



The relationship that CSR (ESG) has with
financial distress in different industries and
different geographies: an analysis in the energy
and industrial sector between Europe and
Northern America

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ABSTRACT

Due to a changing world, sustainability has been receiving more and more attention due to its importance to consumer's eyes. The Relationship between investments done towards sustainability and a firm's probability of financial distress has never been more contradictory than today due to data misalignment and not enough transparency around the practice of sustainability reporting. This study will deep dive in this relationship, by using ESG as a proxy for sustainability and the Altman Z-Score, Current Ratio and Return on Assets as proxies of financial distress. This is a cross-sectional study that will be conducted between two sectors (Energetic sector and Industrial sector) and between two regions (European region and Northern American Region). By analyzing a time span ranging from 2012 to 2024 this study aims to understand whether ESG monetary efforts by a company, influence its financial stability and understand whether the strength and direction of this relationship changes depending on different industry characteristics and geographical context. Even though we have some strong results concerning some of the proxies used in this study, like the negative effect that ESG investments have on liquidity when measured through Current Ratio, the results provide for contrasting evidence throughout the different analysis. The Altman Z-Score appears to be less reliable in assessing the probability of financial distress in the context of ESG, while ROA mainly indicate potential short-term profitability reductions.

Keywords: ESG, Financial Distress, Altman Z-Score, Current Ratio, Return on Assets

A relação entre a RSE (ESG) e as dificuldades financeiras em diferentes sectores e diferentes geografias: uma análise no sector da energia e da indústria entre a Europa e a América do Norte.

Ugo Vittorio Sala

RESUMO

Devido a um mundo em mudança, a sustentabilidade tem vindo a receber cada vez mais atenção devido à sua importância para os olhos dos consumidores. A relação entre os investimentos efectuados no domínio da sustentabilidade e a probabilidade de uma empresa entrar em dificuldades financeiras nunca foi tão contraditória como atualmente, devido ao desalinhamento dos dados e à falta de transparência suficiente em torno da prática de elaboração de relatórios de sustentabilidade. Este estudo irá aprofundar esta relação utilizando o ESG como proxy da sustentabilidade e o Altman Z-Score, o rácio atual e a rendibilidade dos activos como proxies de dificuldades financeiras, entre dois sectores e entre duas regiões. Ao analisar um período de tempo que vai de 2012 a 2024, este estudo pretende compreender se os esforços monetários ESG de uma empresa influenciam a sua estabilidade financeira e perceber se a força e a direção desta relação se alteram em função das diferentes características do sector e do contexto geográfico. Apesar de termos alguns resultados fortes relativamente a algumas das proxies utilizadas neste estudo, como o efeito negativo que os investimentos ESG têm na liquidez quando medidos através do “ROA”, os resultados fornecem evidências contrastantes. O Altman Z-Score parece ser menos fiável na avaliação da probabilidade de dificuldades financeiras no contexto de ESG.

Palavras-chave: ESG, dificuldades financeiras, Altman Z-Score, rácio atual, rendibilidade do ativo

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1. INTRODUCTION

Before introducing this research, I, as the researcher and writer of this dissertation, would like to state one thing. As the information concerning the non-financial corporate practices can be summarized using the three modern pillars of Corporate Social Responsibility (CSR), which are environmental, Social, and Governance (Carnini Pulino et al., 2022) throughout this dissertation the concept of Corporate Social responsibility will be expressed with both the terms of “CSR” and “ESG” as one explains the other.

Over the past two decades ESG factors have emerged as a critical indicator of corporate sustainability and long-term financial performance. Investors, regulators, and stakeholders increasingly view ESG performance not only as a measure of corporate responsibility but also as a key determinant of financial resilience. As global markets face growing economic uncertainties, companies with strong ESG practices are often perceived as better positioned to manage risks, enhance operational efficiency, and maintain investor confidence.

One of the most debated topics in corporate finance today is whether strong ESG performance reduces the likelihood of financial distress. Theoretically, firms with high ESG ratings may benefit from lower capital costs, better risk management, and stronger stakeholder relationships, leading to increased financial stability. Conversely, critics argue that high ESG investments may drain resources and negatively impact short-term profitability, potentially increasing financial vulnerability. This study seeks to explore these competing perspectives by investigating the relationship between ESG scores and financial distress indicators being:

- Altman Z-score;
- Liquidity ratios, specifically current ratio;
- and profitability ratios, specifically Return on Assets (ROA).

For various reasons the choice of proxies fell upon the three above for this study. Throughout the period of preliminary research, Return on Assets has caught the eye as one of the most widely used to evaluate firm performance based also on the firm activities. In particular, Dalal and Thaker (2019) use ROA as a measure to express the firm performance.

In order to have a more comprehensive evaluation of a firm’s performance, the choice fell upon the Altman Z-Score. The paper by Cohen (2022) states how the Altman Z-score is a good

measure of a firm's survival chances. Being this a paper trying to study a firm's probability of entering financial distress, this measure is perfect.

In addition, Madushanka and Jathurika (2018) state the importance of Current ratio in measuring liquidity. They also add that a good liquidity level is what allows the company to continue its day-to-day activities.

This research aims to answer the following key questions:

- Does a higher ESG score correlate with a lower probability of financial distress?
- Does the relationship between ESG and financial distress vary across industries and geographic regions?

To address these questions, the study will analyze financial and ESG data from companies in North America and Europe, spanning the years 2012 to 2024. Using statistical regression models, including panel data analysis and correlation tests, the study will examine how ESG scores influence key financial distress indicators. Additionally, industry-level comparisons will be conducted to assess whether certain sectors benefit more from ESG-driven financial stability than others.

By providing empirical evidence on the link between ESG and corporate financial health, this research will contribute to the ongoing debate on sustainable finance and risk management. The findings may offer valuable insights for investors, policymakers, and corporate decision-makers, helping them understand whether ESG investments truly enhance financial resilience or if they pose a potential risk to financial stability.

The reason behind the choice in investigation regarding the matter, comes from a strong personal interest in the topic. Particularly, I have noticed how the research on these topics either it is concentrated on stock returns or on the analysis on one single country.

My main topic of interest is understanding whether the link between CSR and financial distress measures would be the same when comparing industries and territories.

The uniqueness of this research stems also from the fact that no research prior to this, in the matter of understanding the effect that ESG investments have on the probability of a firm's distress, has focused on the cross-regional differences risen from this analysis, as it is all concentrated on the relationship between the two inside a singular country. By doing so, this research can take into consideration also the different regulatory framework, and many more geographical differences that arise between the two.

I have chosen as my industries of analysis the Energy sector and the Industrial sector as I believe they are the ones under the strongest type of scrutiny, whether because their environmental effects are harder to assess or because they are in constant evolution. In addition, Buallay (2019) already researched the link between ESG and Firm performance in the Banking sector (which has been researched a lot, due to their inclination to follow the sustainability report standard.)

2. LITERATURE REVIEW

As previously mentioned in the introduction, the research topic of this analysis is CSR, financial distress and the relationship encountered between these two factors.

An important and fascinating premise is the fact that no definitive direction of relationship (positive or negative) has been proven completely effective and accurate thus far, as different theories and opposite valid arguments have risen.

Nowadays ESG has been retrieving more and more importance in creating and maintaining long-term value created by the company, industry or simple investor. As a matter of fact, the overwhelming amount of literature present, finds that companies that pay attention to “ESG” show a rise in value creation (Henisz et al., 2019).

Investors, nowadays, are increasingly integrating ESG-related information in their investment decisions (Berg et al., 2022). As a matter of facts, in 2013, The National Global Compact surveyed 1000 CEOs globally and 93% of them considered ESG and related matters essential to the success of their business (Khan, 2022). Lately more and more rating agencies are incorporating CSR/ESG practices into their rating process (Khan, 2022).

On the same note, KPMG released the results of a survey on sustainability reporting in 2020 where they state that 80% of all large and mid-cap firms around the world published a CSR report in 2020 compared to 1993 where it was only 12% (Tsang et al., 2023).

CSR investments should not be considered any different than any other intangible or tangible asset (as it is a strong added value to the portfolio of the company) (Edmans, 2022). This is a big turning point in terms of views on the subject, as before no one believed that ESG would bring benefits but just large costs with it.

