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Is Sustainability a Competitive Advantage? Unveiling the Relationship Between ESG Scores and Startups' Evaluation in the IT Sector.

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ABBREVIATIONS AND ACRONYMS

AUM	Assets Under Management
BD	Big Data
DEI	Diversity, Equity, and Inclusion
EFRAG	European Financial Reporting Advisory Group
ESG	Environmental, Social and Governance
EV	Electric Vehicles
FY	Fiscal Year
GDPR	General Data Protection Regulation
GHG	Greenhouse Gasses
GICS	Global Industry Classification Standard
GPs	General Partners
HBR	Harvard Business Review
LPs	Limited Partners
MRA	Multiple Regression Analysis
MSCI	Morgan Stanley Capital International
NFDR	Non-Financial Reporting Directive
NLP	Natural Language Processing
SASB	Sustainability Accounting Standards Board
SEC	Security and Exchange Commission
SMEs	Small and Medium Enterprises
S&P	Standard & Poor's
UN	United Nations

INTRODUCTION

Despite the huge relevance that Environmental, Social and Governance (ESG) issues have gained nowadays, relatively little research has been dedicated to the study of these topics. Despite the huge relevance that Environmental, Social and Governance (ESG) issues have gained nowadays, relatively little research has been dedicated to the study of this topic in relation to the startup world. And it could not be otherwise, given the amount of investments that each year is poured into the cause: the number is set to reach 70 trillion $ of AUM by 2026 according to the Global Sustainable Investment Alliance's estimates. It follows that recently, a lot of studies have been published trying to unbundle the relationship that ties sustainability to corporate financial performance, much of them getting to the same conclusion: the relationship does exist, and it is a positive one. In the first chapter of the thesis, an in-depth literature analysis is conducted, to present the main areas of discussion regarding the topic in question as well as the challenges that must be faced. Despite much concern in recent years, a unique framework for the implementation of standards has not yet been formulated, although we are seeing the first results from the European Union's commission. These concerns do not only represent a barrier to the comparison among countries but first and foremost in the formulation of a score itself. ESG scores are not yet as regulated and standardized as credit scores are, therefore, the result is a misalignment among credit providers on which factors to consider as well as which ones deserve more attention than others. Despite the vast literature concerning the topic, a significant branch has been neglected: the young entrepreneurship one. The companies that are taken into consideration by the almost totality of the studies are public ones, for whom the ESG score, which stands as a proxy for their level of sustainability, is a publicly available number. Much less light has been shed so far on early venture companies, and startups, which is the aim of this project. The reason why it has not received the same attention as public companies is because of the lack of a framework that takes into consideration the early stage of the company analyzed, as well as the materiality factor. As it is explained in the second chapter in fact, ESG scores cannot be considered equal for all types of industries: Khan et al. (2016) demonstrated in their study Corporate Sustainability: First Evidence on Materiality, that for the relationship to be positive, the score must reflect the affinity of the company to a specific industry. It is a simple rationale to consider: an oil company, given its activity and the type of materials

that every day manages, will be subjected to a higher environmental risk with respect to a software one, for example, where the activity can be performed entirely on the web and often without tapping into natural resources. Scores that do distinguish between one sector or the other, by changing the weights and the type of metrics used to assess the risks, show a positive correlation between the two variables, which does not happen, according to the study, for those that mix the factors. The first challenge posed by this thesis was to assess the materiality framework for the two industries chosen: Hardware & Software. Based on the most prominent agencies delivering ESG scores, as well as those more focused on startups, a list of key issues was individuated. The analysis was performed on a startup sample of US technology companies, that had their last round of financing in the past year. The resulting scores are used to perform a regression analysis to show whether a correlation exists between the companies' ESG scores and their evaluation. A review of the literature on the topic highlighted that there is a positive relationship between the virtue of the ESG score and the financial performance of the company, although the analysis using the capitalization of the company had never been performed before. In chapter three the methodology for the construction of the regression model is explained, following each step of the statistical research. To choose which KPIs to use in my research, I took as a reference the currently existing ESG frameworks. Since their focus is prominently on public companies, I looked at small, independent, startup-centric frameworks as well. The metrics were included in the assessment only if at least two of the frameworks analyzed had them, to avoid the risk of biases. After, I proceeded to weigh the single E, S and G scores obtained according to the pertaining industry: Software, Communication Equipment, Technology Hardware, Storage and Peripherals, Electronic Equipment, Instruments and Components, in line with the MSCI Industry Materiality Map. Finally, in chapter four the regression analysis is performed. Eight models were constructed for the assessment, each differing for the number and type of variables considered: overall, apart from the dependent variable (Valuation) and the independent one (ESG Scores), another nine control variables have been considered to find the best model that could fit the regression. It was discovered that there is a positive relationship between the ESG Score and the Valuation of a startup, with the most significant model bearing a p-value < 0,01 and a level of confidence of 99%. Breaking down the ESG score in its components, the G was the only pillar that resulted significant,

with a strong contribution coming from the KPI Women Presence in Board. Also, the financial components resulted important: Revenues are the control variable with the highest significant coefficient, suggesting that despite the surge of non-financial disclosure popularity, investors still look out for financial milestones.

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I. THEORETICAL FRAMEWORK

1. WHAT IS CORPORATE SOCIAL RESPONSIBILITY?

Corporate social responsibility is one of the fundamentals behind the ESG phenomenon that has become so prominent in the last few years. Despite the recent hype demonstrated by the public, the topic is not new at all, developed firstly by American economist Howard Bowen in his work *Social Responsibilities of the Businessman* (1953). In the book, he states that CSR is "*the obligation of businessmen to pursue those policies, to make those decisions, or to follow those lines of action that are desirable in terms of the objectives and values of our society*".

The exact description of CSR is by no means unique, since it is always evolving, and as Dahlsrud (2008) study pointed out, at least 37 definitions can be individuated. Although the concept was conceived a long time ago, it was not until the 1960s and '70s that a true change happened, and CSR began to develop in the shapes that we know today (Carroll, 2015). The author theorizes the definition by conceptualizing four theoretical frameworks and describing CSR as "*the social responsibility of business encompassing the economic, legal, ethical, discretionary (philanthropic) expectations that society has of organizations at a given point in time*".

Before his studies, in 1991, he had developed *the Pyramid of Corporate Social Responsibility*, framing the four main responsibilities of a firm: economic, legal, ethical, and philanthropic.

I. Economic – constitute the roots of the existence of the firm. Companies have been created with the idea of selling goods and services to people and making a profit along the way. Without economic responsibility, there would be no reason to exist for the other three.

II. Legal – represent the foundations on which we base our social agreement. They are depicted in the second layer, as we can see in Figure 1, but we can frame them in the baseline with the economic ones since without rules to follow, it would not be possible to conduct business.

III. Ethical – these responsibilities are not properly based on laws, but on the sense of ethics, moral justice, and fairness that we all have and that we expect business owners to respect and protect. The dimension strictly interacts with

the legal one, since a change in the law sparks a change in the ideas of people of what is fair and just.

IV. Philanthropic – resembles the expectations that people have toward a firm to make good, which means investing its money, resources, and employees for the good of the community. It is different from the ethical point of view in that philanthropy is expected but not mandatory, meaning that if the firm does not pursue it, it will not be marked as unethical.

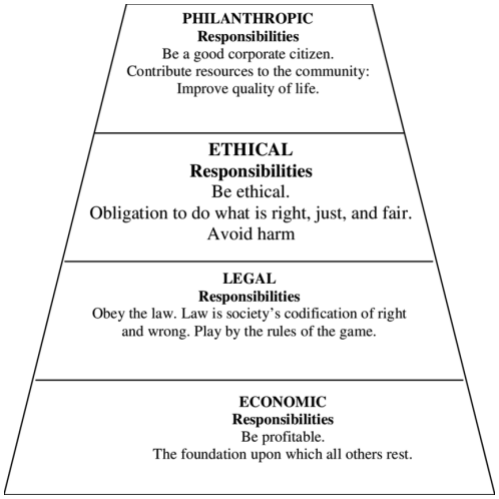


Figure I: The Pyramid of CSR

Source: Carroll, Archie. (1991).

Looking into other definitions that have been given throughout the years, we understand that the debate over the topic is very high: "*imposition of public social preferences on private property rights*" (Sheehy, 2014) and "*something to avoid, to concentrate on the true goal of the company that is profit maximizing"* (Friedman, 1970) are just two of the examples of counter trending views.

To better understand the concept of CSR, the necessary theoretical framework envisages two important theories: the stakeholder theory and the shareholder's theory.

1.1 *Shareholder Theory & Stakeholder Theory*

The shareholder's theory was theorized by Milton Friedman in the 1970s, and therefore it is also known as Friedman Doctrine. The point raised by the American economist was

that the only social responsibility that pertains to a firm is to satisfy economically shareholders; it follows that the use of money to help any other category, being employees or customers, would be an imposition on contributors. He argued that if investors were interested in spending their money on those causes, they could do it privately, without misusing the profits of the firm. The consequences of imposing these actions would be a surge of **agency conflict** between managers and shareholders, since agents could pursue operations with personal gain in mind and not moved by good motives. This theory has of course further developed over the years, and a revisitation of it has also been used to explain why companies that pursue a CSR strategy benefit from higher returns. As Hart and Zingales (2017) lay out in their paper, Friedman has based his theory on the premise that companies generating high financial returns could be separated from those producing negative ESG externalities. History and empirical work have proven this affirmation wrong: businesses should maximize shareholders' welfare, not the market value alone. If ESG is taken into consideration in investors' preferences, indeed strategies that can enhance both aspects will benefit from a premium. These considerations represent a bridge with another important theoretical framework: stakeholder theory.

The stakeholder theory was first theorized by R. Edward Freeman in his book *Strategic Management: A Stakeholder Approach* (1984). Stakeholders, according to the author, are all the people that influence the activity of the corporation by having a claim on it or by being affected by it. In this optic, to perform efficiently, a company must take into consideration the needs of all its stakeholders, action that will result in positive financial returns.

Stakeholder theory and Corporate Social Responsibility are linked one to another, and as the prevalence of scholars has theorized, they stand as complementing concepts (Russo & Perrini, 2010; Jamali et al., 2008; Kurucz, Colbert, & Wheeler, 2008).

As the correlation is evident though, it is important also to consider the differences, which can be pinpointed mainly in the focus areas they consider:

- ST concentrates on every aspect of the company, from the financial to the ethical side, and therefore aims to satisfy the needs and requests of all groups of stakeholders.

- CSR instead, focuses more on the responsibility that the business has towards local communities and society at large, so the **social** component is very strong in its definition.

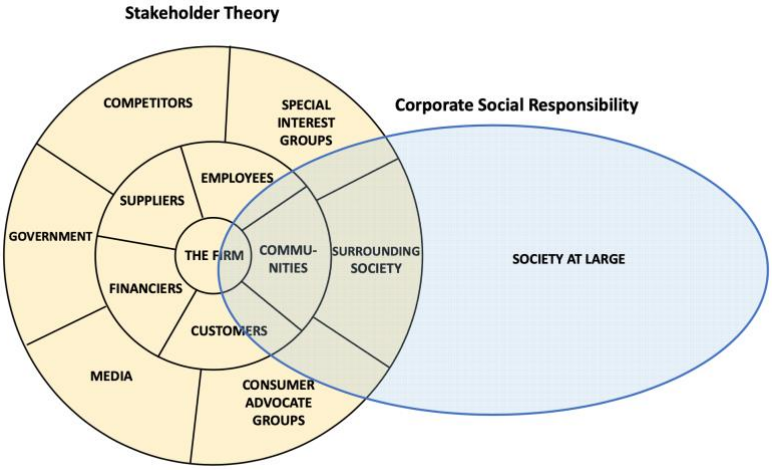


Figure II: Corporate Social Responsibility and Stakeholder Theory Relationship

Source: Freeman, R.E. & Dmytriyev, S. (2017).

1.2 *CSR for Competitive Advantage and The Legitimization of The Company's Strategy*

Different extensions of stakeholder theory have been theorized, and in particular, the one proposed by Jones (1995), *Instrumental Stakeholder Theory* is relevant to this paper. He viewed CSR as a means for competitive advantage, to obtain resources and support.

This is justified by Saeed & Arshad (2012) in their paper, where they affirm that CSR creates an advantage since there are unique, valuable, and hard-to-imitate qualities that come from the company's activity to be exploited. To take advantage of this tool, firms must be able to recognize different situations and react appropriately.

But how do companies translate it into practice? Mohliver et al. (2022) analyze the position that companies take concerning competitors in deciding whether to emulate, ignore or oppose CSR efforts, depending on the social issue beneath.
The outcomes are based on two main variables: *salience* and *agreement*, the first stands for how much stakeholders care about the issue and will consequently reward the firm

for addressing it, while the second is the similarity in the opinion of the public. Now, depending on the level of these two variables, they individuated three equilibria:

- **Universal CSR**, that is when both salience and agreement are high, all firms are keen on embracing the cause. Here the amount of profit that is earned by the charge of the premium on customers is worth the alienation of the minority part.
- **Niche CSR**, that is salience is low/medium and agreement is low. Here, since the level of interest is not very high, it will only be convenient to undertake a form of CSR for one firm. Only one in fact will be able to capture the price premium chargeable to customers. This does not mean that the firm in question will generate higher profits than the others: being supportive of one cause, will alienate the rest of the public who will be tackled by the neutral companies.
- **Social counterpositioning**, is when salience is high, and agreement is low. This prompts one company to position itself in favor of a social cause and its rivals in favor of the opposite stance. In this case, both are realizing the maximum profits since they are fully differentiated.

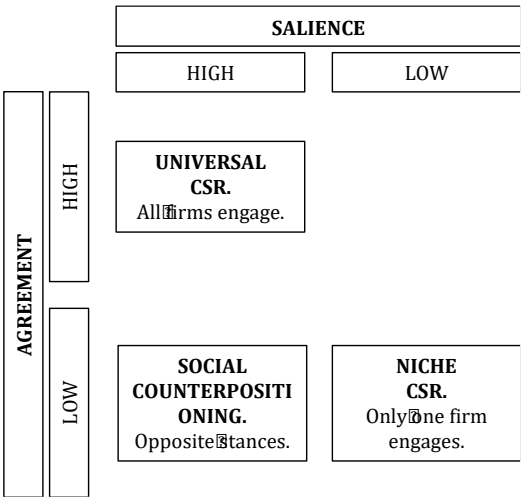


Figure III: Corporate Social Counterpositioning

Source: Own Representation

This paper underlines the importance and uniqueness that each ESG issue has, while at the same time reinforcing the literature on the possibility of premium-charging and superior evaluation of CSR-driven companies.

Seeing CSR by means to reach an end is a very popular explanation of why these practices have been adopted so extensively by companies, and it finds its theoretical justification in

the Legitimacy Theory. LT, theorized by Dowling and Pfeffer (1975), explains that firms try to respect social norms and rules in carrying out their activities. Legitimacy is regarded as a resource that every company values to satisfy the demands of investors and an instrument to increase legitimation by adopting socially responsible practices.
If the implicit social contract is broken, consumers might put in action severe sanctions that could threaten the firm's survival. (Deegan et al., 2002). Legitimacy Theory is a framework through which we can justify the voluntary disclosure of environmental or social information by companies as well as the resources they implement in ESG-related behaviors. Consumers nowadays expect more from companies than just the maximization of profit, and to comply with these requests, they use CSR as a means (Ang and Marsella, 2015).

Wrapping up the concepts that have been explained through this first paragraph, we can then conclude that indeed CSR is a movement developed in the later stage of the 20th century, that poses the premises for what is nowadays a widely accepted best practice. Adopting this strategy in the firm has proven to be rewarding: stakeholders' welfare maximization is the ultimate purpose, and investors integrate ESG goals into their preferences. For these theoretical concepts to be translated into metrics and concrete actions to undertake, particular scores and frameworks have been developed which will be exposed in the next section.

2. MEASURING SUSTAINABILITY: ESG SCORES

Since sustainability and CSR in general are abstract concepts that cannot be measured, in the spirit of the managerial motto *what gets measured, gets managed*, the ESG scores have been developed, and practice grew along the paradigm of Socially Responsible Investing (SRI). In the 1990s, the main method employed consisted predominantly of the use of **negative screening** (to exclude from the investment portfolio stocks of companies that are unsustainable from an ESG point of view). During this decade, the prototypes of ESG metrics were developed: dichotomous measures used to declare if a company was compliant with environmental, social and governance criteria. As years went by, we came to further expand this practice by introducing **positive screening**, along with negative

one, which consists of the selection of the best socially performing companies (Sciarielli et al., 2021).

Hereafter, ESG has become increasingly important, especially thanks to the raised voices of stakeholders who demand from companies more disclosure on related matters. The stronger request comes mostly from Gen Z[1], with 94% of the audience interviewed by Bank of America asking for explicit reporting and 92% of them affirming that they would shift preferences for a brand that supports ESG issues. ESG and social investing have become the trend of the modern economy (Egorova et al., 2022).

The first ever mention of **ESG** was by the United Nations Environment Program Initiative in the Freshfields Report in October 2005 through the figure of Paul Clements-Hunt, who led the works at the time. As the UN PRI reports, there is no definition nor exhausting list of issues that can be considered in the ESG formula, since making one would probably be useless given the impossibility of conveying complete and up-to-date elements. Nonetheless, they provide us with some basic guidelines to follow to better understand the concepts we are referring to.

2.1 *Environmental Pillar*

Environmental issues have taken on an ever-increasing importance mainly due to the bad repercussions that natural events such as extreme temperatures, water scarcity and climate risk, in general, bring on to firms around the world. Once seen as collateral matters concerning business continuity, they now represent real threats which are granted the attention deserved. It comes by no surprise then that in the World Economic Forum's Risk Report 2023, environmental risks take the first four positions in the 10-year-from-now risks ranking: failure to mitigate climate change, failure of adaptation, natural disasters and extreme weather conditions, loss of biodiversity and ecosystem collapse represent the biggest threats we will be asked to face.

Currently score agencies are considering for the evaluation, among others, indicators such as resource use, GHG emissions, innovation (new technologies, processes, or eco-designed products), energy efficiency and climate transition risks.

[1] Generation Z consists of people born between 1997 and 2012 (Pew Research Center).

2.2 *Social Pillar*

The S in ESG stands for Social and can be defined as how a firm interacts with its workforce, suppliers, political environment, and with society overall (S&P Global, 2020). This is an underestimated pillar since, historically, it has not received the same attention as the environmental or governance one, but the negative consequences that it might bring are highly resonating. Many scandals have been brought up, especially regarding the abuse of workers and child-labor exploitation, and the repercussions that companies have faced have been increasingly severe. Another important factor linked to the pillar and extremely prominent in our decade is cyber risk and the insecurities created by the rising number of crimes committed in the field: it is considered in the top ten of risks both in the short and the long terms by the WEF (2023).

All in all, even though it might be stated that it is not the most popular indicator, an S-momentum could be coming: as an analysis found, shareholders rose their social-related proposals by 37% in 2021. Currently, ESG scores embed issues such as health and safety, staff turnover, training and qualification of employees, and absenteeism rate.

2.3 *Governance Pillar*

Governance is the core of the business, representing how it is organized, the distribution of responsibilities, the control of processes as well as dealing with new policies and regulations. Although being by far the most difficult parameter to measure, sound control is a *crucial prerequisite* to address the firm's problems (Who Cares Wins report, 2004).

Issues related to this pillar encompass two macro-groups: i.) Corporate Behavior, which is concerned with ethical issues such as tax evasion, corruption, or anticompetitive practices and ii.) Corporate Governance, which deals with the composition of the board and the ownership structure of shareholders (Larcker et al., 2022).

3. ESG AS A METRIC

3.1 *What Should The ESG Metric Measure?*

The score provided by the different rating agencies is often misunderstood: two different interpretations and uses exist, that people seem to adopt interchangeably, falling consequently into interpretation errors. One view state that ESG measures the impact that

the firm has on the stakeholders as well as the environment's well-being. We are therefore stating that the ESG rating measures how much good is the company doing right now by investing in *just causes* and staying away from those that could harm others. This is defined as an **ESG Impact rating** and is delivered by providers like Moody's and Refinitiv. This type of score is used by investors with an *ESG integration* practice, that is to include in the portfolio companies scoring high that likely align with their values and personal beliefs. Another view instead poses ESG as a metric that measures the impact that external factors could potentially have on the company, mostly from a financial point of view, so that companies can become aware of the eventual damages and prepare strategically for them. This is classified as **ESG risk rating** and is shared by most providers: MSCI, Sustainalytics, S&P, and FTSE Russell. In this sense, it does not matter to calculate and judge the amount of GHG that a company makes each year, as long as there will not be any change in the regulation that might limit or condemn the emissions in the first place, posing a threat to the company. From an investor perspective, this type of score is used to perform what is known as *ESG exclusion*, that is to exclude high-risk firms from the investment.

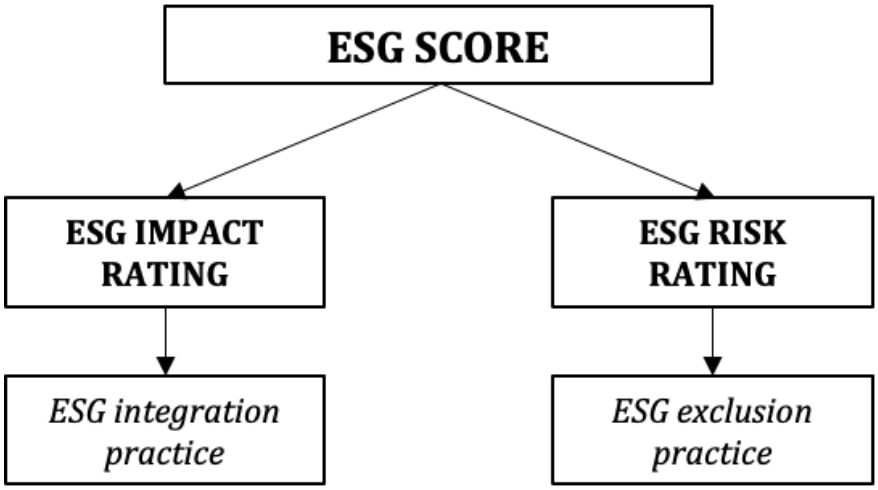


Figure IV: Two Interpretations of the ESG Score

Source: Own Representation

The introduction of ESG metrics and of the agencies that provide these ratings has significantly contributed to the incorporation of ESG considerations in the so-called Responsible Investing practice (Solomon et al., 2004). As it is shown in Figure 5, the

investment into ESG mutual funds in the period 1995-2020 has increased exponentially, reaching 16 trillion USD of AUM.

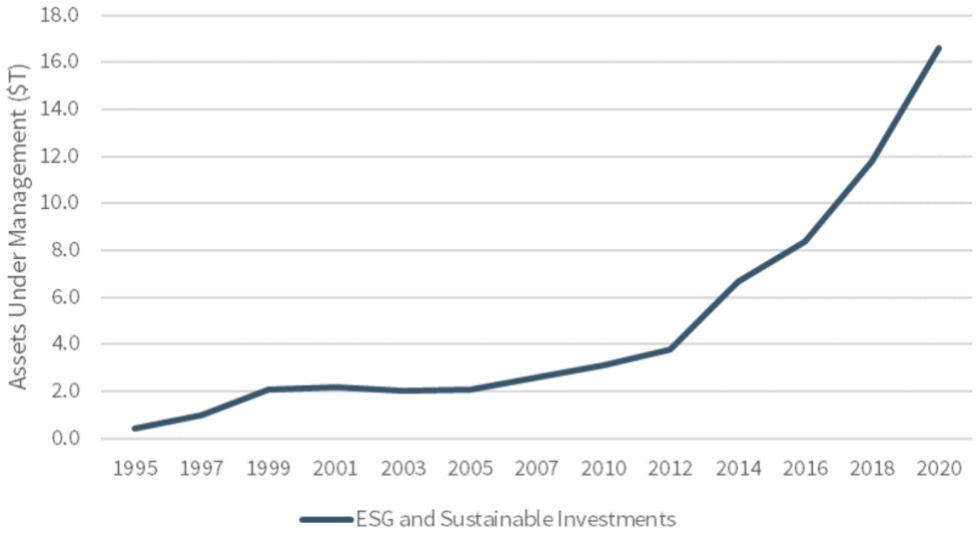


Figure V: Assets Under Management in ESG mutual funds (1995-2020)

Source: U.S. SIF Foundation, "Sustainable and Impact Investing—Money Managers," (2020)

ESG scores are not yet regularized as credit ratings are, which translates into a lack of specific guidelines that assert how they should be composed. The only limitation as of today is in place is that the output must contain some form of **qualitative** input (Mazzacurati for ESMA Report No. 1 2021). It comes as no surprise that among the complaints often brought up by investors and key users, there is a **lack of clarity** in the formulation of these ratings (ESMA Call For Evidence, 2022)[2]. As Joel Makeower, founder of *GreenBiz Group* pointed out, even if the methodologies are published on the websites of the agencies, it does not mean they are understandable.

