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**Exploring the impact
of sustainability
(ESG) on financial
performance (FP):
the role of firm size
in the different
industries.**

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Abstract

Over the past two decades, research on the impact of ESG capitalization on firm value has been prolific. However, despite numerous studies, there is still no consensus on the relationship between ESG and firm value. This has generated a broad range of theories on the topic.

One limitation of these studies is that they largely rely on long-term historical data, which may not be reflective of the current sustainability landscape. Furthermore, the lack of effective regulation on ESG disclosure has made it difficult to draw definitive conclusions from the studies, as analysts tend to assign low weights to non-standardized information. This may soon change in Europe with the implementation of the Corporate Sustainability Reporting Directive (CSRD) that becomes effective in January 2023. This directive will require around 50,000 major companies and listed SMEs to report on sustainability. The aim of this thesis is to explore the potential relationship between sustainability (as measured by ESG disclosure and performance) and financial performance and analyze how these relationships may differ across industries and company sizes. To do this, all the data will be subdivided by industries and sizes, providing a more accurate and precise analysis.

In particular, two different approaches will be used in the study.

The first approach will involve a structural analysis using yearly data, examining both the ESG score and ESG Disclosure Score. The objective is to determine if companies that prioritize sustainability exhibit superior financial performance.

The second approach will be instead more experimental and dynamic, analyzing the monthly relationship between financial data and ESG scores. The focus here is to determine if sustainability performance data, under comparable conditions, can explain price movements and associated returns.

1. Introduction

“We don’t have to engage in grand, heroic actions to participate in change. Small acts, when multiplied by millions of people, can transform the world.”

Apparently mawkish and fuzzy, this famous inspiring quote from Howard Zinn resumes a key aspect regarding the Human society. The relevance of these words is reinforced by the fact that come from who had seen the most material evidence of these belief, namely in the war.

Representing his most famous book, where the quote originates, Howard Zinn wrote “My history ... describes the inspiring struggle of those who have fought slavery and racism (Frederick Douglass, William Lloyd Garrison, Fannie Lou Hamer, Bob Moses), of the labour organizers who have led strikes for the rights of working people (Big Bill Haywood, Mother Jones, César Chávez), of the socialists and others who have protested war and militarism (Eugene V. Debs, Helen Keller, the Rev. Daniel Berrigan, Cindy Sheehan)”¹.

Going back to the history there are a lot of evidence regarding this belief.

The Civil Rights Movement in the United States was a grassroots movement that aimed to end racial segregation and discrimination against African Americans. The movement was characterized by a series of small actions such as sit-ins, boycotts, and peaceful protests that were organized by activists and ordinary citizens. These small actions eventually led to the passage of the Civil Rights Act of 1964 and the Voting Rights Act of 1965, which prohibited racial discrimination in employment, education, and voting.

The Anti-Apartheid Movement in South Africa was a global campaign that aimed to end racial segregation and discrimination against black South Africans. The movement was characterized by a series of small actions such as boycotts, divestment campaigns, and protests that were organized by activists and ordinary citizens around the world. These small actions eventually led to the collapse of the apartheid regime and the release of Nelson Mandela from prison.

The #MeToo movement, which began in 2017, was a social media campaign that aimed to raise awareness about sexual harassment and assault. The movement started with a tweet by actress Alyssa Milano, who encouraged women to share their experiences of sexual harassment and assault using the hashtag #MeToo. The campaign quickly went viral, and millions of people shared their stories, sparking a global conversation about the issue. The movement led to a shift in public attitudes towards sexual harassment and prompted many organizations to take action to prevent it.

The environmental movement is a global movement that aims to protect the natural world from the negative impacts of human activities. The movement is characterized by a series of small actions such as recycling, reducing energy consumption, and using sustainable products that are practiced by millions of people around the world. These small actions have led to the development of new technologies, policies, and regulations that aim to address environmental issues such as climate change, pollution, and biodiversity loss. One of the key moments regarding the development of the

¹ Howard Zinn (July 1, 2007). "Making History". The New York Times. Retrieved November 14, 2010.

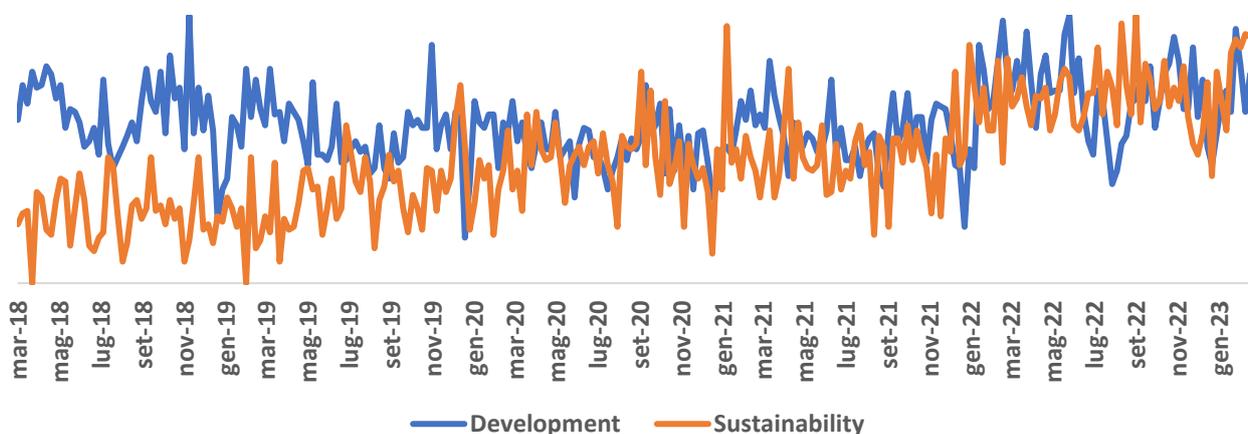
environmental movement was without doubt the August 2018, when a fifteen-year-old girl started spending her Fridays outside the Swedish Parliament to call for stronger action on climate change by holding up a sign reading Skolstrejk för klimatet. A few months later she will say: "I was diagnosed with Asperger's syndrome, OCD, and selective mutism. That basically means I only speak when I think it's necessary. Now is one of those moments."²

It is a general opinion that next big challenge that Human Society must deal with in the near future is the sustainability, especially regarding the environment.

Just to prove that, in plot below we can see how much the word "Sustainability" has grown in trends respect to universal term such that "Development".

This data come from Google Trends which is a website by Google that analyzes the popularity of top search queries in Google Search across various regions and languages.

As we can see, in the last five years the term Sustainability has grown arriving at the start of the 2023 to almost surpass the term "Development".



To reinforce this, we can also look at a famous quote from prince Charles: "the sustainability revolution will, hopefully, be the third major social and economic turning point in human history, following the Neolithic Revolution – moving from hunter-gathering to farming – and the Industrial Revolution."

This is the third year Deloitte has conducted a survey into consumer attitudes and behaviors around sustainability, and over that period their research shows that consumers are increasingly making conscious decisions with sustainability and the environment in mind³.

They find out that the customer that chosen brands that have environmentally sustainable practices/ values has grown by more than 6% from previous year (2021).

Another key finding is that the customer chosen brands that have environmentally sustainable practices/ values has grown over 7% from 2021.

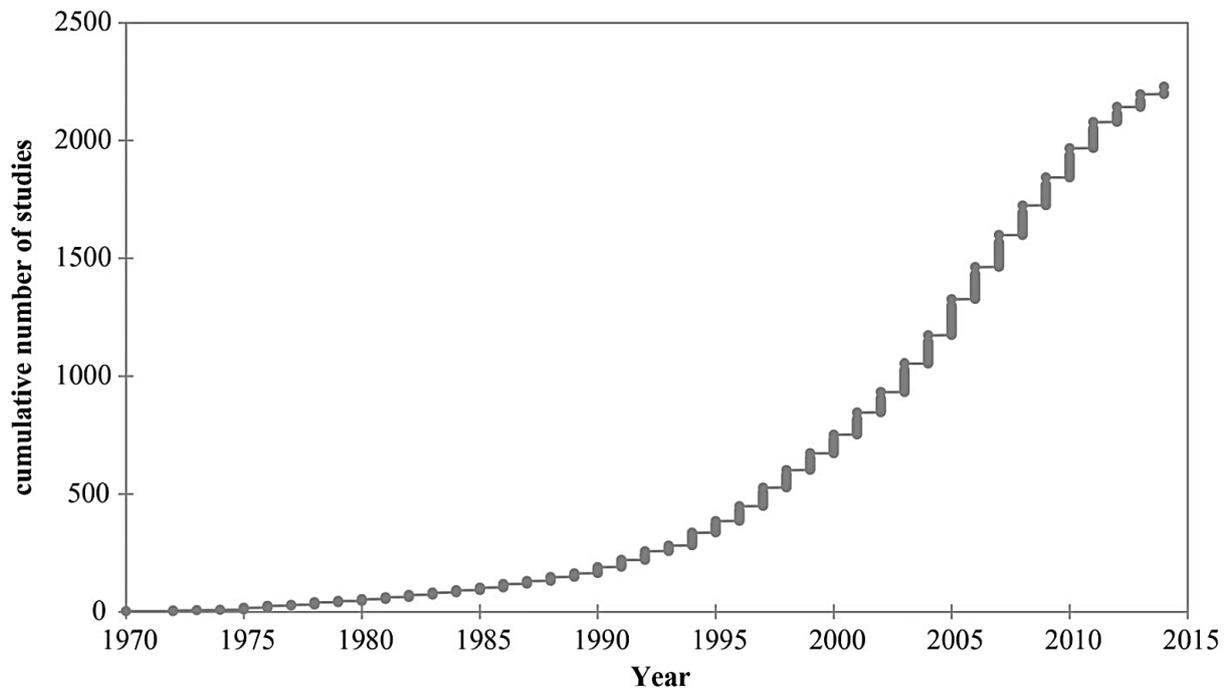
From a universal economy rule, what's has a value and matter for people is then considered by companies. As natural follow-up, responsible behaviors are increasingly being embedded also into

² Brady, Jeff (28 August 2019). "Teen Climate Activist Greta Thunberg Arrives in New York After Sailing The Atlantic". NPR. Archived from the original on 2 October 2019.

³ These findings are based on a consumer survey carried out by independent market research agency, YouGov, on Deloitte's behalf.

new business models and strategies that are designed to meet environmental, societal, and governance deficits. Therefore, the notions of Corporate Sustainability, Social Responsibility, and Environmental Management have become very popular among academia as corporations are moving beyond transparency, business ethics, and stakeholder engagement.

Over 2000 academic studies have been published since the early seventies that investigate the correlation between ESG and corporate financial performance (CFP).



In terms of investment, the surge in interest towards ESG can be demonstrated by examining the assets under management associated with ESG investing. Notably, during the last financial crisis, the assets under management linked to some form of ESG significantly increased. In the United States, this category of assets under management nearly doubled from 2012-2014 (Friede, Busch and Bassen 2005).⁴

All the elements introduced so far explain why companies are increasingly being held accountable for their environmental, social, and governance (ESG) performance by a wide range of stakeholders, including investors, customers, and regulators. ESG factors have become a critical aspect of corporate strategy and decision-making, and companies are expected to report on their ESG performance and disclose relevant information to stakeholders.

From an academic perspective the effect of ESG on the corporate financial performance is still relevant to study since a consensus on the effect of ESG on financial performance is still not found.

In financial markets, it is a widely held belief that the relevance of the relationship between the value of an asset and its specific aspects only emerges after the introduction of regulations governing it. This is because, prior to this moment, there were usually no common rules regarding

⁴ Friede, Gunnar and Busch, Timo and Bassen, Alexander, ESG and Financial Performance: Aggregated Evidence from More than 2000 Empirical Studies (October 22, 2015). *Journal of Sustainable Finance & Investment*, Volume 5, Issue 4, p. 210-233, 2015, DOI: 10.1080/20430795.2015.1118917, Available at SSRN: <https://ssrn.com/abstract=2699610>

the disclosure of relevant information. As a result, investors tended not to place significant reliance on it.

This uncertain relationship between ESG and the corporate financial performance, especially in Europe, might change in recent months as a new regulation regarding Corporate Sustainability Reporting (CSRD) entered into force.

In particular, on 5 January this new directive modernizes and strengthens the rules about the social and environmental information that companies have to report. A broader set of large companies, as well as listed SMEs, will now be required to report on sustainability – approximately 50 000 companies in total.

So, the main purpose of this thesis is to explore the impact of sustainability (ESG) on firm value and financial performance (FP) focusing on the EU companies. Then expand this research investigating the effect of ESG also considering the role of firm size and how this change among all the main industries.

To provide a foundation for the research, this chapter will introduce the concept of sustainability and ESG, mainly focusing on the historical development, then we will introduce the problems and the objectives of the study.

However, while the effect of ESG on financial performance is uncertain, its positive contribution to society is indisputable. Despite this ambiguity, investors are still eager to invest in ESG as a means of making a positive societal impact. Institutional investors share the same motivations as individual investors and are also willing to utilize their assets to benefit society.

In the context of sustainability, companies have the ability to initiate change by implementing sustainable practices within their operations, supply chains, and products.

Reconsidering the words of Howard Zinn, while such actions may appear small on an individual level, when multiplied by thousands of companies, they have the potential to bring about significant transformations and contribute towards creating a sustainable future for the planet.

Therefore, investing in sustainability is not only a responsible choice but also a means to bring about positive change.

1.1. Background and context of the study

Over the past twenty years, there has been significant research on ESG capitalization. Many studies have focused on whether ESG has an impact on a firm's value. However, despite these studies, there is no agreement on the relationship between ESG and firm value. This has led to a variety of theories on the topic.

Just to take a recent example of that, in a study conducted in November 2018 by Bennani, Leila and others researcher, they analyzed the impact of the ESG metrics provided by the Amundi ESG Research department in the pricing of equity market.⁵

Their result are summarized in the table above, and as we can appreciate, the explanatory power of the model including the ESG factor (5F of Fama and French + ESG) was only 0,7% higher than the normal 5F model.

Table 3: Results with long-only risk factors (cross-section regression, average R^2)

Period	North America		Eurozone	
	2010 – 2013	2014 – 2017	2010 – 2013	2014 – 2017
CAPM	40.8%	26.2%	42.8%	37.7%
5F	46.1%	35.4%	49.5%	45.3%
6F (5F + ESG)	46.7%	36.8%	50.1%	46.0%

Another very recent study that produced uncertain result was the one conducted by Imen Khanachel & Naima Lassoued in 2022.

They focused on the relation between ESG disclosure and cost of capital using Bloomberg data.⁶ The result of their study can be appreciated in the following table.

	Panel A: COK–environmental disclosure relationship					
	Time period					
	2011–2014	2011–2015	2011–2016	2011–2017	2011–2018	2011–2019
ENV_SC	−0.06 ***	−0.0431 ***	−0.046 **	−0.057 *	0.027	0.053
LVRG	0.043 **	0.044 **	0.041 ***	0.033	0.021 ***	0.067 ***
SIZE	−0.022 ***	−0.021 ***	−0.011 ***	−0.012 ***	0.024 ***	−0.014 ***
PROFI	−0.007 ***	−0.003	−0.002 ***	−0.003 ***	−0.024 ***	−0.006 ***
INF_ASY	0.015 **	0.021	0.021	0.004	0.02	0.003
FCF	0.021 **	0.014 **	0.014	0.011	0.05 ***	0.022
FIRM_AGE	−0.02	−0.013	−0.013	−0.012 **	−0.049 ***	−0.023 ***
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
R-squared	0.185	0.177	0.196	0.209	0.311	0.326
Number of Observations	1701	2133	2569	3002	3429	3851

As highlight, the environmental disclosure variable had an estimated value of about 5%, however the overall R-squared of the model was well below 50% suggesting a not very reliable statistical estimation of the multilinear regression.

⁵ Bennani, Leila and Le Guenedal, Théo and Lepetit, Frederic and Ly, Lai and Mortier, Vincent and Roncalli, Thierry and Sekine, Takaya, How ESG Investing Has Impacted the Asset Pricing in the Equity Market (November 27, 2018). Available at SSRN: <https://ssrn.com/abstract=3316862> or <http://dx.doi.org/10.2139/ssrn.3316862>

⁶ Imen Khanachel & Naima Lassoued, 2022. "ESG Disclosure and the Cost of Capital: Is There a Ratcheting Effect over Time?" Sustainability, MDPI, vol. 14(15), pages 1-19, July.

To summarize the main academic results obtained so far, we can give a look of this table from the study conducted by Friede, Gunnar and Busch, Timo and Bassen, Alexander in which they highlighted the outcomes of over 2.000 studies on the relationship between corporate financial performance (CFP) and ESG.⁷

Authors	Focus	Number of studies (<i>N</i>)	Number of observations (<i>N</i>)	Average correlation <i>r</i> (uncorrected)
Frooman (1997)	E, S	22	2.161	0.312(b)
Orlitzky and Benjamin (2001)	S, E	18	6.186	0.149
Orlitzky (2001)	S, E	20	6.889	0.061
Orlitzky, Schmidt, and Rynes (2003)	S, E	62	33.878	0.184
Allouche and Laroche (2005)	S, E	79	57.409	0.143
Combs et al. (2006)	S	90	19.319	0.150
Wu (2006)	S, E	120	21.933	0.166
Rosenbusch, Bausch, and Galander (2007)	E	62	21.742	0.190
Darnall and Sides (2008)	E	9	30.000	0.077
Pavie and Filho (2008)	S, E	112	170.737	0.083
van Wijk, Jansen, and Lyles (2008)	S	28	4.627	0.190
Margolis, Elfenbein, and Walsh (2009)	S, E	214	38.483	0.133
Vishwanathan (2010)	E, S	189	n.a.	0.070
Crook et al. (2011)	S	66	12.163	0.170
Rosenbusch, Brinckmann, and Bausch (2011)	S	46	21.270	0.133
Unger et al. (2011)	S	70	24.733	0.076
Rubera and Kirca (2012)	S	153	33.544	0.146
Albertini (2013)	E	52	62.943	0.090
del Mar Miras-Rodríguez et al. (2015)	E, S	91	31.878	0.067
Dixon-Fowler et al. (2013)	E	39	22.869	0.062
Golicic and Smith (2013)	E	31	15.160	0.305
Mayer-Haug et al. (2013)	S	58	50.045	0.044(b)
Endrikat, Guenther, and Hoppe (2014)	E	148	201.511	0.082(b)
Stam, Arzlanian, and Elfring (2014)	S	43	13.263	0.157
Revelli and Viviani (2015)	Funds	80	89.496	-0.003(a)
Total/ <i>n</i> -weighted average		1.902	992.239	0.118

What the study conducted by Friede tells through this comprehensive analysis is that more than 2,100 empirical studies, primarily focused on individual companies, suggest a positive association between ESG factors and financial performance. These findings indicate the existence of ESG outperformance opportunities across multiple market segments, particularly in North America, Emerging Markets, and non-equity asset classes. The results suggest that capital markets have not

⁷ Friede, Gunnar and Busch, Timo and Bassen, Alexander, ESG and Financial Performance: Aggregated Evidence from More than 2000 Empirical Studies (October 22, 2015). Journal of Sustainable Finance & Investment, Volume 5, Issue 4, p. 210-233, 2015, DOI: 10.1080/20430795.2015.1118917, Available at SSRN: <https://ssrn.com/abstract=2699610>

exhibited consistent learning effects regarding the ESG–CFP relationship over time, as the positive correlation patterns observed in primary studies have remained stable since the mid-1990s.

Drawing on the insights garnered from this exhaustive review effort, the primary conclusion is that an orientation toward long-term responsible investing should be prioritized by rational investors to fulfill their fiduciary duties and align their interests with the broader objectives of society. Achieving this requires a deep and comprehensive understanding of how to effectively integrate ESG criteria into investment processes to fully harness the value-enhancing potential of ESG factors. A key area for future research entails delving into the interaction of different ESG criteria within portfolios and the significance of specific ESG sub-criteria in driving financial performance.

Shifting the focus from the observed positive relationship between CFP and ESG to more statistical aspects, we cannot fail to highlight that the majority of goodness-of-fit parameters observed in various analyses are not particularly significant. For example, the R-squared value is usually below 0.25, and the same applies to the correlation coefficient (average 0.11) and this clearly suggests that further studies are needed.

Taking a step back, there are also some theories which instead suggest a negative relationship between sustainability and financial performance. According to the traditional neoclassical approach, investing in socially responsible aspects creates additional costs for a firm. In a competitive market, these costs reduce a company's profits, which can affect its competitiveness and cash flow in the long term. This conflicts with Friedman's shareholder theory, which argues that a firm's only social responsibility is to maximize shareholder value.

An example of this view is one of Milton Friedman's most well-known articles, titled "The Social Responsibility of Business is to Increase its Profits," published in *The New York Times Magazine* on September 13, 1970.⁸ In this piece, Friedman asserted that the sole goal of companies was to maximize profits for their shareholders, and any other objective would go against the interests of the owners. According to Friedman and many other neoclassical theorists, corporate social responsibility (CSR) is incompatible with the fundamental principle of profit maximization as the primary aim of firms. Friedman identified only two limitations to accomplishing this objective: the law and ethics.

To put it differently, Milton Friedman and his supporters believe that businesses have a sole obligation to their shareholders. Any social responsibility is not mandatory for companies as it is the responsibility of the State or other social groups created by society, such as NGOs, if desired. Friedman only justifies social responsibility if companies can benefit from it, for instance, by paying fewer taxes or gaining better access to resources, which would increase their profitability.

Neoclassical authors have criticized the argument that profit maximization is the only objective, and one of the most obvious critiques is related to the increasing complexity of current firms, business environments, and society. Hierarchical organizations were useful in the past when business environments were stable, economies were constantly growing, and technology changes were predictable. In that situation, companies only needed to concentrate on production as everything else was under their control.

⁸ Friedman, M. (1970) The Social Responsibility of Business Is to Increase Its Profits. *New York Times Magazine*, 13 September 1970, 122-126.

As stated earlier, businesses today confront a distinct business climate. The 21st century has ushered in a new model where a multitude of companies participate in a network economy, with knowledge being their primary asset (Drucker, 1993).⁹ This has replaced hierarchical structures with relational governance mechanisms (Achrol et al., 1999), where power and hierarchy are no longer dominant.

In the network economy, organizations face increased complexity and competition, with stakeholders having a significant impact on their outcomes. Profit maximization cannot be pursued without considering their influence.

The 21st century has also changed the competitive landscape of firms, shifting from local to global markets, with consumers having access to more information to make informed decisions. Companies constantly adapt to the ever-changing competitive environment. The pressure for profit maximization is so intense that some firms have disregarded ethics and legal considerations, leading to catastrophic global consequences. The outsourcing of the value chain in developing countries has resulted in worker exploitation and human rights violations. Economic growth, while at its peak, collapsed due to the subprime mortgage scandal, resulting in unemployment and financial loss for shareholders.

The advent of the internet has allowed society to be more aware of events and has opened up new communication channels. NGOs and interest groups can now reach more people with their concerns, exposing companies to reputational risks that could impact their market value. Legitimacy and ethics play a critical role in competition. Businesses must consider their responsibility to shareholders, customers, workers, suppliers, competitors, environment, and society in decision-making processes to achieve long-term survival, good reputation, market confidence, and overall legitimacy granted by the entire society (Valor and Merino, 2005).

To reassume, nowadays businesses operate in a network economy, where knowledge is crucial, replacing hierarchical structures with relational governance. Stakeholders' influence and global competition have increased, requiring organizations to consider ethics and stakeholder interests. The internet has facilitated communication, exposing companies to reputational risks. Legitimacy and ethics are vital for long-term survival and market confidence.

This landscape is obviously enhancing the relevance of a corporate sustainable behavior, and therefore it becomes more and more relevant to understand if this can significantly affect financial performance. As a lot of studies highlighted, there is a general observed positive relationship between ESG and financial performance.

Nevertheless, if we take a broader perspective and delve into the theoretical framework rather than solely relying on numerical data, we may question why do we expect higher value by companies with good ESG?

To address this question, it is helpful to begin by examining the concept of SRI. Socially responsible investing (SRI) also known as ESG investing, has become increasingly popular in recent years. ESG investing is the practice of investing in companies that are believed to be socially responsible or ethical, while avoiding companies that engage in practices that are considered harmful to society or

⁹ Drucker, Peter F. "The Rise of the Knowledge Society." *The Wilson Quarterly* (1976-), vol. 17, no. 2, 1993, pp. 52–71. JSTOR, <http://www.jstor.org/stable/40258682>. Accessed 4 June 2023.

the environment. The reasons for investing in ESG can be two-fold: **ethical or moral** reasons, and **financial** reasons.

From an ethical or moral standpoint, ESG investing aims to make a positive impact on society and the environment. ESG investors often seek to support companies that are aligned with their values and beliefs, such as gender equality, reducing carbon footprint, or avoiding anti-personnel mines and chemical weapons financing. By investing in companies that prioritize ethical and sustainable practices, ESG investors hope to create a better world for future generations.

In a 2013 survey conducted by Accenture, involving 1,000 CEOs from 103 countries and 27 industries, it was revealed that 80% of CEOs perceive sustainability as a strategic tool to achieve a competitive edge over their industry counterparts. The study also highlighted that 81% of CEOs recognize the significance of their company's sustainability reputation in influencing consumers' purchasing decisions. However, the survey revealed a contrasting sentiment, with only 33% of all CEOs surveyed believing that businesses are exerting adequate efforts to address global sustainability challenges.¹⁰

From a financial standpoint, ESG investing can also make sense. ESG investing has been shown to help manage and mitigate long-term risks, such as operational, reputational, regulatory, and financial risks. By investing in companies that prioritize ESG factors, investors may reduce the risk of exposure to negative events, such as scandals or regulatory penalties, which can impact the financial performance of a company. This is especially important for institutional investors, such as pension funds, who have a fiduciary responsibility to manage assets for the long-term benefit of their beneficiaries.

One interesting study conducted by Hao Li, Xuan Zhang and Yang Zhao investigated the connection between ESG and Firm's Default Risk¹¹. Firm's default probability data were obtained from the Risk Management Institute (RMI) of the National University of Singapore (NUS).

The ESG rating data of Chinese listed firms used from 2015 to 2020 come from the Sino-Securities Index Information Service of the Wind database. They translated the ESG rating from AAA to C to numbers 1 to 9. Thus, a higher number (the closer it is to 9) in ESG rating is associated with a higher default risk.

The results of the regression are summarized in the following table, in which the results are subdivided considering the 3 different default time periods: short- (1 month), medium- (6-month) and long-term (12-month). In particular, columns (1), (4) and (7) present the results of the regression equations without any control variables. They added firm-level characteristics in Columns (2), (5) and (8), and further added firm fixed effects and year-by-season fixed effects in Columns (3), (6) and (9).

¹⁰ Accenture (2013). The UN Global Compact-Accenture CEO Study on Sustainability 2013. Accenture Sustainability Services.

¹¹ Hao Li, Xuan Zhang, Yang Zhao, ESG and Firm's Default Risk, Finance Research Letters, Volume 47, Part B, 2022, 102713, ISSN 1544-6123, <https://doi.org/10.1016/j.frl.2022.102713>.

Table 2
The impact of categorical ESG rating on firm's probability of default

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	1 month			6 months			12 months		
L.ESG_rating	0.000189*** (7.85e-06)	0.000180*** (0.000008)	0.000227*** (0.000006)	0.000948*** (0.000031)	0.000909*** (0.000033)	0.001055*** (0.000022)	0.001608*** (0.000045)	0.001552*** (0.000048)	0.001679*** (0.000032)
Total market value		-0.000000*** (0.000000)							
Beta		0.000132*** (0.000011)	0.000013 (0.000010)	0.000793*** (0.000046)	0.000126*** (0.000040)	0.001529*** (0.000072)	0.000303*** (0.000058)	0.000303*** (0.000058)	0.000303*** (0.000058)
Volatility		-0.000000*** (0.000000)	-0.000001*** (0.000000)	-0.000001*** (0.000001)	-0.000001*** (0.000001)	-0.000003*** (0.000001)	-0.000005*** (0.000001)	-0.000005*** (0.000001)	-0.000005*** (0.000001)
Leverage		0.000002*** (0.000000)	0.000001*** (0.000000)	0.000011*** (0.000002)	0.000004*** (0.000001)	0.000013*** (0.000003)	0.000007*** (0.000001)	0.000007*** (0.000001)	0.000007*** (0.000001)
Constant	0.000158*** (2.53e-05)	0.000113*** (0.000025)	0.000087*** (0.000024)	0.001203*** (0.000101)	0.000781*** (0.000105)	0.001096*** (0.000095)	0.002710*** (0.000148)	0.001648*** (0.000161)	0.002819*** (0.000139)
Firm fixed effects	No	No	Yes	No	No	Yes	No	No	Yes
Year by season fixed effects	No	No	Yes	No	No	Yes	No	No	Yes
Observations	176,347	159,249	159,201	176,347	159,249	159,201	176,347	159,249	159,201
R-squared	0.014	0.020365	0.409721	0.019346	0.029099	0.508232	0.022983	0.035908	0.568483

Note: Robust criteria errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

From these results, we can conclude that credit markets well reflect the ESG practices of firms, ESG can reduce the default risk of Chinese listed firms. For policy perspectives, the ESG practice effectively increases the social responsibility and governance of Chinese listed firms, and in turn results in better stock market performance and lower default probability. One possible explanation is that ESG investments increase the shareholder value and result in better future performance and lower default risk (Nguyen et al., 2020). Another possible explanation is that more socially responsible firms have stronger political connections and better credit scores (Jiraporn et al., 2014; Lin et al., 2015).

However, the impact of ESG investing on an investor's performance remains a taboo topic for both asset owners and managers. Some investors argue that the main objective of ESG investing is to have a positive impact on the economy rather than improve portfolio performance. Nonetheless, the fiduciary duty of institutional investors, such as pension funds, extends beyond extra-financial objectives and includes financial responsibility.

Academic research on the performance of ESG investing has produced mixed results. While theoretical economic models strongly support ESG integration, empirical models have yielded less convincing results. Some studies show a positive relationship between ESG and financial performance, while others exhibit a negative or non-positive relationship. A study by Amundi in 2014 concluded that being an ESG investor has no significant cost in terms of risk and return, and the tracking errors of optimized portfolios are low for Europe and the world, but high for the US and the Pacific.

On the other hand, other theories suggest that an active CSR policy could benefit a firm. For example, investing in environmental, social, and governance factors can act as insurance against reputation risks. It can also enhance a firm's reputation and improve employee satisfaction, leading to a positive impact on corporate financial performance.

Some studies provide explanations for the mixed results found in the relationship between CSR and corporate financial performance. For instance, the discounted cash flow theory and the inverted 'U'-relationship theory suggest that doing good is profitable only if the financial benefits exceed the costs, and that investing in CSR can result in additional value only if a firm's value is not already maximized. The learning hypothesis states that generating alpha with ESG factors becomes more difficult when the market pays more attention to it and adjusts current price levels. These theories are all possible reasons for the lack of consensus in recent literature on the effect of ESG on corporate financial performance.

These studies have a major limitation in that they rely on long historical data spanning over 25 years including a lot of different economic and market landscape¹², but moreover, without an effective regulatory concerned about ESG disclosure, is difficult to find results as analysts tend to give low weights to non-standardized information.

The demand for disclosure of sustainability-related information by firms has increased recently due to a growing awareness for responsible business behavior and sustainable growth. This trend is reflected by the increasing number of mandatory and voluntary instruments to report sustainability information around the world.¹³

While some countries have incorporated measures requiring mandatory ESG disclosures (for large companies), it has not yet reached a global forum. Steps have been taken to create a worldwide framework for ESG reporting standards due to demands for standardization of the ESG reporting process. This comes as a result of inconsistencies from participating entities and a bid for transparency and accountability.

One such step came in November 2021, when the IFRS Foundation announced the establishment of the International Sustainability Standards Board (ISSB). The ISSB will generate global sustainability standards for investors in 140 participating countries. The IFRS has also merged the International Integrated Reporting Council (IIRC) and the Sustainability Accounting Standards Board (SASB), two previously independent frameworks, into the Value Reporting Foundation.

Given that the IFRS' existing standards have been fully adopted in over 144 jurisdictions, it seems likely that this will be the template for future developments in a global ESG reporting framework.

Focusing on Europe, the Non-Financial Reporting Directive 2014/95/EU provided an opportunity to investigate the effects of mandatory sustainability reporting across various European countries (La Torre et al., 2018). It was implemented on December 5, 2014, by the EU Parliament and the EU Council of Ministers and came into effect for the financial year beginning on January 1, 2017. The primary objective of the NFR Directive is to enhance transparency, consistency, and comparability of non-financial, i.e., sustainability-related, information disclosed throughout the Union (European Union, 2014).

As a follow up NFRD, the European Commission released a draft of the Corporate Sustainability Reporting Directive (CSRD) on April 21, 2021. The aim of the new directive is to replace the reporting requirements introduced by the Non-Financial Reporting Directive (NFRD) in 2014, which were deemed inadequate in scope and content by the EU Commission. The NFRD was an essential component of the Sustainable Finance initiatives and the Green New Deal. However, the EU Commission identified several fields that required improvement in the European non-financial reporting regime, which led to the creation of the CSRD. The CSRD aims to establish a European reporting regime tailored to the specifics of the ongoing reform program on sustainability within the EU, even if it means limited alignment with established international reporting frameworks. The

¹² Bennani, Leila and Le Guenedal, Théo and Lepetit, Frederic and Ly, Lai and Mortier, Vincent and Roncalli, Thierry and Sekine, Takaya, How ESG Investing Has Impacted the Asset Pricing in the Equity Market (November 27, 2018).

¹³ KPMG International Cooperative, Global Reporting Initiative (GRI), United Nations Environment Programme (UNEP) and Centre for Corporate Governance in Africa (2016), Carrots and Sticks. Global Trends in Sustainability Reporting Regulation and Policy, available at: <https://assets.kpmg.com/content/dam/kpmg/pdf/2016/05/carrots-and-sticksmay-2016.pdf>.

European Lab was also mandated to start preliminary work on European Non-Financial Reporting Standards to provide comprehensive guidelines to companies to improve comparability of the reported information. In March 2021, the EU Commission published the final reports of the European Lab, and only a month later, the proposal for the CSRD was released. The first reactions from stakeholders suggest that the new rules are a significant step forward in sustainability reporting and indicate that European companies will face substantial changes in their reporting environment. The consultation period for the proposal was open until mid-July.

The Corporate Sustainability Reporting Directive (CSRD) has become effective from 5th January 2023. The scope of the directive has been broadened to include a larger number of major companies and listed SMEs, amounting to around 50,000 companies in total, that will now be obligated to report on sustainability.

The development of the new ESG reporting landscape represents a key point in the studies of the impact of sustainability on the firm's financial behavior. Unfortunately, the benefits from these reforms cannot be fully captured by this analysis since the data analyzed will run until 31.12.2022, however, many companies have already begun in recent years to incorporate the new draft directives (although not mandatory) to prepare for the new framework.

1.3 Research questions and analysis elements

What is known, and not known, about ESG provides a springboard from which many other questions, left unanswered, can be answered, and from which many uncharted areas, can be explored. Thus, the following questions still remain, and are examined in this research.

1. What is ESG?
2. What is ESG Disclosure?
3. What is ESG Performance?
4. What is the relationship between ESG Disclosure and Financial Performance?
5. What is the relationship between ESG Performance and Financial Performance?

The ESG stream of literature, found in organizational, economics and financial research, identifies several problems that offer opportunities to fill a gap.

1. Conceptually, ESG has not been defined in terms that are generally acceptable, and ESG has not been adequately distinguished from other corporate responsibility concepts such as CSR, TBL and Sustainability, etc.
2. Second, the current ESG stream of literature points up the issue that the ESG Financial performance link is inconclusive (Coleman 2011) for a number of reasons.¹⁴
 - a. One reason cited is methodological shortcomings – i.e., misspecification of analytical models (McWilliams and Siegel 2000).¹⁵
 - b. Another reason mentioned is the difficulty in obtaining reliable measures of ESG (van Marrewijk 2003).¹⁶
 - c. An additional reason talked about is that measures suffer limitations because they are qualitative and sourced in surveys or content analysis of firm documents (Coleman 2011).¹⁴
3. the literature stream identifies that no conclusive causality link between ESG factors and Financial Performance has yet emerged (Barnett 2005; Coleman 2011).¹⁷
4. measures found in previous studies to test the financial benefits of corporate ESG lack distinguishing features. According to Coleman (2011), ideal measures:

¹⁴ Coleman, L. Losses from Failure of Stakeholder Sensitive Processes: Financial Consequences for Large US Companies from Breakdowns in Product, Environmental, and Accounting Standards. *J Bus Ethics* 98, 247–258 (2011). <https://doi.org/10.1007/s10551-010-0544-8>

¹⁵ McWilliams, A. and Siegel, D. (2000), Corporate social responsibility and financial performance: correlation or misspecification?. *Strat. Mgmt. J.*, 21: 603-609. [https://doi.org/10.1002/\(SICI\)1097-0266\(200005\)21:5<603::AID-SMJ101>3.0.CO;2-3](https://doi.org/10.1002/(SICI)1097-0266(200005)21:5<603::AID-SMJ101>3.0.CO;2-3)

¹⁶ Van Marrewijk, M., Werre, M. Multiple Levels of Corporate Sustainability. *Journal of Business Ethics* 44, 107–119 (2003). <https://doi.org/10.1023/A:1023383229086>

¹⁷ Barnett, Michael. (2005). Stakeholder Influence Capacity And The Variability Of Financial Returns To Corporate Social Responsibility. *Academy of Management Review*. 32. 10.5465/AMR.2007.25275520.

- a. should address behaviour that most stakeholders consider to be representative of ESG.
- b. should quantify a signal that clearly distinguishes between firms on ESG grounds.
- c. need to be objective in that no interpretation or judgment is required.
- d. provide consistent and unambiguous signals that cannot be misinterpreted; and
- e. should emanate from an independent source that is not subject to reporting bias by the firm, or other body, with an interest in the result.

Going over again, the starting point of the research is to define what is meant by ESG. ESG refers to the three key areas that companies need to consider when evaluating their impact on society and the environment. Environmental factors include issues such as climate change, energy use, and pollution. Social factors include issues such as human rights, labour practices, and community engagement. Governance factors refer to issues related to corporate structure, board composition, and executive compensation. Together, these three areas provide a comprehensive framework for evaluating corporate responsibility and sustainability. The definition of ESG will be analysed more in depth in the chapter 2.

