financial return," states the Global Impact Investing Network (GIIN) (GIIN, 2021). Private equity and venture capital businesses may help build a more sustainable future by investing in companies with good environmental, social, and governance (ESG) policies. Moreover, private equity and venture capital businesses might gain a competitive edge via ESG integration. "Integrating ESG concerns into investment strategies may assist private equity firms discover and invest in businesses that are well positioned to resist ESG-related risks and capitalize on ESG-related opportunities," said a research by the International Finance Corporation (IFC) (IFC, 2021). Businesses that prioritize environmental, social, and governance (ESG) factors are more likely to attract investors and customers, leading to increased profits. Last but not least, private equity and venture capital businesses may benefit from ESG integration by attracting and keeping investors that prioritize sustainability and social responsibility. There is "increasing evidence that ESG-integrated investments may generate superior risk-adjusted returns and contribute to more sustainable outcomes for investors and society," as stated by the

Principles for Responsible Investing (PRI), which is backed by the United Nations (PRI, 2021). Private equity and venture capital companies may gain a competitive edge and a greater market share by making ESG factors a central part of their overall investment strategy.

Finally, private equity and venture capital businesses increasingly want a balanced approach that takes environmental, social, and governance (ESG) factors into account. That's because ESG integration has been shown to improve long-term financial performance, spread sustainable company practices, provide an edge in the marketplace, and attract more ethically-minded investors. The Principles of Responsible Investing (PRI), which is backed by the United Nations, states that "ESG integration is fast becoming a mainstream practice for investors globally, and a vital contributor in delivering sustainable, long-term value for stakeholders" (PRI, 2021). Private equity and venture capital businesses may gain a competitive edge and a greater portion of the market by adopting a balanced approach that emphasizes ESG issues.

6.5.1.2. Buyout Strategy

To improve a company's financial performance before selling it for a profit, private equity firms often use what is known as a "buyout strategy," which involves the purchase and acquisition of control of the company. Acquisitions through buyout tactics are most often used when the target companies are well-established ones with a history of success and room for expansion. Taking a firm private via a buyout is one example of a private equity investment, as defined by the Harvard Business Review. "investments in established, successful firms, with a proven track record, with a goal to enhance their performance and exit at a later time," as defined by the European Private Equity and Venture Capital Association (EVCA).

Private equity firms often acquire majority ownership in their targets via either a management buyout or a leveraged buyout (MBO). A leveraged buyout occurs when a private equity group employs debt finance to purchase and take over the operations of a company. The target company's management team, backed by a private equity group, buys out the company in a management buyout. The end game in both scenarios is to increase the value of the target firm via strategic and operational enhancements and then sell it. "buyouts give firms with the ability to continue their development and expansion outside of the public market, free from the restraints of public company life," writes the British Private Equity and Venture Capital Association (BVCA). Buyouts are long-term investments (usually three to ten years or more) used to buy medium- to large-sized businesses. (Metrick & Yasuda, 2011)

There are a variety of opportunities for incorporating environmental, social, and governance (ESG) factors into private equity and venture capital buyout investment

strategies, depending on where the company is in the transaction cycle. The first step is due diligence, which is not only an important part of any investment but also a chance for buyout funds to evaluate the environmental, social, and governance (ESG) performance of possible acquisition targets. Any significant ESG-related hazards may be uncovered in this way. At this juncture, private equity and venture capital firms have a number of options for incorporating ESG factors into their decision-making. At the first stage, ESG data collecting is performed. Information on the target company's environmental, social, and governance (ESG) parameters, such as energy use, emissions, water use, and waste production, may be gathered by buyout funds. By doing so, investors may get a fuller view of the company's ESG practices. As was previously said, the ESG Risk Assessment is a crucial part of the due diligence process, as it allows buyout funds to evaluate the various ESG risks connected with the target firm. If any significant ESG-related risks exist, this may assist you identify them. Stakeholder engagement is also an important consideration for buyout funds because it allows them to hear from the people who matter most to the company — its employees, customers, suppliers, and communities — about how they feel the business is doing with regard to environmental, social, and governance factors. ESG due diligence reports and ratings, such as those offered by sustainability rating agencies, may be used by private equity and venture capital companies to receive an impartial evaluation of the target company's ESG performance during the due diligence process ("ESG in Private Equity: The State of Play" by Preqin). Once everything else is said and done, businesses must tend to ESG Integration into Financial Analysis. It is crucial for buyout funds to incorporate ESG considerations into their financial analysis of the target company, including an assessment of the potential impact of ESG risks and opportunities on the company's financial performance, as this is both requested by regulators and expected by the investing public.

Buyout funds may help portfolio firms enhance their environmental, social, and governance performance by implementing the value creation plan that is developed after an investment has been made. Sustainability efforts may be implemented, supply chain management can be improved, and environmental effect can be reduced, among other things. Another is portfolio management, in which corporations monitor and manage the ESG performance of the companies in their portfolio and interact with them on ESG-related problems as they emerge. Alternatively, buyout funds might analyze the possible effect of a sale on the target company's ESG performance when deciding on an exit plan. If the fund believes that the company's ESG performance may be improved by selling to a new owner who shares this belief, then it may pursue such a sale. But it's worth stressing the significance of ESG metrics since they can be used by buyout funds, along with data, to monitor the ESG performance of their portfolio firms and evaluate the effect of their ESG initiatives on their financial results. In

conclusion, the data from this analysis shows that the buyout approach is the second most popular technique adopted by VC and PE companies.

The chance to make operational and strategic changes that boost the target company's financial performance is a major draw for private equity and venture capital firms considering a takeover strategy. "buyouts give firms with the ability to continue their development and expansion outside of the public market, free from the restraints of public company life," writes the British Private Equity and Venture Capital Association (BVCA). The possibility of large financial gains is another reason why buyout techniques are so well-liked. According to the Harvard Business Review, "private equity investors aim to generate significant returns by purchasing firms, upgrading their operations, and ultimately selling them for a big profit." The chances of a successful takeover are increased when ESG factors are taken into account. "ESG concerns are becoming more essential in private equity since they may play a crucial role in enhancing the long-term sustainability and performance of portfolio firms," writes the European Private Equity and Venture Capital Association (EVCA).

6.6. Performance measurements.

The primary objective of this section is to examine the performance statistics of venture capital and private equity funds to evaluate if ESG funds outperform non-ESG funds. It would be a fascinating undertaking to investigate the link between these performance indicators and the other pertinent elements.

Several individuals are interested in mastering the skill of analyzing the profitability of private equity and venture capital investments. In recent research, exclusive performance indicators and fresh (often confidential) data sets have been used. It is normal practice, while analyzing the profitability of a fund, to study the movement of funds between the general partners and limited partners. This is performed with consideration of tax consequences. The internal rate of return (IRR) on such cash flows or the ratio of cumulative inflows to cumulative capital outflows (commonly referred to as the multiple of invested capital (MIC) or total value to paid-in capital) are common measures for measuring practical performance. These two metrics are referred to together as the return on investment (TIC) indicator (TVPI). Using such indications has a severe drawback, namely that they ignore the overall market situation.

Recent study has addressed a variety of issues with the identification of the key impediments to understanding a fund's performance by examining its performance (Driessen et al. 2012; Jegadeesh et al. 2015; Korteweg and Nagel 2016; Sorensen et al. 2014). Especially important are research into the causes, estimates of their breadth, and

evaluations of the associated risks. Sensoy et al. (2014) group the many limited partners (LPs) that participate in venture capital and private equity firms. According to their results, endowments have a greater rate of return on investment than other limited partnerships (LPs) for investments made between 1991 and 1998. In addition to these inadequate local investments, public pension funds have an excessive allocation to local investments in venture capital or private equity funds, according to the results of Hochberg and Rauh (2013).

In their definition of private equity funds, Kaplan and Schoar focus special emphasis on the fact that returns might vary considerably amongst funds. In addition to specific skill sets, general practitioners have access to a body of information, which makes them extremely helpful. According to the results of Kaplan and Schoar's study, the most successful general partners have an advantage when it comes to detecting and capitalizing on potentially lucrative investment possibilities due to their extensive market knowledge. There is also the prospect that they will be able to negotiate for improved conditions with the targeted companies (Kaplan & Schoar, 2005). Due to their powers, a bigger quantity of money is generated (Kaplan & Schoar, 2005). If funds are managed by the same general partner, investors can expect a decent degree of consistency in the returns they get. The track record is a useful tool for examining potential investments since previous performances may be utilized as a prediction of future performance, making the track record a valuable indication. The authors analyze whether overlapping investments or time periods may be responsible for this recurrent tendency, but conclude that this is not the case (Kaplan & Schoar, 2005). Kaplan and Schoar categorize private equity funds based on the industries and investment stages in which they specialize. This helps them to analyze whether the consistent performance of private equity funds may be attributable to variations in risk. In contrast, they discover that this is also not the case. In addition, the authors suggest that the sequence number of a private equity fund has an effect on the fund's performance. So, using the sequence number, the total number of times the fund has been formed may be determined. In addition, the total number of established funds at the time of the review is supplied. The authors assert that second- and third-generation funds outperform those of the first generation. They attribute this to the general practitioner's enhanced knowledge and the effect of learning.

In addition, there is evidence supporting the concave relationship hypothesis between the size of the fund and its performance. In light of this, it would seem that bigger funds perform better on average than their smaller counterparts. Yet, the significance of marginal returns will diminish in direct proportion to the fund's size. As a consequence, the growth of the funds with the greatest performance is less than that of the funds with the poorest performance. This is because bigger funds often have access to a higher amount of resources, as well as economies of scale and enhanced diversification prospects. Many factors make it more difficult to sustain this level of performance given the size of the fund. These factors include increased administrative

and managerial costs, less investment choice flexibility, and a restricted pool of feasible market opportunities. Hence, despite the fact that bigger funds often outperform smaller ones, the advantages may decline as the fund grows in size. Several studies have shown a concave relationship between the size of the fund and the returns. Cremers and Pareek (2016) have shown that the performance of a fund grows with its size, despite the fact that marginal profits decline beyond a certain threshold. One of the probable reasons of this concavity is the difficulty of maintaining performance while working with a second partner who has the same qualities and capabilities as oneself. There are now few suitable investment options, for instance.

The normal rate of return on investment for venture capital funds is much higher than that of buyout funds, and the superior performance of venture capital funds is sustained over time. Between 1988 and 2001, venture capital funds had a Public Market Equivalent (PME) larger than one, indicating that they outperformed the S&P 500 considerably. Buyout capital nearly never suffered a PME higher than 1 over the same time period. In addition, Kaplan and Schoar give evidence that the entry of new venture capital funds has no effect on the performance of previously existing venture capital funds, and that the returns generated by new venture capital funds are declining. Nonetheless, buyout funds, regardless of how long they've been or how young they are, have a propensity to generate below-average returns. In addition, the current life cycle stage of the investment target may influence the success of an investment. This is because various phases of the target's life cycle correlate to varying degrees of risk, resulting in increased return volatility during some times. The S&P 500 index is often used as a benchmark for examining the performance of private equity firms. Thus, when gross returns are included, they outperform the S&P 500, yet when net returns are considered, they lag behind. According to the statistics, private equity fees may have a significant influence on performance. This is owing to the fact that the higher advantages of using a fund management service are offset by the fees charged by the fund managers. In 2009, Phalippou and Gottschalg conducted a second substantial research on the profitability of investments. According to them, several factors may influence the performance of a fund. Among these considerations are the size of the fund, its sequencing, its track record of past fund raising, its regional focus, its fee structure, and its exit performance. According to the results of their analysis, there seems to be a positive correlation between fund performance and fund size, with bigger funds outperforming those with a smaller asset base. In addition, Phalippou and Gottschalg (2009) theorize that the stronger performance of private equity funds with a higher sequence number may be a result of a learning effect. This would explain why these funds have done better than funds launched for the first time. Working in private equity requires a diverse set of skills, the majority of which can be enhanced through experience alone. As a direct result of their investments in professional development, more general practitioners will report higher incomes as a result of improved decision making. Moreover, many academic experts believe that the returns

of prior fund periods are a good indicator of the success of future fund periods. This is congruent with the conclusions obtained by Kaplan and Schoar (2005). Moreover, private equity firms with a substantial focus on the United States appear to have a higher success rate than those with a comparable focus on the European Union. Given that the majority of private equity funds have positive alphas and outperform the S&P 500, pricing structure is a crucial factor. This conclusion is the direct result of taking into account all relevant fees. Investors can expect returns that are, on average, 3% lower than those achieved by the S&P 500 when fees are accounted for.

The method utilized to calculate management fees is an additional factor that should be considered. For instance, they may be based on the committed capital for the whole term, the committed capital during the investment period, and the invested capital; alternatively, they may be based on the Net Asset Value of the invested capital (NAV). Remember that the share of management fees also has a direct impact on alpha. This is essential knowledge to possess. In addition to the base rate and any other relevant expenses, the fee structure may incorporate catch-up provisions, performance fees, and optional hurdle rates. There is a considerable correlation between the efficacy of an exit plan and the fund's performance. Many regard initial public offerings (IPOs) and mergers and acquisitions (M&As) to be the two most successful exit strategies. Ghai et al. (2014) examine the profitability of private equity investments in a distinct portion of their study titled "Private equity: Changing perceptions and new realities." Ghai and his colleagues found, after comparing the levels of risk, that private equity had higher returns than public equity. They think this year's returns are greater than in the middle of the 2000s, when the performance of private equity started to equal that of public markets (Ghai et al., 2014). The apparent constancy in performance that was seen in the early 2000s is steadily eroding, making the past performance of a fund an increasingly unreliable signal of its future success. It is necessary to do further study on management approaches and the factors that influence one's degree of success. For limited partners (LPs) to decide if the general partners' (GPs') abilities and traits, which drove past success, are still there and adequate to continue outperforming in subsequent funds, further investigation is necessary. This is only possible if the LPs perform more investigation. In addition, potential buyers must consider the fund manager's industry expertise, the fund's location, and the used investment strategy. Ghai et al. (2014) disagree with Kaplan and Schoar (2005) and Phalippou and Gottschalk (2002) about the possible role of fund size in determining performance (2012). Kaplan and Schoar (2005), as well as Phalippou and Gottschalg (2012), have addressed this topic (2005). (2009). It is claimed that general partners (GPs) are striving to raise the amount of their funds while also seeking larger agreements. On the other hand, they assert that criteria like as the size of the fund or the volume of the transaction have no bearing on the performance of the fund. Last but not least, the authors contend that exchanging management fees for performance fees would result in enhanced fund performance, which would boost the profit pool shared by general

partners and limited partners (LPs). The seventh chapter of Sommer's (2013) book "Private Equity Investments: Determinants and Performance Implications of Investment Cycles" is dedicated to a deeper examination of private equity fund performance. Even when varying degrees of risk are considered, Sommer agrees with Kaplan and Schoar (2005) and Phalippou and Gottschalk (2009) that investment in private equity does not necessarily provide higher returns than investing in the public markets. This is true even when the probability of danger is considered. In addition, there is evidence from research indicating that results may vary not just across nations, but even within a single experiment (Sommer, 2013). (Cochrane, 2006). As the market is nearing its peak, general partners' investing activity rises and private equity companies are more likely to launch new funds, according to the results of Sommer's analysis. The influence of herding adds to the acceleration of this trend. Increased investment activity is unrelated to a rise in the number of new fund launches or an improvement in fund performance, as measured by the internal rate of return (IRR). This suggests that the performance of the fund is affected by market cycles. In his recently published article titled "Challenges to Establishing Sustainable Private Equity Markets in Emerging Europe," Precup (2019) investigates the various factors that influence the profitability of private equity funds. According to his statistics, European nations attained Net IRRs more than 10% for both the 1990–1994 and 2000–2004 vintage periods. These results remain accurate over the duration of the investment. According to Precup, private equity investments outperform those in other asset classes. The annual returns of a sample of venture capital and leveraged buyout (LBO) funds are at least three percentage points higher than those of the S&P 500 index.

Due to the extended investment horizon of private equity investments, they often earn an illiquidity premium of 3.5–4%. This might be one of the reasons why the situation exists. The capacity to set and monitor specified objectives is one of the most critical variables in determining the success of an investment plan. Both the fund's management team and the companies in which it has invested should be commended for the fund's extraordinary success. If you want to boost the firm's investment value, you must employ a manager with exceptional leadership skills. These competencies are critical for establishing and refining the firm's strategy and associated methodologies, as well as for implementing any necessary corporate reorganization. Thus, it is crucial to establish a partnership based on mutual confidence and to ensure that the goals of the management team and the fund are congruent. According to the conclusions of Phalippou and Gottschalg's research, it is also important to underline the significance of providing funds with effective exit options (Phalippou & Gottschalg, 2008). For example, a rising stock market might facilitate the distribution of revenue from a venture capital investment through an initial public offering (IPO), resulting in higher returns on that investment (Black & Gilson, 1998). It is thus reasonable to assume that the authors' opinions on whether private or public stocks are more beneficial are split down the middle. It is possible that this discrepancy may

be explained by the fact that different authors choose to concentrate on different historical eras, or by the fact that some authors use European data while others reference American data. Different writers' predilection for focusing on different historical periods is one possible explanation for this phenomena. Ghai et alfindings .'s also suggest that there may be some irregularities in the method in which returns are calculated (2014). Notwithstanding this, all of the authors feel that the success of private equity is determined not just by the variety of returns, but also by the consistency of returns across funds managed by the same general partner (GP). Ghai and his colleagues' earlier work is the only source that gives evidence for the assumption that this persistence is diminishing. According to the authors of this study, the following variables influence the success of private equity funds: Fund size, fund sequence, fund management skills, timing (market conditions and the business cycle), strategy, geographical concentration, fee structure, and exit strategy are all important factors to consider. In addition, Precup underlines the importance of the investment target's management team as a crucial part of the appraisal procedure. In what way, therefore, would sticking to a plan that prioritizes ESG issues effect investment returns? This statistics will provide credence to our results and our research, which seeks to determine the effect of an ESG approach on performance.

6.7. Fund Number (Overall and Series)

The Fund Number (Series) indicates the number of similar funds managed by the General Partner (GP) in the past and which followed the same investing strategy. It is feasible to determine a manager's level of skill based on the number of funds they have managed and, by extension, the performance of those funds (Kaplan & Schoar, 2005; Phalippou & Gottschalg, 2009). Hence, the Fund Number (Series) will also be used as a control variable. The sample includes funds with Fund Numbers between 1 and 19, with a mean of 2.06 and a standard deviation of 5. This signifies that there are between one and two preceding funds in this series. It is crucial to keep in mind that mutual funds with a Fund Number greater than 100 are less prevalent.

When the ESG status is taken into account, two distinct results are possible from inside this aspect. The overall mean value is 2.06, while the standard deviation is 2.10. When just ESG funds are evaluated, the mean value of these assets increases to $2.11 and the standard deviation decreases to 1.74. This indicates that these assets are more concentrated around their mean value. Non-ESG funds constitute the subsample with the most dispersed data, with a mean value of 2.04 and a standard deviation of 2.29. ESG funds have a literature len that is closer to 2 than non-ESG funds, which have a literature len that is more variable. This is a result of the greater ethical responsibility of ESG funds. In addition, although the maximum is lower (10) in the ESG-funds group, it is much higher (19) in the subgroup that excludes ESG-funds.

Figure 23 – Mean and Standard Deviation of the variable Fund Number Series, considering respectively the whole sample, the sample with only ESG funds, and the one with non-ESG funds

The Fund Number (Overall) variable is applied to determine the general partner's level of expertise in the fund development process. This variable may be used to calculate the number of funds launched by the same general partner over the prior time period. Notwithstanding the fact that prior endowments may have used a range of investing strategies, this information is supplied. Several studies have shown that the amount of experience of a fund's management team correlates positively with that fund's level of performance (Kaplan & Schoar, 2005; Phalippou & Gottschalg, 2009). We have opted to add Fund Number (Total) as an independent variable for the same reason.

Our sample consists of funds having anything between two to ninety-six different general partners, with the latter being the most extreme outlier (series). Prior to the one under consideration, there are normally between four and five additional funds in the sample's backlog. The sample consisted of an average of 5.85 distinct funds, which tends in this direction. With 75% of the funds falling into the first-to-seventh-time fund category and a declining tendency as the number of funds grows, these results show that the bulk of the sampled funds are concentrated at lower fund numbers. This is because the data pattern suggests that the number of funds reduces as the number of funds grows.

When just ESG-funds are included, the mean and standard deviation rise to 6.54 and 9.81, respectively. This indicates that the subgroup of ESG-funds has values that are

both more extreme and more dispersed than those of the broader group as a whole. By examining just the group of funds that do not emphasize environmental, social, or governance issues, the mean and standard deviation are substantially lower, at 5.46 and 7.42, respectively.

The number of funds formed by general partners who prioritize ESG is much more than the number of funds established by general partners who do not prioritize ESG.
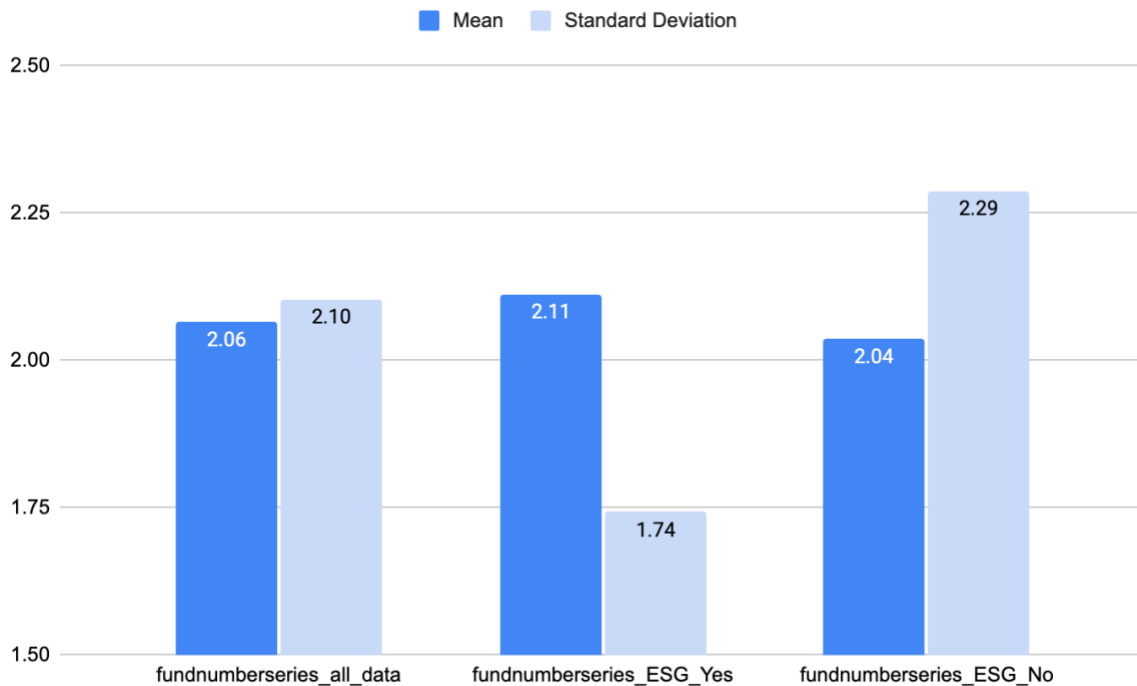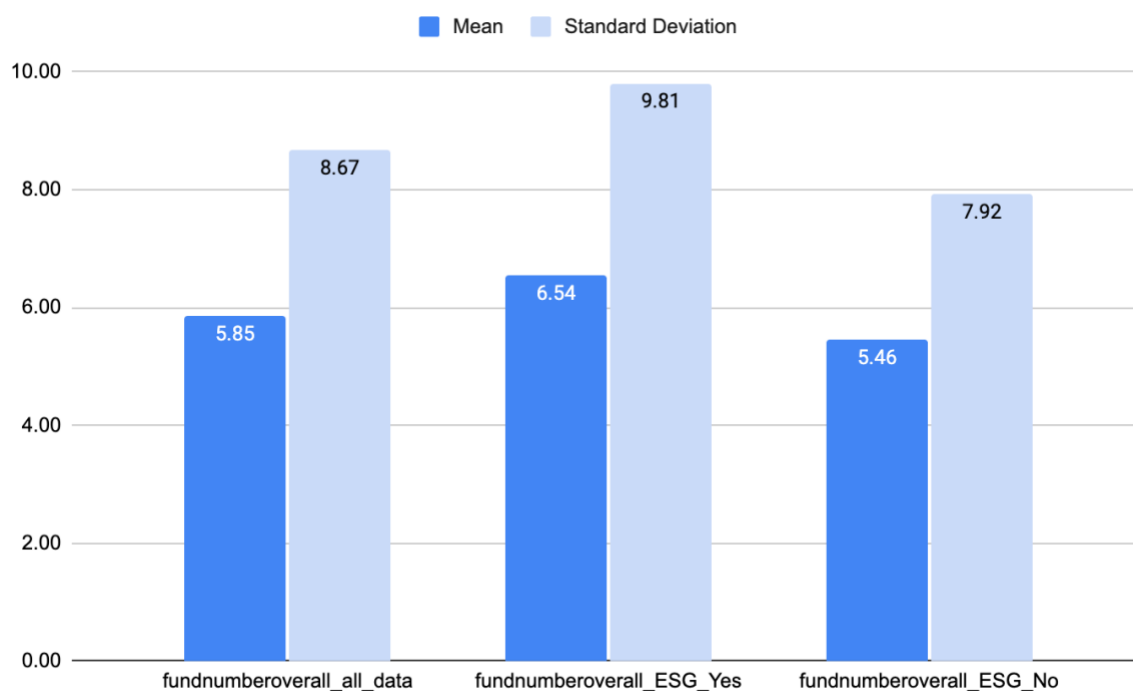

Figure 24 - Mean and Standard Deviation of the variable Fund Number Series, considering respectively the whole sample, the sample with only ESG funds, and the one with non-ESG funds

Before continuing with any more testing, the logarithmic transformation was given to these two variables in order to minimize the variation in those variables and equalize their distribution. This was done since the standard deviations have a significant impact on these two variables.