The complexity of creating an ESG score stands mostly from the fact that a lot of data must be aggregated, coming from three different categories, which translates into three different grades, that must then be turned into a single score. Besides, there is a big

[2] European Securities and Markets Authority: Outcome of ESMA Call for Evidence (Jun 24, 2022). Available at: https://www.esma.europa.eu/sites/default/files/library/esma80-416-347_letter_on_esg_ratings_call_for_evidence_june_2022.pdf

difference in the efforts and policy regulation attention that is being concentrated on the three pillars, with the environmental one being the predominant focus of most regulators. At this pace, it is more likely that the E becomes more standardized and gains credibility among investors much sooner than the S and the G (Berg et al., 2019). Furthermore, the aggregation that takes place is not even homogeneous among the rating providers: some give **equal weight** to each of the pillars, while others instead apply the weights according to the **materiality** of the issues concerning the industry (Mazzacurati for ESMA Report No. 1, 2021). This is a very important point to consider since a company in the oil & extraction industry, of course, will be much more exposed in the environmental pillar than one in the education-technology sector, where data related to privacy protection in the social area represent a concrete risk.

3.2 *Aggregate Confusion of ESG Scores*

There is *aggregate confusion* in the delivery of the ESG rating, mainly brought up by the inconsistency of data sources and the lack of a defined regulation.

Inconsistency of data. Data sources are different for each major rating agency: FTSE Russell has reported that its model uses 300 indicators, Refinitiv 630 metrics and S&P 1.000 data points (Larcker et al., 2022). With this different approach, it comes naturally that the problems faced by the rating agencies are a lot: how to manage this quantity of data, either simplifying or considering the entirety of the set of information they have. Moreover, two other important factors are: i.) how to decide whether an element is material for the company or not (we will treat materiality more thoroughly in Chapter II); ii) how to deal with eventual holes in the material categories: should the rating agency ignore it completely? and iii) how much weight should respectively the E, the S and the G have?

All these diversities have brought evident discrepancies in the results delivered, and as we can see in Figure 3, the correlation between the scores, even considering the same industry, is very low. The study, conducted on 24 sectors for the same 400 firms, shows contradictory results.

ESG Ratings Comparison: Correlations

	MSCI	S&P	Sustainalytics	CDP	ISS	Bloomberg
MSCI		35.7%	35.1%	16.3%	33.0%	37.4%
S&P	35.7%		64.5%	35.0%	13.9%	74.4%
Sustainalytics	35.1%	64.5%		29.3%	21.7%	58.4%
CDP	16.3%	35.0%	29.3%		7.0%	44.1%
ISS	33.0%	13.9%	21.7%	7.0%		21.3%
Bloomberg	37.4%	74.4%	58.4%	44.1%	21.3%	

Figure VI: ESG Correlation between Rating Agencies

Source: Bloomberg Finance

Lack of defined regulation. The disclosure guidelines on ESG are still very opaque and a unique framework has yet to be adopted by companies around the world. This results in around 600 ESG reporting provisions globally that do not provide resembling measures and are therefore meaningless from a comparative point of view.

On the divergence created by various rating agencies in the score delivered, Berg, Kölbel and Rigobon (2019) wrote a paper that aims to identify the roots of these discrepancies. They divided the ratings into three measures: i) the *scope divergence*, that is the lack of agreement on the type of attributes that compose the categories (it goes up to 282 indicators); ii) *measurement divergence*, which is the difference in the measures used by each provider to evaluate the attributes and iii) *weighting divergence*, that is the difference in the importance assigned in weight terms for each category. They found that measurement divergence contributes to 56% of the divergence, scope 38% and weight only 6%. More light has been shed on **weight divergence** and its importance by the research team of the MSCI ESG department (Nagy et al., 2020). They found that the weighting scheme assigned to the combination of E, S and G elements can significantly influence the outcome. The test was performed on a sample from 2006 to 2019, trying to find a correlation between the ESG rating and the financial performance of companies (profitability, residual CAPM volatility and residual volatility). The weights assigned to the scores were of three natures:

i. Equally weighted variables
ii. Optimized weights based on historical performance (Backtested weights)
iii. Industry-specific weights

While backtested weights and equally weighted variables resulted in a stronger relationship with short-term financial performance, industry-specific ones instead showed a great correlation with long-term results. This study provides not only a significant contribution to the ESG score and financial performance correlation, but it sets light on the importance that the weighting scheme has on this relation.

To explain the rating's divergences, the study by Christensen et al., (2021) most surprisingly concludes that the disclosure of ESG information by companies is not reducing the differences but is instead increasing them. They argue that given the lack of general direction on the matter, the more information is available, the more is open for interpretation by agencies. It is also found that usually, firms associated with higher ESG disagreement are also the ones with higher return volatility and a lower likelihood of issuing external financing.

If no unique framework has yet been found to be applied to public companies, startups in this picture are even harder to address. One of the main difficulties of this elaborate is in fact to build a legit score that can take into consideration the early stage of the businesses analyzed, while at the same time highlighting the peculiarity of the technology sector.
The differences that are still strongly traceable in the current rating systems pose a threat to the market and investors, since no legitimation has yet been assigned by entities around the world to which of the numerous providers is delivering the best information. Misleading data can deceive market users, leading to huge losses of money: for this and other important factors, agencies and governments around the world have started to formulate their guidelines on what is ESG and what type of information is necessary to take into consideration.

4. THE NEED FOR AN INTERNATIONAL FRAMEWORK

Given the lack of an international regulation that leads the reporting on ESG matters, there has been a growing momentum asking for clear and sound guidelines, especially after the surge of financial results obtained by sustainable funds during Covid-19 pandemic.
It has come to light recently, in fact, that the main reason why investors do not adopt ESG metrics into their best practices is the **lack of comparability** between measures and time

across industries (Amel-Zadeh & Serafeim, 2018). There should be an accepted reasonable baseline on which companies should be able to work: the excessive demand for the most varied items is not beneficial for either of the parts (Kotsantonis & Serafeim, 2019). The most prominent figure in this context, a self-proclaimed representative of sustainability standards, is the International Sustainability Standards Board, created by the IFRS Foundation on November 3rd, 2021, to "*deliver a comprehensive global baseline of sustainability-related disclosure standards that provide investors and other capital market participants with information about companies' sustainability-related risks and opportunities*[3]". Not everyone seems to have appreciated this self-appointment act, as some scholars have heavily critiqued the approach that the IFRS has towards ESG issues, as we will see in the next paragraph.

How are jurisdictions working towards this?

4.1 International Regulation

4.1.1 European Legal Framework

The EU adopted a proposal in April 2021, the Corporate Sustainability Reporting Directive (CSRD)[4], which **obliges** companies to publish their position on environmental, social and governance themes such as bribery, emissions, and human-rights performance. The scope of the CSRD comprehends all large and listed companies, meaning the ones that meet at least two of the three criteria[5]:

- More than 250 employees
- Turnover higher than 40 million
- Assets higher than 20 million

[3] International Sustainability Standards Board. Available at: https://www.ifrs.org/groups/international-sustainability-standards-board/

[4] European Directive of the European Parliament and European Council amending Regulation (EU) No. 537/2014, Directive 2004/109/EC, Directive 2006/43/EC and Directive 2013/34/EU.

[5] Including the following companies regardless of their legal form: (a) insurance undertakings within the meaning of Article 2(1) of Council Directive 91/674/EEC; (b) credit institutions as defined in Article 4(1), point (1), of Regulation (EU) No 575/2013 of the European Parliament and of the Council

CSRD will be applied for fiscal years starting from January 1st, 2024, to companies already subjected to NFDR and for those that are not, it will be valid from 2025.
For all other listed SMEs, the disclosure will become mandatory from January 1st, 2026, expanding the number of companies from 50,000 to 120,000.
In the formulation of this report, EFRAG has published a set of European Sustainability Reporting Standards (ESRS) that companies will be required to follow.
There will be three macro-categories of standards:

i. Cross-cutting & topical standards – which have a general connotation meaning they are sector-agnostic.
ii. Sector-specific standards.
iii. SMEs specific standards.

Currently, the only drafts available, published in November 2022 are the cross-cutting standards and the topical ones. The other two categories will be available for consultation as soon as possible.
Cross-cutting standards comprise the following:

I. ESRS 1 – requires companies to identify the **group of stakeholders** that might be affected or interested in the disclosure. It is based on the **materiality** principle, meaning each company is required to disclose certain information about its industry although there might be sensitive elements that are required for everyone.
II. ESRS 2 – these include **company-specific** assessment: the business, the risks to which it might be subjected, and the difficulties encountered in the fiscal years, as well as prior periods' errors.

Topical standards, as we can see in Figure VII, are divided into three major categories: Environmental, Social and Governance. They want to tackle specifically how the company is dealing with the issues reported in the ESRS standards for each pillar: the strategy they have adopted, the risks they are incurring, and the solutions found to meet the European Green Deal's objectives.

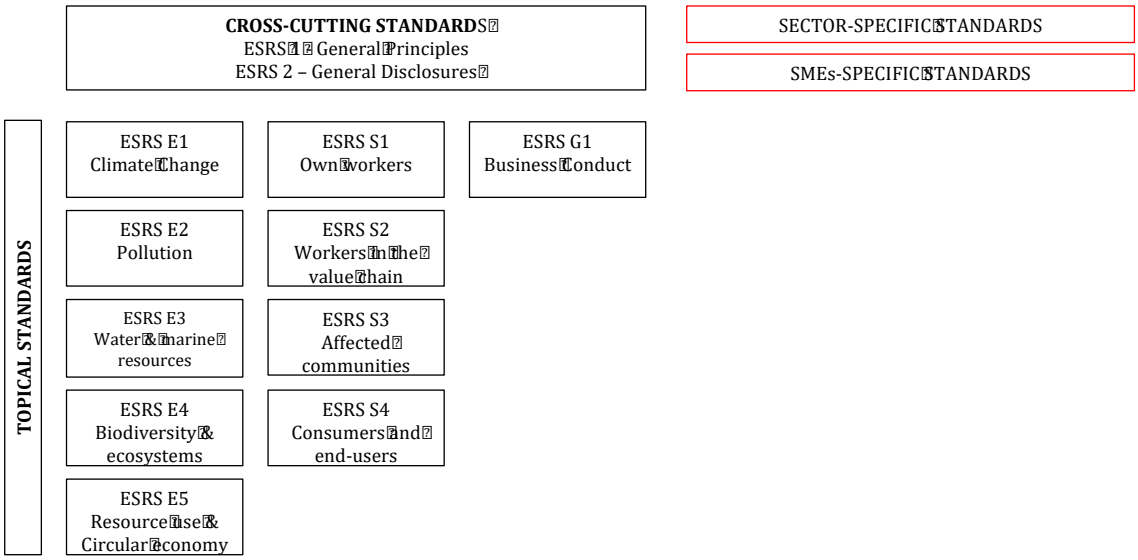


Figure VII: Taxonomy of European Sustainability Reporting Standards

Source: Own Representation

As it has been mentioned in the previous paragraph, the IFRS is now in charge of building Sustainability Standards, by the means of the SASB, although its approach has received different critiques. In the work of Parikh et al. (2021), the main differences between the IFRS' and the EFRAG's ideas are highlighted, as well as an explanation of why the first's approach is counterproductive for stakeholders. Three main reasons have been presented: i.) The audience: IFRS has a narrow scope of public, concentrating only on investors, while the EFRAG addresses all stakeholders, and whoever might have an interest in the company; ii.) The scope: IFRS has a narrower scope, privileging the climate issue, leaving less space to the other two pillars. EFRAG, on the other hand, holds true to the whole meaning of ESG, which envisages the consideration of all the issues, from fair treatment of employees to sustainability of the supply chain; iii.) The approach: IFRS is concentrated on the materiality that the information might have for the financial audience of the disclosure (investors, lenders, and creditors), while EFRAG approaches the situation through what has been called *double materiality*, that is not only considering the impact of ESG risks on the company, but also the impact that company's actions have on the environment.

4.1.2 USA's Legal Framework

The US are historically less prescriptive in the tightness of demanded disclosure, therefore their position on the ESG framework is still far from that of the EU. They have always been more concentrated on the **materiality** of the information disclosed, meaning that it must be useful for the stakeholder that will address the financial statement to be written on it. At the time of the writing, there is no type of mandatory disclosure of ESG information required by the Security and Exchange Commission (SEC), if not, voluntarily, to publish any type of future foreseeable risk that could harm the shareholders, among which, there might also be environmental-related happenings and greenhouse-gas emissions (GHGs)[6].

It is of the general opinion that the requirements of disclosure are currently below the level of other countries, and for this reason, the SEC has advanced a meaningful proposal in this direction. In March 2022, the agency published *The Enhancement and Standardization of Climate-Related Disclosures for Investors*[7] which would require companies to disclose climate change risks, how their strategy has been adapting to increasing risks, as well as Scope 1 and 2 GHGs emissions and Scope 3 if material for the company's stakeholders. The period of adoption would have come as soon as the 2023 FY for some big companies, while it would have started one year later for smaller ones, if not that the commission did not publish the rule at the end of 2022, as planned. Members of the SEC stated that the comments received were so numerous that it has been impossible to finalize the rule, which is now expected in 2023. This delay has been perceived as a political matter though, since US CEOs are critically opposing this regulation by defining it as "overly burdensome" (UPS) and leading to inaccurate disclosure that erodes their significance (BlackRock). Moreover, from June's sentence *West Virginia v. EPA*, agencies need Congress' permission to publish a regulation that has a major economic or political

[6] Release Nos. 33-9106; 34-61469; FR-82, US Securities and Exchange Commission (SEC), February 8, 2010.

[7] Release Nos. 33-11042, 34-94478, File No. S7-10-22, US Securities and Exchange Commission (SEC), March 21, 2022. The proposed rule would not come into effect until fiscal year 2023

impact, which represents another pushback from the political environment to the release of this law.

4.2 Startups Positioning in The Matter

We have analyzed ESG disclosure of two main geographical areas, Europe, and the United States, and what we can assume by the current legislation is that while the EU has decided to frame into well-defined points the information that companies will be required to publish, the US is still trying to figure out how wide its scope could be on the matter.

Now let us analyze further the startup position. As we have seen, even if the regulation is in place for European companies, small enterprises are still out of this scope: this can be traced back to the fact that, historically, disclosure has always comprised huge amounts of cash for companies to invest in. To provide a sound and assured report, you must not only invest resources in the retrieval of information and data, but it is required that you affiliate with an agency, or an auditor, that can assure your information is truthful. Of course, this type of consulting is costly and not something that any kind of company can undertake, especially small ones. Therefore, on the matter startups remain out of the scope of this regulation.

Analyzing the US environment then, since there is still no regulation available for big multinationals or listed companies in general, being startups even further down in the ladder, no regulation whatsoever is required for them.

So, should startups just ignore the matter while they can? Quite the contrary.

It must be acknowledged that the world is changing shape and the interests of major stakeholders that surrounds companies are pointing toward one common direction: ESG-related matters. According to the Global Investor Survey by PwC, 79% of investors consider the company's ESG-risk profile when investing: clearly, it has become a critical component in the investment decision. Since 82% of them think that CEOs should embed ESG directly into the corporate strategy, it is of course more convenient to start early than to wait around and see. Startuppers have a major competitive advantage over well-established companies: since they have not been settled in fully yet, they can easily track down their ESG measures like greenhouse gas emissions and consumption.

When considering customers, PwC points out that 83% of them think that companies should shape an **ESG best practice** in their strategy and 76% affirmed that they would

discontinue the relationship with the brand if they found out that it was acting poorly on an ESG basis. Finally, employees are on the run too from companies that do not respect their values and principles: 8 out of 10 people said they would not work for an employee that does not respect ESG pillars.

There is little room left for companies to avoid completely this matter since stakeholders have raised many points that they want to be acknowledged. But it will not be only a voluntary strategy for long: now that a full regulation has been put in place, soon it will be asked to startups too to show their sustainability numbers. It will be easier to start earlier then, when numbers and consumptions are relatively little and easy to manage. Finally, especially in the US, the proposed legal framework considers Scope 3 emissions in the reporting. As defined by the US Environmental Protection Agency (EPA), they are "value chain" emissions, which means those not produced directly by the company but upstream and downstream of its value chain by the entities that come into contact with it. To be concrete, it means that in the sustainability report of Company X, under the voice Scope 3 emissions, will be reported those produced by its suppliers and vendors. Given the increasing importance that ESG matters are receiving, companies will probably look for an eco-friendlier solution when considering whom to do business with. This will impact other companies as well, making it difficult for those who do not have a concrete sustainable plan integrated into their strategy to do business in the market.

5. LITERATURE REVIEW ON THE TOPIC

5.1 *How Is ESG Integrated into The Investing Practice?*

So far, we have stated the increasing importance that ESG has gained throughout the years in the investing practice. Evidence that can be traced primarily in the legislation changes that have characterized our major markets, first and foremost in Europe, with the publication of the Sustainable Finance Disclosure Regulation (DSCR) as well as an important advancement in supranational organs like the United Nations. The Responsible Investing best practice promoted by the UN poses six fundamental pillars for investors to take on, since it has been made clear that the world relies heavily on private capital to tackle the urgent issues that our planet requires to manage. Although there has been a

large approval of the Sustainable Development Goals inside the investment practice, many operators of the market have been asking why they should address these issues and what is the best way to achieve that outcome. It is important to acknowledge that in this framework, the integration of SDGs goals into investing practice is not seen as part of an impact investing movement, but within responsible investing instead. While the difference may sound thin and neglectable, it is not: impact investing is concerned with the production of social benefit for a community, while responsible investing is focused on addressing the firm's risks and threats, which indeed could come from ESG elements as well as the most classical financial ones. Therefore, if impact investing could be a niche of the comprehensive SRI movement, pursued by impact funds, **responsible investing** instead concerns every kind of business. Risk mitigation, therefore, as an integration of ESG practices into business consideration, is the ultimate goal pursued with this practice and an important part of a firm's strategy (Clark et al., 2015).

There is another important difference to consider when analyzing investment practices: that is, the distinction between screening, divesting and ESG integration strategies. While screening and divesting represent a more mechanical approach to decisions, the ESG integration strategy is by far more proactive in this sense: empirically, the latter bear higher performance concerning the first two (Atz et al., 2022). This could be partially explained because in excluding companies from the pool of investment, a substantial loss in terms of size and diversification results (Trinks and Scholtens, 2017).

5.2 *Empirical Evidence*

Empirical evidence seems to back the theoretical assumption of the importance of adopting ESG practice along with the financial criterion. Just to give an idea, the following graph presents the Global Sustainable Investment Alliance's estimates for the upcoming years and as we can see, the numbers of AUM are to reach 70 trillion by the end of 2026: the US will lead the growth, after Europe who had historically been the most invested in the topic.

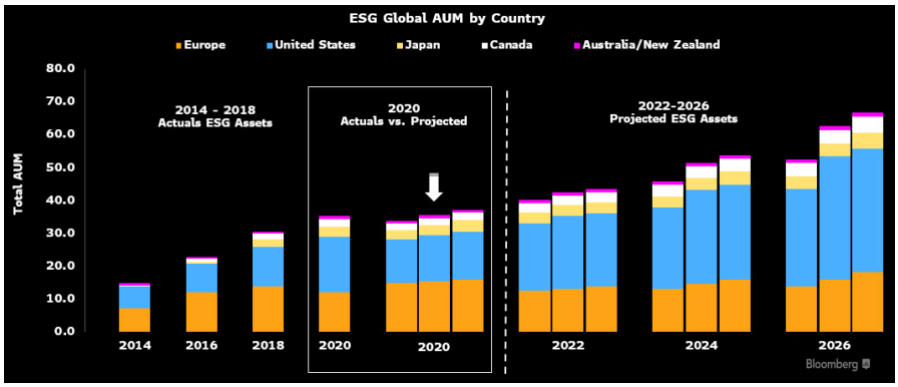


Figure VIII: ESG Global Assets Under Management by Country

Source: Global Sustainable Investment Alliance, Bloomberg Intelligence

Moreover, looking into the recent happenings, according to Morningstar (2021), sustainability funds have upheld better the backlash from the pandemic with regards to their non-ESG invested peers. These results depict ESG funds as "safe heaven" properties that bear protection against downside risk (Atz et al., 2022).

Despite the surge in this type of investment though, whether a positive correlation exists between ESG investments and financial performance is a topic that has been hotly debated in the past years. The first major comprehensive study about the correlation between ESG and corporate financial performance (CFP) was conducted in 2015 by Bassen, Busch and Friede who reviewed more than 2000 academic studies on the ESG-CFP relationship. The sample was composed of 723 primary studies and 1214 meta-analyses. To define corporate performance, they took into consideration: accounting numbers, risk metrics as well as growth ones. The results for each of the two categories were the following: 48.2% of the overall sample showed a positive relationship between the two variables, 10.7% a negative one and 23% showed no correlation.

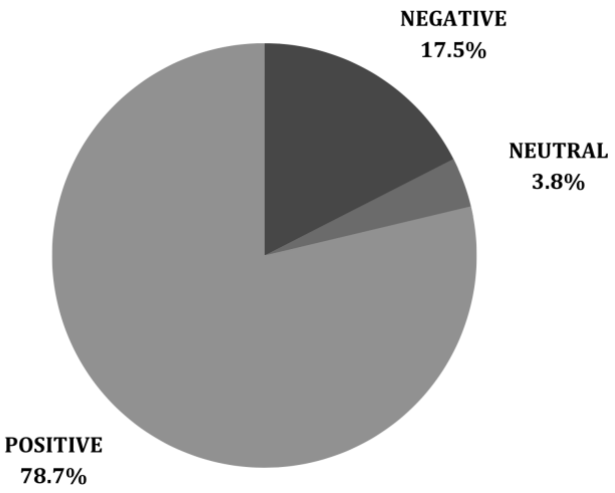


Figure IX: Correlation Results between ESG and Corporate Financial Performance

Source: Own Representation

Breaking down the three pillars though, an even more interesting outcome can be analyzed: Governance represents the higher correlation, 62.3% compared to 58.7% Environmental and 55.1% Social. Considering geographical distribution then, the most promising relationships can be found in North America and emerging markets, with European ones following well below.

For a more recent perspective, an interesting review was made by NYU Stern Center for Sustainable Business in partnership with Rockefeller Asset Management, which analyzed academic papers from 2015 to 2020. They delineated two conceptual definitions of corporate performance: i) financial performance, usually represented by the ROA or ROE metrics, as well as the price of the stock for the company; ii) investment performance, usually represented by metrics like *alpha* or the Sharpe ratio. They as well divided the study into two sub-categories: one that focused only on Investor-focused studies, that is the ones that looked for a direct relationship based on benchmarks, KPIs and governance structure (the model adopted for this thesis); the other approach instead, is Corporate-focused, which finds partial-correlation because it includes in the analysis mediating factors such as improved risk management or operational efficiency.
Considering more than 1000 articles, these were the findings:

- Corporate studies: 58% showed a positive correlation, 8% negative and 34% are either mixed or neutral results.

- Investor studies: 33% positive correlation, 14% negative and 53% mixed or neutral results.

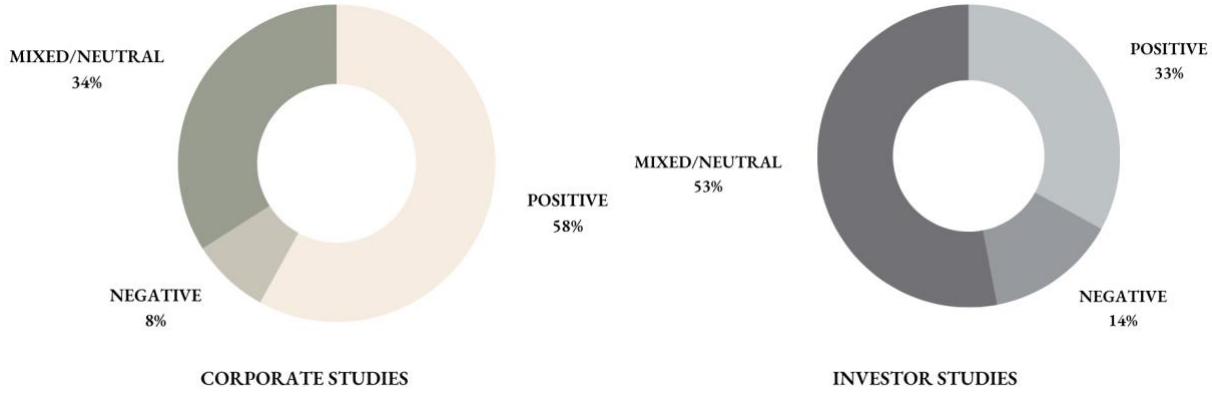


Figure X: Graphic Representation of the Relationship between ESG and Financial Performance

Source: Own Representation

How can we explain this outcome? According to Gillian et al., (2021) who reviewed the most prominent studies that relate ESG performance with companies' characteristics, we can trace back the positive relationship between financial performance and ESG measures to two categories. First, companies have better financial performance because they **increase shareholders' wealth** through ESG practices. This could be because employees prefer to work for firms that have a good reputation or more customers are willing to pay for their product. Moreover, as different studies have discovered (Chava, 2014; El Ghoul et al., 2011), companies that rank high on ESG performance have a lower cost of capital compared to others. Scholars seem to agree that a high ESG score is set to reduce different types of risk: including systematic risk (e.g., Albuquerque et al., 2019; Oikonomou et at., 2012), credit risk (Jiraporn et al., 2014) and idiosyncratic risk (Becchetti et al., 2015).
Second, although the cash flows received might be the same as other firms, shareholders could derive a higher worth because of the **environmental or social value** produced by the company. The outcomes of the study though do not point clearly in one sense, but present instead, both on the investor and in the corporate side, respectively 53% and 34% of mixed or neutral results. This is justified by the authors by the presence of general confusion over terminology (i.e., how Corporate Social Responsibility is defined across

studies), differences in ESG Scores and lack of standardization in the information published.