Once we understand what ESG is, the next question is how companies disclose their ESG information. ESG disclosure refers to the process by which companies provide information on their environmental, social, and governance practices. This information can be disclosed in a variety of ways, including through sustainability reports, annual reports, and corporate social responsibility (CSR) reports. The aim of ESG disclosure is to provide stakeholders with a transparent view of a company's ESG practices and to demonstrate a company's commitment to sustainability. To focusing on Europe, this topic will be examined in chapter 3.

ESG performance is the third area of inquiry. This refers to how well a company is performing in terms of its environmental, social, and governance practices. ESG performance can be measured in a variety of ways, including through the use of ESG ratings agencies and benchmarking tools. Companies can also measure their own performance through the use of internal metrics and key performance indicators (KPIs).

From the analysis of the financial performance and the ESG disclosure levels examined we can then search for relationship. Some researchers have suggested that there is a positive relationship between ESG disclosure and financial performance, with companies that disclose more ESG information performing better financially. However, other studies have suggested that the relationship is more complex, with some factors having a positive impact on financial performance and others having a negative impact.

Finally, the last question is related to the relationship between ESG performance and financial performance. As we have seen in the previous paragraph, there are some studies that evidenced a reducing default risk from firms associated with higher levels of ESG performance. This, mixed with other sources of benefit such as image reputation and new market opportunities, may increase significantly the overall financial performance of firms. These last two questions will be subject to analysis in chapter 4.

Analysed the main questions of this thesis, we will introduce the related analysis elements, exposed in the form of answers to the following questions:

1. What data will be utilized?
2. What metrics will be used to evaluate financial performance?
3. Within what timeframe will the analysis be conducted?
4. What's statistical methods will be employed in the analysis?

We will focus on data related to the **EU financial market** to capture possible effects of the new sustainability regulation. In particular we selected the STOXX 600 index, composed by 600 components representing large, mid, and small capitalization companies among 17 European countries, covering approximately 90% of the free-float market capitalization of the European stock market. So, all the data (financial performance, ESG disclosure levels and ESG ratings) relevant for the analysis, will be related to these 600 companies.

For what concern about financial performance, the indicators that will be used are the **wacc** (weighted average cost of capital), the **prices** (used to compute price returns) and the **cash flows** (subdivided by the different sources).

In addition, other financial measures will be used as control variables. A control variable, also known as a "controlled variable," is a variable in an experiment or study that is kept constant or carefully regulated throughout the research process to prevent it from influencing the outcome of the study. The purpose of controlling variables is to isolate and study the relationship between the independent variable(s) and the dependent variable(s) by ensuring that any changes in the dependent variable(s) are caused solely by the independent variable(s) and not by any other variables. In particular, the control variables that will be used are the **financial leverage, asset value, book to market value, return on asset** and **firms' age**.

For a sufficiently robust statistical analysis we selected a quite long timeframe which goes from **31.12.2016** to **01.01.2023**. In particular, the main idea is to select the most recent data available in order to focus on the possible relationships between financial performance and sustainability considering the last years updates. On the other hand, for a sufficiently large sample data we went back to the 2016 in order to guarantee in a yearly basis at least 7 different observations for each company.

The statistical methods used to conduct the analysis will be the multilinear regression and the panel (longitudinal) data analysis. Multiple linear regression is a statistical technique used to examine the relationship between a dependent variable and two or more independent variables. It is an extension of simple linear regression, which only involves one independent variable.

In multiple linear regression, the goal is to develop a linear equation that predicts the value of the dependent variable based on the values of the independent variables. This equation takes the form:

$$y_i = \beta_0 + \beta_1 x_{i1} + \dots + \beta_p x_{ip} + \varepsilon_i = \mathbf{x}_i^T \boldsymbol{\beta} + \varepsilon_i, \quad i = 1, \dots, n,$$

The y_i is the dependent variable, x_1, x_2, \dots, x_n are the independent variables, β_0 is the intercept, and $\beta_1, \beta_2, \dots, \beta_n$ are the regression coefficients for each independent variable.

The multiple regression model estimates the values of the regression coefficients, which represent the change in the dependent variable associated with a one-unit change in each independent variable, while holding all other variables constant. The model also provides information on the

overall fit of the equation to the data, including the R-squared value, which indicates the proportion of variance in the dependent variable that can be explained by the independent variables.

Another methodology we are going to use is the panel data. Panel data analysis, also known as longitudinal data analysis, is a statistical technique used to analyse data that has been collected over time on the same individuals or units. In panel data analysis, the data is organized in a matrix format where the rows represent the individual units, and the columns represent the time periods or waves.

The advantage of panel data analysis over cross-sectional analysis is that it allows for the examination of changes within each unit **over time** and the identification of **individual-level effects**. Panel data analysis also helps to reduce the bias associated with individual heterogeneity and unobserved variables. The two statistical models will be described more in depth in the chapter's 4 and 5.

Anyway, these are only analysis tools, the main questions are “what is the rationale for using these types of models, and what do we aim to capture?”

The rationale is to use these types of models to investigate the relationship between sustainability and financial performance over **two different layers**:

The first is associated to a **structure analysis** (more general and robust), looking only to the yearly data, and considering both the ESG score and the ESG Disclosure Score.

The objective is to ascertain if establishing comparable conditions between two companies (thanks to control variables), the one that more effectively practices sustainability will yield better results.

The second layer is instead more experimental and investigational and is based on a **dynamical analysis**, focusing on the relationship between financial data and ESG scores on a monthly basis. The aim here is to understand if sustainability performance data are relevant also to explain (in comparable conditions) price movements and related returns.

2. Sustainability and ESG

2.1 Definition of sustainability

Sustainability is a concept that emerged in response to increasing concerns about the impact of human activity on the environment and society.

The term sustainability is derived from the Latin word *sustinere*¹⁸ "to sustain" means to maintain, support, uphold, or endure. The main definition describes sustainability as the ability to "meeting the needs of the present without compromising the ability of future generations to meet their own needs"¹⁹

The roots of the concept of sustainability can be traced back to the early 19th century, when naturalists and environmentalists expressed concern about the impact of industrialization on the environment. The idea gained momentum in the 20th century with the publication of influential works such as Rachel Carson's "Silent Spring" (1962) and the report of the Club of Rome, "The Limits to Growth" (1972).

The Brundtland Commission, formally known as the World Commission on Environment and Development, was established by the United Nations in 1983 to address the growing concerns about environmental degradation and its impact on economic and social development. The commission's report, "Our Common Future," published in 1987, defined the key concepts to illustrate the meaning of sustainability.

Since then, the concept of sustainability has evolved to encompass not only environmental concerns but also social and economic factors. The United Nations Sustainable Development Goals, adopted in 2015, provide a framework for global sustainability efforts, with a focus on ending poverty, protecting the planet, and ensuring prosperity for all.

Sustainability has not been immune to criticism, with various reasons cited. One of these is the claim that the concept is poorly defined and nothing more than a trendy buzzword. Additionally, others have argued that achieving sustainability as an objective may be an unattainable goal, as it has been noted that no country is currently meeting the needs of its citizens without crossing the biophysical planetary boundaries.

Focusing more deeply, there are three main lines of criticism against sustainable development and sustainability²⁰.

The first line is based on the believe that the term is **too boring** to garner the kind of public enthusiasm or interest that is required.

The term "sustainability" for some people expresses an idea that is too modest or unappealing. They prefer to focus on something more positive, such as "abundance" or "thrivability"²¹.

¹⁸ Harper, Douglas. "sustain". Online Etymology Dictionary.

¹⁹ Brundtland Commission, 1987

²⁰ Federico Cheever, John C. Dernbach, "Sustainable Development and Its Discontents", 2015

²¹ Another approach is based on regenerative development. See, e.g., J. Tillman Lyle, Regenerative Design for Sustainable Development (John Wiley & Sons, Inc., 1994); P. Mang & B. Reed, 'Regenerative Development and

“How exciting is sustainability?” architect William McDonough and chemist Michael Braungart ask in their 2002 book, *Cradle to Cradle: Remaking the Way We Make Things*. “If a man characterized his relationship with his wife as sustainable, you might well pity them both.” They also criticize the view that we should address environmental problems simply by being more efficient and polluting less—by being “less bad.”²²

While sustainability is essential for the long-term health of our planet and its inhabitants, it does not necessarily capture the public’s attention. Its solutions are often mundane and require significant effort and dedication to implement, making the process uninteresting to the general public. Additionally, sustainable solutions often require individuals to make difficult decisions, such as sacrificing their own comfort in order to reduce their environmental impact. This sacrifice can be seen as too great a price to pay for most people and results in sustainability being viewed as a burden rather than a desirable lifestyle choice.

Furthermore, many people believe that sustainability projects are too costly and require too much effort to be worth their time²³. This is particularly true for large-scale projects, where the cost of the resources needed to implement the solutions might be too high for any individual or group to take on. Additionally, there are concerns about the effectiveness of some sustainability projects, as some may have little real-world impact or could be reversed in the future. These doubts can make the prospect of investing in sustainability projects appear unappealing or even a waste of time.

Finally, another difficulty faced by sustainability initiatives is the lack of positive reinforcement. People are motivated to undertake activities when they receive positive feedback, such as praise or rewards. Unfortunately, due to the slow and gradual nature of sustainability projects, individuals do not often see tangible results within their lifetime, or even see them reversed due to changes in climate, legislation or policy. The lack of immediate feedback makes it difficult to motivate people to continue taking action on sustainability and leads to the perception that such efforts are futile and a waste of resources.

The second line refers to the **ambiguity** of the term, in fact after more than 40 years there still isn’t a universal comprehensible formula for sustainability.

Sustainability is an incredibly ambiguous concept due to its wide range of interpretations and applications. It is a concept that encompasses environmental, social, and economic considerations, making it difficult to define, and even more difficult to measure and act on. This ambiguity has the potential to lead to confusion and misunderstanding when attempting to apply sustainability principles in a meaningful way. As such, it is important to understand the various interpretations of sustainability, as well as the commonalities between them in order to effectively promote sustainable practices.

Design,’ in *Encyclopedia Science & Technology* (McGraw-Hill 2012), pp. 2112-2145.

²² W. McDonough & M. Braungart, *Cradle to Cradle: Remaking the Way We Make Things* (North Point Press, 2010), p. 155.

²³ Hudson, C. (2019). Here's Why People Find Sustainability Boring. Retrieved from <https://www.greenbiz.com/article/heres-why-people-find-sustainability-boring>.

For instance, some believe that sustainability should prioritize environmental protection above all other considerations, while others advocate for a more moderate approach that considers both environmental and economic impacts. This difference in opinion highlights the complexity of sustainability and the importance of having a clear understanding of the various interpretations of the concept.²⁴

The ambiguity of sustainability also means there is no single standard or metric for measuring progress towards sustainability goals. Different groups and stakeholders measure and prioritize different aspects of sustainability, thus creating a wide variety of approaches to the concept. This lack of clarity makes it difficult to accurately assess the degree of success of sustainable initiatives, as well as the overall effectiveness of sustainability efforts.

Finally, sustainability is often applied to a wide range of topics, from global warming to poverty. This breadth of applicability makes it hard to generalize about sustainability initiatives and their potential for achieving desired outcomes. Additionally, since many aspects of sustainability cannot be quantified, it is difficult to accurately evaluate the impact of sustainability projects and predict future success.

The ultimate objection, which has become increasingly common in recent years, is that achieving sustainability is now almost beyond reach, as present and future circumstances render sustainable development unattainable. Some critics point to the deteriorating state of the environment, while others emphasize climate change as a primary concern. These critics use "resilience" as a benchmark, asserting that it is more practical and suitable than sustainability.

As the world population continues to climb, passing 7.6 billion in 2017²⁵ it is becoming increasingly more difficult to balance these three important aspects of human progress. The main issue that is hindering our ability to achieve sustainability is the sheer scale of resources needed for modern lifestyles. On average, it takes about 1.8 Earths to sustain the current global population in a way that is ecologically and socially sound.²⁶ Thus, our current level of consumption and production is unsustainable, and as the population grows, our resource needs will increase even further. The current pandemic of human-caused global warming is also evidence of a lack of sustainable practices, with levels of atmospheric CO₂ at a record high of 410ppm, largely due to the burning of fossil fuels and industrial activity.²⁷ An investment in renewable energy sources and infrastructure is desperately needed to help mitigate the effects of climate change and reduce our dependence on non-renewable energy sources.

²⁴ World Commission on Environment and Development. (1987). *Our Common Future*. Oxford: Oxford University Press.

²⁵ U.S. Census Bureau. (2017, February 15). International Data Base. Retrieved March 8, 2020, from <https://www.census.gov/programs-surveys/international-programs/about/idb.html>

²⁶ Global Footprint Network. (2019). *Living Planet Report: 2018*. Retrieved March 8, 2020, from <https://www.footprintnetwork.org/>

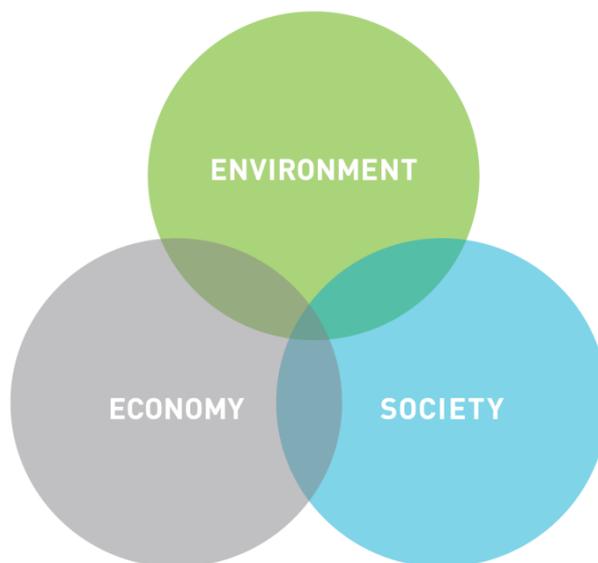
²⁷ Scripps Institution of Oceanography. (2020). Scripps CO₂ Program. Retrieved March 8, 2020, from <https://scrippsco2.ucsd.edu/>

Furthermore, many developing countries still lack the financial and technological capabilities to achieve sustainability. According to the UN's Sustainable Development Goals Report, most countries are facing social and economic inequality, with 1 in every 10 people living in extreme poverty and 32% of the world's population unable to access basic sanitation.²⁸ This has led to a rise of food insecurity in many parts of the world, especially in Sub-Saharan Africa and South Asia. In addition, many less developed countries are struggling to create jobs that provide a living wage, let alone improve environmental protections. Without the necessary investments in education, training, and technology, it is extremely difficult for these countries to achieve sustainable development.

The reality is that achieving sustainability is becoming more difficult with every passing day. To reach sustainability, the global community must make concerted efforts to reduce the resources we consume, invest in renewable energy sources, and provide support to developing countries to help them bridge the gaps in social, economic, and ecological development. Only then will we be able to achieve sustainability and ensure the health of our planet and its people for generations to come.

Going back to the definition, one particularly prevalent description of 'sustainability' employs three interconnected 'pillars'.²⁹ The **three pillars of sustainability**, also known as the triple bottom line, are a framework that represents the interconnected dimensions of sustainable development. These three pillars are **environmental, social, and economic** sustainability.³⁰

Environmental sustainability refers to the conservation of natural resources and protection of ecosystems, while social sustainability relates to the equitable distribution of resources and opportunities, and economic sustainability entails creating economic systems that are resilient, efficient, and capable of meeting present and future needs.



²⁸ United Nations. (2019). The Sustainable Development Goals Report 2019. Retrieved March 8, 2020, from <https://www.un.org/development/desa/publications/2019-sustainable-development-goals-report.html>.

²⁹ Basiago AD (1999) Economic, social, and environmental sustainability in development theory and urban planning practice. *Environmentalist* 19:145–161. <https://doi.org/10.1023/A:1006697118620>

³⁰ Gibson RB (2006) Beyond the pillars: sustainability assessment as a framework for effective integration of social, economic, and ecological considerations in significant decision-making. *J Environ Assess Policy Manag* 8:259–280

2.2 Historical development of ESG

Over the past two decades, there has been a notable increase in publications related to "sustainability," leading to the development of "sustainability science" as a distinct field. Despite this growth, "sustainability" remains a flexible concept that can be interpreted in various ways, depending on context.

One popular way of defining "sustainability", as introduced in the previous paragraph, involves identifying three interconnected "pillars," "dimensions," that encompass economic, social, and environmental factors or "goals." These terms are often used interchangeably, and the preference for "pillars" is arbitrary. The three pillars are frequently depicted as intersecting circles of society, environment, and economy, with sustainability positioned at the intersection. This graphic appears in academic literature, policy documents, business literature, and online, but it often lacks the strict logical properties of a Venn diagram. Alternative representations include the three pillars depicted as nested concentric circles or independent categories for sustainability goals or indicators without visual aids.

To comprehend how the concept of 'sustainability' gained momentum in the 1980s, it is crucial to examine the underlying origins of the concept, which are often obscured by the fact that the ideas that contribute to it predate the language of 'sustainability.' Scholars such as Grober, Caradonna, and Du Pisani have illuminated a diverse array of early roots, including the forestry experts of the 17th and 18th centuries who introduced the concept of sustainable yield, the early political economists who questioned the limits of economic and demographic growth, and the natural scientists and ecologists of the 19th and early 20th century who precipitated the schism between anthropocentric conservationists and biocentric preservationists. Although the modern concept of sustainability did not emerge until the late 20th century, the language of sustainability in a global sense first appeared in the Club of Rome's 'Limits to Growth' report, which advocated for a "world system ... that is sustainable." The concept gained traction in the early 1970s, and by the mid-1970s, several influential works on sustainability had been published, culminating in the emergence of 'sustainable development' in the 1980s.

Above we will introduce some key events over the years that influenced in relevant way the development of the sustainability and ESG.

In 1987, the United Nations Brundtland Commission published its report *Our Common Future*, which defines sustainability for the first time as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". This definition of sustainability has had far-reaching implications and shaped subsequent policy around the world.

In 1992, the United Nations Conference on Environment and Development (UNCED) was held in Rio de Janeiro, Brazil. At this landmark event, 108 heads of state and thousands of delegates gathered to discuss sustainable development and launched Agenda 21, an action plan for global sustainability. Agenda 21 provides guidance for nations on topics such as poverty alleviation, biodiversity conservation, climate change mitigation, and sustainable production and consumption. It also established the Convention on Biological Diversity and the United Nations Framework Convention on Climate Change (UNFCCC).

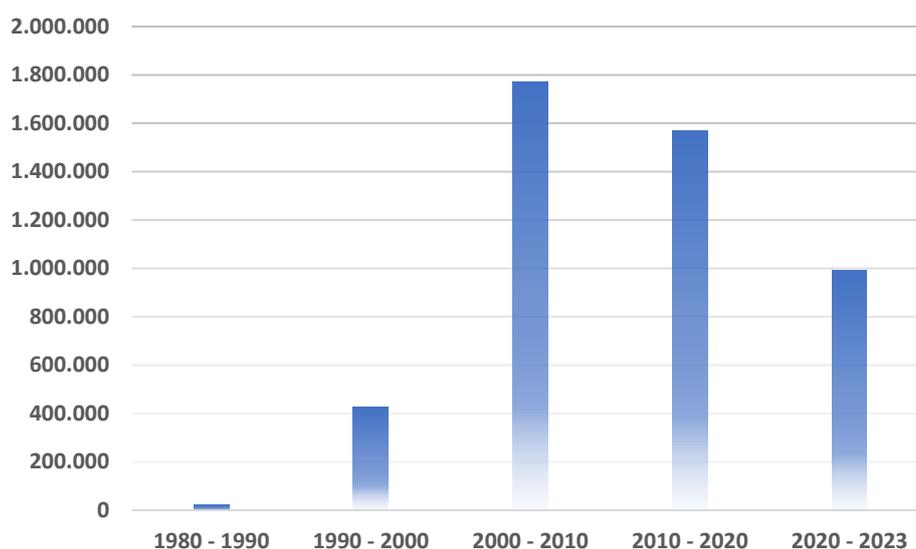
The 1990s also saw a sharp rise in global awareness of environmental issues, with a number of notable environmental campaigns taking place. In 1990, the Intergovernmental Panel on Climate Change (IPCC) was formed, and in 1997 the Kyoto Protocol was signed, establishing legally binding emissions targets for Annex I countries in an effort to curb global warming. Around the same time, the Montreal Protocol was ratified to protect the ozone layer.

In addition to global initiatives, many national governments also took steps to promote sustainability during this period. For example, in 1994, the U.S. government passed the National Environmental Policy Act (NEPA), requiring full disclosure of the environmental impacts of federal projects. In Europe, the European Union developed the Common Agriculture Policy to promote agricultural sustainability, and in 1998 the EU launched the Eco-Management and Audit Scheme (EMAS), which encourages organizations in all sectors to reduce their environmental impact.

In the closing years of the twentieth century, companies began to embrace sustainability as well. A number of corporate social responsibility initiatives were established, such as the Global Reporting Initiative (GRI), which provides guidelines for corporations to report on their sustainability performance. At the same time, green marketing campaigns became widely used, with companies attempting to capitalize on the growing interest in environmental protection.

Overall, the period from 1980 to 2000 saw immense progress in terms of sustainable development. The concept of sustainability was defined, global initiatives like Agenda 21 were launched, and governments, businesses, and individuals all began to take action to reduce their environmental footprints. As a result, the world became gradually more aware of the importance of sustainability and the need for sustainable practices.

To end up and put some relevant figures, below are plotted the numbers of academic papers related to sustainability over the last 40 years³¹.



³¹ Google Scholar, <https://scholar.google.com/>

This shows that in last decades the relevance of the topic has growth a lot, especially in the last years, considering that the numbers of papers from 2020 to 2023 (in just 2 and half years) are more than half of that in the previous decades.

2.3 The role of ESG in corporate strategy and decision-making

Why should companies act in a sustainable way?

Aside from the legal aspect, the key point is understanding what's incites companies to operate sustainably.

The incorporation of ESG considerations into corporate decision-making is driven by a growing awareness of the impact that businesses have on society and the environment. Companies that take ESG factors seriously are more likely to create long-term value for their stakeholders, including shareholders, customers, employees, and the broader community.

Comprising ESG considerations into corporate strategies and decision making has several potential benefits. Firstly, it can enable a company to identify and manage risks that may have an effect on its operations. For instance, Mattel faced significant losses in market share and reputation after recalling toys with toxic paint sourced from its suppliers. Similarly, high-street clothing retailers battled accusations that their sub-tier suppliers were discharging hazardous chemicals into major rivers in China. Nestlé changed its palm oil sourcing when an Indonesian sub-tier supplier engaged in illegal deforestation.

ESG considerations also provide an opportunity to improve the reputation, public image, and market standing of a company. By focusing on areas such as climate change, responsible sourcing, community engagement and ethical standards, a company is able to align itself with current and potential customers who are more informed and aware of these issues. Additionally, investors are more and more aware of ESG factors, and many have begun to consider them when choosing where to invest their money. There is growing evidence that companies that demonstrate a commitment to ESG considerations may have better long-term financial performance and experience lower investment risks than those that do not.

In order to effectively incorporate ESG considerations into corporate strategy and decision-making, there must first be a clear understanding of the company's values and sustainability goals. This requires an effective communications strategy to ensure that these values and goals are consistently communicated to all stakeholders.

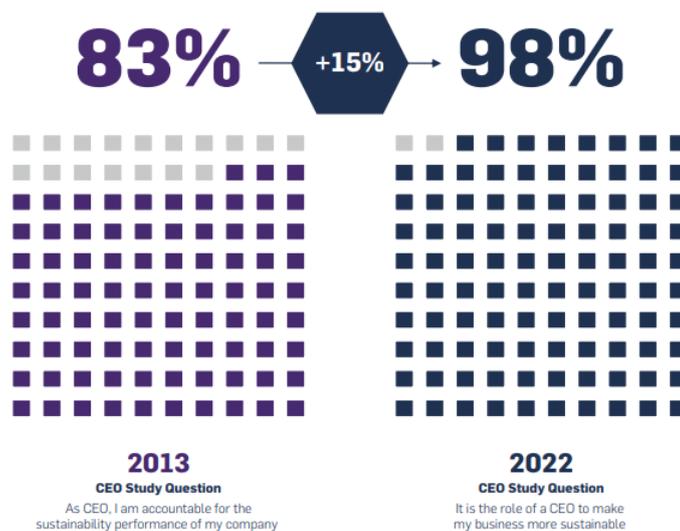
Corporate strategy and decision-making are the processes by which companies set their goals, allocate resources, and make decisions about how to achieve those goals. ESG considerations should be an integral part of this process, as they can help companies identify and manage risks, as well as opportunities, that may not be captured by traditional financial analysis. For example, a company that is heavily dependent on fossil fuels may face significant risks from climate change, including regulatory and reputational risks. By incorporating ESG considerations into their decision-making processes, companies can identify these risks and take steps to mitigate them, such as transitioning to renewable energy sources.

Furthermore, companies that prioritize ESG considerations are more likely to attract and retain customers and employees who share their values. A recent survey by Accenture³² found that 60% of consumers worldwide are willing to pay more for sustainable products and services, and 83% of consumers expect companies to act responsibly.

In addition, the figure above from a survey³³ conducted in the 2022 over 2.800 CEOs across 128 countries and 18 industries, shows that today almost 98% of the CEOs feel that their role is to make the business more sustainable.

FIGURE 3: IN NEARLY A DECADE OF RESEARCH, CEOS NOW UNEQUIVOCALLY FEEL IT IS THEIR ROLE TO MAKE THEIR BUSINESS MORE SUSTAINABLE (98% AGREE)

CEO Survey Question: Which of the following do you think is the role of a CEO?



Similarly, a study by Glassdoor found that companies with strong ESG performance are more likely to attract and retain top talent. This can lead to improved customer loyalty, employee satisfaction, and ultimately, better financial performance. What is more, according to Glassdoor, Best Places to Work companies outperformed S&P500 by an average of 122%, while the lowest rated companies underperformed S&P 500 by 29.5%.³⁴

On the customer side, RepTrak data revealed that ESG Scores are 85% correlated with Willingness to Trust in a Time of Crisis. They also showed that a low ESG Score results in as low as 10-20% willingness to buy, while a high ESG Score typically results in a 60-67% willingness.³⁵

ESG considerations are increasingly becoming a key driver of investment decisions, as investors recognize the importance of sustainable and responsible business practices.

³²https://www.accenture.com/us/en/insights/strategy/reimaginedconsumerexpectations?c=acn_glb_lifereimaginedmediarelations_12240956

³³ Accenture, United Nations Global Compact-Accenture CEO Study, 2022

³⁴ <https://www.glassdoor.com/employers/resources/how-being-on-glassdoors-best-places-to-work-list-pays-off/>

³⁵ RepTrakTrustReport, 2023, <https://2963875.fs1.hubspotusercontentna1.net/hubfs/2963875/RepTrak%20Trust%20Report.pdf>

In fact, according to a recent report by the Global Sustainable Investment Alliance, global sustainable investment assets reached a record \$35.3 trillion in 2020, up 15% from 2018.

However, incorporating ESG considerations into corporate strategy and decision-making can also present challenges. One of the main challenges is measuring and reporting on ESG performance, as there is no standardized framework for measuring and reporting on ESG factors. This can make it difficult for investors and other stakeholders to compare ESG performance across companies and sectors. To address this challenge, a number of organizations have developed ESG reporting frameworks, such as the Global Reporting Initiative and the Sustainability Accounting Standards Board.

Another challenge is the potential trade-offs between financial performance and ESG considerations. For example, a company that prioritizes reducing its carbon footprint may need to make significant investments in renewable energy sources, which could reduce short-term profitability.

However, companies that prioritize ESG considerations are more likely to create long-term value for their stakeholders, as they are better positioned to manage risks and capitalize on opportunities.

2.4 ESG data landscape

ESG factors are a set of non-financial performance indicators that allow investors, analysts, and other stakeholders to evaluate a company's sustainability and ethical practices. ESG data metrics help companies to assess their impact on the environment, their commitment to social responsibility, and their adherence to good governance practices.

ESG data are part of what's called non-financial reporting.

Non-financial reporting, also known as double materiality, is the practice of providing additional information to shareholders and other stakeholders that goes beyond the traditional financial metrics. Non-financial reporting can include both qualitative and quantitative information, such as environmental, social, and governance (ESG) performance. It may also include topics such as diversity, corporate culture, and even customer satisfaction.

Proponents of double materiality argue that it provides a more holistic picture of a company's performance, helping stakeholders gain insight into areas such as strategy, risk management, sustainability, and innovation. This helps them make more informed decisions when evaluating potential investments and understand how their investment could impact on the company's long-term success.

In recent years, the demand for non-financial reporting has seen a marked increase. According to the Global Reporting Initiative, the number of companies issuing ESG reports nearly doubled from 2016 to 2018, with over 7,200 organizations now providing this type of information. Studies have also found that investors more frequently analyze data associated with non-financial reports than previously thought, with nearly two-thirds of global investors considering these metrics when evaluating companies.

However, there are some drawbacks to non-financial reporting that must be considered before making it a standard practice. For instance, the quality of reporting can vary greatly depending on the company's size and industry, making it difficult for stakeholders to compare different organizations' performance.

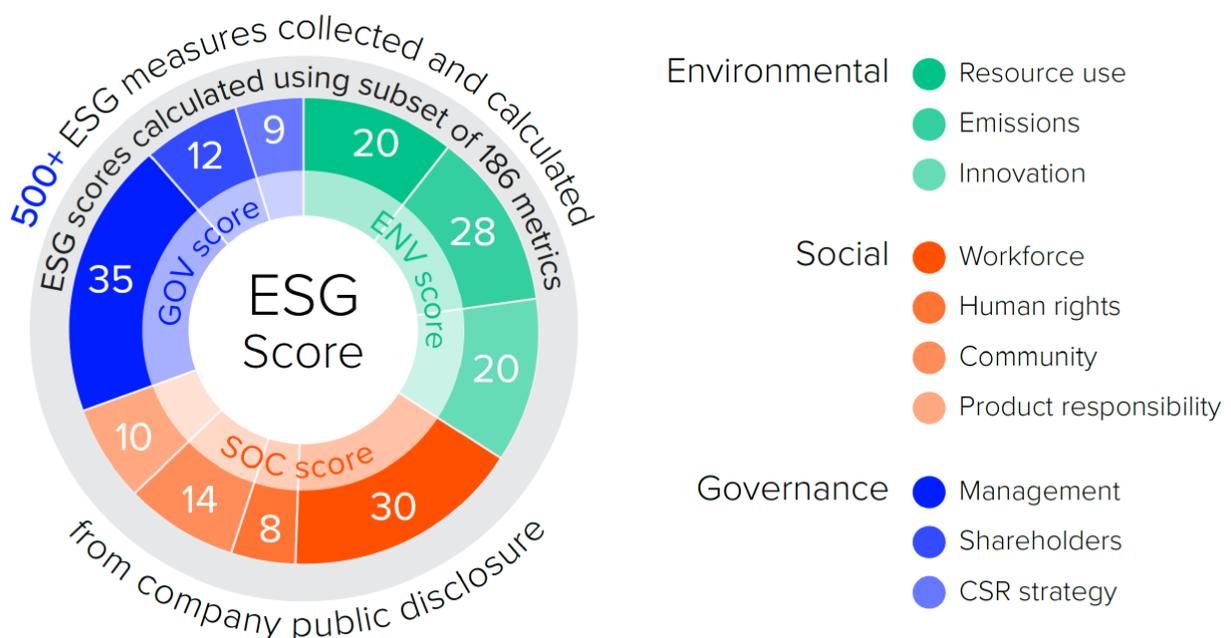
Additionally, ESG metrics often rely on self-reporting, meaning that the accuracy of the data can be questionable. Despite these issues, it is clear that non-financial reporting offers significant benefits to investors and other stakeholders, and its adoption is likely to continue to expand in the near future.

ESG data metrics are used by investors to evaluate a company's long-term performance and potential risks. In the past, investors used traditional financial metrics such as earnings per share and price-to-earnings ratio to evaluate companies. However, with the growing awareness of the impact of climate change, social issues, and ethical practices, investors are now looking at ESG data metrics to evaluate a company's long-term sustainability.

ESG data metrics cover a wide range of areas. Environmental metrics include a company's carbon footprint, energy efficiency, and waste management practices. Social metrics include a company's treatment of its employees, diversity and inclusion practices, and community involvement. Governance metrics include a company's board composition, executive compensation, and compliance with legal and ethical standards.

The main architecture consists of evaluating ESG through the subdivision of the three pillars (Environmental, Social and Governance) into macro risks (such as resources used, workforce...) and then subdivide each macro risk into specific risk to be evaluated individually.

For example, Refinitiv³⁶, uses 10 main categories (macro risks) and more than 500 specific risk metrics for each company analyzed.



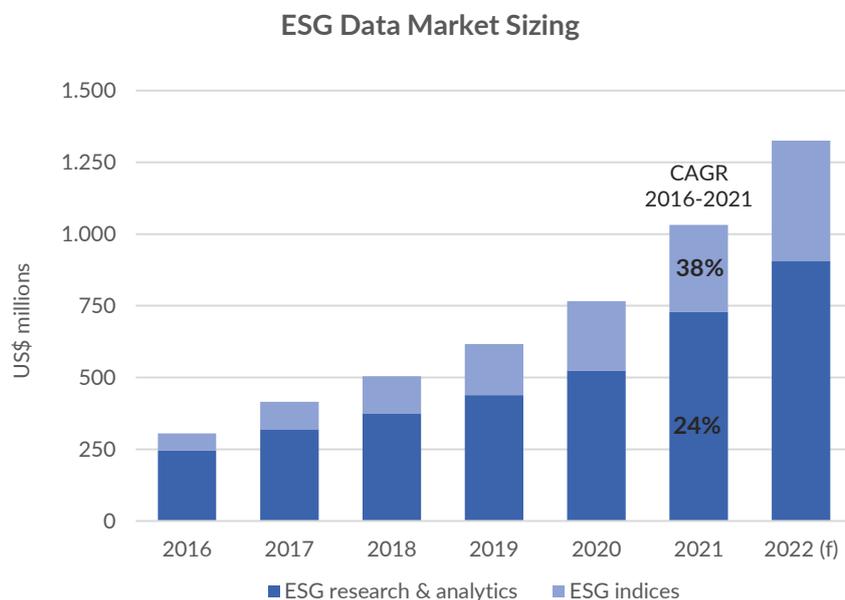
³⁶ https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/refinitiv-esg-scores-methodology.pdf

One of the challenges of ESG data metrics is the lack of standardization. There are currently no universally accepted standards for measuring and reporting ESG data. This has led to inconsistencies in the data reported by different companies, making it difficult for investors to compare the ESG performance of different companies. To address this issue, organizations such as the Global Reporting Initiative (GRI), the Sustainability Accounting Standards Board (SASB), and the Task Force on Climate-related Financial Disclosures (TCFD) have developed frameworks and standards for reporting ESG data.

Another challenge of ESG data metrics is the reliability of the data reported. Companies may report favorable ESG data to improve their image and attract investors, even if the data is not accurate. To address this issue, third-party organizations have emerged to independently assess and verify the ESG data reported by companies.

Despite these challenges, ESG data metrics have become a critical tool for investors to evaluate the long-term sustainability of companies. A growing number of investors are integrating ESG data into their investment decisions. In addition, many companies are recognizing the importance of ESG data and are voluntarily reporting their ESG performance to demonstrate their commitment to sustainability and ethical practices.

In an analysis conducted on 19.04.2022 based on publicly available information, interviews, as well as companies' actual or estimated revenues, Opimas³⁷ finds that the global market for ESG data surpassed US\$1 billion for the first time in 2021. Supported by an impressive 28% annual growth rate over the past five years, the market could exceed US\$1.3 billion by 2022.



Focusing more on the deep of the ESG metrics, which are the main data providers?

The 9 main ESG ratings providers and their main characteristic are reassumed in the table below.