While before companies were “coherced” into working within the rules of environmental policies, lately more and more companies are practicing voluntary disclosure as to ESG (Tsang et al., 2023).

Nowadays large companies with huge nominal of assets under management are not just studied for their short-term earning and returns, but also for their ability to create long-term value (Edmans, 2022).

To understand the meaning of this study is to first understand the meaning of the Corporate Social Responsibility when look at it through the ESG lens.

As a matter of fact, ESG is made of three elements rather three components which are the following;

- “E,” environmental criteria: Every company uses finite resources in a different amount, with different purposes and with a different effect on the “*outside*”. This first letter symbolizes the effects that your company has on the outside world. This encompasses all the energy that your company needs and all the energy it puts back in the air as much as your company’s carbon emissions, and the effect that it has, in general, on climate change (Henisz et al., 2019);
- “S,” social criteria: As the world is becoming more intertwined and more connected, this criterion is meant to express the relationships that your company has and that it intends to foster with the people that work there, with the institutions they work with, and the places they work in (Henisz et al., 2019);
- “G,” governance criteria: Every company, being a legal entity, needs a system of governance to rule the ordinary and extraordinary activities. This last criterion is meant to monitor the procedures used internally by the companies to organize itself. (Henisz et al., 2019).

All these criteria are not “stand-alone” rather they work together (Henisz et al., 2019).

The paper by Cohen (2022) highlights how the Altman Z-score of companies from the S&P500 is negatively influenced by “E” and “S” and not “G”. This, in turn, makes us understand that separating them would shift the entire focus of this research

These are the reasons behind the choice for this research to work with ESG as a unique factor and not work with the independent criteria. As stated also by Alareeni and Hamdan (2020) looking at just one of the three pillars of ESG would not make for robust result as nowadays they are so interconnected that they cannot be separated.

Literature since the 2000s has identified a strong link between the value creation that CSR adds to a company in many ways such as (Tsang et al., 2023):

- Lower cost of capital
- Increased customer and employe satisfaction
- Higher levels of institutional ownership

- Better access to finance
- Etc..

These are very strong points which are still, however, continuously discussed even to understand whether for firms it is important or not to, not only invest what they are “forced” to, but also invest voluntarily on the firm’s environmental, social and governance growth.

In a more numerical and factual way, it is of detrimental exposure to state how ESG investments are not only a small milestone this is not only a superficial step but a turning point for our society, as a matter of fact the Bank of America predicted that in 2019 200 million \$ would flow in ESG funds (Khan, 2022).

In general, the question whether ESG disclosure and ESG investments does lead to better firm performance has not been addressed yet entirely (Carnini Pulino et al., 2022).

Much research has highlighted how the link between ESG and firm value is not so straight forward. It is well highlighted how data constraints are an impactful matter when it comes to the analysis of this relationship, due both to data availability as much as data interpretation. (Dalal & Thaker, 2019).

Not only this, but as stated by Carnini Pulino et al., (2022) the majority of papers show a positive relationship between ESG and firm performance but many times when dissecting the three pillars and analysing them singularly the results might differ.

Dalal and Thaker (2019) state that many times, while the results are positive when analysing the relationship between ESG and firm performance, they are not robust enough to have clear results on the matter.

Alareeni and Hamdan (2020) have found a strong general relationship between ESG and firm performance (mainly measured by Return on Equity and Return on Assets), however this relationship is weaker due to reasons that compete together such as:

- When you are better performing as a firm you tend to have more financial availability to invest in ESG practices, while if the company is more distressed it tends to have fewer financial availabilities
- The other way around the more you invest the better your financial availabilities are supposed to be

In addition to this, research has showed how ESG disclosure varies across different industries, firms and geography (Buallay, 2019), which is something that is very relevant to the understanding of the linkage between these two. Buallay (2019) also expresses how important it is to look at the relationship between CSR and firm performance from a geographical and sectorial point of view, and that is exactly what this research intends to do.

As stated above, Research has been very controversial in finding a clear result when studying this relationship. That is why this research intends to understand whether CSR has truly an impact on the long-term financial sustainability of a company and whether the short-term investment intended to make the “*green*” transition is compensated by a rise in factors like brand reputation, operational efficiency and many more in the future.

3. METHODOLOGY

3.1 Time-range and country selection

The idea behind this research is to do a cross-sectional comparison of the effects that ESG investments have on the probability of financial distress across the years ranging from 2012 to 2024. The idea is to run different regressions to analyze all possible results in order to have a clearer view.

This exact time range as for the dataset was chosen for the following reasons:

- 2010 was a major turning point in terms of ESG reporting and standardization. Around these years it started to be a more standardized disclosure, where regulatory bodies and investors increasingly started to demand from firms to be more consistent and more transparent in their sustainability reporting. This would entail that, including data before than 2012 would have made the dataset less robust and the research null;
- The selected time range covers the most important recent development both from a social and financial stand point. The post 2008 financial crisis and re-development (the crisis itself was not included as it would have made the results null due to the economic situation it brought with it), the pandemic of COVID-19, the recent energetic crisis as much as the latest conflicts that are affecting the global situation;
- Takes into consideration the Paris agreement of 2016 and the EU's Non-Financial Reporting Directive (NFRD) of 2014.

This timeframe allows the study to track ESG evolution and assess its financial performance across different economic conditions and meaningful long-term corporate sustainability strategies.

In terms of geographical selection of the territories the reasons why this research includes Europe and North America is the following:

- As a researcher I have a particular interest in countries where sustainability is shaping the corporate strategies;
- Selecting two geographically distant regions adds significant value to the research by allowing for a comparative analysis more inclusive of the differences between the two;

- The countries have two very different ESG implementation regulations that make the comparison extremely more interesting. While the EU has stricter sustainability reporting standards, the US has a more market-driven approach;
- Both Europe and North America have strong Industrials and energetic sectors, which makes them ideal for comparison.

First, the research will start by doing regressions to analyze the relationship that in the single sectors and separately in the single countries there is between ESG and the three financial ratios in order to have a way to compare them all.

Then, regressions will be run independently. For example, I will run a regression of ESG scores (of the selected companies of this specific regression) as the independent variable on the Altman Z-Score (of the selected companies of this specific regression) as the dependent variable keeping into consideration the country and sector specific factors.

The above explanation is very much a simplification of the amount of work behind it, as the comparisons will be done under many different perspectives.

Explanation of the variables, countries and sectors

The first thing at this point in the analysis was looking at the variables that were going to be taken into consideration. As I stated previously in terms of CSR, the choice fell upon the ESG scores, as they are the closest representation of the level of Corporate Social Responsibility. They also take into consideration many different aspects of it (as specified previously).

Now, there are three main ESG scores providers, which are;

- Bloomberg
- MSCI
- Thomson Reuters (Alareeni & Hamdan, 2020)

For this research, I decided to take into consideration the score by Thomson Reuters for the availability of the dataset to me as a researcher. Given the same level reliability of the three of them, I have chosen the one most practical and most available to me.

When it came to understanding which variables to consider when looking at Corporate Performance, the three that I have chosen and will be studied in this paper are: Altman Z-score, Return on Assets (which throughout the paper will be mentioned as ROA) and the Current

Ratio. I chose the ROA as past research has always identified it as a key metric of corporate performance and the best fit when doing this type of analysis.

Altman Z Score is a common measure to represent a clear measurement of a firm's probability of financial distress and its chances of survival. It is also widely used in financial research to predict bankruptcy and corporate distress. Also, it incorporates different financial indicators, providing a comprehensive measure of financial health. The current ratio is a choice that I believe increases the robustness of the analysis for different reasons that can be identified in the following lines. First, looking at past research, I, to the extent of my knowledge, never found a research based on this measure. Secondly, I, as the researcher, wanted to take into consideration all types of aspects of corporate performance and the current ratio being a liquidity measure and being mainly available for all companies in my dataset was the third metric that I chose to take into consideration.

The reason why I chose the Energy sector and the Industrial sector is due to their unique financial structure, which carries with it strong ESG implications, and strong susceptibility to financial distress. Both these industries play a crucial role in the world economy, yet, both of them, face distinct challenges that make them ideal for examining the relationship between ESG and Financial stability.

Both sectors are characterized by high capital expenditures (CAPEX), long investment cycles, and to say the least significant debt financing and all these factors together make them very prone and sensitive to financial distress. Especially the industrial sector is very sensitive to economic cycles.