The samples that were not paired. t-test, which tests the hypothesis that there is a significant difference between the means of two samples when the variances of the two samples are unknown and the samples are unpaired, has been performed in order to provide more statistical support for the previously observed findings. This test examines the hypothesis that there is a significant difference between the means of two samples when the variances of the two samples are unknown and the samples are unpaired.

The t-test is a statistical hypothesis test that determines whether or not there is a significant difference between the means of two samples. It does this by comparing the data from both samples to a central value. It makes the assumption that the variance of both samples is the same and that the data follow a normal distribution.

If there is a substantial disparity between the variances of the two samples or if the data are excessively skewed, it is possible that the t-assumptions test's results will not be accurate. In some circumstances, the t-test may not be trustworthy and may provide results that are not accurate.

Before running the t-test, the data could have an additional logarithmic transformation performed on them so that these issues are avoided. The application of logarithmic transformation, which may lower the variance of the data and standardize its distribution, can be a useful tool for strengthening the assumptions of the t-test. This can be accomplished by applying the transformation.

Thus, let's imagine you have two data samples, both of which are extremely skewed and have very different variances. In this case, let's pretend you want to compare them. If a logarithmic transformation is done to the data before running a t-test, the findings of the t-test may be more reliable and accurate as a consequence.

In conclusion, before performing a t-test, it is generally a good idea to make a logarithmic adjustment to the data. This is especially true in situations when the data are skewed or the variance is not uniform. This may be helpful in improving the assumptions of the t-test, which may then lead to results that are more reliable and accurate.

Even after applying the log transformation to the data, it is clear that they do not exhibit a normal distribution. This is something that has been seen. This becomes abundantly obvious when the theoretical quantiles are contrasted with the actual quantiles of the variable and it is seen that the two sets of quantiles do not align with the theoretical diagonal.
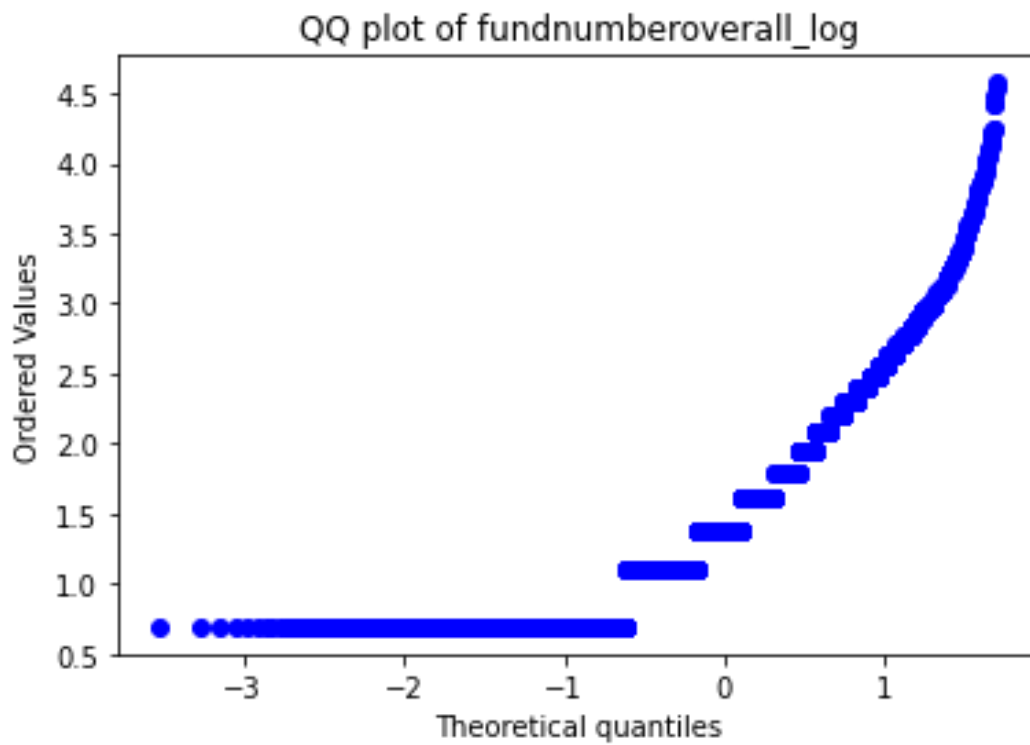
Figure 25 - QQ plot of the Fund Number Overall after applying the logarithmic transformation
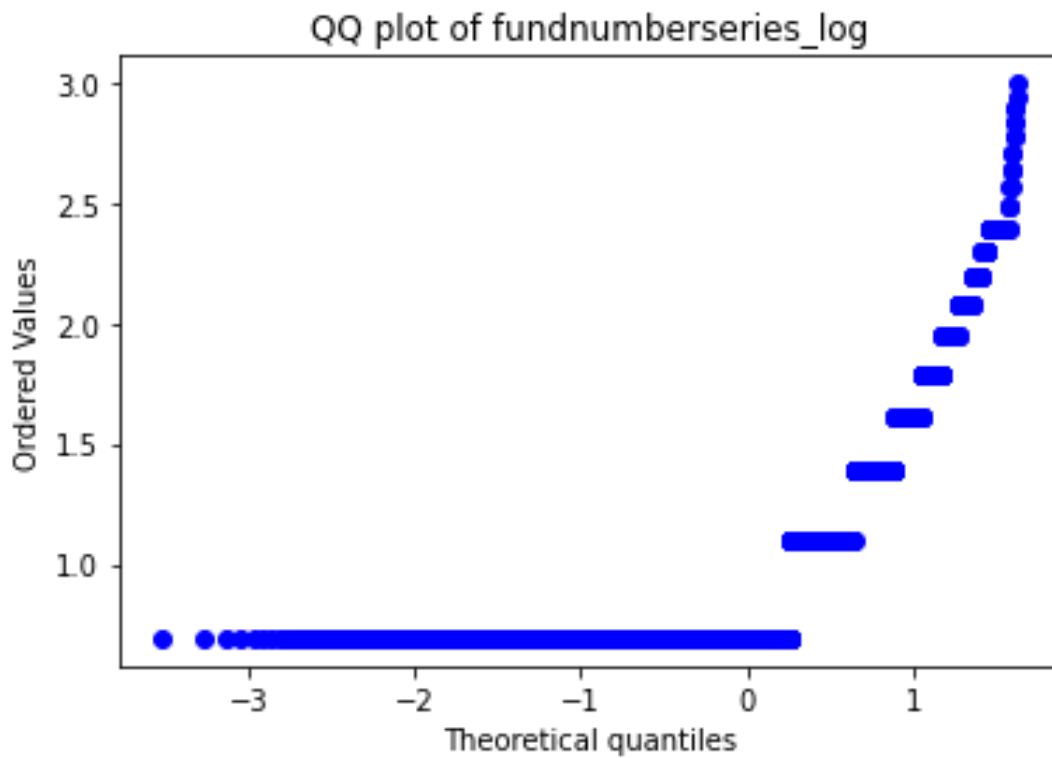
Figure 26 - QQ plot of the Fund Number Series after applying the logarithmic transformation

Figure 27 - QQ plot of the Fund Number Overall considering only Non-ESG Funds, after applying the logarithmic transformation

Figure 28 - QQ plot of the Fund Number Overall considering only ESG-Funds, after applying the logarithmic transformation
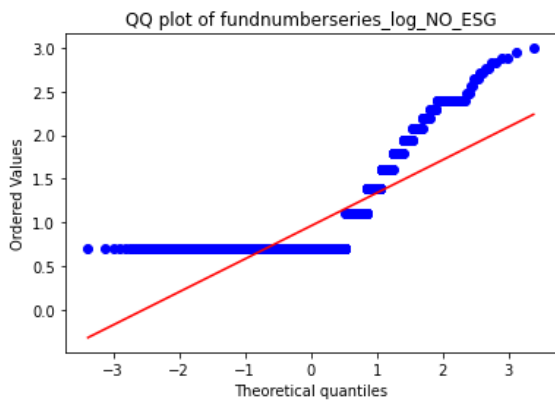
Figure 29 - QQ plot of the Fund Number Series considering only Non-ESG Funds, after applying the logarithmic transformation
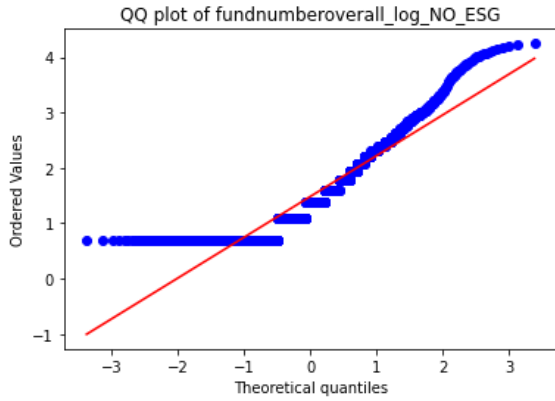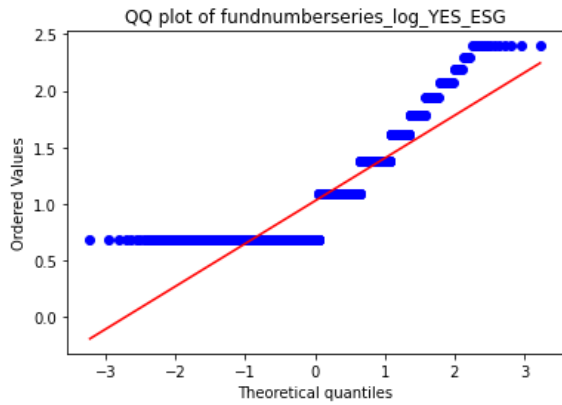
Figure 30 - QQ plot of the Fund Number Series considering only ESG-Funds, after applying the logarithmic transformation
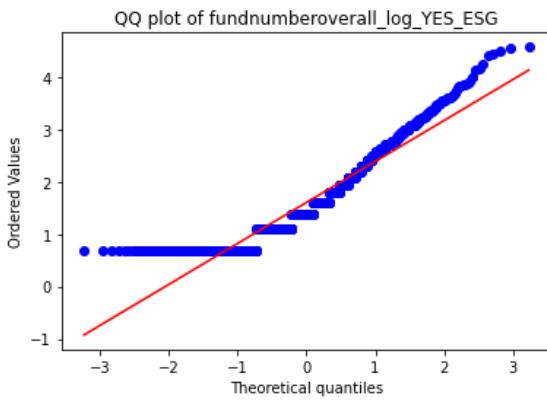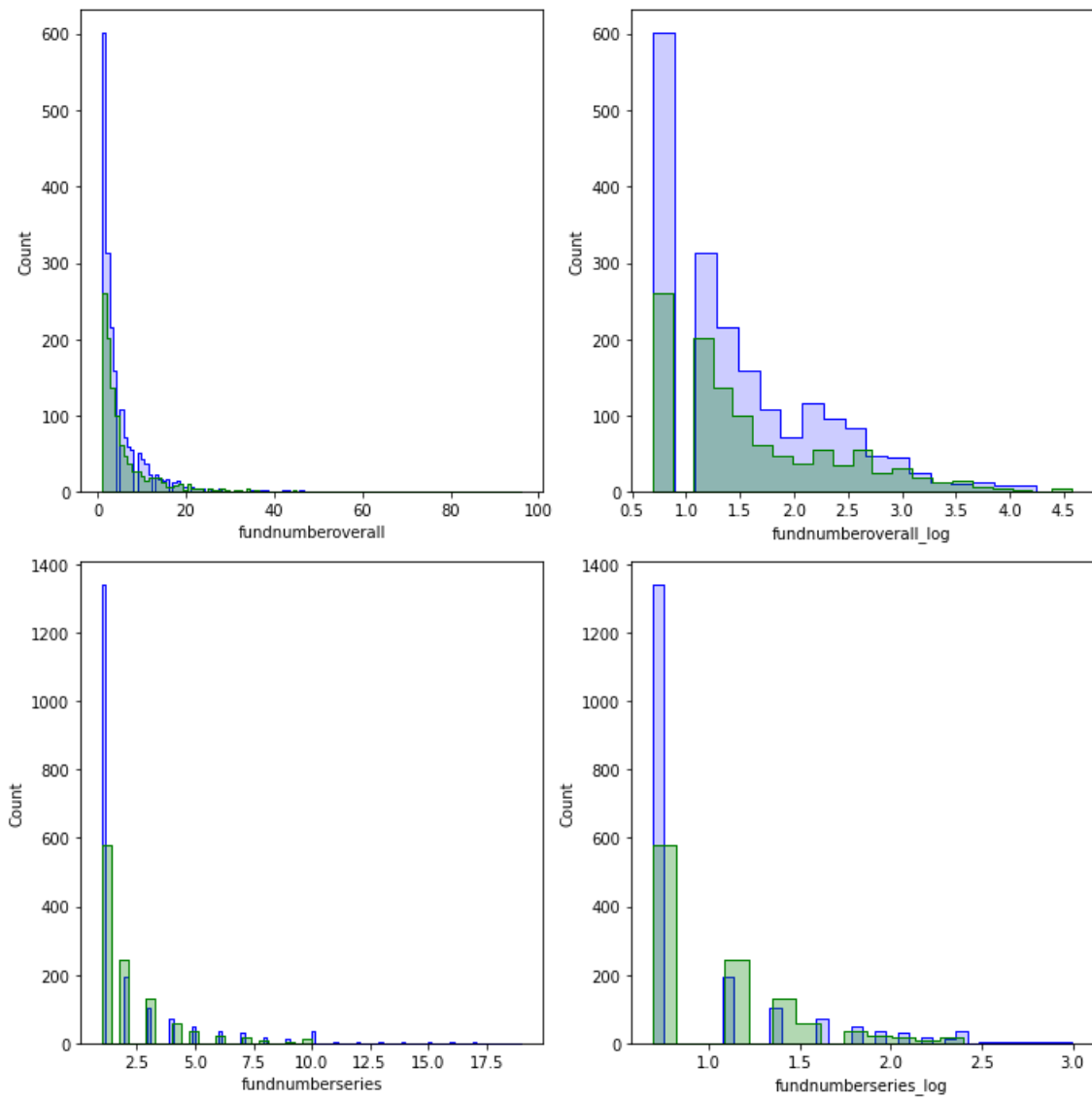

Figure 31 – Frequency histograms of the variables Funds Number Overall and Funds Number Series and the same variables after applying the logarithmic transformations

The QQ values were found to be non-normally distributed upon visual inspection. This was further supported by the results of the Shapiro normality test, which showed that both the fundnumberoverall_log and the fundnumberseries_log had very low p-values (0.00 in both cases). These results indicate that the QQ values do not follow a normal distribution.

Two unique subcategories of each variable were studied based on their ESG status after further study. It appears, based on histograms of these subsets, that there is a difference between the number of previous funds managed by the General Partner that adhere to ESG principles and those that do not, as well as the total number of funds established by a General Partner of an ESG fund and those of a General Partner of a non-ESG fund. This disparity between the number of funds formed by a General Partner of an ESG fund and those established by a General Partner of a traditional fund is significant. According to this statistics, the ESG status of the General Partner may have an impact on the total number of funds established and the number of funds previously handled. It is vital to consider the aforementioned differences while doing data analysis and developing conclusions based on the ESG status of the General Partner.

In order to determine if the ESG subsets of each variable are independent, it is necessary to first assess the normality of these subsets. The visual inspection of histograms and QQ-plots indicate that the subsets do not follow a normal distribution, as the actual quartiles do not align with the theoretical ones. This finding is further supported by the results of the Shapiro normality test, which showed that all four of the ESG subsets (fundnumberoverall_log_NO_ESG, fundnumberoverall_log_YES_ESG, fundnumberseries_log_NO_ESG, and fundnumberseries_log_YES_ESG) were not normally distributed, with p-values of 0.00 for each subset. These results suggest that it is not appropriate to assume normality in these subsets and that alternative statistical tests should be used to assess the independence of the ESG subsets. It is important to consider the distribution of the data when conducting statistical analyses in order to ensure the reliability and validity of the results.

After obtaining statistical confirmation that the QQ values and the ESG subsets of each variable were not normally distributed, the Mann–Whitney U test was conducted in order to test their independence. The results of this test showed that the fundnumberoverall_log had a statistic of 981307.0 and a p-value of 6.819e-05, while the fundnumberseries_log had a statistic of 902990.0 and a p-value of 2.094e-15. These results provide evidence that the ESG subsets of each variable are not independent.

 The Mann–Whitney U test is a non-parametric statistical test that is used to assess the independence of two groups. It is often used when the data is not normally distributed,

as it does not assume normality. In this case, the Mann–Whitney U test was conducted on the QQ values and the ESG subsets of each variable in order to test their independence. The results showed that both the fundnumberoverall_log and the fundnumberseries_log had statistically significant p-values, indicating that the ESG subsets of each variable are not independent.

This finding suggests that there is a relationship between the ESG status of the General Partner and the number of previous funds managed and overall number of funds established. Further research is needed to fully understand the nature of this relationship and to determine the specific factors that contribute to this relationship. It is also important to consider other potential confounding variables that may influence the relationship between the ESG status of the General Partner and the number of previous funds managed and overall number of funds established.

It is important to carefully consider the distribution of the data when conducting statistical tests in order to ensure the accuracy and interpretability of the results. In this case, the non-normal distribution of the data warranted the use of a non-parametric test, such as the Mann–Whitney U test, to assess the independence of the ESG subsets of each variable.

6.8. Cash performance measures

6.8.1. CALLED (%)

This variable may be used to determine how much of the GP's promised funds are really called and invested. If not all of the pledged cash is committed, one interpretation is that the general partner (GP) will be unable to identify suitable investment opportunities, which might be damaging to performance. Due to this, the authors have chosen to incorporate it as a control in the performance studies. There are a total of 3185 observations in the database, but only 633 values for this item. In general, the majority of general partners (GPs) are able to identify investment opportunities that merit the committed cash, and they are able to make 83.22 percent of calls on average. The standard deviation is 28 percent.

When comparing ESG-oriented and non-ESG-oriented funds separately, there are no significant differences. The mean and standard deviation of ESG-oriented funds are both 82.61%, compared to 84.16% and 27.71% for funds that do not emphasize ESG. First, we must determine whether the data follow a normal distribution (similar to what we did with the previous variables), and then, based on the outcome of that investigation, we can select the appropriate test to determine whether or not there is a statistically significant difference between the two groups. The first step is to assess

whether the data follow a normal distribution (much like we did with the previous variables).
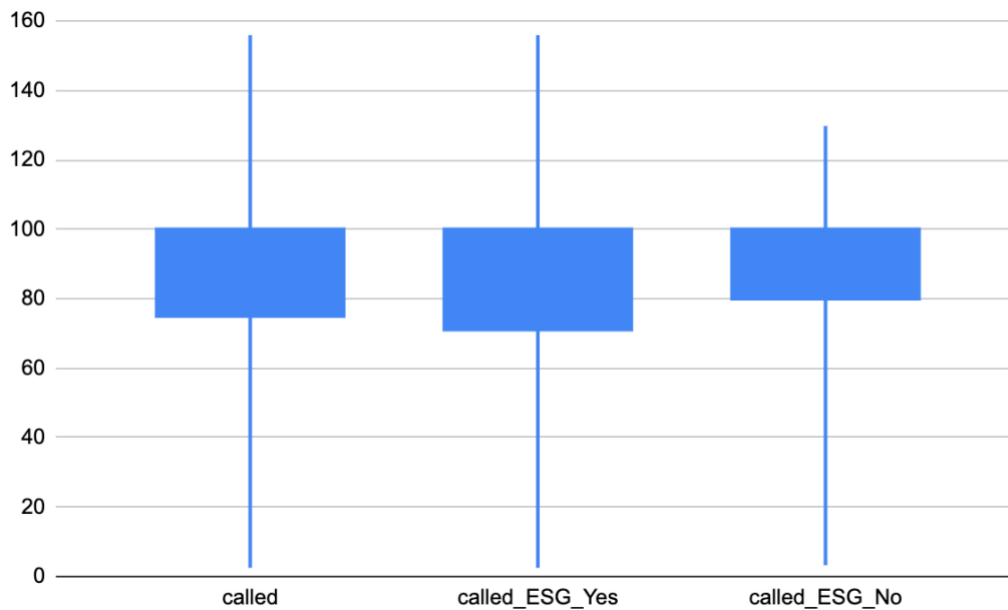
Figure 32 - Box plots of Called variable and the 2 subset considering only ESG-Funds and Non-ESG-Funds

To determine if the called capital ratios were normally distributed throughout the whole sample, the ESG-oriented subset, and the non-ESG-oriented subsample, QQ plots were constructed for each sample. The objective was to determine if the ratios of term capital followed a normal distribution. In contrast, the observed quantiles did not match the theoretical quantiles in any of the plots, showing that none of the samples correspond to a normal distribution. This is one of the most crucial considerations when selecting a statistical test to evaluate if the variations in sample means are statistically significant.

To acquire a better picture of whether the called capital ratio is normally distributed over the whole sample, ESG-oriented subset, and non-ESG-oriented subset, the Shapiro-Wilk test was conducted on all three samples. This was done in order to assess the normalcy of the term capital ratio. With a Statistic of 0.78 and a p-value of 0.00, the tests revealed that the total called capital ratio was not normally distributed. This demonstrated that the ratio did not follow a normal distribution. The called capital ratio for the non-ESG group was not normally distributed (Statistic = 0.76, p = 0.00), and neither was the called capital ratio for the ESG-oriented subgroup (Statistic = 0.802, p = 0.00). They discovered that each of these proportions deviated significantly from what a normal distribution would predict. These findings reinforce the conclusion that can be derived from the QQ plots, namely that none of the three data exhibit a normal

distribution. To evaluate whether or whether differences in sample means are statistically significant, an appropriate non-parametric statistical test will be required. The Mann-Whitney U test may be used to compare the called capital ratios of ESG-oriented and non-ESG-oriented funds if a series of normality tests demonstrate that the data are regularly distributed. The Mann-Whitney U test may be used to compare two independent samples when the assumptions of normality are not fulfilled. With this technique, the significance of any variance between samples may be evaluated.

The results of the Mann-Whitney U test on the two subsamples included in this study supported our previous hypothesis that there is no statistically significant difference between the called capital ratios of ESG-oriented funds and those that do not prioritize environmental, social, or governance considerations. The test resulted in a statistic of 49459.5 and a p-value of 0.459, indicating that the samples did not vary statistically significantly. This suggests that a fund's ESG rating has no impact on its capacity to discover and explore investment opportunities.

Notably, the test yielded a p-value of 0.459, suggesting that the possibility that the difference in means between the two samples is just accidental is quite low. This does not rule out the potential of a difference between the samples, but it suggests that any such difference is not statistically significant and, as a result, may have little practical impact.

After creating QQ plots for each sample, we examined whether the called capital ratios followed a normal distribution throughout the whole sample, ESG-oriented subgroup, and non-ESG-oriented subsample. The purpose of this research was to establish whether or not the called capital ratios followed a normal distribution. In contrast, the observed quantiles did not match the theoretical quantiles in any of the plots, indicating that not a single sample followed a normal distribution. This is one of the most important considerations to bear in mind when picking a statistical test to determine whether or not there are statistically significant differences in the means of the samples.

The Shapiro-Wilk test was conducted on the full sample, the ESG-oriented subset, and the non-ESG-oriented subset in order to gain a more accurate picture of whether or not the called capital ratio is normally distributed across all three samples. This was done to establish whether or not the capital ratio under consideration is regularly distributed. This was performed so that an examination could be conducted to establish whether the called capital ratio was normal. The total called capital ratio did not follow a normal distribution, based on the test findings. The tests generated a p-value of 0.00 and a statistic of 0.785. This revealed that the ratio's distribution of values did not adhere to a normal distribution. In contrast, the called capital ratio for the ESG-oriented grouping was not normally distributed (Statistic = 0.802, p = 0.00), as was the case for the non-ESG group (Statistic = 0.76, p = 0.00). They discovered that each of these proportions deviated considerably from what would be expected based on a normal distribution. These results provide support to the conclusion that can be drawn from viewing the QQ plots, namely that none of the three data sets conform to the

criteria of a normal distribution. It will be necessary to conduct a suitable non-parametric statistical test to determine whether or not differences in sample means are statistically significant.

If a series of normality tests indicate that the data are normally distributed, then the Mann-Whitney U test might be used to compare the called capital ratios of ESG-oriented funds to those of non-ESG-oriented funds. Nevertheless, this is only true if the Mann-Whitney U test is used. The Mann-Whitney U test may be used to compare two independent samples when the assumptions of normality are not fulfilled. With this test, it is possible to determine the significance of any discrepancies between samples.

The results of the Mann-Whitney U test conducted on the two subsamples for this study support our earlier hypothesis that there is no statistically significant difference between the called capital ratios of ESG-oriented funds and those that do not prioritize environmental, social, or governance considerations. This hypothesis was validated by the results of the test performed on the two subsamples included in this study. There was no statistically significant difference between the samples, as shown by the test statistic of 49459.5 and the p-value of 0.459. This suggests that a fund's ESG rating has no impact on its capacity to discover and explore investment opportunities.

The test yielded a p-value of 0.459, which suggests that it is very improbable that the difference in mean scores between the two samples resulted from a mere coincidence. This does not rule out the possibility of a difference between the samples, but it does suggest that any such difference is not statistically significant and, as a consequence, may not have a substantial influence in the actual world.

In conclusion, the findings of this research provide more evidence that the called capital ratio is a credible measure of a fund's capacity to discover and pursue investment opportunities, and that the ESG status of a fund has no impact on this metric. This is due to the correlation between the called capital ratio and the responsiveness of a fund to investment opportunities. Further research may be required to fully comprehend the relationship between ESG status and the called capital ratio in funds.