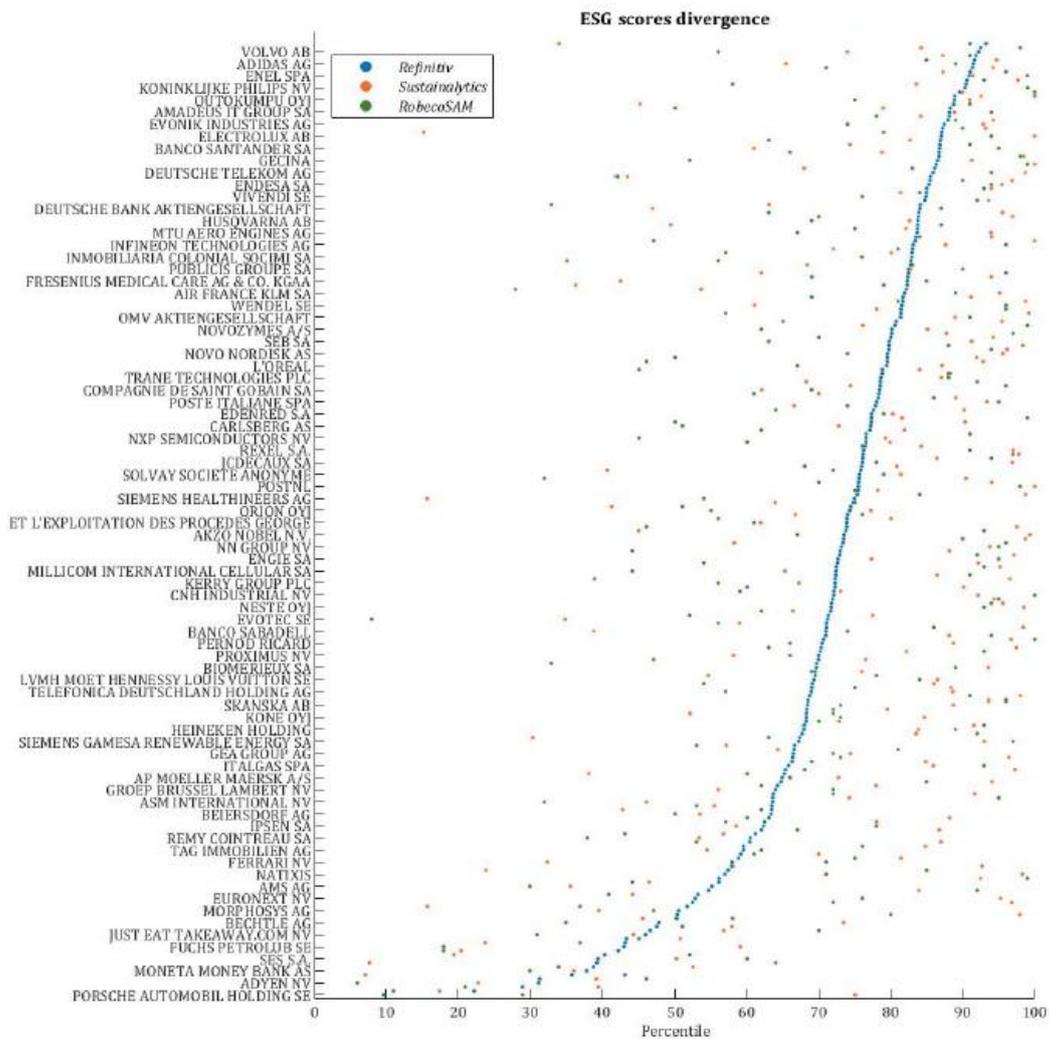
³⁷ ESG Data is Now Worth It, <https://www.opimas.com/research/742/detail/>

Elements	MSCI	VIGEO	EIRIS REFINITIV	SUSTAINALYTICS	ISS OEKOM
RATING SCORE	CCC to AAA	-- to ++	D to A+ and 0 to 100	0 to 100	D- to A+
HISTORY	1990	1983	2002	1992	1985
HEADQUARTER	New York, United States	Paris, France	Toronto, Canada	Amsterdam, Netherlands	Munich, Germany
SOURCES	Company disclosure, 1600+ Media sources, 100+ specialized dataset	Company disclosure, Recommendation, Conventions	Company websites, Company reports, NGO Websites, Media and news, Stock Exchange filings	Public disclosure, Media and news, NGO reports	Publicly available information, Interview with stakeholders, information on company policies and practices, company direct contact
N. CRITERIA	37	38	178	155	100

Elements	ROBECOSAM	ECPI	BLOOMBERG	FTSE RUSSEL
RATING SCORE	0 to 100	F to EEE	0 to 100	0 to 5
HISTORY	1995	1997	2008	2001
HEADQUARTER	Zurich, Switzerland	Milan, Italy	New York, United States	London, United Kingdom
SOURCES	Survey approach	Company reports, Media and news, Regulatory data, Bloomberg and Thomson Reuters, University networks	Company reports, Publicly available information, Company direct contact	Publicly available information, Company direct contact, Other sources (governments and NGOs)
N. CRITERIA	74	80/86	120	300

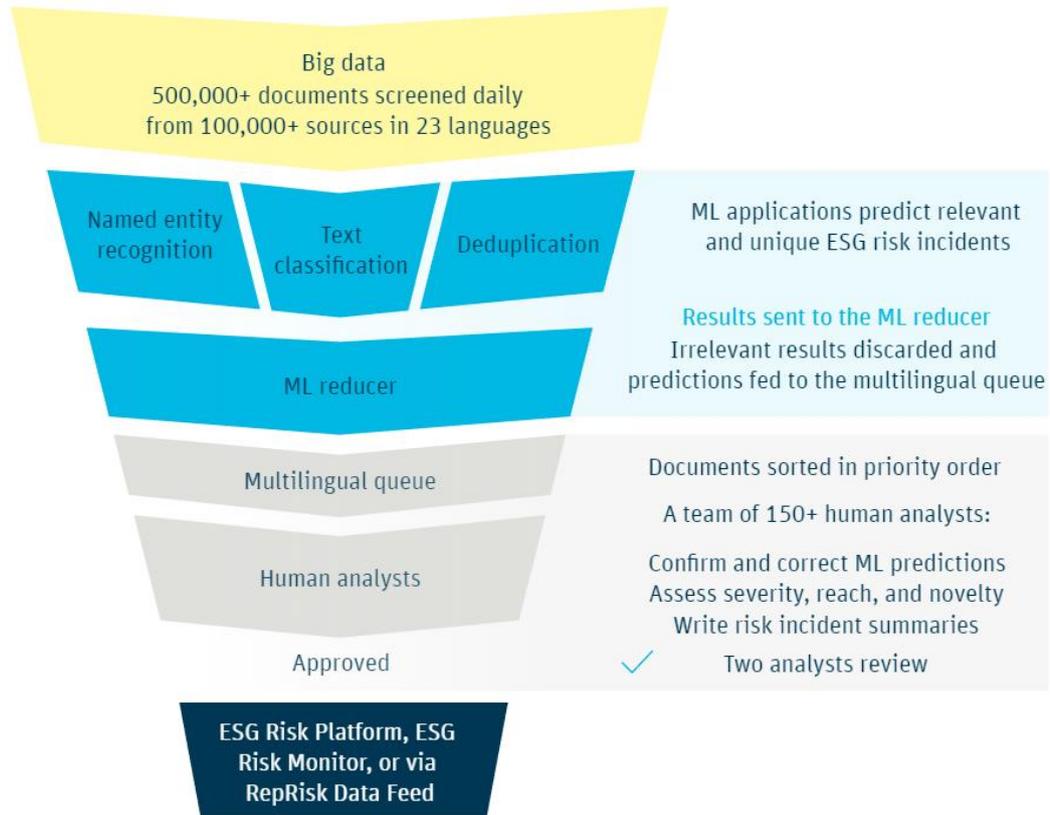
As illustrated, there are significant differences between not only how the ESG metrics are evaluated but also on which kind of data are used. For examples, data provider such as Bloomberg and Vigeo are more focused on company reports, instead data providers like MSCI and Refinitiv focus more on third party information's. The advantage of using internal data (considering an adequate disclosure) is that they are more reliable and less discretionary. However, the issue is that can't be evaluated frequently (only on reporting frequency), and it might not adequately consider the general public information from third parties.

The results of these differences is that there is a lot of divergence on the ratings across the different ESG providers. Just for example, the plot below shows visually the data dispersion for the year 2020 for a sample companies evaluated thought three different rating agencies: Sustainalytics, RobecoSAM and Refinitiv.



For the purpose of this study, we will focus mainly on Bloomberg ESG data for the ESG Disclosure metrics and ESG score rating and Refinitiv, Rebecosam and Sustainalytics for the monthly ESG ratings. This data will be examined in depth in the next chapters.

In the past two years, the growth of Artificial Intelligence (AI) has been remarkable. This has led to extraordinary technological advancements, like robots, digital assistants, machine learning, and automated decision-making. As AI advances, its potential impact on our lives is increasingly evident. One of the most widespread uses of AI is information analysis (texts, images, audios, etc.), and since 2006, RepRisk has been using the power of AI and machine learning alongside human intelligence to convert big data into usable research, analytics, and risk metrics. RepRisk is a global provider of ESG and business conduct risk research and quantitative solutions.



Their software synthesize data in 23 languages with a rules-based approach, allowing to recognize and track significant ESG risks and violations of international standards that could have reputational, compliance, and financial consequences for a company.³⁸

In addition to the ESG metrics introduced before, we will test this innovative ESG data with a small sample in order to perform a very dynamical analysis focusing on monthly data.

³⁸ <https://www.reprisk.com/news-research/resources/methodology>

3. ESG Regulation in Europe

3.1 Overview of ESG regulation in Europe

In Europe, environmental, social, and governance (ESG) regulation has become increasingly important over the last few years. The European Commission (EC) is spearheading the effort to increase ESG regulations in Europe and has implemented various initiatives to promote sustainable investments across the continent. Moreover, the financial industry has taken a more active role in the process, introducing a range of standards and reporting requirements for the purposes of creating more accountable and transparent investments.

The concept of ESG regulation has been gaining traction since the early 2000s. In 2005, the European Commission adopted the Sustainable Investment and Financial Innovation Action Plan (SIFI Action Plan) with the aim of encouraging sustainable investments in Europe. This plan set out a number of goals and initiatives to promote sustainable investment and financial innovation, including the establishment of a European ESG Regulation Framework.³⁹

In 2013, the European Commission developed the Non-Financial Reporting Directive (NFRD), which requires large public companies to report on their ESG performance. This directive provides an EU-wide framework for companies to disclose their environmental and social performance as well as diversity information. In addition, major stock exchanges in Europe, such as the London Stock Exchange, have introduced disclosure requirements for companies listed on the exchange.⁴⁰

However, this was only a part of a bigger set of initiatives represented by the European Green Deal⁴¹ which is an action plan proposed by the European Commission in 2018 and approved in 2020, to transform Europe into a modern, resource-efficient, and competitive economy that is sustainable, as well as climate-neutral by 2050. The plan consists of a number of actions focusing on the energy transition, circular economy, and the protection of biodiversity, among others.

At its core, the plan will increase the ambition of the European Union (EU) in addressing climate change by reducing emissions from all sectors, encouraging entrepreneurship and investment, increasing the share of renewable energy, improving the efficiency of energy use, and accelerating the transition to low-carbon mobility.

In particular, the EU Sustainable Finance Agenda includes ten key actions that can be divided into three categories: Reorient capital flows towards sustainable investment, mainstreaming sustainability into risk management and foster transparency and long-termism.⁴²

In this Communication, the Commission sets out its vision and strategy for delivering on its strategic

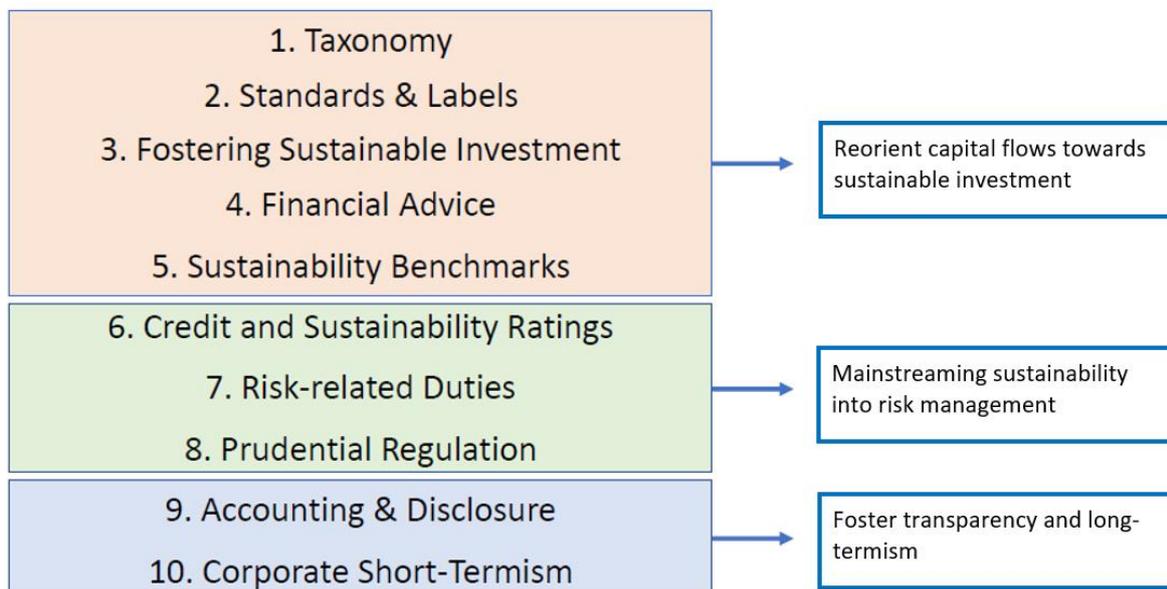
³⁹ European Commission. (2005). Sustainable Investment and Financial Innovation Action Plan. Retrieved from https://ec.europa.eu/environment/investments/pdf/sifi_action_plan.pdf

⁴⁰ European Commission. (2013). Directive 2013/34/EU of the European Parliament and of the Council of 26 June 2013 on the annual financial statements, consolidated financial statements and related reports of certain types of undertakings. Retrieved from <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013L0034>

⁴¹ The European Green Deal, Brussels, 11.12.2019 COM(2019) 640 final, https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF

⁴² European Commission (2018), Communication from the Commission, Action Plan: Financing Sustainable Growth.

priorities in the coming years. The Commission also outlines what actions will be taken to ensure the successful implementation of the European Union’s agenda and how these actions will be monitored and evaluated.



In line with the goals of the European Green Deal, in 2018, the European Commission established the Sustainable Finance Disclosure Regulation (SFDR), which requires financial market participants to provide customers with information on how their products address sustainability risks and opportunities. The SFDR also sets out the minimum requirements for sustainability-oriented investment products, such as green bonds and sustainable ETFs.

Following that, the European Commission presented the CSRD proposal on 21 April 2021 as part of the European Green Deal and the Sustainable Finance Agenda. Corporate Sustainability Reporting Directive (CSRD) represented the European Union’s first comprehensive effort to encourage corporate sustainability reporting.

The law, which was adopted on December 14, 2022, by the European Parliament, requires large companies to disclose their environmental, social and governance risks and performance. This law is designed to provide a consistent and transparent framework for reporting on companies’ progress toward meeting their sustainability goals and strategies. The directive encourages companies to adopt leading practices in sustainability and to develop a long-term vision for their impact on society and the environment.

The figure above resumes the key milestone regarding the proposal and adoptions of the CSRD.

Policy making timeline



The scope of the CSRD is different from the NFRD, as it applies to all large EU companies, that is, EU companies (including EU subsidiaries of non-EU parent companies) exceeding at least two of the following criteria:

- more than 250 employees;
- a turnover of more than €40 million; or
- total assets of €20 million.

CSRD will also apply to companies with securities listed on an EU-regulated market, irrespective of whether the issuer is established in the EU or a non-EU country. This includes listed small and medium-size enterprises (SMEs), except for certain listed micro-enterprises.

For the financial years starting on or after 1 January 2024, CSRD will apply to companies that are already subject to NFRD, with the first report expected to be produced in 2025. Large companies that are not presently subject to NFRD will have to apply CSRD from financial years starting on or after 1 January 2025 and therefore report in 2026 on 2025 data. For financial years starting on or after 1 January 2026, CSRD will be rolled out to listed SMEs, albeit subject to an opt-out until 2028, with the report in 2027 being based on 2026 data.

Companies affected by the CSRD must present their non-financial information in an integrated report alongside their annual financial report. This integrated report should include performance indicators and metrics that can be used to measure overall performance.

The purpose of the CSRD is to increase transparency in corporate sustainability reporting, ensure that companies are accountable to stakeholders, and encourage companies to develop and implement sustainable business practices. In order to comply with the CSRD, companies must publish regular and reliable reports that clearly detail their ESG performance. The data must be verified by an independent auditor and follow best practices in corporate sustainability reporting.

The CSRD provides a number of benefits to both companies and stakeholders. For companies, the CSRD provides a standardized framework that ensures consistency in reporting and provides a baseline for fiduciary responsibility to stakeholders. It also encourages companies to develop and implement sustainable business practices that are in line with their long-term goals and strategies.

For stakeholders, the CSRD provides access to reliable, comprehensive and comparable data that helps them to understand how companies are performing in terms of sustainability. This information can be used to make informed decisions about which companies are best suited for investment, and it can help inform the public policy debate on sustainability.

Just to mention, another important initiative related to the European Green Deal, is the taxonomy of sustainable economic activities and its corresponding guidelines which entered into force in July 2020 and gives businesses and investors a unified framework to evaluate and identify sustainable activities.⁴³

As introduced, the progress of ESG regulation in Europe has been substantial over the last decade, however there are still areas of improvement that could be addressed to further strengthen the ESG landscape in Europe. For example, the regulation of ESG-related funds and investments remains inconsistent across Europe, which can make it difficult for investors to compare different products. Additionally, the disclosure requirements for ESG performance are still voluntary for many companies, so there are still gaps in transparency.

Despite the challenges, the European Commission and other stakeholders have made great strides to move towards more ESG-friendly regulations. As more investors look to invest in sustainable assets, this progress is likely to continue into the future.

⁴³ European Commission [EC]. (2020). Taxonomy. Retrieved from https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/taxonomy_en.

3.2 Disclosure requirements for ESG factors in Europe

An important step in the development of corporate sustainability reporting across the EU are the reports on development of EU sustainability reporting standards prepared at the request of the Commission following an invitation from the Economic and Financial Affairs Council.

The first report proposes a roadmap for the development of a comprehensive set of EU sustainability reporting standards. It was prepared by a multistakeholder task force established by the European Financial Reporting Advisory Group (**EFRAG**).

A second report proposes reforms to EFRAG's governance structure to ensure that future EU sustainability reporting standards are developed using an inclusive and rigorous process. It sets out, for example, how national and European authorities will be involved, while ensuring that the process also draws upon the expertise of the private sector and civil society.

In April 2021, the European Commission approved a Corporate Sustainability Reporting Directive (CSRD) that requires companies within its scope to report using a double materiality perspective that is compliant with the European Sustainability Reporting Standards (ESRS) adopted by the Commission as delegated acts. In the same month, the Commission appointed EFRAG as technical adviser to develop the draft ESRS. This appointment was later confirmed in the text of 21 June resulting from the triilogue between the co-legislators and the text of 10 November 2022 approved by the European Parliament. From June 2021 to April 2022, the EFRAG Project Task Force on European Sustainability Reporting Standards (EFRAG PTF-ESRS) prepared Exposure Drafts (EDs) for public comments from 30 April to 8 August 2022. After considering the feedback of the consultation, the EFRAG Sustainability Reporting Board (EFRAG SRB), with advice from the EFRAG Sustainability Reporting Technical Expert Group (EFRAG SR TEG), amended the twelve draft ESRS and released them to the European Commission. The Commission will now consult EU bodies and Member States on the draft standards before adopting them as delegated acts in June 2023, after a scrutiny period by the European Parliament and Council.

Companies meeting at least two of the following three conditions will have to comply with the CSRD:

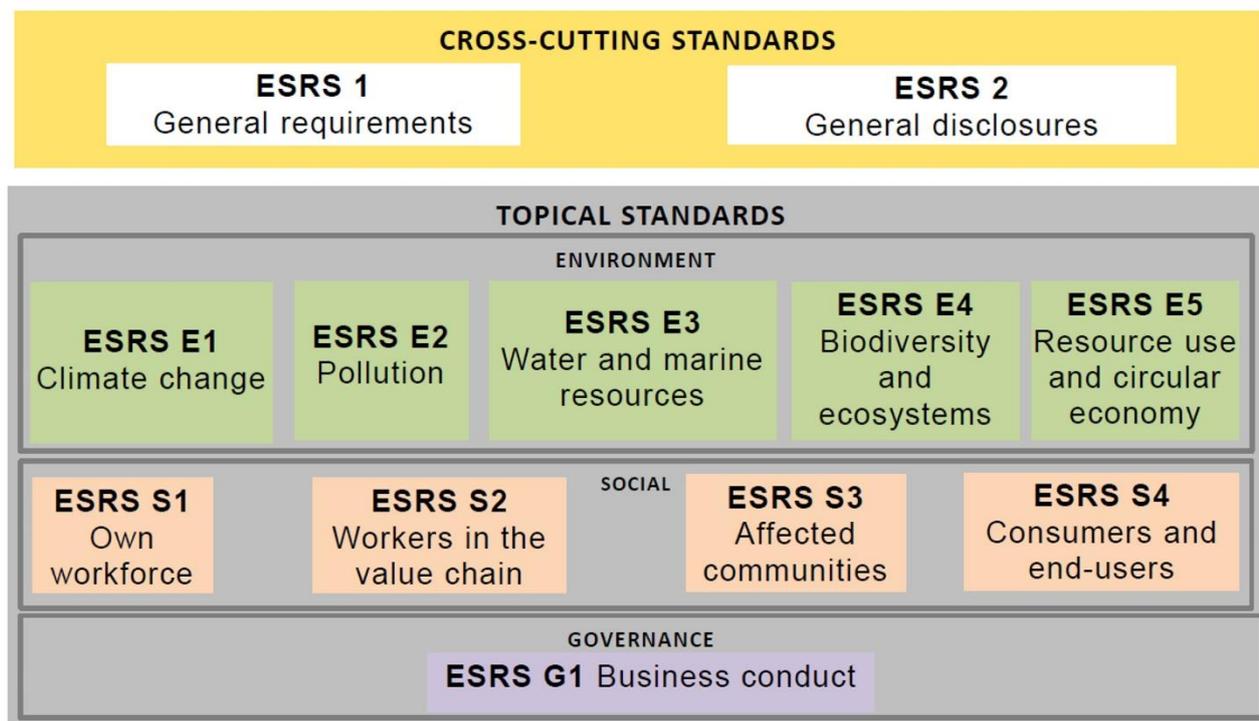
- €40 million in net turnover
- €20 million in assets
- 250 or more employees

The reporting requirements will be implemented gradually for different types of companies. The first group of companies must comply with the standards for financial reports in 2025, which will be required to be published in the year 2024. Small and Medium-sized Enterprises (SMEs) listed on the stock exchange must start reporting as early as 2026, with the possibility of voluntary opting out until 2028, and they will be able to use separate, appropriate standards developed by EFRAG in the following year.

Starting to analyze in deep the first draft of European Sustainability Reporting Standards, the plot below illustrates the structure of the firsts 12 principles evaluated and publicized in November 2022.⁴⁴

⁴⁴ Draft European Sustainability Reporting Standards, EFRAG, November 2022

FIRST SET OF DRAFT ESRS: THE STANDARDS



EFRAG December 2022

The first two standards are off topical standards focusing on giving rules in terms of general requirements and disclosure. These standards are defined as cross-Cutting Standards, meaning that they apply to all sustainability matters.

The purpose of the first draft standard (**ESRS 1**) is to establish the general criteria that organizations must fulfill when creating and displaying sustainability-related information in accordance with the Accounting Directive as modified by the Corporate Sustainability Reporting Directive (CSRD)⁴⁵

“The undertaking shall disclose, in accordance with applicable [draft] European Sustainability Reporting Standards (ESRS), all the material information regarding impacts, risks and opportunities in relation to environmental, social, and governance matters. The information shall enable the understanding of the undertaking’s impacts on those matters and how they affect the undertaking’s development, performance and position.”⁴⁶

The ESRS 1's first article provides a brief outline of the purpose of sustainability reporting standards. This includes the gathering of material information, which encompasses all information pertinent to understanding the effects (positive or negative) on sustainability, risks, and opportunities associated with environmental, social, and governance matters.

The article is structured in the following chapters:

⁴⁵ Draft European Sustainability Reporting Standards, ESRS 1 General Requirements, EFRAG, November 2022

⁴⁶ Draft European Sustainability Reporting Standards, ESRS 1 General Requirements, EFRAG, November 2022, art 1.1 par. 2, page 5.

ESRS 1	1	Categories of (draft) Standards and disclosures under (draft) European Sustainability Reporting Standards
	2	Qualitative characteristics of information
	3	Double materiality as the basis for sustainability disclosures
	4	Sustainability due diligence
	5	Value chain
	6	Time horizon
	7	Preparation and presentation of sustainability information
	8	Structure of sustainability statements
	9	Linkages with other parts of sustainability statements
	10	Transitional provisions

One of the key elements regarding the ESRS 1 is the **double materiality**, which is one of the key fundamental regarding sustainability disclosure.

Above are reported the first two paragraph regarding the double materiality.

40. Double materiality has two dimensions, namely: impact materiality and financial materiality.

41. Impact materiality and financial materiality assessments are inter-related and the interdependencies between these two dimensions shall be considered. In general, the starting point is the assessment of impacts. A sustainability impact may be financially material from inception or become financially material when it becomes investor relevant, including due to its present or likely effects on cash-flows, development, performance and position in the short-, medium- and long-term time horizons. Irrespective of their being financially material, impacts are captured by the impact materiality perspective.⁴⁷

In particular, the materiality related to impact, risks and opportunities related to sustainability should be evaluated through a doble dimension. The first thing that should be considered is the **impact materiality**.

A sustainability matter is of great importance (material) when it comes to the project's actual or potential impacts on people or the environment in the short, medium, and long-term. These impacts can be both positive and negative, as well as a result of the project itself or through its suppliers and vendors. The project's effects should be considered throughout its entire value chain.

The UN Guiding Principles on Business and Human Rights⁴⁸ and the OECD Guidelines for Multinational Enterprises provide an international framework to assess the materiality of negative impacts. In order to determine materiality, the severity of actual negative impacts and the severity and likelihood of potential negative impacts must be evaluated. Severity is assessed using criteria such as scale, scope, and irremediable character of the impact.

⁴⁷ Draft European Sustainability Reporting Standards, ESRS 1 General Requirements, EFRAG, November 2022, art 3.3 par. 1 and 2, page 11.

⁴⁸ United Nations Human Rights, Guiding Principles on Business and Human Rights, https://www.ohchr.org/sites/default/files/documents/publications/guidingprinciplesbusinesshr_en.pdf



The scope of financial materiality for sustainability reporting is an expansion of the scope of materiality used in the process of determining which information should be included in the undertaking's financial statements.

The **financial materiality** assessment process involves identifying information that is useful to investors, lenders and other creditors when they evaluate the impact of sustainability matters on an undertaking's cash flows, development, performance, position, cost of capital or access to finance. It is considered material if omitting, misstating or obscuring the information could reasonably be expected to affect the decisions made based on the undertaking's sustainability statements.

A sustainability matter is considered to be financially material when it produces or has the potential to produce significant financial effects on the undertaking. These effects could range from short-term to long-term risks or opportunities that influence the undertaking's cash flows, development, performance, position, cost of capital or access to finance. Such risks and opportunities could be derived from past or future events and may relate to assets and liabilities (recognized or not) or to non-financial factors that contribute to the generation of cash flows and the development of the undertaking (referred to as "capitals"). In some cases, the capitals may meet the criteria for recognition and reporting in financial statements.

Another important chapter in the ESRS 1 is the **Value Chain**.

*"66. The reporting undertaking for the sustainability statements shall be the one retained for the related financial statements. For example, if the reporting undertaking is a group and if the parent company is required to prepare consolidated financial statements, the consolidated financial and sustainability statements will be for the parent and its subsidiaries."*⁴⁹

⁴⁹ Draft European Sustainability Reporting Standards, ESRS 1 General Requirements, EFRAG, November 2022, art 5.1 par. 66 and 2, page 15.

The reporting undertaking for the sustainability statements shall retain the same undertaking used for the related financial statements. For example, if the reporting undertaking is a group and the parent company is required to prepare consolidated financial statements, the consolidated financial and sustainability statements will be for the parent and its subsidiaries.

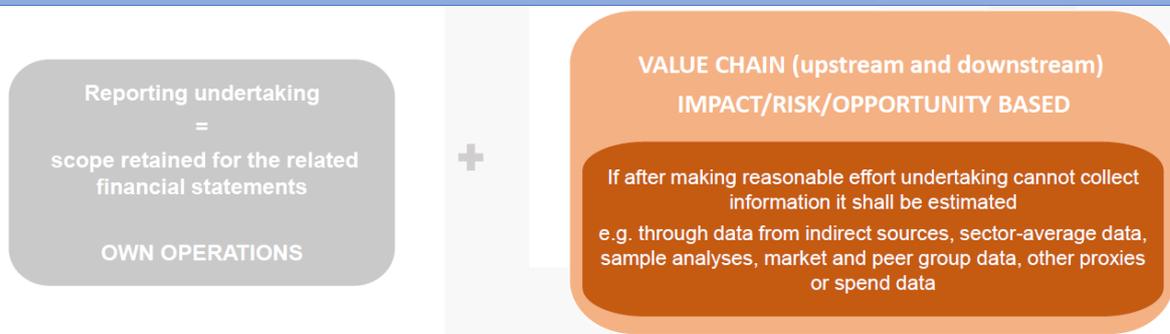
The information about the reporting undertaking provided in the sustainability statements shall be extended to include material impacts, risks and opportunities connected with the undertaking's direct and indirect business relationships in the upstream and/or downstream value chain (“value chain information”).

The information regarding the reporting undertaking must be extended to include material impacts, risks, and opportunities connected with the upstream and downstream value chain(s). This will be determined through the undertaking's sustainability due diligence process(es) and materiality assessment. Additionally, specific requirements of [draft] topical ESRS must be followed when they exist. The inclusion of value chain information does not require information on each entity in the value chain, but rather focuses on the material value chain information.

Value chain

Value chain: Information about the reporting undertaking provided in the sustainability statements shall be extended to include information on the **material impacts*, risks and opportunities** connected to the undertaking through its direct and indirect business relationships in the upstream and/or downstream value chain. (ESRS 1 para 67)

* Impacts include those caused or contributed to by the undertaking and those which are directly linked to the undertaking's own operations, products, or services through its business relationships



Moving to the second reporting standard, **ESRS 2**, the first paragraph is reported below:

“This [draft] ESRS sets out the disclosure requirements that apply to all undertakings regardless of their sector of activity (i.e., sector agnostic) and apply across sustainability topics (i.e., cross-cutting). This [draft] ESRS covers the reporting areas defined in [draft] ESRS 1 General requirements section.”

50

⁵⁰ Draft European Sustainability Reporting Standards, ESRS 2 General Disclosure, EFRAG, November 2022, par. 1 and 2, page 5.

Standard with Disclosure Requirements at sector-agnostic level that cover E, S and G matters . It is not subject to the materiality assessment.



- 4-pillar approach aligned with international sustainability reporting frameworks
- Definition and outcome of the double materiality assessment
- Minimum disclosures for policies, actions and targets applied at topical level
- List of mandatory datapoints across sector-agnostic standards

The objective of this Disclosure Requirement is to ensure that the undertaking is transparent about how it prepares its sustainability statements, including the scope of consolidation and the value chain information. To this end, the undertaking must disclose the following:

- a) whether the sustainability statements have been prepared on a consolidated or individual basis;
- b) if they have been prepared on a consolidated basis, confirmation of the scope of consolidation being the same as that of the financial statements and, where applicable, indication of which subsidiary undertakings are exempted from annual or consolidated sustainability reporting;
- c) the extent to which the sustainability statements cover the undertaking's upstream and downstream value chain (as stated in the [draft] ESRS 1 section 5.1 Reporting undertaking and value chain); and
- d) whether the undertaking has availed itself of the option to omit specific pieces of information relating to intellectual property, know-how or the results of innovation.

Analyzing the **basis for preparation** chapter, the [draft] ESRS requires undertakings to provide disclosures related to particular circumstances in order to illustrate the impact of these circumstances on the preparation of sustainability statements.

These disclosures include a description of their definitions of medium- or long-term time horizons and the reasons for applying them, as well as a list of metrics with value chain data estimated using indirect sources, a description of the basis for preparation, the resulting level of accuracy, and any planned actions to improve accuracy.

When significant estimation or outcome uncertainties exist, they must identify the metrics affected, disclose the sources and nature of the uncertainties, and the factors affecting them, as well as any assumptions made about the future and other sources of significant uncertainty. Any changes in the preparation and presentation of sustainability information from the previous reporting period must be explained and comparative figures restated, unless it is impracticable to do so. Material prior period errors must be disclosed, including the nature of the error, the correction applied to each prior period, or the circumstances leading to the error and how it was corrected.

Moving to the first pillar (**Governance**) of the ESRS 2, the regulation requires that the undertaking disclose:

- a) The composition of the administrative, management and supervisory bodies, their roles and responsibilities and access to expertise and skills regarding sustainability matters (GOV 1).
- b) How they are informed and how these matters were addressed (GOV 2).
- c) Information about the integration of its sustainability related performance in incentive schemes (GOV 3).
- d) Mapping of the information provided in its sustainability statements about the sustainability due diligence process(es) (GOV 4).
- e) The main features of its risk management and internal control system in relation to sustainability reporting process(es) (GOV 5).

For what's regards **Strategy**, the regulation requires the undertaking to disclose its market position, elements of its strategy that relate to or impact sustainability matters, business model(s) and value chain (SBM-1). It must also include how the interests and views of stakeholders are taken into account in the strategy and business model(s) (SBM-2).

Additionally, the undertaking must disclose its material impacts, risks and opportunities and how they interact with its strategy and business model(s) (SBM-3). This should include the outcome of the materiality assessment: a brief description of the material impacts, risks and opportunities (material IROs) and changes compared to the previous year.

The undertaking must also indicate whether it has changed its strategy or business model as part of the actions to address material IROs, as well as the resilience of its strategy or business model.

Going forward to the ESRS 2, the chapter 4 says:

"The objective of this section is to set Disclosure Requirements to be applied when reporting on:

- a) the processes to identify material impacts, risks and opportunities; and*
- b) the information that, as a result" ⁵¹*

The objective of this Disclosure Requirement is to provide an understanding of the process(es) through which the undertaking identifies **impacts, risks and opportunities** and assesses their materiality. The undertaking must disclose a description of the methodologies and assumptions applied in the described processes, an overview of the process(es) to identify, assess and prioritize the undertaking's potential and actual impacts on people and the environment, and an overview of the process(es) used to identify, assess and prioritize sustainability-related risks and opportunities that have or may have financial effects. Additionally, the undertaking must disclose a description of the organization and process of decision-making and the related internal control procedures, and the extent to which and how the process(es) to identify, assess and manage impacts and risks is/are integrated into the undertaking's overall risk management process and used to evaluate the undertaking's overall risk profile and risk management processes. Finally, the undertaking must explain whether the process(es) has/have changed compared to the prior reporting period, when the process(es) was first disclosed.

⁵¹ Draft European Sustainability Reporting Standards, ESRS 2 General Disclosure, EFRAG, November 2022, chapter 4, par. 4.1, page 14.

To conclude the analysis of the ESRS 2, the last pillar refers to **Metrics and Targets**.

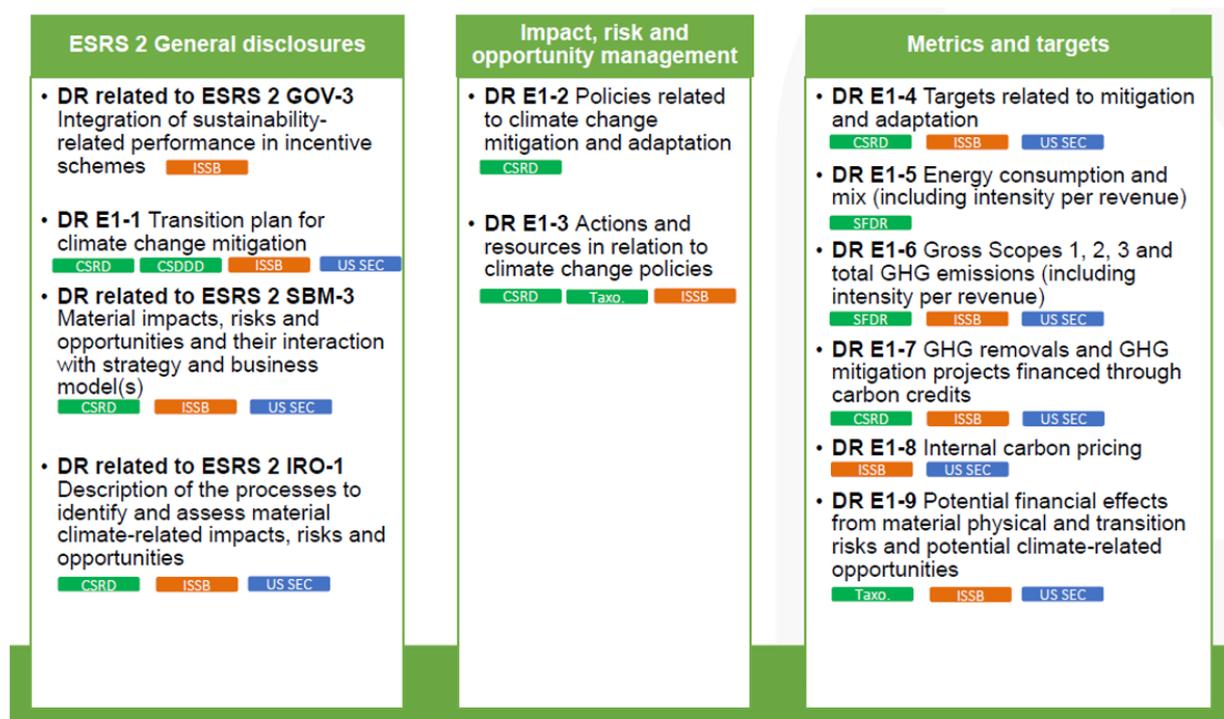
Paragraph 69 sets out that Disclosure Contents shall be included when an undertaking discloses information on its metrics and targets related to each material sustainability matter. These Disclosure Contents shall be applied together with the Disclosure Requirements, including Application Requirements, provided in the relevant [draft] topical ESRS, as well as when the undertaking prepares entity specific disclosures. If an undertaking cannot disclose the information on targets required under the relevant [draft] topical ESRS, because it has not adopted targets with reference to the specific sustainability matter concerned, it shall disclose this to be the case, and provide reasons for not having adopted targets. The undertaking may report a timeframe in which it aims to adopt them. Paragraph 70 states that the corresponding disclosures shall be located alongside disclosures prescribed by the [draft] topical ESRS.

Paragraphs 71-75 provide that the undertaking shall apply the requirements for the content of disclosures when it discloses on the metrics it has in place with regard to each material sustainability matter. It shall disclose any metrics that it uses to evaluate performance and effectiveness, in relation to a material impact, risk or opportunity. For each metric, the undertaking is required to disclose whether the measurement of a metric is validated by an external body other than the assurance provider, label metrics using meaningful, clear and precise names and descriptions, and when currency is specified as the unit of measure, use the presentation currency of its financial statements.

The two cross-cutting general standards give us an insight of how the topical standard are structured, now we will examine the first standard regarding the environment.

The **ESRS E1** is the reference principles regarding the first topic connected to the sustainability of the environment, namely the **Climate change**.

Lot of the requirements included in the ESRS E1 are coherent with the draft regulations in terms of sustainability of other sets of standards like ISSB (International Sustainability Standards Board) and US SEC (Securities and Exchange Commission). The graphic below shows analytically the accordance through the different paragraphs.