Other than their "particular" structure, they are very regulated when it comes to sustainability. The Energy sector, due its high climate-related risks, strong carbon emissions, and very relevant fossil fuel dependency, tends to be more regulated than other sectors. A similar concept is valid for the "Industrial" sector, which due to the strong amount of carbon emission, pollution, and many risks of workplace safety, are always heavily regulated and controlled when it comes to Corporate Social Responsibility.

By focusing on these two sectors, this research captures two critical industries with high financial exposure and regulatory scrutiny which are in constant evolution.

When it comes to the choice of Europe and Northern America, it is more straight forward. Firstly, this research was meant to study companies based in mature and established markets to avoid some of the volatility present in the under developed markets.

Both Europe and North America, are home to some of the world's largest and most mature companies, where ESG reporting and sustainability initiatives have gained significant traction. However, these two regions differ in their approach to their ESG regulation and corporate sustainability which makes them ideal for a cross-region analysis. On one side, Europe has very stringent regulation such as:

- the Green Deal which entails European countries to expand their climate ambitions, mobilize the industries to start supporting a clean and circular economy, have a more stable supply of clean and secure energy and much more (Fetting, 2020) which goes to highlight the stringent regulations being put in place by the European commissions;
- the Sustainable Finance Disclosure regulation which is meant to increase the guidelines and transparency levels for all entities regarding their approach to not only environmental, but also social and governmental (Busch, 2021);
- a stronger investor focus on sustainability;
- and many other reasons.

On the other hand, the United States has a more market-driven approach, with ESG adoption and policies driven by the big institutional investors, however also in the United States the SEC (*"Securities and Exchange Commissions"*) is increasingly moving towards stricter ESG disclosure rules. Furthermore, in the United States companies tend to be more focused on short-term profitability compared to Europe due to the more complex economic structure. One thing for sure, is that by choosing these two countries for the analysis this research provides a comprehensive view on ESG's role in financial distress under two very different but developed markets.

3.2 Numerical description of the variables

As many times, to calculate the same variable different "equations" might be used, the following equations represent the calculation methods that were used for this research.

Altman Z-score is calculated in the following way:

$$Z=1,2*X_1+1,4*X_2+3,3*X_3+0,6*X_4+1*X_5$$

With:

X_1 : Working Capital / Total Assets (measures short-term liquidity, where a lower value indicates higher distress risk);

X_2 : Retained Earning / Total Assets (indicates cumulative profitability where lower values might indicate risk);

X_3 : Earnings Before Interest and Taxes (EBIT) / Total Assets (measures operational efficiency and profitability);

X_4 : Market Value of Equity / Total Liabilities (reflects how much the company's assets are funded by equity versus debt)

X_5 : Sales / Total Assets (signals assets turnover and efficiency in utilizing assets to generate revenue)

A "simpler" interpretation of the Z score can be the following:

- $Z > 2,99$: Financially Stable so low risk of financial distress;
- $1,8 < Z < 2,99$: moderate risk of financial distress;
- $Z < 1,8$: High risk of bankruptcy.

These above are the calculations needed and the interpretation for publicly listed firm, then for private firms the situation is different as the Market Value of Equity is excluded as private firms do not have publicly traded stock. That is why for comparability reasons this study focuses exclusively on publicly listed companies.

Return On Assets is calculated as follows:

ROA: Net Income / Total Assets (Madushanka & Jathurika, 2018)

Also, in this case a simpler interpretation of return on assets can be the following:

- ROA > 10%: Stronger profitability, good asset efficiency;
- 5% < ROA < 10%: average performance;
- ROA < 5%: Low profitability, potential financial inefficiency;
- ROA < 10%: Company is losing money, possible financial distress

Current ratio is calculated as follows:

Current Ratio: Current Assets / Current Liabilities (Madushanka & Jathurika, 2018)

Also, in this case a simpler interpretation of current ratio can be the following:

- $CR > 1,5$: Strong liquidity, company can easily cover its short-term liabilities;
- $1 < CR < 1,5$: adequate liquidity;
- $CR = 1$: the company has just enough assets to cover its liabilities;
- $CR < 1$: potential liquidity problems which may be the cause of short-term financial distress.

3.3 The Dataset

In this paragraph there will be a description of the dataset used to give a full picture of the research. The companies were retrieved entirely from deal screener on Refinitiv workspace, making sure that the companies included were only public companies, because, as I stated before, including private companies would have made the study not reliable, and the results not comparable.

The initial Dataset for which I have downloaded the data was initially made up of over 1500 companies (between the two sectors and the two countries). Then not all the company had availability of data which resulted in an exclusion of some companies from the study. This resulted in a total number of companies of over 1200 distributed in the following way:

- 605 European Industrials companies
- 426 Northern American Industrials companies
- 96 European energetic companies
- 117 Northern American energetic companies

Then, the entire dataset of variables was retrieved using Datastream, for the availability of me as a researcher as well as the precision with which the variables are given out. The majority of the variables were calculated by the researcher himself (with the exception of the indicator “EBIT” for the use is the Altman Z-Score calculation for efficiency purposes).

3.4 Descriptive Statistics

In this paragraph will be reported the descriptive statistics for the different variables, taken into consideration with a brief analysis on the impact that these statistics could have, to gain a better understanding of the results. Before presenting the results, it is important to state again that, in these descriptive statistics, the values reported will be comprehensive of an average of the entire

time range included in this research. This is important because it makes these results more reliable, robust, and more comparable, as it avoids for yearly fluctuation (especially given the global situation we are in under different perspectives) that would compromise the results.

Variable	Mean	Median	Standard Deviation	Skewness	Kurtosis	Minimum	0,25	0,75	Max
Altman									
<i>Energy Europe</i>	2,64	2,52	2,93	1,43	9,58	-4,87	1,96	3,54	16,64
<i>Energy North America</i>	2,03	2,22	3,75	0,11	2,90	-10,39	0,16	3,63	15,39
<i>Industrials Europe</i>	3,36	3,02	2,56	2,36	10,85	-6,79	2,30	3,82	19,73
<i>Industrials North America</i>	3,07	3,25	3,54	-2,83	24,84	-25,84	2,39	4,16	19,78
Current Ratio									
<i>Energy Europe</i>	1,99	1,58	1,60	4,19	22,59	0,78	1,18	2,03	11,50
<i>Energy North America</i>	2,32	1,64	1,88	2,07	4,10	0,27	1,12	2,73	8,83
<i>Industrials Europe</i>	1,70	1,47	1,19	7,87	97,36	0,53	1,15	1,93	18,23
<i>Industrials North America</i>	2,24	1,89	1,73	5,42	40,00	0,58	1,38	2,53	17,95
Return On Assets									
<i>Energy Europe</i>	2,40	3,71	5,37	-0,63	0,76	-12,54	-0,30	5,44	14,91
<i>Energy North America</i>	0,38	1,71	7,32	-1,48	3,10	-25,73	-1,57	4,10	15,03
<i>Industrials Europe</i>	5,21	5,16	4,63	-0,93	7,36	-22,24	2,84	7,37	21,72
<i>Industrials North America</i>	6,75	6,33	4,96	0,14	3,70	-14,29	4,05	8,91	25,96
ESG									
<i>Energy Europe</i>	55,18	61,49	22,52	-0,63	-0,30	4,53	43,14	71,17	91,34
<i>Energy North America</i>	46,89	49,64	21,12	-0,12	-0,94	6,51	30,28	62,89	90,81
<i>Industrials Europe</i>	51,94	52,07	19,32	-0,15	-0,63	3,10	38,12	66,67	91,13
<i>Industrials North America</i>	50,51	51,28	19,16	-0,23	-0,74	7,71	36,62	65,95	93,89

Table 1

Regarding the Altman Z-Score, looking at the mean values, we see that Industrials Europe has the highest score followed by Northern America industrial companies, which suggest that companies in this sector generally exhibit lower financial distress risk. We can notice how the kurtosis of the Industrials North America is very negative, which may signal that even though most firms suffer less from financial distress risk, there are some that are still highly affected by it, which is also in line with the min and max values.

Regarding the Current Ratio, looking at the results of the descriptive statistics, the only values that seem to be out of line are the kurtosis of the Energy Europe, Industrials Europe, and Industrials North America. This suggests that while most firms keep a very high liquidity level, which helps them in their operation, there are some extreme outliers, which show high insolvency problems.

