INSTITUTO UNIVERSITÁRIO DE LISBOA

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Impact of climate transition commitments on financial performance in a high emissions industry

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MSc in Financial Mathematics

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Resumo

À medida que a pressão aumenta sobre as empresas líderes de mercado, especialmente nas indústrias de altas emissões de gases com efeito estufa, pedindo a divulgação pública das suas ambições climáticas e planos de descarbonização, o número de estudos a comparar os esforços ambientais e o desempenho financeiro também aumenta. As pontuações ambientais calculadas, bem como o uso de índices ou estruturas ambientais nesses estudos, no entanto, são feitos principalmente com um amplo conjunto de indústrias e com base em indicadores, classificações ou avaliações focadas em emissões/ações passadas e atuais, o que minimiza as mudanças que acontecem em indústrias intensivas em carbono mais tradicionais e com maior dificuldade de descarbonizar imediatamente.

Esta dissertação irá calcular uma pontuação de transição climática que leva em consideração as métricas *forward looking* para indústrias de altas emissões (Cimento, Carvão, Mineração Diversificada, Utilidades Elétricas e Petróleo & Gás). Como objetivo, pretende-se classificar a propensão de cada empresa para uma economia verde e estudar se os respetivos investimentos feitos para se alinhar a esse cenário pioram o seu desempenho financeiro em relação aos concorrentes que ainda não estão comprometidos em mudar sua estratégia.

Os resultados indicam que existe uma ligação negativa entre a pontuação de Transição Climática e a rendibilidade, estudado como ROE e ROA, a curto prazo em empresas com grande capitalização de mercado. Nas empresas mais pequenas a ligação apesar de negativa não é estatisticamente relevante para metade dos indicadores financeiros estudados.

Palavras-chave: Transição Climática, Indústria de altas emissões de Gases com Efeito de Estufa, *Score* Ambiental, Economia Verde

Abstract

As pressure mounts on market leading companies, especially in a high emissions industry, to publicly disclose their climate ambitions and plans to decarbonise, the number of studies comparing the environmental efforts and Financial Performance (FP) also increases. The environmental scores calculated as well as the use of environmental indices or frameworks in these studies, however, are mostly done with a broad set of industries and based on indicators, ratings or assessments focused on past and present day emissions/actions, which downplays the changes happening in more traditional carbon intensive industries with a higher difficulty to decarbonise right away.

This dissertation aims to calculate a Climate Transition score that factors in forward looking indicators for high emitters industries (Cement, Coal Mining, Diversified Mining, Electric Utilities and Oil & Gas). The aim is to classify each company readiness for a green economy and study if the investments made to align with such scenario, degrades its performance against their competitors who are not yet committed to change their strategy.

The results indicate that there is a negative link between the Climate Transition score and short term profit, computed as ROE and ROA, in companies with a large market cap. In smaller companies the link is also negative, despite not being statistically relevant for half the financial indicators studied.

Keywords: Climate Transition, High GHG emissions industry, Environmental score, Green Economy

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List of Abbreviations

CSR – Corporate Social Responsibility
CT – Climate Transition
ESG – Environment, Social and Governance
FP – Financial Performance
GDP - Gross Domestic Product
GHG – Greenhouse Gas
GRI – Global Reporting Standards
MC - Market Cap
MLR - Multi Linear Regression
P/B – Price to Book
P/E – Price to Earning
PLS - Partial least squares
ROA – Return on Assets
ROE – Return on Equity
SBTi – Science Based Targets initiative
SEM - Structural equation modeling
TCFD - Task Force on Climate- related Financial Disclosures
VAR – Value-at-Risk