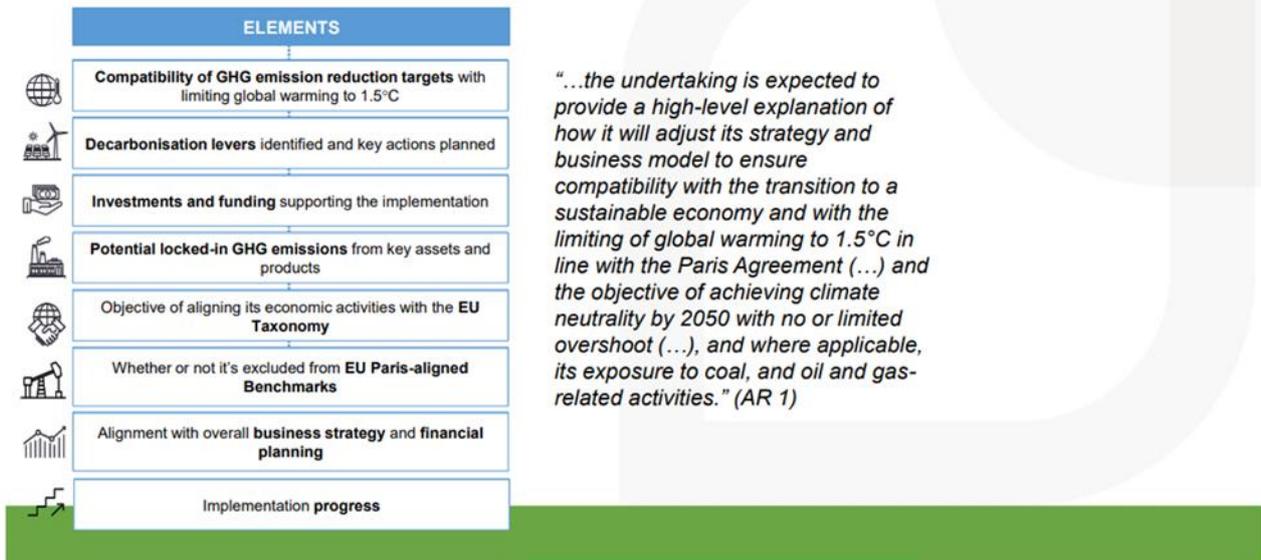


First of all, the principles should be evaluated in combination with the disclosures required by [draft] ESRS 2 Chapters 2 (Governance), 3 (Strategy) and 4 (Impact, Risk and Opportunity Management).

One of the key elements regulated is the transition plan.

The paragraphs 13 and following requires that the undertaking disclose its **transition plan** for climate change mitigation. The objective of this Disclosure Requirement is to enable an understanding of the undertaking's past, current, and future mitigation efforts, ensuring that its strategy and business model(s) are compatible with the transition to a sustainable economy, and with the limiting of global warming to 1.5 °C in line with the Paris Agreement and with the objective of achieving climate neutrality by 2050 and, where relevant, the undertaking's exposure to coal, oil and gas-related activities. The information required includes an explanation of how the undertaking's targets are compatible with the limiting of global warming to 1.5°C in line with the Paris Agreement, an explanation of the decarbonization levers identified, and key actions planned, an explanation of the undertaking's investments and funding supporting the implementation of the transition plan, a qualitative assessment of the potential locked-in GHG emissions, an explanation of the undertaking's objective for aligning its economic activities with the Taxonomy Regulation (EU) 2020/852, a disclosure on whether or not the undertaking is excluded from the EU Paris-aligned Benchmarks, an explanation of how the transition plan is embedded in and aligned with the undertaking's overall business strategy and financial planning, and an explanation of the undertaking's progress in implementing the transition plan. In the case that the undertaking does not have a transition plan in place, they shall indicate whether and, if so, when they will adopt a transition plan.

DR E1-1 – TRANSITION PLAN FOR CLIMATE CHANGE MITIGATION



The disclosure must explain how the decarbonization levers are aligned with its material impacts, risks and opportunities related to climate change mitigation and adaptation. The undertaking shall explain how the decarbonization levers are related to the relevant line items or notes in the financial statements, the key performance indicators required under article 8 of Taxonomy Regulation (EU) 2020/852, and, if applicable, the Capex plan required by Commission delegated regulation (EU) 2021/2178.

The undertaking shall describe the process to identify and assess climate-related impacts, risks and opportunities. This description shall include impacts on climate change, in particular, the undertaking's GHG emissions, as well as climate-related physical and transition risks and opportunities in own operations and along the value chain. It shall also disclose the policies it has adopted to manage its material impacts, risks and opportunities related to climate change mitigation and adaptation. Furthermore, the undertaking shall disclose its climate change mitigation and adaptation actions and the resources allocated for their implementation, as well as the climate-related targets it has adopted. These targets shall include GHG emission reduction targets for Scope 1, 2, and 3 GHG emissions, which shall be disclosed in absolute value and, if deemed meaningful, in intensity value. The undertaking shall also explain how the targets are compatible with limiting global warming to 1.5°C and how the expected decarbonization levers are related to the relevant line items or notes in the financial statements, the key performance indicators required under article 8 of Taxonomy Regulation (EU) 2020/852, and, if applicable, the Capex plan required by Commission delegated regulation (EU) 2021/2178.

One interesting part of the ESRS E1 is the section DR E1-6 related to Metrics and targets regarding emissions.

These requirements include considering the principles, requirements and guidance provided by the GHG Protocol Corporate Standard (version 2004 or the latest one) and GRI 305 (version 2016 which is directly based on the requirements of the GHG Protocol), disclosing the methodologies and emissions factors used to calculate or measure GHG emissions, and providing a reference or link to any calculation tools used.

In addition, the undertaking shall include emissions of CO₂, CH₄, N₂O, HFCs, PFCs, SF₆, and NF₃ and use the most recent Global Warming Potential (GWP) values published by the IPCC based on a 100-year time horizon to calculate CO₂eq emissions of non-CO₂ gases.

The undertaking may also disaggregate its Scope 1, 2 and 3 GHG emissions by country, operating segments, economic activity, subsidiary, GHG category or source type as appropriate. With regard to preparing the information on gross Scope 1 GHG emissions, the undertaking shall calculate or measure GHG emissions from stationary combustion, mobile combustion, process emissions and fugitive emissions, use suitable activity data that include the non-renewable fuel consumption, use suitable and consistent emission factors, disclose biogenic emissions of carbon from the combustion or biodegradation of biomass separately from the Scope 1 GHG emissions, but include emissions of other types of GHG, exclude any purchased, sold or transferred carbon credits or GHG allowances and, for activities reporting under the EU ETS, report on Scope 1 emissions following the EU ETS methodology. For the percentage of Scope 1 GHG emissions from regulated emission trading schemes, the undertaking shall consider GHG emissions from the installations it operates that are subject to regulated Emission Trading Schemes (ETS), including the EU-ETS, national ETS and non-EU ETS, if applicable, only include emissions of CO₂, CH₄, N₂O, HFCs, PFCs, SF₆, and NF₃, ensure the same accounting period for gross Scope 1 GHG emissions and GHG emissions regulated under the ETS and calculate the share by using a specific formula. The undertaking shall disclose the share of GHG emissions regulated under ETS.

The total GHG emissions disaggregated by Scopes 1 and 2 and significant Scope 3 shall be presented according to the table below.

Reporting table	Evolution				Objectives and target years		
	Reference year	N-1	N	% N / N-1	2030	2050	Objective / reference year
EMISSIONS OF GHG SCOPE 1							
Gross GHG emission Scope 1 (tCO ₂ eq)	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	%	tCO ₂ eq	tCO ₂ eq	%
Share of Scope 1 GHG emissions covered by regulated emissions trading schemes (%)	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	%	tCO ₂ eq	tCO ₂ eq	%
SCOPE 2 GHG EMISSIONS							
Gross GHG emission Scope 2 in location-based (tCO ₂ eq)	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	%	tCO ₂ eq	tCO ₂ eq	%
Gross GHG emission Scope 2 in market-based (tCO ₂ eq)	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	%	tCO ₂ eq	tCO ₂ eq	%

To reassume, the EFRAG's first Draft Sustainability standards aims to give a common framework for organizations to report on their sustainability performance. The standards require organizations to provide meaningful information about their impacts on the environment, society, and governance, and also to explain how those impacts are managed.

In particular, following ESRS 1, the impacts on ESG should be evaluated through the principle of the double materiality (impact materiality and financial materiality) giving a holistic view of the company's sustainability effect. In addition, the reporting should include all the material impacts, risks, and opportunities associated with the upstream and downstream value chain(s).

The ESRS 2 highlights that all the sustainability reporting should be evaluated through four pillars: "governance", "strategy", "impact, risk and opportunities" and "metrics and targets".

So for each specific sustainability topical standards the disclosure have to be structured across these principles.

Thanks to these standards, stakeholders will have the ability to analyze the sustainability impacts of companies in a uniform manner, enabling them to make healthier capital allocation decisions. Furthermore, companies can benefit from increased transparency and be rewarded by the market (comprised of customers, suppliers, and investors) for demonstrating positive sustainability behavior.

3.3 Compliance and enforcement of ESG regulation in Europe

Before the entry into force of the CSRD directive, the referenced directive was the Non-Financial Reporting Directive (NFRD) previously applied only to large public interest companies with more than 500 employees, resulting in around 6.000 companies and groups across the European Union such as banks, insurance companies, and other entities designated by national authorities as being of public interest. These companies had to submit reports on their environmental protection, social responsibility, employee treatment, anti-corruption, and diversity on the board of directors' policies. Directive 2014/95/EU provided companies with the flexibility to disclose relevant information in whatever way they believed to be most useful. For companies not subject to the Directive, sustainability-related activities were discussed and disclosed in voluntary, non-audited Supplementary Reports, however the lack of standardization and comparability in these Reports prevented stakeholders from making informed decisions and comparisons.

Throughout history, regulation has been used to ensure compliance with laws and norms, and to protect citizens from potential harm. While laws provide the framework for regulation, it is the enforcement of the regulations that makes them effective.

An example of effective regulation is the Clean Water Act, passed in 1972 in the United States. This act established regulations that set limits on the number of pollutants that can be discharged into waterways. These regulations are enforced by the EPA, which works with individual states to ensure compliance. The EPA has the authority to issue fines, revoke permits, and take other actions against those who fail to comply with the regulations. As a result of this enforcement, water quality has improved significantly since the act was passed.

Another example of effective regulation is the Sarbanes-Oxley Act of 2002, which was passed in response to a series of corporate scandals. This act established requirements for corporate financial reporting and disclosure and set rules for corporate governance. To ensure compliance, the Securities and Exchange Commission was given the authority to impose fines and other punishments on companies that fail to comply with the regulations. Since the act was passed, there have been fewer corporate scandals and the public has greater confidence in the integrity of corporate financial information.

Regulations must be accompanied by enforcement mechanisms to be effective; by enforcing these regulations, governmental agencies are able to protect citizens and promote integrity in the corporate world.

Each Member State will be required to implement the CSRD domestically by July 2024 for it to apply directly to in-scope companies. It remains unclear whether discrepancies may arise between different Member States' implementation and, if so, how any such differences may affect in-scope companies with activities in multiple Member States.⁵²

Enforcement of ESG standards is the responsibility of the European Supervisory Authority (ESA). In particular the ESMA (European Securities and Market Authority) is responsible for monitoring and enforcing compliance with the SFDR, NFRD, and DTR, as well as any other rules and regulations related to ESG standards. The ESMA also has the power to impose sanctions and fines on companies that fail to comply with the regulations.

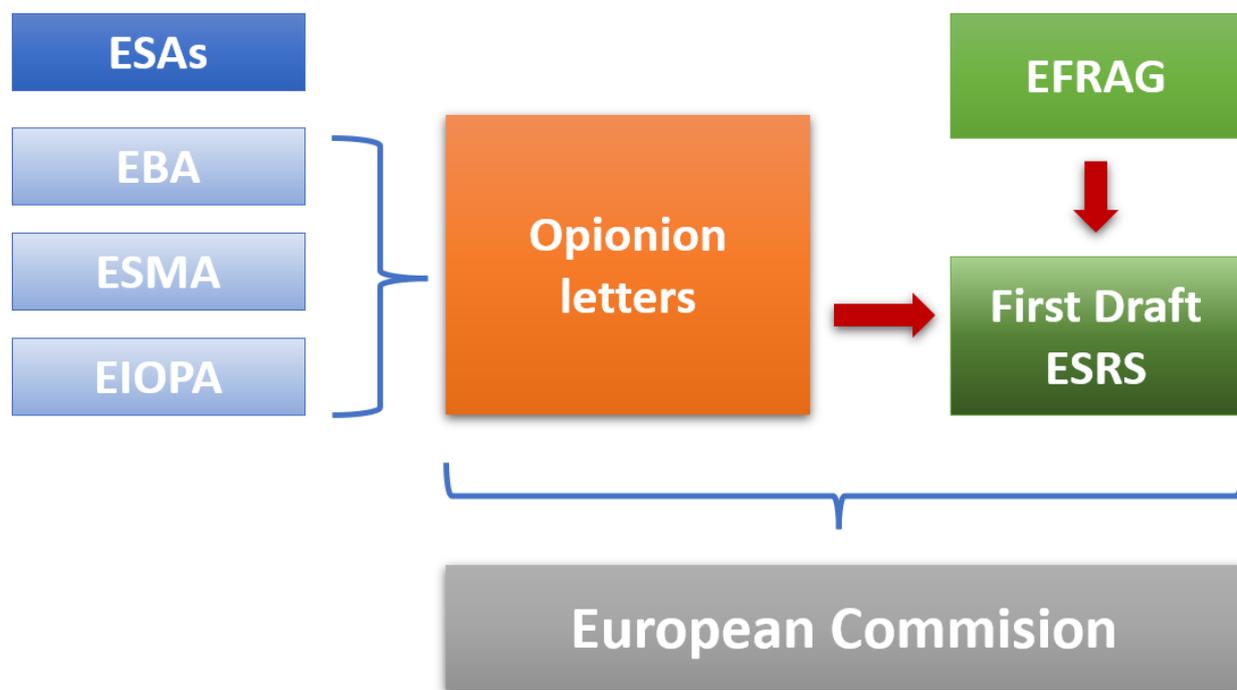
“ESMA’s mandate on corporate sustainability reporting relates to companies with securities listed on a regulated market (i.e., issuers), including their disclosure under the Non-Financial Reporting Directive (NFRD) – soon the Corporate Sustainability Reporting Directive (CSRD) – and under Taxonomy Regulation Article 8. ESMA also contributes to the development of European Sustainability Reporting Standards (ESRS).”⁵³

As highlighted above, the ESMA scope is related to the companies with securities listed on a regulated market. However, the relevance is not limited to the enforcement, in fact, the ESMA is following EFRAG’s work closely and is contributing to it as an observer at both the level of the Technical Expert Group and the Board.

This because, prior to adopting the delegated acts which establish the European Sustainability Reporting Standards, the CSRD requires the European Commission to seek the opinion of EBA, EIOPA and ESMA (Examples of that is the Opinion of The European Securities and Markets Authorities of 26 January 2023). The Commission shall adopt its delegated act for the first set of reporting standards by 30 June 2023, while the delegated act on a second set of reporting standards shall be adopted by 30 June 2024.

⁵² Harvard Law School Forum on Corporate Governance, <https://corpgov.law.harvard.edu/2023/01/30/eu-finalizes-esg-reporting-rules-with-international-impacts/#:~:text=Disclosures%20will%20be%20required%20to,sustainability%20matters%20affect%20the%20company>.

⁵³ ESMA, <https://www.esma.europa.eu/esmas-activities/sustainable-finance/sustainability-reporting>



In addition to the ESA, a number of private companies have emerged to provide assurance services in relation to ESG standards. According to McKinsey & Company, \$5 trillion is expected to be invested annually in sustainability initiatives by 2025. To ensure these sustainability reports are credible and reliable, companies should seek third-party assurance for their ESG and sustainability reporting. ESG assurance, or attestation, provides consistency, comparability, and rigor to non-financial reporting and helps companies prepare for upcoming regulations that require objective reporting. By investing in ESG assurance, companies can ensure their ESG data is accurate and avoid greenwashing. This article provides an overview of ESG assurance and why companies should consider engaging a reputable third-party for one or more components of their ESG reporting.

These companies provide independent third-party verification of companies' ESG reporting and can also provide risk management and advisory services. This has helped to further strengthen the enforcement of ESG standards in the EU.

In conclusion, the European Union has put in place a comprehensive legal framework for regulating ESG standards, and enforcement of these standards is the responsibility of the European Supervisory Authority. Private companies and ESG ratings agencies are also playing an increasingly important role in ensuring compliance. As a result, ESG standards are becoming increasingly important for companies in Europe and investors alike.

4. Structural Analysis on the impact of ESG

4.1 Methodology and research design

In Chapter Two, we conducted a thorough analysis of the concept and historical evolution of sustainability and ESG, along with an overview of the ESG data landscape. In the previous chapter, we examined the current regulations in Europe on ESG disclosure and looked into the framework of the draft sustainability reporting standard developed by EFRAG. Having explored the generation and reporting of this data, we can now focus on addressing the last important question posed in Chapter One: What is the relationship between ESG disclosure, ESG performance, and financial performance?

As introduced in chapter one, the plan is to examine the relationship between ESG, and financial performance through different not only measures but also through different approaches. This is in order to capture all the possible results and give a more holistic view of the effects of sustainability.

The **first strategy** (approach) will emphasize more structural data, specifically less dynamic information, in order to achieve more reliable yet more generalized outcomes.

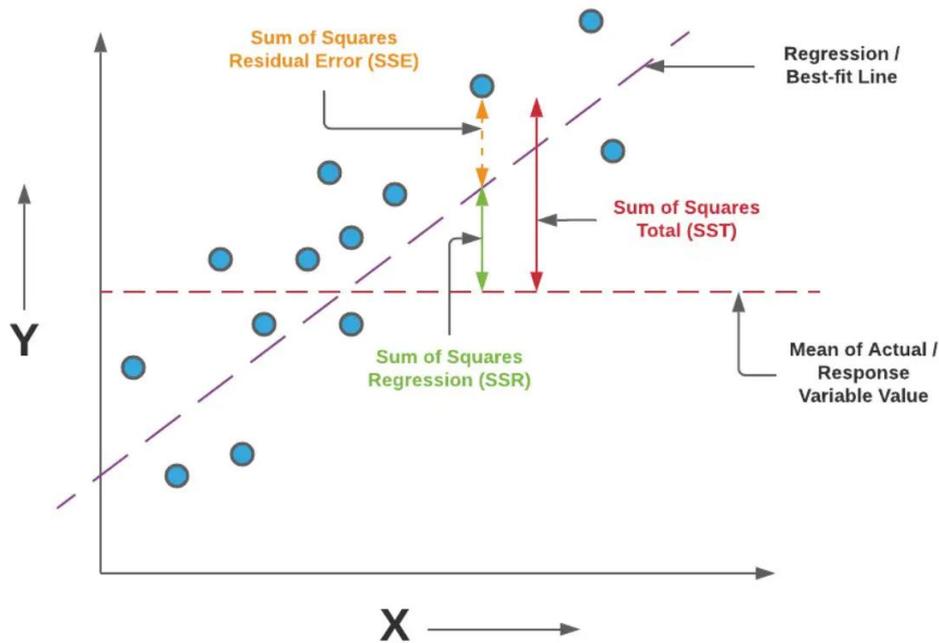
For this analysis we will use data with long timeframe with short periodicity (yearly, quarterly and monthly) and more comprehensive indicators for both ESG and financial performance.

The statistical methodology will be the linear regression which is a linear approach for modelling the relationship between a scalar response and one or more explanatory variables.

The simplest case is referred to as simple linear regression, while multiple linear regression refers to the case when more than one explanatory variable is involved.

The **second approach** will instead be discussed in the chapter 5, and it will involve the use of high frequency data (monthly and weekly) in order to find out if there is a relationship between ESG and markets performance indicators. We named this procedure dynamical analysis as for the nature of the data is focused on less fundamental values (such as WACC, FCFO, ROA, ASY) but more on technical market indicators like the Fama and French 5-Factors.

Different from multivariate linear regression, which is used to predict multiple correlated dependent variables, linear regression focuses on the conditional probability distribution of the response given the values of the predictors. The linear predictor functions and unknown model parameters are estimated from the data and models that depend linearly on their parameters are called linear models. Linear regression is used to reduce error in prediction or forecasting, to explain variation in the response variable attributed to variation in the explanatory variables, or to identify which subsets of explanatory variables may contain redundant information. It is usually fitted using the least squares approach, but other methods such as least absolute deviations regression, ridge regression (L2-norm penalty) and lasso (L1-norm penalty) may also be used. The least squares approach can also be used to fit models that are not linear.



In the multiple regression setting, because of the potentially large number of predictors, it is more efficient to use matrices to define the regression model and the subsequent analyses. Here, we review basic matrix algebra, as well as learn some of the more important multiple regression formulas in matrix form.

$$\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix} = \begin{bmatrix} 1 & x_1 \\ 1 & x_2 \\ \vdots & \vdots \\ 1 & x_n \end{bmatrix} \begin{bmatrix} \beta_0 \\ \beta_1 \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_n \end{bmatrix}$$

$$\mathbf{Y} = \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon}$$

Linear regression models rely on restrictive assumptions about the predictor variables, the response variables, and their relationship. To address this, various extensions have been developed that allow these assumptions to be weakened or even removed altogether. However, these extensions tend to involve more complex and time-consuming estimation procedures, as well as a greater need for data in order to achieve an equally precise model.

The following are the major assumptions made by standard linear regression models with standard estimation techniques:

- **Weak exogeneity.** This essentially means that the predictor variables x can be assumed to be without error, so not contaminated with measurement errors. This assumption is not always realistic, as there may be measurement errors present. However, if this assumption is dropped, it leads to significantly more complex errors-in-variables models.

- **Linearity.** In linear regression, it is assumed that the mean of the response variable is a linear combination of the parameters (regression coefficients) and the predictor variables. This assumption allows for great flexibility in the model structure, as the predictor variables can be transformed in various ways, such as polynomial terms, and multiple copies of the same predictor variable can be added. However, this flexibility can result in overfitting the data, so regularization techniques such as ridge regression, lasso regression, and Bayesian linear regression are typically used to prevent this issue.
- **Homoscedasticity.** This means that the variance of the errors does not stay the same regardless of the values of the predictor variables. Therefore, a variable whose mean is large is likely to have a greater variance than one whose mean is small. The absence of homoscedasticity is called heteroscedasticity, which can be checked with a plot of residuals versus predicted values or predictor variables. This can lead to less precise and biased parameter estimates, resulting in misleading tests and interval estimates. To fix the problem, various estimation techniques such as weighted least squares and heteroscedasticity-consistent standard errors can be used. Additionally, Bayesian linear regression techniques and transformations to the response variable can be employed.
- **Independence of errors.** This assumes that the errors of the response variables are statistically independent. Some methods, such as generalized least squares, can handle correlated errors, although they usually require more data unless some form of regularization is used to bias the model towards assuming uncorrelated errors. Alternatively, Bayesian linear regression can be used to address this issue.
- **Lack of perfect multicollinearity** in the predictors. For standard least squares estimation methods, the design matrix X must have full column rank p ; otherwise, perfect multicollinearity exists in the predictor variables, meaning a linear relationship exists between two or more predictor variables. This can occur when a variable is duplicated in the data, when a linear transformation of a variable is used along with the original (e.g., the same temperature measurements expressed in Fahrenheit and Celsius), or when a linear combination of multiple variables is included in the model, such as their mean. It can also happen if there is too little data available compared to the number of parameters to be estimated (e.g., fewer data points than regression coefficients). When the design matrix does not have full rank, the parameter vector β will be non-identifiable, meaning it has no unique solution. In such a case, only some of the parameters can be identified (i.e., their values can only be estimated within some linear subspace of the full parameter space R^p). Near violations of this assumption, where predictors are highly but not perfectly correlated, can reduce the precision of parameter estimates. Methods for fitting linear models with multicollinearity have been developed, some of which require additional assumptions such as effect sparsity—that a large fraction of the effects are exactly zero. Note that more computationally expensive iterated algorithms for parameter estimation, such as those used in generalized linear models, do not suffer from this problem.

To ensure that these assumptions are met, the regression can't be done directly between the ESG metrics and the financial performance, but we need to include a set of control variables accurately selected and tested.

These variables have a duplicate function. From one side they allow the independence between errors (due to relevant information that's effect financial performance as is obviously not related solely to ESG) and secondly to decompose in a more analytically way the weight of the different key measures on the dependent variable (financial performance).

Let's first focus on the dependent variable. Dependent variables are studied under the supposition or demand that they depend, by some law or rule (e.g., by a mathematical function), on the values of other variables. In our case the dependent variable, which represents the measure whose value we want to explain through the independent variables, is represented by financial performance.

The purpose of corporate financial performance is to provide an objective measure of a company's overall financial health. It is the extent to which a company meets its financial goals and is generally considered to be a reflection of the effectiveness of the management team in executing the company's strategy. Corporate financial performance is typically measured by analyzing such metrics as earnings, profitability, liquidity, and shareholder return.

Which financial performance are we going to consider?

There are some elements we need to keep in mind in order to select the best financial measures for this study. First of all, we are analyzing the relationship with sustainability (ESG) performance.

So, this is unlikely to benefit any particular economic and financial area. As we have seen, it is something that can benefit on several fronts-for example, a reduction in borrowing and capital costs, improving brand gearing and awareness, and attracting customers who are more sensitive to sustainability issues.

Secondly, the selection of very specific performance indicators will require a deep understanding of the financials for at least all the different industries represented in the sample in order to guarantee a correct defining of the control variables. In fact, if from a purely statistically view, an autocorrelation analysis between the independent variable could be enough to guarantee independence in the experiment, to the other sides without a clear financial reasoning between the different variables the lack of dependency might be purely random.

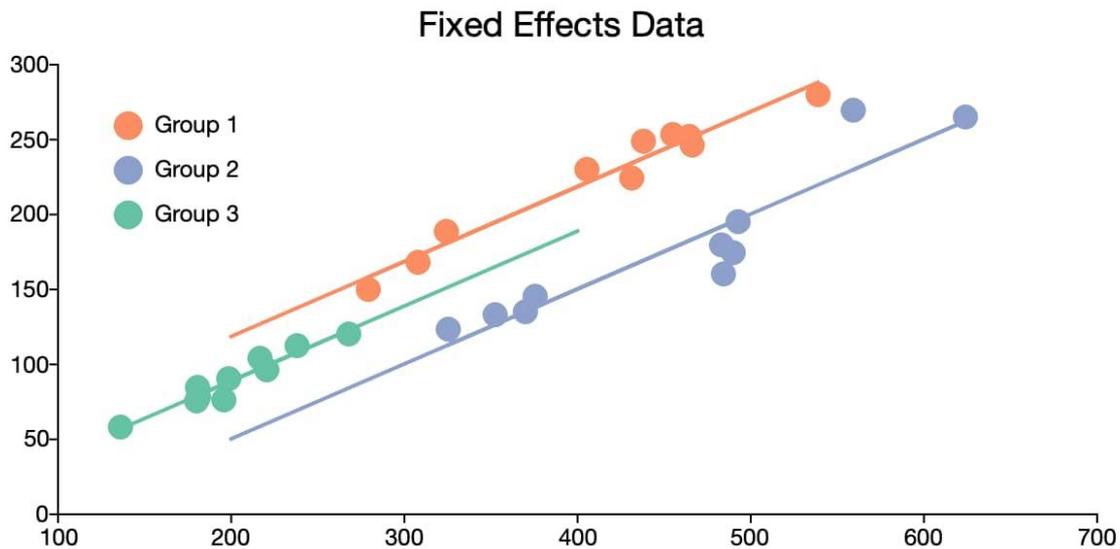
For these reasons, the financial performance indicators selected for the analysis will be the general ones. In particulate we selected three different indicators:

1. Weighted Average Cost of Capital (**WACC**).
2. Price returns (**RoR**).
3. Free Cash Flow from Operations (**FCFO**).

We will undertake a thorough analysis of all these measures in order to gain an understanding of their fundamentals and learn how to manage and interpret the results from the regression.

Before moving to the dependent variables, we are going to introduce the **second technique** we will use in order to analyze the relationship between ESG and financial performance.

In particular, the second methodology will be a **panel (data) analysis**, which is a statistical method, widely used in social science, epidemiology, and econometrics to analyze two-dimensional (typically cross sectional and longitudinal) panel data.



The data are usually collected over time and over the same individuals and then a regression is run over these two dimensions.

This is advantageous relative to pooled regression, which ignores the temporal dimension and combines data from different years, and therefore fails to take into account any potential heterogeneity or unobserved individual effects.⁵⁴ Furthermore, the panel data approach has several advantages over the analysis of individual time series or cross-sectional data. It gives more information with less collinearity among the variables, more degrees of freedom, and more efficiency, and it can control for individual heterogeneity.⁵⁵ Both fixed and random effects estimators were applied and distinguished on the basis of the Hausman test, which suggested that the random effects specification was more appropriate.

$$\begin{aligned}
 y_{i,t1} &= \mathbf{x}'_{i,t1} \boldsymbol{\beta}_{t1} + u_{i,t1} \\
 y_{i,t2} &= \mathbf{x}'_{i,t2} \boldsymbol{\beta}_{t2} + u_{i,t1} \\
 &\vdots \\
 y_{i,T} &= \mathbf{x}'_{i,T} \boldsymbol{\beta}_T + u_{i,T}
 \end{aligned}
 \quad , \quad t=1,2,\dots,T$$

$$\mathbf{y}_i = \mathbf{X}_i \boldsymbol{\beta} + \mathbf{u}_i, \text{ where } \mathbf{y}'_i = y_{i,t1}, y_{i,t2}, \dots, y_{iT}$$

The dependent and control variables for this second analysis will be the same of the previous.

⁵⁴ Ben Rejeb Attia, M.; Lassoued, N.; Chouikha, M. State ownership and firm profitability in emerging markets: A simultaneous equations analysis. *Int. J. Public Sect. Manag.* 2018, 31, 167–183.

⁵⁵ Lee, C.C.; Chiu, Y.B. The impact of real income on insurance premiums: Evidence from panel data. *Int. Rev. Econ. Financ.* 2012, 21, 246–260

4.2 The dependent variables

The **Weighted Average Cost of Capital** (WACC) begins with the insight that companies are simultaneously financed with both debt and equity.⁵⁶ It's calculated as the weighted average of the cost of capital (COE) and the cost of debt (COD) in which the weights are determined by the ratio between equity and debt value (expressed not in book value but in market values).

The WACC can be seen as the return that a company must ensure to its security holders in order to finance its assets. This rate is mandated by the external market, not management, and must be met for creditors, owners, and other capital providers to remain invested. It serves as the minimum return required for a company to maintain its existing asset base.⁵⁷

The formula for the evaluation is reported below:

$$COK = COE \times \frac{\text{Equity}}{\text{Debt} + \text{Equity}} + COD \times \frac{\text{Debt}}{\text{Debt} + \text{Equity}} \times (1 - t)$$

The rationale behind this formulation comes from Modigliani-Miller Theories. Their first proposition which is widely considered one of the most results in all corporate finance, assesses that assuming that individuals can borrow at the same terms as firms, the value of an unlevered firm should be equal to the value of a levered firm.⁵⁸

To understand why this should be true, consider the scenario where an investor is deciding between investing in either firm Unlevered or firm Levered. Rather than purchasing the shares of the levered firm L, they could purchase the shares of firm U and borrow an equal amount of money. Regardless of which option they choose, the investor will receive the same return on their investment.

However, more relevant in the generalization of the WACC was the second proposition, which assesses that a higher debt-to-equity ratio leads to a higher required return on equity, because of the higher risk involved for equity-holders in a company with debt. Debt can be seen as a fixed cost that the company has to pay independently by the results. The shareholders instead can obtain dividends only if the company generates returns.

It follows that the cost of equity of a levered firm (r_E) is an increasing function composed by the of cost of equity of an unlevered firm (r_0) plus the leverage ratio multiplied by the difference between the r_0 and the cost of debt (r_D).

$$r_E = r_0 + \frac{D}{E}(r_0 - r_D)(1 - T_C)$$

⁵⁶ Capital Structure: Valuation and Capital Budgeting for Levered Firm: Chapter 20 from Corporate Finance 4E by Hillier, Ross, Westerfield, Jaffe, Jordan, 2021.

⁵⁷ Fernandes, Nuno. 2014, Finance for Executives: A Practical Guide for Managers, p. 32.

⁵⁸ Capital Structure: Basic Concepts: Chapter 18 from Corporate Finance 4E by Hillier, Ross, Westerfield, Jaffe, Jordan, 2021.

For the determination of the WACC, the main two elements to be computed are the cost of equity and the cost of debt. Before going over the analysis of these key elements, we want to highlight a major mistake frequently made. When use the WACC to discount the cash flows from an investment in order to find its present value is important to use the **unlevered cash flows** because using the levered one it means pricing two times the financial costs (one as interest on the cash flow and one as component of the cost of capital in the WACC determination). Instead, if we want to use the levered cash flows, we should use the cost of equity as discounting factor.⁵⁹

The two main ways of calculating the cost of equity (COK).

- a) Dividend Discount Method (DDM)
- b) Capital Asset Pricing Model (CAPM)

The DDM is based on the assumption that the value of a company is given by the stream of dividends the investor expects to receive over a period of time. Assuming that:

- the growth rate of dividends and the cost of equity are constant from 0 to 1; and
- the growth rate of dividends cannot exceed the cost of equity. Then, we can say – rewriting the Gordon formula – that the cost of equity is:⁶⁰

$$P_0 = \frac{\text{Div}_0 \times (1 + g)}{k_E - g}$$

$$\text{i.e. } k_E = \frac{\text{Div}_0 \times (1 + g)}{P_0} + g$$

Harry Markowitz's pioneering work in modern portfolio theory in 1952 served as the foundation for the Capital Asset Pricing Model (CAPM), which was formalized in articles by William Sharpe, John Linter and Jan Mossin 12 years later. The CAPM provides a prediction of equilibrium expected returns for risky assets.⁶¹

The Capital Asset Pricing Model (CAPM) considers an asset's sensitivity to non-diversifiable risk, commonly referred to as systematic or market risk, represented by beta (β). It also examines the expected return of the market and the risk-free asset.

The CAPM is based on two sets of assumptions. The first set is related to investors behavior and assumes that they are all mean-variance optimizers with common time horizon and set of information's. The second is instead related to the market, asserting that markets are well-functioning with few impediments to trading (efficient market theory).

In light of these assumptions, investors will develop the same risky portfolio, which in turn will determine the **market portfolio**.

⁵⁹ Capital Structure: Valuation and Capital Budgeting for Levered Firm: Chapter 20 from Corporate Finance 4E by Hillier, Ross, Westerfield, Jaffe, Jordan, 2021.

⁶⁰ Pierre Vernimmen. Corporate Finance, Theory and Practice, 2005

⁶¹ Investments, Zvi Bodie, Alex Kane and Alan J. Marcus, 2021, Chapter 9 pp 275

In the CAPM all investors use the same input list, therefore they face the same expected returns, variances and covariances. To compute the variance of the portfolio we need to compute all the covariance between the securities.

In particular focusing on a single security, its contribution to the overall variance of the portfolio will be the weight (w) of the security multiplied by its covariance with the market portfolio $Cov(Re, Rm)$. Including the contribution to risk premium, determined by the weight and the security expected return $E(Re)$, we obtain the following reward-to-risk ratio:

$$\frac{\text{contribution to risk premium}}{\text{contribution to variance}} = \frac{wE(Re)}{wCov(Re, Rm)}$$

Returning back to the market portfolio, it's efficient mean-variance relation is:

$$\frac{\text{Market risk premium}}{\text{Market variance}} = \frac{E(Rm)}{\sigma^2 M}$$

This ratio, also called market price risk, represents the extra return investors will demand to bear portfolio risk. A basic principle of equilibrium is that all investments should offer the same reward-to-risk ratio, so the two reward should be the same:

$$\frac{E(Re)}{Cov(Re, Rm)} = \frac{E(Rm)}{\sigma^2 M}$$

Rearranging, we obtain:

$$E(Re) = \frac{Cov(Re, Rm)}{\sigma^2 M} E(Rm)$$

The ratio between $Cov(Re, Rm)/\sigma^2$ represent the linear regression of the rate of return of the security on the rate of return of the (typically value-weighted) stock-market index and is normally denoted β (*Beta*).

Using the term β and considering the Sharpe ratio of the market portfolio $(E(Rm)-rf)/\sigma^2 M$, we obtain the final equation for the CAPM is:

$$E(Re) = r_f + \beta_m [E(Rm) - r_f]$$

Although this theory has been tested and failed numerous times, as well as competing with more modern portfolio selection approaches, it remains popular due to its simplicity and utility.

For the purpose of the analysis, we will focus on the determination of the cost of equity through the CAPM, in particular we will use the estimations computed by Bloomberg.

The Bloomberg Terminal is a computer software system provided by the financial data vendor Bloomberg L.P. that enables professionals in the financial service sector and other industries to access Bloomberg Professional Services through which users can monitor and analyze real-time financial market data and place trades on the electronic trading platform. It was developed by

employees working for businessman Michael Bloomberg. The system also provides news, price quotes, and messaging across its proprietary secure network.⁶²

We will explain all the steps involved in determining the cost of equity on Bloomberg.

The first element needed is the Beta, in particular the **adjusted Beta** which differentiates for the fact that it tries to estimate a security's future beta.

According to Blume, there is a tendency for betas to converge towards the mean of all betas. He describes the tendency by correcting historical betas to adjust the beta to revert to 1, assuming that adjustment in one period is a good estimate in the next period.

So the adjusted beta is determined in Bloomberg through the following formula:

$$\beta_a = \frac{2}{3} \cdot \beta_{est} + \frac{1}{3} \cdot 1$$

The default settings used by Bloomberg to compute adjusted betas are:

- S&P 500 Index as the independent variable (market portfolio).
- two years' time frame for the data
- regression on the weekly prices for the stock.



The **risk-free rate** is not specific to the security, but rather it is consistent across the market. By default, Bloomberg uses the 10 years old Government Bond yield. The 10-year rate on this screen has a yield of 2.486%.