Delving further into the literature, we can find studies supporting the other side of the medal, that is, that a negative correlation exists between the two variables. As Di Giuli and Kostovetsky, (2014) argue, the rationale beneath these papers is that to provide extra non-financial returns, they must come at the expense of the firm value. It must be acknowledged though, that the papers that find an exclusively negative correlation are infrequent; on the other hand, when authors report "mixed results" it often signifies that a positive and neutral or negative relationship has been found.

5.2.1 Evidence From The United States Technology Sector

Okafor et al. (2021), conducted a comprehensive study by performing a multilinear regression on the top 100 technology companies in the USA, obtaining mixed results. On the one hand, he found a positive relationship between CSR activity and companies' revenues, providing a breakthrough in research. Moreover, a positive association was also found between CSR and profits, again demonstrating that adopting an ESG practice can be a competitive advantage for companies. On the other hand, though, results are mixed as no relationship was found when analyzing Tobin's Q measurement.

Analyzing the performance of S&P500 companies between 2007-2011, researchers found a U-shape relationship exists between ESG commitment and CFP, specifically with the **Governance** pillar. This type of relationship differs from the linear regression since it presumes that for CSR to be an effective source of competitive advantage for companies, they must invest beyond a threshold and plan for the long run (Nollet et al., 2016).

5.2.2 Evidence in young entrepreneurial finance

Zooming in on the entrepreneurial finance literature, and startups more specifically, we found scarce literature so far, represented by only a few studies conducted in the past years. Zhang, (2022) contributes by analyzing the performance of impact ventures with respect to profit-driven ones. She found out that venture capitalists in her experiment

consistently underestimated the ESG-driven startups, thinking that they would bear lower financial returns: the outcomes though were the opposite. ESG ventures have a 13,6% higher likelihood to raise another round of financing and a 2,6% lower likelihood to go bankrupt. Given these findings, we would expect that the valuation of the startup is influenced by its ESG commitment, hypothesis that will be examined in this dissertation. Finally, a correlation between the ESG performance of companies and the intellectual, human, and social capital of people has been found: they are all key qualities for a startup's CEO to have (Ahlers et al., 2015).

5.3 Literature Review Summary

To summarize, there have been mixed contributions by authors regarding the relationship that ties Corporate Social Responsibility and Financial Performance of companies. Many of the discrepancies can be traced back to the lack of a unified Score framework, as well as divergence in the information disclosed by companies.

What emerges though, is that good CSR contributes significantly to those areas that consequently improve CFP: reduction of idiosyncratic risk, credit risk and equity cost of capital. The direct analysis that detects whether there is a consistent relationship between CFP and CSR though, is not giving clear results.

AUTHOR	TIME FRAME	TYPE OF SAMPLE	GEOGRAPHIC	RELATIONSHIP ANALYZED	CORRELATION
Albuquerque (2019)	2003-2015	4.670 U.S. Firms	USA	ESG - Systematic Risk	**Negative**
Atz, Van Holt, Zongyuan, Bruno (2022)	2015-2020	+1000 research papers	World	Corporate Studies Investors Studies	**Mixed Results**
Bassen, Busch & Friede (2015)		723 primary studies and 1214 meta-analyses	World	CSR - CFP relationship	**Positive**
Becchetti, Ciciretti, Hasan (2015)	1992 - 2005 2006 - 2010	4.383 US Public Companies	USA	ESG - Idiosyncratic Risk	**Negative**
Chava (2014)	1992-2007	Sample of US companies rated by KLD Research & Analytics	USA	ESG - Equity Cost of Capital	**Negative**
Di Giuli and Kostovetsky, (2014)	2003-2009	3000 publicly traded US Companies (Russell 3000)	US	CSR - CFP relationship	**Negative**
El Ghoul (2011)	1992-2007	12.915 US Public Firms	USA	ESG - Systematic Risk	**Negative**
Gillian, Koch & Starks (2021)	2009-2020	Companies listed on worldwide stock exchanges	World	CSR - CFP relationship	**Mixed Results**
Okafor (2021)	2017-2019	Top 100 Tech Companies listed in the S&P 500	USA	CSR - CFP relationship	**Mixed Results**

Figure XI: Literature Review Summary

Source: Own Representation

6. PURPOSE OF THIS THESIS

Few papers so far have addressed the link that there is between ESG performance and entrepreneurial finance. Many of the scholars that have tried to study the relationship that ties the two variables have found themselves in front of a framework dilemma: there is currently no specific score that addresses startups' ESG characteristics. Therefore, the first purpose of this thesis is to propose a framework that can measure the ESG risk of startups. Through that, I will examine whether a correlation exists between the evaluation of the business and its position in the ESG world by using the quantitative data that better represents this commitment: ESG score.

The general feeling is that a positive relationship between the two variables exists, or in other words, that a negative relationship exists between a firm's ESG risk score and its financial evaluation. Studies on the topic have concluded that startups scoring high on ESG could benefit from an evaluation premium given the fact that: (i) they are more likely to raise further rounds of financing; (ii) more investors could be attracted given the ESG rents (extra-returns that are non-financial in nature) they receive in addition to the conventional ones.

My research question will be:

I. *Does ESG score affect startup valuation in the market?*

II. THE TECHNOLOGY INDUSTRY

For this thesis, the sample considered has been selected observing two important criteria:

- Industry: the industry chosen for the paper is Information Technology.
- Location: the startups selected all have their official Headquarters registered in the United States.

1. CORE CHARACTERISTICS

The technology industry has not yet received a definitive list of specific parameters through which it can be classified, although there are general guidelines that scholars seem to agree on when considering the sector. These chore characteristics (Hooton, 2019) are i.) High investments in R&D, ii.) A high number of STEM-graduated employees, iii.) Production of a complex product or service and, iv.) Novelty brought in the production of the output. If the parameters cited seem to be widely accepted by academics, it is still hard to precisely define which firms deserve to be considered inside the technology sector due to a lack of specific quantitative and qualitative aspects that are difficult to parametrize. Two approaches are academically accepted: the expert panel and the quantitative method.

The expert panel. As the name suggests, a group of experts is set to decide whether a firm has the right qualifications to be considered inside the tech sector. The obvious limitation of this approach is the subjectivity of the decision, which makes it almost impossible to replicate a study following the same criteria (Cortright & Mayer, 2001).

Quantitative method. This by far more objective criteria consists of the selection of companies that respect a significant threshold in the fundamental characteristics cited above.

Both methods bear intrinsic limitations, since the first one is too loose in its parameters, while the other one is too tight. Especially the tightness could mislead the research in our study because startups, for example, might meet the STEM-graduated and disruptive product characteristics, but still be discarded because of a low R&D investment dictated by the novelty of the business. Another point to be raised in the matter is: a tech startup is it one producing technology or one that intensely uses it? (Hatzichronoglou, 1997).

As the reader understands, there are intrinsic problems in the classification of a business, especially for a startup, for their still underdeveloped business model as well as reduced financial possibilities. To avoid misevaluation of the businesses, another classification was implemented.

2. CLASSIFICATION

Taking the distance from the quantitative-like classifications, the approach used in this research was intrinsically qualitative. For the definition of the sector, I adopted the taxonomy of the Global Industry Classification Standard (GICS), which was created jointly by S&P Dow Jones Indices and MSCI in 1999. The first level is the sector, *Information Technology* in our research. The second layer relates to the industry's groups, which in IT are: *Software and Services*, *Technology Hardware & Equipment* and *Semiconductors & Semiconductor Equipment*, but only the first two were taken into consideration for this research. The division further breaks down into 4 industries and 8 sub-industries.

SECTOR	INDUSTRY GROUP	INDUSTRY	SUB-INDUSTRY
Information Technology Code (45)	**Software & Services** Code (4510)	**IT Services** Code (451020)	**IT Consulting & Other Services** Code (45102010)
			Data Processing & Outsourced Services Code (45102020)
			Internet Services & Infrastructure Code (45102030)
		Software Code (451030)	**Application Software** Code (45103010)
			Systems Software Code (45103020)
	Technology Hardware & Equipment Code (4520)	**Communications Equipment** Code (452010)	**Communications Equipment** Code (45201020)
		Technology Hardware, Storage & Peripherals Code (452020)	**Technology Hardware, Storage & Peripherals** Code (45202030)
		Electronic Equipment, Instruments & Components Code (452030)	**Electronic Equipment & Instruments** Code (45203010)
			Electronic Components Code (45203015)
			Electronic Manufacturing Services Code (45203020)
			Technology Distributors Code (45203030)
	Semiconductors & Semiconductor Equipment Code (4530)	**Semiconductors & Semiconductor Equipment** Code (453010)	**Semiconductor Equipment** Code (45301010)
			Semiconductors Code (45301020)

Figure XII: Weighting scheme according to MSCI Industry Materiality Map

Source: S&P Sector Primer Series

1.1 Hardware

Hardware is a term that is generally associated with the computer world, developed firstly in 1967 to perform calculation and evaluation analysis that was beyond the mean of a

human brain. Historically, we distinguished between the vital parts (e.g., CPU, motherboard, processor) and the peripheral hardware (e.g., monitors, mouse, keyboard). Although the evolution of these components has been fast and extraordinary in its advance throughout history, the basic elements that nowadays we still employ are the same (Manikandeshwar, 2015).

1.2 Software

Software, on the other hand, is something that we can hardly fit into a category, and somehow its quintessential nature sometimes seems imponderable and unknowable (Osterweil, 2018). This unfolds into the classification difficulties encountered in the definition itself, since the tendency would be to put into the basket what could be considered an excessive number of sub-industries.

As is the case with hardware, software is often associated with the computer world, where it was first developed. The core of the element is the *code*, a set of instructions that are delivered for something (usually hardware) to function. There are two main distinctions, as it is reported in the GICS classification: system software and application software. **System** refers to the enablement of a platform for application software to run; **Application** instead is designed to perform functions directed by the user. A movement of scholars has theorized that it would be reductive and pointless to say that software is limited to that: the software does not simply code (Osterweil, 1997). In his book, the professor highlights that *process* could in a way be considered software as well: it entails a series of steps guided by procedures and standards, performed through tools and techniques.

Although a unique definition has not yet been provided by the literature, some core features enable us to identify what can be considered *Software*.

Composition. Software is a non-tangible product that generally, but not always, is designed to manage physical assets.

Evolution. Software is expected to be changed, modified, and improved throughout time. There is a margin of error granted in the conception of this product, embedded in it.

1.3 Hardware vs. Software

It seems generally agreed upon that Hardware startups have it harder than Software ones. This is the consequence of the intrinsic nature of the product delivered: Software is non-physical, and often saleable through a service business model that grants a stable stream of revenues. For Hardware instead, the product is physical, and the business model implies almost always a one-time transaction that does not create a relationship with the client.

Eric Ries, the author of *The Lean Startup*, has written about the challenges of developing and scaling Hardware products in an article for Harvard Business Review. He pointed out that Hardware startups often face longer development cycles, higher costs, and more complex manufacturing processes than Software startups. This translates into a much higher barrier cost of entry to kickstart a Hardware company, which constitutes the reason for the failure of most startups.

Finally, another important distinction to be made is the *malleability* that Software has in comparison to Hardware. Software can have initial bugs but still be outed and sold as a Beta or Version 1. It is not only a bug-correction feature, but it is also a question of keeping up to date: Software can be corrected, revised, and amended to perform according to the latest trends. Hardware is physical, almost immutable and it is excessively costly to modify it.

In summary, scholars and authors generally agree that Hardware startups face unique challenges related to product development, manufacturing, and scaling, which can be more complex and costly than Software businesses.

	HARDWARE	SOFTWARE
Product	**Physical** product that contains different rare metals and hard to find materials: higher cost, longer production.	**Non-physical** product, often based on a Cloud infrastructure that can/cannot be managed by the same company.
Business Model	**One-time transactions** that does not create a relationship with the customer.	Transactions are more frequent because almost always it is a **membership** type of contract: continuous stream of revenues.
Malleability	Hardware is released and eventual bugs cannot be corrected until the next version is published.	Software has beta versions, can be debugged and republished faster, easily modifiable.

Figure XIII: Key differences between Hardware and Software

Source: Own Representation

1.4 Technology Startups

As a universal definition that precisely describes the technology sector has yet to be created, the same goes for what startups are concerned. In previous literature that studies behaviors of early-stage companies in the high-tech industry, there are only a few examples of peculiar descriptions. Many focus only on the young age of the companies, by describing them as without sufficient resources and operating in a highly uncertain environment, without an established legitimization (Wang et al., 2016). In this thesis, tech startups are judged as companies that not only have a high degree of innovativeness intrinsically built into their business model, but also entities that combine different technologies already existing, providing a huge impact on society and gaining a competitive advantage by doing it. (Ulč, 2021).

2. MATERIALITY

Materiality is an exquisite accounting principle, which states that all items that could in any case influence the investor's decision-making process should be reported in businesses' disclosures. This concept has been applied to the sustainability practice in that it must be disclosed what goals and functions are put into place by the company, to prove not only the financial performance but also the social values and how long-term goals will be achieved.

Sustainability materiality can be considered a practical tool, implemented to govern organizational behaviors (Douglas et al., 2017). Sets of predefined key criteria have been

created for us to judge the consistency and usefulness of data provided by companies, since a unique perspective has yet to be defined. It is important to remember that businesses are not required to provide specific information in their non-financial disclosure, which can consequently be selected at will. Hence pages and pages could be disclosed by firms that, at a closer and expert look, result redundant and boilerplate.

The main causes of this differentiation in the materiality assessment can be traced, among others, to the lack of a unique framework that defines what is material to the sustainability field, and freedom that leaves room for managerial discretion (Edgley, 2014). This sparks another important phenomenon that is *greenwashing*, the disclosure of positive information by companies in irrelevant matters, without mentioning the relevant negative ones (Lyon & Maxwell, 2011). The adoption of this practice is dictated by trade-offs that businesses are compelled to make between short-term, easy-to-reach goals and long-term, resource-consuming ones. By framing a unique materiality map, these trade-offs can be exposed and undergo public scrutiny (Guo et al., 2018).

2.1 How To Determine Materiality

A call for a unique framework has been upheld by several scholars (Eccles et al., 2012) to combat the arbitrary decisions of managers and prevent vague and immaterial disclosures. To come forward with this request, the SASB has introduced the *Materiality Map*[8], a scheme divided per industry, for companies to find the most relevant ESG issues to consider when producing their non-financial reporting. Although representing a big advancement in the materiality panorama, it still bears many doubts as to its intrinsic applicability: MNEs are regarded as big, complex organisms that cannot, consistently, be categorized into just one industry (Puroila & Mäkelä, 2019). This is also strictly relevant in the conceptualization of materiality itself: as it has been laid out by Ferraro et al., (2015), industry-based assessment ignores the "*complexity, uncertainty and evaluative nature of sustainability challenges*" that are firm-specific.

Complexity. Sustainability challenges are complex because they result from the interaction of many actors, none of whom can be identified as the root of a bigger problem. Moreover, when considering one problem, it must be acknowledged that the solution for

[8] Available at: https://www.sasb.org/standards-overview/materiality-map/.

one group of stakeholders may result in somebody else's trouble. For example, tackling non-renewable resources problems by introducing biofuels may enhance the well-being of someone, but it might lead to deforestation or loss of biodiversity (Ferraro et al., 2015).

Uncertainty. The inherent perplexity in confronting sustainability challenges comes from the multiple perspectives that must be taken into consideration when dealing with the matter. To make a practical example, climate change is a problem that involves many other sub-problems that must be tackled: GHG emissions, land and water usage, and extraction of raw materials. Not all stakeholders perceive these matters as having an equal weight: some of us give more importance to one instead of another, which results in firms preferring boilerplate conformity instead of alternative pathways *that challenge the status quo* (Hahn et al., 2018). This has another important consequence: the pursuit of short-term impact challenges in the materiality assessments, instead of more forward-looking alternatives (Eccles & Serafeim, 2010).

Evaluative. This can be conceptualized through the fact that when deciding what issue deserves the employment of resources by the company, there is an intrinsic evaluation being made among different problems that concern stakeholders.

Overall, taking into consideration the challenges we have just exposed in the formulation of a sustainability report by companies, the IMP (Impact Management Project) conveyed that there are two dimensions to consider when dealing with materiality: **business case** perspective and **societal impact** perspective. The first refers to the topic's ability to influence the financial performance of the firm, while the second reflects the impact that the firm has on society (Garst et al., 2022).

2.2 Empirical Evidence of Materiality

A prominent study in this field has been conducted by Khan et al. (2016), who introduced the need to distinguish between material and immaterial investments when assessing ESG's relationship with corporate financial performance. It has been pointed out, that there is indeed a relationship between the two variables, but that it is impellent to discern between "material" and "immaterial" commitments. Firms with good performance on material issues have been found to outperform those who do not pursue the same path.

Those who perform well on immaterial issues instead, at least do not underperform those who perform poorly, suggesting that there is no value lost in the investments. The most surprising result though, is that **firms who perform best on material issues and poorly on immaterial ones are the ones with the best performance**.

The study has been supported throughout the years by further research that confirmed the enhancement of a firm's value by material ESG matters concerning immaterial ones (Van Heijningen, 2019; Aras et al., 2022), all of which were taken using the SASB's framework as a reference.

Another important perspective was delineated by the study of Nardi et al. (2021), that by digging deeper into the materiality assessment, shed light on an interesting point of view for the research. In their paper, they proceed on confirming the positive relationship between the materiality of ESG disclosure and a company's financial performance, but at the same time, constrain this positive effect to the peculiarity of the industry. Starting with the premise that firms who develop a Unique CSR strategy can outperform their competitors, they conclude that **the number of issues considered material in an industry weakens the financial performance of the company**. This follows because "*the number of material categories in an industry constraints firms' ability to develop uniquely valuable CSR positions*". The higher the number for a predetermined industry, the higher will be the areas where the firm needs to put resources into, resources that will be neglected for other areas, consequently reducing differentiation opportunities. If companies did not show their commitment to those fundamental issue areas in fact, they would be subjected to a negative review by their stakeholders.

3. MATERIALITY ASSESSMENT OF HARDWARE AND SOFTWARE

Despite pertaining to the same macro-industry, that is Information Technology (IT), Hardware and Software's materiality concerns might differ slightly, due to their core characteristics. In the following paragraph, we will describe in more depth each of the two key issues. Following what has been done in prior literature (Van Heijningen, 2019; Aras et al., 2022), the framework that will be discussed in this thesis will be based primarily on the SASB materiality framework, merged with MSCI Industry Materiality KPIs as they represent the two most credible sources of information in this area, as well as providing a focus on specific industries.

3.1 Hardware Materiality Assessment

The SASB provides users with a complete framework for what concerns Hardware, particularly taking into consideration the aspects that will be described in the following subparagraphs.

3.1.1 Data Security

This aspect is a core element of the IT sector in general, which is trusted by its users with a massive amount of personal and sensitive information. The risks associated with the Hardware sector refers to possible attacks during the production, design, and implementation of the product. Moreover, once it has reached its final stage and is being sold to customers, data is collected through its usage, which represents indeed a big threat to customers. Information is currently regarded as the primary asset of many IT companies, given the amount of it that is in their possession: customers need to make sure there are rules for the treatment, secrecy and non-divulgate clauses on it and eventually, accountability frameworks put in place in case there is a breach on these dispositions.

3.1.2 Supply Chain & Product Disposal

These represent two key problems that every Hardware company must address immediately at the beginning of its life. The increasing obsolescence rate of Hardware, along with the rapidly changing consumer tastes that require an increasing number of new products to be ready and marketable, demands an organized and fast-paced product chain by companies. The main issues are represented by the fact that most of the components necessary to produce these products are rare elements founded only in remote or specific areas of the world, often in countries with geopolitical instability and where working conditions are not regulated. Therefore, stakeholders demand accountability in those situations, requiring that no abuses or improper actions are taken during the procurement of the resources. Along with the creation, a major problem is represented by the disposal of these items: some of them can be recovered, and many companies are taking advantage of this by providing customers with the possibility of trading in old items (e.g., Apple, Tesla), but unfortunately, not everything can be gifted with a second life.

3.2 Software Materiality Assessment

For what concerns Software, the key issues to be considered will be explained in the following subparagraphs.

3.2.1 Data Privacy

As previously exposed with Hardware, data privacy is an imperative concern for IT companies in general. The issues that characterize Software solutions though are different from the ones concerning Hardware. In fact, Software companies are much more exposed to a data breach problem since the amount of information, given the nature of the products, is much higher than in other sectors. Sensitive data might not only be the target of stealing, but it might be voluntarily ceased to third parties by companies for profit, as well as other illegitimate purposes (for example a governance affiliation). Therefore, companies in this sector must be extra careful in the formulation of their privacy terms because the increasing importance regarded to these issues by customers is the reason why scandals in this field represent a hard nut to crack. The most famous example in this sense is the Cambridge Analytica scandal, which costed Meta, among others, a 725 million dollar fine (McCallum, 2022). This data exposé represented, as Bloomberg (Bodoni, 2018) describes it, a *game changer* in data protection history, making the regulation on the matter even tighter. Particularly, it was put in place to ensure the protection of customers' data and privacy. One of the most prominent examples is Europe's General Data Protection Regulation (GDPR), in effect from 2018, which among others offers the possibility to the customer to access the data, of which the company is in possession, and ask for its deletion. For what the US is concerned instead, there is not a single comprehensive data protection law in place that can be compared to the GDPR for coverage and power, but there are nonetheless Federal impositions on companies: the Health Insurance Portability and Accountability Act, (HIPAA), which sets stringent rules over health-care patients data usage and disclosure; the Gramm-Leach-Bliley Act (GLBA), which applies in the same optic to financial institution. The most resembling state law to the GDPR is in place in California, the California Consumer Privacy Act (CCPA), which became effective in January 2023.

3.2.2 Biases & Freedom of Expression

For this thesis, given the sample of startups that have been considered, this issue will be represented by eventual biases of AI-powered products. In particular, the score that will be given in this area is a result of an assessment of the training of the algorithm: the context, people, perspective, and contribution in terms of diversity and inclusion it receives to detect potential biases that might arise. This represents a major area of focus for Software companies, as it has been proved by different scholars that a bad-trained AI could lead to disastrous consequences: loss of money, unfair decisions, break of the law and even death. As it has been mercilessly pointed out by AI Now Report, the frameworks currently responsible for AI are not ensuring its accountability toward society. In particular, the paper refers to several worrying AI applications:

- *Surveillance*: facial recognition to begin with, but also social media tracking as well as sensors are positioned all around us and most of the time, we are not even aware of it. Practices that in any way analyze, collect, and store our data pose a threat to our freedom and an occasion for possible biases and discrimination to arise. The most surprising fact is that many of these applications, analyzed in this thesis, do not need any permission from customers to collect these data.
- *Human testing*: many programs are used to "scan people" using AI, especially in the USA, but not limited to that geographical area, that has been published without a specific regulation that imposes at least an accountability framework in case of misleading results. This is most times the gap in the chain: companies are left free to publish, test, and collect data on the population without any regulation being imposed and, above all, without consequences should their actions lead to catastrophic results.

Therefore, I regard as a primary area of scrutiny to consider in the ESG assessment proposed in this thesis, whether companies have taken actions against certain immoral and biased behaviors through a just and fair training of their AI technology.

3.2.3 Environmental Footprint of Hardware

Even though software is most times immaterial, we all know that technologies like *Cloud Computing* and data centers are very tangible: as it is pointed out by Dr. Lucivero in her essay on the impact of ICT, the name, that recalls something impalpable and untouchable,

was accurately chosen to disguise a very present and environmentally impactful technology (Lucivero, 2018).