1. Introduction

Environmental concerns continue to reflect on the financial markets, with governments and several organizations producing related annual status reports, such as Task Force on Climate-related Financial Disclosures (TCFD) or the Global Reporting Initiative (GRI). These serve as guidance for companies looking to disclose relevant and material metrics related to their business activity. With new regulations being pushed frequently regarding public disclosure, all key players in the market begin to have the information needed to make a sustainable choice for their investments. The appearance of more small investment products for the average citizen also helps the market to gain traction and evolve the sustainability reporting of asset managers and the correspondent companies within the product. While some investors may only invest in green products because of their sustainability awareness others will try to look for better returns in specific sectors, time horizons or coutries. This increased attention pushes the alpha packs of their industry to modernize their enterprise, while taking actions to decrease greenhouse gases emissions. While there has been an intuition that larger companies have higher Environmental, Social and Governance (ESG) Scores (Drempetic et al., 2020), and might be seen as a competitive advantage against smaller companies, improving in the sustainable field comes as a large investment made by the big firms that may decrease short-term profit and return (López, 2007). Following these points a question can be raised: Do companies heavily investing in and being transformed for a green economy have lower financial performance than their peers? This question is the cornerstone of this thesis and it is extremely relevant through this day and age with all key stakeholders having high expectations on Climate Transition.

Numerous studies and articles have been published over recent years showcasing the link between companies' ESG or Corporate Social Responsibility scores and Financial Performance. Such studies either show no causation between the two previous indicator types (Taliento et al., 2019) or report some degree of positive link between them (Ameer et al., 2011). There are some accounts of a short-term negative effect of Corporate Social Responsability on business performance (López, 2007). Some of them are, however, based on GRI standards that have a high emphasis on the social responsibility aspect (Moneva et al., 2006) which is not part of the objective for this thesis. Furthermore, Roca and Searcy (2012) explain that accuracy issues can happen in sustainability reports because of the high degree of qualitative information.

While most bibliography focuses on a broader market, not doing specific industry analysis, and looking at more factors than just the Environmental one, like Social and Governance, there begins to appear more environmental specific comparisons and focus on just one sector (Abdi et al., 2021; Casado-Díaz et al., 2014). Similarly, this thesis also focuses on five specific sectors, traditionally high emitters. The high emissions industries

usually have the worst ESG scores and environmental results. The inclusion of only present-day metrics, mainly Greenhouse Gas (GHG) emissions, may sway new possible investors and hurt the chances for these industries to re-strategizing themselves given the nature of their products and activities (for example mining or fossil fuel exploration). It is also important to study these industries as they will be the most challenging ones to decarbonise. Given this setback, it is important to look ahead of time and assess what these current "grey" companies are doing to align themselves with the green economy of the future. Babiak et al., (2010) studied the causes for senior executives to adopt green management practices and concluded that the main driver to change was strategic motives, underlining the importance of stakeholders' pressure for more sustainable ambitions within the firms.

To assess companies' commitment, one has to look beyond the current emissions and look at several factors indicating whether or not they are investing in greener technology or compensate for emissions they can not stop right away. Some companies will have to redesign their foundations if they are really committed to the Climate Transition. Over history we have seen similar cases happening for other reasons and in different industries. The basis for the Climate Transition score methodology is exactly the forward looking metrics that are often overlooked in existing papers. But these complete transformations can destabilize the companies' financial results and instill panic within shareholders if not communicated correctly. So, is the risk worth it? Are companies that are investing heavily on Climate Transition financially outperforming their peers that are not so concerned with such issue? This thesis studies if companies that are already embarking on emissions reductions and other environmental actions possess the financial upper hand against companies that still have a long way to go to weaken their negative impact on the environment.