⁶² "Bloomberg Professional Services". Bloomberg. Archived from the original on March 5, 2017. Retrieved February 27, 2020

Top Results Fixed Income (500) Functions (82) Index/Stats (500) Companies (25) More ▾

Bonds | SRCH »

	R ↓	Issuer Name	Ticker	Coupon	Maturity Date	Currency	Amt Out
42)	▲	United States Treasury Not...	T	1.875	02/15/2032	USD	99.1MMM
43)	▲	United States Treasury Not...	T	1.500	02/29/2024	USD	60.91MMM
44)	▲	United States Treasury Not...	T	1.875	02/28/2027	USD	62.08MMM
45)	▲	United States Treasury Not...	T	2.250	02/15/2052	USD	60.28MMM
46)	▲	United States Treasury Not...	T	1.875	11/15/2051	USD	90.24MMM
47)	▲	United States Treasury Not...	T	1.750	03/15/2025	USD	56.07MMM

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Treasury Yields Surge as Fed Traders Price In Even More Hikes	BN	11:07
Treasuries Sharply Lower; Front-End Slides as Hike Premium Jumps	BFW	09:46
Goldman Sees Higher U.S. Treasury Yields, Curve Inversion (1)	BN	11:13
CNBC: BREAKING 10-year Treasury yield rises to 2-year high of 2.5% as inves...	NS1	11:17
*U.S. 10-YEAR YIELD RISES TO 2.50%, HIGHEST SINCE MAY 2019	BFW	11:15
Goldman Sees Higher U.S. Treasury Yields, Curve Inversion (1)	BN	11:13

Yield Curve Is Flattening Again -- Which Means What?: QuickTake Background
 In bond markets across the world, yield curves are twisting and turning -- and flattening. The curve is a summary of the spreads between the yields on short-, medium- and long-term

Current United States 10 Year Government Note - CT10 Govt Government Bond
 Price ↓ 94-21 1 Day Chg 03 3/8
 Yield 2.486 Type FIXED

Similar to the risk-free rate, the **market risk premium** is also consistent across the market. Often, companies or professors will have a standard market risk premium to use, but you can find Bloomberg's estimate by typing "Market Risk Premium" in the search bar. The resulting page will give further information on the market risk premium as well as Bloomberg's estimate (circled in blue), which is 5.41%.

low yields as a result of this assumed reliability. Equity market returns are based on expected returns on a broad benchmark index such as the Standard & Poor's 500 index of the Dow Jones industrial average. Real equity returns fluctuate with operational performance of the underlying business, and the market pricing for these securities reflects this fact. Historical return rates have fluctuated as the economy matures and endures cycles, but conventional knowledge has generally estimated long-term potential of approximately 8% annually. As of 2016, some economists were calling for a reduction in this assumed rate, though opinions on the topic diverged. Investors demand a premium on their equity investment return relative to lower risk alternatives because their capital is more jeopardized, which leads to the equity risk premium.

Calculation and Application

The market risk premium can be calculated by subtracting the risk-free rate from the expected equity market return, providing a quantitative measure of the extra return demanded by market participants for increased risk. Once calculated, the equity risk premium can be used in important calculations such as CAPM. Between 1926 and 2014, the S&P 500 exhibited a 10.5% compounding annual rate of return, while the 30-day Treasury bill compounded at 5.1%. This indicates a market risk premium of 5.4%, based on these parameters.

The required rate of return for an individual asset can be calculated by multiplying the asset's beta coefficient by the market coefficient, then adding back the risk-free rate. This is often used as the discount rate in discounted cash flow, a popular valuation model.

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So, using the values analyzed before, we can compute the cost of Equity (COK).

$$\text{Cost of Equity} = \text{Risk Free Rate} + (\text{Beta} * \text{Market Risk Premium})$$

$$\text{Cost of equity} = 2.486\% + (1.057 * 5.41\%)$$

$$\text{Cost of equity} = 8.20\%$$

The **cost of debt** is the return that a company provides to its debtholders and creditors. These capital providers need to be compensated for any risk exposure that comes with lending to a company.

Since observable interest rates play a big role in quantifying the cost of debt, it is relatively more straightforward to calculate the cost of debt than the cost of equity.

In particular, the cost of debt can be computed dividing all the costs associated with the provision of debt capital (interests, commissions, etc.).

The simple's formula used for the determination of the cost of debt is the following:

$$\text{Pre tax Cost of Debt} = \frac{\text{Annual costs of financing}}{\text{Avg. Total Financial Debt}}$$

$$\text{After tax Cost of Debt} = \text{Pre tax Cost of Debt} \times (1 - \text{Tax Rate})$$

For large, mostly listed companies, who finance mainly themselves through the issuance of bonds, another methodology is consider the weighted average of the yield on the issued bonds.

Doing this analysis for Apple, the cost of debt determined is about 2.65%.

Corp		Govt	Loan	Pfd	CDS	CDS Idx	Muni	Futr	Opt	IRS	IRS Vol	Gen Govt	Muni Issuer
60	Excluded (45)	Matured/Called, Non-Verified Bonds	62	Advanced Search		SRCH	»	61	Column Settings				
R ↓	Name	Ticker	Coupon	Maturity	BB R..	Mty	Type	Announce	Amt Issued(M..	Ask Px	Bid	Yield to M...	Bid Modified Du...
1	Apple Inc	AAPL	2.700	08/05/2051	AA+	CALLABLE	07/29/2021	1800.00	86.620	3.455	19.233		
2	Apple Inc	AAPL	2.400	05/03/2023	AA+	BULLET	04/30/2013	5500.00	100.501	1.977	1.061		
3	Apple Inc	AAPL	1.700	08/05/2031	AA+	CALLABLE	07/29/2021	1000.00	89.369	3.047	8.475		
4	Apple Inc	AAPL	2.550	08/20/2060	AA+	CALLABLE	08/13/2020	1750.00	81.698	3.444	22.556		
5	Apple Inc	AAPL	1.400	08/05/2028	AA+	CALLABLE	07/29/2021	2300.00	90.897	3.020	5.973		
6	Apple Inc	AAPL	1.200	02/08/2028	AA+	CALLABLE	02/01/2021	2500.00	90.625	2.991	5.564		
7	Apple Inc	AAPL	2.200	09/11/2029	AA+	CALLABLE	09/04/2019	1750.00	95.121	2.966	6.780		
8	Apple Inc	AAPL	3.450	05/06/2024	AA+	BULLET	04/29/2014	2500.00	102.152	2.433	1.991		
9	Apple Inc	AAPL	3.450	02/09/2045	AA+	BULLET	02/02/2015	2000.00	99.124	3.557	15.571		
10	Apple Inc	AAPL	2.400	08/20/2050	AA+	CALLABLE	08/13/2020	1250.00	82.878	3.375	19.430		
11	Apple Inc	AAPL	2.650	02/08/2051	AA+	CALLABLE	02/01/2021	3000.00	86.340	3.428	19.151		
12	Apple Inc	AAPL	3.350	02/09/2027	AA+	CALLABLE	02/02/2017	2250.00	102.158	2.902	4.229		
13	Apple Inc	AAPL	4.650	02/23/2046	AA+	CALLABLE	02/16/2016	4000.00	117.584	3.585	14.892		
14	Apple Inc	AAPL	3.250	02/23/2026	AA+	CALLABLE	02/16/2016	3250.00	101.752	2.808	3.409		
15	Apple Inc	AAPL	1.650	02/08/2031	AA+	CALLABLE	02/01/2021	2750.00	89.526	3.039	8.085		
16	Apple Inc	AAPL	2.850	02/23/2023	AA+	CALLABLE	02/16/2016	1500.00	100.939	1.885	0.717		
17	Apple Inc	AAPL	1.650	05/11/2030	AA+	CALLABLE	05/04/2020	1750.00	90.486	3.013	7.427		
18	Apple Inc	AAPL	4.500	02/23/2036	AA+	CALLABLE	02/16/2016	1250.00	113.583	3.338	10.209		
19	Apple Inc	AAPL	2.950	09/11/2049	AA+	CALLABLE	09/04/2019	1500.00	91.646	3.458	18.189		
20	Apple Inc	AAPL	3.000	11/13/2027	AA+	CALLABLE	11/06/2017	1500.00	100.469	2.941	4.869		
21	Apple Inc	AAPL	3.850	05/04/2043	AA+	BULLET	04/30/2013	3000.00	104.867	3.557	14.310		
22	Apple Inc	AAPL	2.375	02/08/2041	AA+	CALLABLE	02/01/2021	1500.00	86.584	3.376	14.661		
23	Apple Inc	AAPL	1.125	05/11/2025	AA+	CALLABLE	05/04/2020	2250.00	95.477	2.683	3.011		
24	Apple Inc	AAPL	3.200	05/13/2025	AA+	BULLET	05/06/2015	2000.00	101.414	2.755	2.917		

The last two elements are the capital structure and the tax rates. For the capital structure, market values of debt and equity should be used when computing the weights in the WACC formula.⁶³

In Bloomberg this information is highlighted in the Financial Analysis tab.

In Millions of USD except Per Share	Y	2017 Y	2018 Y	2019 Y	2020 Y~	2021 Y	Current
12 Months Ending	6	09/30/2017	09/29/2018	09/28/2019	09/26/2020	09/25/2021	03/29/2022
Current Market Cap	4	796,064.9	1,090,307.5	988,887.0	1,920,272.7	2,428,612.0	2,889,357.0
Short and Long Term Debt	0	115,680.0	114,483.0	108,047.0	122,278.0	136,522.0	122,798.0

The market capitalization, sometimes referred to as market cap, is the total value of a publicly traded company's outstanding common shares owned by stockholders.⁶⁴

Considering the market cap and the current short- and long-term debt, the capital structure can easily be evaluated:

$$\text{Weight of equity} = 2,889,357 / (2,889,357 + 122,798) = 95.93\%$$

$$\text{Weight of debt} = 122,798 / (2,889,357 + 122,798) = 4.07\%$$

Lastly, the tax rate refers to the corporate tax rates in force in the countries where the various listed companies are headquartered.

Considering all the elements, we can then evaluate the WACC:

$$\begin{aligned} WACC &= [\text{Cost of equity} * \text{weight of equity}] + [\text{Cost of Debt} * \text{Weight of debt} * (1 - \text{Tax rate})] \\ WACC &= [9.6\% * 95.93\%] + [2.65\% * 4.07\% * (1 - 13.3\%)] \\ WACC &= 9.21\% + .09\% \\ WACC &= 9.3\% \end{aligned}$$

The second dependent variable we will use are the **prices returns on the stock exchange**.

Once trading starts, share prices are largely determined by the forces of supply and demand.⁶⁵

The stock market is one of the most important venues where companies list their securities and investors can buy and sell them. Investors rely on share prices to make informed decisions about which stocks to purchase, and as such it is important to understand how share prices are determined in the stock market.

⁶³ Fernandes, Nuno. Finance for Executives: A Practical Guide for Managers. NPV Publishing, 2014, p. 30.

⁶⁴ Graham, John R; Smart, Scott B.; and Megginson, William J. (2010). Corporate Finance (third ed.). Mason OH: South-Western Cengage Learning. p. 387. ISBN 9780324782967.

⁶⁵ U.S. Securities and Exchange Commission. "Initial Public Offerings, Pricing Differences."

To begin, share prices are determined through the process known as “**price discovery**”.⁶⁶ This is an ongoing process of buying and selling shares that helps the market gauge the value of a stock. In order for the market to accurately price a security, the supply and demand for the security must be understood. For example, if more investors are buying a stock than sellers, then the price of the stock will increase. Conversely, if more investors are selling a stock than buyers, then the price of the stock will go down. This process of buying and selling shares can also be affected by external economic factors such as inflation or interest rates.

In addition to price discovery, the supply and demand of a security can also be affected by other factors such as news events or **investor sentiment**.⁶⁷ For example, if news outlets release information regarding a company’s improved performance, this may cause an increase in the share price due to increased demand. On the other hand, if the news highlights the company’s poor performance or other negative information, this may cause a decrease in the share price due to reduced demand. Similarly, investor sentiment can have a significant impact on share prices. This is because investors wait to see how other investors are reacting to news before making their own decisions, causing share prices to fluctuate depending on overall investor confidence.

Another key factor in determining share prices is the **profit** of the company. Companies that are profitable tend to have higher share prices than those that are not profitable. This is because when a company is making a profit, investors expect it to do so in the future and thus the stock is likely to be valued higher. On the other hand, if a company is not profitable, then investors may not be willing to pay as much for its shares.⁶⁸

The efficient-market hypothesis (EMH) is a hypothesis in financial economics that states that asset prices reflect all available information. A direct implication is that it is impossible to "beat the market" consistently on a risk-adjusted basis since market prices should only react to new information. Therefore, in an efficient market there is no place for additional factor that influence prices, as all public information should be already incorporated.

Given this assumption, analysts in the fields of economics and finance utilize **random walk** models to analyze the behavior of asset prices, specifically stock prices on markets.

Studies have shown that prices do not simply follow a random walk. Although the serial correlations tend to be low (about 0.05) in the short term, they become stronger over time. Additionally, the sign and strength of these correlations can vary depending on various factors.⁶⁹

In conclusion, there are several factors that influence the share prices of a company in the stock market. These factors include price discovery, news events, investor sentiment, and the company’s

⁶⁶ Khoury-Kassabri, M., & Naim, M. (2020). Price discovery and volatility components across different markets in MENA region. *Journal of Applied Business Research*, 36(3), 58-77.

⁶⁷ Fountas, K., & Hassapis, L. (2019). Investor sentiment and its effect on the stock markets: A case study with artificial neural networks. *International Journal of Computational Economics and Econometrics*, 9(3), 234-258.

⁶⁸ Sengarasy, S., & Rajaram, A. (2015). Stock prices and company's profitability. *Indian Journal of Commerce and Management Studies*, 6(1), 118-126.

⁶⁹ Lo, A. W.; A. C. MacKinlay (1988). "Stock market prices do not follow random walks: evidence from a simple specification test". *Review of Financial Studies*. 1 (1): 41–66. CiteSeerX 10.1.1.4.3468. doi:10.1093/rfs/1.1.41. ISSN 0893-9454.

profitability. By understanding how these factors play a role in share prices, investors can make more informed decisions when investing in the stock market.

In order to obtain stock returns, we will use the prices from Bloomberg and the following formula:

$$R_t = \frac{P_t - P_{t-1}}{P_{t-1}}$$

$$R_t = \ln(P_t) - \ln(P_{t-1})$$

We will use the log return as they grant symmetry. This means that an investment of \$100 that yields a simple return of 50% followed by a simple return of -50% will result in \$75, while an investment of \$100 that yields a logarithmic return of 50% followed by a logarithmic return of -50% will come back to \$100.

Secondly, simple returns are not additive over time. Adding returns for multiple periods does not yield the total return over the total length of time. In other words, simple returns don't satisfy the property of time consistency. For example, if your portfolio goes from \$10 to \$11 in one year and then to \$12 the next year, your annual simple returns would be 10.0% and 9.09% respectively. Adding those returns up would sum up to 19.09%, which is not your actual return of 20%.

The last dependent variable is the **Free Cash Flow from Operations (FCFO)**. FCFO is an important concept in financial accounting used to calculate the total amount of cash a company earns from its regular operations, excluding costs associated with investments in long-term capital items or securities.⁷⁰ Operating activities include any spending or sources of cash that's involved in a company's day-to-day business activities.⁷¹

This financial measure is relevant also in the valuation of the enterprise value through the discounted cash flow technique. The enterprise value is the total value of a company (generally used by other companies when considering a merger or acquisition or by investors to evaluate the fair price), while market value is the value of its shares on the stock market.

$$Enterprise\ value = \sum \frac{FCFO \times (1 + g)}{(WACC - g)}$$

This value can be easily obtained by the quarterly financial statements; therefore, we will only introduce the main elements that compose this measure without further analysis.

The starting measure for the valuation of the FCFO through the indirect technique is the EBIT (Earnings Before Interests and Taxes). To this measure we need to add again the taxes, computed this time without considering the interest, ending up in a lower earning value (NOPAT).

To this value, we need to subtract all the non-cash expenses like depreciation and amortization as they do not really represent a cash outflow but instead an accounting mechanism to distribute the costs of the assets through their lifetime.

The third element to consider is the working capital. The Working capital is a financial metric used to measure the operating liquidity available to an organization, governmental entity, or business. It

⁷⁰ Ross, Stephen, Randolph Westerfield and Bradford Jordan Fundamentals of Corporate Finance

⁷¹ "Financial Dictionary". Kernel. 2021-01-21. Retrieved 2021-02-24.

is comprised of current operational assets, such as cash and inventories, minus current operational liabilities, such as accounts payable and debt coming due within one year. This figure represents the funds that are available to finance operations over a short period of time.⁷²

The change in working capital (difference between the actual value and the values from the previous period) is deducted from the NOPAT. If the current operating asset growth from the previous period, this means for example that the company is accumulating more account receivable which means less cash inflow.

The next elements to be subtracted are the operational capital expenditures (CAPEX), which are measures that are not included in the income statements as relies on multi-year costs that accordingly to IAS 16 should been shown in the balance sheet and amortized annually across their useful lives in the income statement.

Not all CAPEX should be included, but only those related to the core purpose of the business (operational). The capital expenditure (CAPEX) is the cost of developing or providing non-consumable parts for the product or system.⁷³

The last element is represented by the disinvestments, which are the proceeds from the sales of asset. This measure should be added to the value as it means a cash inflow.

$$\begin{aligned} &+ \text{EBIT} \times (1 - \text{Tax Rate}) \\ &+ \text{Non-cash Expenses (Depreciation, Amortization, etc.)} \\ &- \text{Change in Working Capital} \\ &- \text{Operational Capital Expenditures (CAPEX)} \\ &+ \text{Operational Disinvestments} \\ \hline &= \text{Free Cash Flow from Operations} \end{aligned}$$

For the purpose of the analysis, to use a more standardized measure, we divided the FCFO by the total asset, and then we compute the logarithm of this value.

The formula below reassumes the calculus.

$$FCFO\ r = \ln\left(\frac{FCFO}{Tot\ Asset}\right)$$

⁷² Gross Working Capital vs Net working Capital

⁷³ Aswath Damodaran, Applied Corporate Finance: A User's Manual (John Wiley and Sons, 1999),

http://pages.stern.nyu.edu/~adamodar/New_Home_Page/AppldCF/derivn/ch5deriv.html. ISBN 978-0-471-33042-4

4.3 The Independent variables

In this section we will introduce and analyze the ESG data we are going to use in the regression as independent variables.

A symbol that stands for an arbitrary input is called an independent variable, which mean that this measure is not seen as depending on any other variable in the scope of the experiment in question.⁷⁴ In our case, the dependent variable is a measure representing the level of environmental, social and governance of the various companies being analyzed.

In chapter 2 we widely presented the meaning and historical development of sustainability and ESG, while in chapter 3 we analyzed the current regulation in term of ESG disclosure in Europe.

The third relevant step is how people (mainly analysts and investors) use this information to evaluate the levels of sustainability of a firm or an investment.

In the introduction of this thesis, we seen that there are a lot of academic mixed result regarding the relationship between ESG and financial performance.

Despite the mixed empirical evidence, Amel-Zadeh and Serafeim find that many institutional investors, when considering ESG factors in their investment decisions, are motivated by financial performance.⁷⁵

As sustainability has become increasingly important for risk mitigation, green finance, and eco-investing, the demand for data and analysis on this topic has surged. Green finance involves structured financial activities that are designed to achieve better environmental outcomes⁷⁶, while eco-investing involves investing in companies that promote technologies that reduce our carbon dependence and promote more sustainable alternatives.⁷⁷

Going back to the 90's, some financial data service started collecting and analyzing data regarding sustainability. Domini Research & Analytics, Inc. (KLD) founded in 1988 and acquired first by KLD was the first provider of ESG ratings in the world. Since then, a lot of data providers started to analyze ESG data.

For the purpose of this analysis, we selected fives ESG data providers, which are highlighted in the table below:

⁷⁴ Stewart, James. Calculus. Cengage Learning, 2011. Section 1.1

⁷⁵ Amir Amel-Zadeh and George Serafeim, "Why and How Investors Use ESG Information: Evidence from a Global Survey" (2018) *Fin Anal J* 74:87.

⁷⁶ "What is green finance and why is it important?". World Economic Forum. Retrieved 2020-12-28.

⁷⁷ Henshaw, Mark (2010). "Eco Investor Guide" (PDF). Eco Investor Guide, Inc. Archived from the original (PDF) on 25 May 2010. Retrieved 11 June 2010.

Data Provider	Data Matrics	Frequency
	ESG Disclosure	Yearly
	ESG Rating	
	ESG Rating	Monthly
	ESG Rating	Monthly
	ESG Rating	Monthly
	ESG Rating	Monthly

The first data provider we will use is **Bloomberg**. Since 2009, Bloomberg researchers have continually compiled ESG data on thousands of companies from published disclosures and news items and turned it into one number: a disclosure score. This score, along with Bloomberg’s other ESG products, helps investors assess your company’s transparency, risks, and opportunities.

Bloomberg ESG disclosure (B_ESGD) score is not meant to be a quality measure, but instead only shows the extent of ESG-related info made public by an enterprise. It is an exclusive Bloomberg function that goes from 0.1 for companies that reveal the lowest degree of ESG data to 100 for those that publish all ESG-related details collected by Bloomberg. Bloomberg states that “each data point is weighted in terms of importance” and “the score is also tailored to different industry sectors.”⁷⁸ In this way, each company is only evaluated in terms of the data that is relevant to its industry sector.” In comparison, the **Sustainalytics ESG quality** ranking, like the others ESG metrics we will use from different data providers, is “assigned to the company based on its environmental, social and governance (ESG) total score relative to its industry peers.”⁷⁹

The rating runs from 0 for the lowest quality ESG firms to 100 for the highest. This ranking intends to cover a company's level of preparedness, disclosure and controversy involvement across all three ESG themes.

The Bloomberg ESG disclosure score assesses the amount of ESG data a company releases and does

⁷⁸ Bloomberg Professional Services, “The Terminal” available at <https://www.bloomberg.com/professional/solution/bloomberg-terminal/>.

⁷⁹ Sustainalytics Ratings and Research, “Understanding Your Company’s ESG Ratings” (May 2019) available at <https://www.sustainalytics.com/sustainable-finance/2019/04/26/webinar-understanding-esg-risk-ratings-2/>.

not measure the quality of a company's performance on any data point. Nevertheless, we think that being a top-notch ESG company involves disclosing ESG quality. Furthermore, considering the mostly voluntary nature of ESG disclosure requirements, as well as the lack of standardization, one of our hypotheses is that there will be a strong connection between ESG disclosure and ESG quality. Moreover, the Bloomberg ESG disclosure score is more objective in nature, as it does not assign any subjective quality judgements to the individual ESG criteria aside from the relative importance of the data point itself and not what makes a “good” or “poor” quality. Although the Sustainalytics ESG quality score is widely used and published by the industry (as seen on the Bloomberg Financial Terminal), the scores contain considerable value judgements as to what constitutes a company’s “good” or “poor” performance concerning ESG.

Similar to sustainability is the **Bloomberg ESG score (B_ESG)** which is instead of Bloomberg ESG disclosure a quality score. The measure goes from 0 to 100 and tries to capture the performance of the firms in terms of sustainability through the different topic of ESG.

Refinitiv (RE_ESG) provides one of the most comprehensive databases of ESG metrics in the industry, with coverage over 85% of global market cap, incorporating over 630 different ESG metrics, and records dating back to 2002. They offer users the ability to combine and analyze these ESG data with advanced applications for detailed exploration.

The ESG scores are designed to objectively and transparently measure a company’s ESG performance, commitment and efficiency, based on company-provided data. This data includes 10 primary topics, such as emissions, environmental product innovation, human rights, shareholders, etc.⁸⁰ They also provide an overall ESG Combined (ESGC) score, which takes into account any potential ESG controversies impacting the organizations we cover.

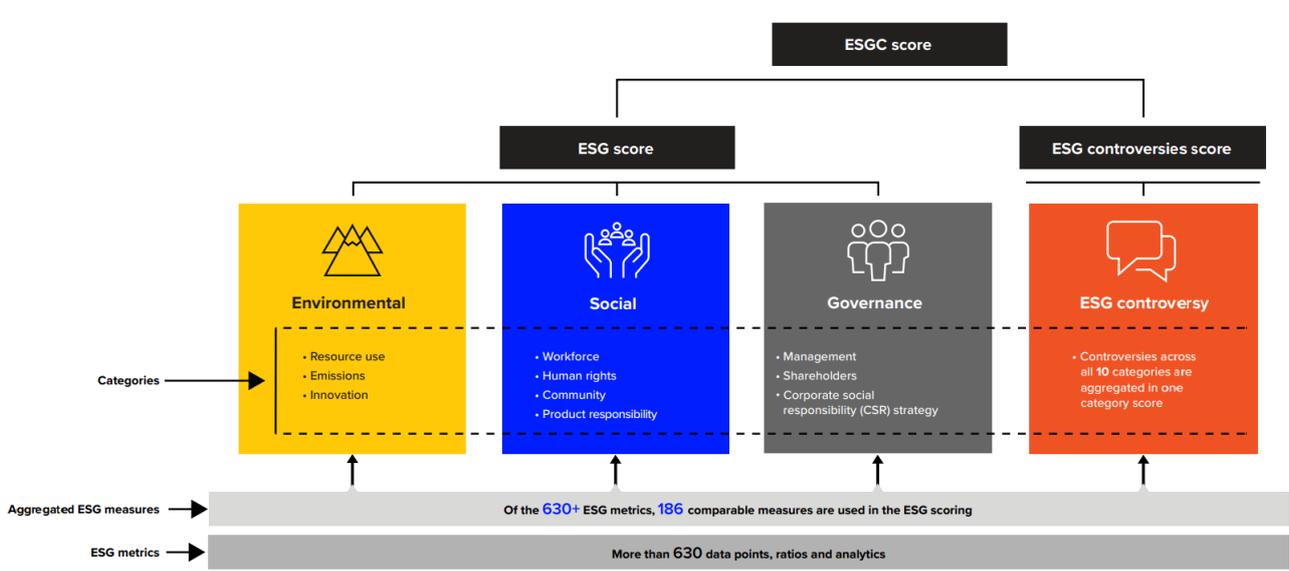
Ratings are provided for more than 12,500 public and private companies globally, and our time series data extends back to 2002. Their percentile rank scores are simple to understand, with scores being expressed in percentages and letter grades from D- to A+. They are benchmarked against The Refinitiv Business Classifications (TRBC – Industry Group) for all environmental and social categories, as well as the controversies score, and against the country of incorporation for all governance categories. Refinitiv's ESG scores are data-driven, accounting for the most significant industry metrics, while minimizing company size and transparency biases. The scores are based on a relative performance of ESG factors with the company’s sector (for environmental and social) and country of incorporation (for governance). Refinitiv does not attempt to define what ‘good’ looks like; we let the data determine industry-based relative performance within the framework of our criteria and data model. The Refinitiv ESG scoring methodology is underpinned by five key calculation principles:

1. **Unique ESG magnitude** (materiality) weightings – as the importance of ESG factors differs across industries, Refinitiv have mapped each metric’s materiality for each industry on a scale of 1 to 10.
2. **Transparency stimulation** – company disclosure is at the core of our methodology. Applied weighting means that not reporting ‘immaterial’ data points will have only a

⁸⁰ Environmental, Social and Governance (ESG) Scores from Refinitiv - May 2022, https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/refinitiv-esg-scores-methodology.pdf

limited effect on a company's score, while not reporting on 'highly material' data points will have a significantly negative impact.

3. **ESG controversies overlay** – they verify companies' actions against their commitments, to magnify the effect of significant controversies on the overall ESG score. The scoring methodology accounts for the market cap bias that larger companies may suffer from, by introducing severity weights, which ensure that controversy scores are adjusted based on a company's size.
4. **Industry and country benchmarks** at the data point scoring level – to enable comparable analysis within peer groups.
5. **Percentile rank scoring methodology** – to eliminate hidden layers of calculations. This methodology allows Refinitiv to generate a score between 0 and 100, as well as easy-to-understand letter grades.



Every twelve months, **RobecoSAM (RO_ESG)** requests 3.500 of the planet's biggest publicly traded companies to join the CSA (RobecoSAM's Corporate Sustainability Assessment).

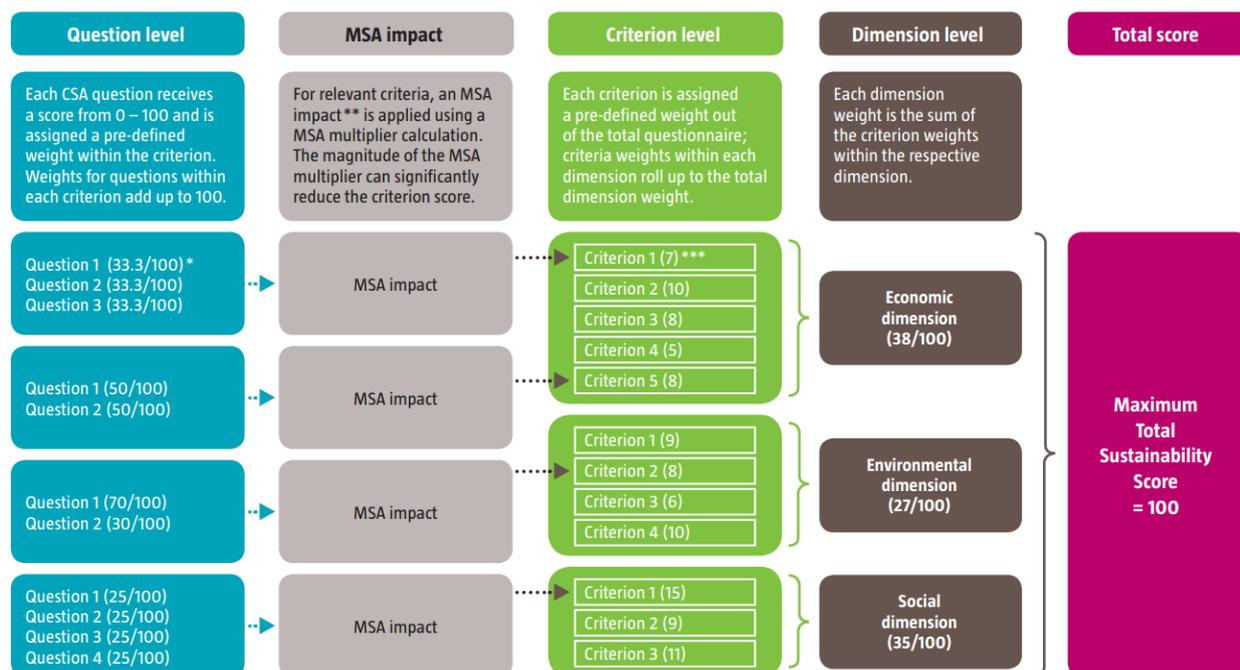
The opening point for RobecoSAM's yearly corporate examination is an **industry-specific questionnaire** concentrating on money related, ecological and social criteria. Because this information is additionally coordinated into money related examination for resource the board items, RobecoSAM centers consideration on supportability elements that can have an effect on organizations' long haul worth creation. As indicated by the maintainability information gathered through the CSA, RobecoSAM recognizes organizations that are bound to surpass desires because of their reception of maintainability best practices.

Computing an organization's last supportability scores is a cycle of applying focuses which are step by step weighted and aggregated until a last gathered score is arrived at. The beginning stage comprises of individual inquiries, the qualities of which are weighted, tallied and accumulated into more extensive regions called criteria.

Similarly, criteria qualities are weighted, tallied and conglomerated into more extensive regions called measurements. Pursuing a similar example, measurements qualities are then weighted and

tallied to locate a most extreme supportability score.⁸¹

While every year the CSA accumulates new information on corporate supportability rehearses, the announced outcomes are supplemented with a **Media and Stakeholder Analysis (MSA)** that inspects more ongoing discoveries which have surfaced through the media and other channels. The MSA screens an organization's supportability execution on a continuous premise by evaluating current contentions which could have possibly negative reputational or money related effect on an organization. The MSA is an extra overlay utilized to change organization scores descending dependent on proof running from deliberate inclusion and mismanagement of questionable episodes to careless lapses in oversight.



Sustainalytics' (S_ESG) ESG Risk Ratings are designed to help investors identify and understand financially material ESG risks at the security and portfolio level and how they might affect the long-term performance for equity and fixed income investments.

The ESG Risk Ratings are based on a two-dimensional materiality framework that measures a company's exposure to industry-specific material ESG risks and how well a company is managing those ESG Risks.⁸²

Sustainalytics ESG Risk Ratings places companies into five risk categories and ranges between 0 to 100:

- **Negligible Risk** (Overall Score of 0-9.99 points): Enterprise value is considered to have a negligible risk of material financial impacts driven by ESG factors.

⁸¹ Measuring Intangibles ROBECOSAM'S CORPORATE SUSTAINABILITY ASSESSMENT METHODOLOGY, https://www.spglobal.com/esg/csa/static/docs/measuring_intangibles_csa-methodology.pdf

⁸² Sustainalytics ESG Risk Rating - FAQs for Corporations.pdf, <https://connect.sustainalytics.com/hubfs/SFS/Sustainalytics%20ESG%20Risk%20Rating%20-%20FAQs%20for%20Corporations.pdf>

- **Low Risk** (10-19.99 points): Enterprise value is considered to have a low risk of material financial impacts driven by ESG factors.
- **Medium Risk** (20-29.99 points): Enterprise value is considered to have a medium risk of material financial impacts driven by ESG factors.
- **High Risk** (30-39.99 points): Enterprise value is considered to have a high risk of material financial impacts driven by ESG factors.
- **Severe Risk** (40 and higher points): Enterprise value is considered to have a severe risk of material financial impacts driven by ESG factors.

These risk categories are absolute, i.e. comparable across sectors.

The ESG Risk Ratings' emphasis on materiality required the addition of a new dimension to our ratings, ESG risk exposure, which reflects the extent to which a company is exposed to material ESG risks and affects the overall risk score for a company as well as its risk score for each MEI. Exposure can be considered as a set of ESG-related risk factors that pose potential financial risks for companies. Another way to think of exposure is as a company's sensitivity or vulnerability to ESG risks. Negligible exposure suggests that the issue is of little material importance to a company; higher exposure suggests that the issue is material. Exposure helps to determine the weight we assign to MEIs; this weight signals how much the issue contributes to a company's overall management score as well as its overall ESG Risk Ratings score. An issue with higher exposure will have a higher weight and an issue with a lower exposure will have a lower weight in a company's overall rating.

The assessment of a company's exposure is done in three steps:

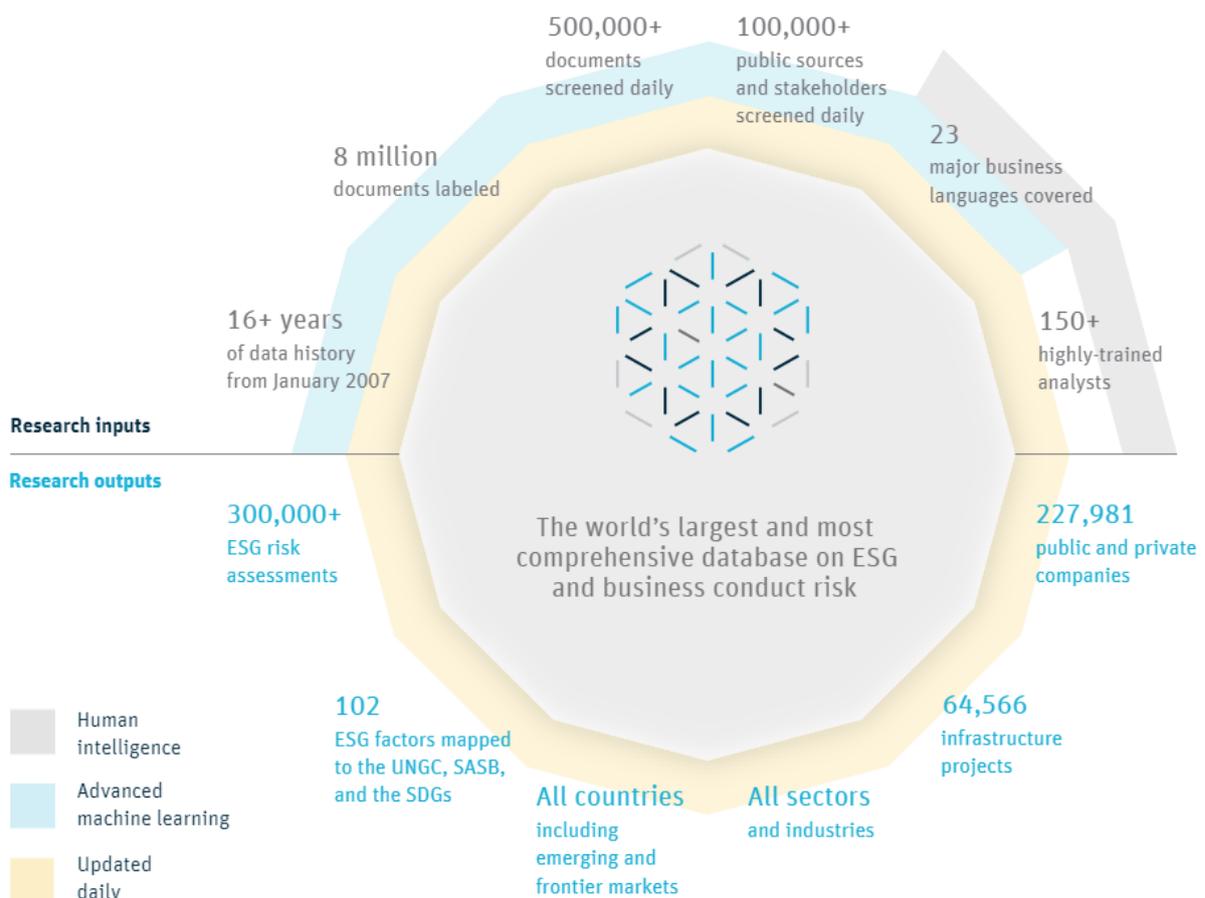
- Step 1: Subindustry Exposure Assessment
- Step 2: Beta Assessment
- Step 3: Calculation of the final exposure score.