Giant rooms filled with computers exist, which overall represent a big impact on the consumption of non-renewable resources, as well as the release of GHG emissions (Williams, 2011)[9]. What stands out as one of the most polluting practices of our times though are blockchain-powered solutions. Despite their applicability in numerous sustainable initiatives, they still bear a big environmental impact overall. The main reason is the huge amount of electricity usage that blockchain technologies require for their functioning, in primis represented by their block validation approaches, which depending on the type require more or less amount of energy. To tackle this environmental issue, many blockchain protocols waiting to find a greener option for their activity, have opted for a carbon offsetting practice. These are certificates that companies purchase to attest that they have offset a certain amount of their emissions by financing a carbon reduction project in another area. They provide a positive impact overall, since the offsetting contributes often to empowering communities or protecting fragile ecosystems, as PwC reports in its *Sustainable Blockchain Innovation* paper. Despite their overall more than positive impact though, it should be clear that these mechanisms must be adopted only for those emissions that cannot be avoided, always preferring an elimination of the others.

3.3 Common Ground Issue Area

As we have seen, the SASB materiality framework makes a practical distinction between issues that are material for Hardware and Software, although often they pertain to the same areas with different nuances. There are two areas though, that can be regarded as *common ground* since they do not reflect a particular industry, but instead relate to something transversal in nature that is: *Energy & Resources Management* and *Diversity and Inclusion*.

Energy & Resources Management. Like most industries, the IT sector suffers from high energy and water consumption due to the intrinsic nature of the products it manufactures,

[9] Williams, E. (2011). Environmental effects of information and communications technologies. *Nature, 479*(7373), 354–358. https://doi.org/10.1038/nature10682.

which represents one of the major issues today (D'Agostino et al., 2020). Different venues are currently being explored by experts to lower the rate of usage of these precious resources, as well as solutions that can contribute to the improvement of climate conditions. Considering this, one of the areas where the ESG assessment will focus is the presence or not of an effort by companies to reduce their environmental footprint. It is assessed in fact, whether products were designed with a resource reduction in mind and if they are eligible to be considered in the EU Taxonomy Compass[10], which will be discussed in detail in the next chapter.

Employee Diversity & Inclusion. The IT Sector in general still suffers from a low percentage of diversity in its workforce, which might hurt indeed the companies in this sector as they lack the diversity of opinions, open-minded solutions and generally the diversity of perspectives that a well-differentiated workforce could bring. Moreover, firms that are more representative of their clients through their employees might experience higher results concerning those that do not. Both for Hardware and Software, the issue in question is regarded with medium to high importance by the SASB, especially if we consider DEI practices in the board environment. Despite the huge investments made by companies every year, 8 billion USD in 2021 (Wiley, 2021), in the US 73.3% of technology's workforce is male and 62% is white.

3.4 Differences in The Materiality Assessment

As we can observe through the highlighted materiality issues, as well as what is reported in the MSCI Industry Materiality Map, there is not a significant difference when comparing Hardware and Software on the key elements to consider in the ESG assessment.

However, it must be acknowledged that: i.) Hardware industries are more concerned with the *Environmental* side of the business, explicating especially in the capacity of firms of deploying clean energy solutions; ii.) Software companies are instead scrutinized more heavily on the *Social pillar*, especially for the management of Privacy & Data Security[11].

[10] The author is aware of using an EU instrument for the analysis of companies headquartered in the US, but given the general nature of the metric, as well as the universality of the theme, it is judged nonetheless correct to apply it.

[11] See MSCI Industry Materiality Map: https://www.msci.com/our-solutions/esg-investing/esg-industry-materiality-map#

This is explicated in the ESG framework by assigning different weights, according to MSCI weighting scheme, to the categories for Hardware and Software, which will be explained further in the next chapter.

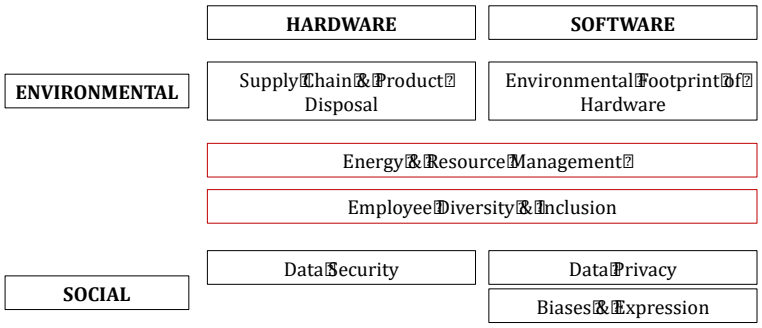


Figure XIV: Materiality Assessment of Hardware and Software

Source: Own Representation

3.5 Governance Assessment

According to the SASB Materiality Map, governance in both Hardware and Software is represented by the same main KPIs, namely the Board's composition, policies adopted for the retention of employees and the ethical direction pursued by the company. Generally speaking, Governance is important for the realization of both the E and the S pillars inside the company, therefore could be seen as the basis points for the implementation of ESG. Different studies have been performed on the importance of the single G pillar in a company's performance, and results have proven that indeed a correlation exists, and it's a positive one: firms performing high experience on average a 2% higher ROA than others (Koroleva et al., 2020). This is justified by highlighting how companies oriented towards governance have a competitive advantage over others, which is reflected through an improvement of CFP.

4. CONTROVERSIES LINKED TO MATERIAL ASPECTS' IMPACT ON COMPANIES' ESG AGENDA

4.1 Big Data

As we have mentioned in the above paragraph, when assessing the material categories that regard both Hardware and Software, especially considering the latter, Big Data is

regarded as one of the crucial aspects companies must pay attention to. Extensive literature has concentrated so far on the controversies that affect BD, addressing the fact that they are both considered as a holy grail for their predictive, analytical and informative nature as well as a *curse*, due to the controverse environmental and social impact.

It is undeniable that data has the power to improve our society, enabling us towards a more conscious and developed ecosystem from which we, as citizens, can all benefit (Morozov, 2013). Supranational agencies (namely the UN and the EU), as well as governments, praise the use of different methods and networks that can facilitate the retrieval of this information for the noblest reasons: accountability, societal development and, of course, sustainability (Sharon, 2018). Being able to analyze and extract key information from data, especially in those areas of the world that are less developed and wealthy, is something that many agencies praise and fund willingly, nourishing what could be defined as *Data Enthusiasm* (Lucivero, 2018). This is especially relevant considering the number of businesses that are growing out of this movement, many of which work with data to prevent climate change, study the malformation of our territory as well as develop software to be used in public health that can early detect, and one day maybe even prevent, disastrous diseases to invade the human body, as it can be seen through the companies collected for this thesis.

But is it gold all that glitters? Not quite so. Despite being identified as a massive opportunity for improvement of society, data is a double-faced matter, and especially a dark one. To power all the computers, those that are reunited in data centres, as well as all the common devices that we use in our everyday life, a huge amount of energy is still required. Research conducted on GHGs from the ICT world pointed out that, of the whole contribution that the category has on world emissions, 45% comes from data centers. Overall, the share of these emissions by the sector will outreach by 16% by 2040 the ones produced in 2016 by the same category (Belkhir and Elmeligi, 2018). Besides, evidence showed that even if more efficient products are marketed, people tend to spend the money saved on one object to buy more technologically polluting items, increasing the overall impact on the planet: the *rebound* effect (Lucivero, 2018).

It is clear that now we cannot disregard their usage anymore, being it so important for our daily activities, but it has also been proved that its impact must be addressed. Another significant point is raised by Professor Corbett in his paper, *How sustainable is Big Data?,* upon the fact that much has been pointed out on the pollution produced by these technologies but not on the resource consumption that comes with it: first of all water, that is extremely important in a cooling system, as in 2014 only, data centers in the US consumed 626 billion liters (Shenabi et al., 2016).

The ethical dilemma mentioned in the title of this paragraph refers exactly to this dichotomy coexisting in the nature of data and technology as a whole: it represents a powerful and beneficial instrument, used in many cases to foster sustainability but at the same time, it bears a hidden dark side. What can we, as a society, do to address this multifaceted discussion? Some voices suggest an ethicist's intervention, a collective standpoint on urgent matters like where should these centers be located, how and by whom they should be used, and broadly speaking guidelines that shed light on the social and environmental dilemma they currently represent. Ethics can contribute mainly by apprising the naïve public on the urgent matters that characterize the tech world, as well as promoting solutions to the matters cited above.

Data represents not only an environmental threat nowadays, but to a great extent, a social one too given the use of personal information, gathered through the most structured means, including surveillance and control. What could represent a turning point is an enhanced accountability and disclosure system, through the exposition of bad practices that might contribute to the correction of misbehaviors by companies. This translates not only into environmental metrics to be accounted for, but also and most importantly, a thorough investigation into how companies use users' data. If businesses find their activities scrutinized by stakeholders, inevitably the standards will be raised to a more fair justice practice.

4.2 Artificial Intelligence

Artificial Intelligence is undoubtedly one of the hot topics of the moment, considering the enormous potential as well as risks associated, that just recently we have come across since the diffusion of AI instruments to the public (e.g., Chat GPT). AI proved to be a very powerful tool that can be used to assess several problems in different sectors of life, but at the same time, bears numerous concerns, just as the privacy one mentioned before or the bias and discrimination one. Artificial Intelligence, as the name tells, cannot predict or take any kind of decision without first being trained, that is, without being shown how to take these decisions and which elements to consider when doing so. If we analyze the work of, say, an AI system trained to recognize a specific quality in people, one that does not have an objective measure on it, chances are that we might run into biased decisions by the computer. To be practical, let us imagine a workplace that screens its candidates based on their level of *talent*, a quality that can take numerous shapes as we know, and uses a huge amount of curricula to train machine learning into recognizing this trait. The AI could inadvertently start picking people that have played a specific sport (maybe one accessible only to wealthy people) or are more popular among females than males, falling into a sex-driven biased choice. Moreover, when the selection is completed, a money offer must be made: by analyzing previous employment, as well as socio-economic conditions, AI could make a specific offer knowing that candidates are likely to accept, even if not correct for the position.

Besides the ethical reasons that regard the pure act of AI training, there is a growing interest, not yet fully addressed by scholars, that concerns the environmental impact of Artificial Intelligence. AI, as pointed out in the paragraph above for Big Data, functions thanks to computer infrastructures, servers and data centres, and therefore bears the same considerations that were made before. It might be useful to consider a practical example: a recent study tried to analyze the GHGs from different AI instruments and found that there is a process that, above all, takes the lion's share of emissions. Contributing to approximately the release of 300,000 kg of CO_2e into the atmosphere is the training of Natural Language Processing (NLP) models, and this goes without considering its usage. NLPs are very much widespread in our everyday life, famous examples of them being Amazon’s Alexa and Apple’s Siri. Analyzing the situation in this optic, it results even more

curious the fact that these companies are striving to reach a carbon neutrality equilibrium (obtained through the purchasing of emission credits), though there is no evidence of the exact amount of CO_2 produced, a figure that stays carefully hidden. Besides the release of noxious gasses, there is a dangerous exploitation of rare metals necessary for the production of IT equipment, like cobalt, palladium, silver and gold.

But it must be said: AI represents also one of our biggest tools to solve the problems currently affecting our world, especially environmental and social ones as several studies have pointed out recently. The areas and means through which the world could use AI to increase awareness will now be briefly exposed, as ways we could exploit to raise environmental consciousness as well as tangibly reduce pollution, bringing us closer to the Paris Agreement's goals. First, we could employ AI for more efficient use of tools as well as the energy that we are currently using: electricity grids, buildings and generally speaking the current technology infrastructure (Rolnick et al., 2019). AI could be employed for the improvement of existing software energy usage, data compression as well as many other segments where we struggle to effectively exploit resources. Second, we could use it to spark future innovations: ask the Intelligence to provide new types of fuels or materials that serve more efficiently our needs, although these solutions of course will require a larger amount of time compared to the first ones. And finally, a more peculiar solution might be adopted, pointed out by Professor Mark Coeckelbergh from Vienna University. He suggests the adoption of AI to gently **nudge** people into more environmentally conscious behaviors, an attitude that, of course, would have a big positive impact on our environmental fight.

Nudging is an interesting concept raised for the first time by economist Richard Tahler in 2008, who explained the attitude of gently convincing, *nudging*, people into a certain type of behavior that might be difficult in the beginning but bears positive results at the end. He argues that the act of nudging does not fall into the coercion branch, as it is not intended to force people into doing something, but rather to psychologically induce them into the desired behavior. An example of us being nudged into greener conduct would consist of being presented with greener products at the supermarket in more engaging positions, to be noticed and purchased by customers (Coeckelbergh, 2020). It goes

without saying, that this usage of AI bears with it deep **ethical** considerations to be made: are we limiting the freedom of people? Who should be responsible for the usage and implementation of these AI practices?

Going back to the starting point of this discussion, inevitably we find ourselves in front of an **AI usage paradox**: its huge contribution to the progress and advancement towards our coveted environmental goals on one hand, while at the same time bearing a high number of different concerns. As Nordgren (2023) describes in his article, *Artificial intelligence and climate change: ethical issues*, the ones we are asked to assess stretch from deciding who is entitled to govern AI, who has to make sacrifices for the greater good and finally how we as a society must make use of AI instruments. General opinions suggest that higher-income countries should be the ones bearing the higher costs of climate adaptation and mitigation, since their population has the means to issue more restrictive policies than those in low-income ones and, most importantly, its population is the one responsible for the greater amount of emissions of the past century (Singer, 2010). But even if we were able to find an agreement over this, concerns remain high over the How Artificial Intelligent instruments should be deployed. Living in a free world, it might be difficult, ethically and practically, to limit the use of AI to certain types of actions or sectors, not to mention illegal and unfair in many jurisdictions. It must be acknowledged that, as many other instruments so far created by the human hand, AI is currently being used not only to search for climate change solutions but also for practices that inevitably contribute to it. Prominent AI tools created by tech giants like Microsoft, Amazon and Google are currently being employed by Oil giants like Shell and BP to increase drilling capacity. They exploit machine learning to find the most efficient locations and methods for drilling, as well as general ways to maximize their production. Overall though, given the complexity of the human population, as well as the coexistence of many ethnicities, our society is too dynamic to implement a single set of rules for AI (Scholz, 2018).

So what can be done concretely to mitigate the damages and threats that AI usage poses, while simultaneously implementing it for the greater environmental and social good that it has the power to provide? For starters, we can design ways through which **accountability** can be built, by demanding disclosure of which materials, practices,

energy consumed as well as primary data (to control for the biases) are used by companies (Vinuesa, 2020, Anthony et al., 2020). Again, ESG reporting is a primary tool in this sense, one that can hugely contribute to these dynamics especially if many actors, governments above all, come together to a comprehensive formulation of disclosure requirements. Scores can be then used to keep track of progresses, highlighting key aspects where more work is necessary.

4.3 Common Denominator

To conclude, in this paragraph two important material aspects of the IT sector have been exposed, along with the paradoxes that come from their implementation. There is no doubt about the usefulness that both of them have in our daily life, as well as the ways we could exploit them further for the greater environmental and social good. Controversies exist as well in their usage, given the intrinsic nature of the elements examined, but a common solution might be found to address these matters: **disclosure and accountability**, through the mean of ESG reporting and scoring.

It must be said though: disclosure, unfortunately, *does not translate* into good behaviour all the time. This is especially true if we look at the real world's figures in the past decades: sustainable investing has increased more than $30 trillion, and along with growing attention to green assets, also the reports of companies have increased through non-financial disclosure; with that though, we have experienced also an increase in negative factors, the same we are trying to tackle by using these tools, for example CO_2 emissions (Pucker, 2021)[12].

[12] Pucker, K. P., Overselling Sustainability Reporting; Harvard Business Review, Sustainable Business Practices. May-June 2021.

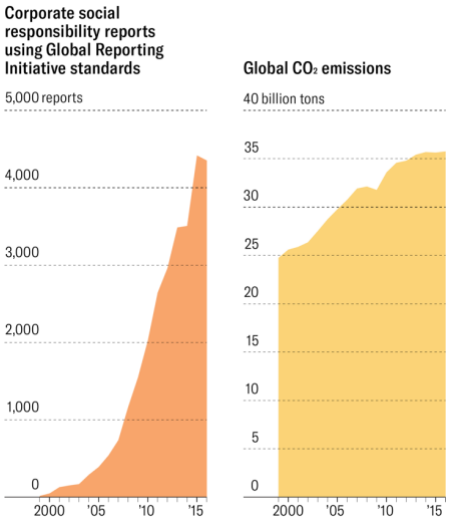


Figure XV: Increase in CSR reports compared to increase in CO2 emissions.

Source: Harvard Business Review

What drives this dichotomy and misalignment between the willingness by companies of reporting, and the increase in the same bad practice we are trying to eradicate, is the lack of a common check system. Financial information is overall trusted and useful thanks to the auditors that verify the truthfulness and compliance of companies to our common regulations. The fact that nowadays there is no similar mechanism for the non-financial side of disclosure makes the information more *vulnerable* and favours greenwashing. It is not only a problem of verifying the facts of course, but also of deciding which are the facts that need to be disclosed. As it has been widely described so far in this thesis, nailing down what KPIs and aspects need to be prioritized is key for heightening the usefulness of the disclosure tool. Therefore, with a system of checks and balances in place, as there currently is for the financial side, we could try and limit the dangerous and illegal acts of companies, as well as nudge them into more favourable actions from the sustainability point of view. This would mean that the full circle of accountability is put in place: disclosure by companies for stakeholders, checks by auditors, and a mechanism of responses by the same stakeholders.

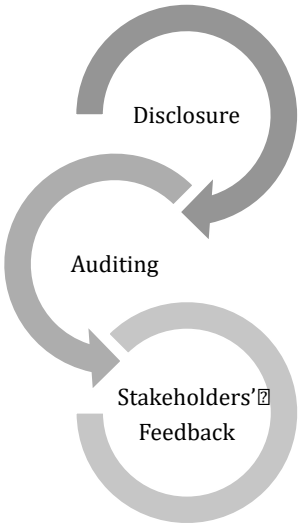


Figure XVI: Checks and Balances system.

Source: Own Representation

5. CURRENT STATUS OF ESG PRACTICE IN THE IT SECTOR

So far, we have discussed the importance of ESG practice in the IT industry, with a particular highlight on the materiality assessment that companies must perform to be rewarded with meaningful results in their financial returns. A legitimate question that the attentive reader might pose now is: what is the current state of adoption of this practice in the IT industry?

According to a comprehensive study conducted by reputation-benchmarking company *RepTrack*, both Hardware and Software have lost credibility for what **reputation** is concerned, with the first registering a -1.6 and the second -1.1 points since 2021. This was dictated primarily by the fading away of the optimism that characterized the post-pandemic life in 2021, which was busted by problems in the supply chains, data breaches and raw materials shortages. The decrease in the score is meaningful in our discussion because the main causes of this outcome have been two: the *lack of a fair, rewarding, and well-being-enhancing workplace* along with an *environmental consciousness* that brings a positive impact in society.

Delving into the ESG conversation more deeply, ESG scores for Hardware and Software industries have both decreased with respect to the previous year, attesting respectively at **67.5** (-1.5 points) and **67.2** (-2.7 points). How does this concretely affect companies?

There is a 0.78 statistical R^2 significance that the ESG score is correlated to a customer's *willingness to buy*, as well as 0.86 R^2 significance tied to *reputation*. It follows that the overall decrease in scores by the two sectors brings no good news for tech CEOs.

III. STARTUP SAMPLE AND METHODOLOGY

This research aims to investigate the relationship that exists between ESG Impact scores and the **evaluation** of startups. To conduct it, a quantitative method is applied through the performance of a regression analysis that indicates whether a correlation exists between our two primary variables. In the previous chapter, the theoretical basis on which the research poses have been analyzed, paying particular attention to the concept of materiality, a key one for the assessment.

In this chapter, a more practical approach is proposed, with an outline of the different phases adopted for the construction of the model: the criterion used for the collection of the sample, the premises on which KPIs have been constructed and the descriptive statistics.

1. SAMPLE COLLECTION

The research concentrates on the Information Technology sector, and in particular on the industries of Hardware and Software. To find startups that meet these criteria, the GICS classification is used as described in detail in the previous chapter. To get access to the amount of information required by good statistical research, the data has been retrieved from *Crunchbase*, which represents one of the most valid alternatives to collect accurate and updated information on startups, although it is not equipped with an ESG section.

The dataset consists of 120 startups belonging to the Software & Hardware industries that have been granted their last funding round in the past twelve months. As for the geographical position, the United States has been selected as the home country of the Headquarters for different practical reasons:

I. The US is arguably one of the best places to flourish a business, given its interconnection of VCs and business angels: therefore, most startups, especially in the IT sector, concentrate there. It follows that to build a solid sample, it is easier to retrieve data concentrating on that geographical area.

II. By selecting a unique country of origin, I am homogenizing my sample and in part controlling for eventual **biases** that might tamper the research e.g., having a little number of VCs in a specific area, a small and underdeveloped cluster of

research (universities' hubs), different fiscal or legal impositions (Renneboog et al., 2008). Finally, even though we are considering startups that currently do not fall under any specific ESG requirements by the SEC, it is undeniable that the accounting laws to which corporations are subjected influence the areas where they tend to concentrate their efforts: if Scope 1, 2 and 3 emissions are important factors in the US' ESG assessment, startups might inevitably be biased towards the construction of their business operations towards the fulfilment of those obligations, or at least planning accordingly.

To have the most comprehensive sample available, a **non-representative** method is applied, using the subjective criterion previously mentioned of the last funding date.

1.1 Novelty of The Present Research

Retrieving information about young businesses is hard work since there are few databases available for the research; the sampling gets even harder if we consider available ESG information. So far, papers have concentrated only on two venues that are Initial Coin Offerings and Crowdfunding (Mansouri & Momtaz, 2022; Vismara, 2019), given the abundance of disclosure required in these two fields concerning the startup world in general. For this thesis instead, startups have been analyzed to perform a study on the relationship between startups' ESG disclosure and investor valuations.

The measurement also differs from previous studies as the existing research uses an ad-hoc ESG scoring method performed through a text-analysis assessment: the higher the number of words related to the ESG world, the higher the consequential score given to the startup (Mansouri & Momtaz, 2022). For this thesis instead, the score was built on numerical variables that will be further described in this chapter.

2. ESG FRAMEWORK

2.1 Theoretical Background on ESG Scores in The Startup Ecosystem

Most companies we are considering are intrinsically **young**, as they range from 1 to 7/8 years of life, all spanning between 1-10 Million of revenues, in what is defined as their *Early-Stage Venture*. Despite the lack of a plateau of rating agencies scoring these businesses, there are a few exceptions worth mentioning for their particularly accurate

techniques. The most prominent agency in this sense is *ESG_Venture Capital*[13], which consists of a network of venture capitalists brought together by the desire of improving the sustainability, equity, and governance practices of its startups. Another key player in this field is VentureESG[14], which developed a less detailed framework with respect to the first one, that cuts through the chase by highlighting the most important areas of focus for young entrepreneurs.

The main takeaway that must be acknowledged considering the nature of the companies involved is that, quoting the words of the WEF, "ESG metrics must be *friendly* with startups", meaning that we cannot expect these businesses to bear the same type of efforts and costs that multinationals go through to assess their performance, but we must instead formulate practical metrics that are easy to evaluate.

2.2 Technical Assessment

To construct the ESG framework, a two-dimension approach is applied, meaning that along with the pure score based on the performance of the specific companies, also the **sector of belonging** is actively taken into consideration. To classify to which industry the companies pertain, I used the GICS Information Technology Classification[15], that as described earlier, was created conjunctly by Standard & Poor's (S&P) and MSCI in 1999.
The first dimension refers to the industry-weighted optimization process of the three core categories that are Environmental, Social and Governance. MSCI has released an Industry Materiality Map[16], where a weight is assigned to the ESG indicators for the MSCI ESG ratings. The weights are dynamically optimized every year, to reflect the evolution of key industry issues over time. The second dimension comprises the *materiality* concern, that is the selection of the KPIs and indicators to use in the ESG assessment. For this purpose, the SASB Materiality Map[17] was used, which is an International Financial Reporting

[13] https://www.esgvc.co.uk
[14] https://www.ventureesg.com/academic-research
[15] https://www.spglobal.com/spdji/en/documents/education/education-sector-primer-series-information-technology.pdf
[16] https://www.msci.com/our-solutions/esg-investing/esg-industry-materiality-map#information-section
[17] https://www.sasb.org/standards/materiality-map/

Standards Foundation's (IFRS) proprietary technology that enables the user to explore the most prominent issues for a specific industry. In the attempt to bridge the two nomenclatures used by the different entities, the GICS and the IFRS Foundation, I made use of the conversion table that was created by the ESG Data Convergence Initiative. It is a private initiative led by GPs and LPs, the two founders being *CalPERS* and *Carlyle*, that aims to converge the numerous ESG frameworks that currently exist with a focus on the private sector, where regulation is scarcer. For a more detailed description of the categories considered, see Table T.2 of the Appendix.