6.8.2. NETIRR

In the area of fund analysis, the "Net Internal Rate of Return" or "Net IRR" is one of the most used performance measures. This is owing to the fact that the Net Internal Rate of Return (IRR) represents the actual profits that may be generated for investors after deducting all expenditures and fees. Thus, it is a significant indicator of a fund's future profitability. There has been an increasing tendency in recent years to include environmental, social, and governance (ESG) aspects into analyses of different funds. Insights into the potential influence of environmental, social, and governance (ESG) concerns on the long-term performance of a fund, as well as investors' growing

demand for investments that correspond with their values and beliefs, all contribute to this trend. Furthermore, investors are seeking assets that correspond with their values and views. By analyzing the impact that ESG factors have on the net internal rate of return, investors may be able to learn more about the possible risks and opportunities connected with a specific fund and make more informed investment decisions (IRR).

The Net Internal Rate of Return (Net IRR) values for a sample of 3185 individual funds are analyzed using descriptive statistics, which serve to describe and explain the Net IRR values. The fact that there are only 464 results for Net IRR indicates a relatively tiny sample size. The very high mean Net IRR of 18.53 for all funds in the sample suggests remarkable success across the board. Despite this, the sample's enormous standard deviation of 29.99 suggests that the Net IRR values within the sample are very variable, with some values being much higher or lower than the mean. This gap might be attributable to the presence of a few extreme instances in the sample. In this sample, the observed range of outcomes is rather large, with the lowest possible Net IRR coming in at -40% and the greatest possible Net IRR coming in at 407.69%. A score of 6.75 in the first quartile, which corresponds to the 25th percentile, indicates that a considerable proportion of the sampled funds have underperformed. A third quartile result of 21.81, which corresponds to the 75th percentile, indicates that a large proportion of the funds have generated outstanding returns. Since the third quartile reflects the 75th percentile, this is the case. The fact that 13.3 is the median indicates that around half of the funds in the study fared worse than this amount, while the other half performed better. According to these descriptive statistics, there was a large degree of variance in the overall performance of the sampled funds. Although some funds performed fairly well, others performed poorly.

The study team divided the funds into two unique groups based on the results of an analysis of the net internal rate of return (IRR): the first category prioritized financial returns, while the second prioritized environmental, social, and governance (ESG) concerns. The first category comprises ESG-funds, which are investment vehicles that prioritize social and environmental responsibility. Non-ESG funds are investments that do not value environmental, social, or governance issues. These subgroups were created so that we could explore the relationship between a fund's ESG status and its net IRR, as well as construct hypotheses and draw conclusions about the advantages of investing in ESG strategies.

Using descriptive statistics, we were able to summarize and interpret the Net Internal Rate of Return (Net IRR) values for two sets of funds. These two categories of funds emphasize environmental, social, and governance factors and return on investment, respectively. Following is a list of numbers that describe the subset of ESG-funds: The lowest value is -28.86, the mean is 15.16, the standard deviation is 22.91, the highest value is 261.8, the middle quartile value is 10.95, and the third quartile value is 19.55. The range is between -288.6 and 261.8. The average net internal rate of return (IRR) for

ESG funds is lower than that for non-ESG funds, indicating that the sample size for ESG funds is less than that for non-ESG funds. In a similar manner, the low standard deviation indicates that the Net IRR values tend to cluster closely around the mean. The sample results fell somewhere in the middle of the range shown by the minimum and maximum values. According to the quartiles, the bulk of ESG funds in the sample had below-average returns, while only a tiny fraction have fared very well.

The descriptive statistics for non-ESG funds indicate a total of 172, a mean value of 24.25, a standard deviation of 38.59, a minimum value of -40, a median value of 17, a 25th percentile value of 9.73, a 75th percentile value of 28.73, and a maximum value of 407.69. Statistics indicate that the sample size and average Net IRR value seem to be greater for funds that do not comply to ESG requirements than for funds that do adhere to ESG standards. In addition, as a consequence of the significant standard deviation of the sample, the Net IRR values are more volatile than usual. The lowest and maximum figures indicate the performance of the sample at the two extremes of the spectrum. Despite the fact that some of the non-ESG funds in the sample have done badly, the quartiles suggest that the bulk of the funds have performed well.

In the subset of funds that adhere to ESG principles, the average net internal rate of return (IRR) is lower and the sample size is less than in the subset of funds that do not adhere to ESG principles. In addition, the ESG-funds show a smaller standard deviation, providing further evidence that the Net IRR values are more tightly grouped around the mean. The gap between the lowest and highest Net IRR numbers for the ESG-funds subgroup as a whole demonstrates a relatively narrow range. According to the quartiles, the bulk of ESG funds in the sample had below-average returns, while only a tiny fraction have fared very well. Despite the fact that the ESG funds group has a bigger sample size overall, the non-ESG subgroup has a higher average Net IRR than the ESG funds group. The bigger standard deviation of non-ESG funds indicates that the sample's Net IRR values are more distributed than ESG fund values. The range of feasible values for the net internal rate of return is greater for non-ESG funds. The quartiles indicate that a considerable proportion of the non-ESG funds in the sample have underperformed, while a bigger proportion of the funds have outperformed expectations.
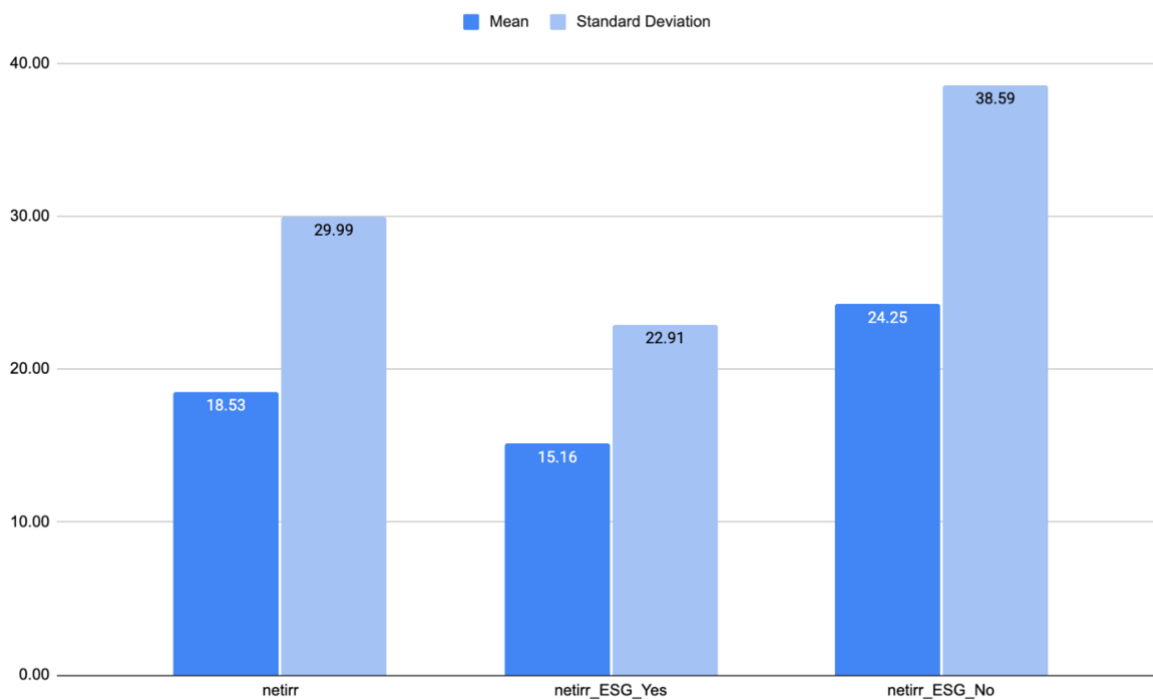
Figure 34 - Mean and Standard Deviation of the NetIRR variable, considering respectively the whole sample, the sample with only ESG funds, and the one with non-ESG funds
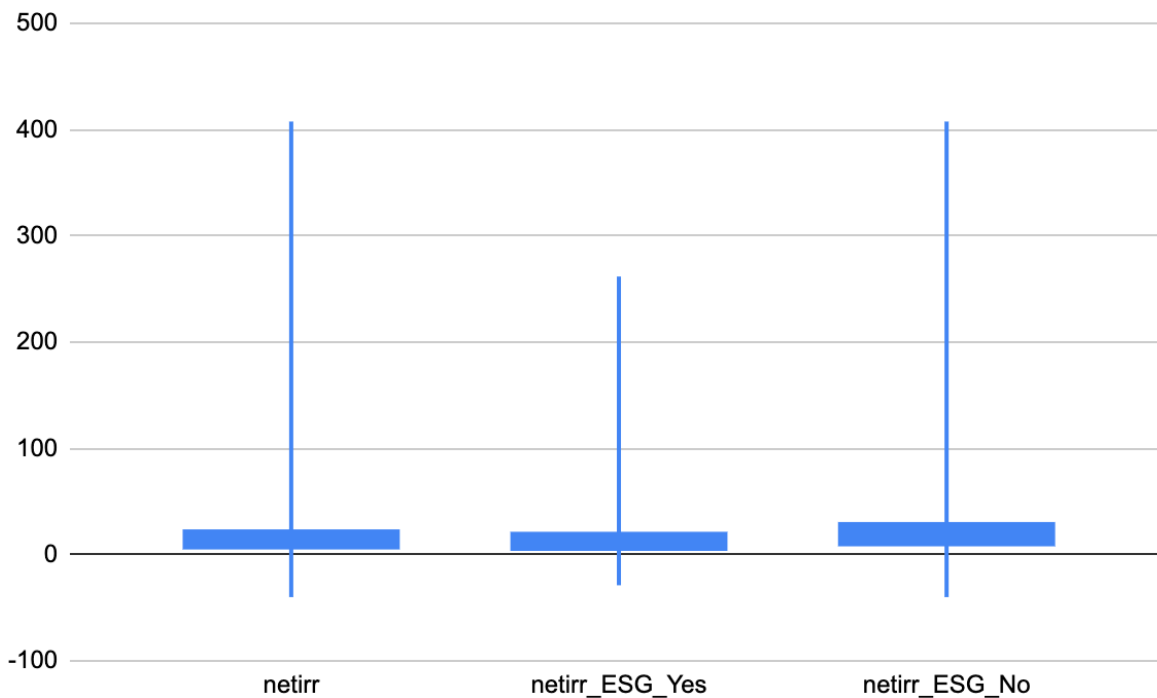
Figure 33 - Box plots of NetIRR variable and the 2 subset considering only ESG-Funds and Non-ESG-Funds

To statistically compare the distribution of the Net Internal Rate of Return (Net IRR) within two subsamples of funds (i.e. non-ESG-funds and ESG-funds), it is necessary

to first assess the normality of the data. This can be done using a normality test, which determines whether the data is approximately normally distributed or not. Once the normality of the data has been established, an appropriate independence test can be conducted to determine whether there is a statistically significant difference between the distribution of the Net IRR within the two subsamples. This is important because the normality of the data and the appropriate test to use are both factors that can influence the validity and reliability of the results. By understanding the normality of the data and selecting an appropriate test, it is possible to determine the difference more accurately between the distribution of the Net IRR within the two subsamples.
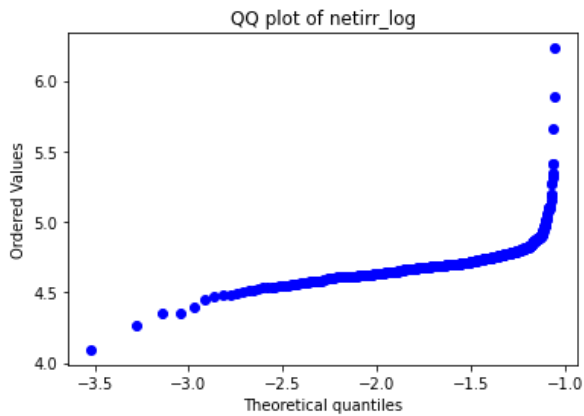
Figure 35 - QQ plot of NetIRR variable, after applying the logarithmic transformation
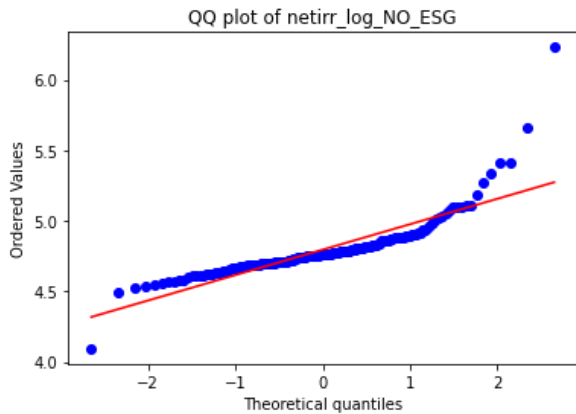
Figure 36 - QQ plot of NetIRR variable considering only Non-ESG Funds, after applying the logarithmic transformation
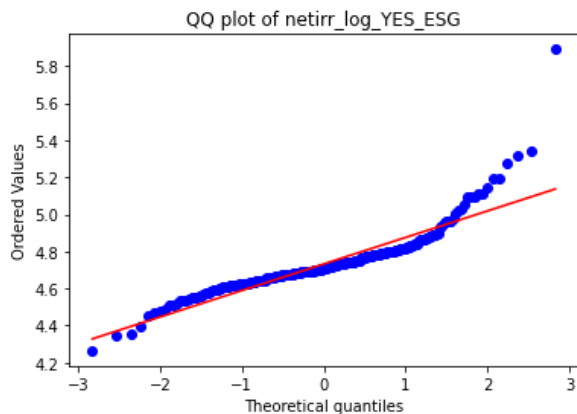
Figure 37 - QQ plot of NetIRR variable considering only ESG-Funds, after applying the logarithmic transformation

In order to demonstrate this, the QQ-plot of the net internal rate of return was constructed (Net IRR). The results for the whole sample of funds in the sample indicate that the data do not follow a normal distribution. This is supported by the fact that the QQ-plot of the Net IRR values for the two subsamples (non-ESG-funds and ESG-funds) likewise demonstrates a non-normal distribution. This demonstrates that the distributions of ESG funds and non-ESG funds are distinct. This suggests that the values of the Net IRR obtained throughout the whole sample and within the two subsamples deviate significantly from what would be predicted by a normal distribution.

The Shapiro Wilk test was run to statistically determine that the two subsamples of Net Internal Rate of Return (Net IRR) values (i.e., non-ESG-funds and ESG-funds) are not normally distributed. Before running this test, the sample's Net IRR values were changed by adding 100 to each number to make them positive, followed by a logarithmic transformation. This process produced a more robust sample, allowing for more reliable testing. The Shapiro Wilk test was then performed to the converted data to evaluate the distribution's normality. Shapiro Wilk test findings for the whole sample of funds' Net IRR values revealed a statistic of 0.80 and a significance level of 0.00. This signifies that the data are not regularly distributed and indicates a considerable departure from normalcy. The findings for the Net IRR values of non-ESG funds revealed a statistic of 0.77 and a p-value of 0.00, suggesting a substantial departure from normalcy. The findings for the Net IRR values of ESG-funds indicated a statistic of 0.838 and a p-value of 0.00, again suggesting a substantial departure from normalcy. These findings imply that the distribution of Net IRR values throughout the whole sample and the two subsamples deviates considerably from a normal distribution.

According to the findings of the Shapiro Wilk test, it is evident that the Net Internal Rate of Return (Net IRR) values for the whole sample of funds as well as for the two subsamples (i.e., non-ESG-funds and ESG-funds) are not normally distributed. Hence, statistical procedures that presume normality, such as the t-test or ANOVA, cannot be

used to assess the distribution of the Net IRR between the two subsamples. Instead, it is required to employ a non-normality-assuming statistical test, such as the Mann-Whitney U test.

This nonparametric test is used to compare the means of two independent samples. It is based on the rankings of the data rather than the raw data values and is thus insensitive to the distribution shape of the data. Due to the non-normal distribution of Net IRR values within the two subsamples, the Mann-Whitney U test was undertaken to assess if there was a statistically significant difference in the distributions of Net IRR values within the non-ESG-funds and ESG-funds subsamples.

The Mann-Whitney U test yielded a statistic of 31491.5 and a significance level of 4.817e-06. The statistic measures the disparity between the two samples, with a bigger value suggesting a greater disparity. A low p-value indicates that a difference is statistically significant, while a large p-value indicates that the difference is not statistically significant.

The low p-value of 4.817e-06 in this instance suggests that the difference between the Net Internal Rate of Return (Net IRR) values for the non-ESG-funds and ESG-funds subsamples is statistically significant. This indicates that the distribution of Net IRR values inside the two subsamples is considerably different and that the means of the two subsamples are unlikely to be identical. So, it is acceptable to assume that the Net IRR numbers for ESG-funds and non-ESG-funds do not come from the same population.

Overall, these findings indicate that the incorporation of environmental, social, and governance (ESG) concerns into the investing process has a statistically significant effect on the Net IRR values of the sampled funds. It is conceivable that ESG-funds have lower average Net IRR values than non-ESG-funds, or that the distribution of Net IRR values within the ESG-funds subsample differs from the distribution within the non-ESG-funds subsample in some other manner. It may be required to do further analyses, such as analyzing the means and medians of the two subsamples and the distribution of the Net IRR values within each subsample, to fully comprehend the nature and size of the difference between the two subsamples.

Notwithstanding what may be assumed based on an analysis of a crucial performance metric such as the NET IRR, the findings of this research indicate that ESG Funds do not display a higher performance in terms of the projected annual growth rate of the assets considered. In accordance with the findings of a research released by Brad M. Barber ("Impact Investing" (University of California), 2019), ESG funds demonstrate a lower Internal Rate of Return when compared to non-ESG funds, our analysis confirms this finding. In contrast, the authors found that UNPRI members showed a greater willingness to pay (WTP), "indicating their strong commitment to impact-oriented missions."

Various explanations may be considered: Firstly, non-ESG funds often have access to a broader universe of investment options, which may include firms in areas or industries that ESG funds ignore owing to low ESG ratings. This may enable non-ESG

funds to invest in firms with a greater growth potential or greater profitability. Another explanation relates to the investment horizon; in most situations, non-ESG funds have a shorter investment horizon than ESG funds, which may result in better short-term gains. Nevertheless, ESG funds may prefer longer-term investments that line with their ESG criteria, resulting in lower short-term returns. In addition, the risk profiles of non-ESG funds and ESG funds are distinct; non-ESG funds may be ready to assume more risk in particular assets, which might result in better returns but also greater volatility. ESG funds, on the other hand, may avoid certain high-risk assets in accordance with their ESG criteria, resulting in lower returns but also reduced risk.

In conclusion, it is not possible to say that ESG funds have a higher NET IRR than non-ESG funds, and this reveals an important theme: a metric such as the NET IRR is insufficient to measure the positive return of ESG funds, and thus there is a pressing need to develop other indicators that are more effective at addressing both financial and ESG returns.

6.8.3. Total Value to Paid-in Capital

The Total Value to Paid-in Capital (TVPI) multiple is a financial indicator that can be used to determine the success of an investment. The total value of an investment is determined by adding the Net Asset Value (NAV) and any dividends to the initial investment and then dividing this new amount by the sum of all capital calls made by the investment. This results in the total investment value. The TVPI may be used to do the appropriate calculations to assess the return on investment. For the purpose of calculating the TVPI, the Residual Value to Paid-in Capital (RVPI) and Distributions to Paid-in Capital (DPI) multiples are added and then combined (Higson & Stucke, 2012). The difference between the RVPI and the DPI shows, respectively, the residual value of the investment and the dividends received. When considered together, these two indicators give a comprehensive view of an investment's performance.

RVPI refers to the residual value of the portfolio after all obligations have been paid and all assets have been sold or otherwise liquidated. It is calculated by dividing the value of the investment's remaining balance by the initial amount invested. The return on invested capital, or RVPI, measures the profitability of an investment. The ownership and use of its assets define its worth.

The dividend payout ratio (DPR) is a measure of an investor's total income from an investment, taking dividends and capital gains into account. It is possible to assess an investor's return on investment by comparing their payouts to the amount of money they originally invested (ROI). The distribution profit index indicates how profitable a company is at dispersing its funds to its many stakeholders.

To give a thorough evaluation of an investment's success or failure, the total value performance index (TVPI) incorporates both the residual value performance index (RVPI) and the distribution performance index (DPI). When evaluating the efficacy of various investments and calculating the return on investment, the TVPI may be a helpful instrument.

There are many advantages to dividing your DPI and RVPI examinations into two distinct sections. Offering a more accurate picture of the data studied. If the TVPI is decomposed into its two component multiples, the performance of the funds may be more readily understood. This may be particularly useful when seeking to isolate the effects of certain factors or when comparing the returns of various investments.

By separating the investment into its component parts, such as DPI and RVPI, one may get a more nuanced knowledge of the asset as a whole. You may be able to investigate, for instance, the impact of various assets on the investment's residual value or to detect patterns in the distribution of earnings over time. This may help you get a greater grasp of the investment's essential characteristics and guide your following actions. Examination of the DPI and RVPI may be quite useful for identifying faults or opportunities for development within an investment. This is the last argument. For instance, a low dividend payout ratio (DPR) may suggest that the investment is not producing enough money to fund dividend payments. If, on the other side, the RVPI is low, this may indicate that the ownership and management of the investment are not providing an acceptable level of value. As these concerns come to light, investors and analysts may take corrective action, which will eventually result in higher investment returns.

6.8.4. DPI

The total amount of distributions to paid-in capital (DPI) for the sample of 3185 funds was 625. Given that the sample had a mean DPI of 97.90, we can conclude that investors in the sample earned returns roughly equivalent to 98 times their initial investment. The standard deviation of DPI was 123.19, which quantifies the spread of the data around the mean. In contrast to data with a small standard deviation, which tend to cluster around the mean, data with a large standard deviation may encompass a wide range of values. The range for DPI in this particular data set was all the way from 0 to 809.80. The best 25% of the sample achieved a DPI of 1.28, while the worst 50% had a score of 60.00. Less than one-fourth of the funds had a DPI of less than 1.28, and more than half of the funds in the sample had a DPI that was less than 60.00. 75% of the funds in the study had a DPI that was less than 147.33, as indicated by the third quartile value of 75%.

The value of Distributions to Paid-In Capital (DPI) for each of the 3185 sampled funds was evaluated objectively. This was performed independently for ESG funds and non-ESG funds. There were a total of 379 ESG-funds that were analyzed, and their average

DPI ranged from 87.15 to 105.22. The deviation standard was 105.22. This would imply that there was a substantial amount of variation in the DPI scores of the various ESG-funds, with specific scores either exceeding or falling below the mean. The DPI values in this group varied significantly, with the lowest value being 0 and the highest value being 705.70. According to the quartiles, fifty percent of ESG funds had a DPI value of less than 2.37, and seventy-five percent had a value of less than 135.24.

There were a total of 246 non-ESG funds, with a mean value of 114.47 and a standard deviation of 145.31. This meant that there was minimal variation amongst the funds. The distribution of DPI values across non-ESG funds was strikingly comparable to that of ESG-funds, as seen by the candlestick chart.