Lastly, regarding Return on Assets, Industrials North America stands out for having the highest mean with a value of 6,75, while Energy North America the lowest with a mean value of 0,38. This highlights the difficulties that the energetic sector may incur being characterized by strong capital expenditure, and a strong presence of debt borrowing in their capital structure. This is in line also with the mean value of the ROA for Energy North America which is the lowest with

a total of -25,73. Finally the high kurtosis values in Industrials Europe (7,36) and Industrials North America (3,7) further indicate that while some firms have moderate profitability, there are some extreme cases of both very high and very low returns.

Looking at the ESG performance, energetic European companies have the highest mean ESG score, standing at 55,18, suggesting that these have stronger sustainability and governance practices compared to their north American counterparts. Energy Europe (22,52) and Energy North America (21,12) have the highest standard deviations, suggesting that ESG performance is highly dispersed among energy firms, which in turn shows that some of the firms in this sector have strong ESG adoption, while other lack the adoption of it. The cross-sectional comparison, results in a uniform slight negative skewness, which highlights that all the companies analyzed have moderate to high ESG scores, with very few reporting extremely low scores. In conclusion, ESG scores are higher in Europe than in North America, especially in the Energy Sector.

It can be noticed how the max is encountered by the Industrials companies in Northern America (93.89) and the lowest value of ESG score can be encountered with a value of 3.1 from Industrials Europe.

All four categories exhibit negative skewness, meaning that most firms have moderate-to-high ESG scores, with fewer companies having extremely low ESG performance. The least skewed distributions are found in Energy North America (-0.12) and Industrials Europe (-0.15), meaning that these sectors have the most balanced ESG score distributions.

Industrials Europe have the highest kurtosis (3.10) meaning that some firms have extremely high or low ESG scores, making the distribution more peaked. Energy Europe and Industrials North America have very moderate kurtosis which suggests they have a very linear ESG score distributions.

Finally, it is important to state that this summary statistics were calculated for all years together, rather than year by year to secure robustness, reliability and consistency in the data analyzed, and in order to avoid having our results affected by the fluctuation of just one year (for example having very skewed value in the pandemic period and making our results close to useless). Additionally, our research focuses on the relationship between ESG performance and financial distress, rather than the pure analysis of how these variables change over time. The primary goals of these summary statistics were to have an outlook on the data analyzed as well

as highlighting the differences across industries and regions rather than just identifying short-term trends.

3.5 Hypotheses and equations for the regression

In this paragraph I will explain the hypothesis underlying this research, as well as the reasoning behind, and how the research will be conducted.

1) *First hypothesis*

This is where I develop the connection between ESG and Financial Distress measured by the Altman Z-Score.

Underlying Hypothesis: Higher ESG scores are associated with higher Altman Z-Score, suggesting that ESG adoption reduces financial distress risk

Null Hypothesis (H0): ESG performance has no significant impact on financial distress

Alternative Hypothesis (H1): ESG performance reduces financial distress (higher ESG equals higher Altman Z-score).

The following regression is the one I took into consideration for my analysis:

$$\text{Altman Z-Score}_{i,t} = \beta_0 + \beta_1 \text{ESG Score}_{i,t} + \epsilon_{i,t}$$

2) *Second Hypothesis*

This is where I develop the connection between ESG and ROA to measure how efficiently a company generates profits from its assets. ESG investments might generate long-term profit but might also have short-term costs that should be taken into consideration.

Underlying Hypothesis: Higher ESG scores are associated with higher profitability (ROA), meaning that firms with stronger ESG performance are more profitable.

Null Hypothesis (H0): ESG performance does not affect profitability.

Alternative Hypothesis (H1): ESG performance enhances profitability (higher ESG means higher ROA).

The following regression is the one I took into consideration for my analysis:

$$\text{ROA}_{i,t} = \beta_0 + \beta_1 \text{ESG Score}_{i,t} + \epsilon_{i,t}$$

3) *Third Hypothesis*

This is where I develop the connection between ESG and Current ratio to measure a firm's liquidity and financial flexibility. Firms with strong ESG strategies may have better liquidity due to an increased investor trust, lower financing costs, and improved risk management. However, these investments tie up resources which in the short run reduce liquidity, greatly because the investments tend to be conspicuous.

Underlying Hypothesis: Higher ESG scores are associated with higher Current Ratios, meaning ESG-driven firms have better liquidity management.

Null Hypothesis (H0): ESG performance has no effect on liquidity.

Alternative Hypothesis (H1): ESG performance boosts liquidity which means that higher ESG levels equal a higher current ratio.

The following regression is the one I took into consideration for my analysis:

$$\text{Current Ratio } i,t = \beta_0 + \beta_1 \text{ ESG Score } i,t + \epsilon i,t$$

4. RESULTS

These first paragraphs are intended to understand the relationship between ESG score and financial distress measures without tackling any sectoral or regional difference. By first analyzing the general impact of ESG on financial stability, profitability, and liquidity across all the companies in the dataset, we are able to establish a baseline understanding of whether ESG has any type of correlation with financial health and the probability of a firm's financial distress.

This initial approach seems rather essential as it allows us to identify any fundamental trend or relationship, before delving into the stronger effects that emerge when differentiating by countries and by industries. Other than that, it helps us get a better understanding of the results that will be presented later in the study. If ESG were to show a strong coefficient of interdependence with the financial indicators, on a broad level it would only reinforce the need for us to examine its impact within specific categories. Otherwise, if the relationship were to be weak (taking into consideration that these are only preliminary results), it would make us believe that the relationship is highly-context dependent, and give us a good reason to delve more into the relationship doing also an analysis on the subcategories.

This step is particularly relevant for the structure of the thesis, as it ensures that the subsequent analysis conducted on sector- and region-specific analyses are not conducted in isolation, but rather as an extension of the previously established relationship. This sequential approach not only enhances the clarity and richness of this analysis, but also helps in drawing robust and noteworthy conclusions.

4.1. Companies and Altman

This paragraph will examine the relationship encountered between the complete dataset of companies with their related Altman Z-Score and their ESG scores. This examination aims to provide an overarching view of the connection between ESG performance and financial distress before looking into sector- and region- specific variations.

REGRESSION SUMMARY

Statistic	Value
Multiple R	0,06
R Square	0,003
Adjusted R Square	0,00
Standard Error	19,68

ANOVA TABLE

Source	SS	MS	F	Significance F
Regression	875,21	875,21	2,26	0,13
Residual	286731	387		
Total	287607			

Variable	Coefficient	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	51,00	0,74	69,05	0,00	49,55	52,45
Variable X1	0,06	0,04	1,50	0,13	-0,02	0,14

Table 2

Table 2 is a representation of the results introduced previously. R squared is very low at a value of 0.03 % meaning that only that percentage of the variation in the Altman Z-Scores is explained by the independent variable being ESG scores. A very low R squared suggests that ESG alone does not well predict the probability of financial distress (when measured using the Altman Z-score) but rather that other factors might play a role in it.

Looking at the results we can also highlight how a standard error equal to 19.68 suggest a large spread in terms of Altman Z-scores across companies, meaning that the firms in the dataset exhibit rather high varied financial distress level (when measured using the Altman Z-Score), and that is independent of ESG scores.

This lack of evidence confirming a relationship is rather explicit when looking at the F-statistic which has a p-value of 0.1333 showing us that there is no strong evidence suggesting that ESG scores have an impact on companies' financial distress levels (when measured using the Altman Z-Score).

Even though beta 1 is statistically insignificant, it means that a 1-point increase in ESG score is associated with only a 0.06- point increase in the Altman Z-Score.

4.2. Companies and ROA

This paragraph will examine the relationship encountered between the complete dataset of companies with their related Return on Assets (calculated as an average of the yearly results, consistent with the methodology used throughout the research) and their ESG scores. This examination aims to provide an overarching view of the connection between ESG performance and the firm's probability of financial distress given by the firm's profitability before looking into sector- and region- specific variations.