For the high emissions I select the Cement, Coal Mining, Diversified Mining, Electric Utilities and Oil & Gas sectors. The main reason for this choice is their negative impact to the environment, specially on GHG emissions, throughout the years. Energy Supply and Industry are the first and third, respectively, high emissions industries according to the European Environment Agency[1]. The secondary reason is the existence of different states of the Climate Transition in each one of the sectors. For example, concerning the Electric Utilities sector, some decades ago most electricity manufacturers still relied on coal and oil to produce and distribute electricity while in the present just a few companies still heavily depend on non-renewable sources. This means, that while the sector itself is still carbon intensive it has lots of positive examples. In recent years the Cement sector has been having technological innovations that target emission reductions and that will allow, innovative driven companies to transition their business to what the world expects of them. This sector, just like the Electric Utilities, is crucial for the transition, as new infrastructures to support change, including climate mitigation or adaptation projects,

[1]Greenhouse gas emissions by aggregated sector, https://www.eea.europa.eu/data-and-maps/daviz/ghg-emissions-by-aggregated-sector-5#tab-dashboard-02

will still rely on cement. So, it is important to transform and support the sector in its journey since discarding it completely is not an option. On the other hand, the Coal Mining sector has little room for innovation or sustainable alternatives. There is the existence of "green" coal that emits one third of the usual carbon amount but that is not a long term solution as the world needs to get as close to zero emissions as possible while offsetting the rest with avoided or captured emissions. It will be interesting to analyse the outcome as there are different benefits for companies to go green in some of these sectors.

To measure Financial Performance (FP), while trying to maintain it without corporate size dependency, I select Return on Assets (ROA), Return on Equity (ROE), Price to Earning (P/E) and Price to Book (P/B). These common financial indicators, which reflect firms' economic and value performance, serve as basis to test the hypothesis of this thesis.

From the analysis of the results, there is a significant negative link between high capped companies with a high Climate Transition score, which is associated with better environmental practices and metrics, and their Financial Performance. Smaller companies also show similar results with some FP indicators negatively linked with the score, despite not being so statistically significant.

It is in the financial market best interest to know all the answers and to be in possession of all information, so knowing the next big environmental indicator that is linked to higher returns gives asset managers and investors the hedge over competitors. For sustainable investors, sometimes the current returns and short-term financial indicators are not the most important factors considered when investing, but rather the environmental commitments made by the firm. Asset managers and investors benefit from a more detailed analysis within the high emissions industries. This thesis differentiates from other papers in that it looks only at high emission industries, it calculates a Climate Transition score with handpicked environmental factors for a more detailed analysis of the industry, and uses more forward-looking metrics than the usual ESG scores.

The study is composed of 6 more sections. Section 2 will review the existing literature that is relevant for the thesis hypothesis. Section 3 explores the environmental metrics used in the Climate Transition score as well as the Financial Performance metrics used to assess a company success in the market. Section 4 explains the methodology used for the analysis, including the Climate Transition score weighting, and source of the data used. Data treatment, for all extracted data, is summarized in Section 5. Section 6 is comprised of the statistical analysis describing the process and models used. In the last section I lay out the conclusions and show how mathematics, finance and sustainability can help the financial market.

2. Literature Review

Most authors use either a Corporate Social Responsibility (CSR), Environmental Social and Governance (ESG) score or a bespoke classification using GRI Standards when studying the link between sustainability with Financial Performance of a firm, but in this thesis the focus will be the Environmental pillar as it is the most quantitative one and easier to assess given the factual nature of the metrics disclosed and analysed. Building on that note, the high emissions industries are the best candidates for such analysis given their historical contribution to CO2 and other GHG levels in the atmosphere. Ekwurzel et al. (2017) use climate data for 90 companies, most of them oil and natural gas related, between 1980-2010, to show their negative effect over the years. Around 55% of the observed rise in atmospheric CO2 and 42–50% of the rise in global mean surface temperature can be traced to those 90 companies.

In order to show the importance, and financial relevance, in protecting the balance in the atmospheric gases, Matsumoto et al. (2016) studied the impact of different cumulative carbon dioxide emissions pathways until 2100, changing the emissions reduction baseline year and how it affected the GDP. They show that a scenario with late emissions reduction will have a greater negative impact on GDP than early emissions reduction. This is relevant for this thesis as the high emissions industry has the highest emissions reduction potential compared to low emissions industries or the ones already aligned for a green economy. Companies will have to embark on the decarbonisation route sooner or later, voluntarily or via government regulations.