There was substantial diversity in the DPI values of both ESG and non-ESG funds within the sample, with some values much higher and others significantly lower than the sample average. While the average DPI for both groups was almost identical, the range of values for ESG-funds was much larger, ranging from 0 to 705.70.
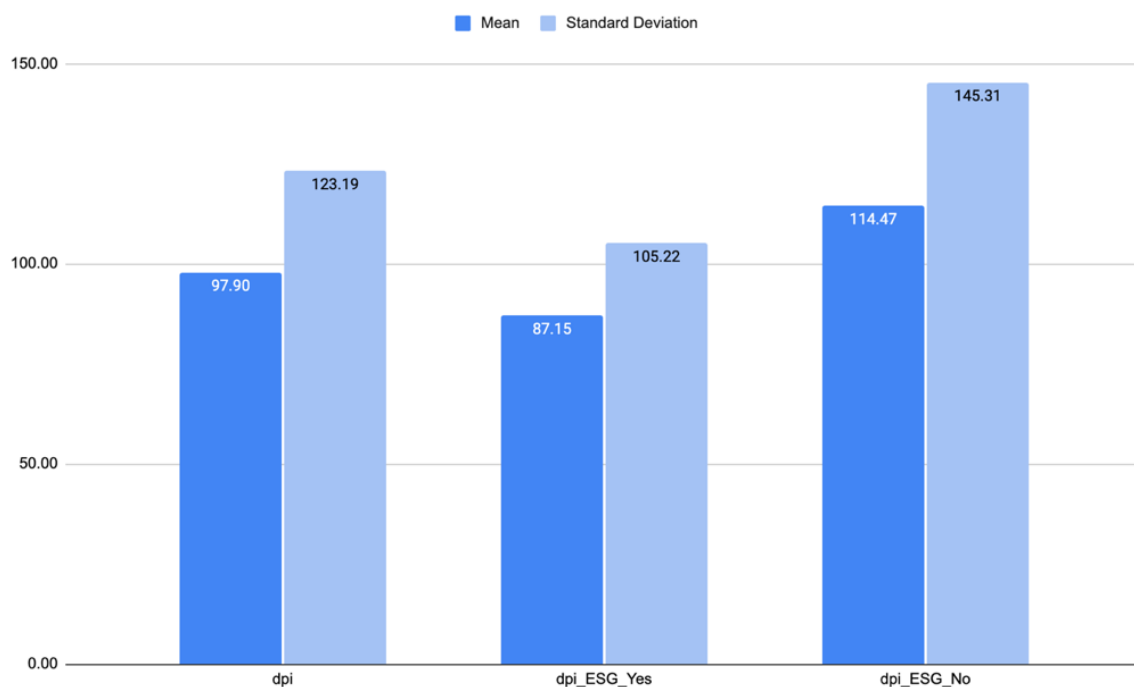
Figure 38 - Mean and Standard Deviation of the DPI variable, considering respectively the whole sample, the sample with only ESG funds, and the one with non-ESG funds
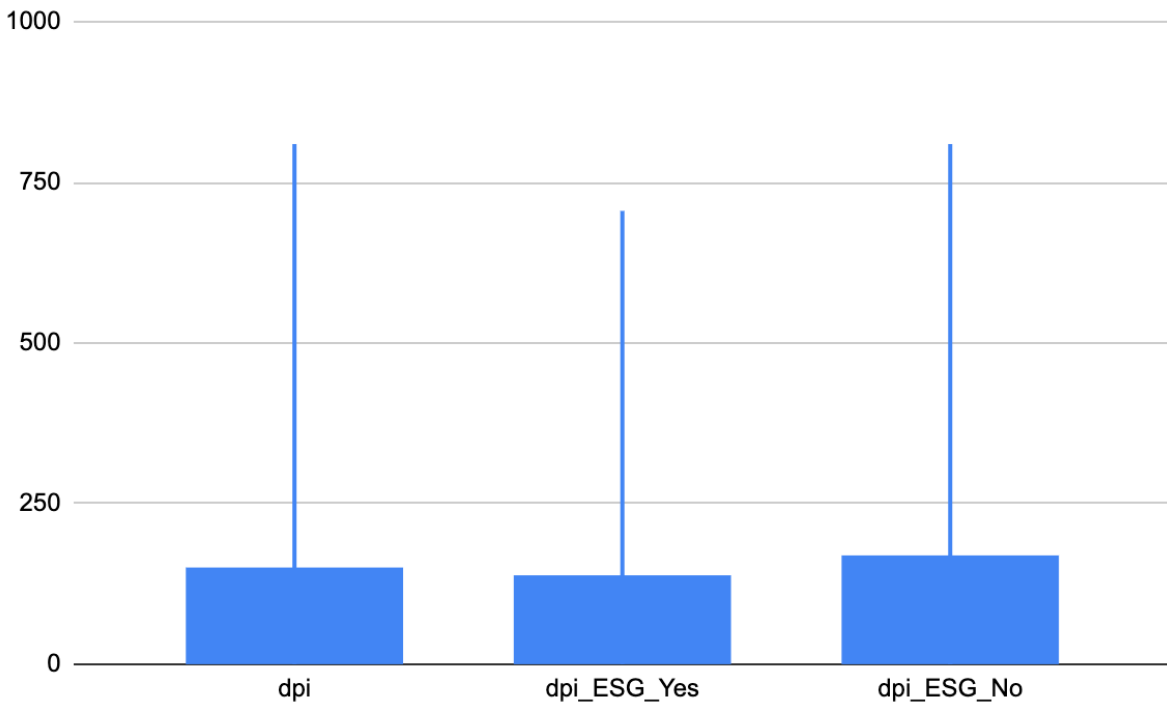
Figure 39 - Box plots of DPI variable and the 2 subset considering only ESG-Funds and Non-ESG-Funds

Before conducting statistical tests on the Distributions to Paid-In Capital (DPI), the sample was transformed by applying a logarithmic transformation. This transformation is often used to normalize the distribution of data and make it more robust, allowing for the construction of more reliable tests.

A QQ-plot of the DPI values for the whole sample revealed a non-normal distribution. In order to statistically test for differences in the distribution of DPI between the two subsets of the sample (i.e. non-ESG-funds and ESG-funds), a normality test was conducted. This test is used to determine whether the data follows a normal distribution, which is a common assumption in many statistical tests. The results of the normality test can help to determine which statistical test can be appropriately applied to the data.

The QQ-plot revealed a non-normal distribution for the DPI values of the whole sample. When considering only the two subsets of the sample (i.e. non-ESG-funds and ESG-funds), the QQ-plot still revealed a non-normal distribution. This suggests that the distribution of DPI values among both non-ESG-funds and ESG-funds deviated from a normal distribution. In order to statistically test for differences in the distribution of DPI between the two subsets, a normality test was conducted to determine which statistical test could be appropriately applied to the data.
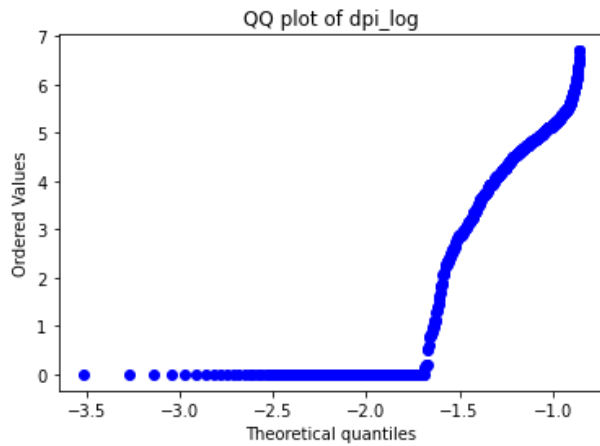
Figure 40- QQ plot of DPI variable, after applying the logarithmic transformation
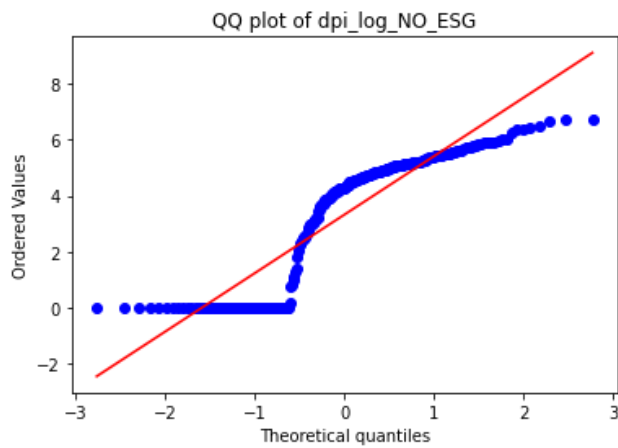
Figure 41 - QQ plot of DPI variable considering only Non-ESG Funds, after applying the logarithmic transformation
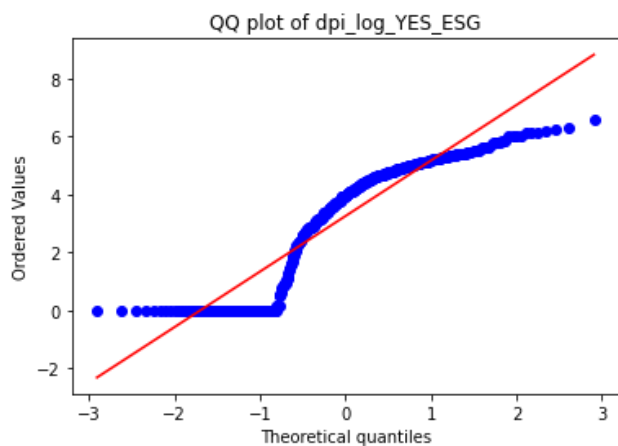
Figure 42 - QQ plot of DPI variable considering only ESG Funds, after applying the logarithmic transformation

The Shapiro-Wilk test was conducted on the Distributions to Paid-In Capital (DPI) values for the two subsets in order to assess the normality of the data using a quantitative approach. The results of the test indicated that the DPI values for both subsets (i.e. non-ESG-funds and ESG-funds) did not follow a normal distribution, as the p-values for both subsets were less than 0.05. This suggests that the distribution of DPI values among non-ESG-funds and ESG-funds was significantly different from a normal distribution. The test statistic, which is a measure of the deviation from normality, was relatively high for all three samples (i.e. the whole sample, non-ESG-funds, and ESG-funds). The test's results indicate that the Distributions to Paid-In Capital (DPI) values, as well as for the subsets of non-ESG-funds and ESG-funds, did not follow a normal distribution. The p-values for all three samples were less than 0.05, which is the threshold for statistical significance in many cases. The test statistic, which is a measure of the deviation from normality, was relatively high for all three samples. For the whole sample, the test statistic was 0.849, while it was 0.825 for non-ESG-funds and 0.859 for ESG-funds. These relatively high test statistics further support the conclusion that the DPI values for all three samples did not follow a normal distribution. Overall, these results suggest that the DPI values, as well as for the subsets of non-ESG-funds and ESG-funds, were significantly different from a normal distribution. This deviation from normality may have important implications for the interpretation of statistical tests conducted on the DPI values and should be taken into consideration when analyzing the results.

Based on the results of the Shapiro-Wilk test, it was agreed that it was only possible to conduct the Mann-Whitney U test on the data. The Mann-Whitney U test is a non-parametric statistical test that can be used to compare the distribution of two independent samples when the data does not follow a normal distribution. The Mann-Whitney U test was conducted on the DPI values for the two subsets of the sample (i.e. non-ESG-funds and ESG-funds). The results of the test were as follows: Statistic = 46183.5, p-value = 0.73. The p-value of 0.73 indicates that there was no significant difference in the distribution of DPI values between the two subsets. This suggests that the DPI values for non-ESG-funds and ESG-funds were not significantly different from each other.

6.8.5. RVPI

Using descriptive statistics, the ratio of a fund's Residual Value to Paid-in Capital (also known as RVPI) was studied for all 615 eligible funds. Overall, the sample had a mean RVPI of 72.4% and a standard deviation of 67.92%. Thus, the sample average RVPI was determined to be 72.40, and the standard deviation was estimated to be 67.92, indicating that the data is very volatile. The data set had a range of values, the lowest

of which was an RVPI of 0 and the highest of which was 625. This suggests that the sample was exposed to a wide range of RVPI values, from extremely low to extremely high, with some funds landing in the middle.

25 percent of the funds had RVPI ratings that were lower than the 2.65-point threshold for the first quartile. The median RVPI value that reflected the whole data set was 77.31. (the 25th percentile). In accordance with this criteria, fifty percent of the sampled funds had RVPIs lower than 77.31. 75 percent of the funds had an RVPI that was less than the median value of 112.15, which was the third quartile. Lower quartile RVPI values in the sample indicate those with the lowest values, whereas upper quartile RVPI values indicate those with the highest values.

In conclusion, the descriptive statistics presented here shed light on the RVPI-related performance of the selected funds. Despite the fact that the mean and standard deviation represent the average and dispersion of the data, the quartiles give insight into the sample's value distribution. It was discovered that the RVPI values span a wide range, as evidenced by the minimum and maximum values. With the aid of these statistics, you may find it easier to analyze the distribution of RVPI values among the funds in your sample and to make comparisons to other samples or benchmarks.

According to the Environmental, Social, and Governance (ESG) status of each individual fund, our sample was divided in half. The first subset, which consisted of ESG-funds, was characterized using the following descriptive information: There were 368 observations with a range from 0 to 418.37, a mean of 71.15, and a standard deviation of 63.76. The first quartile, which corresponds to the 25th percentile, had a value of 6.92, the second quartile, which corresponds to the 50th percentile, had a value of 75.1, and the third quartile, which corresponds to the 75th percentile, had a value of 418.37. According to these computations, the median RVPI for the ESG-funds subgroup was 71.15, with a wide range of potential values (as evidenced by the standard deviation of 63.76). We observed RVPI values between 0 and 418.37 for the whole sample. This suggests that the subgroup was exposed to a wide range of RVPI values, from very low to extremely high, with some funds falling anywhere in between. The quartiles indicate the distribution of RVPI values within the subset, with lower quartiles indicating smaller values and higher quartiles indicating bigger values. This is due to the fact that lower quartiles represent smaller values and higher quartiles represent larger values.

The following collection of descriptive data was also utilized to describe the second group, which was comprised of non-ESG-related funds: The minimum value is zero, the first quartile (the 25th percentile) is 0.28, the second quartile (the 50th percentile) is 87.4, the third quartile (the 75th percentile) is 115.61, and the maximum value is 625. The average was 74.27, while the standard deviation was 73.76. These data are comparable to those of the ESG-funds subset, as both have a mean RVPI of 74.26, a standard deviation of 73.76, and quartile values that suggest a comparable distribution

of RVPI values within the subset. In this instance, the range is identical to that of the ESG-funds subgroup, with equal minimum and maximum values.
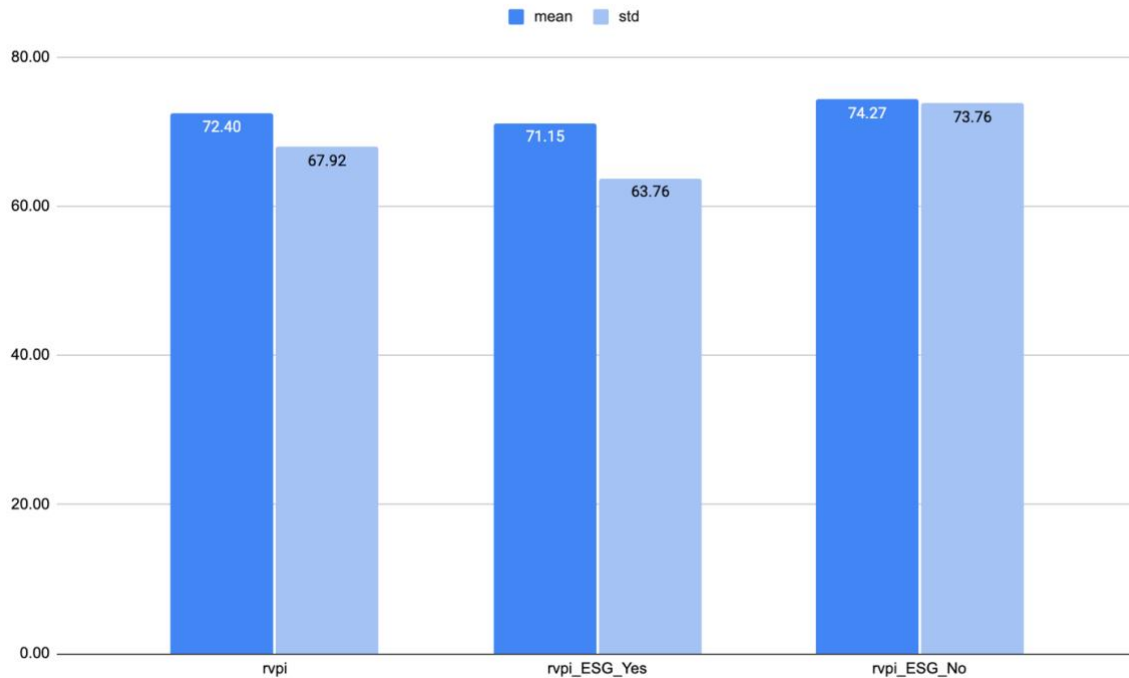
Figure 43 - Mean and Standard Deviation of the RVPI variable, considering respectively the whole sample, the sample with only ESG funds, and the one with non-ESG funds
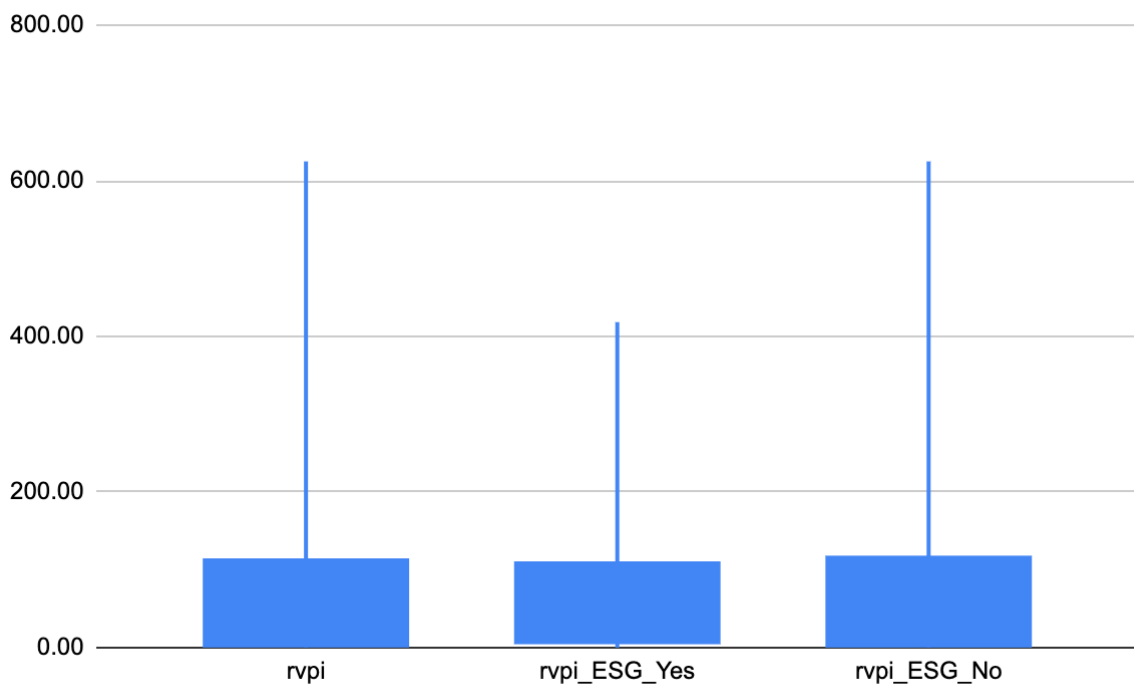
Figure 44 - Box plots of RVPI variable and the 2 subset considering only ESG-Funds and Non-ESG-Funds

The sample of Residual Value to Paid-In Capital (RVPI) data was logarithmically converted before statistical tests were run on the distribution of the RVPI values across the funds. This adjustment may provide for a more reliable sample by decreasing the weight given to outlying or otherwise extreme results. The reliability of statistical tests on data may be improved by expanding the sample size.

The sample-wide RVPI values show a non-normal distribution when shown on a QQ-plot. The quantiles of a data sample may be compared to the quantiles of a normal distribution using a graphical tool called a QQ-plot. On a QQ-plot, the points will cluster closely together if the data follows a normal distribution. In the absence of a normal distribution, the data points will diverge more sharply from the straight line. The sample RVPI values are not regularly distributed, as seen by the QQ-plot.

A normality test was performed to statistically demonstrate that the RVPI values within the two subsamples (i.e., non-ESG-funds and ESG-funds) did not follow the same distribution. The goal of this test was to establish whether or not the data follows a normal distribution so that an appropriate independence test could be selected to compare the two subsamples' distributions of RVPI values. The difference in the

distribution of the RVPI values between the two subsamples may be more precisely determined if the data's normalcy is known.
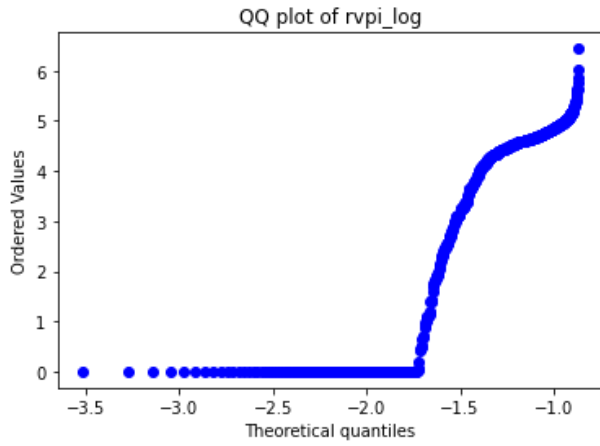
Figure 45 - QQ plot of RVPI variable, after applying the logarithmic transformation
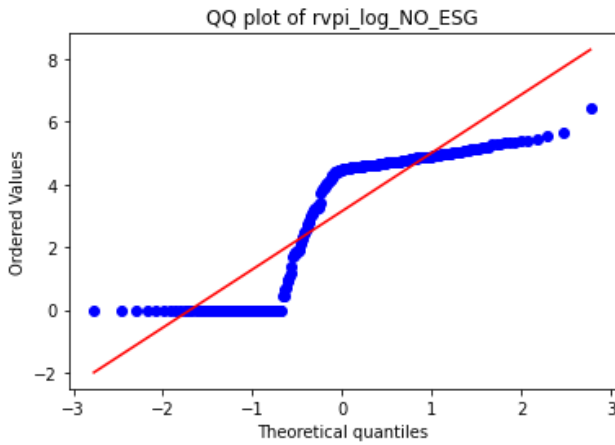
Figure 46 - QQ   plot of RVPI variable considering only ESG Funds, after applying the logarithmic transformation
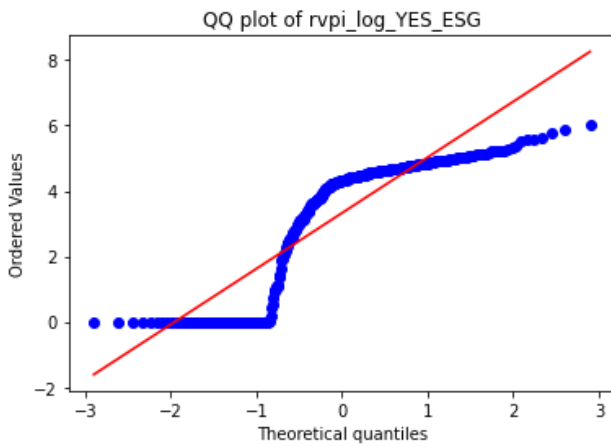
Figure 47 - QQ   plot of RVPI variable considering only ESG Funds, after applying the logarithmic transformation

Residual Value to Paid-In Capital (RVPI) values for the two subsamples of funds (ESG-funds and non-ESG-funds) continue to exhibit a non-normal distribution when shown on a QQ plot. A QQ plot is a graphical tool used to determine whether or not a sample of data follows a normal distribution. This is achieved by comparing the quantiles of the sample data to those of a normal distribution. If the data have a normal distribution, the points on the QQ-plot will seem to be aligned in a straight line. If the data are not regularly distributed, there will be a substantial amount of variation around the mean.

The QQ plot of the two subsamples of RVPI values still reveals a non-normal distribution, indicating that the RVPI values have a considerably non-normal distribution within the two subsamples. Due to the fact that so many statistical tests need the data to be normal, the tests that can be performed to compare the RVPI values between the two subsamples are limited. To examine the distribution of the RVPI value between the two subsamples, it may be required to use statistical tests that do not assume normality or to change the data so that it is more normally distributed. Both of these alternatives may be found in the following phrase.

ESG-funds and non-ESG-funds had their Residual Value to Paid-In Capital (RVPI) values analyzed using the Shapiro Wilk test to identify whether or not they correspond to a normal distribution. The Shapiro–Wilk test is one of the most frequent statistical processes used to determine whether or not a data sample follows a normal distribution. It operates on the idea that if a sample is drawn from a population with a normal distribution, then the sample's distribution will likewise be normal. Using the Shapiro-Wilk test, it is feasible to determine whether the RVPI values included inside the two subsamples adhere to a normal distribution.

The Shapiro–Wilk test offers both a statistical and a numerical estimate of the probability that an event will take place. The p-value quantifies the statistical significance of the statistic and measures the degree to which the data depart from the normal distribution. If the deviation's p-value is low, the data are likely not normally distributed. This occurs when the p-value is small.

The Shapiro Wilk test on the RVPI values for the whole pool of money generated a significance level of 0.00 and a statistic of 0.784. This suggests that the test's results are not statistically significant. This shows that the data are not distributed regularly and reflect a considerable departure from the expected value. Non-ESG fund RVPI values likewise deviated significantly from normalcy, as shown by a statistic of 0.778 and a p-value of 0.00. This suggested a statistically significant degree of significance. Similarly, the RVPI values for ESG-funds indicated a statistic of 78% and a p-value of 0.00, both of which indicate a substantial divergence from the norm. Taken as a whole, these statistics clearly suggest that neither the whole sample nor either of the two subsamples had a normal distribution of RVPI values. Due to the fact that so many statistical tests need the data to be normal, the tests that can be performed to compare the RVPI distribution between the two subsamples are limited.

The Residual Value to Paid-In Capital (RVPI) values are not normally distributed, as shown by the Shapiro Wilk test for both the total sample of funds and the two subsamples. This holds true for the whole sample of funds as well as the two subsamples (i.e. non-ESG-funds and ESG-funds). Owing to the non-normal distribution of the RVPI values within each subsample, non-parametric tests such as the t-test cannot be used to compare these values. Employing a non-normality-assuming statistical test, such as the Mann-Whitney U test, is one option that might be examined.

The Mann-Whitney U test is used to compare the means of two independent samples since it is a nonparametric test. As it is not reliant on the values of the raw data, but rather on the relative positions of the data, it may be used regardless of the researched distribution's form. We used the Mann-Whitney U test to assess whether there was a statistically significant difference between the RVPI value distributions of the non-ESG funds and ESG funds groups. Since the RVPI values in both subsamples did not follow a normal distribution, this was done.

The Mann-Whitney U test findings indicated that the statistic was 46183.5, and the p-value was 0.73. A higher statistic implies that the two samples are more distinct from one another, whilst a lower statistic suggests that the two samples are more comparable. A large p-value implies that the difference is not statistically significant, whereas a small p-value indicates that the difference is statistically significant. The p-value is used to assess whether the difference is statistically significant.

The significant p-value of 0.73 implies that there is no statistically significant difference between the RVPI values of the ESG-funds subsample and the subsample that does not include ESG funds. This indicates that there is little to no variation in the distributions of RVPI values in the two subsamples and that the respective means of the RVPI values in each subsample are likely identical.

7 Classification Algorithms

7.1. Classification goal

Classification algorithms that target the ESG status of funds while utilizing descriptive and performance variables as independent variables can help identify the factors that contribute to sustainable and responsible investing. The goal of these algorithms is to provide a clear understanding of the variables that have the most significant impact on a fund's ESG rating. The use of descriptive variables and performance variables can provide insight into a fund's overall sustainability and social responsibility. The algorithms can reveal which variables have the most considerable effect on the ESG status of funds, thereby aiding investors in identifying the most impactful factors when making investment decisions.

7.2. Model scouting

The goal of developing a grid search function was to maximize precision by adjusting the parameters of each model. As the model's precision relies on the chosen parameters, this stage of developing a machine-learning algorithm is critical. Using the grid search feature, we can search the parameter space thoroughly, testing how well various configurations of each model perform. This allows for the most accurate parameters to be chosen for the model.