The table below reports the results:

REGRESSION SUMMARY

<i>Statistic</i>	<i>Value</i>
Multiple R	0,06
R Square	0,004
Adjusted R Square	0,00
Standard Error	19,70

ANOVA TABLE

<i>Source</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1246,76	1246,76	3,21	0,07
Residual	308120	388		
Total	309366			

<i>Variable</i>	<i>Coefficient</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	50,70	0,75	67,49	0,00	49,22	52,17
Variable X1	0,12	0,06	1,79	0,07	-0,01	0,24

Table 3

Table 3 resumes the results when comparing all the companies in the dataset with their related ROA, and their related ESG scores. Looking at the results we can see that 0.4% of the variations in ROA are explained by ESG scores, which even though it seems low it is higher than when compared with the results obtained in the regression above.

The high level of standard error indicates substantial variability in ROA among companies, suggesting that firms have highly diverse financial performance (when measured with Return on Assets).

When talking about the F-statistic, we notice a coefficient of 3.21, and a p value of 0.0734, which means that it is not statistically significant at the 5% level but is approaching significance at the 10% level. This suggests that there might be a weak relationship between ESG and ROA, but it is not strong enough to be considered conclusive.

The beta zero has a coefficient of 50.70, which says that the average ROA is 50.7 when ESG is zero, which is not relevant as ESG score tends not to be zero. The beta one being the coefficient for the ROA, even though it is not statistically significant at the 5% level, shows that a 1-point increase in ESG is associated with an increase of 0.12 in ROA,

4.3. Companies and Current Ratio

This paragraph will examine the relationship encountered between the complete dataset of companies with their related Current Ratio (calculated as an average of the yearly results,

consistent with the methodology used throughout the research) and their ESG scores. This examination aims to provide an overarching view of the connection between ESG performance and the firm's probability of financial distress, given by the firm's liquidity levels before looking into sector- and region- specific variations.

REGRESSION SUMMARY

<i>Statistic</i>	<i>Value</i>
Multiple R	0,04
R Square	0,0016
Adjusted R Square	0,00
Standard Error	19,73

ANOVA TABLE

<i>Source</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significan</i>
Regression	491	491	1	0
Residual	308597	389		
Total	309088			

<i>Variable</i>	<i>Coefficient</i>	<i>Standard</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	51,54	0,76	68,08	0,00	50,05	53,03
Variable X1	-0,10	0,09	-1,12	0,26	-0,28	0,08

Table 4

Table 4 resumes the results when comparing all the companies in the dataset with their related Current Ratio and ESG scores. Looking at the results we can see that 0.16% of the variations in Current Ratio are explained by ESG scores, which even though it seems low, it is higher than when compared with the results obtained in the regression above.

The high standard error with a value of 19.73 indicates a large spread in Current ratio values among companies, meaning that liquidity levels vary significantly, regardless of ESG performances.

The ESG coefficient is negative, suggesting that even though not statistically significant, ESG score reduces liquidity levels in a company.

The analysis of the three financial distress proxies used in this research brings us to believe that an in-depth analysis of the sector- and region- specific factors is important to get a better outlook on what the actual relationship is, because it might be affected by more peculiar reasoning.

Sector- and region-specific regressions

In this section, I will present the most significant regression results, with focus on models that provide the strongest statistical evidence regarding the relationship between ESG scores and

financial distress measures. Even though the entirety of the regression will be reported in the appendix, in order to avoid being repetitive and placing the highlight on the wrong relationships, there will be a selection in term of importance in this paragraph.

This approach allows for a full presentation of the dataset analysis while keeping the main discussion focused on the results that offer robust and interpretable insights.

Now the research will outline the most relevant results regarding the more detailed regressions, and the results will be highlighted below:

4.4. Energy Europe And Current Ratio

REGRESSION SUMMARY

Statistic	Value
Multiple R	0,40
R Square	0,16
Adjusted R Squa	0,14
Standard Error	21,07

ANOVA TABLE

Source	SS	MS	F	Significance F
Regression	4349,44	4349,44	9,80	0,00
Residual	23525,47	443,88		
Total	27874,91			

Variable	Coefficient	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	66,27	4,52	14,66	0,00	57,20	75,33
Variable X1	-5,56	1,78	-3,13	0,00	-9,12	-2,00

Table 5

Table 5 shows the relationship between ESG scores and Current Ratio in the energetic companies in Europe.

Looking at the table we can notice that the R squared is equal to 16% which means that almost 16% of the variation in Current Ratio is explained by ESG scores. Being the Adjusted R-squared a little bit lower than the R squared itself, with a total value of 14%, we can notice that adding maybe more explanatory variables would give more robustness to the analysis.

The F-statistic of 9.8 with a p-value of 0.00 (below 0.05) tells us that the model is statistically significant which suggests that ESG scores have a meaningful impact on liquidity (when measured with the proxy Current Ratio) for Energetic European companies.

The negative ESG coefficient with a value of -5.56 (significant at a p-value of 0.00) meaning higher ESG scores brings down liquidity as a 1-point increase in ESG score is associated with 5.56 points decrease in the Current Ratio.

In addition, the 95% confidence interval (-9.12 to -2) does not include zero, reinforcing that the effect of ESG on liquidity is statistically significant and negative.

Industry

4.5. Industrial Europe and Current Ratio

REGRESSION SUMMARY

Statistic	Value
Multiple R	0,110759501
R Square	0,012267667
Adjusted R Square	0,009715387
Standard Error	19,22795096

ANOVA TABLE

Source	SS	MS	F	Significance F
Regression	1777,050146	1777,050146	4,806552293	0,028946591
Residual	143079,356	369,7140982		
Total	144856,4062			

Variable	Coefficient	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	54,97746275	1,694316038	32,44817468	1,8242E-112	51,64624635	58,30867916
Variable X1	-1,786523318	0,814876612	-2,192385069	0,028946591	-3,388662634	-0,184384001

Table 6

Table 6 shows the relationship between ESG scores and Current Ratio in the Industrial companies in North America.

With a r-squared of 1.23% we can see that only 1.23% of the variation in Current Ratio is explained by ESG scores.

The F-statistic with a value of 4.81 and a p-value of 0.0289 which is below 0.05, makes the overall model statistically significant. Even though the model is significant its very low R squared suggests a very weak relationship.

The ESG coefficient of -1,79 is negative and statistically significant (having a p-value of 0.0289), meaning higher ESG scores are associated with lower liquidity (when measured by Current ratio). The 95% confidence interval (-3.39 to -0.18) does not include zero, confirming that the effect of ESG on liquidity (when measured with Current Ratio) is statistically significant and negative. A 1-point increase in ESG score is associated with a reduction equal to 2.309 in Current Ratio, and the effect is statistically significant.

4.6. Energy NA and ROA

REGRESSION SUMMARY

<i>Statistic</i>	<i>Value</i>
Multiple R	0,30
R Square	0,09
Adjusted R Square	0,08
Standard Error	20,21

ANOVA TABLE

<i>Source</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	2879,636501	2879,636501	7,047060988	0,009740382
Residual	29829,94824	408,629428		
Total	32709,58474			

<i>Variable</i>	<i>Coefficient</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	47,44861316	2,335341322	20,31763525	9,0889E-32	42,79428	52,10294
Variable X1	0,60809715	0,229070389	2,654630104	0,009740382	0,151561	1,064634

Table 7

Table 7 shows the relationship between ESG scores and Return on Assets in the energetic companies in North America.

First of all, we can notice an r squared of 9 %, which shows that ESG scores explain almost 10% of the variations in Return on Assets. In addition, the slight difference between the R squared and R squared adjusted, means that maybe adding more explanatory variables could improve the model's explanatory power.

We see an F-statistic of 7.05, with a p value of 0.0097, which allows us to say that this model is statistically significant.

In addition, The ESG coefficient is 0,6 which is negative and statistically significant having a p-value of 0.0097 meaning higher ESG scores are associated with lower profitability (when

using ROA as a proxy). Also, the 95% confidence interval (0.15 to 1.06) does not include zero, reinforcing that the effect of ESG on ROA in Energetic companies in Northern America is statistically significant and negative.

4.7. Industry North America and Altman

REGRESSION SUMMARY

<i>Statistic</i>	<i>Value</i>
Multiple R	0,06
R Square	0,00
Adjusted R Square	0,00
Standard Error	18,89

ANOVA TABLE

<i>Source</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	243,75	243,75	0,68	0,41
Residual	77466,15	356,99		
Total	77709,90			

<i>Variable</i>	<i>Coefficient</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	49,82	1,38	36,06	0,00	47,10	52,54
Variable X1	0,16	0,19	0,83	0,41	-0,22	0,53

Table 8

Table 8 shows the relationship between ESG scores and Altman Z-Score in the energetic companies in Northern America.