2.3 The Selection of KPIs

As it has been pointed out before in this thesis, the divergence of the rating system is one of the main problems in this field of research, therefore, to legitimize the ESG framework proposed and make the study as replicable as possible, I decided to build it on the premises of existing frameworks that were formulated by the following organizations: the IFRS Foundation in primis, whose critical ESG assessment areas for the two industries were described in depth in the previous chapter, ESG_Venture Capital[18], the World Economic Forum[19], B-Lab[20] and the European Union Taxonomy Compass[21].

The SASB Materiality Map, as mentioned earlier, is taken as a benchmark in this research to identify the key issues that pertain to the industries examined. Unfortunately, the organization does not always produce detailed KPIs to assess the ESG evaluation, therefore the guidelines provided have been taken as a reference and integrated with the other frameworks that will be now briefly mentioned.

ESG_Venture Capital is one of the first pioneers in the startup world for what ESG scores are concerned, and despite it not being legitimized as the others included in this framework, I judged the contribution important to bring a startup-centric view. Along with a proprietary framework that is published on their websites, they partnered with a consulting firm that created its platform to help young entrepreneurs in the ESG assessment of their company.

[18] https://www.esgvc.co.uk
[19] https://www3.weforum.org/docs/WEF_IBC_Measuring_Stakeholder_Capitalism_Report_2020.pdf
[20] https://www.bcorporation.net/en-us/standards
[21] https://ec.europa.eu/sustainable-finance-taxonomy/taxonomy-compass

VentureESG[22], on the premises of the one just delineated, is responsible for the ideation of an ESG framework that specifically focuses on startups and its mission is the simplification of KPIs at the early stage of business to ensure access to everyone. The goal pursued by the agency is that of simplifying the collection of this information, making it affordable for young entrepreneurs too.

The World Economic Forum provides an interesting point of view on what the KPIs are concerned with, as it divides its framework into four pillars: Governance, Planet, People and Prosperity. The fourth is the one that cannot be identified immediately into one of the classic three issues we are accustomed to analyzing (E, S and G), and for this exact reason, it brings a fresh perspective to the overall score. I decided to include a metric regarding this sector, that is the *Social Contribution* generated by the product considered and merge it into the social pillar.

B-Lab is the non-profit organization that oversees the assignment of the B-Corp Certification, an acknowledgement that is awarded only to worthy companies around the world. The association measures the impact that businesses have on Environmental and Social matters, as well as if they have a solid legal structure and a commitment to transparency. To obtain this certification, which indeed can be assigned to every type of company, an assessment must be passed which is based on similar KPIs as the ESG framework and therefore has been considered for the creation of one in this thesis.

Finally, the European Union Taxonomy Compass[23] is a visual map of the EU Taxonomy. It contains a matrix, which on one hand displays the industries and on the other the environmental objectives they are set to achieve: either for climate change adaptation, climate change mitigation or both. That is, how much the companies analyzed in this study provide a solution to the two mentioned categories, for example by implementing solutions for the mitigation of climate risks material to that activity, providing a breakthrough technology for the reduction of GHG emissions or enabling a platform that

[22] https://www.ventureesg.com

[23] Please note that the author is aware of the conflict of using an EU KPI while analyzing USA's startups, but it is worth mentioning that the metric in question does not, in any way, include geographical references or legal ones that could tamper or bias the result. Being instead a-politic and exclusively tech-based, it has been decided to include it in the assessment.

can analyze data and convert it into precious research conclusions related to the climate mitigation area.

In the following subsections, I will explain the framework used in the formulation of the ESG score and present the variables adopted. The general starting point, as mentioned before, was the SASB materiality assessment, where the areas that I will now describe were regarded as **material** respectively for Hardware and Software. From there, I extracted some KPIs to translate those elements into numbers that I drew from the ESG frameworks described above. To assess the integrity of the KPI, with few exceptions, I inserted only those that were mentioned at least two times; the full list with the references is available in Table T.2 of the Appendix.

2.3.1 Environmental Pillar

The environmental pillar is the first area assessed in the framework, and the general material issues brought up by the SASB assessment are the **Environmental Footprint of Infrastructure** and **Opportunities in Clean Tech**. The KPIs associated with these macro-areas are the following:

- *Certification & Impact*. This metric represents primarily a proxy for the Opportunities in Clean Tech, which comprises the ability that startups have to conduct businesses that progress our knowledge and usage of clean technologies. To be assigned a point in this category companies must comply with the EU Taxonomy Compass: the business either contributes to climate change adaptation or climate change mitigation. The score given is 0 if it does not meet the criteria, 1 if it does.
- *Products & Services that reduce resource consumption*. This metric represents a proxy for the Environmental Footprint of Infrastructure. The score in this case is given to companies that designed their manufacturing, wholesale, or general processes with a *reduction* of precious resources in mind (e.g., energy, water). The frameworks considered for the assessment of the KPI are the ones proposed by ESG_Venture Capital and B-Lab.

- *Blockchain Emission Offsetting*. Given the sector I decided to analyze, many companies employ blockchain infrastructures, reason why I decided to include this metric. Being heavily energy-intensive, companies that use these infrastructures are often responsible for a high quantity of GHG emissions. To reduce their overall impact on the planet, they "buy" carbon offsetting credits, that is they contribute monetarily to projects that reduce carbon emissions and have a positive impact on the environment. The frameworks considered for the assessment of the KPI are the ESG framework proposed by ESG_Venture Capital and the one of B-Lab.

A note to mention on this pillar was the lack of disclosed data by companies: emission of GHG as well as supply chain management are two grey areas when it comes to startups. These two metrics, originally considered for the project, had to be dropped because most of the companies assessed in the sample did not find it significant to publish this information.

2.3.2 Social Pillar

The social pillar includes the following SASB areas of interest: **Data Security**, **Employee Diversity & Inclusion** and **Freedom of Expression**. I decided to translate these general areas into the following KPIs:

- *Data treatment*. I picked this metric as a proxy for Data Security, which is an area of interest both in Software and Hardware. Given our ubiquitous presence online, both for leisure that for work reasons, privacy and security of the data shared are regarded as a primary importance aspect. The purpose for which companies collect our data, the third parties with whom this data is shared and whether the company sells this type of aggregated information collected are all assessed in this metric. The frameworks considered for the formulation of the KPI are those proposed by ESG_Venture Capital and SASB's guidelines.
- *Workplace conditions*. As a proxy for *Employee Diversity, Equity, and Inclusion* (DEI) and *Freedom of Expression*, which in the last years have come to represent one of the most relevant matters in the sector. As a fact, this is regarded as one of the basic elements stakeholders as well as venture capitalists take into consideration when analyzing companies in this industry. In this metric, I consider different factors

such as: whether the company assures a diverse and fair working environment, taking into consideration the needs and not discriminating against minority groups; a fair compensation package, eventual training programs for employees, basic benefits like healthcare (because the companies are all US-based), paid parental leave as well as other types of perks that encourage mental health and wellbeing. The frameworks considered for this metric are numerous, given the centrality of the matter analyzed, all of which are specified in Table T.2 of the Appendix.

- *AI algorithm*. Given the industry we are considering for this research, AI solutions both in Software and Hardware are getting more popular every day. AI must be trained though, because it is not infrequent to hear of unpleasant bad consequences of a poorly trained and biased computer. The score is consequently awarded to the company if it provides training to tackle bias and discrimination problems, following the Data Values & Principles by The Linux Foundation[24].
- *Products and Services Creating a Social Contribution* & *Mention of Charity Donation.* These are two metrics that represent the contribution that concretely the company is giving to society. Both are extrapolated from the World Economic Forum framework and that of ESG_VC.

2.3.3 Governance Pillar

The governance pillar is not included in the SASB materiality assessment since the matrix is more concerned with the first two areas of the ESG score. Nevertheless, I decided to include the metrics as I think they represent important KPIs in the overall ESG assessment of companies:

- *Women's presence on the Board*. This metric is one of the most popular among the ESG frameworks I used as a reference, therefore essential to be included in the overall score. As the name suggests, companies obtained a score of 1 if inside their executive board there is a woman.

[24] https://datapractices.org

- *Mission & Vision*. This metric evaluates the strategic long-term thinking of companies, and whether their approach contributes to a material positive impact both on society and on the environment. The score is 1 if indeed the company presents this feature in its strategic vision, and the frameworks from where I drew it are those of the WEF and B-Lab.
- *Remote Working*. The third KPI used to assess the governance pillar is whether the company has a remote working policy in place. Besides the well-known environmental effects of resource reduction, this practice is important because it empowers people around the world to have access to a job, even if not physically residing in the country (the USA in our sample). As a paper from Standard & Poor's reports (2021), this is a great opportunity for upskilling remotely those that cannot invest their time and money to physically move from one place to another. By giving the possibility of remote working, companies are contributing to the professional development of a diverse and inclusive team. The frameworks used as a reference were B-Lab certification and ESG_VC.
- *Code of Ethics*. Leading with purpose is the primary requirement to bring your company towards a rightful path in terms of Social and Governance areas. The management must clearly define guidelines that employees are expected to follow and behaviors that are aligned with the mission and vision preached. The score is 1 if the company has a published code of ethics on their website or whitepaper, and 0 if not. The reference frameworks were ESG_VC and B-Lab.

2.4 Weighting Scheme Assigned

The weighting scheme for each sub-industry follows the dynamic assignation based on MSCI Industry Materiality Map and is comprised as shown in the Figure below.

	SOFTWARE	HARDWARE		
	SOFTWARE	COMMUNICATIONS EQUIPMENT	TECHNOLOGY HARDWARE, STORAGE & PERIPHERALS	ELECTRONIC EQUIPMENT INSTRUMENTS & COMPONENTS
ENVIRONMENTAL	15,60%	15,90%	22,10%	16,50%
SOCIAL	47,10%	46,60%	42,40%	44,60%
S1 - Data Privacy & Protection	21,30%	1,50%	6,36%	6,93%
S2 - Community Impact	0,10%	23,20%	14,84%	16,17%
S3 - Working Conditions	27,20%	21,90%	21,20%	21,50%
GOVERNANCE	37,30%	37,50%	35,50%	38,90%

Figure XVII: Weighting scheme according to MSCI Industry Materiality Map

Source: Own Representation

2.5 Empirical Evidence of Startups' Performance

Given the peculiarity of the companies we are evaluating, although the ones described above are the main KPIs to be considered when approaching the IT sector, another precaution must be adopted that is, to adjust for the earliness of the stages we are taking into consideration. As a study published by ESG_VC[25] reports, ESG performance tends to improve as companies scale, being significantly better in Social and Governance issues. They state that the average score obtained by the three categories, on a scale from one to four, is: 1.4 for E, 2.6 for S and 2.7 for G.

As we said, the performance improves along with the company's scaling up, and it was found that only 12% of companies in a Series A stage score high on Environmental matters, compared to a more than double sample of 27% if we look at Series C stage. If we look at social matters than, the difference is even higher of 30 percentage points, 51% for Series A compared to an 84% of Series C.

Considering this, I argue in my thesis that there is indeed a correlation between the Stage and the ESG level of companies, a relationship that will be tested empirically with an interaction model described in the next chapter.

3. REGRESSION COMPOSITION

3.1 Dependent Variable

The dependent variable in this paper is the financial evaluation of the startup, interpreted as the total round of financing received by the company, as it has been conducted in prior research (Hidayat et al., 2021). The data is retrieved from the Crunchbase database, and the funding rounds considered are Seed, Series A, Series B and Series C.

3.2 Independent Variable

The independent variable in this research is the ESG score that each startup has been given through the framework described above. It must be acknowledged that in this

[25] For the comprehensive study, please see: https://www.esgvc.co.uk/wp-content/uploads/2022/03/ESG_VC_Report_2022.pdf.

paper, the ESG score is interpreted as an *Impact Rating*, therefore, the higher it is, the better and a **positive** relationship with the dependent variable is expected.
It is also essential to notice that all the scores that have been assigned are exclusively based on publicly available data that the startups have decided to share, either through their websites or whitepapers. If the vision and mission, as well as strategic actions that have been claimed through these media channels, are not reflected through their actions, this will not be captured by the ESG scores.

To analyze in depth the relationship between the dependent and independent variables, the ESG Score has further been broken down into three singular pillars: E_Score, S_Score and G_Score.

3.3 Control Variables

Different papers have so far analyzed the relationship that explains the evaluation of a startup, and many variables have been taken into consideration to better clarify this correlation (Houlihan, 1998; Miloud et al., 2012; Hidayat et al., 2021). When companies are very young, as is the case with our sample, concentrating only on the financial components like the cash flow or the financial results can be of little help for investors like venture capitalists: as it has been pointed out by Sievers (2012), given the little historical data available in this sense, non-financial information explains as much as financial one when talking about startups' evaluations.

3.3.1 The Team

Following prior literature studies (Amit et al., 1990; Sievers, 2012), the **team**, especially the founding group, has been regarded as the most important feature of a startup. The people that first decide to build the business, their abilities as well as common knowledge, have a major impact on the overall success (Keeley and Roure, 1990). To capture this aspect, I used the variable *founding team size*. It has been proved that the more diverse the founding team is, the higher will be the skills and abilities available, and the greater the probability of achieving success.

In addition to the composition of the initial team, I included in the regression model also the *team size* in full (Hidayat et al., 202; Mansouri & Momtaz, 2022). This metric is important because it represents a good proxy for the human capital that is present inside the company, which is part of the intangible assets that inevitably help the startup grow and strive.

3.3.2 The Development

To control for the development of the companies considered, I decided to include the *Age*, measured as years of life of the startup in the model.
It is important to consider the stage of a company when assessing its financial evaluation: Seed and Series A companies found themselves in clearly less competitive positions compared to other startups in the sample, therefore the *Stage* is also included in the model.
It is well known that the capacity of small companies like startups to innovate and commercialize new products is slowed down most of the time by a constraint in the budget available, which makes it crucial to receive the highest amount possible of funds to make the business viable. This is why, along with the previous two, I have included whether the startup is *Venture Capital backed*, and consequently, benefits from financial and managerial support (Caselli et al., 2009). Companies obtain the score 1 if they have been financed by a VC in their last funding round, and 0 otherwise.

3.3.3 Geographical Position

The location might not always strike as a primary factor of influence for the life of a startup, but accordingly to several scholars, it is. As it is reported by Houlihan, startups that are located on the East Coast and West Coast, in particular California-based ones, have a higher evaluation with respect to those in the other areas of the United States (Houlihan, 1998). Another report produced by Kauffman Fellows in 2020[26] got to the same conclusion: analyzing the investments of Venture Capital from 2000 to 2018, a

[26] https://www.kauffmanfellows.org/journal_posts/valuations-are-higher-in-the-pacific-and-northeast-regions

significantly higher amount of that money was directed towards coastal companies, and not those on the inside. This is justified by the easier way through which a connection can be established between the entrepreneur and the Venture Capitalist if there is geographical proximity (Freear, et al. 1994). Moreover, it is not only the presence of VCs in a specific location that enhances the correlation between geography and evaluation, but also the distribution of startups themselves. Business Angels generally favor investments geographically closer to their previous ones, meaning they are biased to direct their investments into specific geographical regions (Berchicci et al., 2011). This contributes to the emergence of clusters, like Silicon Valley, located in the South San Francisco Bay area in California, that favor not only external investments but also knowledge spillover between companies.

I constructed two variables for the geographical assessment: one that would consider only the coastal/inside characteristic of the Headquarters (HQ_BINARY), and another that would instead address the specific geographical position by pinpointing whether a startup belongs to the East Coast, West Coast or Inside (HQ_CATEGORY).

3.4 Descriptive Statistics

The sample is based on 120 startups retrieved from the online database Crunchbase. As it shows, each company has at least received one round of financing, starting from the Seed level (47,5%), through Series A (35%), Series B (10%) and Series C (7,5%). The youngest company assessed was created in 2022, while the oldest in 2012, with a mean year of life being 4,01.

Given the differences in age among companies, it follows that the *valuations* also have a broad distribution: the lowest registered is short below $ 100.000 while the highest is in the range of hundreds of millions ($ 450.000.000).

The *ESG Score* theoretical range should be between 0 and roughly 3,5, although the maximum registered is 3,18; the average number obtained was **1,39**.

The startups that have been financed by at least one VC in their last funding round are 81,7%, while the ones that did not are 17,5%. Data was impossible to retrieve for the 0,8% of the sample.

Table I: Descriptive Statistics/1

VARIABLE	MEAN	MINUMUM	MAXIMUM	ST.DEVIATION
Funding Amount (in thousand $)	33.266.044,75	99.998,00	450.000.000,00	61.842,78
ESG Score	0,30	0,01	0,81	0,76
Age (in n. of years)	4,01	-	11,00	2,41
Number of Founders	2,33	1,00	5,00	1,03
Number of Investors per startup	6,05	1,00	40,00	8,06
Number of Employees	54,74	3,00	279,00	56,65

Source: Own Representation

Table II: Descriptive Statistics/2

	ATTRIBUTE	FREQUENCY	PERCENTAGE
Stage	Seed	57	47,5%
	Series A	42	35,0%
	Series B	12	10,0%
	Series C	9	7,5%
	Total	120	100,0%
Industry	Communication Equipment	4	3,3%
	Electronic Equipment Instruments & Components	40	33,3%
	Software	71	59,2%
	Technology Hardware, Storage & Peripherals	5	4,2%
	Total	120	100,0%
Venture Capital Backed Startups	Yes	98	81,7%
	No	21	17,5%
	NA	1	0,8%
	Total	120	100,0%
HQ_Category	No Coast	25	20,8%
	West Coast	60	50,0%
	East Coast	35	29,2%
	Total	120	100,0%

Source: Own Representation

The founding team is distributed equally among all startups, usually being 2-3 co-founders, with the highest startup registered having 5, while the lowest 1.

As for what concerns the geographical distribution, I have pinpointed 3 main variables: No Coast, as to all the companies whose headquarters are in the backcountry, which represents the 20,8%, East Coast with 29,2% and the lion's share, mainly driven by California, in the West Coast with 50,00%. To visualize a State-by-State analysis, please refer to Figure F.1 of the Appendix.

Table 3.4 represents the statistics for the ESG score, as well as its single components. As has been pointed out before, the **Environmental** pillar was the hardest to retrieve, given the lack of information present in startups' whitepapers and websites. **Social** was on the other hand easier to compose since much of the data necessary for the assessment is currently published by companies. Among the fair and justice work practices represented, as it can be observed, most of the sample complies with DEI Policies (80,83%), but only 10% mentioned a donation and 15,83% provides training for its employees. For what **Governance** is concerned, the distribution of the KPIs seems to be quite homogeneous with respect to the previous ones, with some being more spread than others. Crunching down the numbers, we see that almost half of our sample (48,33%) nowadays provides the possibility of remote working for their employees, a very important percentage to increase the chance of being hired by people living in not strategic locations. Another important metric that I want to point out is the percentage of Boards with women presence inside, settled at 44,17%.

Table III: Descriptive Statistics/3[27]

ATTRIBUTE	FREQUENCY OF POSITIVE ASSESSMENT	PERCENTAGE
ENVIRONMENTAL		
Certifications & Impact N = 120	22	18,33%
Reduction of resources consumption N = 120	33	27,50%
Blockchain Emission's Offsetting N = 120	3	75,00%
TOTAL OBSERVATIONS	120	100,00%
SOCIAL		
Products that will create a social contribution N = 120	37	30,83%
Mention of donation / charity N = 120	12	10,00%
Training Policies N = 120	19	15,83%
DEI Policies N = 120	97	80,83%
Perks & Benefits N = 120	61	50,83%
Healthcare Coverage N = 119	57	47,90%
Equity Compensation N = 119	39	32,77%
Time-off N = 120	55	45,83%
Data Treatment N = 120		
0	26	21,67%
0,25	19	15,83%
0,5	2	1,67%
0,75	21	17,50%
1	52	43,33%
TOTAL OBSERVATIONS	120	100%
GOVERNANCE		
Women Presence In Board N = 120	53	44,17%
Mission & Vision N = 120	46	38,33%
Remote Working N = 120	58	48,33%
Code of Ethics N = 120	46	38,33%
TOTAL OBSERVATIONS	120	100,00%

Source: Own Representation

[27] The Blockchain Emission Offsetting is reported with 75% of frequency because the overall sample is considered out of 4, that is the number of companies dealing with blockchain solutions in the overall startups.

IV. REGRESSION AND EMPIRICAL RESULTS

The following research has been centered around searching for empirical evidence that would lead us to conclude that a positive relationship exists between the current financing received by a startup and its ESG score. To do this, different regression tests have been performed to find the best possible equation that would fit our model.

1. CORRELATION ANALYSIS & EXPECTED SIGNS

Table 4.1 summarizes all the variables used in the model, their meaning and expected signs. As can be observed, the ESG score, the independent variable in our assessment, has been further broken down into the single E, S and G scores, which are all expected to have a positive sign of correlation with the evaluation. The control variables employed in the regression model are 10, with the addition of 3 interaction terms. I based the choice of these particular 10 on previous literature, cited in the column *Theoretical Premise*, except for the industry, where I found different sources claiming a different evaluation between Software and Hardware, although it had not been tested empirically before.

All the control variables reported, like the Number of Employees, the Revenues and the Stage of the Startup are expected to have a positive impact on the dependent variable, that is the Evaluation, as the literature cited in the right reports. A particular point must be raised for what Geographical Position is concerned. I have reported both a + and a – in their correlation with the dependent variable because of the different effects I expect. In fact, in line with previously cited results, I expect the category of startups based on the coast, especially the West one, to experience a higher evaluation, with respect to the ones in the center, from which I expect a lower one.

For what concerns the variables that I have personally decided to test, the expected signs are the following:

- Industry: given the lack of prior research in this area, as well as missing evidence on established corporations, there are no scientifically based expectations on whether Hardware or Software startups will be higher evaluated. Intuitively, one might hypothesize that environmental concerns would matter more for hardware startups than for software ones, given the concerns highlighted in Chapter II.

- The number of investors: despite not being reported in the literature, as a logical consequence, I expect that the higher it is the number of investors that fund the startup, the higher will be its evaluation.

Table IV: Summary of Variables and Expected Signs

VARIABLE	SIGN	DESCRIPTION	THEORETICAL PREMISE
Dependent Variable			
Startup Evaluation		The sum of all the financing round received by the company.	
Independent Variable			
ESG Score	+	The ESG Impact Score that results from the assessment.	
ESG_E Score	+	The Environmental Impact score alone.	
ESG_S Score	+	The Social Impact score alone.	
ESG_G Score	+	The Governament Impact score alone.	
Control Variables			
N. OF FOUNDERS	+	The number of founders of the startup.	Keeley and Roure, 1990
N. OF EMPLOYEES	+	The number of employees officially working for the company.	Hidayat et al., 202; Mansouri & Momtaz, 2022
N. OF INVESTORS	+	The number of investors that funded the startup so far.	
STAGE OF THE STARTUP	higher/+	The Round of Financing the company has received: Seed, Series A, Series B or Series C.	Díaz-Santamaría et al. 2021 Kam et al., 1999
ESTIMATED REVENUES	+	The Estimated Revenues for the last fiscal year of the startup.	Damodaran 2009, Berre 2022
AGE	+	The age of the company.	Díaz-Santamaría et al. 2021
INDUSTRY	+/-	The binomial variable: 0 - Software 1 - Hardware Wheter one industry is more evaluated than the other.	Own research
HQ_BINARY	+/-	Whether or not the Evaluation is affected by the Geographical Position of the company. Binary variable: 0 - Coast 1 - No Coast	Houlihan, 1998
HQ_CATEGORY	+/-	Whether or not the Evaluation is affected by the Geographical Position of the company. Variable: 0 - No Coast 1 - West Coast 2 - East Coast	Houlihan, 1998
VENTURE CAPITAL	+	Whether the company has received financing funds by a VC in its last financing round.	Caselli, 2009 Davila et al., 2003
		CATEGORICAL VARIABLES	
Industry#ESG_Score		To verify whether the interaction between the two variables is stronger in one cathegory with respect to the other.	Own research
Funding Stage#ESG_Score		To verify whether the interaction between the two variables is stronger in one cathegory with respect to the other.	Own research
Estimated Revenues#ESG_Score		To verify whether the interaction between the two variables is stronger in one cathegory with respect to the other.	Own research

Source: Own Representation

After analyzing the potential relations from the variables in consideration, I performed a Pearson Correlation Analysis to investigate whether there is a significant relationship. The coefficient can vary between +/- 1, which means that there is a perfect positive/negative correlation between the two variables; if it is 0, it means that the two are uncorrelated.

As is displayed in Table 1, the valuation seems to be moderately correlated with the ESG Score, the main theme of research of this dissertation, and the result that I would expect to find consequently in the statistical analysis, although it is important to keep in mind that *correlation does not imply causation*.

A strong relationship can be found between the evaluation and the Number of Employees, as well as with the Stage of the startup (Seed, Series A, Series B and Series C): this could result from the fact that both measures can be taken as proxies for growth; as the company grows then, it follows that it experiences an increase in evaluation.