To create a grid search, we use the hyperp search(classifier, parameters) function. For fine-tuning its hyperparameters, it employs the scikit-learn library's "GridSearchCV" technique, an implementation of cross-validation. The approach is implemented by using a classifier, and the grid search function takes the classifier's settings as input. For accuracy assessment, the function employs a 3-fold cross-validation technique. Accuracy is utilized as the scoring measure, and the best accuracy and the corresponding parameters are output by the function. The best model, the most precise estimator, is also returned by the function.

To sum up, the grid search function is a crucial component in the creation of machine learning programs. It aids in maximizing model accuracy by assisting in the optimization of model parameters. The grid search function used here is a thorough and effective tool for hyperparameter tweaking, which will boost the effectiveness of models employed in data analysis and prediction.

7.3.   Why maximize the accuracy

Accuracy is the optimum statistic to maximize when analyzing a fund's ESG status since it immediately demonstrates the model's ability to correctly forecast the ESG status based on the independent factors. In this setting, a fund's ESG status is strongly reliant on descriptive and performance-related independent elements. The purpose of accuracy maximization is to make the most exact forecasts feasible given the facts at hand. Because of its clarity and simplicity, accuracy is an important factor for evaluating a fund's environmental, social, and governance (ESG) performance.

Moreover, since ESG is so multifaceted, it may be difficult to get valid measures. A fund's ESG status may be influenced by a variety of factors, including the industry in which it operates, its location, and its management processes. The model's ability to analyze and account for these aspects is critical in establishing a fund's ESG position.

Finally, when evaluating a fund's ESG performance, the most crucial criterion to optimize is accuracy. The accuracy of the model, which shows the model's ability to make proper assessments of the dependance between the target and the independent variables, makes the model's performance clearly understandable. Moreover, ESG is a complex and multidimensional concept; maximizing accuracy ensures that the model takes into account all relevant factors when establishing a fund's ESG status.

7.4.   Classification algorithms' results

7.4.1. K-Nearest Neighbor

K-Nearest Neighbor (K-NN) is a supervised machine learning technique that is used for classification and regression tasks. The K-NN method classifies new examples in the feature space based on their closeness to the nearby training instances. In essence, the method evaluates the "k" training examples that are the closest to a new instance and classifies it based on the majority class among those "k" neighbors.

The K-NN method begins by determining how many closest neighbors, "k," will be examined for each subsequent occurrence. After "k" is determined, the method computes the distance in the feature space between the new instance and each of the training examples. Several metrics, such as Euclidean distance, Manhattan distance, and Minkowski distance, may be used to compute the distance. After calculating the distances, the method chooses the "k" closest neighbors and classifies the new instance based on the majority class among those neighbors.

While the K-NN technique is simple and straightforward to implement, it does have significant drawbacks. The approach is computationally intensive since it needs distance calculations for each new instance. Moreover, the method is sensitive to the value of "k" as well as the distance metric utilized. Selecting the appropriate "k" and distance measure is important to the algorithm's success. Lastly, outliers in the data may have a considerable influence on the categorization of new cases, therefore the K-NN method is sensitive to their existence.

A grid search algorithm was utilized to discover the best results among a range of "k" values ranging from 1 to 50 in order to establish the ideal number of closest neighbors (k) in the K-NN model. The grid search program determined that the optimal number of neighbors was 12, with an accuracy of 0.76.

Accuracy is a popular assessment statistic for classification tasks, defined as the ratio of accurate predictions to total number of cases. The accuracy of 0.764067 in this example implies that the K-NN model with 12 closest neighbors correctly predicted the class of 76.41% of the cases in the test set. This score is pretty high, indicating that the K-NN method with 12 closest neighbors is an excellent option for this classification task.

7.4.2. Decision Tree Classifier.

A prominent machine learning approach for handling classification issues is the decision tree algorithm. It is a tree-based model that recursively divides the data into smaller subsets based on the attributes that best distinguish the target classes. The procedure is repeated until a stopping requirement, such as establishing a minimum sample size or a specific degree of homogeneity in the target variable, is fulfilled.

The decision tree technique produces a tree-like structure, with each node representing a feature test, each branch representing a potential test outcome, and each leaf node representing a prediction for the target variable. The decision tree approach can handle both continuous and categorical variables and gives a clear, interpretable representation of the variables' links to the goal.

Since the goal variable is a dummy variable, and four of the seven independent variables are also dummies, the decision tree approach is well suited for our investigation. The algorithm can easily manage the categorical character of the data in such instances and determine the key correlations between the variables and the goal. Since the decision tree technique can capture non-linear correlations and interactions between variables, it is an effective tool for tackling difficult classification problems.

Moreover, the decision tree method has the benefit of being simple to understand and display. The resultant tree structure is a clear representation of the decision rules utilized by the model to produce predictions, making it simple to comprehend the rationale and explain the findings to others. The decision tree approach is also capable

of handling huge datasets and is reasonably quick, making it a viable and efficient option for tackling large-scale classification issues.

In order to generate the model, a decision tree algorithm needs certain parameters to be given. These factors have a significant impact on the model's accuracy and the interpretation of the findings. The following are some of the most significant parameters for a decision tree algorithm:

1. Maximum depth: This parameter controls the maximum depth of the tree and determines the complexity of the model. A deep tree with many splits can capture complex relationships in the data, but it may also lead to overfitting, where the model becomes too specific to the training data and loses its ability to generalize to new data. On the other hand, a shallow tree with few splits may not capture the complexity of the data, leading to underfitting and poor accuracy.

2. Minimum samples per leaf: This parameter controls the minimum number of samples that must be present in a leaf node in order for a split to occur. A higher minimum sample per leaf value will result in larger and fewer leaf nodes, which can reduce overfitting but may also reduce the ability of the model to capture complex relationships in the data.

3. Criterion: This parameter determines the method used to evaluate the quality of a split. Common criteria include Gini impurity and information gain. The choice of criterion can affect the interpretation of the results and the accuracy of the model.

4. Splitting algorithm: This parameter determines the algorithm used to select the best feature to split the data on at each node. Common splitting algorithms include greedy search, random search, and exhaustive search. The choice of splitting algorithm can affect the accuracy and efficiency of the model.

Adjusting these parameters may have a considerable influence on the decision tree model's accuracy and interpretability. A grid search algorithm may be used to identify the optimal combination of parameters for the provided data by searching through a range of parameter values. The optimal settings will be determined by trial and error based on the unique qualities of the data and the goal variable.

By looking through the following parameters, the grid search function was utilized to discover the optimal parameters for the decision tree algorithm: criteria, max depth, min samples split, min samples leaf, and min weight fraction leaf.

The criteria parameter gives the user the option of assessing the quality of a split using either entropy or the Gini index. Entropy and the Gini index are both used to assess the impurity or disorder of a collection of samples. The entropy criterion computes entropy as a measure of impurity, while the Gini index computes the likelihood of misclassifying a randomly selected element from the collection. Both strategies try to

reduce impurity in the ensuing splits, but their mathematical formulations vary somewhat and may result in distinct tree architectures.

The max depth option specifies the tree's maximum depth, which is the number of split levels from the root to the leaves. A deeper tree may capture more complicated associations in the data, but it may also result in overfitting, which occurs when the model becomes too particular to the training data.

The min samples split argument specifies the bare minimum of samples needed to split an internal node. A higher number results in bigger and fewer splits, lowering the danger of overfitting, but may also limit the model's capacity to capture complicated connections in the data.

The min samples leaf option specifies the minimum number of samples that must be present at a leaf node. A higher number results in bigger and fewer leaf nodes, which reduces the danger of overfitting but also limits the model's capacity to capture complicated connections in the data.

The min weight fraction leaf option specifies the weighted fraction of input samples that must be at a leaf node. This option gives you more control over the tree's size and intricacy.

These parameters enable fine-tuning of the decision tree algorithm and have a significant impact on the accuracy and interpretability of the results. To discover the optimal combination of parameters for the provided data, the grid search function looks across a range of values for each parameter.

The grid search function results suggest that the optimal parameters for the decision tree model are criterion: entropy, max depth: 6, min samples leaf: 6, min samples split: 18, and min weight fraction leaf: 0. With an accuracy of 0.77, the decision tree model can properly predict a fund's ESG status 76.66% of the time. Given the task's difficulty and the little information supplied, this is an excellent performance. The grid search function's settings are excellent for this assignment since they provide the best accuracy.

7.4.3. Logistic regression classifier

Logistic Regression is a statistical technique for assessing a dataset in which one or more independent factors influence the result. Given a collection of independent variables, it predicts a binary result (1 / 0, Yes / No, True / False). The term "regression" refers to the process of predicting a continuous dependent variable. Nevertheless, logistic regression is utilized when the dependent variable is binary.

The primary principle underlying Logistic Regression is to fit a regression line to the data to establish a link between the independent factors and the dependent variable. The line divides the data into two halves, one for each dependent variable result. The Decision Boundary is the line that divides the binary outcomes. The slope of the line

is determined by the coefficients of the independent variables, and a threshold value is added to the line to get the Decision Boundary.

Logistic Regression predicts the likelihood of a binary outcome using a function called the Logistic Function (also known as the Sigmoid Function). The logistic function returns a probability value between 0 and 1, which may then be thresholded to provide a binary result. The logistic function produces the probability by taking the input of the independent variables and the coefficients of the independent variables.

To improve the model, the grid search function was utilized to find the optimal value of the regularization parameter "C." According to the findings, the optimum value for "C" was 150, resulting in an accuracy of 0.74.

The grid search function aided in determining the best value for the 'C' parameter, which regulates the level of regularization in the logistic regression model. Regularization prevents overfitting by adding a penalty term in the loss function that discourages the model from overfitting the training data. The intensity of this regularization is determined by the value of 'C,' with smaller values signifying greater regularization.

Its accuracy is lower than the decision tree model's accuracy, indicating that logistic regression may not be as ideal for this specific dataset, which is mostly made up of dummy variables, including the target variable.

7.4.4. Support Vector Classification

Support Vector Classification (SVC) is a well-known and effective technique used in machine learning and data analysis. This approach is very beneficial for studying the link between dependent and independent variables, as is the case in our example, where we want to discover the association between descriptive factors, performance metrics, and a fund's ESG status.

SVC has the virtue of being able to handle complicated and non-linearly separable data, making it an excellent option for our investigation. To divide the data into two classes, the method employs a hyperplane as a decision boundary. The hyperplane is set such that it optimizes the margin, or distance between the closest data points from each class, resulting in the best separation between the two classes.

The descriptive data and performance metrics will be the independent variables in our research, while the fund's ESG status will be the dependent variable. SVC successfully captures the link between these factors, even if they are not linearly separable, and may assist us in developing a robust model that reliably forecasts a fund's ESG status.

Moreover, SVC allows us to include domain knowledge into the model-building process by defining unique kernel functions that may be utilized to represent the

particular connection between the variables in our research. This may lead to greater model performance and more accurate outputs.

To maximize the performance of the SVC algorithm, numerous hyperparameters must be tuned. These settings may have a major influence on the model's accuracy. In this scenario, the grid search was carried out among the following hyperparameters:

- "kernel": This parameter defines the type of kernel used to perform the SVC. The two options in this case are "rbf" (Radial Basis Function) and "poly" (Polynomial). The choice of kernel determines the shape of the decision boundary, affecting the model's ability to separate the classes.
- "degree": In case the "poly" kernel is selected, this parameter defines the degree of the polynomial. In this case, the grid search considers degrees from 1 to 7.
- "gamma": This parameter determines the shape of the decision boundary for the radial basis function. The gamma value controls the influence of individual training samples in determining the decision boundary. Larger gamma values will result in a tighter boundary, which may lead to overfitting, whereas smaller values may lead to underfitting.
- "C": This is a regularization parameter that controls the trade-off between achieving a low training error and a low testing error. A smaller value of C results in a wider margin and allows for more instances to be classified as support vectors, while a larger value will result in a smaller margin and fewer support vectors.

The support vector classifier model was applied using grid search, which explores a combination of different parameters to find the optimal set of parameters that maximizes the model's accuracy. The grid search algorithm found the set of parameters that gave the highest accuracy, which was 0.778745, using {'C': 9, 'degree': 2, 'gamma': 1, 'kernel': 'poly', 'max_iter': 200000}.

The 'C' parameter represents the cost of misclassification, and a smaller value of 'C' indicates a higher cost of misclassification. In this case, the optimal value found for 'C' was 9, ranging it from 10E-4 to 10E+4. The 'degree' parameter refers to the degree of the polynomial kernel function and the optimal value found was 2. The 'gamma' parameter controls the shape of the decision boundary in the model and a smaller value of gamma creates a more flexible boundary, while a larger value of gamma creates a more rigid boundary. In this case, the optimal value found for 'gamma' was 1. The 'kernel' parameter defines the type of function used to separate the data into classes, and the optimal value found was 'poly'. Finally, the 'max_iter' parameter sets a limit on the number of iterations for the solver to converge, and the optimal value found was 200000.

The results suggest that the support vector classifier model with these parameters is capable of accurately classifying the ESG status of a fund, with an accuracy of 77.87%.

7.4.5. Multi-layer Perceptron classifier

The Multi-layer Perceptron (MLP) is a sort of artificial neural network that is commonly utilized for different classification and regression tasks in machine learning. It is based on the structure of the Perceptron algorithm, although it can handle more complicated input-output interactions.

An MLP is made up of three layers: an input layer, one or more hidden layers, and an output layer. The input layer receives data and sends it to the hidden layer (s). The data is processed by the hidden layer(s), which generates a collection of intermediate outputs that are then passed on to the output layer. The output layer computes the final output using the intermediate outputs and network settings.

Each buried layer node represents a linear combination of inputs with associated weights. To generate an output for each node in the hidden layer, the activation function is applied to the sum of the weighted inputs. The sigmoid, tanh, and ReLU functions are common activation functions in MLPs.

An optimization approach, such as gradient descent or stochastic gradient descent, is used to learn the weights in the MLP from the training data. Throughout the training phase, the network changes the weights to ensure that the output generated by the network is as near to the genuine output as feasible. This procedure is continued until the network achieves convergence, which occurs when the weights no longer vary substantially in response to the training data.

MLPs have the benefit of being able to manage non-linear correlations between inputs and outputs, making them useful for a broad variety of classification and regression problems. MLPs may also be trained on vast quantities of data and deliver very accurate results. Another feature of MLPs is their ability to handle complicated data, such as high-dimensional data and multi-class issues, making them a popular option for numerous machine learning applications.

MLPs can capture complicated interactions between inputs and outputs and create reliable predictions in the context of examining the reliance between descriptive data and a fund's performance metrics and ESG status.

MLP classifiers have the capacity to describe complicated connections in data, have excellent prediction accuracy, and can handle a huge number of input characteristics. Moreover, MLP classifiers may be trained using a variety of optimization strategies and can deal with missing data in the training set.

For assessing the relationship between descriptive data and a fund's performance metrics and ESG status, the MLP classifier may be a better alternative than other classification methods. This is due to the fact that a fund's ESG status is impacted by a variety of variables, some of which are non-linear in nature. Moreover, descriptive variables and performance metrics might be highly inter-related, necessitating the use of a more sophisticated model to capture such complicated interactions. The capacity

of the MLP classifier to handle non-linear connections makes it an appropriate option for this kind of investigation.

In the case of our classification challenge, the MLP is especially well-suited to dealing with dummy variables, which make up the majority of our database. This is because the MLP can handle non-linear interactions between input and output variables. In the case of dummy variables, these connections may frequently be complicated, since there may be interactions between distinct variables that typical linear models cannot simply capture.

Moreover, MLPs can handle a high number of input variables, which is commonly the case with datasets that are predominantly made up of dummy variables. The network may learn intricate correlations between these variables and the target variable, enabling it to predict the target variable correctly based on the input variables' values.

Overall, the MLP classifier has multiple benefits in our classification problem, making it a useful tool for examining the relationship between descriptive characteristics, performance metrics, and a fund's ESG status.

To determine the optimal parameters for the Multi-layer Perceptron (MLP) classifier, the grid search approach was utilized. The grid search looked at various combinations of the following factors.:

1. **hidden_layer_sizes**: This is a tuple representing the number of neurons in each hidden layer of the MLP. In this case, the grid search will try different combinations of layer sizes ranging from 3 to 100 neurons per layer. Grid search function has been sought among different ranges and different numbers of layes.

2. **activation**: The activation function to be used by the neurons in the hidden layer. In this case, the grid search will try both the **relu** and **logistic** activation functions.The activation function in a neural network determines the output of a neuron given an input or set of inputs. The Rectified Linear Unit (ReLU) activation function is a piecewise linear function that returns the input if it is positive, and 0 if it is negative. This activation function has become popular in recent years due to its ability to alleviate the vanishing gradient problem in deep networks, where the gradients become very small as they are backpropagated through many layers. The logistic activation function, on the other hand, is the sigmoid function, which maps any input to a value between 0 and 1. This activation function is often used in the output layer of binary classification problems, as it represents a probability of an observation belonging to a certain class. The choice of activation function is a crucial component in the architecture of a neural network, and the performance of the network can be significantly affected by the choice of activation function.

3. **batch_size**: The number of samples used in each iteration of the optimization algorithm. In this case, it is set to **auto**, meaning that the batch size will be automatically chosen based on the size of the training data.
4. **solver**: The optimization algorithm used to train the MLP. In this case, it is set to **lbfgs**, It stands for Limited-memory Broyden-Fletcher-Goldfarb-Shanno, which is a type of quasi-Newton optimization algorithm. The "lbfgs" solver uses an approximation of the inverse of the Hessian matrix to efficiently update the weight values in the network during the training process. This method is particularly well-suited for training MLP networks, as it can handle large amounts of data, is relatively fast and efficient, and often produces good results. When using the "lbfgs" solver, it is important to choose appropriate values for the "tol" and "max_iter" parameters to ensure that the optimization algorithm converges to an appropriate solution in a reasonable amount of time.
5. **tol**: The tolerance for stopping the optimization, defined as the relative change in the loss function. In this case, it is set to 0.001.
6. **max_iter**: The maximum number of iterations the optimization algorithm will run before stopping. In this case, it is set to 5000.
7. **alpha**: The regularization parameter, which is used to control the complexity of the model and prevent overfitting. In this case, the grid search will try values of 0.001, 0.1, and 10 for this parameter.

The accuracy of the grid search using the Multi-layer Perceptron (MLP) classifier on the database is 77.36%. The best grid search settings were 'activation':'relu,' 'alpha': 10, 'batch size': 'auto,' 'hidden layer sizes': (10, 10, 10),'max iter': 5000,'solver': 'lbfgs,' and 'tol': 0.001.

In MLP, 'Alpha' refers to the regularization parameter. A high alpha number leads to more regularization and a simpler model, while a low alpha value leads to less regularization and a more complicated model. The figure of 10 utilized in this result indicates that regularization is strong.

When the batch size parameter is set to 'auto,' the batch size is decided by the solver, in this instance 'lbfgs'. The solver 'lbfgs' is an optimization technique used to address the optimization issue in MLP. It stands for limited-memory Broyden-Fletcher-Goldfarb-Shanno. It is a quick and resilient optimization approach that is well-suited for optimization problems with high-dimensional search spaces.

The parameter hidden layer sizes (10, 10, 10) indicates that the MLP has three hidden layers, each having ten neurons. The number of neurons in each hidden layer may have a significant impact on the model's performance. Overfitting may occur when there are too many neurons, and underfitting occurs when there are too few neurons.

The maximum number of iterations'max iter' of 5000 indicates that the optimization process will run no more than 5000 times in order to identify the optimum solution.

With a tolerance of 0.001, the optimization method will terminate when the change in the objective function is less than 0.001.

In conclusion, the MLP classifier results reveal that the optimum parameters result in an accuracy of 0, which is an excellent performance for the classification task. The activation function'relu' and solver 'lbfgs' that are used may result in a quicker and more robust optimization process, whilst a high regularization parameter and a modest number of neurons in each hidden layer can avoid overfitting and lead to a more generalizable model.

7.4.6. Random forest

Random Forest Classifier is a decision tree-based ensemble learning technique. It generates a huge number of trees, often hundreds or thousands, then aggregates their output. The method works by building each decision tree on a random sample of the data, and then combining the findings of the trees to generate the final prediction. As compared to single decision tree models, this leads in a more robust and less prone to overfitting classifier.

One of the Random Forest Classifier's primary benefits is that it handles missing values and outliers effectively, making it an excellent option for datasets with such concerns. It also includes a measure of feature relevance, which helps users understand which factors are the most relevant predictors of the target variable. The classifier is also quite adaptable, since it can be used to solve both binary and multiclass classification problems.

Another benefit of the Random Forest Classifier is its ease of usage, which may typically be achieved with just a few lines of code. It is also a fast method, making it appropriate for huge datasets and high-dimensional issues. It is also a highly interpretable model, making it an excellent candidate for situations in where knowing the model's workings is critical.

Random Forest Classifier excels at handling datasets with a large number of dummy variables, which is common in many real-world datasets. One of the Random Forest Classifier's benefits is its ability to handle categorical data successfully. Categorical variables, commonly known as dummy variables, have a limited set of potential values. They are often employed in statistical models to represent group membership or to capture the impacts of non-quantifiable factors.

When dealing with datasets that are predominantly made up of dummy variables, it is critical to ensure that the classifier can properly handle them. Random Forest Classifier does this by handling missing values and creating decision trees based on subsets of the data. This enables the classifier to account for non-linear correlations between descriptive factors, performance metrics, and a fund's ESG status.

Additionally, Random Forest Classifier can cope with multicollinearity, a prevalent issue in datasets with a large number of dummy variables. The occurrence of significant correlation between two or more predictor variables is referred to as multicollinearity, and it may pose issues in regression analysis by resulting in unstable and unreliable conclusions. The Random Forest Classifier may manage multicollinearity by examining just a portion of the available predictors in each split, decreasing the model's effect. It is a strong tool for assessing the relationship between descriptive factors, performance metrics, and a fund's ESG status, particularly when dealing with datasets that are mostly made up of dummy variables. Random Forest Classifier gives robust and trustworthy results because to its capacity to tolerate missing data, multicollinearity, and non-linear correlations, making it a perfect solution for this sort of classification issue.

The RandomForestClassifier classifier algorithm is being optimized using a grid search method with the following parameters:

1. n_estimators: The number of trees in the forest. This parameter determines the size of the Random Forest model. The values being considered are 50, 100, 150, and 160.
2. criterion: The function to measure the quality of a split. The two criteria being considered are entropy and gini.
3. max_depth: The maximum depth of the tree. The tree will stop growing once it reaches the maximum depth. The values being considered range from 2 to 100.
4. min_samples_split: The minimum number of samples required to split an internal node. The values being considered range from 2 to 10.
5. min_samples_leaf: The minimum number of samples required to be at a leaf node. The values being considered range from 2 to 10.

These parameters are critical in determining the ideal hyperparameters for the Random Forest Classifier, and the grid search technique will utilize them to discover the best combination that optimizes the model's accuracy.

The grid search investigated several parameter combinations such as the number of estimators, the criteria for dividing the data, the maximum depth of the trees, the least number of samples necessary to divide a node, and the minimum number of samples required to be at a leaf node. The grid search looked at a variety of values for each parameter to find the ideal combination that would provide the greatest accuracy.

The grid search results revealed that a criteria of gini, a maximum depth of 50, a minimum number of samples necessary to split a node of 5, a minimum number of samples required to be at a leaf node of 2, and 50 estimators were the optimum parameters for the Random Forest Classifier. These factors yielded an accuracy of 77.43%, showing that it is a viable tool for examining the relationship between descriptive characteristics, performance metrics, and a fund's ESG status.

7.4.7. AdaBoost Classifier

In the field of machine learning, one well-known method of boosting is called AdaBoost, which is an abbreviation for adaptive boosting. The process of "boosting" is an efficient way to combine a number of less accurate classifiers into a single more accurate one. In order to construct a powerful classifier that does well on a specific classification test, AdaBoost trains a series of weak classifiers, each of which corrects the faults of the one that came before it.

AdaBoost achieves its results by repeatedly training weak classifiers, with each training iteration concentrating on examples that were misclassified by the previous training classifier. The algorithm provides each sample with a weight, which defines the sample's significance in the subsequent iteration of the process. Samples that were unsuccessfully classified by the previous classifier are assigned a higher weight, whereas samples that were successfully classified are assigned a lower weight. The ultimate classifier is produced by combining the forecasts of all of the less reliable classifiers and assigning each forecast a relative importance based on how well it predicts.

When the underlying data is complicated and cannot be simply categorized into two or more groups, AdaBoost is a very helpful tool. This method can deal with noisy input and can handle linear as well as non-linear data distributions. In addition, it can handle both. In addition, AdaBoost is able to deal with unbalanced datasets, which are those in which the number of samples belonging to one class is significantly higher than the number of samples belonging to another class.

A variety of fundamental classifiers, such as decision trees, k-nearest neighbors, and support vector machines, are all compatible with AdaBoost's application. Because it has such a significant bearing on the overall performance of the final classifier, the choice of the base classifier is an extremely important one.

In the first attempt, the AdaBoost algorithm used the RandomForestClassifier as its primary classifier. This was done in order to maximize accuracy. The RandomForestClassifier is a method of ensemble learning that begins by generating a large number of decision trees and then combines the results of these trees to form a conclusive forecast. The decision trees are built by first selecting at random a subset of the characteristics and samples, and then building a decision tree based on the characteristics and samples that were chosen for the subset. This helps classifiers be less susceptible to overfitting and more reliable overall.

Before using the RandomForestClassifier as the basis classifier for the AdaBoost method, a grid search was carried out in order to determine the optimal RandomForestClassifier parameters. This was done in order to maximize the accuracy of the classification. During the grid search, the parameters n estimators, criteria, maximum depth, minimum samples split, and minimum samples leaf were looked for.