The last data provider we will use is **RepRisk (RP_ESG)**. RepRisk follows a strict, rules-based research process that helps ensure consistent data over time. AI and machine learning combined with human intelligence help translate big data into curated research and metrics. The goal of the screening process is to identify any company or project associated with an ESG risk incident, per RepRisk's research scope. RepRisk screens, on a daily basis, over 100.000 public sources and stakeholders in 23 languages. Every day, more than 500.000 documents are aggregated through advanced text and metadata extraction from unstructured content and undergo multilingual de-duplication and clustering processes, reducing incoming documents to approximately 150.000 dailies. These documents are analyzed for relevancy and sentiment scoring, as well as entity detection and issue classification, based on proprietary machine learning models to further support the automatic identification of relevant risk incidents. Based on the machine learning model predictions, each risk incident is automatically tagged to all the entities identified, for example the related companies, projects, sectors, countries, ESG Issues, etc. The automated tagging serves to pre-select the relationships between various entities and issues in the RepRisk Dataset before being distributed for analysis and curation. When a particular risk incident appears in multiple sources, the incident is taken only once, from the most influential source, as this reflects the overall risk exposure.

Whenever possible a sample source in English is selected for display. The incident is only added again if the risk profile of the incident changes.⁸³

The RRI ranges from zero (lowest) to 100 (highest). The higher the value, the higher the risk exposure:

- 0-25 generally denotes **low risk exposure**.
- 26-49 denotes **medium risk exposure**.
Note: It is expected that most large multinationals have an RRI between 26-49, due to their global footprint and salience vis-à-vis media and stakeholders.
- 50-59 denotes **high risk exposure**.
- 60-74 denotes **very high-risk exposure**.
- 75-100 denotes **extremely high-risk exposure**.
Note: The RRI is calibrated in such a way that only the handful of companies that are extremely exposed ever reach this threshold, helping clients to easily identify these companies.



One of the biggest advantage this ESG metrics can represent respect to the other “more traditional” metrics is the combined use of AI algorithm and large data sources.

As a recent study conducted by C. Claudy, Karl Aquino and Maja Graso confirm, AI driven processes

⁸³ RepRisk, Methodology Overview, <https://www.reprisk.com/news-research/resources/methodology>

can guarantee a more impartial and consistent results: *“First, our study sheds new light on the role of impartiality in human-AI interactions. Since AI is not freighted with some of the characteristics that can lead humans to stray from impartiality, it holds the promise of enhancing the accuracy, consistency, and incorruptibility from the social influence of many decision procedures. Importantly, impartiality has been shown to influence the acceptance and legitimacy of decision procedures (Tyler et al., 1985)”*⁸⁴

Unfortunately, due to inability to obtain full access to the data, this ESG metrics will be used only for a small sample (15-25) of US stock.

So, to reassume, all the ESG metrics we will use have a **range in between 0 to 100**, which will help us during the regression.

⁸⁴ Artificial Intelligence Can't Be Charmed: The Effects of Impartiality on Laypeople's Algorithmic Preferences, Marius C. Claudy, Karl Aquino and Maja Graso, 29, June, 2022

4.4 The control variables

Control variables, also known as confounding variables or nuisance variables, are extraneous variables that are not of primary interest in a research study. In regression analysis, these variables are used to compare the effect of an independent variable on the dependent variable, while controlling for other factors. Control variables can help isolate the effect of a primary independent variable on the dependent variable and prevent spurious correlations.

To control for company characteristics that are expected to have a direct or an indirect impact on the cost of capital and for firm risk profile, our review of the cost of capital literature suggests that five factors are most likely to affect the cost of capital. The following factors are used in our study.

1. Total Asset (**Size**)
2. Firm's return on assets (**Return**)
3. Long-term debt/total assets (**Financial Leverage**)
4. Market to book ratio (**information asymmetry**)
5. Years since the company's incorporation date (**Firm age**)

The first control variable is the total **firm's asset (SIZE)**. In financial accounting, an asset can be any resource owned or possessed by a company or an economic entity. It is anything (real or intangible) that can be used to generate positive economic value. Assets symbolize the worth of possession that can be transformed into money (although money itself is also thought of as an asset).⁸⁵

For this reason, the total asset value is usually seen a representative measure of firm's size.

In our case we will use the "logarithm of total assets". Previous studies have shown that firm size has a negative and significant impact on COK; small firms are perceived as riskier than their larger peers.⁸⁶ Large firms attract more media and analyst coverage, which could mitigate information asymmetry risk since they dispose of more information to disclose than their smaller peers.

It is essential to take into account this factor as a control variable, as it is reasonable to assume that larger companies tend to generate a higher level of media attention and, consequently, a higher degree of benefits or detriments to their reputation based on their sustainability practices.

The second control variable is the **return on asset (ROA)**. The return on assets (ROA) shows the percentage of how profitable a company's assets are in generating revenue.

ROA can be computed as below:

$$ROA = \frac{Net\ Income}{Total\ Asset}$$

This figure reveals how effective the firm is at utilizing its resources to generate profits, or how many bucks of income they generate from each dollar of assets they possess. It is a handy metric for evaluating rival companies in the same sector. We include return on assets approximated by the

⁸⁵ O'Sullivan, Arthur; Sheffrin, Steven M. (2021). *Economics: Principles in Action*. Washington, DC: Pearson Prentice Hall. p. 271. ISBN 978-0-13-063085-8.

⁸⁶ Dhaliwal, D.; Li, O.Z.; Tsang, A.; Yang, Y.G. Corporate social responsibility disclosure and the cost of equity capital: The roles of stakeholder orientation and financial transparency. *J. Account. Public Policy* 2014, 33, 328–355

ratio “operating income before depreciation divided by total assets”. Firms with a high return on assets enjoy a low cost of capital.⁸⁷

The third variable is the **financial leverage (LEV)**. In finance, borrowing (or leverage in the United Kingdom and Australia) is a method of taking out loans to purchase items, hoping that upcoming earnings will be many times more than the cost of borrowing. This strategy is called after a lever in physics, which increases a small input force into a bigger output force, as effective leveraging magnifies the smaller amounts of money necessary for borrowing into larger quantities of profit. However, the process also carries the high danger of not being able to pay back a large loan. Generally, a lender will set a limitation on the amount of risk it is willing to take and will set a limit on how much leverage it will allow and would require the purchased asset to be provided as collateral for the loan.

$$\text{Financial Leverage} = \frac{\text{long term debt}}{\text{Total Asset}}$$

Leverage increases profits when the yield from the resource surpasses the expenses of borrowing, but it can also heighten losses. A business which has taken on too much debt could be at risk of going bankrupt or failing to meet payments during a period of economic adversity, while a company with less leverage may stay afloat. For example, if an investor purchases a stock with a 50% margin, they will suffer a 40% loss if the stock price decreases by 20%.⁸⁸

Leverage has a direct impact on the cost of capital since it relates to financial distress. Therefore, high leverage is expected to relate to a higher cost of capital. Previous studies have shown that leverage positively relates to the cost of capital.⁸⁹

The extensive utilization of debt can lead to higher interest costs, which are classified as fixed expenses. If revenues decline, this could lead to potential losses since fixed costs cannot be quickly and easily reduced. If losses accumulate, this increases the possibility of default, prompting financial intermediaries to demand greater compensation for risk (higher interest rates) and, as a result, higher expenses. For this reason, this measure is very important and should be taken into account.

The fourth element is added to take into account the information asymmetry (INFO).

Information asymmetry is estimated by the **market-to-book ratio**, which is calculated by the market worth of equity/the book value of equity.

$$\text{Market to book ratio} = \frac{\text{Market capitalization}}{\text{Book value of equity}}$$

This ratio depends on how a firm's returns on existing assets and anticipated future investments surpass its required rate of return on equity. We claim that the bigger the MB ratio is, the greater is

⁸⁷ Dhaliwal, D.S.; Li, O.Z.; Tsang, A.; Yang, Y.G. Voluntary Nonfinancial Disclosure and the Cost of Equity Capital: The Initiation of Corporate Social Responsibility Reporting. *Account. Rev.* 2011, 86, 59–100.

⁸⁸ Bodie, Zvi, Alex Kane and Alan J. Marcus, *Investments*, McGraw-Hill/Irwin (June 18, 2008)

⁸⁹ Suto, M.; Takehara, H. CSR and cost of capital: Evidence from Japan. *Soc. Responsib. J.* 2017, 13, 798–816.

the information asymmetry between the market and the company.⁹⁰ Companies with a large market-to-book ratio tends to have a higher cost of capital.⁹¹

The last control variable is the **firm age (AGE)**. This measure is computed as years since the company's incorporation date and we will add to the research model because, as predicted by firm lifecycle theory, the cost of capital tends to fall for older firms.⁹² We expect a negative relationship between the firm age and the cost of capital.

For all the measures we will use logarithm of the values in order to obtain symmetry and additivity to the time series.

4.5 The impact of ESG on financial performance

In the previous paragraph we introduced the methodology and all the variables we will use in the analysis. To give a quick visualization recap, the table below reassumes all the elements.

Type	Variables	Description
Dependent Variables	WACC	Weighted Average Cost of Capital
	ROR	Price Returns
	FCFO	Free Cash Flow From Operations
Independent Variables	B_ESGD	Bloomberg ESG Disclosure
	B_ESG	Bloomberg ESG Score
	RE_ESG	Refinitiv ESG Score
	RO_ESG	RobecoSAM (S&P Global) ESG Rank
	S_ESG	Sustainalytics ESG Risk Score
	RP_ESG	RepRisk Index (RRI)
Control Variables	SIZE	Total Asset
	ROA	Return on Asset
	LEV	Financial Leverage
	ASY	Market to book ratio
	AGE	Years since the company's incorporation date

$$WACC_{i,t} = \beta_0 + \beta_1 B_ESGD_{i,t} + Control\ Variables + \varepsilon_{i,t}$$

$$ROR_{i,t} = \beta_0 + \beta_1 B_ESGD_{i,t} + Control\ Variables + \varepsilon_{i,t}$$

$$FCFO_{i,t} = \beta_0 + \beta_1 B_ESGD_{i,t} + Control\ Variables + \varepsilon_{i,t}$$

⁹⁰ Khanchel El Mehdi, I.; Seboui, S. Corporate diversification and earnings management. *Rev. Account. Financ.* 2011, 10, 176–196.

⁹¹ Dhaliwal, D.; Li, O.Z.; Tsang, A.; Yang, Y.G. Corporate social responsibility disclosure and the cost of equity capital: The roles of stakeholder orientation and financial transparency. *J. Account. Public Policy* 2014, 33, 328–355.

⁹² Lassoued, N.; Ben Rejeb Attia, M. Benefits and costs of political connections: Evidence from Tunisia. *Int. J. Account. Audit. Perform. Eval.* 2014, 10, 299–325.

Above are illustrated the regression equations for the first independent variable (B_ESGD). The same structure will be evaluated for all the independent variables resulting in 18 total regressions.

Before going deep to the analysis, we are going to quickly introduce and analyze the sample of companies we will use.

As introduced in the first chapter, the sample we selected is the **STOXX Europe 600 index**.

The STOXX 600 Index is a broad-based index comprising 600 of the largest and most liquid stocks across 18 European countries. The STOXX Europe 600 was introduced in 1998.

Its composition is reviewed four times a year, in March, June, September, December. The index is available in several currencies (AUD, CAD, CHF, EUR, GBP, JPY, USD) and return (Price, Net Return, Gross Return) variant combinations. The index is weighted based on the free-float adjusted market capitalization of the constituents. The components of the index are reviewed and adjusted quarterly, based on criteria such as liquidity, size, and sector balance. The index is calculated using the net total return method, which includes reinvestment of all dividends and other distributions.

The Free-Float Market Capitalization, which determines the weights of each constituent in Free-Float Market Capitalization weighted indices is computed with in the following way:⁹³

1. Determination of free-float market capitalization weights:

$$w_{it} = \frac{p_{it} \cdot n_{it} \cdot ff_{it}}{\sum_{i=1}^n p_{it} \cdot n_{it} \cdot ff_{it}}$$

Above are plotted the 10 main companies with the relative weights.⁹⁴

Company	Supersector	Country	Weight (%)
NESTLE	Food, Beverage & Tobacco	Switzerland	3.15
ASML HLDG	Technology	Netherlands	2.57
NOVO NORDISK B	Health Care	Denmark	2.44
LVMH MOET HENNESSY	Consumer Products & Services	France	2.23
ASTRAZENECA	Health Care	Great Britain	2.02
ROCHE HLDG P	Health Care	Switzerland	1.88
SHELL	Energy	Great Britain	1.87
NOVARTIS	Health Care	Switzerland	1.81
TOTALENERGIES	Energy	France	1.38
HSBC	Banks	Great Britain	1.29

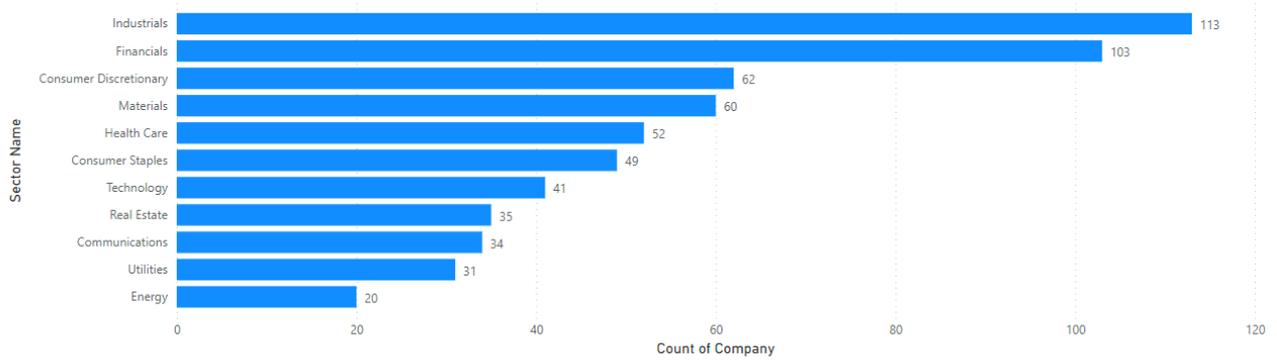
The data we are going to use is dated **31.03.2023**, and the tables above reassumes the numbers of firms by industry and firm size.

⁹³ STOXX_index_guide_2023-04-06,

https://www.stoxx.com/document/Indices/Common/Indexguide/stoxx_index_guide.pdf

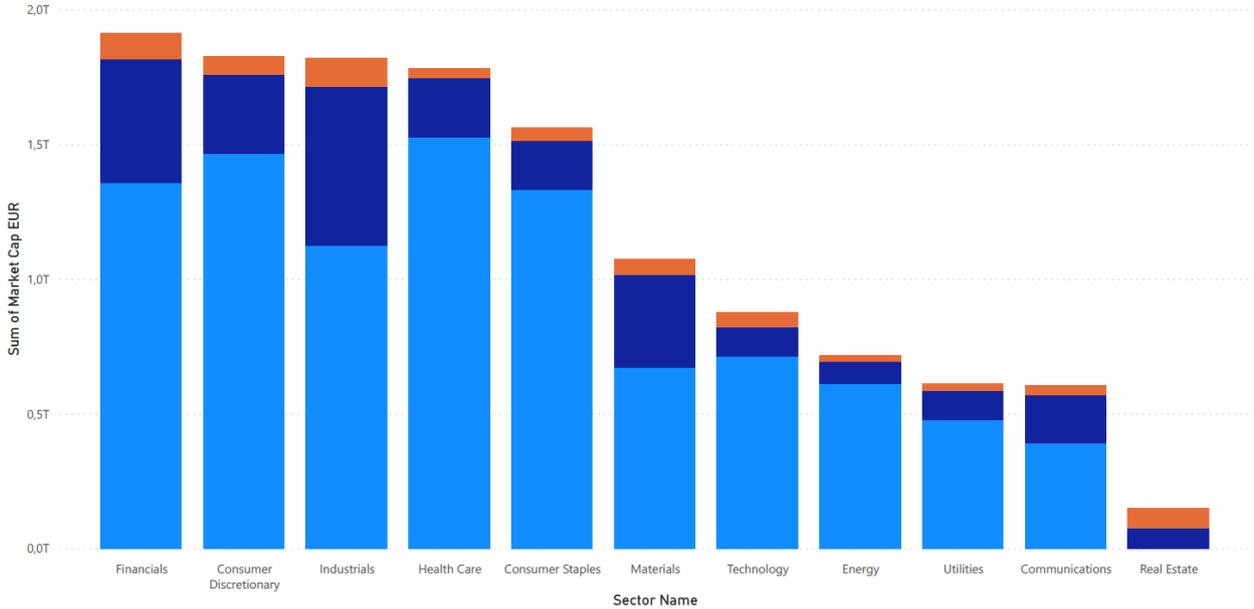
⁹⁴ Based on the composition as of Mar. 31, 2023

Count of Company by Sector Name

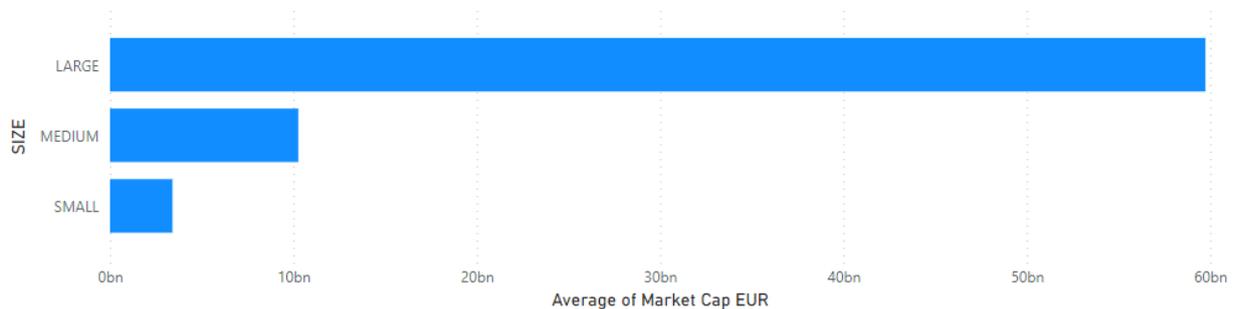


Sum of Market Cap EUR by Sector Name and SIZE

SIZE ● LARGE ● MEDIUM ● SMALL



Average of Market Cap EUR by SIZE



In order to have all the ESG metrics with a range from 0 to 100, we multiplied the Bloomberg ESG performance by 10. The last two ESG metrics (S_ESG and RP_ESG) will be used only in the second type of analysis as the data we obtained starts only by the 01/01/2019.

The table (table1) above reassumes the main descriptive statistics of all the variables used in the regression.

Except for SIZE, all the other variables have a median very close to the mean, this is an important information as it means that the distributions of the variables tend to be normal.

Table 1

Variables	Median	Mean	Std. Dev.	Min	Max
AGE	9,000	7,179	3,327	0,000	10,000
LV	0,621	1,221	3,807	0,000	84,737
SIZE	15.870	117.187	316.720	155	3.061.000
ROA	4,32%	5,15%	6,08%	-21,75%	69,01%
ASY	2,25	3,49	4,04	0,02	47,68
WACC	7,44%	7,64%	3,17%	0,00%	25,02%
FCFO	722	1.529	13.257	-243.977	159.110
ROR	3,84%	3,17%	27,97%	-127,83%	134,90%
B_ESGD	54,532	54,115	10,914	13,062	83,010
B_ESG	38,600	39,094	12,890	6,300	80,100
RE_ESG	71,970	69,402	15,222	3,300	95,130
RO_EGS	70,000	66,118	25,776	0,000	100,000

The first regression is focused on analyzing the relationship between the financial performance (the three indicators highlighted in paragraph 4.2) and the ESG performance. We used the annual data for the whole sample, without subdividing the companies by size and industry.

In the table below (Table 2) are summarized the results.

First of all, if we focus on the R^2 values (or coefficient of determination) which represent how well observed outcomes are replicated by the model, based on the proportion of total variation of outcomes explained by the model.⁹⁵ Values of R^2 near zero means that the model fails to predict well the data and its result are not statistically significance.⁹⁶

Table 2

Regression	N° of Obs.	R ²	ESG	SIZE	ROA	ASY	LV	P Values	Sign
FCFO-B_ESGD	2.877	0,27	0,0185	-0,1756	0,5364	0,0126	-0,0105	0,0000	***
FCFO-B_ESG	2.568	0,28	0,0057	-0,1693	0,6537	0,0152	-0,0123	0,0020	***
FCFO-RE_ESG	1.800	0,30	0,0129	-0,1905	0,5377	0,0157	-0,0065	0,0000	***
FCFO-RO_ESG	2.842	0,26	0,0061	-0,1769	0,5090	0,0116	-0,0148	0,0000	***
ROR-B_ESGD	2.877	0,04	-0,0003	-0,0037	0,3872	0,0095	0,0004	0,4849	
ROR-B_ESG	2.568	0,04	-0,0005	0,0018	0,4816	0,0092	-0,0082	0,2687	
ROR-RE_ESG	1.800	0,09	0,0001	-0,0204	0,0984	0,0137	0,0015	0,7365	
ROR-RO_ESG	2.842	0,04	-0,0006	0,0007	0,4104	0,0094	-0,0046	0,0037	***
WACC-B_ESGD	2.877	0,17	0,0003	-0,0065	0,0238	0,0007	-0,0003	0,0000	***
WACC-B_ESG	2.568	0,23	0,0002	-0,0048	-0,0072	0,0010	-0,0061	0,0000	***
WACC-RE_ESG	1.800	0,19	0,0001	-0,0062	0,0048	0,0010	-0,0006	0,0087	***
WACC-RO_ESG	2.842	0,18	0,0001	-0,0061	0,0166	0,0008	-0,0020	0,0000	***

⁹⁵ Draper, N. R.; Smith, H. (1998). Applied Regression Analysis. Wiley-Interscience. ISBN 978-0-471-17082-2.

⁹⁶ Casella, Georges (2002). Statistical inference (Second ed.). Pacific Grove, Calif.: Duxbury/Thomson Learning. p. 556. ISBN 9788131503942.

If we compare this finding with others obtained in other studies, we can confirm that they are in line. For example, in the work conducted by Friede, Gunnar and Busch⁹⁷ they highlighted a weighted average correlation of 0,11.

In our case, all the regression computed with dependent variable price returns (RoR) are not significant as the R-squared are always (independently by the ESG metrics used) below 10%.

If we move to the regressions computed on WACC and FCFO we observe more interesting results, with R² of about 20-25% which are not very satisfactory but are in lines with other previous studies on ESG.⁹⁸

In the WACC regressions, looking at the ESG estimates, we observe values which are quite insignificant (below 0,1%) suggesting that in the data analyzed there is no relationship between the dependent and independent variables. Also, the control variables don't show significant values.

Moving to the FCFO, the regressions evidence more appreciable coefficient of determination values (almost 30%). However, the more interesting indicators are the ESG parameter estimations.

If we focus to the more consistent ESG metrics from the point of view of data reliability (due to the fact that is computed considering only information's directly reported by the companies), which is Bloomberg ESG Disclosure (B_ESGD), the estimate is almost 2%.

Is true that control variables such as Size and ROA have a higher impact (respectively -17% and 53%) but the interesting part is that the others (ASY, LV and AGE and AGE) do not exhibit a higher impact.

This suggests that in our sample, analyzing data from 31.12.2016 to 31.12.2022, the Bloomberg ESG disclosure value has a higher impact in the Free Cash Flow from Operations than the leverage and the information asymmetry. We have seen in the paragraph that 4.4 that previous studies have shown that leverage positively relates to the cost of capital.⁹⁹ Other analysis have shown that firms with a high market-to-book ratio (ASY) tend to have a higher cost of capital.¹⁰⁰

Mixing up all these elements, the result obtained, although not exceptional, represent a stimulating starting point for more structured and detailed future analyses.

We move now to the **panel data analysis**, where we conducted distinct regressions for each individual year.

In the table below (table 3) are summarized the key results by year. The estimates confirm what we observe in the total regression, however the objective of this analysis was more focused on the trend behavior of the ESG estimates.

In particular, the results highlight a certain growth in the significance of ESG values on financial performance especially in 2021 and 2022.

Moreover, in 2022 we observe a certain relationship not only on FCFO but also in ROR and WACC.

⁹⁷ Friede, Gunnar and Busch, Timo and Bassen, Alexander, ESG and Financial Performance: Aggregated Evidence from More than 2000 Empirical Studies (October 22, 2015). Journal of Sustainable Finance & Investment, Volume 5, Issue 4, p. 210-233, 2015, DOI: 10.1080/20430795.2015.1118917, Available at SSRN: <https://ssrn.com/abstract=2699610>

⁹⁸ Khanchel, I.; Lassoued, N. ESG Disclosure and the Cost of Capital: Is There a Ratcheting Effect over Time? Sustainability 2022, 14, 9237. <https://doi.org/10.3390/su14159237>

⁹⁹ Sharfman, M.P.; Fernando, C.S. Environmental risk management and the cost of capital. Strateg. Manag. J. 2008, 29, 569–592.

¹⁰⁰ Dhaliwal, D.; Li, O.Z.; Tsang, A.; Yang, Y.G. Corporate social responsibility disclosure and the cost of equity capital: The roles of stakeholder orientation and financial transparency. J. Account. Public Policy 2014, 33, 328–355.

This supports the thesis that sustainability is emerging as an increasingly pertinent measure that society cares about. Also, the average R² demonstrates slightly improved values compared to the full regression, indicating a more accurate model estimate over the years.

Similar result were also founded in the work conducted by Khanchel.⁹⁸

The rationale underlying this finding is based on stakeholders and the financial market demonstrating an increasing and substantial interest and enthusiasm for green products and environmental practices. This profound dedication to ecological commitment can be harnessed as a competitive edge. Managers are aware of the significance of environmental disclosure in effectively portraying a proactive environmental image, thus preserving or elevating their firms' legitimacy. With growing stakeholder interest and heightened media focus on environmental endeavors, the present environment offers CEOs an ideal platform to foster a favorable perception among stakeholders and society as a whole.

Table 3

Regression	R ²	ESG 2016	ESG 2017	ESG 2018	ESG 2019	ESG 2020	ESG 2021	ESG 2022
FCFOL-B_ESGD	0,33	2,28%	1,84%	1,89%	2,13%	1,85%	2,10%	2,44%
FCFOL-B_ESG	0,33	1,15%	0,75%	0,40%	0,80%	-0,43%	0,38%	0,42%
FCFOL-RE_ESG	0,35	1,29%	1,02%	0,99%	1,96%	1,77%		
FCFOL-RO_EGS	0,34	1,07%	0,63%	0,51%	0,65%	0,36%	0,51%	0,53%
ROR-B_ESGD	0,05	0,25%	-0,07%	0,03%	-0,18%	0,09%	2,10%	2,17%
ROR-B_ESG	0,07	0,37%	-0,15%	-0,08%	-0,07%	-0,02%	0,38%	0,28%
ROR-RE_ESG	0,04	0,16%	-0,06%	-0,01%	-0,06%	0,06%		
ROR-RO_EGS	0,04	0,04%	-0,10%	0,05%	0,03%	0,00%	0,51%	0,53%
WACC-B_ESGD	0,16	0,04%	0,02%	0,02%	0,01%	0,02%	2,10%	2,17%
WACC-B_ESG	0,23	0,03%	0,00%	0,01%	0,00%	0,01%	0,38%	0,28%
WACC-RE_ESG	0,27	0,01%	0,01%	0,01%	0,00%	0,01%		
WACC-RO_EGS	0,22	0,01%	0,01%	0,00%	0,00%	0,01%	0,51%	0,53%

We will now analyze the results dividing the data by industry. In this case we used the total time span (2016-2022) with yearly observations. From the result highlighted in the table 4, we observe that for some industry like Communications, Consumer Discretionary and Technology there is no significant evidence of a positive relationship between financial performance and ESG ratings, indeed, in some cases is even negative.

Table 4

Industry	N° of Obs.	R ²	B_ESGD	B_ESG	RE_ESG	RO_ESG
Communications	154	0,16	-1,67%	-1,41%	0,19%	-0,97%
Consumer Discretionary	280	0,35	-0,52%	-0,21%	-1,44%	0,28%
Consumer Staples	252	0,11	1,32%	0,80%	1,09%	0,15%
Energy	91	0,11	1,32%	0,80%	1,09%	0,15%
Financials	511	0,21	0,54%	-1,65%	1,18%	0,67%
Health Care	252	0,34	0,19%	-1,87%	0,57%	1,49%
Industrials	567	0,18	0,26%	-0,71%	1,14%	0,09%
Materials	336	0,22	3,97%	3,66%	2,66%	1,25%
Real Estate	119	0,28	4,24%	3,21%	3,32%	1,25%
Technology	161	0,18	-0,55%	0,01%	-1,31%	-1,17%
Utilities	154	0,22	-2,51%	0,55%	-1,55%	-1,55%

The most encouraging results are in the materials and real estate industries, with values of about 4 %. This behavior is confirmed by research conducted in 2022 by Phoenix Health & Safety¹⁰¹ in which they highlight that the manufactory and the real estate are among the industries where there is greater adoption of sustainable practices (table 5).

Table 5

Overall category	No. Businesses	% of Total
Retail	145	7.94%
Manufacturing	142	7.78%
Hospitality (Real Estate)	135	7.39%
Veterinary	126	6.90%
Housing & Property	104	5.70%
Technology & Security	101	5.53%
Fashion	96	5.26%
Finance	90	4.93%
Personal Care Services	70	3.83%
Digital & Telecommunications	69	3.78%
Education	65	3.56%
Agriculture	59	3.23%
Energy & Renewables	51	2.79%
Construction	46	2.52%

The final aspects to consider in this initial structural analysis pertain to the impact of size on the correlation between ESG factors and financial performance.

In order to perform this type of analysis we divided the STOXX 600 companies by size using the following intervals, calculated with the aim to have equals number of observations within the different size classes (table 6).

¹⁰¹ Nick Higginson, CEO - Phoenix Health and Safety | Published: 11 DECEMBER 2022, Data Source Phoenix Health & Safety, <https://www.thehrdirector.com/features/csr/what-are-the-most-sustainable-industries/>

Table 6

INTERVALS	SIZE
ASSET < 10.000	SMALL
10.000 > ASSET < 50.000	MEDIUM
ASSET > 50.000	LARGE

ASSET represented in millions.

The table 7 resumes the result of the multilinear regression.

Table 7

Variables	FCFO			WACC			ROR		
	SMALL	MEDIUM	LARGE	SMALL	MEDIUM	LARGE	SMALL	MEDIUM	LARGE
N° of Obs.	1.034	1.015	828	1.034	1.015	828	1.034	1.015	828
R ²	0,10	0,10	0,24	0,09	0,15	0,21	0,06	0,08	0,04
RE_ESG	0,009	0,010	0,028	0,000	0,000	0,000	-0,001	0,000	0,000
RO_ESG	0,005	0,002	0,004	0,000	0,000	0,000	-0,001	-0,001	0,001
B_ESGD	0,011	0,004	0,025	0,000	0,000	0,000	0,000	0,001	-0,001
B_ESG	0,006	0,000	0,011	0,000	0,000	0,000	-0,001	-0,001	0,000
SIZEL	-0,105	-0,134	-0,552	-0,009	-0,001	-0,008	-0,024	-0,004	-0,008
ROA	0,271	-0,633	0,674	-0,018	-0,031	0,053	-0,305	0,724	0,924
ASY	0,017	0,120	0,019	0,000	0,003	0,002	0,013	0,019	0,005
LV	-0,103	-0,104	0,010	-0,007	-0,009	-0,002	-0,031	-0,018	0,001
P_values	0,025	0,356	0,093	0,030	0,026	0,393	0,343	0,361	0,410
Sign	**	*	**			*	**	**	**

From the estimate we can observe that there is a significant higher correlation between ESG and financial performance (mainly FCFO) in large companies then in smalls and mediums.

One possible reason is that there is a slightly higher ESG performance in large companies than in smalls as shows table below (table 8).

Table 8

SIZE	B_ESGD	B_ESG	RE_ESG	RO_ESG
SMALL	50,12	37,22	62,29	54,53
MEDIUM	55,71	40,90	70,89	69,67
LARGE	57,16	39,13	76,76	76,09

However, the difference is not so relevant, and moreover this can't justify alone a higher relation in the multilinear regression. So, the result can confirm that one of the main benefits from sustainability is the opportunity to improve the brand awareness, reputation, public image, and market standing of a company. These types of benefits are clearly more effective in large companies which have the possibility to communicate in a wider and more holistic way their sustainable investments and initiatives.

This is confirmed by a survey conducted by Accenture and reported in the paper “From The stockholder to the Stakeholder”¹⁰².

In particular, they found that “81% of CEOs believe that the sustainability reputation of their company is important in consumers’ purchasing decisions”.

The last and more complex study we made on the structural analysis are the regressions considering both industries and size.

In order to compute that, we determined for each industry the 33% and 66% percentiles of total Asset, and then we divided the companies by these thresholds into small, medium and large.

The table below (table 9) resumes all the thresholds values computed.

Table 9

INDUSTRY	SMALL	MEDIUM	LARGE
Industrials	ASSET < 6.835	6.835 < ASSET < 15.880	ASSET > 15.880
Consumer Staples	ASSET < 8.005	8.005 < ASSET < 40.494	ASSET > 40.494
Financials	ASSET < 94.067	94.067 < ASSET < 502.904	ASSET > 502.904
Technology	ASSET < 3.587	3.587 < ASSET < 11.692	ASSET > 11.692
Health Care	ASSET < 3.379	3.379 < ASSET < 18.479	ASSET > 18.479
Materials	ASSET < 8.402	8.402 < ASSET < 16.666	ASSET > 16.666
Consumer Discretionary	ASSET < 6.517	6.517 < ASSET < 19.015	ASSET > 19.015
Energy	ASSET < 13.925	13.925 < ASSET < 121.840	ASSET > 121.840
Real Estate	ASSET < 10.161	10.161 < ASSET < 21.751	ASSET > 21.751
Communications	ASSET < 10.228	10.228 < ASSET < 37.613	ASSET > 37.613
Utilities	ASSET < 19.595	19.595 < ASSET < 47.617	ASSET > 47.617

Then we computed the regression for each combination of size, industry, dependent variable (ROR, WACC and FCFO) and independent variable (B_ESG, E_ESGD, RE_ESG and RO_ESG).

In particular, in total we computed 396 different regressions.

The table below reassumes the values for the small companies.

The first key results that stands out are the R² estimates, which are significantly better than previous analysis. This is might due to the use of more homogeneous data structure as all the companies shares a lot of characteristics (industry and size). In this way data are more normalized and more suitable for computing regression. Normalization refers to the process of scaling the features or variables in a dataset to a standard range. This is typically done to ensure that all variables have a similar influence on the regression model and to prevent any particular variable from dominating the others due to differences in their scales or units.¹⁰³

By normalizing the variables, you can alleviate the impact of scale differences and promote stable and accurate coefficient estimates in linear regression. This can be particularly beneficial when the variables in your dataset have different measurement units or varying ranges of values.

¹⁰² Clark, Gordon L. and Feiner, Andreas and Viehs, Michael, From the Stockholder to the Stakeholder: How Sustainability Can Drive Financial Outperformance (March 5, 2015). Available at SSRN: <https://ssrn.com/abstract=2508281> or <http://dx.doi.org/10.2139/ssrn.2508281>

¹⁰³ The Elements of Statistical Learning" by Trevor Hastie, Robert Tibshirani, and Jerome Friedman (Section 3.2.3: "Preprocessing and Scaling")

Small Companies

Industry	Regressor	Obs.	Rsquared	B_ESGD	B_ESG	RE_ESG	RO_ESG	SIZEL	ROA	ASY	LV
Communications	WACC	50	0,207	0,000	0,000	0,000	0,000	0,016	0,125	0,004	-0,015
	FCFOL	50	0,249	0,023	0,001	0,026	0,013	0,194	-0,651	0,145	0,291
	ROR	50	0,126	0,001	-0,003	0,000	-0,004	-0,099	-0,843	0,025	-0,202
Consumer Discretionary	WACC	92	0,088	0,000	0,000	-0,001	0,000	0,001	-0,015	0,000	-0,006
	FCFOL	92	0,576	-0,002	0,014	-0,009	0,001	-0,160	0,526	-0,020	0,226
	ROR	92	0,212	-0,003	-0,003	-0,003	-0,001	-0,026	-0,114	0,034	-0,293
Consumer Staples	WACC	83	0,099	0,000	0,000	0,000	0,000	-0,006	-0,002	0,001	-0,009
	FCFOL	83	0,219	0,028	0,018	0,015	0,010	-0,255	0,655	0,069	0,091
	ROR	83	0,288	0,005	0,009	0,000	0,001	-0,024	0,125	0,081	-0,195
Energy	WACC	30	0,698	-0,002	-0,001	-0,002	0,000	0,033	-0,095	0,003	-0,052
	FCFOL	30	0,536	0,028	0,026	-0,012	0,011	0,164	0,542	0,142	-0,763
	ROR	30	0,301	-0,005	-0,002	0,005	0,001	-0,199	0,757	0,110	-0,383
Financials	WACC	168	0,165	0,000	0,000	0,000	0,000	0,007	-0,036	0,004	-0,007
	FCFOL	168	0,341	-0,009	-0,011	-0,008	-0,002	-0,390	0,260	0,077	-0,222
	ROR	168	0,119	-0,002	-0,003	-0,002	-0,001	0,037	0,670	0,005	0,001
Health Care	WACC	83	0,243	0,000	0,000	0,000	0,000	-0,016	-0,014	0,000	-0,005
	FCFOL	83	0,281	-0,023	-0,038	0,005	0,013	-0,126	0,122	0,007	-0,292
	ROR	83	0,178	-0,003	-0,009	-0,001	-0,002	0,058	0,298	0,009	0,068
Industrials	WACC	186	0,146	0,000	0,000	0,000	0,000	-0,014	-0,051	0,000	-0,006
	FCFOL	186	0,087	-0,016	-0,002	0,008	-0,007	-0,057	-0,077	0,041	-0,487
	ROR	186	0,053	0,001	-0,001	0,002	0,000	-0,039	-0,232	0,014	0,062
Materials	WACC	111	0,069	0,000	0,000	0,000	0,000	-0,001	0,034	0,000	-0,003
	FCFOL	111	0,270	0,023	0,002	0,014	0,007	0,290	0,877	-0,064	-0,302
	ROR	111	0,126	0,000	0,002	-0,002	-0,002	-0,003	-0,847	0,029	-0,037
Real Estate	WACC	39	0,722	0,001	0,001	0,000	0,000	0,002	-0,135	0,007	-0,044
	FCFOL	39	0,564	0,024	0,035	0,018	0,015	-0,728	0,810	-0,651	-0,385
	ROR	39	0,382	-0,007	-0,003	0,001	-0,007	-0,033	-0,948	0,436	-0,152
Technology	WACC	53	0,362	0,001	-0,001	0,000	0,000	-0,013	0,079	-0,001	0,001
	FCFOL	53	0,426	-0,064	0,041	-0,008	-0,015	0,938	-0,040	0,028	-0,103
	ROR	53	0,287	-0,014	-0,024	-0,002	-0,008	-0,070	-1,396	0,008	-0,072
Utilities	WACC	50	0,388	0,000	0,000	-0,001	0,000	-0,011	-0,072	0,007	-0,009
	FCFOL	50	0,602	-0,049	-0,010	-0,015	-0,006	-0,805	-2,878	0,034	0,248
	ROR	50	0,341	0,001	0,002	-0,010	-0,003	0,023	-0,955	0,088	-0,094

Looking at the estimates, we observe a higher impact of ESG on financial performance especially in the Real Estate, Materials, Energy, Consumer Staples and Communications. In particular, in the Real Estate we observe for the FOFO (with a good R-squared of 56%) a relevant impact of all the ESG performance metrics. In particular the estimate of B_ESG is more or less the same of the estimate of LV indicating that the impact on the free cash flow from operations of the Bloomberg ESG score is comparable with the one provided by the leverage level. This is an important result as a lot of studies has shown that there is a relationship between leverage and profitability.