The R-Squared of 0.00% tells us that around 0.00 % of the variation in Altman Z-score is explained by ESG scores, which being very low shows that ESG performance has almost no predictive power for financial distress (when measured by the Altman Z-Score) in the Industry Sector in North America.

The model is not significant as the p-value is much greater than 0.05, which suggests, that there is no evidence to indicate that ESG scores influence financial distress (when measured by the Altman z-Score) in Northern American Industrial firms.

The ESG coefficient of 0,16 is positive, suggesting that higher scores may be weakly associated with lower financial distress (higher Altman Z-score), but the effect is not significant. Also, when it comes to the 95% confidence interval (-0.22 to 0.53) as it includes zero, it confirms that the model is not statistically significant.

5. CONCLUSIONS

Now that all the results, at least the most impactful, have been reported and analyzed in terms of their quantitative effects, it is important to understand their effects on our final research. This conclusive paragraph will be organized in the following way: Firstly, there will be conclusions related to each of the table above, to understand the effects that the single ones have on our analysis. Then there will be an analysis of what we can deduct from the results of the tables that are not presented above due to their limited results and their statistically insignificance (but they will be reported in the appendix). In conclusion, there will be a final “*wrap up*”.

5.1 Energy NOA and ROA

Firstly, let's analyze the effect that ESG scores have on Return on Assets in Energetic companies in North America. As we can see above, a 1-point increase in ESG score is associated with a 0,6 decrease in ROA, and also this result is statistically significant at the 1% level having a p value of 0.00097 meaning that, even though only 9 % of the variation in ROA is explained by ESG scores, there is strong evidence that ESG scores negatively affect probability in the Northern American Energy Sector 8 when measured by Return On Assets).

On a more qualitative level, the negative relationship between the two, suggests that investments in ESG initiatives may require substantial financial resources reducing the short-term profitability.

5.2 Energy Europe and Current Ratio

As stated before, the point of this paragraph will be to analyze the different results that were obtained in this research, mainly the most relevant, in order to reach some conclusions through the use of it and then have a more qualitative final analysis of the result through the help of the dissection done before.

That is why in this subparagraph there will be the analysis of the relationship between the ESG levels of European companies working in the energy sector and their Current ratio.

This is one of the most relevant analyses in terms of significance for different reasons:

1. Being the Current Ratio one of the main measures of liquidity and being able to analyze, and through the use of it, the firm's ability to cover its liabilities through the use of its assets, this is a rather important analysis given all the different types of liabilities (taxes as well) companies in Europe being able to cover it is very relevant to understand the relationship it has on ESG;

2. We would expect that companies that have higher sustainability spending receive less taxation or lower interest rates due to their effort to maintain high standard (in terms of environment, social and governance);
3. The most relevant results are found (throughout the whole research) when ESG is compared to Current Ratio. This can have a double impact because it can either mean that the company is affected only throughout the short-term horizon (ESG investments require more extraordinary spending) or it could actually bring a long-term effect

These are the reasons behind the importance of the analyses of the relationship between current ratio and the ESG levels of the companies (in both sectors and both regions).

In terms of the results obtained, starting from the r squared it is important to state, as previously done, the relevance of this regression given the level of 16% which shows that there is a strong part of the Current ratio levels that are indeed explained by ESG change in levels. Even though there is a high level of variation explained by it, there are other factors that could play a role in it. These factors could vary for every company and it is rather impossible to control for all of them, which will be further explained in the chapters related to the limitations in order to give a more comprehensive outlook on why that is not relatable to what this research is trying to do.

Even though we see a strong r squared we also see a negative coefficient. I do believe strongly that the negativity of -5,56 is related more to a short-term effect (also this will be explained in detail in the limitations). As logically stated before, a bigger spending in ESG would also mean lower liquidity available to the company itself which, in the short-term, would mean lower ability in covering their liabilities. The research does believe that in the long-term these effects are reverted and hypothetically that coefficient would become “strongly positive.”

Also, these negative relationship between the two is more interesting when thinking that, in the energy sector, especially in Europe where their regulations are strict, the upfront investments needed to do a “*green transition*” (under all the ESG perspectives) might be extremely expensive. This also allows us to understand that the coefficient of his relationship might be negative mainly due to the length of the investment needed from the company itself, rather than form the investment itself.

Also, it is important to mention that both sectors I have chosen are capital intensive, which means that their liabilities are very conspicuous as well as their resources which makes this relationship rather complicate. This would also mean that a short-term decrease in liquidity, as

per output reported above, would cause serious financial problems and the company's inability to successfully continue.

5.3 Industrials Europe and Current Ratio

In this paragraph, the relationship between EGS levels in European industrials company and their level of current ratio, will be explained to understand what could be the takeaways for further research and for the help of businesses

In this case, the *r squared* shows us that less variation is explained in these results and this makes sense as industrials is a “*vaguer*” sector in terms of what the companies actually do, as there might be companies in the aviation sector as much as companies working in the manufacturing. This also shows us how the factors that could play a role in this relationship are many more than the energetic sector, and it might be almost impossible to control for all of them.

But, in terms of the coefficient, we see how a higher ESG score means a lower liquidity, when measured with current ratio. This is, for the reasons explained above, even more applicable as the standards for the manufacturing companies as they are more *concrete* than the energetic sectors (as they have liabilities on all the assets, different properties and many other things).

Also, the industrial sector is highly capital intensive. If, for example, you think about the aviation companies, they require a lot of costly assets and a lot of capital to sustain their day-to-day activities. These companies require a large amount of liquidity just to maintain their day-to-day operations active. Also, these companies in the industrials sector might face off higher tradeoffs, longer investment cycles, due to the duration required for them, to have a return on their “*investment*” and higher fixed costs.

As they have a lot of visible engagement with the society in general (in term of environmental, social and governance), they face a lot of more stringent rules, especially in Europe where the transparency required is stronger and the regulations are rather stricter. Sectors like the aviation, being so capital intensive, have a preference to not go outside of the sustainability guidelines to avoid incurring into large sanctions.

From a practical point of view I would say that the transition to a more sustainable environment is rather costly for companies in the industrial sector, and especially in Europe. Even though, the coefficient is expressing a short-term liquidity deficiency, it goes “*hand-in-hand*” with a long-term benefit.

This is also enhanced by the fact that the first investment in terms of turning the business “green” is the largest while after is, mainly about maintaining the same levels of sustainability. This means, that the decrease in liquidity should be mainly applicable to a more short-term vision rather than a long-term one, due to what explained above.

5.4 Industry North America and Altman

In this paragraph there will be some conclusions regarding the relationship between ESG levels in North America industrial companies and the Altman Z-score.

Against my expectations, the Altman Z-score, as a measure of possibility of distress, is the one where less robust results, even not significant, were encountered. I would have believed otherwise as on a logical basis a lower level than required of ESG investments (in highly regulated environments, like the ones analyzed in this research) would lead to more “sanctions”, which would lead to more financial problems and then a higher possibility of distress.

The *r squared* is low but in line with the industrials sector all together as explained before given the different factors that could play in the probability of financial distress of a company.

The low significance and the low r-squared for the analysis when it comes to ESG levels in industrials companies in Northern America and the probability of financial distress (when measured with the Altman Z.-score) might be related to the fact that in the United States the factors that contribute to the financial default of a company are others

Also, given the competitiveness in this sector and specifically in this geographical region, there might be an incentive for companies to over perform the market, rather than caring about sustainability all together. Also, unlike the European market, the Northern America one is less regulated and have fewer external pressures when it comes to investing in sustainability.

5.5 General conclusions

In this paragraph, there will be an examination of the results obtained in this research and an analysis of the learnings.

From the research above, we can observe that the strongest relationship can be observed when ESG is correlated with liquidity (if measured with current ratio). These results are very important, as they help us understand the strong effects that ESG investments, that in these two sectors have to be very large, have a company’s liquidity and make us understand in a clearer way why many times companies, even though they fully understand the importance of

sustainability, refrain from committing to these large investments as they might irreversibly impact their ability to perform their normal business.