Taliento et al. (2019) did their analysis on the relation between ESG Scores and economic (financial and market) performance, focusing the sample on a limited number of European indices (BEL, CAC, DAX, FTSE-MIB, IBEX). Using MLR (Multi Linear Regression) and PLS (Partial Least Squares)/SEM (Structural Equation Modeling) methodologies the correlation between ESG scores, individually and aggregated, with economic performance was studied. While the initial method did not find any connection, the latter showed correlation between excess ESG score (when compared to each company industry sector) and financial performance.

In an older study, López et al. (2007) studied the relation between two sets of European companies, one group present in the Dow Jones Sustainability Index and another composed of companies of the Dow Jones Global Index that were never included in the sustainable index version. Similar country weights and size were taken into consideration when choosing the sample. It was concluded that some years after the inclusion of the firms in the Sustainability Index (certain requirements in the corporate social responsibility field are needed for a company to integrate this index) some of the operating activity factors were shown to be inferior to the non-sustainable group on the short term.

Using as basis the paper of López et al. (2007), Ameer and Othman (2011) show superior Financial Performance indicators on sustainable global companies in some activity sectors. A new Corporate Social Responsibility score was created for the analysis, instead of using disclosure as the main differentiator between samples. A tighter control sample was also drafted that forced the sustainable company and the control company to be in the same industry sector, unlike the previous paper. These changes allowed for a more "grounded" result without industry sector mismatches.

While shrinking the sample size Abdi et al. (2021) focus their analysis on the airline industry and the impact of ESG on Financial Performance. Corporate size and age are also taken into account in a moderating role, even though no connection is found to the latter. They find a positive link between the Environmental and Social factors and Financial Performance.

While the literature so far has been focusing in the financial performance and a set of ESG indicators or indice analysis, there are more factors that can be considered. For example, Drempetic et al. (2020) state a positive correlation between a company size and the availability and performance of ESG data. This raises the question if larger companies have the upper hand on smaller competitors by simply having more resources to invest in sustainability and reporting. Or if there are stricter regulations in place, depending on the country, for a more complete disclosure from larger firms.

Moneva et al. (2006) and Roca and Searcy (2012) show the inaccuracy of qualitative information and the imbalance between social, environmental and governance factors within common standards such as GRI. As such, the Climate Transition score created for the thesis analysis is mainly composed of quantitative metrics and focused only on the environmental pillar to study the impact of the high emitter industry on the planet and transition capacity to a green economy. Some pertinent questions start to appear based on all the papers mentioned. No concrete answer was given so far in the literature regarding the question: Does Corporate Social Responsibility/ESG affect Financial Performance? While this thesis approaches the first part of the question differently, as it only focuses the analysis on the environmental part, the basis is similar as it provides a correlation analysis between the Climate Transition score and each one of the Financial Metrics and Market Cap of the companies within the sample.

As expected, most of the studies mention a slight positive link between ESG scores or indices and financial performance. Based on insights from previous literature, I have layout below the set of hypotheses:

H1: There is a positive correlation between the size of the company and the Climate Transition score.

H2: There is a positive impact of the Climate Transition score on Financial Performance.

3. Environmental and Financial Metrics

In this chapter I will introduce and enter in great detail the environmental and financial metrics that were chosen to test the hypotheses created for this analysis.

3.1. Environmental Metrics Context

On October 2020, the Task Force on Climate-related Financial Disclosures (TCFD) launched the Forward Looking Financial Sector Metrics Consultation paper[2] to help asset owners, asset managers, banks and insurance to better disclose climate metrics and targets to their stakeholders. As high emissions industries often look for financing through the financial sector and the banks or asset owners are becoming more aware of climate-related risks, the high emissions companies are being pressured to disclose more climate metrics, plans, commitments and targets for the near future. The aforamentioned paper highlights the importance of the implementation of forward-looking metrics alongside the carbon metrics recommended to be disclosed by TCFD (Absolute Emissions, Carbon Footprint and Weighted Average Carbon Footprint).