Taking into consideration the financial aspect of the analysis, also Revenues show a moderate correlation (almost 40%), data that is important to highlight, as it proves the importance that financial benchmarks still have on financial performance. Even if investors are broadening their horizons by looking at non-financial matters represented by the ESG scores, the financial side still holds an important share of interest.

		VALUATION	ESG	N. OF FOUNDERS	N. OF EMPLOYEES	STAGE	AGE	VENTURE BACKED	N. OF PATENTS	N. OF INVESTORS	REVENUES	HQ_CATEGORY	E_SCORE	S_SCORE	G_SCORE
VALUATION	Pearson Correlation N = 120	100,00%													
ESG	Pearson Correlation N = 120	**32,64%**	100,00%												
N. OF FOUNDERS	Pearson Correlation N = 120	8,49%	17,06%	100,00%											
N. OF EMPLOYEES	Pearson Correlation N = 120	**56,83%**	24,70%	-0,47%	100,00%										
STAGE	Pearson Correlation N = 120	**54,46%**	24,28%	16,97%	56,88%	100,00%									
AGE	Pearson Correlation N = 120	16,62%	5,88%	19,83%	18,16%	48,66%	100,00%								
VENTURE BACKED	Pearson Correlation N = 119	11,26%	6,87%	4,40%	19,65%	8,27%	10,07%	100,00%							
N. OF PATENTS	Pearson Correlation N = 120	8,62%	-11,35%	3,33%	5,84%	23,23%	13,49%	-22,04%	100,00%						
N. OF INVESTORS	Pearson Correlation N = 111	**26,60%**	3,46%	-6,44%	8,03%	-2,45%	-23,76%	-17,06%	3,44%	100,00%					
REVENUES	Pearson Correlation N = 115	**38,15%**	17,12%	-10,46%	4,64%	0,46%	-18,88%	0,82%	-0,53%	29,77%	100,00%				
HQ_CATEGORY	Pearson Correlation N = 120	6,95%	12,58%	14,95%	12,72%	22,04%	22,32%	11,72%	8,34%	-5,93%	0,42%	100,00%			
E_SCORE	Pearson Correlation N = 120	19,84%	-	-10,95%	16,36%	26,35%	24,58%	9,66%	6,38%	-19,46%	-5,62%	15,09%	100,00%		
S_SCORE	Pearson Correlation N = 120	20,96%	-	15,59%	16,33%	15,91%	1,87%	7,90%	-13,38%	8,70%	23,73%	3,16%	-	100,00%	
G_SCORE	Pearson Correlation N = 120	**35,30%**	-	10,26%	23,11%	18,62%	0,77%	1,38%	-5,35%	-0,09%	10,27%	15,61%	-	-	100,00%

Figure XVIII: Pearson Correlation

Source: Own Representation

The strength of the relationship described between the variables follows Cohen's (1988) general guidelines on the matter:

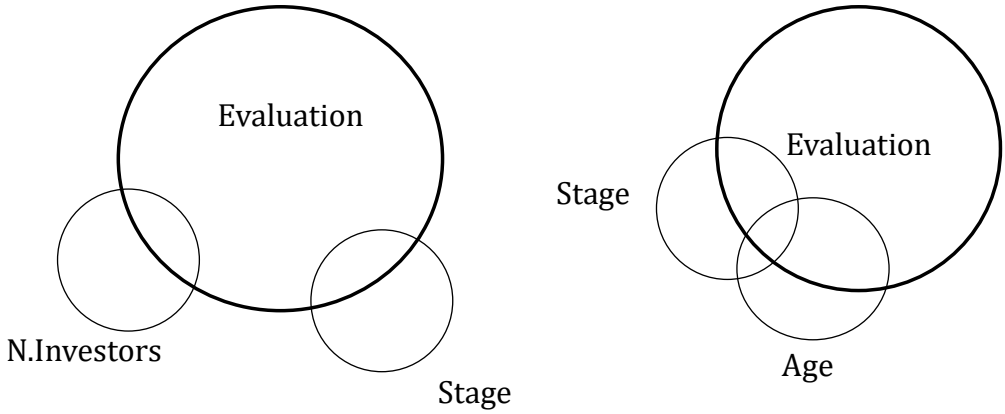
If $r < 0,3$ → Weak Relationship

If $0,3 < r < 0,5$ → Moderate Relationship

If $r > 0,5$ → Strong Relationship

Variables that show a number *r* close to zero indicate that there is no linear relationship between the two variables. This could be happening for different reasons: i.) The two variables are independent, therefore one variable can by no means explain the changes of the other; ii.) These two variables are highly volatile; iii.) There is another type of relationship between the two, that is non-linear (Khamis, 2008).

Finally, except for the Number of Employees and the Age correlation with the Stage (moderate-strong correlation), all other variables seem to be uncorrelated with each other. This is very important in the construction of the regression models, as independent variables should always be as uncorrelated as possible, to reduce the amount of shared variance. Figure 2 better explains the concept just described: the effect of having correlated independent variables over the explanation power of the model. This phenomenon is called **Multicollinearity**, but since in our sample all variables present a correlation coefficient below 0,7, it is safe to imply that the predicting power over the dependent variables' variance is consistent (Wooldridge, 2019).



Uncorrelated Independent Variables **Correlated Independent Variables**

Figure XIX: Visual Representation of Correlation Effects in Independent Variables

Source: University of Southern Queensland

2. REGRESSION ANALYSIS

To inspect the relationship between the variables in object, I have decided to detect their eventual statistical relationship through eight different models.

Multiple Regression Analysis has the following general equation:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \ldots + \beta_n X_n + \varepsilon$$

Where:

- Y_i is the dependent variable.
- β_0 is the value of the dependent variable when all other coefficients are 0.
- β_1 is the regression coefficient, found through the statistical model, of the first independent variable (X_1); it returns the effect that increasing the independent variable has on the dependent one. For this analysis, the focus point is not so much understanding the numerical variation but analyzing the sign of this relationship.
- ε is the error term, that is the amount of variation in our estimate of the dependent variable.

The purpose of the thesis is to analyze whether an increase in the ESG scores of the startups analyzed could result in a significant increase in their evaluation, a relationship represented by the following function:

$$\text{EVALUATION}_i = \beta_0 + \beta_1(\text{ESG Score}) + \beta_i\ (\text{Control variable})$$

where β_0 is the intercept of the dependent variable, β_1 is the regression coefficient for the ESG Score and β_i is the coefficient of the different control variables added to explain the model.

By using MRA, we can describe the (eventual) correlation by using a fit line, where ideally the observations of the dataset should lie.

Hereafter, I present the regression functions for the main models I have analyzed:

MODEL	FUNCTION
1	EVALUATION = $\beta_0 + \beta_1$ESG_SCORE + β_2N. of Founders + β_3N. of Employees + β_4Stage + β_5Years + β_6Venture Backed + ε
2	EVALUATION = $\beta_0 + \beta_1$E_Score + β_2S_Score + β_3G_Score + β_4N. of Founders + β_5N. of Employees + β_6Stage + β_7Years + β_8Venture Backed + ε
3	EVALUATION = $\beta_0 + \beta_1$ESG_SCORE + β_2N. of Founders + β_3N. of Employees + β_4Stage + β_5Years + β_6Venture Backed + β_7Industry + β_5HQ_Binary + ε
4	EVALUATION = $\beta_0 + \beta_1$ESG_SCORE + β_2N. of Founders + β_3N. of Employees + β_4Stage + β_5Years + β_6Venture Backed + β_7Industry + β_5HQ_Category + ε
5	EVALUATION = $\beta_0 + \beta_1$ESG_SCORE + β_2N. of Founders + β_3N. of Employees + β_4Stage + β_5Years + β_6Venture Backed + β_7N. of Investors + ε
6	EVALUATION = $\beta_0 + \beta_1$ESG_SCORE + β_2N. of Founders + β_3N. of Employees +β_4Stage + β_5Years + β_6N. of Investors + β_7Revenues + ε
INTERACTION	
1	EVALUATION = $\beta_0 + \beta_1$ESG_SCORE + β_2ESG_SCORE*Industry + β_3N. of Founders + β_4N. of Employees + β_5Stage + β_6Years + β_7Venture Backed + ε
2	EVALUATION = $\beta_0 + \beta_1$ESG_SCORE + β_2ESG_SCORE*Stage + β_3N. of Founders + β_4N. of Employees + β_5Industry + β_6Years + β_7Venture Backed + ε
3	EVALUATION = $\beta_0 + \beta_1$ESG_SCORE + β_2ESG_SCORE*Revenues + β_3N. of Founders + β_4N. of Employees + β_5Stage + β_6Years + β_7Venture Backed + β_8Industry + ε

Figure XX: Models Constructed for the Regression

Source: Own Representation

Models 1-6 represent the regression functions constructed to calculate the coefficients and to check whether the assumptions made before when performing the Pearson Correlation, were correct. The interaction analysis 1-3 was created to find if some variables act as *moderators* in the model, therefore if relationships between variables exist that can better explain the variance of the Y.

2.1 Hypothesis Testing

When an MRA analysis is performed, it is important to remember that we are building a hypothesis that, through the regression, we are trying to demonstrate.

In our model, the hypotheses formulated are the following:

H_0 = There is no relationship between the evaluation of the startup and its ESG Score, which in statistical terms results in β_{IV}[28] = 0.

H_1 = There is a linear relationship between the evaluation of the startup and its ESG Score, which in statistical terms results in $\beta_{IV} \neq 0$.

Further hypotheses being tested in this model are:

H_2 = There is a linear relationship between the evaluation of the startup and its E_Score

H_3 = There is a linear relationship between the evaluation of the startup and its S_Score

H_4 = There is a linear relationship between the evaluation of the startup and its G_Score

[28] Where β_{IV} is the coefficient of the independent variable present in the model.

H_5 = There is a linear relationship between the evaluation of the Startup and its Industry; in particular, following the literature, it seems to prevail the notion that Hardware companies have it harder than Software when it comes to kickstarting the business, therefore I want to test whether the fact that the company pertains to a specific industry influences its evaluation.
H_6 = The relationship between the ESG Score and the Evaluation of the company is different throughout the Stages[29].

2.2 Statistical Results[30]

Table V summarizes the main statistical results found when analyzing the models with simple variables.
As mentioned earlier in this chapter, different variables have been tested through different stages and combinations to understand the behavior of the relationships and check whether there was significance.
The main statistical result I want to highlight is the significance level of the ESG Score: in all the six models here presented, the relationship between the mentioned variable and the valuation of the startup resulted significant both at the highest level, with a p-value below 0,01 and below 0,05. We can therefore reject the null hypothesis H_0 and accept the alternative one, H_1: an increase in the ESG Score will consequently lead to an increase in the startup's evaluation. The positive nature is indicated by the sign of the coefficients: in our models, all positive ones.
Several justifications might support this result, many of which have been described in the first chapter of this thesis when outlining the theoretical background. To recall a few, it might be that the better positioning with respect to competitors in the Social pillar has consequently helped the startup retain the best employees, due to a more favorable treatment in terms of benefits, training possibilities and equal and fair treatment. The Environmental pillar might have affected the outcome in terms of improved consideration by consumers, since the particular attention regarded to the products delivered, as well as a general increase in the company's reputation. And finally, Governance, which arguably is the most important pillar in terms of stakeholder relationships, might have resulted in an improved consideration by them too.

[29] This will be analyzed with an interaction model.

[30] For a more detailed statistical analysis and graphical representation see the Appendix B.

Table V: Statistical Results for the Simple Relationships

		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
VALUATION							
ESG SCORE		16,88 ***		16,85 ***	16,81 **	14,21 **	8,40 **
	ESG_E	-	24,11	-			
	ESG_S	-	8,04	-			
	ESG_G	-	27,69 **	-			
NUMBER OF FOUNDERS		1,94	2,80	2,19	2,12	0,51	3,11
NUMBER OF EMPLOYEES		0,25 **	0,24 **	0,25 **	0,25 **	0,14	0,17 *
FUNDING STAGE							
	Series A	0,82	1,02	1,09	1,05	-7,82	-3,34
	Series B	39,31 **	39,83 **	38,92 *	38,88 *	40,21 **	45,87 **
	Series C	106,57 ***	103,21 ***	106,13 ***	105,76 ***	95,65 ***	98,31 ***
YEARS		-2,93	-	-3,03	-3,08	-2,88	-1,57
VC_BACKED		10,68	-	11,51	11,70	12,13	-
INDUSTRY		-	-	2,42	2,58	-	-
HQ_BINARY		-	-	-3,49		-	-
HQ_CATEGORY	East Coast	-	-	-	-3,96	-	-
	Central	-	-	-	-1,91	-	-
NUMBER OF INVESTORS		-	-	-	-	2,45 ***	2,02 ***
ESTIMATED REVENUES		-	-	-	-		130,08 **
_CONS		-17,73	-22,81	-17,13	-17,10	-26,94	
NUMBER OF OBS.		115,00	115,00	115,00	115,00	107,00	107,00
R-Squared		0.4676	0.4773	0.4729	0.4783	0.5405	0.5613
Adjusted R-Squared		**0.4274**	**0.4271**	**0.4222**	**0.4225**	**0.5011**	**0.5206**
Prob > F		0.0	0.0	0.0	0.0	0.0	0.0

*Significance levels *** p < 0,01, ** p < 0,05, * p < 0,1*

Source: Own Representation

Model 2 further breaks down this relationship by analyzing the single components of the score (E, S and G): as it is shown, the one that resulted significant is the *Governance pillar*; this is consistent with previous literature that claims that good governance can help companies obtain more external financing at a lower cost (Atan et al., 2018). Moreover, by studying the coefficient of every single G component, I have found that Women's presence on the Board bears the highest significance among the KPIs, consistent with the results of Bradley et al. (2011).

It seems then that we can trace the positive relationship to only this pillar, a conclusion supported by previous studies as well as by the fact that Governance is the mean through which stakeholders interact with the company: it makes sense then, that above others, the information that flows through this channel is the most significant for investors.

Despite previous literature showing a significance result, (Keeley and Roure, 1990), the Number of Founders did not prove to be an important player in explaining the variance of the dependent variable, showing nonetheless a positive coefficient that is in line with other empirical studies.

Finally:

- The Number of Employees has a positive coefficient and is relevant with a p-value of less than 0,05; this metric is often used as a proxy for a company's development. It is logical to conclude then that as the company expands, and the number of employees grows, also its evaluation follows (Hidayat et al., 2021).
- Stage shows a positive and significant relationship in Stage B and Stage C, with a p-value that ranges from the highest level (< 0,01) to the lowest (< 0,1) as the variables in the model change. It is rational to conclude that as a company grows, it goes through different funding rounds and therefore has a higher chance of having an overall higher evaluation (Kam et al., 1999).

  Special consideration must be made for Stage A companies, whose coefficients in Models 5 and 6 resulted negative. It is important here to underline that, although it is negative, it does not comprise a negative relationship between the Y and the Stage variable, since this number must be related to the base level (here not shown, it is *Seed*); therefore, the correct interpretation for this would be that, relatively to the Seed level, Stage A companies show a lower evaluation. The result though is not meaningful given the fact that the coefficient resulted insignificant, with a p-value of 0,939 which is indeed too high to reject the null hypothesis.

Moving to the financial parameters, which have been reduced to only one voluntarily to concentrate on the relevance of non-financial ones when it comes to the evaluation of young businesses, Revenues show a positive and significant relationship with the Evaluation, with a p-value lower than 0,05. This is not a surprise indeed, as we are all accustomed to seeing the importance that financial KPIs have for investors, and stakeholders generally, when assessing the health status of a company. This result of course does not threaten the importance of the non-financial parameters significance that we have outlined, but only proves the importance of keeping the two aspects in consideration.

As **Models 3 and 4** layout, although the coefficient of the Industry variable is positive, as expected when we had formulated Hypothesis 5, the relationship does not have a p-value below the threshold considered, and therefore is not significant in the model. This might be justified by the fact that the startups considered in this sample have already passed the first round of financing, therefore have already been judged as having the potential to succeed by investors.

Despite showing a positive coefficient, therefore keeping up to the expectations formulated in the previous paragraph, neither the Headquarter location of the startups seems to have an effect over the dependent variable: previous literature supported this argument by asserting that the concentration on one particular area (coastal), favored the knowledge spillover among employees, as well as increased the possibility of being funded by VCs, as for example happens in the Silicon Valley. This research though does not show evidence that supports these theories, or at least the relationship, if present, is not linear.

All in all, the attentive reader might be asking themselves why, throughout the models, those variables that did not show any type of significance were kept still and not dropped, which in our case would be the Number of Founders, Headquarters location, whether the startup is backed by a Venture Capitalist and the Industry of belonging. According to Gelman and Hill (2007), keeping a predictor that has the expected sign, although resulting insignificant, still has either no impact at all on the predicting power of the model, or it might at least help us to avoid omitting a variable that might be determinant to the explanation of the dependent one. Since the statistical result would not be affected by this decision, I decided to keep them.

Aside from the sign and number of the coefficients, an important metric to consider when assessing the validity of the regression is **R^2** and the **Adjusted R^2**, reported at the bottom of each model in Table 4.3. This statistical measure determines the proportion of the variance of the dependent variable that can be explained by the independent one. In other words, how well the data provided fit the model and therefore can predict the value and relationship between evaluation and the ESG + control variables. The best fit in this analysis is represented by Model 6, where R^2 = 0,56, that is the ESG Score + control variables explain 56% of the variance of Evaluation. Since we are dealing with Multiple Linear Regression, it is useful for us to look at another similar metric which is the Adj. R^2, in the model 0,52. It has the same meaning as the

R^2, though it is adjusted for the number of predictors inserted in the regression. When we add variables in a model in fact, the R^2 tends to increase, even if these are not significant and therefore do not enhance in any way the fit of our model. By using the adjusted metric, we account for this fact and are therefore presented with a more honest association between the Y and the X.

2.2.1 Interactions Results

Table 4.4 shows the statistical results obtained when using interactions to test the significance level of the variables.

Table VI: Statistical Results for Categorical Interaction Models

			Model 7	Model 8	Model 9
CATEGORICAL INTERACTIONS	VALUATION				
	ESG SCORE		23,59 ***	30,10 ***	3,85
		ESG_E	-		
		ESG_S	-		
		ESG_G	-		
	NUMBER OF FOUNDERS		3,53	2,90	3,05
	NUMBER OF EMPLOYEES		0,27 **	0,26 ***	0,14 **
	FUNDING STAGE				
		Series A	-1,87	42,85 **	12,47
		Series B	33,32 *	66,47 *	62,00 ***
		Series C	100,35 ***		12,74 ***
	YEARS		-2,87		-2,19
	VC_BACKED		10,51		6,72
	INDUSTRY		27,65		3,88
	HQ_BINARY		-		
	HQ_CATEGOTY	East Coast	-		
		Central	-		
	NUMBER OF INVESTORS		-		
	ESTIMATED REVENUES		-		-527,99 ***
	_CONS		-30,79	-40,44	-9,54
	Industry*ESG_Score		-17,51		
	Funding Stage*ESG_Score				
		Series A	-	-32,60 **	
		Series B	-	-22,67	
		Series C	-	20,06	
	Estimated Revenues#ESG_Score				303,05 ***
	NUMBER OF OBS.		115,00	115,00	107,00
	R-Squared		0.4779	0.5088	0.6711
	Adjusted R-Squared		**0.4277**	**0.4511**	**0.6330**
	Prob > F		0.0	0.0	0.0

*Significance levels *** p < 0,01, ** p < 0,05, * p < 0,1*

Source: Own Representation

When including interactions in the regression terms, we are implicitly asking whether the third variable (Z) modifies the behaviors that the X and Y have, for a given level of Z. In this case,

three interaction terms have been studied, and now we will analyze them singularly. First, the interaction between the Industry and the ESG score was studied, to find whether the change in the industry makes the relationship between the sustainability score and the Evaluation change. It is worth noting that we are performing a continuous–categorical regression: continuous means that there are no gaps in the hypothetical values that the variable can assume, while categorical (or discrete) can assume only specific values (e.g., binomial variables) (Khamis, 2008). By regressing the coefficient of *Industry*ESG* Score, we are trying to see if the relationship that there is between the dependent and the independent variable changes when we control for the industry, that is, if Hardware and Software have two different types of relationships between ESG Score and Evaluation. The coefficient, as Model 7 shows, is not significant (-17,21), therefore we can't reject the null hypothesis. This comes as no surprise as, since the industry term alone is not significant, the probability of it resulting so in the interaction term was low.

The second interaction term created is in **Model 8**, and it tests the relationship between DV and IV, controlling for the Stage of the startup. In other words, we are trying to see if the relationship between ESG Score and Evaluation is different as the different stages of the startup change.
By first analyzing only the regression, **without the interaction**, we can see that: i.) the constant (-9639108) is the predicted evaluation for a Seed company with an ESG score = 0; ii.) the more the company grows, the higher is their predicted evaluation with respect to a Seed company that has the same level of ESG. This can be observed better through a graphical representation. As it is observed in Figure 4, if the ESG score is increasing, so does the difference between the lines (which represents the different stages of the startup), widening with respect to the Seed level, here taken as a benchmark.

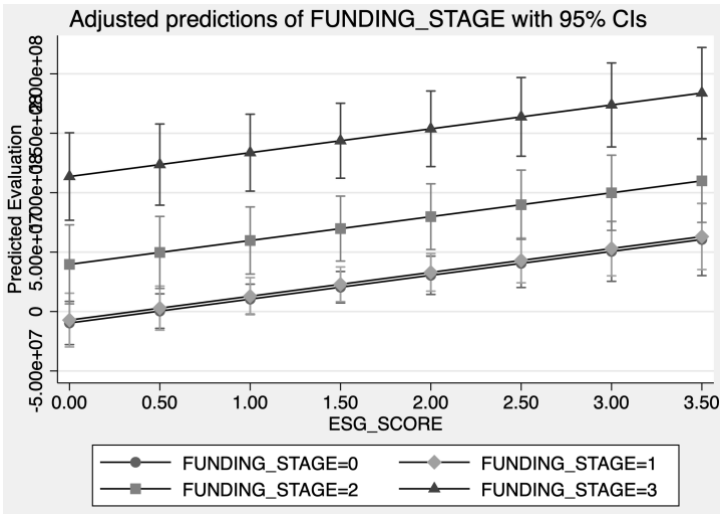


Figure XXI: Graphical Representation of Stage Variable Without Interaction

Source: Own representation through Stata

Let's see what happens when we add the interaction. **Model 8** shows the coefficients observed in the interaction term between *ESG*Stage*, which we might interpret as follows:

1. The coefficient of ESG: when inserting an interaction inside the model, we must remember that there is no single effect of ESG anymore, but they are all effects of ESG, based on the stage of the startup (here a categorical variable that ranges from 0 to 4). Therefore, +30100000 is the coefficient of ESG for those startups falling in Stage 0.
2. The coefficients of Stage: although negative, again, these coefficients do not have the same meaning as before, therefore they are not predicting a negative relationship between evaluation and the stage. Their meaning instead, is the difference in the slope between the Stages (Series A, B and C) with respect to startups falling in Seed level, when the ESG = 0. Being ESG a continuous variable, and not having any case in the sample where ESG = 0, we can ignore the result.
3. Although present, significance level relates to the previous point since they only test whether there is a meaningful difference between the coefficients of Stages when the ESG score = 0, therefore a case that does not exist in the sample.

The third interaction tests the role of Revenues as a moderator, which entails an interaction term whose coefficient is *β*ESG*Revenues*, portrayed in **Model 9**. By constructing this model, we are trying to analyze whether the relationship between ESG and Evaluation is different for the different levels of Revenues (here a categorical variable with two levels: 0 - Startups

whose revenues are below 50 million; 1 - Startups whose revenues are above 50,1 million). By analyzing the model **without interaction** first, we can see that for the same level of ESG, companies that are in the higher bracket of revenues have a higher evaluation with respect to the others. This comes as no surprise, as we had already asserted in the previous models that there is a positive relationship between the Evaluation and the Revenues. By looking at this graphically, we can just observe that: for a given level of ESG score, the difference is the same between levels 0 and 1 of revenues, represented by the slope of the curve.