The behavior of the RandomForestClassifier is controlled by these parameters, and choosing the appropriate values for these parameters has the potential to significantly improve the model's performance.

After determining which RandomForestClassifier parameters worked best, those parameters were used as the foundation for the AdaBoost method's basic classification strategy. After that, the grid search was performed once more, this time on the parameters labeled "n estimators" and "algorithm." Within the range of 0 to 1000, the 'n estimators' option was investigated in ten-point increments. This parameter is responsible for determining the number of base classifiers that are incorporated into the AdaBoost method. In the field labeled "algorithm," a search was conducted to find the values "SAMME" and "SAMME.R." This parameter is responsible for determining the fundamental mathematical operations that are performed by the AdaBoost method. When using the 'SAMME' method, the weights are dispersed in a discrete fashion, whereas when using the 'SAMME.R' algorithm, the weights are dispersed in a continuous fashion.

In conclusion, the grid search was utilized not once but twice throughout this investigation. The initial grid search was carried out in order to locate the most effective settings for the RandomForestClassifier. During the second grid search, the RandomForestClassifier that had the most successful parameter combinations was utilized as the basis classifier in order to locate the AdaBoost method's optimal parameter combinations. The performance of the AdaBoost algorithm can be significantly improved by selecting the appropriate values for the parameters in a thoughtful and deliberate manner.

The results of the grid search for the RandomForestClassifier, which is the base estimator, revealed that the optimal parameters for this classifier were as follows: criterion: entropy, max depth: 14, min samples leaf: 3, min samples split: 6, and n estimators: 160. These parameters were used during the training of the RandomForestClassifier, and the accuracy that was achieved was 76.85%.

The RandomForestClassifier that had been obtained in the past was used as the basis estimator while the AdaBoostClassifier was put through a second grid search. Within the context of this grid search, the terms "algorithm" and "n estimators" were looked for. The 'algorithm' parameter was hunted for the values 'SAMME' and 'SAMME.R,' while the 'n estimators' parameter was hunted for values ranging from 0 to 1000, with increments of 10. Searches were conducted for both parameters. The parameters 'algorithm': 'SAMME.R' and 'n estimators': 20 provided the best results when used with the AdaBoostClassifier. When the AdaBoostClassifier was trained with these parameters, the level of accuracy that could be achieved was 0.743895.

It is important to point out that the accuracy of the RandomForestClassifier was significantly higher than that of the AdaBoostClassifier. This result may imply that the

AdaBoostClassifier is not the best solution for this classification problem, and that alternative machine learning methods or alternative AdaBoostClassifier setups should be investigated instead.

After that, the Support Vector Classifier (SVC) was utilized in order to serve as the basis estimator for the AdaBoost algorithm. A grid search was performed on the SVC in order to identify the parameters that should be adjusted for optimal performance. As a proposal, the results of an earlier grid search were applied only to the SVC. The words 'kernel,' 'C,' 'degree,' 'gamma,' and 'shrinking' were among those that were searched for as parameters. After completing the grid search, the highest accuracy score was used to determine which parameters should be used for the optimal solution.

After determining which values for the SVC parameters were the most accurate, those values were put to use as the basis estimator for the AdaBoost method. The grid search was carried out once more, this time focusing on the n estimators and algorithm parameters of the AdaBoost method. When compared to previous efforts, the number of estimators has been decreased in order to bring the computational cost of the grid search down to a more manageable level. We tested the n estimators option with values ranging from 15 to 30, with 1 point increments. The algorithm parameter was evaluated in comparison to the values "SAMME" and "SAMME.R." It is possible that the performance of the model can be significantly improved by selecting appropriate values for the parameters that govern the underlying mathematical computations that are used in the AdaBoost method.

The findings of two grid searches, one on the base estimator (Support Vector Classifier (SVC)) and one on the parameters of the AdaBoost classifier, showed that the optimal parameters for the SVC were a C value of 830 and a radial basis function (rbf) kernel with a maximum iteration of 200000. These parameters were determined based on the results of the base estimator grid search and the AdaBoost classifier grid search. The accuracy of the results obtained from the grid search performed on the SVC was 74.39%.

The grid search performed on the AdaBoost classifier parameters, on the other hand, found that the best results were obtained by using the 'SAMME.R' method and a base estimator of None, along with 25 estimators. This was the conclusion reached by the grid search. It was determined that the AdaBoost classifier, when used with these settings, had an accuracy of 74.61%.

According to these findings, the AdaBoost classifier, when used with the settings that were provided, performed better than the previous model.

7.4.8. Gradient Boosting Classifier

The Gradient Boosting Classifier is an effective machine learning algorithm that is a member of the boosting algorithm family. Boosting is a method that takes several less

robust models and combines them into a single more robust model. This method was initially developed to circumvent the shortcomings of straightforward decision tree models; however, since its inception, it has found widespread use in numerous machine learning and data analysis applications of varying kinds. The Gradient Boosting Classifier is an advancement on the original boosting algorithm and has been demonstrated to be a very successful model in a variety of settings. It can be used to improve classification accuracy.

The Gradient Boosting Classifier is put to use by first building a sequence of decision trees, with each tree in the sequence attempting to rectify the errors that were caused by the tree that came before it. The algorithm begins by first fitting a basic decision tree to the data, and then it proceeds to evaluate the residuals, which can be defined as the difference between the actual values that were collected and the predictions that were generated by the decision tree. After that, the residuals are utilized in the fitting process for a second decision tree, which makes an attempt to predict the residuals and adds that information to the prediction made by the initial tree. This procedure is carried out an infinite number of times, with each successive tree attempting to rectify the errors produced by the trees that came before it. The ultimate prediction is arrived at by adding up the estimates provided by each of the trees that comprised the series.

A gradient descent optimization technique is utilized by the Gradient Boosting Classifier in order to achieve the goal of minimizing the loss function. The loss function is a way of representing the disparity between the values that have been observed and those that have been predicted by the model. The goal of the algorithm is to find the best possible combination of decision trees that will result in the lowest possible loss. It does this by minimizing the loss function. Finding the optimal parameters for the model in a way that is both computationally and mathematically efficient is the goal of the gradient descent optimization technique.

It is possible that using the Gradient Boosting Classifier to conduct an investigation into the relationship that exists between descriptive variables and performance measurements and the ESG (environmental, social, and governance) status of a fund is a useful strategy for a number of reasons.

To begin, the Gradient Boosting Classifier is a robust algorithm for machine learning that has the capacity to manage complex non-linear relationships between variables. This algorithm is able to capture the intricate relationships between these variables, which can help identify the key drivers of fund performance and ESG status when it is applied to the context of analyzing the dependence between descriptive variables and performance measurements and the ESG status of a fund. This analysis is conducted in the context of determining how the ESG status of a fund depends on the descriptive variables and performance measurements.

Second, the Gradient Boosting Classifier is capable of managing large datasets that contain multiple variables, which makes it an ideal instrument for conducting large-

scale analyses of financial data. The Gradient Boosting Classifier's capacity to effectively process this data is becoming increasingly valuable as the number of descriptive variables and performance measurements associated with funds continues to grow.

Last but not least, the Gradient Boosting Classifier has a high degree of adaptability and can have its performance enhanced by adjusting a number of hyperparameters. Because of this capability to fine-tune the model, it is possible to tailor the analysis to the particular needs and requirements of the fund analysis task that is currently being performed.

In conclusion, applying the Gradient Boosting Classifier in order to conduct an analysis of the dependence between descriptive variables and performance measurements and the ESG status of a fund can provide valuable insights into the primary drivers of both fund performance and ESG status. A useful instrument for conducting this kind of analysis is an algorithm that, in addition to being able to manage complicated relationships and large datasets, can also be improved in terms of its performance.

A grid search was carried out over a group of parameters in order to locate the GradientBoostingClassifier settings that produced the best results in terms of accuracy. Within the context of the grid search, some of the parameters that were investigated were referred to as "n estimators," "learning rate," "random state," and "max depth."

The number of trees in the forest is reflected by the value of the "n estimators" parameter. It was searched over the values 20, 50, 70, 100, and 200 in an effort to find the number of trees that strikes the best possible balance between accuracy and computational efficiency.

It is up to the "learning rate" parameter to figure out how much each tree should contribute to the overall prediction. It was searched over the values 0.1, 0.5, 1, and 2, with the goal of finding the learning rate that enables the model to effectively capture the relationships in the data while avoiding overfitting. This was accomplished by searching over these values.

The "random state" parameter is a random seed that is used to guarantee that the results can be reproduced accurately. It was zeroed out so that the findings from this experiment can be reliably replicated in any future investigations.

The "max depth" parameter, which is the last one, represents the maximum number of nodes that can be found in a single tree. It was searched over the values 1 and2, with the objective of locating the maximum depth that offers the best possible balance between accuracy and interpretability. The risk of the model overfitting to the training data is mitigated by placing a cap on the maximum depth to which the trees can expand.

The accuracy of the GradientBoostingClassifier was determined to be 0.762606 thanks to the grid search that was applied to it. Based on these findings, it appears that the GradientBoostingClassifier is capable of correctly classifying the variable that is dependent on it with an accuracy of 76.26%.

It was discovered that the values 0.5 for the 'learning rate' parameter, 2 for the 'max depth' parameter, 70 for the 'n estimators' parameter, and 0 for the 'random state' parameter gave the model the best results.

The step size at which the model corrects itself based on the feedback it receives from its previous iteration is determined by the learning rate parameter. If you have a value of 0.5, it means that the model is learning at a pace that is neither too fast nor too slow; it is just right in the middle.

The max depth parameter allows for the maximum number of levels to be built into the decision tree to be specified. In this instance, a value of 2 indicates that the decision tree consists of two levels, which results in decision boundaries that are not overly complicated.

The number of trees that are going to be constructed in the forest is indicated by the n estimators parameter. If there is a value of 70 trees, it means that the model is taking into account the conclusion reached by those 70 trees as a group.

Lastly, the random state parameter is used to set the seed for the random number generator so that the results can be reproduced.

According to the findings presented here, the GradientBoostingClassifier with a learning rate of 0.5, a maximum tree depth of 2, and 70 trees yields the most accurate predictions.

Collection of results:

- **KNN**: Accuracy: 0.764067 using {'n_neighbors': 12}
- **Decision tree**: Accuracy: 0.766640 using {'criterion': 'entropy', 'max_depth': 6, 'min_samples_leaf': 6, 'min_samples_split': 18, 'min_weight_fraction_leaf': 0}
- **Logistic regression**: Accuracy: 0.742431 using {'C': 10000000, 'max_iter': 1000000}
- **SVC**: Accuracy: 0.778745 using {'C': 9, 'degree': 2, 'gamma': 1, 'kernel': 'poly', 'max_iter': 200000}
- **MLPClassifier**: Accuracy: 0.773608 using {'activation': 'relu', 'alpha': 10, 'batch_size': 'auto', 'hidden_layer_sizes': (10, 10, 10), 'max_iter': 5000, 'solver': 'lbfgs', 'tol': 0.001}
- **Random Forest Classifier**: Accuracy: 0.774344 using {'criterion': 'gini', 'max_depth': 50, 'min_samples_leaf': 2, 'min_samples_split': 5, 'n_estimators': 50}

- **AdaBoostClassifier_using_SVC**: Accuracy: 0.746093 using {'algorithm': 'SAMME.R', 'base_estimator': None, 'n_estimators': 25}
- **AdaBoostClassifier_using_RandomForest**: Accuracy: 0.743895 using {'algorithm': 'SAMME.R', 'base_estimator': None, 'n_estimators': 20}
- **GradientBoostingClassifier**: Accuracy: 0.762606 using {'learning_rate': 0.5, 'max_depth': 2, 'n_estimators': 70, 'random_state': 0}

7.4.9. Results Interpretation

The preceding algorithms' findings reveal that the Support Vector Classifier (SVC), Random Forest Classifier (RFC), and Multi-layer Perceptron Classifier (MPC) are the best algorithms for capturing the link between an ESG status and its attributes. SVC had the greatest accuracy of 77.87%, followed by RFC with a 77.43% accuracy and MPC with a 77.36% accuracy.

Although SVC had the best accuracy, it did not give information about the relative relevance of model components. This makes understanding the fundamental elements that impact a fund's ESG rating challenging. The Random Forest Classifier, on the other hand, not only offers equivalent accuracy but also gives a way of analyzing the findings. This makes it an appealing alternative for determining the relevance of features. The findings of this investigation will be helpful in developing a better understanding of the elements that influence a fund's ESG status.

Understanding the determinants of a fund's Environmental, Social, and Governance (ESG) status requires determining the relevance of the elements. The feature importance of the model and the Shapley values will be employed in this study to assess the link between the ESG status and its attributes.

The model's feature significance may be calculated by examining the weights assigned to each feature by the machine learning algorithm. The Random Forest Classifier was utilized in this situation, and the feature importances may be derived by examining the average feature importances over all decision trees in the ensemble. This will offer an insight of which characteristics are most relevant in predicting the ESG status.

Shapley values will be used to determine feature importances in addition to the model's feature importances. The Shapley values are a technique for evenly distributing the total value of a forecast among the attributes. They present a method for calculating each feature's contribution to the prediction while allowing for feature interactions.

By examining the Shapley values, it is possible to determine which elements are most important in explaining the variation in ESG status. The feature significance of the model and the Shapley values will be used in this study to determine the factors of a

fund's ESG status. These approaches provide a complete and fair investigation of the relationship between ESG status and its characteristics, which may be useful in making investment decisions.

7.5. Features analysis.

7.5.1. Features importance in the Random Forest Classifier

According to the results obtained by the algorithms that came before it, the Support Vector Classifier (SVC), the Random Forest Classifier (RFC), and the Multi-layer Perceptron Classifier (MPC) are, in order, the most effective algorithms for capturing the link between an ESG status and its attributes. The accuracy of the SVC was the highest, coming in at 77.87%, followed by the accuracy of the RFC, which was 77.43%, and the accuracy of the MPC, which was 77.36%.

The SVC model had the best accuracy, but it did not reveal anything about the relative weights of the various model components. This was one of the model's major shortcomings. As a result of this, it might be challenging to have a solid understanding of the fundamental factors that influence the ESG rating of an investment fund. On the other hand, the Random Forest Classifier not only achieves the same level of accuracy as its rivals, but it also offers a strategy for evaluating the outcomes of the analysis. When determining the significance of features, this makes it an appealing option to take into consideration as a possible alternative. Because they will provide specific examples, the findings of this investigation will be helpful in creating a better knowledge of the factors that impact the ESG status of a fund. This will be possible because the findings will provide examples.

It is necessary to first determine the significance of the component parts in order to understand the factors that determine the Environmental, Social, and Governance (ESG) status of a fund. This is because it is necessary to understand the factors that determine the status of the fund. In order to evaluate the connection that exists between the ESG status and its characteristics, this investigation will make use of the model's feature significance as well as the Shapley values.

Analyzing the weights that the machine learning algorithm assigns to each of the model's characteristics is one way to establish whether or not the model's features should be considered relevant. In this example, the Random Forest Classifier was used, and the feature importances can be figured out by taking a look at the average feature importances across all of the decision trees that made up the ensemble. This will shed some light on which factors are most important in determining the ESG status and provide some insight into what those factors are.

In addition to the feature importances derived from the model, Shapley values will be utilized in order to arrive at a conclusion regarding the significance of the features. The Shapley values are a method that can be used to fairly disperse the entire value of a

prediction across the many aspects of the forecast. This can be accomplished by dividing the total value of the prediction among the Shapley values. They propose a method for calculating the contribution that each feature makes to the prediction while also taking into account the interactions that occur between features.
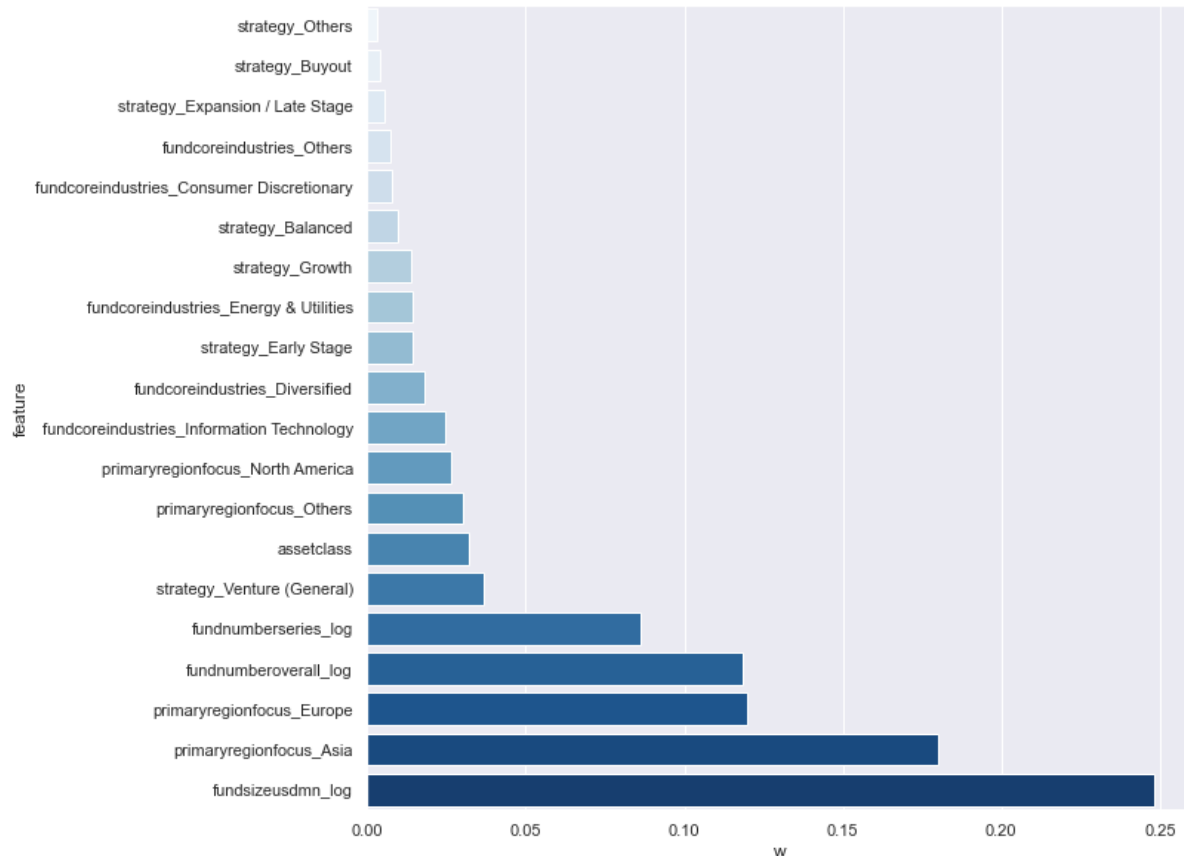
Figure 48 - Features importance after applying Random Forest Classifier

7.5.2. Shap values

The SHapley Additive Explanations, also known as SHAP values, are a way to understand how machine learning models make their predictions. They are based on the Shapley values idea, which was mostly made for cooperative game theory to figure out how to divide the values that a group of players creates. You can find the idea of Shapley values here.

In machine learning, SHAP values are used to figure out which parts of a model are responsible for its predictions. They help you figure out how important each part of the prediction is and how much each part adds to the whole.

Each sample and characteristic in the data is given a SHAP value. The SHAP values for each sample show the positive and negative effects that each characteristic had on the prediction. The sum of the SHAP values for a sample is equal to the difference between the model's prediction and the expected value of the prediction based on the training data distribution. The difference between the actual value and the predicted value is used to figure out this difference.

The SHAP values are unique because they work with a number of desirable qualities, such as local accuracy, consistency, and the fact that some values are missing. The SHAP values stand out from other values because of this. Because of this, they are a good way to compare the predictions made by machine learning models to other methods like feature significance scores or partial dependency plots.

Our study will use the SHAP values to get a better idea of how important the different things are that go into figuring out a fund's ESG rating. By figuring out the SHAP values for each sample, we can find out how much each attribute contributes to the prediction, either positively or negatively. This will help us figure out which parts of a fund's ESG status are the most important, and it will also shed light on the underlying connections between the parts and the ESG status.

In conclusion, SHAP values are an excellent tool for interpreting the results of machine learning analyses. Understanding the underlying relationships between the characteristics and the ESG status of the fund, as well as the relative significance of each feature in the process of determining the ESG status of the fund, can be attained through the calculation of the SHAP values for each sample.

When analyzing the output of a machine learning model, it is crucial to have a firm grasp on the relative importance of the features that are driving the prediction. There are a number of ways to evaluate a feature's importance, but two of the most common are the SHAP value and the feature significance.

In order to assess how crucial each feature is to the model as a whole, feature importances are calculated. This is typically calculated by tallying the sum of the split-feature-attributable reductions in model impurity. The ability to filter out contaminants is widely regarded as the most crucial feature. This method can be used to quickly and easily determine the importance of features in decision tree models like Random Forest Classifiers. However, it is not clear how the various qualities affect the model's predictions because feature significance does not account for interactions between features.

SHAP values, on the other hand, are a more recent innovation that allow for a more nuanced understanding of the significance of features. SHAP values, also known as SHapley Additive exExplanations, are a standardized way to describe the results of any type of machine learning model. They describe a model's output in terms of the relative importance of its constituent features. The value of a SHAP feature is different from other values because it considers not only its intrinsic worth but also its relationship to the other features in the model. For this reason, SHAP values are a powerful tool for evaluating models with complex feature relationships.

Finally, the SHAP values and feature significance both serve as independent measures of feature relevance in a machine learning model. The feature significance method streamlines the process of determining the importance of features in decision tree models. On the other hand, SHAP values provide a more nuanced perspective of the significance of features because they take into consideration not only the value of the feature but also its interaction with the features of other products. This means that SHAP values offer a richer understanding of the significance of features. For the purpose of developing a model for machine learning, it may be beneficial to measure the relative significance of the features, and both feature importances and SHAP values can be beneficial for this purpose. Nonetheless, the choice of the appropriate measure is dependent on the objectives of the research as well as the structure of the model.
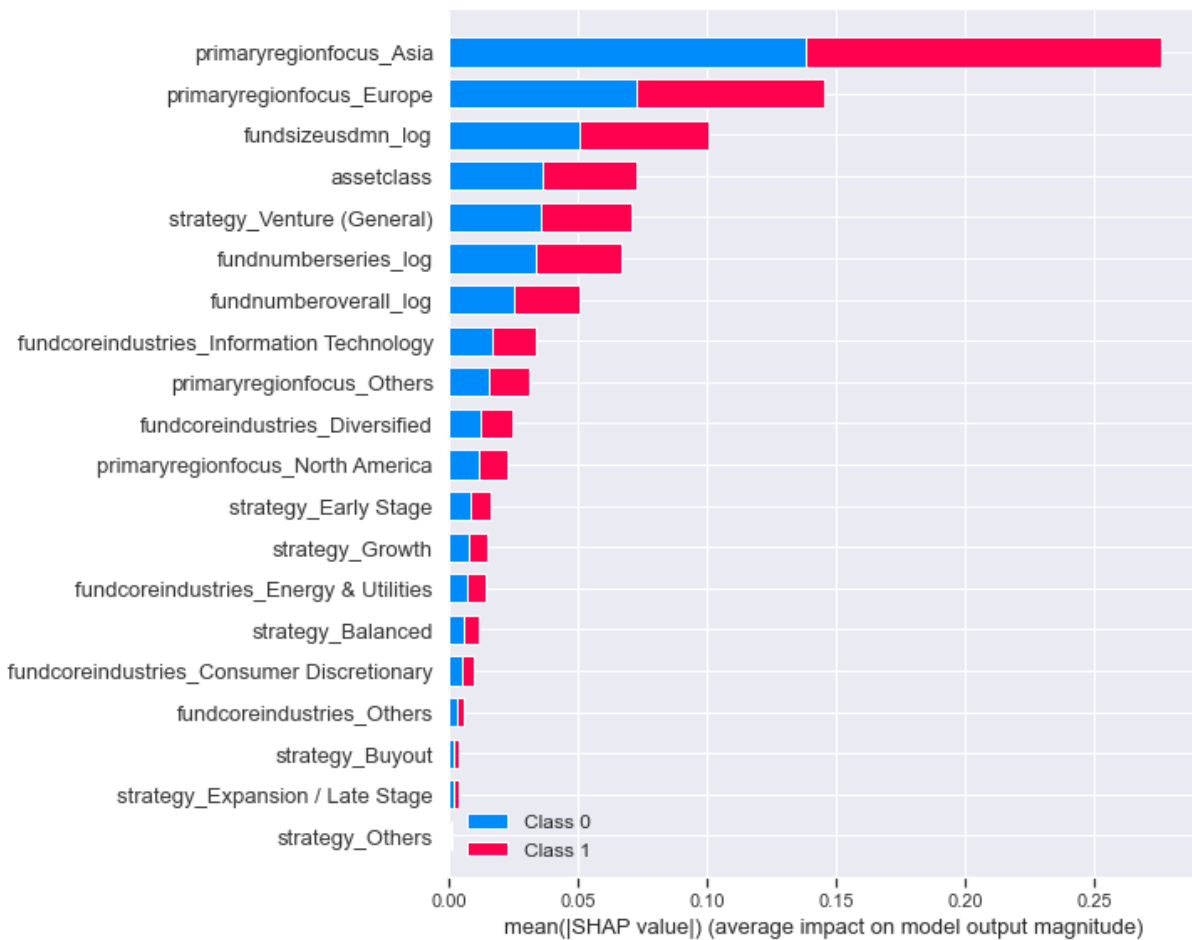
Figure 49 - Features SHAP values, after applying Random Forest Classifier on the Dataset

The Shapley values give a distinct viewpoint on features importance since they quantify each feature's contribution to the prediction for an individual instance. The Shapley values take into account feature interactions and give a more accurate depiction of feature relevance since each feature's contribution is evaluated in relation to the other features.