One of the objectives of the TCFD is to help financial investors and managers to assess climate-related risks. For example, the expected temperature rise over the next decades, especially in less developed and vulnerable countries, may lead to rapid deterioration of physical capital that in turn will affect the distribution and transformative chain. Therefore, the disclosure and assessment of some climate metrics is crucial for investors to understand the risks that their investments have if certain climate scenarios happen in the future. There is a mounting pressure over companies to disclose if they assess such risks and what commitments are they willing to take to reduce their effect on the environment.

The TCFD document was open for consultation over 4 months, and it had 209 respondents, with 46% of them being financial services organizations. While most of them already disclose some forward looking metrics, there are still lots of doubts regarding the methodology and accuracy of these metrics, as calculating and assuming emissions in the future is bound to be questioned.

As seen in Figure 3.1 there is a reasonable percentage of the financial services companies that use forward looking metrics in internal processes. In order to maintain the hedge over competitors, asset managers use these metrics to make informed decisions in their investment portfolio, with 73% of them confirming their usage. Investors' demand for sustainability reports and inclusion of more impactful metrics represent a strong motive for the advancement and validation of newer methodologies.

[2]TCFD Forward Looking Financial Sector Metrics Consultation, https://assets.bbhub.io/company/sites/60/2021/03/Summary-of-Forward-Looking-Financial-Metrics-Consultation.pdf

Despite the growth in popularity there are still a number of challenges to its use. Figure 3.2 gathers some of the most common problems when using or disclosing these forward looking metrics. On top of the list are concerns around the reliance on the assumptions required to derive future emissions and overall uncertainty. Methodologies are also difficult to understand sometimes as they are either too shallow or too complicated. When disclosing the metrics around half of the companies distrust the reliability of the outcomes and don not consider them useful for public disclosure.

The non-financial reporting field is rapidly growing and with it the surrounding methodologies. It is expected that with time, data providers, regulators and academic research will be able to provide sufficient reliability to financial services companies and investors. Data is also becoming more widely available with new data frameworks and algorithms making it cheaper for providers to sell licenses. Validation of some forward looking metrics, such as flooding or wildfire risk areas, is also being helped with drone technology and specialized geographic scanners.

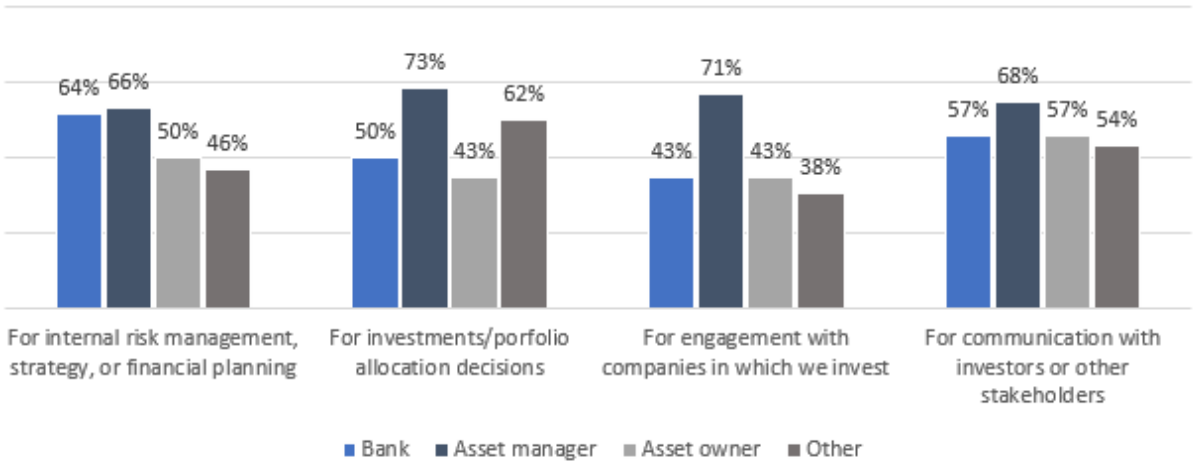

Figure 3.1 Respondents use of forward-looking metrics
Adapted from TCFD Forward Looking Financial Sector Metrics Consultation