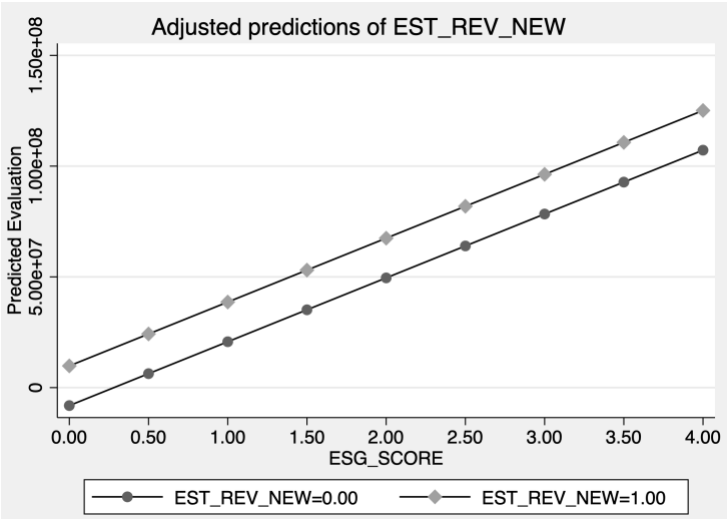


Figure XXII: Graphical Representation of Revenues and ESG Relationship without Interaction

Source: Own representation through Stata

Let's look at the relationship with the interaction, as observed in **Model 9**. There are several important observations to be made:

1. β_{REVENUES} - before was the same for all levels of revenues because we were considering companies with the same ESG. Now that we are accounting for the IV's change, the coefficient is negative (-527,29). This is not the coefficient that the single variable has over the dependent one, which means that there is not a negative relationship between the two. Instead, it stands for the difference in evaluation for companies in levels 0 and 1, that have an ESG score of 0. Being a continuous variable though, this does not happen often, if ever, so virtually we can avoid considering this number.
2. $\beta_{\text{REVENUES*ESG SCORE}}$ - this is the coefficient of the interaction term, which is the only one we have to consider when we create these types of analyses. It represents the effect of

an increase in the ESG when a startup is in the category "1" of revenues, in this case, +303,5. The interpretation behind this could be that once startups build a solid financial background by improving their revenues, investors are more interested in taking into consideration also the non-financial information when deciding whether to invest.

2.3 Results Summary

Figure V summarizes the main empirical results obtained through the statistical Multiple Linear Regression analysis. As it can be observed, out of the six hypotheses formulated, H_1, H_4 and H_6 resulted statistically significant, therefore we can safely reject the null hypothesis.

MODEL	HYPOTHESIS	RESULT
Model 1-4	H_1 = There is a linear relationship between the evaluation of the startup and its ESG Score, which in statistical terms results in $\beta_{IV} \neq 0$.	A **significant** relationship is observed between the DV and IV. The significance level is 99% in the first model, and 90% when corrected for Heteroskedasticity.
Model 2	H_2 = There is a linear relationship between the evaluation of the startup and its E_Score	It is not observed a relationship between the two variables.
Model 2	H_3 = There is a linear relationship between the evaluation of the startup and its S_Score	It is not observed a relationship between the two variables.
Model 2	H_4 = There is a linear relationship between the evaluation of the startup and its G_Score	It is observed a **significant** positive relationship between the two variables; particuarly significant resulted the KPI *Women Presence on Board.*
Model 3	H_5 = There is a linear relationship between the evaluation of the Startup and its Industry;	It is not observed a relationship between the two variables.
Model 8	H_6 = The relationship between the ESG Score and the Evaluation of the company is different throughout the Stages	Graphically, the point is proven to be correct. For further information, refer to paragraph 2.2.1

Figure XXIII: Summary of Statistical Hypotheses

Source: Own Representation

2.4 Robustness Checks

In this paragraph, I will outline the robustness checks that must be implemented when performing a linear regression analysis, as well as the corrections I have applied whenever required.

The main assumptions when performing an MLR analysis are the following:

1. Linearity – that is the relationship between the dependent and independent variable is linear.

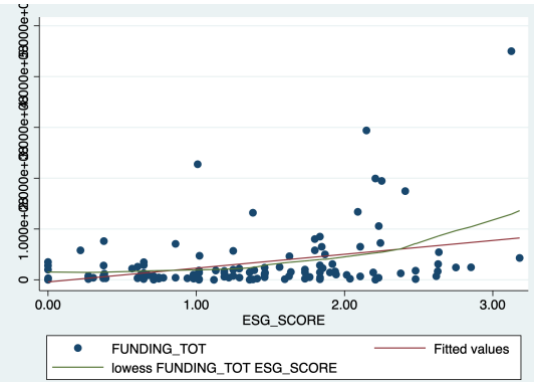


Figure XXIV: Linearity Check

Source: Own Representation through Stata

To check for the first assumption, we create a graph that scatters the observation through a fit line: if the dots, that represent the dependent variable (FUNDING_TOT) fit the regression line, we conclude that linearity is respected. As can be observed, although there are some outliers, the distribution is consistent with a linear relation.

2. Independence – the observations are independent, that is there is no multicollinearity. This was already inspected in paragraph 1, where the Pearson Correlation analysis was performed, and it was concluded that since the coefficients are all below 0,7, it is safe to perform the analysis.
3. Homoskedasticity – The variance of the residuals is the same for all values of the independent variables.

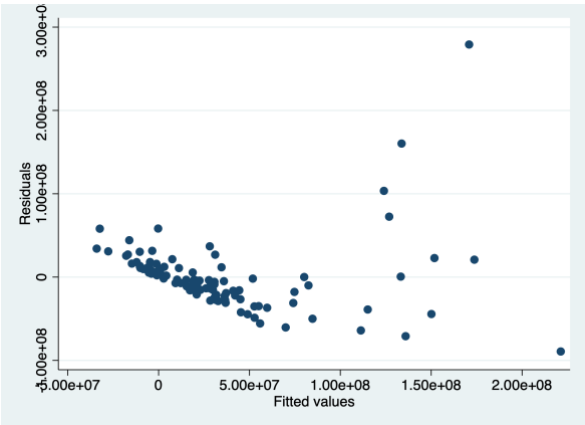


Figure XXV: Residuals Plot

Source: Own Representation through Stata

As it is shown in Figure 4.2, a graphical way to assert whether there is Homoskedasticity or Heteroskedasticity is to plot the residuals vs. the predicted value: if there is no pattern in the graph, the data should be Homoscedastic. As it can be observed though, there seems to be a pattern among the residuals, therefore it might be necessary to deal with Heteroskedasticity. To be sure, I performed the Breusch-Pagan test: the null hypothesis here is that the residuals are Homoscedastic.

```
Breusch–Pagan/Cook–Weisberg test for heteroskedasticity
Assumption: Normal error terms
Variable: Fitted values of FUNDING_TOT

H0: Constant variance

    chi2(1) = 187.51
Prob > chi2 = 0.0000
```

Figure XXVI: Breusch-Pagan Test for Heteroskedasticity

Source: Own Representation through Stata

Since the p-value of the X^2 statistics is below 0,01, we must reject the null hypothesis and affirm that there is **Heteroskedasticity**. This implies that the variance of the errors is not constant: the coefficient found for the regression will still be reliable, but the p-value is often overestimated with respect to real terms.

2.5 Robustness Corrections

Heteroskedasticity is so common, that we should always assume its presence in our model (Stock and Watson, 2003). There are two ways through which we deal with this: one is to use the robust-standard errors, while the other is to use weighted least squares. The latter is only applied when you know that the variance is due to a specific increase in value, and since we do not have this information at hand, and the dataset is of medium size (above the threshold of 50 observations), I decided to proceed with the robust correction. To do so, I used the *robust* function in Stata, which allows us to correct the problem by assuming Homoscedastic errors.
The results are displayed in Table 4.5, where I reported only the last two models (Models 5 and 6 of the previous analysis) since the others did not bear significant results.

Two important conclusions:

1. ESG Score is still significant, although with a lower level of confidence (p-value < 0,1), thus we can reject the null hypothesis. This is an important outcome, as it strengthens the results obtained the first time and therefore the validity of the model used.

2. The number of Employees & Stage are significant too (p-value < 0,1 & 0,05) therefore implying the importance of these two elements in the prediction of the dependent variable.

Table VII: Statistical Results with Robustness Checks

	Model 5	Model 6
VARIABLES	Model 1	Model 2
ESG_SCORE	8,56*	8,72*
N_FOUNDERS	**2,88**	**2,33**
N_EMPLOYEES	**0,15***	**0,17***
1.FUNDING_STAGE	-4,29	-4,15
2.FUNDING_STAGE	46,33**	38,47**
3.FUNDING_STAGE	100,03**	91,85**
YEARS	-1,70	
VC_BACKED	6,10	
N_INVESTORS	2,03	2,01*
EST_REV_NEW	128,58	132,18
Observations	107	115
R^2	0.63	0.62

**** p<0.01, ** p<0.05, * p<0.1*

Source: Own Representation through Stata

3. DISCUSSION OF THE RESULTS AND INTRINSIC LIMITATIONS OF THE RESEARCH

3.1 Implications and Literature Comparison

This thesis has analyzed from an empirical point of view the relationship that might exist between the dependent variable, evaluation, and the relative Sustainability level demonstrated by startups, as well as many other factors that might contribute to the explanation of the Y.
The study shows indeed controversial results, and now I will illustrate why. The ESG score shows one of the highest significance percentages, with a 99% level of confidence (90% when corrected for homoskedasticity), which might draw the reader to think that investors regard non-financial information as a key factor in their decisions. When deconstructed in its own three components (E, S and G) though, only one of them holds the relationship true. This concludes that the environmental side is still not important for investors when choosing whether to fund a startup, and the same holds for the social pillar. This is in line with the article by Cohen (2023), where analyzing the ESG concerning S&P's companies, he too concluded that there is no significant relationship that ties evaluation to the environmental pillar. **Governance** instead seems to be the only one showing this significance. Furthermore, we saw through the interaction model with the Stage, that the relevance of Governance is increasing along the stage of the startup, that is ESG scores increase their significance over the Evaluation as the stage of the company grows. Along with this, we draw another important implication out of this result: investors seem to still hold to their nature, meaning that they privilege financial information over non-financial ones. In support of this thesis, when tested in the regression, Revenues showed the highest significance in explaining the evaluation (p-value < 0,01) and, additionally, as the revenues grow, investors care more about the ESG score, as Model 9 has proven. This means that all things considered, the non-financial side takes part in the play only when the financials are in good shape, and never the other way around. This might sound paradoxical to the literature that has been cited in the first paragraph but, after careful analysis, it makes sense. Governance is the translation and incorporation of what good business should be, no company would ever be able to grow and thrive without this primary component, which is indeed shown since the first stages of the startup. While environmental and social elements are important, they are still not ultimately necessary to keep the business alive, as instead is the other, along with financials. Therefore, it makes sense that investors keep this as the primary interest focus, along with financial KPIs, and only after that, as Model 9 has proven, they start caring for other

dimensions. Literature seems to hold true to this conclusion, as an article by Alvarez & Marsal (2020) defines governance as the *Secret Sauce* in an organization. That is because investors often give this aspect for granted, as mentioned before, but when it lacks, it immediately raises questions and alarms. It could be argued that the most important scandals in the recent business industry (e.g., Enron) happened exactly because of a lack of a working governance system.

As far as other non-financial KPIs are concerned, I have incorporated several in my models, and these are the main empirical results. Contrary to the findings of Keely and Roure (1990), the number of founders did not result playing a pivotal role in the explanation of the dependent variable in this research. The same was true for the geographical position, which Houlihan (1998) claimed to be an important player in the evaluation explanation, but did not result so by this empirical analysis. The results exposed above showed instead an existing relationship between the Revenues of the startups and their evaluation, in line with the previous study of Berre (2022); it is a remarkable point to keep in mind, as it again underlines the importance of finance in evaluation processes.

The validity of the conclusions presented has been corroborated by the correction for the Heteroskedasticity of the sample considered, performing the regression using the *robust* function in Stata. Although previous variables that had shown significance (Revenues and Number of Employees) had a p-value of respectively 0,14 and 0,13, therefore could not be considered statistically significant anymore, both the ESG and the Stage relationship held true. This is a very important result considering that the focus of this research was exactly to prove the existence of the first relationship.

3.2 Intrinsic Limitations

This research has produced an empirical result through a quantitative approach method, trying to deliver the best possible objective result that could be extracted from the data in hand. Nonetheless, there are indeed some limitations.

The subjectivity of the ESG Scores. Past research in this context has mainly focused on crowdfunding or token offerings when trying to extract a significant result, due mainly to the

abundance of publicly available data in this area. I have analyzed instead startups, that for their intrinsic nature, do not provide the public with much available information. To construct the ESG assessment, I tried to recreate an objective model, by looking for the prominent ESG score agencies, as well as those that focused on startups, to be able to deliver an unbiased score. The data though, all come from public information that businesses have decided to share online (either through their whitepapers or websites), therefore, if their words do not match the actions, the scores would not be able to capture this aspect. Further research could therefore concentrate on retrieving non-public information through questionnaires, interviews with CEOs or by accessing Venture Capitalists' private information. This is particularly relevant for the Environmental pillar, as while conducting the necessary fieldwork to gather the data, I have realized that many companies do not find it necessary to disclose important information regarding their Environmental behavior: e.g., how their supply chain is distributed or whether they recycle any product or have a disposal program.

Another aspect that struck me was the lack of information regarding AI training procedures by companies heavily implementing this type of technology: due to the late clamor raised, I would have expected special attention, as well as a higher request for information by investors.

Geographical limitations. For this thesis, a single setting was preferred instead of expanding the sample to more regions. The reasons that have led to this decision have been mainly practical and political: first, if we consider different countries, indeed we are dealing with different regulations and therefore the perks of one or another company might invalidate the results; second, being the focus of the research young companies whose main financial source comes from third parties, the presence of a well-established network of venture capitalists might indeed favor one area more than others. Moreover, the companies taken into consideration belong to a single Industry (IT Sector), therefore again geographical differences might have tampered with the results because of different stages of development around the world. Further research could address this limitation by expanding not only in geographical nature but also in the sectorial one, perhaps by limiting it to clusters of innovations in big countries, instead of considering them as a whole, to reduce the biases that come from places where there is a higher diffusion of VCs.

Statistical limitations. As mentioned in the previous paragraph, the sample studied suffered a heteroskedasticity problem, which after being addressed, showed a 10% level of significance for the main independent variable studied (ESG). Although still representing a remarkable

result, some scholars could argue that due to the low level of significance, the chances of incurring in a statistical error are still high. It must be considered that the sample in object contains 120 observations, therefore it might be necessary to expand it to be able to generalize the results and obtain a more significant outcome.

Another statistical limitation is given by the endogeneity problem, which is the chance of having a missing variable in the model, often cited by many scholars (Giannopoulos et al., 2022). This study does not account for this possibility, although many control variables have been inserted, therefore incurring in the probability of omitting a "*variable that is determinant of the dependent variable*" (Stock and Watson, 2003). Further research could concentrate on retrieving more control variables, by following previous literature, as well as performing different tests to control for it.

ESG and Financial Performance. This research has concentrated on proving a potential nexus between ESG scores and the financial performance of startups in their funding rounds, that is the amount of money received while being supported mainly by external finance. The question remains if this result holds true at a later stage in the life of the company, and in particular in their financial results. Mansouri and Momtaz (2022) for example, studying the token offering context, have found countertrending results in this setting. Startups with superior ESG scores consistently underperformed financially, in a one-year frame, their peers with a lower ESG score. Moreover, due to a lack of regulation that reflects inevitably in the type of data available, to construct the ESG score only the elements published by the companies have been taken into consideration, therefore if real actions do not correspond to what the company wish to communicate to stakeholders, the ESG score would not be able to capture this bias. Moreover, ESG score is not capable of capturing the CSR effort that a company is involved in. This means that a startup might be more active in the pursuit of sustainable activities that were not considered in the score (Nollet et al., 2016).

Further research could investigate the same companies in 5 or 10 years from now, to see if eventually the results have changed and if the hypotheses that were confirmed or denied still hold true.

CONCLUSIONS

This study proposes to empirically detect whether there is a relationship between the evaluation of a startup, and the sustainability level they currently display. This is indeed a very important question considering the latest investment trends, as well as the preferences of consumers: the funds poured into sustainable venues, as laid out in the first chapter, have constantly raised in the past decade, making it one of the most promising sectors of the economy. To calculate numerically this type of effort by companies, the ESG scores have been adopted: many international agencies, public and private, have tried to come up with a definitive guide on how these scores should be created, but we can nonetheless observe what has been called *Aggregate Confusion*. This term has been coined by Berg et al. (2019) to describe the inconsistency revolving around the source of data used to build ESG scores, as well as a lack of defined regulation. Moreover, besides the substantial differences that each score provider shows, startups are not currently subjected to any type of evaluation from third parties.

The first goal of this thesis was to provide the readers with an objective and impartial ESG framework, that might be used to replicate further studies in this area. To do so, I have constructed it by taking as a benchmark one of the most popular frameworks among scholars, that is *SASB Materiality Map*. From there, I selected key KPIs from different prominent agencies, as well as some small ones, as they added a more startup-centric view. KPIs are not all the same, in fact, and for startups especially, they must be calibrated more *loosely,* given the lack of budget in the first years. Finally, the metrics found were weighted for each sub-industry, since literature has proved before that by assigning a different weight to the pillars, the results would be more truthful. This is justified by the fact that each sub-industry is more subjected to peculiar non-financial risks than others, which means that, for example, tech ones are more prone to cybersecurity risks (Social), while a company that is into extraction would be subjected to stringent polluting regulation (Environmental). By assigning different weights to each Pillar, we are considering this. The principle is called **Materiality**, thoroughly explained in Chapter 2, where also an overture of the industry of belonging, that is Information Technology, has been provided.

I regard this sector with much interest because not only do I think it will increasingly play a decisive role in our life, more than what is currently doing, if possible, but also because there is

an intrinsic dichotomy in its nature. IT, and its various forms (e.g., Natural Language Processing, Data Centers, Computers, Engineering Software) will be the mean through which we will succeed in stopping the phenomenon of climate change, if ever we will be able to do it. At the same time though, while big companies' CEOs pledge to goals of carbon neutrality and net 0, they are the ones releasing the biggest shares of CO_2. Furthermore, almost all of this is done in the dark, since the public many times is not even aware of the damages created. As I regard this as one of the biggest dilemmas we will need to face, I try to address some possible solutions: will disclosure be the right path to follow? So far, we have managed to obtain honesty in the financial side of the medal, so I think that through a system of checks and balances, we might be able to conquer also the non-financial one.

Looking at concrete numbers, currently Hardware and Software positions are almost at the same place according to RepTrack for what ESG level is concerned, which is in line with my results: the average score for Hardware was 1,39 while for Software 1,31. This introduces us to the second goal of this thesis, which was proving whether a relationship exists between the Evaluation of the startups and their ESG score. I divided the empirical analysis into two parts: the first was the assessment of the relationships, and the second was the robustness checks. In the first half, I found that ESG and evaluation were significant at 99%, with a p-value less than 0,01, and therefore concluded that for an increase in the ESG value of the startup, an increase in its evaluation follows. Breaking down the score further into its main components, E, S and G, I discovered that the significance was driven by only one pillar: **Governance**. Many previous studies have found mixed results when considering this analysis, both in the US Information Technology Sector (Okafor, 2021), and in other sectors generally (Atz et al., 2022; Gillian et al., 2021). Nonetheless, it still represents an interesting result, as it highlights the importance for young entrepreneurs to look ahead, to focus their resources and attention on other non-financial venues, because they indeed influence the financial ones. As reported by Nollet et al. (2016), which also found a relationship between evaluation and governance pillar, for it to be effective and long-running, CEOs must plan for the long term.

Along with the independent variable, I studied other 10 control variables, of which four resulted significant (N. of investors, N. of employees, Revenues and Stage). Moreover, I decided to include interactions in my models to understand deeper the relationships between the control

and independent variable. Through those, I found that the ESG relationship with the evaluation is different at different stages of the company, as well as different levels of revenues. In particular, the conclusions I drew are the following: i.) ESG score increases its significance over the evaluation, as the stage grows (though this relationship holds true only for companies in Series C); ii.) As revenues increase, investors are more interested in the ESG component as well.

By assuming a constant heteroskedasticity stage in the samples collected (Stock and Watson, 2003), I studied graphically and mathematically if it was present in my sample, and indeed, it was. The condition implies that the variance of the errors is not constant, therefore the coefficients of the previous regressions are valid, but the p-value might be overestimated. I thus corrected this by applying the robust-standard error function in Stata, and as expected, some variables showed higher p-values concerning the previous models, but nonetheless, the ESG Score still resulted significant at 90% level of confidence. Statistically speaking it is not a precise outcome, as there is a margin of error, but it still represents an important result.

This project contributes to a still emerging literature that deals with young entrepreneurship concerning sustainability practices and provides further researchers with an objective framework to be adopted. It is no secret that this practice has grown in the past few years, and it still will according to the statistics, but the results found here are mixed, as much previous research before this. Different limitations have been exposed in the last chapters, to provide a guide for future scholars. Future studies shall try to overcome them, by employing more sophisticated tools and carrying out scientific research.

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APPENDIX A. FIGURES & TABLES

I. Companies' characteristics

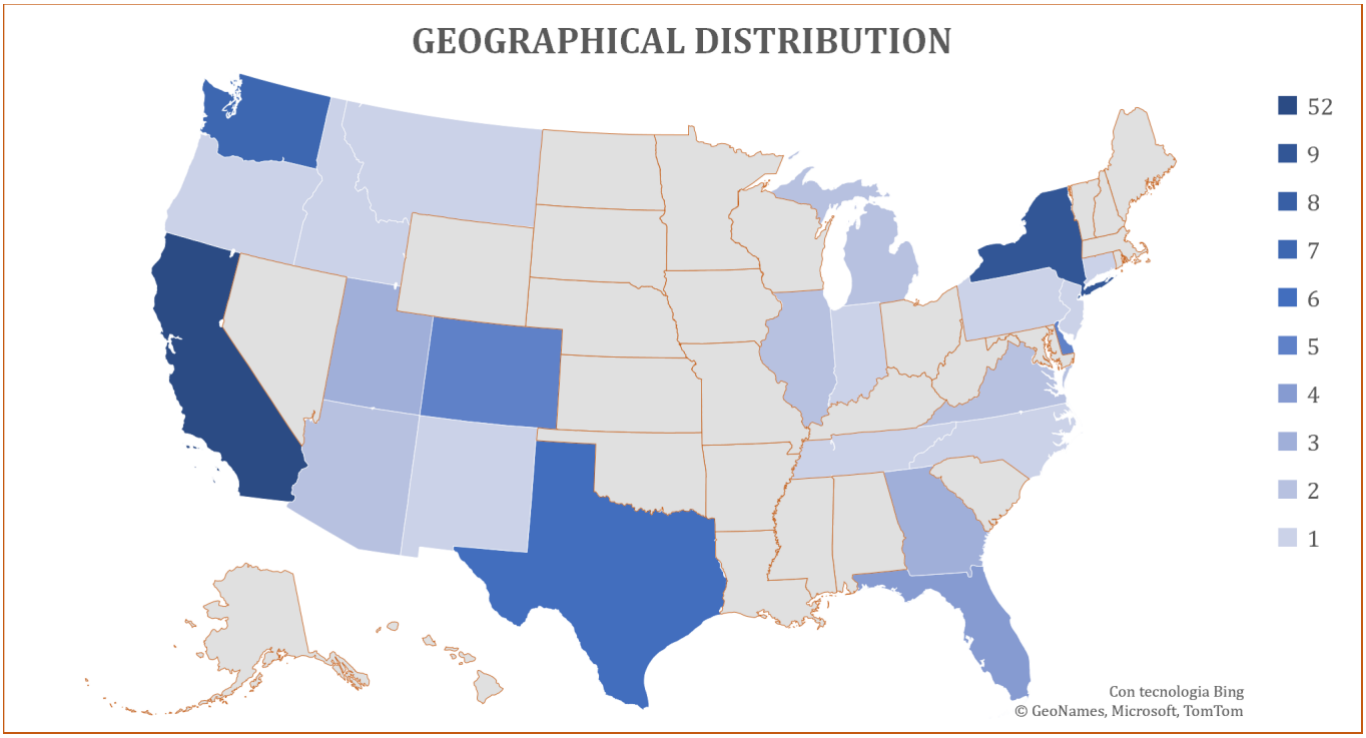
Table T.1 – List of Companies and their Relevant Characteristics