In particular Bebczuk, Ricardo and Galindo, Arturo José found in a study that leverage in large firms is positively related to firm size and tangibility, while it is negatively related to profitability, consistent with the asymmetric information approach to corporate finance.¹⁰⁴

¹⁰⁴ Bebczuk, Ricardo and Galindo, Arturo José, Corporate Leverage, the Cost of Capital, and the Financial Crisis in Latin America (March 24, 2010). Available at SSRN: <https://ssrn.com/abstract=1577687> or <http://dx.doi.org/10.2139/ssrn.1577687>

Medium Companies

Industry	Regressor	Obs.	Rsquared	B_ESGD	B_ESG	RE_ESG	RO_ESG	SIZEL	ROA	ASY	LV
Communications	WACC	53	0,396	0,002	0,000	0,001	0,000	-0,023	-0,127	0,011	-0,022
	FCFOL	53	0,532	-0,059	0,012	-0,039	-0,015	0,806	-0,141	0,344	-0,270
	ROR	53	0,156	0,006	-0,001	0,004	0,001	0,001	0,114	0,048	-0,083
Consumer Discretionary	WACC	95	0,330	0,001	0,001	0,000	0,000	-0,023	-0,136	0,001	-0,023
	FCFOL	95	0,208	-0,015	0,010	-0,006	-0,001	0,208	0,683	0,007	0,253
	ROR	95	0,133	0,001	0,003	0,004	0,000	-0,013	0,231	0,029	-0,017
Consumer Staples	WACC	86	0,217	0,000	0,000	0,001	0,000	0,004	0,362	-0,001	0,001
	FCFOL	86	0,212	0,009	0,004	0,018	0,000	-0,144	0,173	0,046	0,083
	ROR	86	0,270	-0,001	-0,004	-0,005	-0,003	0,038	-0,141	0,067	-0,072
Energy	WACC	31	0,495	0,000	0,000	-0,001	0,000	0,019	0,214	0,008	0,017
	FCFOL	31	0,429	0,016	0,003	0,034	-0,002	-0,080	0,371	0,134	0,205
	ROR	31	0,238	-0,021	-0,020	-0,022	-0,002	0,115	0,163	0,032	-0,011
Financials	WACC	174	0,198	0,000	0,000	0,000	0,000	-0,008	-0,110	0,000	0,000
	FCFOL	174	0,120	0,042	-0,004	0,033	0,004	0,535	-0,289	0,019	0,004
	ROR	174	0,130	0,002	0,003	-0,004	0,000	-0,019	0,499	-0,008	0,003
Health Care	WACC	86	0,090	0,000	0,000	0,000	0,000	0,002	-0,056	0,000	0,009
	FCFOL	86	0,131	0,023	0,005	-0,006	0,011	-0,372	0,187	-0,024	-0,199
	ROR	86	0,180	-0,003	0,002	0,003	-0,002	0,074	0,535	0,020	-0,097
Industrials	WACC	194	0,137	0,000	0,000	0,000	0,000	0,014	0,043	0,001	-0,007
	FCFOL	194	0,071	0,014	-0,006	0,022	0,010	-0,118	0,552	-0,087	0,029
	ROR	194	0,091	-0,003	-0,004	0,000	-0,001	0,032	0,342	0,024	0,000
Materials	WACC	114	0,200	0,000	0,001	0,000	0,000	0,033	0,074	0,000	-0,004
	FCFOL	114	0,401	0,070	0,079	0,052	0,014	-2,183	-0,345	0,072	-0,460
	ROR	114	0,083	-0,001	-0,001	0,000	-0,001	-0,032	0,533	0,023	-0,026
Real Estate	WACC	41	0,303	0,001	0,001	0,000	0,000	0,022	-0,006	0,001	-0,019
	FCFOL	41	0,360	0,073	0,059	0,062	0,026	-2,076	-0,625	-0,902	-0,018
	ROR	41	0,466	0,002	0,000	0,004	0,001	-0,113	0,129	0,410	-0,097
Technology	WACC	55	0,081	0,000	0,001	0,000	0,000	0,001	0,050	0,000	-0,002
	FCFOL	55	0,314	0,007	-0,004	-0,025	-0,014	-0,438	0,230	0,082	0,113
	ROR	55	0,130	0,002	-0,005	0,003	0,000	-0,069	0,332	0,028	-0,094
Utilities	WACC	53	0,242	0,000	0,000	0,000	0,000	0,005	0,026	0,005	-0,006
	FCFOL	53	0,411	0,146	0,056	-0,065	-0,022	0,580	-0,367	0,288	-0,101
	ROR	53	0,231	-0,016	0,001	0,009	0,003	0,044	0,154	-0,047	-0,032

Similar results were obtained in the regressions for medium and large suggesting, in contrast to previous analysis (considering only industry without size), a not significant difference between small, medium and large companies.

Large Companies

Industry	Regressor	Obs.	Rsquared	B_ESGD	B_ESG	RE_ESG	RO_ESG	SIZEL	ROA	ASY	LV
Communications	WACC	51	0,406	-0,001	-0,001	0,000	0,000	-0,020	-0,049	0,003	0,001
	FCFOL	51	0,273	-0,002	-0,029	-0,060	-0,037	-0,030	-0,129	0,085	-0,172
	ROR	51	0,118	-0,010	0,003	0,002	0,001	0,031	0,616	0,016	-0,027
Consumer Discretionary	WACC	93	0,661	-0,001	0,000	0,000	0,000	-0,004	-0,026	0,004	-0,027
	FCFOL	93	0,447	-0,001	-0,025	-0,049	-0,003	-0,489	-0,861	0,201	-0,006
	ROR	93	0,212	-0,002	-0,005	-0,006	-0,002	0,085	-0,375	0,046	-0,099
Consumer Staples	WACC	83	0,261	0,000	0,000	0,000	0,000	-0,003	0,027	0,003	0,001
	FCFOL	83	0,133	0,011	0,005	-0,001	-0,003	-0,099	-0,086	0,038	0,175
	ROR	83	0,149	-0,002	-0,002	-0,002	-0,001	-0,030	-0,348	0,030	-0,094
Energy	WACC	30	0,499	-0,001	0,000	-0,001	-0,001	0,000	0,153	0,026	0,054
	FCFOL	30	0,416	0,025	0,005	0,075	0,017	-0,172	0,325	0,343	-0,450
	ROR	30	0,564	0,003	-0,007	-0,009	-0,002	0,007	0,304	0,183	-0,055
Financials	WACC	169	0,574	-0,001	-0,001	0,000	0,000	-0,018	0,141	0,009	-0,012
	FCFOL	169	0,151	-0,137	-0,031	0,002	0,030	-0,441	0,695	-0,103	0,172
	ROR	169	0,149	-0,003	0,001	0,001	0,000	0,042	0,260	0,070	-0,010
Health Care	WACC	83	0,105	0,001	0,000	0,000	0,000	-0,005	-0,040	0,001	-0,002
	FCFOL	83	0,502	0,003	-0,012	-0,020	0,018	-0,070	0,850	0,083	-0,100
	ROR	83	0,125	-0,001	-0,006	-0,002	-0,002	0,065	0,016	0,026	-0,033
Industrials	WACC	187	0,218	0,000	0,000	0,000	0,000	-0,004	-0,068	0,005	-0,006
	FCFOL	187	0,144	0,002	-0,012	-0,002	-0,003	-0,436	0,552	0,053	-0,002
	ROR	187	0,120	0,001	0,000	-0,001	0,000	0,034	0,238	0,010	0,014
Materials	WACC	111	0,140	0,001	0,001	0,001	0,001	-0,014	0,038	-0,003	0,003
	FCFOL	111	0,226	0,048	0,047	0,007	0,019	-0,045	-0,105	0,345	-0,125
	ROR	111	0,068	0,005	0,001	0,003	0,001	0,045	-0,509	0,090	-0,113
Real Estate	WACC	39	0,245	0,001	0,001	0,001	0,000	0,006	0,060	-0,007	0,006
	FCFOL	39	0,615	0,109	0,037	0,098	0,026	-0,518	-0,349	0,485	-0,442
	ROR	39	0,491	0,005	0,004	0,002	0,000	-0,057	0,268	0,272	0,024
Technology	WACC	53	0,322	0,001	0,002	0,003	0,001	-0,018	-0,026	0,001	-0,010
	FCFOL	53	0,396	0,038	0,083	0,017	-0,033	-0,253	-0,140	0,047	0,134
	ROR	53	0,201	-0,004	-0,003	-0,008	-0,003	-0,053	0,447	0,011	-0,055
Utilities	WACC	51	0,326	0,001	0,000	0,000	0,000	-0,005	-0,023	0,007	-0,007
	FCFOL	51	0,348	-0,073	-0,049	-0,078	-0,011	0,643	0,644	0,005	0,269
	ROR	51	0,139	0,003	0,001	0,005	-0,003	-0,027	-0,117	0,053	-0,090

To reassume all the result obtained, we computed the average estimates for the two main ESG measures (Bloomberg ESG disclosure and Bloomberg ESG) and highlighted the values in the table below (table 10). This summary confirms what discussed before, in particular shows a good value in terms of R-squared confirming the goodness of the fitting multilinear models. In terms of ESG impact it shows promising values, which are in the majority of the cases not only positive but significant in terms of the estimates of the other control variables.

Table 10

INDUSTRY	Bloomberg ESG score			Control Variables				R ²
	SMALL	MEDIUM	LARGE	SIZE	ROA	ASY	LV	
Communications	-0,023	0,012	-0,016	0,323	-0,307	0,191	-0,050	0,35
Consumer Discretionary	-0,002	0,006	0,013	-0,147	0,116	0,063	0,158	0,41
Consumer Staples	0,006	0,023	0,008	-0,166	0,247	0,051	0,116	0,19
Energy	0,009	0,027	0,015	-0,030	0,413	0,206	-0,336	0,46
Financials	0,019	0,010	-0,084	-0,099	0,222	-0,003	-0,015	0,20
Health Care	0,014	-0,031	-0,004	-0,189	0,386	0,022	-0,197	0,30
Industrials	0,004	-0,009	-0,005	-0,203	0,342	0,003	-0,153	0,10
Materials	0,075	0,013	0,048	-0,646	0,142	0,118	-0,296	0,30
Real Estate	0,066	0,029	0,073	-1,107	-0,055	-0,489	-0,282	0,51
Technology	0,001	-0,011	0,060	0,082	0,016	0,052	0,048	0,38
Utilities	0,101	0,029	-0,061	0,139	-0,467	0,109	0,139	0,45

Returning back to the original question “What’s the relationship between ESG and corporate performance?”, and giving a short academic view, some interesting studies showed that poorly governed firms do have lower operating performance levels.¹⁰⁵ Similarly, there are also papers showing that good corporate governance leads to better firm valuations.¹⁰⁶

From the market view, firms behaving environmentally irresponsibly demonstrate significant stock price decreases.¹⁰⁷

A multitude of studies, alongside numerous others, consistently demonstrate that Environmental, Social, and Governance (ESG) factors play a crucial role in enhancing a company's corporate performance. This improvement can be observed from both operational and financial perspectives (FCFO), and both from stock and market view (WACC and RoR).

To summarize the results we found, there is evidence that a positive relationship between ESG and corporate financial performance exists, however from a purely statistical view this intensity of this relationship is still not clear. As discussed previously, the main reason are the difficulties on clearing data from all effects and biases already understood and the lack of standardizing of the ESG metrics.

In the next few years, especially after the implementation of the EU Corporate Sustainability Reporting Directive (CSRD) that became effective in January 2023, I believe there will be the possibility to achieve even more solid results.

¹⁰⁵ Core, Guay, and Rusticus (2006) show that firms with more anti-takeover devices in place (i.e., fewer shareholder rights as measured by the G-index of Gompers, Ishii, and Metrick (2003)) display lower returns on assets. Likewise, Cremers and Ferrell (2013) show that poorly-governed firms exhibit significantly lower industry-adjusted Tobin’s Qs over the period 1978-2006. Giroud and Mueller (2011) also support these results by finding a significant negative relationship between the number of anti-takeover devices in place and firm valuation.

¹⁰⁶ See, for example, Brown and Caylor (2006). They study the governance quality of 1,868 firms and relate it to their valuation statistics. Brown and Caylor show that their measure for corporate governance quality is positively and significantly related to firm value.

¹⁰⁷ See, Flammer (2013). The author investigates stock price reactions around news related to the environmental performance of corporations. Investigating environmentally related news over the time period 1980-2009, the author concludes that on the two days around the news event (i.e. one day before the announcement of the environmentally related news and the announcement day itself), stocks with “eco-friendly events” experience a stock price increase of on average 0.84% while firms with “eco-harmful events” exhibit a stock price drop of 0.65%.

5. Dynamical Analysis on the impact of ESG

5.1 Introduction to the variables

As introduced in paragraph 4.1, the approach we will use to analyze the relationship between financial performance and ESG consists in two different strategies.

The first, focused on a structural analysis was described in the previous chapter. We commented on all the result considering all the possibles combinations of industries, sizes and variables.

Now we are going to describe and illustrate the dynamic analysis, in which we focus on more technical and volatile market data. The sample we will use is the same of the previous study, in particular the **STOXX 600** company list evaluated on **31.03.2023**.

For the purpose of conducting a multi-linear regression, the choice we made was to utilize **monthly** data. This timeframe allows us to capture all the changes that occur within the specified period, while avoiding excessive fluctuations associated with daily or weekly data.

The approach we will follow in order to evaluate the impact of ESG it will consist in threaten the ESG as a **new risk factor** to be considered in the **asset pricing models**.

An asset pricing model (such as CAPM) is a finance model that establishes a linear relationship between the required return on an investment and risk. So in particular it allows (under certain assumptions) to determine the expected rate of return of a particular asset (stocks, bonds...) based on its risk.

The Capital Asset Pricing Model (CAPM) relies on two distinct sets of assumptions. The initial set pertains to investor behavior and assumes that all investors are engaged in mean-variance optimization, sharing a common time horizon and possessing the same set of information. Conversely, the second set of assumptions focuses on the market itself, asserting that markets are efficient and operate smoothly with minimal barriers to trading (as per the efficient market theory).

However, when conducting our analysis, the most compelling approach for an asset pricing model lies in iteratively testing its validity by starting with actual returns and assessing the impact of various risk factors. In such cases, employing multi-factor models like the Fama and French 3-Factors or 5-Factors models proves more beneficial due to the ability to capture more sources of risk.

This is a methodology already used in some studies like the one conducted by Leila Bennani, Théo Le Guenedal etc.¹⁰⁸

In particular, as highlighted below, they made different regressions considering ESG as a risk factor and they found out that there is a slightly improvement of R^2 when including ESG.

¹⁰⁸ How ESG Investing Has Impacted the Asset Pricing in the Equity Market, Leila Bennani, Théo Le Guenedal, Frédéric Lepetit, Lai Ly, Vincent Mortier, Thierry Roncalli & Takaya Sekine Amundi Asset Management, Paris, November 2018.

Table 3: Results with long-only risk factors (cross-section regression, average R^2)

Period	North America		Eurozone	
	2010 – 2013	2014 – 2017	2010 – 2013	2014 – 2017
CAPM	40.8%	26.2%	42.8%	37.7%
5F	46.1%	35.4%	49.5%	45.3%
6F (5F + ESG)	46.7%	36.8%	50.1%	46.0%

In particular, they used as base model the 5-faktors Fama and French model. The Fama and French model, developed by Eugene Fama and Kenneth French, is an influential asset pricing model that seeks to explain stock returns based on five factors. These factors provide a framework for understanding the sources of risk and return in the stock market. In this essay, we will introduce and discuss the five factors of the Fama and French model, supported by relevant references.

Market Risk (Mkt-RF): The first factor in the Fama and French model is market risk, which captures the overall return of the market relative to a risk-free rate. It represents the excess return of the market portfolio over the risk-free rate. This factor reflects the systematic risk that affects all stocks in the market.

Size (SMB): The second factor is size, also known as the Small Minus Big factor (SMB). It measures the historical excess returns of small-cap stocks compared to large-cap stocks. The size effect suggests that smaller companies tend to outperform larger companies over the long term.

Value (HML): The third factor is value, also referred to as the High Minus Low factor (HML). It captures the difference in returns between high book-to-market ratio (value) stocks and low book-to-market ratio (growth) stocks. The value effect implies that value stocks outperform growth stocks in the long run.

Profitability (RMW): The fourth factor is profitability, known as the Robust Minus Weak factor (RMW). It reflects the difference in returns between firms with high operating profitability and those with low operating profitability. The profitability effect suggests that more profitable companies tend to generate higher returns.

Investment (CMA): The fifth factor is investment, also called the Conservative Minus Aggressive factor (CMA). It measures the returns of companies with low levels of investment relative to companies with high levels of investment. The investment effect suggests that companies with conservative investment policies tend to achieve higher returns.

In order to compute our analysis, we obtained the data relative to the 5-Faktors directly by the website of Kenneth R. French, where all these measures are reported historically.¹⁰⁹

In particular we will use the **5-faktors data** relative to **Europe**.

For what regards the ESG metrics, some are the same presented in the previous chapter, with only one difference since the Bloomberg ESG Disclosure is only reported yearly so it will be substituted by Sustainalytics ESG. In particular, the measures we will use are:

¹⁰⁹ https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

1. Bloomberg ESG (B_ESG)
2. RobecoSAM ESG (RO_ESG)
3. Refinitiv ESG (RE_ESG)
4. Sustainalytics ESG (S_ESG)

We will be examining more recent data compared to the previous study, as we have increased the number of observations for a period of one year (12 instead of just one). The time frame for this study will be from **January 1, 2018**, to **December 31, 2022**, with **60 observations** for each company, resulting in a total of **33.360** observations.

In order to capture the possible effects of lagged ESG values, a common methodology used such as the one conducted by Sakanoue and Y. Himayat, is to consider also the **distributed lagged 5 Factors Model**.¹¹⁰

The theoretical fundamental of this type of analysis relies on the existence of a **cross-correlations**. In time series analysis and statistics, the cross-correlation of a pair of random process is the correlation between values of the processes at different times, as a function of the two times.

This means that there is for example correlation between the ESG value of the past month with the returns of the current month.

To account for the interrelationships between variables, we performed a regression analysis that incorporated the lagged ESG values spanning 1, 2, 3, and 4 months.

¹¹⁰ Firman, Sukono & Hidayat, Yuyun & Bon, A. & Supian, S.. (2017). Modelling of capital asset pricing by considering the lagged effects. IOP Conference Series: Materials Science and Engineering. 166. 012001. 10.1088/1757-899X/166/1/012001.

5.2 The Impact of ESG on Asset Pricing in the Equity Market

Introduced in the previous paragraph the variables and the methodology we are going to use, we will now focus on the outcomes.

In the tables below we printed all the results considering three different models (3-F, 5-F and 5-F + ESG) and the 5 different lag (Lag-0, Lag-1, Lag-2, Lag-3, Lag-4).

3-F

Dep Var	N° of Obs.	R ²	MRK	SMB	HML	P-Value	Sign
MRK	33.360	0,22	0,006%	0,005%	0,001%	0,000%	***

3F + ESG

Indep. Var	Regression	N° of Obs.	R ²	ESG	MRK	SMB	HML	P-Value	Sign
B_ESG	Lag-0	33.360	0,24	0,105%	0,894%	0,404%	0,164%	0,0304	**
RE_ESG	Lag-0	33.360	0,26	-0,028%	0,895%	0,429%	0,136%	0,0000	***
RO_ESG	Lag-0	33.360	0,25	-0,011%	0,883%	0,449%	0,164%	0,0000	***
S_ESG	Lag-0	33.360	0,21	0,016%	0,853%	0,359%	0,146%	0,0005	***
B_ESG	Lag-1	32.804	0,23	-0,089%	0,893%	0,403%	0,163%	0,0699	*
RE_ESG	Lag-1	32.804	0,25	0,028%	0,890%	0,441%	0,139%	0,0000	***
RO_ESG	Lag-1	32.804	0,25	-0,011%	0,883%	0,449%	0,165%	0,0000	***
S_ESG	Lag-1	32.804	0,20	0,017%	0,853%	0,349%	0,149%	0,0005	***
B_ESG	Lag-2	32.248	0,24	-0,093%	0,897%	0,391%	0,163%	0,0599	*
RE_ESG	Lag-2	32.248	0,25	-0,029%	0,899%	0,423%	0,130%	0,0000	***
RO_ESG	Lag-2	32.248	0,25	-0,008%	0,886%	0,438%	0,164%	0,0004	***
S_ESG	Lag-2	32.248	0,20	0,020%	0,855%	0,344%	0,152%	0,0000	***
B_ESG	Lag-3	31.692	0,24	-0,093%	0,897%	0,392%	0,164%	0,0639	*
RE_ESG	Lag-3	31.692	0,25	0,027%	0,899%	0,433%	0,128%	0,0000	***
RO_ESG	Lag-3	31.692	0,25	-0,007%	0,888%	0,435%	0,164%	0,0016	***
S_ESG	Lag-3	31.692	0,21	0,023%	0,860%	0,413%	0,180%	0,0000	***
B_ESG	Lag-4	31.136	0,24	-0,080%	0,898%	0,389%	0,163%	0,1146	
RE_ESG	Lag-4	31.136	0,25	-0,027%	0,896%	0,422%	0,133%	0,0000	***
RO_ESG	Lag-4	31.136	0,25	0,007%	0,888%	0,430%	0,162%	0,0027	***
S_ESG	Lag-4	31.136	0,21	0,024%	0,861%	0,414%	0,175%	0,0000	***

5-F

Dep Var	N° of Obs.	R ²	MRK	SMB	HML	RMW	CMA	P-Value	Sign
MRK	33.360	0,22	0,86%	0,37%	0,22%	-0,13%	-0,30%	0,00%	***

5F + ESG

Ind. Var	Reg.	Obs.	R ²	ESG	MRK	SMB	HML	RMW	CMA	P-Val.	Sig
B_ESG	Lag-0	33.360	0,24	0,098%	0,871%	0,335%	0,267%	-0,058%	-0,289%	0,0445	**
RE_ESG	Lag-0	33.360	0,26	-0,029%	0,873%	0,335%	0,278%	-0,115%	-0,461%	0,0000	***
RO_ESG	Lag-0	33.360	0,25	-0,011%	0,862%	0,387%	0,258%	-0,049%	-0,261%	0,0000	***
S_ESG	Lag-0	33.360	0,21	0,016%	0,827%	0,265%	0,242%	-0,030%	-0,253%	0,0005	***
B_ESG	Lag-1	32.804	0,24	-0,084%	0,865%	0,330%	0,289%	-0,026%	-0,314%	0,0871	*
RE_ESG	Lag-1	32.804	0,25	0,028%	0,861%	0,344%	0,307%	-0,079%	-0,490%	0,0000	***
RO_ESG	Lag-1	32.804	0,25	-0,010%	0,859%	0,382%	0,277%	-0,029%	-0,283%	0,0000	***
S_ESG	Lag-1	32.804	0,20	0,016%	0,829%	0,270%	0,236%	-0,042%	-0,250%	0,0005	***
B_ESG	Lag-2	32.248	0,24	-0,087%	0,869%	0,318%	0,289%	-0,026%	-0,315%	0,0791	*
RE_ESG	Lag-2	32.248	0,25	0,029%	0,873%	0,321%	0,291%	-0,080%	-0,486%	0,0000	***
RO_ESG	Lag-2	32.248	0,25	-0,008%	0,862%	0,369%	0,272%	-0,042%	-0,287%	0,0008	***
S_ESG	Lag-2	32.248	0,20	0,020%	0,830%	0,269%	0,258%	-0,008%	-0,252%	0,0001	***
B_ESG	Lag-3	31.692	0,24	-0,087%	0,871%	0,320%	0,285%	-0,029%	-0,306%	0,0832	*
RE_ESG	Lag-3	31.692	0,25	-0,028%	0,873%	0,335%	0,280%	-0,086%	-0,470%	0,0000	***
RO_ESG	Lag-3	31.692	0,25	-0,007%	0,864%	0,369%	0,272%	-0,031%	-0,278%	0,0029	***
S_ESG	Lag-3	31.692	0,21	0,023%	0,831%	0,362%	0,363%	0,137%	-0,254%	0,0000	***
B_ESG	Lag-4	31.136	0,24	-0,073%	0,872%	0,316%	0,282%	-0,036%	-0,305%	0,1532	
RE_ESG	Lag-4	31.136	0,25	0,028%	0,873%	0,344%	0,254%	-0,080%	-0,373%	0,0000	***
RO_ESG	Lag-4	31.136	0,25	-0,007%	0,864%	0,363%	0,269%	-0,033%	-0,279%	0,0040	***
S_ESG	Lag-4	31.136	0,21	0,024%	0,824%	0,370%	0,426%	0,222%	-0,321%	0,0000	***

From the results, we can observe an increased R² in the regression with the ESG factor, which match the previous study were a similar analysis were performed.¹¹¹ However, there aren't significant differences between the regression in the different time-lags, suggesting a weak cross-correlation.

Furthermore, the ESG estimates generally exhibit a **slightly negative** trend, suggesting an inverse relationship between monthly returns and monthly ESG values. It is important to note that these findings hold true when considering the entire sample without differentiating across industries, implying that the sign of sustainability may not be a significant factor in this context.

Nonetheless, our primary focus was to ascertain whether incorporating ESG factors can improve the explanatory power of the capital pricing model. In this regard, the directionality of sustainability, given the comprehensive nature of our analysis, may not hold substantial relevance.

Overall, while the inclusion of ESG metrics resulted in an increased R² and revealed a negative association with monthly returns, the absence of significant differences across time-lags and the potential limited significance of the sustainability sign suggests a nuanced interpretation of the findings.

For these reasons we will now focus on the analysis conducted considering the different industries (since the size elements is already accounted for in the SMB risk factor).

The table below (5-F + ESG) reassumes the results.

¹¹¹ How ESG Investing Has Impacted the Asset Pricing in the Equity Market, Leila Bennani, Théo Le Guenedal, Frédéric Lepetit, Lai Ly, Vincent Mortier, Thierry Roncalli & Takaya Sekine Amundi Asset Management, Paris, November 2018.

5-F + ESG

Industry	Ind Var	N° of Obs.	R	ESG	MRK	SMB	HML	RMW	CMA	P_value	Sign
Communications	B_ESG	154	0,10	-0,429%	0,605%	0,161%	0,592%	0,150%	27,968%	0,280	
	RE_ESG	0	0,09	-0,051%	0,672%	0,007%	0,761%	0,484%	10,480%	0,105	
	RO_ESG	0	0,20	0,005%	0,640%	0,290%	0,416%	0,107%	61,703%	0,617	
	S_ESG	0	0,15	-0,052%	0,551%	0,220%	0,810%	0,429%	9,901%	0,099	*
Consumer Discretionary	B_ESG	280	0,34	-0,396%	1,049%	0,276%	0,564%	0,589%	1,528%	0,015	**
	RE_ESG	280	0,34	-0,018%	0,997%	0,584%	0,612%	0,502%	29,083%	0,291	
	RO_ESG	280	0,32	-0,011%	1,041%	0,575%	0,515%	0,471%	13,413%	0,134	
	S_ESG	280	0,24	-0,022%	1,043%	-0,065%	0,213%	0,143%	31,357%	0,314	
Consumer Staples	B_ESG	252	0,20	-0,013%	0,801%	-0,194%	-0,173%	0,079%	93,473%	0,935	
	RE_ESG	252	0,17	-0,043%	0,797%	-0,001%	-0,143%	-0,072%	1,909%	0,019	**
	RO_ESG	252	0,19	-0,010%	0,765%	0,001%	-0,116%	0,076%	18,855%	0,189	
	S_ESG	252	0,26	-0,004%	0,783%	0,036%	0,000%	0,301%	80,226%	0,802	
Energy	B_ESG	91	0,26	0,110%	0,939%	0,345%	1,227%	-0,515%	73,876%	0,094	*
	RE_ESG	91	0,49	0,027%	1,033%	-0,146%	0,889%	-0,115%	41,512%	0,415	
	RO_ESG	91	0,22	-0,015%	0,921%	0,157%	0,825%	-0,700%	41,561%	0,416	
	S_ESG	91	0,21	0,010%	0,856%	0,266%	-0,402%	-2,644%	69,154%	0,692	
Financials	B_ESG	511	0,34	-0,012%	0,921%	0,472%	0,740%	-0,303%	92,362%	0,924	
	RE_ESG	511	0,45	-0,030%	1,006%	0,479%	0,666%	-0,795%	0,601%	0,006	***
	RO_ESG	511	0,34	-0,009%	0,916%	0,449%	0,781%	-0,244%	7,499%	0,075	*
	S_ESG	511	0,20	0,008%	0,752%	0,095%	0,726%	-0,189%	57,110%	0,571	
Health Care	B_ESG	252	0,21	-0,775%	0,763%	-0,099%	-0,544%	-0,630%	0,003%	0,000	***
	RE_ESG	252	0,15	-0,075%	0,727%	-0,411%	-0,403%	-1,022%	0,014%	0,000	***
	RO_ESG	252	0,18	-0,023%	0,720%	-0,029%	-0,435%	-0,601%	0,362%	0,004	***
	S_ESG	252	0,27	0,017%	0,806%	0,518%	-0,583%	-0,576%	22,236%	0,222	
Industrials	B_ESG	567	0,27	-0,088%	0,946%	0,430%	0,045%	-0,022%	39,044%	0,390	
	RE_ESG	567	0,30	-0,007%	0,917%	0,516%	0,031%	0,004%	52,824%	0,528	
	RO_ESG	567	0,27	-0,005%	0,943%	0,473%	0,069%	-0,011%	28,239%	0,282	
	S_ESG	567	0,22	0,021%	0,918%	0,261%	0,007%	-0,053%	5,942%	0,059	*
Materials	B_ESG	336	0,33	0,068%	0,996%	0,625%	0,105%	-0,174%	65,395%	0,058	*
	RE_ESG	336	0,35	0,013%	1,027%	0,642%	0,049%	0,041%	25,712%	0,057	*
	RO_ESG	336	0,31	-0,006%	0,938%	0,687%	0,185%	-0,028%	34,483%	0,345	
	S_ESG	336	0,28	0,014%	0,890%	0,553%	0,837%	0,627%	22,553%	0,226	
Real Estate	B_ESG	119	0,34	-0,056%	0,747%	0,904%	0,868%	0,174%	29,963%	0,300	
	RE_ESG	119	0,32	0,008%	0,469%	0,802%	1,056%	0,197%	77,426%	0,774	
	RO_ESG	119	0,30	-0,015%	0,699%	0,673%	0,860%	0,173%	22,921%	0,229	
	S_ESG	119	0,29	0,083%	0,692%	1,239%	0,831%	0,606%	19,465%	0,095	*
Technology	B_ESG	161	0,16	-0,488%	0,748%	0,378%	-0,041%	0,227%	15,192%	0,152	
	RE_ESG	161	0,26	-0,070%	1,025%	0,209%	-0,349%	-0,404%	0,369%	0,004	***
	RO_ESG	161	0,22	-0,037%	0,835%	0,339%	-0,158%	-0,344%	0,070%	0,001	***
	S_ESG	161	0,16	0,004%	0,692%	-0,209%	-0,242%	-0,494%	90,105%	0,901	
Utilities	B_ESG	154	0,19	-0,014%	0,624%	0,310%	0,151%	0,262%	94,358%	0,944	
	RE_ESG	154	0,24	-0,017%	0,514%	0,308%	0,656%	0,755%	52,765%	0,528	
	RO_ESG	154	0,22	-0,011%	0,669%	0,323%	0,218%	0,423%	14,934%	0,149	
	S_ESG	154	0,25	0,010%	0,851%	0,644%	0,012%	0,297%	59,069%	0,591	

One notable finding is the improved R-squared value achieved through the utilization of more normalized data obtained by sampling firms according to their respective industries. This refinement allowed for a more accurate assessment of the relationship between ESG and financial performance.

Additionally, our analysis reveals that the ESG estimates generally hover around zero or display a negative trend across the majority of industries, indicating a weak or ambiguous association

between monthly price returns and monthly ESG values. However, there are noteworthy exceptions observed in the Energy, Real Estate, and Materials sectors, where we observe a positive relationship. This observation is further supported by high R-squared values and significant p-values.

Furthermore, it is noteworthy that both the **Real Estate and Energy** industries exhibited a similar positive relationship between sustainability and financial performance in the structural analysis conducted in the previous chapter. This consistency reinforces the evidence of a beneficial association between sustainability practices and financial outcomes within these specific sectors.

In summary, while the majority of industries demonstrate a weak or inconclusive relationship between monthly price returns and monthly ESG values, the Energy, Real Estate, and Materials sectors stand out with a notable positive behavior. This aligns with our previous findings and underscores the potential impact of sustainability on financial performance within these particular industries.

Before drawing conclusions, it is essential to ensure that all aspects of the analysis have been thoroughly considered. There is one particular aspect that requires further investigation. Are the ESG data we have used thus far **truly indicative of the actual monthly sustainability** performance levels of the analyzed companies?

This question arises because upon closer examination of the data, we observe remarkably low volatility between the months, with many metrics remaining constant throughout the entire year. It appears that these ESG metrics may reflect more of a "monthlyzation" of quarterly and yearly data, rather than truly monthly data. On the other hand, it is possible that sustainability is not inherently characterized by significant fluctuations, and it may require sufficient time for appropriate analysis and measurement.

In any case, to complete the dynamical analysis also considering this aspect, we made another study considering a new ESG metrics introduced in the paragraph 4.3.

In particular the measure we will use is **RepRisk ESG (RP_ESG)**, which, as described before, has the peculiarity to rely a lot on **external information's** (such as news, investigations, third party report.) and use a **machine learning** process to evaluate these data providing a very dynamical measure which updates daily incorporating all the new information.

To highlight this aspect, the table below reassumes the average standard deviation of the different ESG metrics used.

Measure	RE_ESG	RO_ESG	S_ESG	B_ESG	RP_ESG
Mean	68,55	62,29	26,79	38,69	48,74
Std	3,51	5,47	3,49	4,65	8,13

As can be seen, the volatility of the RP_ESG is much higher than the other "more traditional" ESG metrics. Unfortunately, we were able to obtain this metrics only for 15 stocks, so we are going to make the regression only using this small sample.

The other variables used are the same of the previous analysis, in particular the dependent variable is represented by the price returns, and as regressors we are using the Fama and French 5-Factors + RP_ESG.

Also in this analysis we computed the regression considering 3 different lagged ESG metrics, in particular, zero lag, 1 month lag and 2 months lag in order to capture possible cross-correlations. The results are highlighted below.

Lag	Var	R ²	Model_val	Std_errors	P_values
LAG_0	Intercept	0,15	0,454%	0,0190	0,8110
	RP_ESG	0,15	0,014%	0,0004	0,6920
	MKT	0,15	1,239%	0,0014	0,0000
	SMB	0,15	-0,045%	0,0042	0,9132
	HML	0,15	-0,036%	0,0040	0,9278
	RMW	0,15	-1,520%	0,0054	0,0048
	CMA	0,15	-0,132%	0,0059	0,8219
LAG_1	Intercept	0,15	0,507%	0,0191	0,7913
	RP_ESG	0,15	0,011%	0,0004	0,7504
	MKT	0,15	1,257%	0,0014	0,0000
	SMB	0,15	-0,012%	0,0042	0,9779
	HML	0,15	-0,067%	0,0040	0,8672
	RMW	0,15	-1,480%	0,0054	0,0066
	CMA	0,15	-0,050%	0,0059	0,9322
LAG_2	Intercept	0,15	0,590%	0,0195	0,7618
	RP_ESG	0,15	0,009%	0,0004	0,8060
	MKT	0,15	1,269%	0,0014	0,0000
	SMB	0,15	-0,064%	0,0043	0,8800
	HML	0,15	-0,144%	0,0041	0,7259
	RMW	0,15	-1,548%	0,0055	0,0053
	CMA	0,15	0,056%	0,0061	0,9269

Based on the analysis, it is evident that the R-squared values are significantly lower compared to the previous analysis, falling below the 30% threshold. This indicates that the model does not explain a substantial portion of the variation in the financial performance measures (such as stock returns).

When examining the variable estimates, it is observed that the RP_ESG variable consistently has positive coefficients. However, these coefficients are relatively small, and the corresponding p-values are higher, indicating that the measure may not be statistically significant.

In summary, even when considering a different, more dynamic measure, there is no statistically significant relationship observed between monthly ESG (Environmental, Social, and Governance) scores and financial performance measures, in particular stock returns.