The EU Green Taxonomy for sustainable activities was launched in June 2020 and will serve as a base to harmonize investments from financial institutions in transition-aligned activities. The regulation states the requirements needed for certain activities to be labelled as “green”, which include: (i) avoid doing significant harm to any of the environmental objectives set out in the regulation, (ii) contributes substantially to one or more of the environmental objectives, and (iii) be carried out in compliance with the minimum safeguards. This work done by the EU will be subject to further upgrades such as include a "in-between" category for assets neither green nor hurtful for the environmnent. The taxonomy is a perfect example of the regulations that will become common in the biggest financial markets and how they will push Climate Transition to the top of every company’s board agenda.

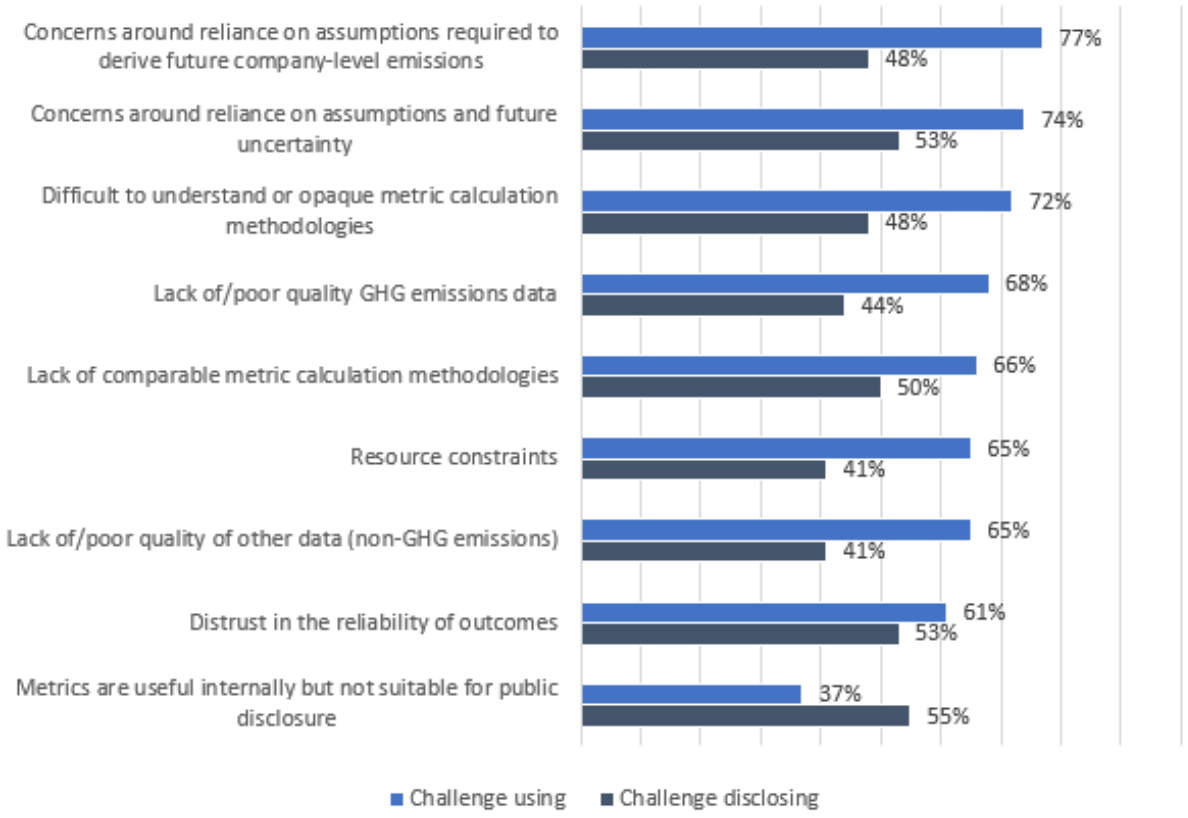

Figure 3.2 Challenges faced using or disclosing forward-looking metrics Adapted from TCFD Forward Looking Financial Sector Metrics Consultation