NAME	LAST FUNDING TYPE	FOUNDED DATE	GICS CORRESPONDING SUB-INDUSTRY	HEADQUATERS LOCATION	NUMBER OF FOUNDERS	NUMBER OF EMPLOYEES
RELAY ROBOTICS	Series A	2022	Electronic Equipment Instruments & Components	California	2	101-250
GAIZE	Seed	2021	Electronic Equipment Instruments & Components	Montana	1	01-10
ATOMIC FORM	Seed	2021	Software	Delaware	1	01-10
ENABLD	Seed	2021	Software	Delaware	2	11-50
CONVEYER	Seed	2022	Software	New Jersey	3	11-50
CALL SIMULATOR INC.	Seed	2021	Software	Florida	1	11-50
SEASHELL	Seed	2021	Software	Washington	2	11-50
META CARBON	Seed	2021	Software	Connecticut	1	01-10
COIN SHIFT	Series A	2021	Software	Michigan	1	11-50
REVENUE BASE	Seed	2021	Software	Massachussets	2	01-10
YUGA LABS	Seed	2021	Software	Florida	2	101-250
VEEFRIENDS	Seed	2021	Software	New York	1	11-50
OPENCOMP	Series A	2021	Software	California	2	51-100
EPSILON3	Series A	2021	Software	California	3	11-50
REDBRICK AI	Seed	2021	Software	Delaware	1	01-10
DATAMILK	Seed	2021	Software	Delaware	1	11-50
MENTUM	Seed	2021	Software	California	3	11-50
STYLO	Seed	2021	Software	Colorado	2	11-50
ImIn	Seed	2021	Software	Georgia	1	01-10
TESTBOX	Seed	2020	Software	Colorado	2	11-50
SUBJECT	Series A	2020	Software	California	3	11-50
CLOAKED	Series A	2020	Software	Massachussets	2	11-50
WELOVENOCODE	Seed	2020	Software	California	1	11-50
ARMORCODE	Series A	2020	Software	California	2	11-50
TRUV	Series A	2020	Software	California	2	11-50
HAMMOQ	Seed	2020	Software	Arizona	2	251-500
AESOP TECHNOLOGY	Seed	2020	Software	California	4	11-50
TERNARY	Seed	2020	Software	California	2	11-50
VIRDEE INC.	Seed	2020	Software	Texas	2	11-50
PLAYBOOK	Series A	2020	Software	California	2	01-10
ANROK	Series A	2020	Software	California	2	11-50
WELCOME	Series A	2020	Software	Colorado	3	1150
UiFlow	Series A	2020	Software	California	2	11-50
REWST	Series A	2020	Software	Florida	2	11-50
HEADROOM	Seed	2020	Software	California	3	11-50
HYPOTENUSE	Seed	2020	Software	California	2	1-10
CARTWHEEL	Seed	2020	Software	California	3	11-50
NIVATI	Seed	2020	Software	Utah	1	11-50
GIGS	Series A	2020	Software	California	2	11-50
DRIZZLEE X	Series A	2019	Electronic Equipment Instruments & Components	California	2	11-50
EGGTRONIC	Series B	2012	Software	California	1	51-100
EMBUE	Seed	2015	Communication Equipment	Massachussets	4	01-10
SOMEWEAR LAB	Series A	2017	Electronic Equipment Instruments & Components	California	2	01-10
OTOLITH LABS	Series A	2015	Electronic Equipment Instruments & Components	Washington	1	01-10
CLARITY MOVEMENT	Series A	2014	Technology Hardware, Storage & Peripherals	California	5	11-50
RETIA MEDICAL	Series B	2011	Technology Hardware, Storage & Peripherals	New York	2	01-10
LIGHT FIELD LAB	Series B	2017	Electronic Equipment Instruments & Components	California	3	1150
TOKEN	Series B	2014	Electronic Equipment Instruments & Components	New York	3	11-50
SPANJO	Series B	2018	Technology Hardware, Storage & Peripherals	California	1	51-100
LUMINOUS COMPUTING	Series A	2018	Software	California	3	101-250
SHIFT5	Series B	2019	Electronic Equipment Instruments & Components	Virginia	1	51-100
TOGGLE	Series A	2016	Software	New York	2	11-50
CROWDBOTICS	Series B	2016	Electronic Equipment Instruments & Components	California	1	101-250
SCYTHE	Series B	2018	Electronic Equipment Instruments & Components	Colorado	3	11-50
VERDANT ROBOTICS	Series A	2018	Communication Equipment	California	3	51-100
AERWAWE	Series A	2018	Electronic Equipment Instruments & Components	Texas	3	11-50
PAINTJET	Seed	2019	Electronic Equipment Instruments & Components	Tennessee	3	01-10
WILKINSON BAKING COMPANY	Seed	2017	Electronic Equipment Instruments & Components	Washington	1	01-10
DIAMOND AGE	Series A	2018	Electronic Equipment Instruments & Components	Arizona	2	101-250
ATLAS ROBOTICS	Seed	2017	Electronic Equipment Instruments & Components	Pennsylvania	4	11-50
OHMNILABS	Seed	2015	Electronic Equipment Instruments & Components	California	3	01-10
ORANGEWOOD LABS	Seed	2017	Electronic Equipment Instruments & Components	California	3	11-50
ROBOMART	Seed	2017	Electronic Equipment Instruments & Components	California	3	11-50
MEKONOS	Series A	2017	Technology Hardware, Storage & Peripherals	California	4	01-10
NEAR SPACE LAB	Series A	2017	Electronic Equipment Instruments & Components	New York	3	11-50
OMNITRON SENSORS	Seed	2019	Electronic Equipment Instruments & Components	California	1	01-10

Table T.1 – Continued from the Previous Page

NAME	LAST FUNDING TYPE	FOUNDED DATE	GICS CORRESPONDING SUB-INDUSTRY	HEADQUATERS LOCATION	NUMBER OF FOUNDERS	NUMBER OF EMPLOYEES
ANALOG INFERENCE	Series A	2018	Communication Equipment	California	1	11-50
MESH++	Seed	2017	Electronic Equipment, Instruments & Components	Illinois	1	01-10
CHEF ROBOTICS	Seed	2019	Electronic Equipment, Instruments & Components	California	1	11-50
BOXLOCK	Seed	2017	Electronic Equipment, Instruments & Components	Georgia	2	11-50
TOMAHAWK ROBOTICS	Seed	2019	Software	Florida	2	01-10
MANGOMINT	Series A	2017	Software	California	3	11-50
PACKET DIGITAL	Seed	2019	Software	California	3	11-50
CURBFLOW	Seed	2018	Software	Washington	1	11-50
RECLAIM.AI	Seed	2019	Software	Oregon	2	11-50
AUTOMOTUS	Seed	2017	Software	California	3	11-50
USERPILOT	Seed	2018	Software	Delaware	2	51-100
CIVIL ROBOTICS	Seed	2018	Software	California	2	01-10
DENDI	Seed	2018	Software	North Carolina	2	01-10
AIREXPERT	Seed	2018	Software	New York	1	11-50
LIGVEGISTICS, INC.	Seed	2017	Software	Michigan	3	11-50
IOOGO	Seed	2017	Software	Texas	3	11-50
TECHFORCE	Seed	2017	Software	Virginia	4	11-50
DIGITSEC	Seed	2017	Software	Washington	1	11-50
ALPHY	Seed	2020	Software	Idaho	1	11-50
HANDLE	Series A	2018	Software	California	4	11-50
OVERVIEW.AI	Series A	2018	Software	California	3	11-50
KANARYS	Series A	2018	Electronic Equipment, Instruments & Components	Texas	3	11-50
Rgo ROBOTICS	Series A	2018	Software	Massachussets	3	11-50
HEALTHIE	Series A	2016	Software	New York	2	51-100
BIOTIA	Series A	2016	Software	New York	4	11-50
BOARDABLE	Series A	2016	Electronic Equipment, Instruments & Components	Indiana	3	51-100
R-ZERO	Series C	2020	Communication Equipment	Utah	3	101-250
OWL LABS	Series C	2014	Electronic Equipment, Instruments & Components	Massachussets	2	101-250
MACRO FAB	Series C	2013	Electronic Equipment, Instruments & Components	Texas	2	101-250
PARTICLE	Series C	2012	Technology Hardware, Storage & Peripherals	California	2	101-250
SENSE	Series C	2013	Electronic Equipment, Instruments & Components	Massachussets	3	101-250
AYAR LABS	Series C	2015	Electronic Equipment, Instruments & Components	California	4	101-250
MENLO MICRO	Series C	2016	Electronic Equipment, Instruments & Components	California	2	101-250
HUUE	Series A	2018	Software	California	2	01-10
URBAN FOOTPRINT	Series B	2014	Electronic Equipment, Instruments & Components	California	2	01-10
TWELVE	Series B	2015	Software	California	1	101-250
PASSIVE LOGIC, INC.	Series B	2016	Software	Utah	4	51-100
SAFEHUB	Series A	2015	Software	California	3	11-50
JERRY	Series C	2017	Electronic Equipment, Instruments & Components	California	3	101-250
HEIRLOOM	Series A	2020	Electronic Equipment, Instruments & Components	California	2	11-50
AIGEN	Seed	2020	Electronic Equipment, Instruments & Components	Washington	2	01-10
AMBI ROBOTICS	Series A	2018	Software	California	4	51-100
CELLARITY	Series C	2017	Electronic Equipment, Instruments & Components	Massachussets	4	101-250
LIMINAL	Series A	2015	Electronic Equipment, Instruments & Components	California	4	11-50
KEBOTIX	Series A	2017	Software	Massachussets	5	11-50
AKASA	Series B	2018	Software	California	4	51-100
CLOVERLY	Seed	2018	Software	Georgia	1	01-10
UbiQD	Series A	2014	Electronic Equipment, Instruments & Components	New Mexico	1	11-50
HARVEST THERMAL	Seed	2019	Electronic Equipment, Instruments & Components	California	1	11-50
EXUM INSTRUMENTS	Seed	2016	Electronic Equipment, Instruments & Components	Colorado	2	01-10
MEEZ CULINARY SOLUTIONS	Series A	2015	Software	New York	2	11-50
SOFY	Seed	2015	Software	Washington	1	01-50
ZENUS	Seed	2015	Software	Texas	4	01-10
KEYO	Seed	2015	Electronic Equipment, Instruments & Components	Illinois	3	11-50

Figure F.1 – Geographical Distribution of Companies



As can be observed in the map, the geographical distribution of the companies follows a recurring path: the two main clusters are on the west coast, California, and Washington and on the East Coast, New York. On the inside of the country, we can see that Texas is the major aggregation state, followed by Colorado.

I. ESG FRAMEWORKS CHARACTERISTICS

As it has been described in Chapter III, retrieving information on the startups of this paper has been hard for two main reasons: i.) they are private companies, therefore not required to publish any type of information regarding their activities; ii.) they are very small, with a business that is often not fully established, therefore applying an existing ESG framework would be counterproductive and useless since the metrics are not pondered for early stage companies.

By proceeding in the construction of the ESG Impact Score, I had to ponder my choices of measures between elements that of course would be relevant for the industries that I was considering, according to the IFRS Framework and MSCI Industry Materiality Map, and those that I could retrieve. The result consisted of 17 variables, distributed as 3 in the Environmental Pillar, 10 in the Social Pillar and 4 in the Governance Pillar. Unfortunately, I had to remove one metric from the Environmental one, which is the *Use of Recycled Materials* because only the 1,6% of the sample (2 companies) mentioned this in their publicly available data.
In the same vein as this, there was another metric that struck me for the little information that I could find, despite it being a problem that recently got media attention: the training of AI algorithms. With the increasing diffusion of AI systems, both in the work environment that online, companies must create an accountability system for their clients, so to inform people if there are risks for them or unfair treatment.

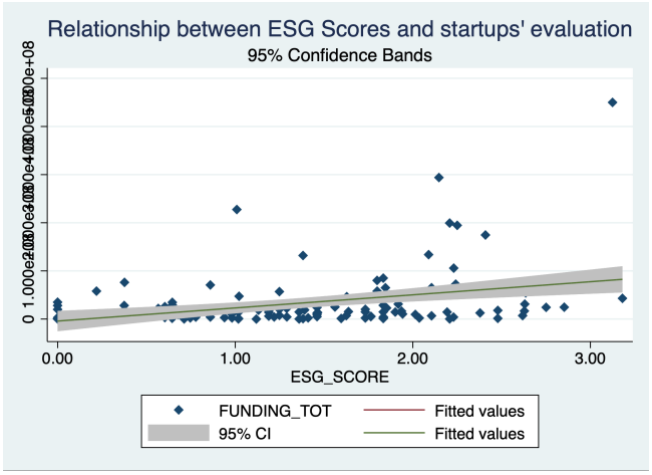
Table T.2 – ESG Metrics and their Sources

PILLAR	KPI USED		MEASURE ADOPTED	ANSWERS	SOURCES
Environmental	Certifications & Impact		Does the company currently produce a product that enables either climate change mitigation or climate change adaptation so to be considered in the EU Taxonomy Compass?	YES/NO	European Union
Environmental	Energy consumption reduction		Has the compay designed its products with a reduction of precious resources in mind?	YES/NO	*ESG_VC/B-Lab*
Environmental	Blockchain Emission		*Is the company part of a blockchain emissions reduction program? (e.g., carbon offsetting)*	YES/NO	B-Lab/ESG_VC
Social	Data Treatment		1 = No mention at all 2 = Mention of boilerplate system, data is collected and among others and it may be sold for profit to third parties (AGGREGATED / DE-IDENTIFIED) 3 = The data is collected, and eventually ceded to third party for business purposes (e.g., data analytics). There is a data protection encrypting software. **AFFILIATES** 4 = The data is collected, storaged and eventually shared only for the functioning of the site/product. **BUSINESS PARTNERS.** 5 = Collected, shared only for law purposes.	LIKERT SCALE FROM 1 TO 5	SASB/ESG_VC
Social	Workplace conditions				
		W1	Does your company provide training, funding or specific courses to employees?	YES/NO	WEF/BCORP/ESG_VC
		W2	Does your company have a Diversity, Equity and Inclusion policy in place? (diverse hiring and promoting, equal pay, parental leave)	YES/NO	ESG_VC/VentureESG/ESG_VC
		W3	Does your company provide employees with different benefits (e.g., parental leave, pension plan or mental health funds or activities?)	YES/NO	ESG_VC/B-LAB
		W4	Does your company provide the employees with an healthcare coverage plan?	YES/NO	ESG_VC/B-LAB
		W5	Does your company provide employees with the possibility of being remunerated with equity compensation packages?	YES/NO	B-LAB
		W6	Does the company provide Paid Time Off (PTO) to its employees in excess with respect to the mandatory governamental days?	YES/NO	ESG_VC/B-LAB
Social	AI Algorithm		1 = No mention at all 2 = Boilerplate general mention 3 = Specific landing page, customized vague mention of AI training 4 = Specific page that reference to the process of AI training, unbiased and inclusive 5 = Specific landing page that references to the process of AI training, unbiased and inclusive & adherence to public standards of policy https://datapractices.org	LIKERT SCALE FROM 1 TO 5	
Social	Charity		Has the company donated to a charity cause in the past year?		ESG_VC/WEF/B-Lab
Social	Products/services creating social contribution		The products and services have been created to enhance social contribution: diversity & inclusion, empowering communities	YES/NO	WEF
Governance	Women Presence		Are there women present in the company's Board of Director?	YES/NO	ESG_VC/WEF/ESG DCI
Governance	Corporate Policy		Do you have a remote working policy in place?	YES/NO	ESG_VC/B-Lab
Governance	Code of Ethics		Do you have a corporate code of ethics in place?	YES/NO	ESG_VC/B-Lab
Governance	Mission & Vision		Your company has a defined purpose statement contributing to a **material positive impact** on society and the environment and is incorporated into the organizational strategy. SOLVING A SOCIETAL PROBLEM	YES/NO	WEF/B-Lab

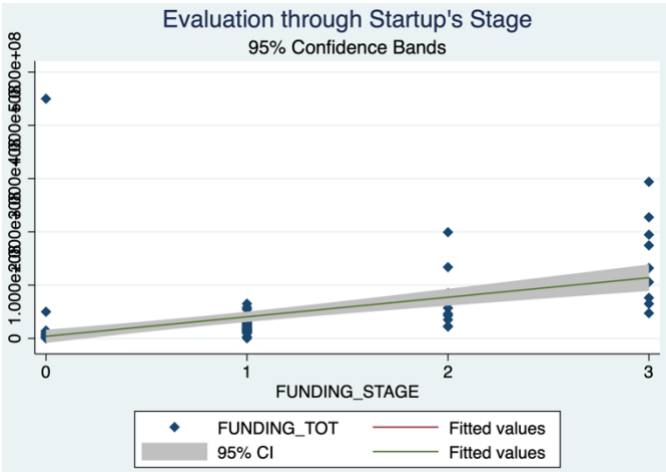
APPENDIX B. IN-DEPTH ANALYSIS OF REGRESSION

I. DATA ANALYSIS

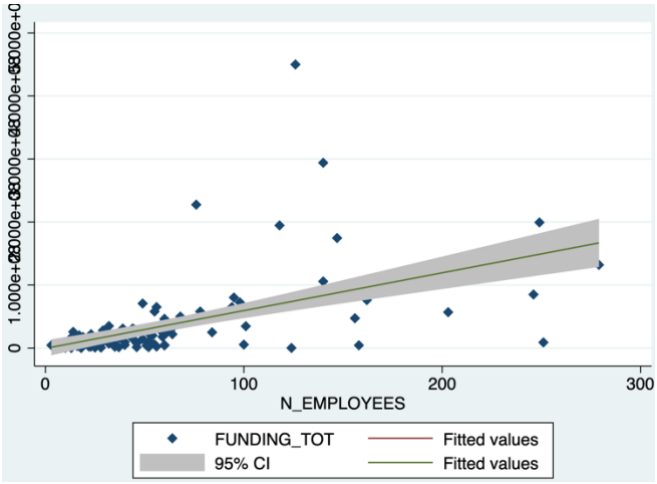
Figure B.1 Shows plots of the regression analysis for the significant variables.



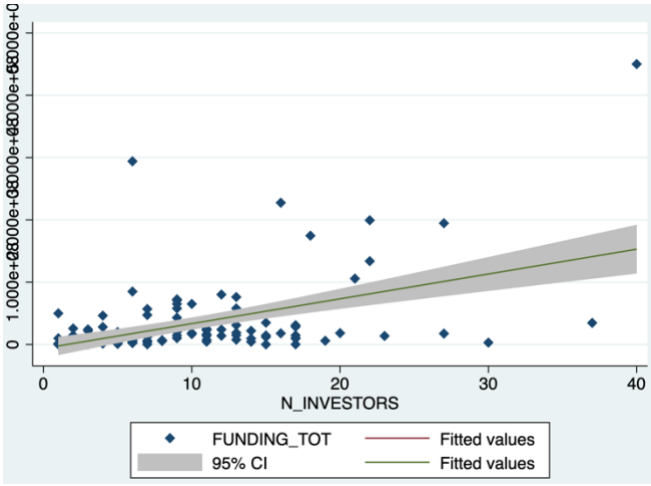
(a) ESG and Evaluation linear plot



(b) Evaluation and Stage of the Startup



(c) Evaluation and Number of Employees

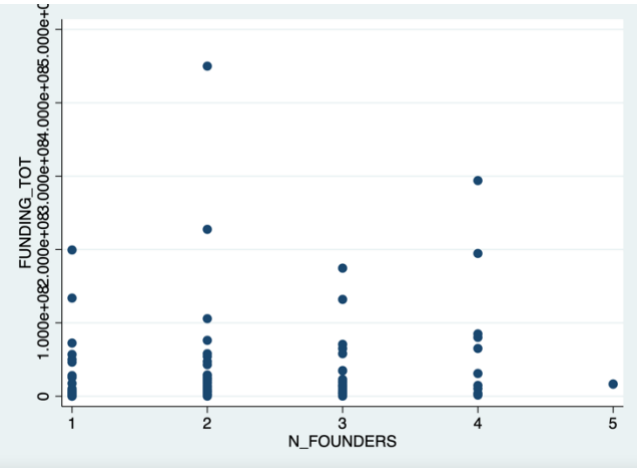


(d) Evaluation and Number of Investors

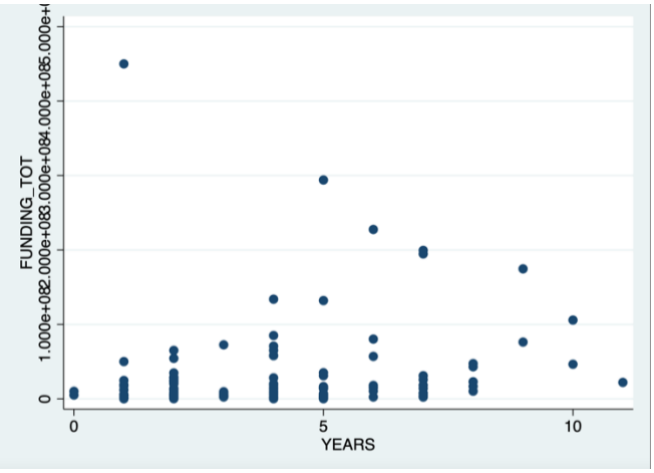
Figure B.1 – Model Examination through variables' scatterplots

Remarks:

- The overlay of the straight-line fit is reasonable, although we see there is substantial variability which might be caused by, and not limited to, variance heteroskedasticity and omitted variables.



(a) Number of Founders and Evaluation plot.

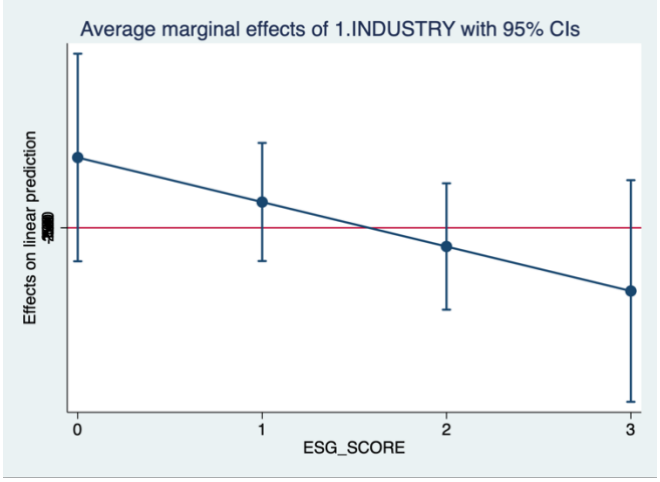


(b) Years and Evaluation plot

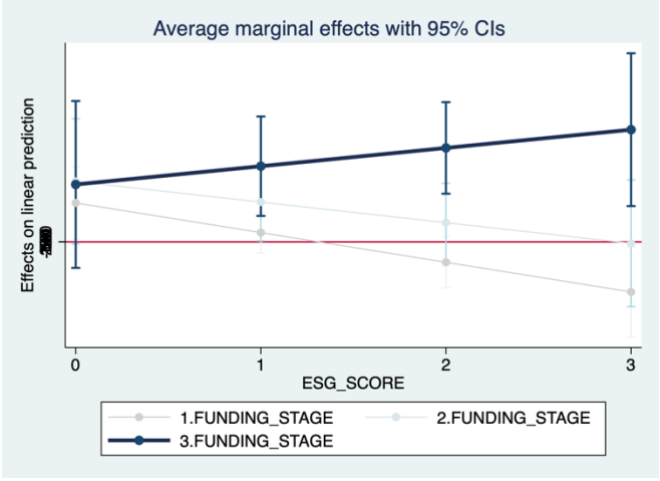
Figure B.2 – Model Examination through variables' scatterplots

Figure B.2 shows the plots of the variables in the model that did not show a significant result. It is clear from the disposition of the dots that there is not a linear regression.

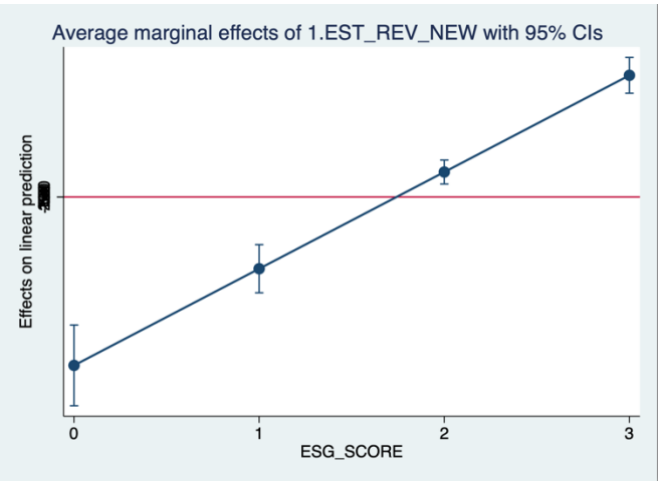
II. INTERACTION ANALYSIS



(a) Interaction term between Industry and ESG



(b) Interaction term between Stage and ESG



(c) Interaction Term between Revenues and ESG

Figure B.3 – Analysis of Interaction terms

Figure B.3 shows the graphic of the three regressions that include the interaction terms.

(a) Refers to **Model 7**, and it is clear by the graph, given the intertwining of the confidence intervals between the baseline (Software) and the red one (Hardware), that we cannot conclude that there is a significant difference between the relationship between ESG and evaluation for the two industries.

(b) Refers to **Model 8**, the interaction between ESG and Stage of the startup. Since the confidence intervals overlap with the baseline (Stage Seed) in Series A and Series B, we conclude that there is no significance between the variables. However, for Series C the lines are distinctively separate as the ESG score increases, a sign of significance. This confirms Hypothesis 6 since ESG scores increase their significance over the Evaluation as the stage of the company grows.

(c) Refers to **Model 9**, the interaction between Revenues and ESG. By the clear difference between the two slopes, we can easily conclude that the term is statistically significant. This translates to the fact that as estimated revenues are higher, investors begin to show increasing attention to the ESG component as well.