In general, it is important to say that given the conformity behind how current ratio is calculated in this research, and how it is calculated in general, tends to take into consideration a more short-term outlook on the liquidity levels rather than more of the benefits that can be extracted from it. Past research has shown us how investments that may seem to harm the short term might be good and important for the future. As a matter of fact, the research by Ererdi and Güneren Genç (2025) shows how investments in sustainability in the short-term bring operational and extraordinary costs, but in the long-term they are associated with a “*general*” improvement of the company itself.

The Altman Z-Score throughout the research has been proven not as effective as the first developed hypothesis would believe for different possible reasons:

1. While liquidity (Current Ratio) and return on assets are clear measures of the probability of distress that a company might enter a time of financial distress, the same cannot be said for Altman Z score. As previously stated, in the United States the different variables that go into the calculation of the Altman Z-score are not too good of a predictor of the probability of distress of a company. This can be also credited to the fact that, due to the uncontrollable differences that are present between the companies, a calculated variable as specific as the Altman Z-Score might be analyzing factors that are relevant for a certain company but are not relevant for another company. For example, “*Earnings Before Interest and Taxes*” might be more relevant for companies that have a large quantity of tangible assets, as their level of taxes might be higher compared to a company that has one manufacturing point.
2. The Score itself was created in 19688 to study the probability of a firm’s financial distress specifically for manufacturing firms. It relies heavily on balance sheet and profitability ratios which may not be that relevant for the industries we studied given their highly leveraged structure, as much as the fact that, they are capital-intensive (like the aviation and the energy sector which require large amount of investments before getting a return, and their fixed costs are higher than other sectors). Given that many of the companies the analysis is based on are service-based companies, so their reliance on financial numbers is more limited due to the structure of their business itself.

Even though the research did find some significance and applicability of the results, especially in Europe they do not seem robust enough, also compared to the other results obtained when using different metrics.

As stated also in the literature review, Return on Assets is a very strong measure to understand these types of relationship as it helps predicts the actual state that a company is in and if a certain investment is going to harm or help the company given also the business they are in.

Once analyzed the importance of the different variables used in the study, it is of great relevance to understand the actual differences encountered between the two sectors and between the different geographical regions.

We can see in the energetic sector a great distinction when it comes to its relationship with the proxy Return on Assets between the northern America part and the European part. In north America there is a strong negative effect of ESG on RoA that is not present in Europe. This shows how many times ESG is more about how it is perceived by the customers suppliers, and all the other stakeholders, rather than what the investments actually are. Customers many times would go to a certain company that offers the same service maybe a bit more expensive than the competitors just because it is perceived by the customer as more sustainable. This is truer in the United States rather than in Europe as we can also see from the analysis.

In general, this research has brought to our attention how ESG investments have stronger effect in Europe compared to North America. This is very important, being at the core of the analysis proposed in this paper, because it gives the readers the possibility to understand potential differences in terms of regulations and norms when it comes to ESG adoption in European against northern American firms. An increase in sustainability (measured through the use of ESG score) tends to have a negative effect on profitability (when measured by the return on assets) and liquidity (when measured by the current ratio). This effect is stronger when on European companies, which gives this research a strong point of analysis. Indeed, it shows us how, being European countries stricter on ESG regulations, companies tend to adapt to them more and lose more liquidity and profitability, which are two important proxies when it comes to understanding the probability of a firm's financial distress.

Compared to the energy sector, the industrial one in general shows a weaker, less consistent, and many times not significant relationship between ESG performance and financial health and stability, used as proxies for the probability of financial distress. As stated before, while the energetic sector is more "*straight forward*" (in terms of its composition due to the similar

nature of all the companies that are part of it), the industrial sector varies in a bigger way and more often which makes it more difficult to control for.

Due to the structure of the sector, the energetic one is more affected by an increase in the investments in sustainability in their liquidity levels rather than what the industrial sector is.

In conclusion, the negative effects that an increase in ESG investments has on firms' liquidity (when measured with Current ratio) shows us that firms in Europe face more pressure in the short term than American ones, due to more strict sustainability regulations.

We noticed how, even though we did not find definitive results on the sectorial differences, the energetic sector suffers more sustainability pressure compared to the Industrial sector.

Even though we have concluded that liquidity is indeed affected by large ESG investments, this is a standing point for future research as it allows us to understand whether this decrease in liquidity given the amount of costs related to the "*green*" transition are compensated by a steep increase in brand reputation, reduced regulatory risks and increased operational efficiency which would make it all worth it.

The low explanatory power, encountered behind the Altman Z-Score, raises questions on whether traditional financial distress models are still useful when working with a constantly changing environment like the ESG one.

In conclusion, yes it has been proved in this study that there are significant sectorial and geographical difference in terms of the effects that ESG investments have on the probability of financial distress. In addition, the research does show a strong correlation between Current Ratio and ESG investments, and opens the doors for future research to focus on more specific details of this connection.

6. LIMITATIONS

In this paragraph I will address some of the limitations, some uncontrollable for, that might make the results and the conclusions of the study less reliable. While this research took into consideration different factors when choosing the sectors and the countries to analyze I believe it might have encountered a problem that is common in the literature that has been trying to analyze this relationship.

One of the key challenges of this research is the difficulty in finding available data for all the companies in terms of the different variables and in terms of the ESG scores. Below I will report the main problems encountered when trying to select the data:

- Gaps in the years;
- ESG scores measured always differently;
- Financial indicators missing;
- Balance Sheet items like Earnings before Interest and Taxes calculated in different manners;
- Data missing for one variable but not for the other (for example I had total asset but was missing ESG scores). So even though it had all the more financial metrics, I was missing a very important piece.

For these reasons this research was naturally constrained by the data availability and as a result some companies had to be naturally excluded from the dataset of the final analysis due to incomplete or missing information. It is important to emphasize that the results presented in this study are only as reliable as the data provided by firms and financial databases.

It is relevant to state that, While I took all the necessary and possible precautions to ensure the integrity of my dataset, the responsibility for missing or inconsistent data lies entirely with the reporting entities, not with the research process itself.

Further research could potentially mitigate this by only using companies with more transparent databases and a more reliable information release process. However, until ESG disclosure standards become universal and standardized across both industries and regions, the challenge presented above will remain inherent to this particular field of study and it should not compromise the validity of the research.

When looking at the countries the situation might get more complicated. The countries inside of Europe so inside of the European Union, as the countries inside the United States have different rules that vary between them. So as in the United States there are federal laws and state laws for example, in the European Union that are characteristics that are common to only one single country. Comparing two smaller countries like if I were to say Italy and California instead of Europe and the United States would make the research even less reliable almost useless due to one hand the low availability of data of the single companies, and because it would not be reliable to analyze the relationship itself.

In addition to this, there might be a problem of selection bias. Some of the companies are not forced to report in detail their CSR performance which might have caused my research to have selected only the companies that have ESG available. Even though this is a big limitation, it is something that a researcher can have no control over since it is internal to the company.

These are the limitations that are rather applicable to any research of this type, now as a comprehensive researcher I will share what I believe are the limitations to this particular analysis, that if tackled in the correct way (even though some of these might not be realistically), could give a very useful outlook on this relationship for every *business* decision in the future.

One of the key limitations of this study is the intrinsic difference and diversity that surrounds the industrial sector, which introduces a very high number of uncontrollable factors compared to the energetic sector. While the Energy sector is mainly homogeneous, as it consists primarily of companies engaged in oil, gas, and renewable, the industrial sector comprises a wide variety of sub-industries including manufacturing, aviation, transportation, construction and many more. As stated before, taking only one of them would have made this research completely null and without significance. Each of these sub-industries work under different financial structures, investment cycles, and very different regulatory pressure which make it extremely challenging to establish a single and consistent relationship between ESG performance and the probability of financial distress. Unlike energy firms, which operate under similar capital investment patterns and regulatory pressures, the companies in the industrial sector face vastly different market conditions due to their different business structures and different business models.

Another specific challenge of this research is that both the sectors (even though they were selected after a long round of personal thorough research) are in a capital-intensive environment, which might affect the interpretation of the relationship between ESG performance and the probability of financial distress for different reasons as listed below:

1. Their line of possible financial distress is thinner as many times due to their higher need of liquidity and higher fixed costs they might be less liquid than other sectors;
2. The companies in these sectors might require large upfront investments in either infrastructure or equipment or long-term projects, which leads to high financing needs and many times longer time needed to observe returns. These factors might make the measures I used not enough to highlight the relationship between ESG performance and the probability of financial distress;
3. Also, liquidity constraints are given by the fact that these companies have to allocate a relatively big portion of their liquidity into research and development, which makes it rather impossible to use a liquidity ratio to measure this.