The rise of sustainable finance as a relevant area in the finance world has helped the development and implementation of frameworks within companies, taking into account their sector of activity. By incorporating relevant experts from multiple fields (Finance, Environmental Sciences and Mathematics), just to name the main components, the area has the expertise needed to make significant contributions for the incorporation of environmental metrics in remuneration, financial instruments and reporting. With this practice, the importance of the Climate Transition in the organization and market is underlined. It is expected that more uniformed regulations, frameworks, guides, consulting papers are released in developed and under developed markets as a consequence of the sustainable finance area maturing.

3.2. Greenhouse gases emissions (tonnes of carbon dioxide equivalent)

GHG include carbon dioxide, methane, nitrous oxide, and chlorofluorocarbons (Jain, 1993). Because of the hard task of monitoring all gases produced through the companies' activity, carbon dioxide is sometimes used as a proxy for GHG. Each gas is also attributed a warming potencial factor so they can also be transformed into carbon dioxide equivalent. Figure 3.3 is taken out from GHG Protocol organization website[3], shows potential different

[3]GHG Protocol Emissions Scopes, https://ghgprotocol.org/blog/you-too-can-master-value-chain-emissions

activities carried out by firms and indicating how they are classified in terms of GHG scope.

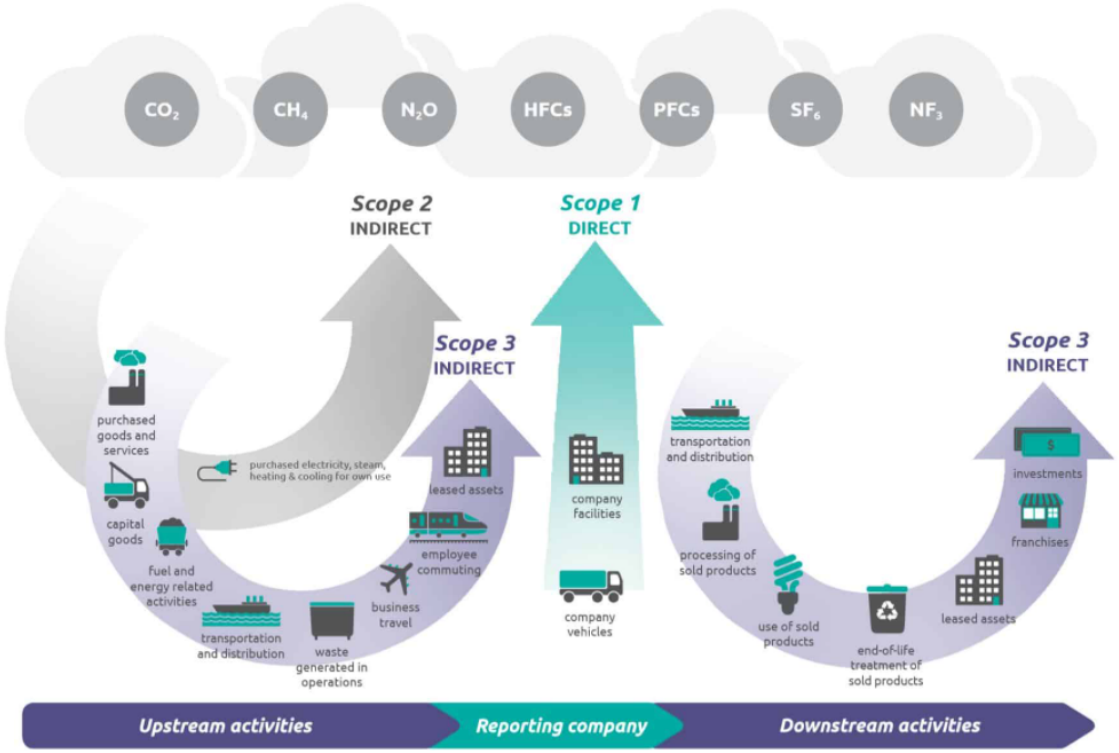

Figure 3.3 Emissions Scope
Source - GHG Protocol

GHG Scope 1 tracking and reporting has been recommended by EU Guidelines[4], based on TCFD papers on reporting climate-related information. It is also recommended by TCFD to disclose Scope 2 data as its reporting and reliability has been increasing over the years. If possible, companies should also disclose Scope 3 emissions information. However, they are harder to assess and not all firms are comfortable with the current methodology, with the possibility of some emissions being double counted, and with data availability. Partnership for Carbon Accounting Financials (PCAF) launched in 2020 the Global GHG Accounting and Reporting Standard for the Financial Industry, that discloses and tries to standardize, methodologies used for several climate metrics including GHG emissions. This guidance is used by the Science Based Target Initiative (SBTi) that helps the financial institutions setting GHG targets over the upcoming years.

The GHG emissions are often the most disclosed quantitative metric and is commonly used in ESG scores and indices. Given its historical importance, the GHG emissions reductions over a timeframe will be part of the score being created for this analysis. There are several accredited data providers that assure the quality of the companies disclosures.