Despite the variations in viewpoints on feature significance determined by the RFC features importance and the Shapley values, the findings are relatively comparable, indicating that some variables have no substantial influence on the model. The variables strategy Early Stage, strategy Growth, fundcoreindustries_ Energy & Utilities, strategy Balanced, fundcoreindustries Consumer Discretionary, and fundcoreindustries Consumer Discretionary Other words, strategy The strategies of buyout, expansion / late stage, and others have little effect on the model.

This data can be useful for additional study since it emphasizes the elements that aren't important in defining a fund's ESG status, allowing for a more concentrated evaluation of the major drivers of ESG performance.

7.5.3. Simplified model

To confirm the findings of the feature significance analysis further, a simpler database was developed, and the Random Forest Classifier was tested on it. The following variables were removed from the simplified database: "fundcoreindustries Diversified", "fundcoreindustries Information Technology", "assetclass", "strategy Venture (General)", "fundnumberseries log", "fundnumberoverall log", "primaryregionfocus Europe", "primaryregionfocus Asia", and "fundsizeusdmn log".

This strategy was chosen in light of the findings of the feature significance analysis. It was feasible to further examine the validity of the results by employing only the factors believed to have the greatest influence on the model. The goal was to investigate if the model would still perform well when only these factors were included, and if the findings would be consistent with the results obtained from the complete database.

Testing the Random Forest Classifier on a simplified database is a frequent strategy in machine learning since it allows you to see how each variable affects the model's performance. It also offers information on the most relevant variables in the dataset as well as the relationships between the variables.

It was feasible to acquire a better understanding of the factors that have the biggest influence on the model's performance by testing the Random Forest Classifier on a simpler database. This data may be utilized to enhance the accuracy of future models as well as to investigate the underlying link between factors and a fund's ESG status.

Despite the fact that the model was trained on a reduced database with just 11 out of 20 characteristics, the Random Forest Classifier's accuracy was not greatly affected. The model's accuracy in this revised setup was determined to be 77.10%, which is still regarded pretty excellent. This implies that the elements previously identified as having little influence on the model can be removed without significantly compromising the model's accuracy.

It's worth noting that the model was trained using the same methods and parameters as before. This highlights the Random Forest Classifier's resilience and ability to perform well even with a limited number of features. Furthermore, the model's simplified version gives a better and more comprehensive explanation of the elements that determine a fund's ESG status.

It becomes simpler to grasp the links between a fund's ESG rating and its attributes by focusing on the most essential factors. This can assist to influence future investments and build more focused and effective ESG policies.

7.6. Empiric interpretation of Random Forest Classifier results

The model's final tree was shown to address the constraints in interpreting the outcomes of the other classification technique. This visualization provided intriguing insights on the ESG status of funds in the sample. To begin, it was discovered that 82.52% of the investigated sample does not have an ESG status when just examining funds that do not belong to the EU and do not employ venture capital as a strategy. If this sample is further restricted to include just funds with a major region emphasis on Asia and information technology as the fundscoreindustry, the percentage of funds without ESG designation jumps to 87.84%. This research implies that funds that exhibit these characteristics are less likely to adhere to ESG requirements.

When just EU-based funds were considered, the results revealed that 75.16% of these funds have an ESG designation. When this sample is further refined to include only funds with a size of less than 1.23 million USD, the percentage of funds adhering to ESG criteria rises to 81.18%. This conclusion is surprising given that fund size is frequently linked with higher investing ability and more resources to engage in long-term strategy. Nonetheless, the findings indicate that smaller funds inside the EU are more likely to adhere to ESG standards.

8 Funds ESG status impacts on companies accounting data.

8.1. Database construction

The database that Prequin provides was consulted, just as it had been in earlier studies, in order to identify the names of the companies and the nations in which they were initially established. After that, companies registries were entered into Orbis, a worldwide database of companies, in order to obtain financial data pertaining to the companies invested in.

Orbis is a worldwide database that contains information on each and every type of company and organization in the world, as well as all of their financial and commercial metrics. Financial data such as balance sheets, income statements, and cash flow statements are included in the database, in addition to important company characteristics such as firm size, industry classification, and ownership structure. Key company characteristics are included in the database. For the purpose of the study, access to the required accounting data was obtained through the use of Orbis.

The combination of Prequin and Orbis made it possible to rapidly gather a substantial amount of information regarding the selected companies. We were successful in gathering information that was accurate and relevant, which laid a solid groundwork for the investigation, thanks to the application of this method. In the end, the method provided us with insights that not only improved our understanding of the financial performance of the companies, but also enabled us to draw analytical conclusions about the market as a whole.

The research conducted by Orbis led to the discovery of 62,112 businesses. Between the years 2021 and 2011, accounting information was collected and analyzed for each of these businesses. The intangible fixed assets, the fixed assets, the cash and cash equivalents, the shareholders' equity, the long-term debt, the sales and service revenues, the operating income (EBIT), the profit or loss for the year (net income), and the employee count are some of the variables that have been selected to be used in accounting.

We were able to obtain a comprehensive understanding of the financial health of each company that was the subject of our investigation by utilizing a combination of accounting metrics. We were able to arrive at an estimate of the potential contribution that patents, trademarks, and other forms of intellectual property have to the overall value of a business after conducting research on intangible fixed assets. On the other

hand, the value of a company's fixed assets reflected the total sum of money that the company had invested in things such as buildings and machinery.

When determining a company's liquidity and solvency, we also considered the amount of cash it had on hand as well as its short-term investments. We also included information regarding shareholders' equity, which is a measure of the degree to which stockholders have a financial interest in the company and its potential for future profitability. We also took into account the long-term debt held by the company, which provided insight into its financial leverage and maturity maturity profile.

We also investigated the company's sales and service revenue statistics, which provide insight into the company's sources of income and the extent to which it can maintain its financial health over time. We were able to calculate a company's profitability before interest and taxes by using data on the company's operating income (also known as EBIT), which shed light on the company's primary line of business. Last but not least, we looked at data on the company's net income as well as the number of employees it has. Both of these metrics are good indicators of a company's profitability as well as its ability to effectively manage its human resources.

After that, the data frame was created by combining the information about the deal that was obtained from Prequin and the financial information that was obtained from Orbis. Following the completion of the preliminary research, this data frame was developed. We evaluated the health of every company that was involved in a transaction that was recorded in the Prequin database by using this methodology to analyze their financial standing.

The accounting information that is associated with each contract also covers the years that came before the first agreement that the two parties made with one another. In order to find a solution to this problem, a Python program was written. The software took into account the year in which each company received investment, and for each row associated with that year, it inserted the value "Not A Number" in the columns that related to accounting data from the years prior to the year in which the investment was received. This ensured that the data was accurate. Because of the analysis, the two parties involved in the transaction had access to only the information that was pertinent to the situation and absolutely necessary. Because of this, the accuracy of 2,123,070 values has been improved, which has resulted in a significant increase in the degree to which each transaction can be held accountable in light of the information contained in the company's books.

We compared the financial health of the companies before and after the investments by conducting an analysis of the financial records of the companies both before and after the transactions.

The database was cleaned, as was mentioned in the introduction. After that, the average time-based shift in each accounting measurement was computed for each individual contract. This was done in accordance with the preceding step. It is essential

to keep in mind that this calculation only takes into account the period of time that follows the pertinent transaction. The in-depth analysis provided in this study of the ways in which accounting measures have evolved over time makes it possible to gain a more profound comprehension of post-deal trends and patterns.

A cleaning operation was performed on the database in order to facilitate improved comprehension of the changes in accounting measures that have occurred over the course of time. After that, an annualized average change in accounting metrics was calculated, with the difference being that this time, only the years after the acquisition were taken into consideration. This type of analysis makes it possible to conduct a more in-depth review of the accounting data, which, in turn, reveals the true impact that the transaction had on the bottom line of the company. This all-encompassing methodology allows for a deeper comprehension of the effects of the agreement's long-term repercussions by taking into account the myriad of potential repercussions that the ESG status could have had on those repercussions.

In order to ensure that the viewpoints held by the various funds were consistent with one another, a calculation was performed to determine the typical percentage change that occurred in businesses as a direct result of the transactions carried out by the various funds. The estimated monetary impact of the transactions involving each fund was determined in a separate calculation. This research provides a more comprehensive assessment of the overall influence that the fund's agreements have had on the companies in which they have invested by focusing on the median percentage shifts. When we implement this strategy, we are able to obtain a more nuanced picture of the monetary performance of the funds.

Following the initial data cleansing, there were 853 accounts that required further investigation. ESG and non-ESG are the two classifications that have been established for these investments. The majority of the funds in the data set, which made up 62.37% of the total, did not have an ESG-focused strategy. The remaining 37.63% of the whole data set was comprised of ESG investments.

8.2. Descriptive statistics

In order to acquire a fundamental understanding of the connection between each fund's environmental, social, and governance (ESG), status and its level of financial success, it was necessary to conduct a comparison from one year to the next of the average percentage change in the accounting data of the companies in which the fund had invested. The first thing that needed to be done in order to proceed with this strategy was to collect descriptive data for each percentage change.

The results of this research offer an initial examination of the potential influence that environmental, social, and governance (ESG) concerns can have on the financial performance of funds. Any trends or patterns in the data indicating a link between

ESG status and financial success can be identified through an examination of descriptive statistics of percentage changes for ESG and non-ESG funds. This is achieved by contrasting the descriptive statistics of ESG funds with those of funds that do not adhere to ESG standards.

The comparison of the two primary descriptive studies, the average and standard deviation of percentual accounting data changes year over year, provides significant insight into the disparities that exist between ESG funds and non-ESG funds. These studies looked at changes in the accounting data year over year. It is possible to determine the difference in financial performance between ESG funds and non-ESG funds by comparing the standard deviation of the percentual accounting data changes from one year to the next. This information is provided by the standard deviation of the accounting data changes.

Table 5 - Average and Standard Deviation of percentage changes YoY after the deal year of companies invested by ESG and non-ESG funds.

Accounting voices	Average of percentage changes YoY after the deal year of companies invested by:		Increase/Decrease of non-ESG funds values over ESG-funds values	Standard Deviation of percentage changes YoY after the deal year of companies invested by:		Increase/Decrease of non-ESG funds values over ESG-funds values
	non-ESG-Funds	ESG-funds		non-ESG-Funds	ESG-funds	
Intangible Fixed Assets	99.98%	126.08%	26.10%	532.84%	517.35%	-2.91%
Fixed assets	126.85%	108.67%	-14.33%	674.65%	266.39%	-60.51%
Cash and cash equivalents	193.86%	161.28%	-16.81%	657.64%	285.18%	-56.64%
Total Assets	174.26%	204.79%	17.52%	1156.62%	1134.69%	-1.90%
Shareholders' equity	151.00%	168.51%	11.60%	1179.62%	865.03%	-26.67%
Long-term debt	94.22%	102.41%	8.69%	814.05%	707.17%	-13.13%
Revenues from sales and services	139.00%	97.29%	-30.00%	474.35%	507.92%	7.08%
Operating income [EBIT]	175.13%	140.98%	-19.50%	1710.37%	1439.43%	-15.84%
Operating profit/loss [net income]	68.54%	77.74%	13.42%	2872.64%	3590.67%	25.00%
Number of employees	42.27%	23.08%	-45.41%	277.46%	87.29%	-68.54%

The fact that ESG funds and non-ESG funds have different averages and standard deviations of percentage changes in accounting data demonstrates that a fund's ESG status may have a significant impact on the financial performance of the companies in which it invests. The wide range of effects, which can be seen by looking at the absolute amount of percentual gains or losses, demonstrates how potentially relevant a fund's ESG status can be in determining its level of financial success.

The repercussions of these shifts could have a wide range of potential ramifications. Better financial returns are generated by a higher average, while a larger standard

deviation generates a greater range of possible future financial outcomes. An increase in both the average and the standard deviation would be beneficial because it would result in stronger financial performance with more accuracy and less dispersion in future results. This would be the case because the increase would bring about stronger financial performance. This is especially true with regard to cash and other equivalents of monetary value. As a consequence of this, after determining whether or not the changes are statistically significant, a comprehensive analysis of each accounting component will be carried out.

8.3. Database analysis

The impact of ESG and non-ESG funds, respectively, on the financial success of the company they were invested in was the subject of a number of experiments, which were carried out in order to obtain statistical confirmation of the relationship between the two types of funds.

Using QQ plots, we first determined whether or not each company's financial performance followed a normal distribution. There does not appear to be a normal distribution in any of the QQ charts. As a direct result of this, the distribution of their values appears to be abnormal. This could be the result of a number of factors, such as the presence of outliers or skewness in the data.

In order to provide evidence that quantitative data are normally distributed, the Shapiro-Wilk test was applied to all of the examined financial performances. This test is used quite frequently to determine whether or not normality exists, and it produces a p-value that indicates the likelihood of discovering the data if it follows a normal distribution. In this particular instance, the test provided support for the previously held presumptions, which led to all of the p-values being relatively close to 0.

Because the data did not follow a normal distribution, non-parametric tests had to be utilized in order to analyze the differences between ESG funds and funds that did not adhere to ESG standards.

In order to evaluate the effect of ESG status on the alterations in accounting data, the Mann-Whitney U test was carried out. The Mann-Whitney U test was used for each accounting voice in the dataset in order to test the hypothesis that there is a significant difference in the rate of improvement in a company's financial performance between businesses that are supported by ESG funds and firms that are invested by non-ESG funds. For the purpose of putting this hypothesis to the test, a collection of samples was crafted for each accounting voice. Among these samples, one included financial enhancements for companies that were supported by ESG funds, while the other included such enhancements for companies that were not supported by ESG funds. After that, the Mann-Whitney U test was carried out in order to ascertain whether or

not there was a disparity that could be considered statistically significant between the medians of these two samples.

The null hypothesis that there is no difference in the increase in financial performance improvements between businesses that were invested by ESG funds and those that were invested by non-ESG funds was put to the test using the Mann-Whitney U test, which was applied to each and every accounting statement. The alternative hypothesis states that there is a significant difference between the two groups of businesses' progress in terms of improving their financial performance.

The findings of the tests were summarized in a table, along with the p-values that were suitable for each different accounting voice. A p-value that is less than the significance threshold, which is typically established at 5%, indicates that there is strong evidence that contradicts the null hypothesis and strong evidence that supports the alternative hypothesis.

Only the Fixed Assets test had a p-value that was lower than 5%, indicating that there was a significant difference in the financial performance improvements of businesses that were financed by ESG funds as opposed to non-ESG funds in this accounting statement. This conclusion was reached after an exhaustive examination of the table. This study has the potential to demonstrate that a company's ESG status has a significant impact on financial performance improvements related to fixed assets.

It is essential to keep in mind that the Mann-Whitney U test compares the medians of two samples rather than the means of the samples. This indicates that the test is less sensitive to extreme outcomes or data outliers, both of which have the potential to have a significant effect on the mean. Because of this, the failure to find statistical significance for accounting voices other than Fixed Assets may be due to the fact that the differences in median financial performance improvements between the two groups of firms are not large enough to achieve statistical significance using this test. As a consequence, the lack of statistical significance for accounting voices may be explained by this.

In order to test this hypothesis, additional research was conducted on the median values of each sample. It is possible that the fact that the Mann-Whitney U test did not produce significant results for those accounting voices is due to the fact that the medians of each sample were discovered to be relatively close to one another in many instances.

The Mann-Whitney U test did not produce significant results; therefore, the t-test is one of the possible options for determining whether or not there are significant differences in means between ESG and non-ESG funds' financial performance improvements for accounting statements. The t-test, in contrast to the Mann-Whitney U test, is a parametric test that operates under the assumption that the data are distributed normally. However, after looking over the data, it was found that the samples were not distributed in a manner that was consistent.

Due to the absence of a normal distribution, the t-test cannot be utilized on these samples because it would result in the violation of a key assumption. However, one viable choice is to alter the data by employing the Box-Cox transformation in the process. In spite of this, the Box-Cox transformation can only be applied to positive data; therefore, an additive constant would be required in order to move all of the data into the positive range.

According to the findings of this investigation, the additive constant has the lowest value of all the accounting data contained in the dataset. The normality of the data was reevaluated using QQ plots and the Shapiro-Wilk test after the Box-Cox transformation was applied to the data on the financial performance improvement for each accounting voice. This additive constant was used in the Box-Cox transformation. The Shapiro-Wilk test was applied to the modified data in order to accomplish this goal. The Shapiro-Wilk test demonstrated that the changed data had become more regularly distributed, indicating that the Box-Cox transformation had successfully normalized the data.

The normality assumption could now be verified using the updated data, which meant that the t-test could be carried out. It was possible to investigate whether there were statistically significant differences between the means of the ESG and non-ESG funds' financial performance improvements for the accounting voices by running the t-test on the transformed data. This was done in cases where the Mann-Whitney U test did not yield significant results.

The findings of the t-test indicated that there are statistically significant differences between the average increases in financial performance of ESG funds and those of non-ESG funds in a variety of accounting languages. In fact, the t-test yielded p-values near to zero for all of the accounting voices analyzed, as indicated by the descriptive statistics.

Based on these findings, it is clear that environmental, social, and governance (ESG) funds, in comparison to other types of funds, have a significant influence on the growth of financial performance at the companies in which they invest.

The assumption that was made in the previous section by the Mann-Whitney U test is supported by the findings of the t-test. Because it looked at the medians of the samples being used, the Mann-Whitney U test produced inaccurate results. In our particular example, the medians were not that far apart, which indicates that, from an accounting point of view, there were no significant differences in the rises in financial performance achieved by businesses that had received investments from ESG funds compared to those that had received investments from funds that did not focus on ESG. The results of the Mann-Whitney U test in each accounting voice were unable to provide meaningful information regarding the differences in financial performance improvements between businesses that were invested by ESG funds and those that were invested by funds that did not focus on ESG issues because of this consequence.

The t-test, on the other hand, is a parametric test that is predicated on the assumption that the data is normal. After applying the box-cox transformation to the transformed data in order to normalize it, the Shapiro-Wilk test demonstrated that the data follows a regular distribution. As a direct result of this, the t-test was selected as the method of analysis to use when evaluating the dataset. The results of the t-test indicate that there are statistically significant differences between the means of financial performance improvements achieved by ESG funds and those achieved by non-ESG funds; these differences are indicated by the descriptive statistics.

The significant disparity between the means and medians revealed by our investigation may have been caused by outliers or skewed data. This could be due to the fact that the data do not follow a normal distribution or the fact that there are extreme values in the dataset. It is possible for outliers to exert a significant amount of influence on the mean, causing the mean to move in the same direction as the outlier; however, the impact of outliers is typically smaller on the median. When dealing with distributions that are not normal, it is more accurate to use the median as a measure of central tendency rather than the mean. The examined data has been shown to be non-normal, and the presence of multiple outliers is indicated by the large standard deviations that are displayed in the final table. In point of fact, this has been established.

8.4. Empiric analysis of descriptive statistics.

8.4.1. Intangibile Fixed Assets

The current study explores the influence of ESG funds on the percentual improvements in the Intangible Fixed Assets of firms invested in, year over year. The research compares the performance of ESG and non-ESG funds in the years following the transaction. Descriptive statistics were used to calculate the book value of Intangible Fixed Assets, and the information was gathered from a sample of enterprises that received investment from either ESG or non-ESG funds.

First and foremost, it is critical to explain to the reader what Intangible Fixed Assets are and the implications of having a high figure in this balance sheet metric on the overall stability of the organization. These intangible assets are employed on a continuous basis in the company's procedures and everyday operations; they are characterized by intangibility and so are non - monetary assets that cannot be touched or seen. Patents, trademarks, registered designs, goodwill, and, more broadly, any knowledge or method with commercial, industrial, or economic worth are examples.

According to Dancaková et al. (2022), there is strong evidence from an analysis of companies from various industrial sectors that having a high value of Intangible Assets generates a higher company's market value. This outcome might be seen as a good indicator of the firm's success; after all, a larger market value, according to

numerous studies and research, leads to the conclusion that the company is performing better financially. In his work (An empirical assessment of the link between intellectual capital and business market value and financial performance, 2005), Ming-Chin Chen maintains that intellectual capital, including intangible assets, has a positive impact on both market value and financial performance; his argument concludes the importance of analyzing this parameter to determine whether or not good figures for intangible fixed assets are a sign of better performance.

According to our findings, firms invested by ESG funds have a bigger rise in Intangible Fixed Assets than companies invested by non-ESG funds. Intangible Fixed Assets of enterprises that got an ESG fund investment climbed by 126.08% on average, whereas those invested by non-ESG funds increased by 99.98%. This implies that ESG funds have a major influence on the growth of a company's Intangible Fixed Assets, double the likelihood of raising the book value of these assets.

According to the findings and previous research, firms that get investments from environmental, social, and governance (ESG) funds are more likely to increase their intangible assets. This is due to a variety of causes, including the increased emphasis on sustainability and social responsibility that these funds promote, which may lead to expenditures in programs like as staff training and development, research and development, and brand creation. Furthermore, organizations that emphasize ESG elements have higher long-term performance and resilience, which may transfer into stronger intangible assets like reputation and customer loyalty. According to a study conducted by Khan et al. (2020), organizations with better ESG ratings had higher intangible asset intensity, implying that their investments in sustainability and social responsibility programs were positively connected with intangible asset growth. Similarly, Eccles and Serafeim (2013) discovered that firms with good sustainability strategies have greater intangible asset values, such as reputation, brand, and human capital. Intangible fixed assets including as patents, trademarks, registered designs, and goodwill have also been demonstrated to benefit from ESG investments. One reason for this is that ESG investments frequently push firms to focus on product uniqueness and innovation, which may lead to the creation and purchase of new intellectual property. Furthermore, ESG-focused businesses are frequently perceived as more trustworthy and socially responsible, which may contribute to increased brand recognition and customer loyalty, both of which are important drivers of goodwill growth. According to Flammer and Ioannou (2019), organizations with higher ESG ratings had a larger number of patent applications and a stronger patent citation impact, implying that ESG investments were favorably connected with innovation and intellectual property creation. These findings imply that ESG investments may help organizations not just socially and environmentally, but also contribute to long-term wealth generation through the increase of intangible assets.

The findings have important implications for investors interested in sustainable investments and the influence of ESG funds on the financial performance of

organizations. The findings suggest that investing in firms through ESG funds may result in higher financial returns due to faster growth in Intangible Fixed Assets. This may result in improved financial condition and competitiveness for the invested firms, benefiting both investors and society as a whole. The study emphasizes the necessity of considering ESG elements in investing decisions and advises investors to assess the potential influence of ESG funds on firms' long-term success.

8.4.2. Fixed assets

Fixed assets, often known as property, plant, and equipment (PP&E), are long-term tangible assets retained by a firm to generate revenue. Buildings, machinery, vehicles, and land are examples of fixed assets. Fixed assets are not designed for rapid sales since they are expected to give advantages to the firm for more than one accounting period. Fixed assets are an important part of a company's long-term investment plan since they may be used as collateral for debt financing.

According to the findings, the intangible fixed assets of enterprises that got ESG fund investments rose by an average of 108.67% year over year. Companies that got investments from non-ESG funds, on the other hand, increased 126.85% year over year.

The findings imply that investors thinking about investing in ESG funds should be aware of the possible trade-offs between financial returns and non-financial elements, as well as the risks associated with investing in firms that emphasize non-financial criteria. Moreover, non-ESG funds may invest more heavily in fixed assets since tangible assets like PP&E are simpler to value and sell than intangible assets, which are more difficult to measure and monetize. Fixed assets are thus a more secure investment option for non-ESG funds that emphasize short-term profitability over long-term value development. Moreover, corporations that invest extensively in fixed assets may appear more appealing to non-ESG investors seeking to maximize short-term returns, as these assets may provide quick cash flows and serve as collateral for debt financing. It is crucial to emphasize, however, that this short-term emphasis on material assets may come at the price of long-term sustainability and social responsibility. Businesses that emphasize PP&E investments above social responsibility and sustainability programs may be more exposed to shocks such as climate change, supply chain disruptions, and changes in customer preferences. Companies that invest in intangible assets like innovation, human capital, and brand value, on the other hand, may be better positioned to handle these problems and produce long-term value for stakeholders.

In conclusion, while non-ESG funds are more inclined to invest in fixed assets like PP&E, this short-term concentration on physical assets may come at the price of long-term sustainability and social responsibility. Businesses that prioritize intangible asset investments may be better positioned to provide long-term value for stakeholders and navigate business upheavals.

8.4.3. Cash and Cash Equivalents

Physical currency in the form of coins, notes, and bank deposits that is readily available for use in transactions is referred to as cash. It is the most liquid form of an asset and is an important part of a company's working capital. Cash equivalents, on the other hand, are highly liquid assets that may be converted to cash in as little as 90 days. Short-term investments such as government securities, certificates of deposit, and commercial paper are examples of cash equivalents. Cash equivalents, which are utilized to address short-term liquidity demands, are also considered part of a company's cash balance. Cash and cash equivalents are crucial components of a company's balance sheet since they are used to support day-to-day operations, pay debts, and invest in growth possibilities.

Companies invested by non-ESG funds had an average growth in Cash and cash equivalents of 193.86% year over year, while firms invested by ESG funds had an average increase of 161.28% year over year. This implies that firms invested by ESG funds are more likely to retain high levels of liquidity and financial stability, which may be crucial during times of economic uncertainty or market volatility.

Furthermore, the standard deviation of cash and cash equivalents growth for firms invested by ESG funds was lowered by 57% when compared to non-ESG funds. This suggests that ESG funds' investments have a more predictable trajectory for their cash and cash equivalents, which may reflect the concentration of ESG investing on firms with solid financial management and sustainability policies.

Businesses that are invested by ESG funds may be more inclined to focus long-term value development and financial stability. Companies that value environmental sustainability, for example, may engage in projects to minimize their carbon footprint, which can lead to cost savings and increased efficiency.