Another limitation that might be taken into consideration is the short-term nature behind the current ratio. Current ratio, as all measures of liquidity tend to measure more a short-term horizon rather than a long-term one, which might be critical when investigating the probability of financial distress. As a result of this, as stated above as well, a negative impact of ESG increase in score might mean a negative impact on short term liquidity, but not necessarily on long-term liquidity. Due to the importance of the liquidity factor in this research, as the majority of the crisis by the companies, have been averted and overcome by the ability of the company to use it more liquid correctly, and the fact that research previously has overcome this particular nature of this measure.

When it comes to the current ratio, future research could concentrate in understanding whether investments in sustainability, which reduce the company's liquidity, get compensated in the future by a rise in other factors that will enhance the firm's profitability.

Future research could also concentrate itself on understanding how to standardize the process of ESG reporting, for future analysis to become more comparable and more robust.

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APPENDIX

REGRESSION SUMMARY

Statistic	Value
Multiple R	0,01
R Square	0,00
Adjusted R	-0,02
Standard E	22,93

ANOVA TABLE

Source	SS	MS	F	Significance F
Regression	2,45	2,45	0,00	0,95
Residual	27872,46	525,90		
Total	27874,91			

Variable	Coefficient	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	55,17	3,38	16,32	0,00	48,39	61,95
Variable X1	0,04	0,58	0,07	0,95	-1,12	1,19

REGRESSION SUMMARY

Statistic	Value
Multiple R	0,09
R Square	0,01
Adjusted R Square	0,00
Standard Error	21,19

ANOVA TABLE

Source	SS	MS	F	Significance F
Regression	291,39	291,39	0,65	0,42
Residual	32766,55	448,86		
Total	33057,95			

Variable	Coefficient	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	47,50	2,67	17,77	0,00	42,17	52,82
Variable X1	-0,35	0,43	-0,81	0,42	-1,20	0,51

REGRESSION SUMMARY

Statistic	Value
Multiple R	0,07
R Square	0,01
Adjusted R Square	-0,01
Standard Error	22,87

ANOVA TABLE

Source	SS	MS	F	Significance F
Regression	142,07	142,07	0,27	0,60
Residual	27732,83	523,26		
Total	27874,91			

Variable	Coefficient	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	53,81	4,16	12,94	0,00	45,47	62,15
Variable X1	0,55	1,05	0,52	0,60	-1,56	2,66

REGRESSION SUMMARY

<i>Statistic</i>	<i>Value</i>
Multiple R	0,14
R Square	0,02
Adjusted R Square	0,01
Standard Error	20,97

ANOVA TABLE

<i>Source</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	606,42	606,42	1,38	0,24
Residual	32103,16	439,77		
Total	32709,58			

<i>Variable</i>	<i>Coefficient</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	50,75	3,84	13,23	0,00	43,10	58,39
Variable X1	-1,51	1,29	-1,17	0,24	-4,08	1,05

REGRESSION SUMMARY

<i>Statistic</i>	<i>Value</i>
Multiple R	0,09
R Square	0,01
Adjusted R Square	0,00
Standard Error	19,27

ANOVA TABLE

<i>Source</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1069,41	1069,41	2,88	0,09
Residual	144089,70	371,37		
Total	145159,11			

<i>Variable</i>	<i>Coefficient</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	51,15	1,07	47,78	0,00	49,04	53,25
Variable X1	0,17	0,10	1,70	0,09	-0,03	0,37

REGRESSION SUMMARY

<i>Statistic</i>	<i>Value</i>
Multiple R	0,03
R Square	0,00
Adjusted R Square	0,00
Standard Error	19,16

ANOVA TABLE

<i>Source</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	66,84	66,84	0,18	0,67
Residual	99150,81	367,23		
Total	99217,64			

<i>Variable</i>	<i>Coefficient</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	50,64	1,28	39,64	0,00	48,12	53,16
Variable X1	-0,04	0,09	-0,43	0,67	-0,22	0,14

REGRESSION SUMMARY

<i>Statistic</i>	<i>Value</i>
Multiple R	0,07
R Square	0,01
Adjusted R Squa	0,00
Standard Error	19,30

ANOVA TABLE

<i>Source</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	725,55	725,55	1,95	0,16
Residual	144130,85	372,43		
Total	144856,41			

<i>Variable</i>	<i>Coefficient</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	51,67	1,00	51,80	0,00	49,71	53,63
Variable X1	0,06	0,04	1,40	0,16	-0,02	0,14

REGRESSION SUMMARY

<i>Statistic</i>	<i>Value</i>
Multiple R	0,07
R Square	0,00
Adjusted R Squa	0,00
Standard Error	19,12

ANOVA TABLE

<i>Source</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	478,99	478,99	1,31	0,25
Residual	98738,65	365,70		
Total	99217,64			

<i>Variable</i>	<i>Coefficient</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	52,12	1,89	27,58	0,00	48,40	55,84
Variable X1	-0,76	0,67	-1,14	0,25	-2,07	0,55

REGRESSION SUMMARY

<i>Statistic</i>	<i>Value</i>
Multiple R	0,03
R Square	0,00
Adjusted R Squar	0,00
Standard Error	19,26

ANOVA TABLE

<i>Source</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	228,95	228,95	0,62	0,43
Residual	245106,20	370,81		
Total	245335,15			

<i>Variable</i>	<i>Coefficient</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	51,06	0,82	62,26	0,00	49,45	52,67
Variable X1	0,05	0,07	0,79	0,43	-0,08	0,19

REGRESSION SUMMARY

<i>Statistic</i>	<i>Value</i>
Multiple R	0,06
R Square	0,00
Adjusted R Squar	0,00
Standard Error	19,15

ANOVA TABLE

<i>Source</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	933,06	933,06	2,54	0,11
Residual	222634,57	366,78		
Total	223567,63			

<i>Variable</i>	<i>Coefficient</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	51,12	0,79	64,52	0,00	49,56	52,67
Variable X1	0,06	0,04	1,59	0,11	-0,01	0,14

REGRESSION SUMMARY

<i>Statistic</i>	<i>Value</i>
Multiple R	0,09
R Square	0,01
Adjusted R Square	0,01
Standard Error	19,19

ANOVA TABLE

<i>Source</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1976,73	1976,73	5,37	0,02
Residual	243075,60	368,30		
Total	245052,33			

<i>Variable</i>	<i>Coefficient</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	53,61	1,23	43,65	0,00	51,20	56,02
Variable X1	-1,17	0,51	-2,32	0,02	-2,17	-0,18

REGRESSION SUMMARY

<i>Statistic</i>	<i>Value</i>
Multiple R	0,22
R Square	0,05
Adjusted R Square	0,04
Standard Error	21,48

ANOVA TABLE

<i>Source</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	3127,23	3127,23	6,78	0,01
Residual	59495,05	461,20		
Total	62622,29			

<i>Variable</i>	<i>Coefficient</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	50,16	1,89	26,61	0,00	46,43	53,89
Variable X1	0,57	0,22	2,60	0,01	0,14	1,00

REGRESSION SUMMARY

<i>Statistic</i>	<i>Value</i>
Multiple R	0,05
R Square	0,00
Adjusted R Squar	-0,01
Standard Error	22,01

ANOVA TABLE

<i>Source</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	149,64	149,64	0,31	0,58
Residual	62472,65	484,28		
Total	62622,29			

<i>Variable</i>	<i>Coefficient</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	51,23	2,20	23,31	0,00	46,88	55,58
Variable X1	-0,23	0,41	-0,56	0,58	-1,04	0,58

REGRESSION SUMMARY

<i>Statistic</i>	<i>Value</i>
Multiple R	0,25
R Square	0,06
Adjusted R Squar	0,06
Standard Error	21,33

ANOVA TABLE

<i>Source</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	3924,55	3924,55	8,62	0,00
Residual	58697,73	455,02		
Total	62622,29			

<i>Variable</i>	<i>Coefficient</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	57,37	2,95	19,42	0,00	51,53	63,21
Variable X1	-3,10	1,05	-2,94	0,00	-5,18	-1,01