From a theoretical standpoint, there is a prevalent belief that Environmental, Social, and Governance (ESG) considerations generate investment flows that can have an impact on asset prices and, consequently, portfolio returns. In general, positive investments lead to price increases, while negative investments result in price decreases, adhering to the fundamental principle of supply and

demand.¹¹²

However, ESG cannot be easily compared to other risk factors with related investment styles (large or small, value or growth...). Typically, investors are primarily motivated by financial considerations when implementing a specific investment strategy. However, this is not the case with ESG investing, as the primary motivation stems from non-financial factors.¹¹³

Other studies like the one conducted by André Breedta and others, indicates that any benefit from incorporating ESG credentials into a portfolio is already captured by other well defined and known equity factors.¹¹⁴ Moreover, although ESG has garnered more wide-spread acceptance, it seems that most Portfolio Asset Manager do not (yet) fully, nor systematically integrate ESG into a decision-making process.¹¹⁵

This point of view is also supported by the results we obtained in the dynamical analysis and might suggest the fact that ESG has a primary impact at corporate operational and financial layer rather than in equity market pricing.¹¹⁶ In addition, we observed these effects on financial performance in the structural analysis and the results we found were by far more interesting.

¹¹² How ESG Investing Has Impacted the Asset Pricing in the Equity Market, Leila Bennani, Théo Le Guenedal, Frédéric Lepetit, Lai Ly, Vincent Mortier, Thierry Roncalli & Takaya Sekine Amundi Asset Management, Paris, November 2018

¹¹³ Andersson, M., Bolton, P., and Samama, F. (2016), Hedging Climate Risk, *Financial Analysts Journal*, 72(3), pp. 13-32.

¹¹⁴ "Is ESG an Equity Factor or Just an Investment Guide?", André Breedta, Stefano Cilibertia, Stanislaio Gualdia, Philip Seagera a Capital Fund Management, 23 rue de l'Université, Paris, France 75007

¹¹⁵ Carmen Juravle and Alan Lewis. Identifying impediments to SRI in Europe: a review of the practitioner and academic literature. *Business Ethics: A European Review*, 17(3):285-310, 2008.

¹¹⁶ Core, Guay, and Rusticus (2006) show that firms with more anti-takeover devices in place (i.e., fewer shareholder rights as measured by the G-index of Gompers, Ishii, and Metrick (2003)) display lower returns on assets. Likewise, Cremers and Ferrell (2013) show that poorly-governed firms exhibit significantly lower industry-adjusted Tobin's Qs over the period 1978-2006. Giroud and Mueller (2011) also support these results by finding a significant negative relationship between the number of anti-takeover devices in place and firm valuation.

6. Conclusion

The research conducted in this thesis aimed to shed light on the relationship between sustainability, as measured by environmental, social, and governance (**ESG**) and **financial performance**. The thesis recognized the prolific nature of research in this field over the past two decades, yet the absence of a consensus on the relationship between ESG and firm value. This lack of agreement has given rise to a multitude of theories and has driven the need for further investigation.

Starting from its concept, which emerged in 1987, sustainability has experienced significant growth in recent decades. However, it is not without its critics who find it boring, ambiguous, or even unattainable. Despite these challenges, sustainability has gained momentum as environmental movements strive to mitigate the adverse effects of human activities on the natural world. It is now a prominent objective in numerous countries, with the EU Green Act serving as a noteworthy example of this trend.

The **EU Green Act** refers to a comprehensive package of initiatives and policies proposed by the European Union (EU) to tackle climate change and promote sustainability.¹¹⁷ The EU's overall goal is to become the world's first climate-neutral continent by 2050. To achieve this, the EU has developed a series of initiatives and legislation aimed at transitioning to a low-carbon and environmentally friendly economy. Some key elements of the EU's green agenda include:

- **European Green Deal:** The European Green Deal is a flagship initiative that encompasses a range of policies and measures to make Europe climate-neutral, including reducing greenhouse gas emissions, promoting sustainable energy production, and fostering a circular economy.
- **Climate Action:** The EU has committed to significantly reducing greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels. This involves implementing stricter regulations, such as the Emission Trading System (ETS), which sets a cap on emissions and allows trading of allowances.
- **Renewable Energy Transition:** The EU aims to increase the share of renewable energy sources in its energy mix. This involves supporting the deployment of renewable technologies, setting renewable energy targets, and promoting clean energy research and innovation.
- **Sustainable Agriculture and Biodiversity:** The EU is working to promote sustainable agricultural practices, reduce chemical pesticide use, and protect biodiversity. Initiatives such as the Farm to Fork Strategy aim to make the food system more sustainable, healthy, and resilient.
- **Circular Economy:** The EU is promoting a circular economy model that focuses on reducing waste, reusing, and recycling materials, and minimizing resource consumption. This includes measures to improve waste management, increase recycling rates, and encourage eco-design.

¹¹⁷ The European Green Deal, Brussels, 11.12.2019 COM(2019) 640 final, https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF European Commission (2018), Communication from the Commission, Action Plan: Financing Sustainable Growth.

- Sustainable Finance: The EU is developing a framework for sustainable finance to direct investment towards environmentally friendly activities and projects. This involves establishing guidelines for green investments, disclosure requirements, and the creation of a taxonomy for sustainable economic activities.

These initiatives reflect the EU's commitment to addressing climate change, promoting sustainable development, and transitioning to a greener economy.

In the evolving context of sustainable development, there is a widespread belief that sustainability can significantly impact the **performance of individual companies**.

Empirical research examining the connection between environmental performance and financial outcomes consistently supports a clear trend. Studies reveal that strong corporate environmental practices ultimately lead to a competitive advantage and, consequently, improved corporate performance. This evidence highlights the tangible benefits of implementing effective environmental practices for companies.¹¹⁸

The concept of **ESG investing**, also known as sustainable investing or socially responsible investing (SRI), has gained considerable popularity in recent years. This investment approach involves selecting companies that are considered socially responsible or ethical, while avoiding those engaged in practices deemed harmful to society or the environment. The motivations for investing in ESG can be seen from two perspectives: ethical/moral considerations and financial incentives.

A recent study by PricewaterhouseCoopers claims that “sustainability is emerging as a market driver with the potential to grow profits and present opportunities for value creation — a dramatic evolution from its traditional focus on efficiency, cost, and supply chain risk”.¹¹⁹

From an **ethical/moral standpoint**, ESG investing aims to create a positive impact on society and the environment. ESG investors often seek to support companies that align with their values and beliefs, such as those promoting gender equality, reducing carbon emissions, or refraining from involvement in activities like the financing of anti-personnel mines or chemical weapons. By investing in companies that prioritize ethical and sustainable practices, ESG investors strive to contribute to a better world for future generations.¹²⁰

From a financial standpoint, ESG investing can also offer advantages. Research has indicated that integrating ESG factors into investment decisions helps manage and mitigate long-term risks. These risks encompass various aspects, including operational, reputational, regulatory, and financial considerations. By investing in companies that prioritize ESG factors, investors may decrease their exposure to adverse events, such as scandals or regulatory penalties, which can negatively impact a company's financial performance. This is especially relevant for institutional investors, such as

¹¹⁸ Porter, M. E., & van der Linde, C. (1995a). Green and Competitive. *Harvard Business Review* (September-October), 120-134.

¹¹⁹ PricewaterhouseCoopers. (2010). Green products: Using sustainable attributes to drive growth and value: Sustainable business solutions. Available at: <http://www.pwc.com/us/en/corporate-sustainability-climate-change/assets/green-products-paper.pdf>

¹²⁰ For evidence of the effect of anti-pollution measures, see Fogler and Nutt (1975), Spicer (1978), Hart and Ahuja (1996), King and Lennox (2001), and Clarkson, Li, and Richardson (2004). Clarkson et al. (2004) show that investments in pollution abatement technologies pay off, especially for firms that pollute less.

pension funds, who have a fiduciary duty to manage assets for the long-term benefit of their beneficiaries.

The academic research investigating the performance of ESG investing has generated diverse outcomes. While economic models theoretically support the integration of ESG factors, empirical studies have produced less conclusive results. Certain studies have demonstrated a positive correlation between ESG and financial performance, while others have shown a negative or neutral association. For instance, a 2014 study conducted by Amundi found that being an ESG investor does not incur significant costs in terms of risk and return. The study also observed low tracking errors for optimized portfolios in Europe and globally, but higher tracking errors in the US and the Pacific region.

One limitation identified in the existing literature was the heavy reliance on long-term historical data, which may not accurately reflect the current sustainability landscape. The dynamic nature of sustainability practices necessitates considering recent developments and changes in the way companies operate. Additionally, the absence of effective regulation regarding ESG disclosure has hindered the ability to draw definitive conclusions from the analyses conducted so far. Analysts often assign lower weights to non-standardized information, making it challenging to fully capture the impact of sustainability on financial performance.

However, the implementation of the Corporate Sustainability Reporting Directive (CSRD) in Europe, effective from January 2023, is set to transform the ESG disclosure landscape. The directive mandates approximately 50,000 major companies and listed small and medium-sized enterprises (SMEs) to report on their sustainability practices. This significant regulatory change is expected to enhance the availability and comparability of ESG information, thus enabling more robust analyses and potentially leading to a more standardized understanding of the relationship between sustainability and firm value.

As we analyzed in the chapter 3, the new reporting disclosure framework is based on two fundamental reporting standards (ESRS 1 and 2). The key element of the first reporting standard is the **double materiality**.

Impact materiality refers to the level of importance a sustainability matter holds in terms of its actual or potential effects on people or the environment in the short, medium, and long-term. These effects can arise from the project itself or from its suppliers and vendors, and they may be positive or negative. Evaluating the project's impact should encompass the entire value chain.

Instead, the process of assessing financial materiality involves identifying information that proves valuable to investors, lenders, and other creditors when they evaluate how sustainability matters influence cash flows, development, performance, position, cost of capital, or access to finance within an undertaking. If omitting, misstating, or obscuring this information could reasonably be expected to affect decisions based on the undertaking's sustainability statements, it is deemed material.

The objective of the second reporting standards is to ensure that the undertaking is transparent about how it prepares its sustainability statements, including the scope of consolidation and the value chain information. In particular, the standard is based on 4 pillars:

1. Governance
2. Strategy
3. Impact, risk, and opportunity management
4. Metrics and targets.

Under the Strategy pillar, the regulation requires disclosure of the market position, strategy elements impacting sustainability, business models, and value chain (SBM-1). The pillar also requires considerations of stakeholder interests and views in strategy and business models (SBM-2), and the material impacts, risks, and opportunities and their interaction with strategy and business models (SBM-3), including changes from the previous year and resilience of strategy/business model.

The objective of the Disclosure Requirement in ESRS 2 is to provide understanding of the process(es) used to identify and assess impacts, risks, and opportunities. It includes disclosing methodologies, overviews of identification and assessment processes, organization of decision-making, integration with overall risk management, changes from prior reporting, and disclosure of when the process was first disclosed.

Regarding Metrics and Targets, the regulation states that disclosure contents should be included when disclosing information on metrics and targets related to material sustainability matters. Undertakings should apply the requirements in conjunction with relevant ESRS and disclose reasons for not adopting targets if applicable.

The undertaking must disclose metrics used to evaluate performance and effectiveness, external validation, clear names, and descriptions for metrics, and use the presentation currency of financial statements when currency is specified as the unit of measure.

In summary, the primary objectives of ESRS reporting standards are as follows:

- Alignment with other ESG standards: ESRS aims to enhance coordination with other evolving standards, such as the international Sustainability Standards Board (ISSB), to ensure consistency and coherence in reporting practices.
- Meeting investor information needs: ESRS intends to meet the information requirements of investors by providing a more comprehensive representation of sustainability-related information. This expanded scope now includes considerations related to the value chain.
- Enabling comprehensive sustainability reporting: ESRS enables companies to provide extensive sustainability information to global capital markets, allowing for a more comprehensive understanding of their environmental, social, and governance performance.
- Facilitating interoperability and stakeholder engagement: ESRS seeks to facilitate the compatibility of disclosures with jurisdiction-specific requirements and cater to a broader range of stakeholders, thereby promoting transparency and effective communication of sustainability-related information.

Returning to the purpose of this work, the implementation of these standards in Europe holds significant importance as it will lead to improvements in the quality, comparability, and usefulness

of sustainability disclosures for stakeholders in global capital markets. By adopting more standardized and robust information, analysts and investors will increasingly recognize the significance of ESG factors and their potential impact on financial performance. This enhanced clarity and observability of the relationship between ESG and financial outcomes can have far-reaching implications.

Moving to the analysis, the strategy we used to study the relationship between ESG and financial performance involved two different approaches.

The first approach was primarily focused on structural data, specifically less dynamic information, to investigate more reliable and generalized outcomes. To conduct this analysis, we utilized data with a long timeframe and short periodicity (yearly, quarterly, and monthly). We considered comprehensive indicators for both ESG and financial performance. The statistical methodology employed was the linear regression.

As introduced in the first chapter, the sample we selected was the STOXX Europe 600 index.

The **STOXX 600 Index** is a broad-based index comprising 600 of the largest and most liquid stocks across 18 European countries.

The regression conducted considering the whole sample without grouping it by size and industry showed a slightly positive relationship between ESG and financial performance (WACC and FCFO) with no evidence on price returns. Among the more reliable ESG metrics in terms of data quality (as they consider only information directly reported by the companies), Bloomberg ESG Disclosure (B_ESGD) stands out with an estimate of approximately 2%. While control variables such as Size and ROA have a greater impact (at -17% and 53% respectively), it is noteworthy that the other variables (ASY, LV, and AGE) do not exhibit a significant impact.

These findings suggest that, within our sample spanning from December 31, 2016, to December 31, 2022, the Bloomberg ESG disclosure value has a stronger influence on Free Cash Flow from Operations compared to leverage and information asymmetry. Previous studies have indicated a positive relationship between leverage and the cost of capital, as well as higher cost of capital for firms with a high market-to-book ratio (ASY). Considering all these elements together, the results obtained, though not exceptional, serve as an encouraging starting point for future analyses that are more structured and detailed.

Next, we conducted panel data analysis, conducting separate regressions for each individual year. The estimates confirmed the observations from the overall regression; however, the objective of this analysis was primarily focused on assessing the trend behavior of the ESG estimates. Particularly, the results highlight a growing significance of ESG values on financial performance, especially in 2021 and 2022. Moreover, in 2022, we observe a certain relationship not only with FCFO but also with ROR and WACC. This supports the thesis that sustainability is increasingly becoming a relevant measure of societal concern. Additionally, the average R2 values demonstrate slight improvements compared to the full regression, indicating a more accurate model estimate over the years.

In our comprehensive structural analysis, we conducted regressions considering both industries and company size. To accomplish this, we determined the 33rd and 66th percentiles of total assets for each industry. Subsequently, we divided the companies into small, medium, and large categories

based on these thresholds. The table below provides a summary of all the computed threshold values. The results reaffirm the earlier discussions and notably demonstrate favorable R-squared values, indicating the reliability of the multilinear models. In terms of the impact of ESG, the summary reveals promising values, which are not only generally positive but also significant in relation to the estimates of other control variables in the majority of cases in particular in the Real Estate and Materials industries.

This trend is supported by a study conducted in 2022 by Phoenix Health & Safety, which emphasizes that the manufacturing and real estate industries are leading in terms of adopting sustainable practices.¹²¹

In contrast, the second approach, discussed in chapter 5, involved the use of high-frequency data (monthly) to examine the relationship between ESG and market performance indicators. We refer to this approach as dynamical analysis due to the focus on less fundamental values such as WACC, FCFO, ROA, and ASY, and a greater emphasis on technical market indicators like the Fama and French 5-Factors model.

Our approach for evaluating the impact of ESG involves treating it as a new risk factor in asset pricing models. This methodology has been employed in previous studies.

From the results, we observe an increased R^2 in the regression with the inclusion of the ESG factor, which aligns with the findings of a similar analysis conducted in a previous study. However, we did not find significant differences between the regressions at different time-lags, indicating a weak cross-correlation.

Moreover, the ESG estimates generally exhibit a slightly negative trend, suggesting an inverse relationship between monthly returns and monthly ESG values.

It is important to note that these findings hold true when considering the entire sample without differentiating across industries, implying that the sign of sustainability may not be a significant factor in this context.

In any case, our main focus was to assess whether incorporating ESG factors can enhance the explanatory power of the capital pricing model. In this regard, the directionality of sustainability, given the comprehensive nature of our analysis, may not hold substantial relevance. For these reasons we then focused on the analysis considering the different industries (since the size element was already accounted for in the SMB risk factor).

To summarize the findings, the refined analysis based on industry-specific sampling reveals an improved R-squared value, providing a more accurate assessment of the relationship between ESG and financial performance. However, across most industries, the association between monthly price returns and monthly ESG values appears weak or inconclusive, with estimates hovering around zero or displaying a negative trend.

Notably, exceptions are observed in the Energy, Real Estate, and Materials sectors, where a positive relationship between sustainability and financial performance is evident. It is worth mentioning that

¹²¹ Nick Higginson, CEO - Phoenix Health and Safety | Published: 11 DECEMBER 2022, Data Source Phoenix Health & Safety, <https://www.thehrdirector.com/features/csr/what-are-the-most-sustainable-industries/>

these sectors also exhibited a positive relationship in the previous structural analysis, further emphasizing the potential impact of sustainability on financial outcomes within these industries.

Most industries show a weak or inconclusive relationship between monthly price returns and monthly ESG values. However, there is a slight positive association observed in the Energy, Real Estate, and Materials sectors.

In conclusion, the result we obtained from the two different analyses (structural and dynamical) gave us a comprehensive overview of the possible effects of ESG on corporate financial performance in Europe. The use of different types of not only dependent variables (FCFO, WACC and RoR), but also independent variables (different ESG metrics) enhanced the extensivity of this survey.

The fact we grouped the data by market area (EU), industry and size allowed us to use a very homogeneous and normalized measures and mitigate possibles biases.

The Structural analysis shows interesting results, both in terms of R^2 with average values of 0,35-0,45 which are quite good for these types of analysis and in terms of impact of ESG. We observed in fact a general positive estimate for ESG suggesting a positive relationship between ESG and financial performance. Focusing on the intensity of this relationship, the result is quite varying based on the industry and size. In particular, industries like Utilities, Materials and Real Estate showed interesting estimates. Considering that the effects of the introduction of the Corporate Sustainability Reporting Directive (CSRD) are not included in the data we used, these results are very promising and emphasize the need for additional research to be conducted.

Moving to the dynamical analysis, the result we obtained, considering the ESG as a new risk factor to be accounted for in evaluating market asset pricing, are as interesting. In particular grouping data by industry the R^2 obtained were on average about 0,15-0,25 which are not so good for this type of regression (Leila Bennani, Théo Le Guenedal etc. obtained values of 0,48-0,50 in their study).

Apart from that, the analysis indicates that ESG estimates tend to cluster around zero or exhibit a negative trend across most industries, suggesting a limited or inconclusive connection between monthly price returns and monthly ESG values. This mainly due to the difficulties of isolating the selected data from elements such as market sentiments and market uncertainty drive by Covid, Wars and other factors. For these reasons is understandable that finding a clear relationship between ESG and stock price is not easy but needs an accurately data selection and data clearing. Moreover, we need to consider the critical issues connected to ESG metrics used. In fact, the data used shows a remarkably low volatility between the months, with many metrics remaining constant throughout the entire year. It appears that these ESG metrics may reflect more of a "monthlyziation" of quarterly and yearly data, rather than truly monthly data.

Furthermore, we faced the same issue of the structural analysis as the data we gathered lacks the inclusion of the Corporate Sustainability Reporting Directive (CSRD), which was not effectively implemented in Europe in our sample (ends on 31.12.2022). This absence of standardized and transparent ESG disclosure by companies has resulted in potentially biased ESG metrics.

Based on our comprehensive review, we have arrived at a significant conclusion: prioritizing responsible practice/investments is crucial for all companies to leverage their operational performance and align their interests with society's broader objectives. This approach not only helps mitigate long-term risks but also contributes to an improved reputation and image in the eyes of stakeholders.

Also from an investor perspective, investing in companies with good ESG make sense not only from financial point of view but also from non-financial factors.

A lot of studies showed that firms behaving environmentally irresponsibly demonstrate significant stock price decreases. This is an enhanced source of risk that investors should account for.

Moreover, 90% of the studies on the cost of capital show that sound sustainability standards lower the cost of capital of companies.¹²²

From an ethical or moral perspective, ESG investing strives to generate a positive influence on society and the environment. ESG investors frequently seek to back companies that align with their values and principles, such as promoting gender equality, reducing carbon emissions, or abstaining from financing anti-personnel mines and chemical weapons. By investing in companies that prioritize ethical and sustainable practices, ESG investors aspire to contribute to the creation of a more favorable world for future generations.

Stepping back and revisiting the introduction of this work, we want to reminded the Howard Zinn's insight: although individual actions may seem small in scale, when multiplied by millions of companies, they possess the capacity to catalyze profound transformations and make meaningful contributions to the establishment of a sustainable future for our planet.

So independently by its financial value, investing in sustainability is not only a responsible choice but also a means to bring about positive change.

To fully leverage the value-enhancing potential of ESG factors, a thorough and profound comprehension of integrating ESG criteria into investment processes is essential. An important area for future research is to gain a deeper understanding of the interplay between various ESG criteria and the significance of specific ESG sub-criteria for financial performance. These insights will provide further clarity on the ESG drivers that positively impact long-term performance. Moreover, as mentioned multiple times, the adoption of a more standardized sustainable disclosure will bring to more accurately and transparent ESG metrics.

¹²² Clark, Gordon L. and Feiner, Andreas and Viehs, Michael, From the Stockholder to the Stakeholder: How Sustainability Can Drive Financial Outperformance (March 5, 2015). Available at SSRN: <https://ssrn.com/abstract=2508281> or <http://dx.doi.org/10.2139/ssrn.2508281>

References

Bibliography

Accenture (2013). *The UN Global Compact-Accenture CEO Study on Sustainability 2013*. Accenture Sustainability Services.

Accenture, United Nations Global Compact-Accenture CEO Study, 2022

Amir Amel-Zadeh and George Serafeim, "Why and How Investors Use ESG Information: Evidence from Global Survey" (2018) *Fin Anal J* 74:87.

Andersson, M., Bolton, P., and Samama, F. (2016), *Hedging Climate Risk*, *Financial Analysts Journal*, 72(3), pp. 13-32.

Andrè Breedta, Stefano Cilibertia, Stanislao Gualdia, Philip Seagera, "Is ESG an Equity Factor or Just an Investment Guide?", *a Capital Fund Management*, 23 rue de l'Université, Paris, France 7500

Aswath Damodaran, *Applied Corporate Finance: A User's Manual* (John Wiley and Sons, 1999), http://pages.stern.nyu.edu/~adamodar/New_Home_Page/AppldCF/derivn/ch5deriv.html. ISBN 978-0-471-33042-4.

Barnett, Michael. (2005). *Stakeholder Influence Capacity And The Variability Of Financial Returns To Corporate Social Responsibility*. *Academy of Management Review*. 32. 10.5465/AMR.2007.25275520.

Basiago AD (1999) *Economic, social, and environmental sustainability in development theory and urban planning practice*. *Environmentalist* 19:145–161. <https://doi.org/10.1023/A:1006697118620>

Bebczuk, Ricardo and Galindo, Arturo José, Corporate Leverage, the Cost of Capital, and the Financial Crisis in Latin America (March 24, 2010). Available at SSRN: <https://ssrn.com/abstract=1577687> or <http://dx.doi.org/10.2139/ssrn.1577687>

Ben Rejeb Attia, M.; Lassoued, N.; Chouikha, M. *State ownership and firm profitability in emerging markets: A simultaneous equations analysis*. *Int. J. Public Sect. Manag.* 2018, 31, 167–183.

Bennani, Leila and Le Guenedal, Théo and Lepetit, Frederic and Ly, Lai and Mortier, Vincent and Roncalli, Thierry and Sekine, Takaya, *How ESG Investing Has Impacted the Asset Pricing in the Equity Market* (November 27, 2018).

Bloomberg. "Bloomberg Professional Services". Archived from the original on March 5, 2017. Retrieved February 27, 202

Bodie, Alex Kane and Alan J. Marcus, *Investments*, Zvi 2021, Chapter 9 pp 27

Bodie, Zvi, Alex Kane and Alan J. Marcus, *Investments*, McGraw-Hill/Irwin (June 18, 2008)

Carmen Juravle and Alan Lewis. *Identifying impediments to SRI in Europe: a review of the practitioner and academic literature*. *Business Ethics: A European Review*, 17(3):285-310, 2008.

Casella, Georges (2002). *Statistical inference* (Second ed.). Pacific Grove, Calif.: Duxbury/Thomson Learning. p. 556. ISBN 9788131503942.

Clark, Gordon L. and Feiner, Andreas and Viehs, Michael, *From the Stockholder to the Stakeholder: How Sustainability Can Drive Financial Outperformance* (March 5, 2015). Available at SSRN: <https://ssrn.com/abstract=2508281> or <http://dx.doi.org/10.2139/ssrn.2508281>

Clarkson, P. M., Li, Y., & Richardson, G. D. (2004). *The Market Valuation of Environmental Capital Expenditures by Pulp and Paper Companies*. *The Accounting Review*, 79(2), 329–353. <http://www.jstor.org/stable/3203247>

Coleman, L. *Losses from Failure of Stakeholder Sensitive Processes: Financial Consequences for Large US Companies from Breakdowns in Product, Environmental, and Accounting Standards*. *J Bus Ethics* 98, 247–258 (2011). <https://doi.org/10.1007/s10551-010-0544-8>

Core, J.E., Guay, W.R. and RUSTICUS, T.O. (2006), *Does Weak Governance Cause Weak Stock Returns? An Examination of Firm Operating Performance and Investors' Expectations.* *The Journal of Finance*, 61: 655-687. <https://doi.org/10.1111/j.1540-6261.2006.00851>.

Dhaliwal, D.; Li, O.Z.; Tsang, A.; Yang, Y.G. *Corporate social responsibility disclosure and the cost of equity capital: The roles of stakeholder orientation and financial transparency.* *J. Account. Public Policy* 2014, 33, 328–355

Draper, N. R.; Smith, H. (1998). *Applied Regression Analysis.* Wiley-Interscience. ISBN 978-0-471-17082-2.

Drucker, Peter F. "The Rise of the Knowledge Society." *The Wilson Quarterly* (1976-), vol. 17, no. 2, 1993, pp. 52–71. JSTOR, <http://www.jstor.org/stable/40258682>. Accessed 4 June 2023.

EFRAG, *Draft European Sustainability Reporting Standards*, November 2022.

European Commission (2018), *Communication from the Commission, Action Plan: Financing Sustainable Growth.*

European Commission. (2005). *Sustainable Investment and Financial Innovation Action Plan.* Retrieved from https://ec.europa.eu/environment/investments/pdf/sifi_action_plan.pdf

European Commission. (2013). *Directive 2013/34/EU of the European Parliament and of the Council of 26 June 2013 on the annual financial statements, consolidated financial statements and related reports of certain types of undertakings.* Retrieved from <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013L0034>

Federico Cheever, John C. Dernbach, "Sustainable Development and Its Discontents", 2015

Fernandes, Nuno. 2014, *Finance for Executives: A Practical Guide for Managers*, p. 32.

Fernandes, Nuno. *Finance for Executives: A Practical Guide for Managers.* NPV Publishing, 2014, p. 30.

Firman, Sukono & Hidayat, Yuyun & Bon, A. & Supian, S.. (2017). *Modelling of capital asset pricing by considering the lagged effects.* *IOP Conference Series: Materials Science and Engineering.* 166. 012001. 10.1088/1757-899X/166/1/012001.

Fountas, K., & Hassapis, L. (2019). *Investor sentiment and its effect on the stock markets: A case study with artificial neural networks.* *International Journal of Computational Economics and Econometrics*, 9(3), 234-258.

Friede, Gunnar and Busch, Timo and Bassen, Alexander, *ESG and Financial Performance: Aggregated Evidence from More than 2000 Empirical Studies (October 22, 2015).* *Journal of Sustainable Finance & Investment*, Volume 5, Issue 4, p. 210-233, 2015, DOI: 10.1080/20430795.2015.1118917, Available at SSRN: <https://ssrn.com/abstract=2699610>

Friedman, M. (1970) *The Social Responsibility of Business Is to Increase Its Profits.* *New York Times Magazine*, 13 September 1970, 122-126.

Gibson RB (2006) *Beyond the pillars: sustainability assessment as a framework for effective integration of social, economic, and ecological considerations in significant decision-making.* *J Environ Assess Policy Manag* 8:259–280

Global Footprint Network. (2019). *Living Planet Report: 2018.* Retrieved March 8, 2020, from <https://www.footprintnetwork.org/>

Graham, John R; Smart, Scott B.; and Megginson, William J. (2010). *Corporate Finance (third ed.).* Mason OH: South-Western Cengage Learning. p. 387. ISBN 9780324782967.

Hao Li, Xuan Zhang, Yang Zhao, *ESG and Firm's Default Risk,* *Finance Research Letters*, Volume 47, Part B, 2022, 102713, ISSN 1544-6123, <https://doi.org/10.1016/j.frl.2022.102713>.

Harper, Douglas. "sustain". *Online Etymology Dictionary.*

Harvard Law School Forum on Corporate Governance, <https://corpgov.law.harvard.edu/2023/01/30/eu-finalizes-esg-reporting-rules-with-international-impacts/#:~:text=Disclosures%20will%20be%20required%20to,sustainability%20matters%20affect%20the%20company.>

Henshaw, Mark (2010). "Eco Investor Guide" (PDF). Eco Investor Guide, Inc. Archived from the original (PDF) on 25 May 2010. Retrieved 11 June 2010.

Hillier, Ross, Westerfield, Jaffe, Jordan, *Capital Structure: Basic Concepts: Chapter 18 from Corporate Finance 4E 2021*.

Hillier, Ross, Westerfield, Jaffe, Jordan, *Capital Structure: Valuation and Capital Budgeting for Levered Firm: Chapter 20 from Corporate Finance 4E 2021*

Howard Zinn (July 1, 2007). "Making History". *The New York Times*. Retrieved November 14, 2010.

Hudson, C. (2019). *Here's Why People Find Sustainability Boring*. Retrieved from <https://www.greenbiz.com/article/heres-why-people-find-sustainability-boring>.

Imen Khanchel & Naima Lassoued, 2022. "ESG Disclosure and the Cost of Capital: Is There a Ratcheting Effect over Time?" *Sustainability*, MDPI, vol. 14(15), pages 1-19, July.

J. Tillman Lyle, *Regenerative Design for Sustainable Development* (John Wiley & Sons, Inc., 1994);

Jeff Brady, (28 August 2019). "Teen Climate Activist Greta Thunberg Arrives in New York After Sailing The Atlantic". NPR. Archived from the original on 2 October 2019

Kernel, "Financial Dictionary". 2021-01-21. Retrieved 2021-02-24

Khanchel El Mehdi, I.; Seboui, S. *Corporate diversification and earnings management*. *Rev. Account. Financ.* 2011, 10, 176–196.

Khanchel, I.; Lassoued, N. *ESG Disclosure and the Cost of Capital: Is There a Ratcheting Effect over Time?* *Sustainability* 2022, 14, 9237. <https://doi.org/10.3390/su14159237>

Khoury-Kassabri, M., & Naim, M. (2020). *Price discovery and volatility components across different markets in MENA region*. *Journal of Applied Business Research*, 36(3), 58-77.

KPMG International Cooperative, Global Reporting Initiative (GRI), United Nations Environment Programme (UNEP) and Centre for Corporate Governance in Africa (2016), *Carrots and Sticks. Global Trends in Sustainability Reporting Regulation and Policy*, available at: <https://assets.kpmg.com/content/dam/kpmg/pdf/2016/05/carrots-and-sticksmay-2016.pdf>.

Lassoued, N.; Ben Rejeb Attia, M. *Benefits and costs of political connections: Evidence from Tunisia*. *Int. J. Account. Audit. Perform. Eval.* 2014, 10, 299–325.

Lee, C.C.; Chiu, Y.B. *The impact of real income on insurance premiums: Evidence from panel data*. *Int. Rev. Econ. Financ.* 2012, 21, 246–260

Leila Bennani, Théo Le Guenedal, Frédéric Lepetit, Lai Ly, Vincent Mortier, Thierry Roncalli & Takaya Sekine, *How ESG Investing Has Impacted the Asset Pricing in the Equity Market*, Amundi Asset Management, Paris, November 2018.

Lo, A. W.; A. C. MacKinlay (1988). "Stock market prices do not follow random walks: evidence from a simple specification test". *Review of Financial Studies*. 1 (1): 41–66. CiteSeerX 10.1.1.4.3468. doi:10.1093/rfs/1.1.41. ISSN 0893-9454.

Marius C. Claudy, Karl Aquino and Maja Graso, *Artificial Intelligence Can't Be Charmed: The Effects of Impartiality on Laypeople's Algorithmic Preferences*, 29, June, 202

McWilliams, A. and Siegel, D. (2000), *Corporate social responsibility and financial performance: correlation or misspecification?*. *Strat. Mgmt. J.*, 21: 603-609. [https://doi.org/10.1002/\(SICI\)1097-0266\(200005\)21:5<603::AID-SMJ101>3.0.CO;2-3](https://doi.org/10.1002/(SICI)1097-0266(200005)21:5<603::AID-SMJ101>3.0.CO;2-3)

Nick Higginson, CEO - Phoenix Health and Safety | Published: 11 DECEMBER 2022, *Data Source Phoenix Health & Safety*, <https://www.thehrdirector.com/features/csr/what-are-the-most-sustainable-industries/>

O'Sullivan, Arthur; Sheffrin, Steven M. (2021). *Economics: Principles in Action*. Washington, DC: Pearson Prentice Hall. p. 271. ISBN 978-0-13-063085-8.

Pierre Vernimmen. *Corporate Finance, Theory and Practice*, 2005

Porter, M. E., & van der Linde, C. (1995a). *Green and Competitive*. *Harvard Business Review* (September-October), 120-134.

PricewaterhouseCoopers. (2010). *Green products: Using sustainable attributes to drive growth and value: Sustainable business solutions*. Available at: <http://www.pwc.com/us/en/corporate-sustainability-climate-change/assets/green-products-paper.pdf>

P. Mang & B. Reed, 'Regenerative Development and Design,' in *Encyclopedia Science & Technology* (McGraw-Hill 2012), pp. 2112-2145.

Ross, Stephen, Randolph Westerfield and Bradford Jordan *Fundamentals of Corporate Finance*

Scripps Institution of Oceanography. (2020). *Scripps CO2 Program*. Retrieved March 8, 2020, from <https://scrippsco2.ucsd.edu/>

Sengarasy, S., & Rajaram, A. (2015). *Stock prices and company's profitability*. *Indian Journal of Commerce and Management Studies*, 6(1), 118-126.

Sharfman, M.P.; Fernando, C.S. *Environmental risk management and the cost of capital*. *Strateg. Manag. J.* 2008, 29, 569–592.

Stewart, James. *Calculus*. Cengage Learning, 2011. Section 1.1

Sustainalytics Ratings and Research, "Understanding Your Company's ESG Ratings" (May 2019)

Suto, M.; Takehara, H. *CSR and cost of capital: Evidence from Japan*. *Soc. Responsib. J.* 2017, 13, 798–816.

Trevor Hastie, Robert Tibshirani, and Jerome Friedman. *The Elements of Statistical Learning*" (Section 3.2.3: "Preprocessing and Scaling")

The European Green Deal, Brussels, 11.12.2019 COM(2019) 640 final, https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF

United Nations Human Rights, *Guiding Principles on Business and Human Rights*, https://www.ohchr.org/sites/default/files/documents/publications/guidingprinciplesbusinesshr_en.pdf

United Nations. (2019). *The Sustainable Development Goals Report 2019*. Retrieved March 8, 2020, from <https://www.un.org/development/desa/publications/2019-sustainable-development-goals-report.html>.

Van Marrewijk, M., Werre, M. *Multiple Levels of Corporate Sustainability*. *Journal of Business Ethics* 44, 107–119 (2003). <https://doi.org/10.1023/A:1023383229086>

W. McDonough & M. Braungart, *Cradle to Cradle: Remaking the Way We Make Things* (North Point Press, 2010), p. 155.

World Commission on Environment and Development. (1987). *Our Common Future*. Oxford: Oxford University Press.

World Economic Forum, "What is green finance and why is it important?". Retrieved 2020-12-28.

Webliography

- Environmental, Social and Governance (ESG) Scores from Refinitiv - May 2022*,
https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/refinitiv-esg-scores-methodology.pdf
- ESG Data is Now Worth It*, <https://www.opimas.com/research/742/detail/>
- ESMA*, <https://www.esma.europa.eu/esmas-activities/sustainable-finance/sustainability-reporting>
- European Commission [EC]. (2020). Taxonomy. Retrieved from https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/taxonomy_en.*
- Google Scholar*, <https://scholar.google.com/>
- https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html
- https://www.accenture.com/us/en/insights/strategy/reimaginedconsumerexpectations?c=acn_glb_lifereimaginedmediarelations_12240956
- <https://www.glassdoor.com/employers/resources/how-being-on-glassdoors-best-places-to-work-list-pays-off/>
- https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/refinitiv-esg-scores-methodology.pdf
- <https://www.reprisk.com/news-research/resources/methodology>
- [https://www.sustainalytics.com/sustainable-finance/2019/04/26/webinar-understanding-esg-risk-ratings-2/.](https://www.sustainalytics.com/sustainable-finance/2019/04/26/webinar-understanding-esg-risk-ratings-2/)
- RepRisk, Methodology Overview*, <https://www.reprisk.com/news-research/resources/methodology>
- RepTrakTrustReport,2023*,<https://2963875.fs1.hubspotusercontentna1.net/hubfs/2963875/RepTrak%20Trust%20Report.pdf>
- STOXX_index_guide_2023-04-06*,
https://www.stoxx.com/document/Indices/Common/Indexguide/stoxx_index_guide.pdf
- Sustainalytics ESG Risk Rating - FAQs for Corporations.pdf*,
<https://connect.sustainalytics.com/hubfs/SFS/Sustainalytics%20ESG%20Risk%20Rating%20-%20FAQs%20for%20Corporations.pdf>
- U.S. Census Bureau. (2017, February 15). International Data Base. Retrieved March 8, 2020, from https://www.census.gov/programs-surveys/international-programs/about/idb.htm*
- Measuring Intangibles ROBECOSAM'S CORPORATE SUSTAINABILITY ASSESSMENT METHODOLOGY*,
https://www.spglobal.com/esg/csa/static/docs/measuring_intangibles_csa-methodology.pdf