ESG funds, on the other hand, tend to invest in companies that are more focused on sustainability and social responsibility, such as renewable energy companies or companies that prioritize employee welfare and environmental stewardship, as supported by Eccles (Eccles, R. G., & Serafeim, G. (2013). The Performance Frontier: Innovating for a Sustainable Strategy). These enterprises may require more upfront investment and may take longer to generate cash flows, resulting in a reduced short-term gain in cash and cash equivalents. Non-ESG funds, on the other hand, may be more inclined to invest in firms focusing on conventional industries like oil and gas or manufacturing, which may create more rapid cash flows. This is a significant discovery that contradicts our findings, but in the majority of the cases and other documents examined, it is correct to support our thesis, and our findings are verified. Notwithstanding this, when assessing the impact of ESG investing on the amount of growth of Cash and Cash Equivalent, there are some discrepancies.

In general, one of the most significant advantages of organizations that emphasize social and governance concerns may be their capacity to establish a strong corporate culture and effective risk management systems, which may lead to greater financial performance and stability. According to research, organizations with strong environmental, social, and governance (ESG) policies outperform their rivals in financial performance, risk management, and innovation (Serafeim, 2018). According to a Harvard Business School research, organizations that score highly on ESG indicators are more likely to have superior financial performance, reduced capital expenses, and higher values (Eccles & Serafeim, 2013). This shows that emphasizing social and governance concerns may provide corporations with both short-term and long-term benefits, such as enhanced cash flows and improved financial stability.

The amount of regulation and control that ESG funds are subject to is another major aspect that may explain the difference in cash and cash equivalents growth between ESG and non-ESG funds. ESG funds may be subject to stricter environmental and social governance rules, which may necessitate bigger cash and cash equivalent reserves to handle possible risks and liabilities. Non-ESG funds, on the other hand, may be subject to less rules and hence more likely to invest in riskier assets with lower capital and cash equivalents levels.

Higher average growth in Cash and cash equivalents growth for companies invested by non-ESG funds may indicate that these companies are better positioned to overcome economic uncertainty and market volatility, which can be important for investors seeking stable and reliable returns. However, further study may be conducted to investigate how these findings varied between market segments, locations, and investment methods, as well as how they connect to other financial and non-financial performance variables.

8.4.4. Total Assets

Total assets are an important financial parameter that businesses use to assess their financial performance and health. It is the total of all a company's assets, both tangible and intangible, that are projected to deliver future economic rewards. Tangible assets are those with a physical presence, such as property, plant, and equipment, whereas intangible assets do not, such as patents, trademarks, copyrights, and goodwill. Cash and cash equivalents, accounts receivable, inventories, and other short-term assets are examples of current assets that are expected to be converted to cash within a year or less. Long-term investments, property kept for investment reasons, and fixed assets such as machinery and equipment are examples of non-current assets. Total assets reveal a company's financial status as well as its potential to create revenue and profits. This indicator is used by investors and analysts to analyze a company's capacity to pay its obligations and invest in future development possibilities. Furthermore, a company's total assets number may be used to compare its financial performance to

that of other firms in the same industry, allowing investors to make better educated judgments about which companies to invest in.

According to the findings, there is a difference in the average rise in Total Assets between firms invested by ESG funds and those invested by non-ESG funds. The percentage difference between the two groups was determined to be 17.52%, showing that firms invested by ESG funds saw a larger average rise in Total Assets year over year. This research implies that ESG investment might help organizations increase asset growth and create long-term value.

The large difference in average rise in Total Assets between firms invested by ESG funds and companies not invested by ESG funds implies that ESG investment may lead to higher asset growth and long-term value development for companies. This conclusion is consistent with previous studies that found a link between sustainable practices and financial performance. Businesses that prioritize sustainability are frequently better positioned to foresee and react to changing market situations, regulatory settings, and stakeholder expectations, resulting in higher returns and increasing market value over time.

Firms invested by ESG funds may have superior risk management procedures in place, which may assist to decrease risks and costs connected with potential environmental or social liabilities. This can lead to greater profitability and asset growth over time. Investors may choose companies with more consistent financial performance since they can provide more predictable returns with fewer risk. Furthermore, organizations that prioritize sustainable practices and social responsibility may be better positioned to withstand economic downturns or other market shocks because they are less vulnerable to reputational hazards or regulatory punishments.

8.4.5. Shareholders' equity

Shareholder equity is an important component of a company's financial status because it represents the owners' remaining claim on the company's assets after all debts and obligations are paid. It represents the amount of money invested in the firm by its owners as well as any earnings maintained over time. The components of shareholder equity differ based on the capital structure and financial policies of the organization. Common stock reflects the shareholders' ownership stake and is often the largest component of shareholder equity. Preferred stock is a sort of ownership interest in which the shareholder is entitled to a fixed dividend payment before common shareholders receive any dividends. Retained earnings, on the other hand, represent the company's accumulated profits or losses from its start, less any dividends given to shareholders. Accumulated comprehensive income, which includes unrealized profits or losses on certain financial assets, as well as any reserves or money set aside for specific objectives, such as capital reserves or contingencies, may also be included as components of shareholder equity. Shareholder equity is a key measure of a company's

financial health and may be used to evaluate its potential to create profits and sustain growth over time. Businesses having a strong shareholder equity position may be perceived as more financially secure and appealing to investors, whilst those with a poor shareholder equity position may be perceived as greater risk.

The average difference in Shareholders' equity book value growth between firms invested by ESG funds and companies not invested by ESG funds is large, with ESG companies growing at a pace 11.60% faster than non-ESG companies. This research implies that ESG investment may help to create long-term shareholder value. Furthermore, organizations that prioritize long-term growth and stability are more likely to have robust and durable business strategies. They often prioritize sustainable practices, social responsibility, and robust governance systems. As a result, these businesses are frequently better suited to manage risks and create consistent profits, resulting in larger retained earnings and, eventually, more shareholder equity. Second, firms that emphasize ESG concerns are more likely to appeal to socially responsible investors, who are increasingly seeking for companies with good ESG credentials. Increased demand for ESG-focused enterprises may result in greater valuations and stock prices, resulting in a bigger market capitalization and, as a result, higher shareholder equity. Another aspect worth mentioning is that organizations that emphasize ESG concerns may be better at managing environmental and social risks, which can lead to a decreased likelihood of unfavorable occurrences that could harm shareholder value. These firms may enhance their financial stability and lower the chance of possible financial losses by managing risks linked with environmental, social, and governance aspects.

The favorable impact of ESG investment on equity growth might have serious consequences for a company's financial leverage. Greater amounts of equity can improve a company's financial stability and lessen its reliance on debt funding, lowering financial risk. Higher equity levels strengthen the buffer available to withstand financial losses and provide the firm more financial flexibility to explore development prospects.

Overall, the findings concerning Shareholders' equity indicate that ESG investment may help to create long-term shareholder value and financial stability, while simultaneously encouraging sustainability and social responsibility. As more investors discover the potential benefits of ESG investing, we may continue to witness a trend toward more sustainable and responsible investment methods that prioritize both financial returns and social and environmental impact.

8.4.6. Long-term debt

Long-term debt is a sort of borrowing with a maturity of more than one year that needs continuous interest payments during the loan's life. It is a financial commitment incurred by a business to fund long-term investment initiatives or to meet continuing

operating expenditures. Long-term debt might comprise a number of debt instruments produced by the corporation and sold to capital market investors or borrowed from financial institutions, such as bonds, loans, and mortgages. It is a critical component of a company's capital structure and can have an influence on its financial health and risk profile. It can offer the necessary cash for the firm's long-term growth objectives, but it also carries the danger of default if the company is unable to make the needed payments. Businesses that rely too heavily on long-term debt may be considered as greater risk by investors and may experience future difficulties acquiring more financing. Debt-to-equity and interest coverage ratios are two financial measures that may be used to analyze a company's capacity to handle its long-term debt.

Long-term debt levels did not differ substantially between ESG and non-ESG funds, according to a review of long-term debt growth in firms invested by ESG and non-ESG funds. This study implies that the type of fund invested in a firm may have little influence on its capacity to finance its operations through debt. But, excessive amounts of long-term debt can raise a company's financial risk and make it more vulnerable to economic downturns.

ESG-focused organizations are more likely to emphasize long-term growth and have a long-term perspective, which may result in lower levels of debt since they are less likely to participate in short-term debt financing to support their operations. Non-ESG enterprises, on the other hand, may have a shorter-term focus and may be more prone to use debt financing to support their operations, resulting in greater levels of debt. However, as indicated in the previous chapter, when analyzing the approach followed by ESG Funds, the great majority of the examples described in this work primarily operate through buyout, resulting in a higher amount of debt accumulation. This might explain why there is no statistically significant difference in the effects on enterprises receiving investments from ESG funds vs non-ESG funds. Another critical aspect to consider is that the amount of debt a firm incurs is determined by a variety of circumstances, including the type of its business, industry, and overall economic conditions. As a result, the level of debt may not differ much between ESG and non-ESG organizations, as these variables may have a higher effect on the amount of debt a company takes on.

8.4.7. Revenues from sales and services

Revenues from sales and services are the earnings generated by a company's principal business operations, which might include the selling of goods, the supply of services, or a mix of the two. This revenue stream is the primary source of income for the majority of businesses and is represented on the income statement as the total revenue collected for a given time, often a fiscal year. Sales revenues are often generated through the selling of goods or products manufactured or purchased by a corporation for resale to clients. Service revenues, on the other hand, are generated by the delivery of services to consumers, which might include consultation, repair, maintenance, and

other services. Some businesses generate money from both sales and services, such as a manufacturing firm that sells its goods and also provides installation and maintenance services for those items. Sales and service revenues are an essential metric of a company's financial performance because they reveal the company's capacity to produce profits from its primary businesses. Businesses with high sales and service income are considered financially secure and may be more appealing to investors. Furthermore, revenue growth over time might suggest that a company's products or services are in high demand and that it is extending its client base.

According to the research, firms invested in ESG funds have a smaller average rise in revenue from sales and services than companies involved in non-ESG funds. Companies investing in ESG funds improve this financial number by 97.29% on average, whereas non-ESG funds raise it by 139.00%. This shows a 30% difference in average revenue growth from sales and services between the two categories.

The lower average rise in revenue from sales and services for firms investing in ESG funds might be attributed to their emphasis on environmental, social, and governance considerations. ESG funds may focus investing in firms that promote sustainability and social responsibility, which may limit their short-term revenue growth potential.

In reality, enterprises invested by non-ESG funds may emphasize short-term profit maximization over environmental and social responsibility, potentially leading to faster revenue growth rates (Berg et al., 2019). These firms may prioritize fulfilling quarterly objectives and generating short-term returns to shareholders above investing in long-term processes that will benefit the company (Mertens et al., 2021). Companies engaged in ESG funds, on the other hand, may adopt a longer-term strategy to revenue development by targeting environmental, social, and governance challenges (Berg et al., 2019). These firms may establish a more stable and sustainable growth trajectory over time by investing in sustainable practices that benefit the world and society. Short-term earnings can cause environmental harm and have a detrimental influence on society. Businesses that emphasize profits above sustainability may sacrifice environmental efforts, such as waste reduction or emission reduction, in order to enhance earnings in the near term. This method may have significant environmental consequences, exposing the corporation to reputational and legal issues as well as damaging the environment. Companies that emphasize profits above social responsibility may also fail to prioritize activities such as improving working conditions or assisting local communities, which can undermine their reputation and impact their long-term performance. Companies that emphasize ESG concerns, on the other hand, may create a stronger reputation among stakeholders, which may eventually assist revenue growth. As previously examined, a result may be observed in the total rise in Intangible Fixed Assets, which is larger in firms receiving investments from ESG funds. Prioritizing sustainability and responsibility may assist businesses in attracting and retaining consumers, investors, and workers that share their values, resulting in better long-term success. Furthermore, by investing in

sustainable practices, these businesses may enhance operational efficiency and save costs in the long run.

Overall, these data indicate that ESG funds and non-ESG funds may have distinct investing goals and tactics, resulting in different financial outcomes for the firms in which they invest.

8.4.8. EBIT

EBIT, also known as operating income, is a valuable indicator for evaluating a company's financial performance for investors, analysts, and management. EBIT is a metric that assesses a company's capacity to make profits from its core operations, regardless of its capital structure or tax environment. EBIT gives a better view of a company's operating profitability by removing interest and taxes, allowing for simpler comparisons with other firms in the same industry. EBIT is computed by deducting all operational expenditures from total revenue, including cost of goods sold, wages, and depreciation. The resultant amount indicates the company's earnings before interest and taxes from its core businesses. EBIT is a critical indicator for determining a company's capacity to meet its interest and tax commitments while also profiting from its activities. While EBIT is an essential indicator for assessing a company's financial performance, it should be noted that it is not the same as net income, which includes interest, taxes, and other non-operating expenditures.

Companies invested in ESG funds have an average rise in EBIT of 140.98%, whereas firms involved in non-ESG funds had an average gain in EBIT of 175.13%, according to the report. This suggests that firms invested in ESG funds have a 19.50% smaller EBIT rise than companies invested in non-ESG funds.

It should be noted that EBIT is an important indicator for evaluating a company's profitability and financial performance. The fact that non-ESG funds invest in firms with a larger average growth in EBIT implies that they may be more profitable than ESG funds.

Our findings support the notion that enterprises invested by non-ESG funds may emphasize maximizing short-term profits, which may result in higher EBIT but at the expense of environmental and social responsibilities. Companies that emphasize ESG issues, on the other hand, may focus on long-term sustainable growth and may be prepared to forego short-term benefits for the purpose of long-term success. This might result in reduced EBIT in the short term, but more steady and sustainable profits over time.

Notwithstanding our findings, research shows that there is a long-term favorable association between ESG performance and financial performance. According to a Harvard Business School research, organizations that enhance their ESG performance enjoy an increase in financial success, with a 4.8% gain in stock returns for each one-point increase in ESG ratings. This shows that, despite potential short-term

compromises, organizations that prioritize ESG considerations may nevertheless attain excellent EBIT values in the long run.

Overall, these data indicate that investing in ESG funds may have an impact on a company's financial performance, notably in terms of profitability and unpredictability in financial indicators like EBIT.

8.4.9. Net income

Net income is an important indicator for investors and analysts since it gives information about a company's profitability and performance over a specific time period. It is computed by deducting all expenditures and taxes from the total income of a firm. This comprises operating expenses such as payroll, rent, and other business-related costs, as well as interest payments on any existing debt. Changes in market demand, adjustments in consumer behavior, changes in interest rates or tax regulations, and numerous macroeconomic variables can all have an impact on a company's net income. For example, a company's net income may be reduced if it has spend more money on R&D, marketing, or other expenditures targeted at boosting future growth. A high net income shows that a firm is profitable and may be able to reinvest earnings in growth possibilities or return profits to shareholders through dividends or stock buybacks. A low or negative net income, on the other hand, indicates that a corporation is struggling to make profits and may be in financial trouble.

The Net Income accounting metric analyzes a company's bottom-line performance, and the results demonstrate that firms invested in both ESG and non-ESG funds had considerable rise in their average Net Income throughout the investigated period. Nonetheless, the gap between these two groups is significant, with firms investing in ESG funds growing at a rate of 77.74%, while for non-ESG funds it is 68.54%. This difference shows a 13.42% difference between the two groups, demonstrating that ESG firms may be more concerned with long-term sustainability rather than short-term earnings.

Generally, the Net Income accounting statement gives information on the profitability of firms in which ESG and non-ESG funds have invested. While both groups grew, the findings show that firms involved in ESG funds may be more focused on long-term sustainability and social responsibility while maintaining consistent financial success.

8.4.10. Number of Employee

The number of workers is an important factor for determining a company's size and prospective growth. According to the findings, firms engaged in ESG funds have a smaller average rise in the number of employees than non-ESG companies. Companies engaged in ESG funds, in particular, grow the average number of workers by 42%,

whereas non-ESG enterprises expand it by 23%. This suggests that ESG funds may favor long-term growth above aggressive expansion.

Furthermore, there is a considerable difference in the standard deviation of the average number of employees in firms supported by ESG funds vs non-ESG funds.

Overall, the findings imply that the investment methods of ESG funds may have an influence on the number of workers at the firms in which they invest. While non-ESG funds appear to encourage more aggressive expansion, ESG funds may prefer long-term growth with less fluctuation in staff numbers. Further study is needed, however, to properly understand the link between ESG investing and the number of employees in businesses.

8.5. Conclusions

When these essential financial criteria are taken into consideration, it is possible to reach the conclusion that there is a discernible effect on businesses in terms of the amount of investment they receive from ESG funds. Investors who are interested in sustainable investments and the effect of ESG funds on the financial performance of companies should pay close attention to the findings on intangible fixed assets in particular since these findings have substantial consequences. According to the findings, investment in companies by means of ESG funds can result in greater financial returns owing to quicker development in intangible fixed assets. This might lead to an improvement in the financial position and competitiveness of the enterprises in which investors have been placed, which would be to the advantage of both investors and society as a whole. The research highlights how important it is to take environmental, social, and governance (ESG) factors into account when making investment decisions and encourages investors to evaluate the potential impact that ESG funds might have on the long-term profitability of companies. In addition, the findings show that investors who are looking for continuous and stable growth in Intangible Fixed Assets may benefit from investing in ESG funds, which have a more consistent influence on these assets. This is because ESG funds have a more sustainable impact on these assets.

Companies that receive investments from ESG funds perform better in other financial metrics such as Cash and Cash Equivalents, Total Assets, and Shareholder Equity, according to the analysis that was carried out in this chapter. This suggests that the presence of ESG funds is indeed beneficial to companies, as it enables them to achieve a more robust and stable financial position. One further positive effect that can be deduced from these findings is that companies who have access to investments from ESG funds have seen an increase in their net income over time.

In spite of this, drawing the conclusion that these companies operate more effectively based on their EBIT levels is not fully logical.

In addition, businesses that place a priority on sustainability are typically in a better position to anticipate shifting market conditions, regulatory regimes, and stakeholder expectations, which may, in the long run, result in higher returns and increased market value.

By incorporating environmental, social, and governance (ESG) factors into their investment research and decision-making processes, investors may be able to identify companies that are in a strong position to produce long-term financial success while also managing risks related to environmental and social concerns. Research has shown that companies that have strong ESG performance are more likely to provide long-term shareholder value. This is due to the fact that these companies have a positive effect on society and the environment, and they are also less likely to have their reputations harmed. In addition, companies that place an emphasis on ESG factors may be in a better position to attract and keep top personnel, cultivate positive connections with customers and communities, and reduce the regulatory and legal risks that are associated with environmental and social difficulties. The realization that long-term financial performance may be increased through sustainable business practices is one of the primary drivers behind the emphasis placed on ESG. These ethical and moral issues are not the only reason for this focus. Thus, environmental, social, and governance (ESG) investing may contribute to a more sustainable and responsible investment strategy, which is to the advantage of investors as well as society as a whole.

However, more research may be carried out to analyze how these findings differed across different market groups, geographies, and investing strategies, as well as how they link to a variety of other financial and non-financial performance indicators. The research shows that ESG investing may assist to maintain financial stability and long-term wealth growth while simultaneously fostering sustainability and social responsibility. This is demonstrated by the overall finding that ESG investment can help.

9 Conclusions

The main objective of this thesis was to understand whether or not, Private Equity and Venture Capital funds following ESG practices explicit a better financial performance than non-ESG funds, and thus provide an answer to the main research question: Are ESG funds more profitable than non-ESG funds? Do they explicit a higher financial return?

In order to have a better picture of what ESG Funds are and which are their peculiarities, a statistical analysis have been conducted by the authors, tackling the following question: Do we have a correlation between the funds_PEESGstatus and other significative variables about the fund itself?

ESG funds are mostly Private Equity funds, rather than Venture Capital ones; this is mainly due to the fact that the former have more power and control on the company invested. Another characteristic is connected to the Fund Size, in fact ESG funds in most of the cases exhibit a larger size, because of their long-term investment focus, the necessity to have a strong reputation and more negotiating power, allowing them to strive for and accomplish greater ESG development. Usually, ESG funds operate in the Energy & Utility or Consumer Discretionary sectors; and they are more concentrated in Europe and North America.

Moreover, the Buyout or the Balanced strategy are the ones that are most applied by ESG funds to acquire and manage their target companies.

In order to tackle the main research question, different financial performance measurements have been analysed; among them, the results brought by NET IRR, DPI (Distributions to Paid-In Capital) and RVPI (Residual Value to Paid-In Capital), brought the authors to the conclusion that non-ESG funds perform better than ESG ones. This is a strong result for this work and there could multiple explanations. The ESG funds may have a narrower universe of potential investments, as they typically exclude companies that do not meet certain ESG criteria, and this may limit their investment opportunities and potentially impact their returns. Additionally, ESG funds may incur higher expenses related to the analysis of ESG factors, which could also affect their performance.

Furthermore, the authors have analysed the impact that ESG funds have on the companies invested and thus, they answered to the last research question: Do ESG funds bring more value to companies than non–ESG funds?

Investing in ESG-compliant companies can lead to an increase in intangible assets such as reputation and brand value and this can help create a positive image for the company and attract more customers, leading to long-term growth and profitability.

Moreover, companies that prioritize ESG factors tend to have better risk management practices, which can lead to more resilient businesses. Investing in such companies can lead to an increase in total assets, as well as cash levels, which can improve the company's financial stability and reduce its exposure to risks. Despite these advantages, the results have shown that enterprises benefitting from non-ESG funds' capital tend to exhibit a bigger increase in earnings before interest and taxes (EBIT) levels. This suggests that non-ESG funds may be more suitable for companies focused on short-term financial gains.

However, it is worth noting that ESG funds may have a positive influence on companies in the long run, contributing to higher brand value and more resilient businesses. As such, investors may want to consider incorporating ESG funds into their investment portfolios to support sustainable and socially responsible practices.

In conclusion, the importance of ESG investing has grown significantly in recent years as investors increasingly seek to align their investments with their values and promote positive social and environmental outcomes. The global focus on sustainability and corporate responsibility has further reinforced the importance of ESG investing, and companies are expected to play a significant role in achieving the United Nations Sustainable Development Goals. ESG investing has reshaped the way investments are conducted, with many firms integrating ESG criteria into their investment strategies. Compliance has also become a critical consideration, with ESG standards and frameworks providing guidelines for reporting on ESG criteria. Moreover, investing in companies that meet ESG criteria is expected to provide financial returns, as companies that prioritize ESG factors tend to outperform those that do not. Private equity and venture capital funds are also increasingly incorporating ESG factors into their investment decisions, and understanding how ESG factors play a role in their investment decisions is crucial. Through this thesis, we have evaluated the performance of ESG funds compared to non-ESG funds and examined the impact of ESG factors on the companies they invest in. This research provides valuable insights on the characteristics of ESG funds how they can impact the companies they invest in and the role it can play in promoting sustainable, socially responsible investments.

10 Limitations

One of the primary limitations of this study is the limited number of funds that exhibit the variable analyzed, which is called pesg_status. Out of the 14,333 funds analyzed, only 3,185 exhibit this variable, and out of these, 1,169 are classified as ESG and 2,016 as non-ESG. This small sample size could potentially affect the generalizability of the results. The small sample size also makes it difficult to make strong conclusions about the differences between ESG and non-ESG funds. It's possible that the small sample size could be due to limitations in the dataset, such as missing data or incomplete reporting by fund managers.

In addition, the fact that a fund is classified as ESG is described only by one variable, and it is necessary to better explain and deepen the analysis of environmental, social, and governance factors. It could also be interesting to explore the need for considering ESG data and sustainable profit and loss, including how emissions have a financial cost. It is important to note that ESG data can be complex, and there are many different factors to consider beyond the simple binary classification of ESG or non-ESG.

Moreover, the variable's result "yes" does not provide a detailed explanation of a fund's effort towards ESG, which limits the interpretation of the results. In other words, the "yes" classification does not give an indication of how much emphasis a fund places on ESG factors or how much it integrates ESG considerations into its investment decisions. A more detailed analysis of ESG practices and policies across different funds could help to better understand the relationship between ESG and financial performance.

Finally, there is an unbalancing in the database, particularly in terms of geography, sector, and strategy, as there are a significant number of funds from Asia that are not classified as ESG funds. This could potentially limit the generalizability of the results, as it's possible that there are regional or sector-specific factors that influence the relationship between ESG and financial performance.

Overall, while this study provides some valuable insights into the relationship between ESG and financial performance in private equity and venture capital, it's important to keep in mind these limitations when interpreting the results. Future research that addresses these limitations could help to provide a more comprehensive and nuanced understanding of this complex topic.

11 Future Developments

Climate change is one of the most pressing issues of our time, and there is growing recognition that ESG factors play a critical role in addressing this global challenge. As investors increasingly integrate ESG considerations into their decision-making, it is becoming clear that investments in companies with strong environmental and social practices can have a positive impact on both financial performance and broader sustainability goals. By supporting companies that prioritize ESG considerations, investors can help to shift capital towards more sustainable business models and help to mitigate the impacts of climate change.

However, to truly harness the power of ESG for climate change, it is important to have robust and reliable evaluation indices. While there are a growing number of ESG rating systems available, many of these lack standardization and can be inconsistent in their assessment of different companies and sectors. This can make it difficult for investors to compare and evaluate different funds, and can limit the impact of ESG considerations on investment decision-making.

To address this challenge, there is a need for stronger and more consistent evaluation indices that can provide investors with reliable and comparable data on ESG performance. This could involve greater collaboration between investors, asset managers, and other stakeholders to develop more standardized ESG reporting frameworks and metrics. It could also involve the development of more sophisticated data analytics and machine learning tools to help investors more effectively evaluate and compare ESG performance across different funds and sectors.

In conclusion, while there is growing recognition of the importance of ESG for climate change and sustainable investment, there is still much work to be done to strengthen evaluation indices and ensure that investors have access to reliable and consistent data. By continuing to focus on this important issue, we can help to drive positive change in the private equity and venture capital industry and contribute to a more sustainable future for all.

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