[4]European Commission Guidelines on reporting climate-related information, https://ec.europa.eu/finance/docs/policy/190618-climate-related-information-reporting-guidelines_en.pdf

3.3. Science Based Target initiative

The initiative works alongside the Carbon Disclosure Project, the UN Global Compact, World Resources Institute and World Wide Fund, providing an independent scientific analysis and rigor to define and help companies set up a net zero plan and interim targets. Nowadays, the biggest companies are being pushed by stakeholders to commit themselves to a net zero plan and in some instances are being regulated by governments to do the same. In the United Kingdom, listed companies will have to disclose their net zero plans by 2023. However, one's commitment is not enough if it is not backed up by scientific processes and targets. SBTi provides support and guidance for companies while transmitting assurance in relation to their targets and plans.

Science Based Targets are defined as "'"science-based" if they are in line with what the latest climate science says is necessary to meet the goals of the Paris Agreement—to limit global warming to well-below 2°C above preindustrial levels and pursue efforts to limit warming to 1.5°C." The Initiative sets out the invitation to all companies to commit to these emissions targets, basing the emission reporting on PCAF methodology. The targets need to cover a minimum of 5 years and a maximum of 15 years to be approved fulfilling the criteria for forward looking climate metric.

The Science Based Target metric is assumed to be binary, with companies with SBTi approved targets being represented by 1 and those who have not by 0.

3.4. Implied Temperature Rise (°C)

The Implied Temperature Rise (ITR, °C) metric, taken from the TCFD document consultation is, according to Figure 3.4, one of the currently most disclosed metrics with forward-looking methodology.

This metric tries to calculate the increase in the global average temperature above preindustrial levels if every company had the same carbon intensity as the selected firm. So, if we calculate that company X has a certain carbon intensity, although some data providers also incorporate projected future emissions, and assume that the rest of the world follows the same carbon intensity as X, the ITR calculates by how much the global average temperature would rise in consequence.

This indicator can then indicate both Climate Transition opportunities within a portfolio or the exposure to physical risk. While it is a growing metric in terms of use, methodologies still vary from provider to provider, with some using cumulative emissions throughout the company's history, while others just focus on present day emissions. The emissions scope analysed can also differ, with some only looking at direct emissions while others incorporate Scope 2 and 3.

3.5. Climate Value-at-Risk

Climate Value-at-Risk is briefly described in the TCFD document to assess "potential loss, at a particular probability of occurrence for loss, and the relevant timeframe." It

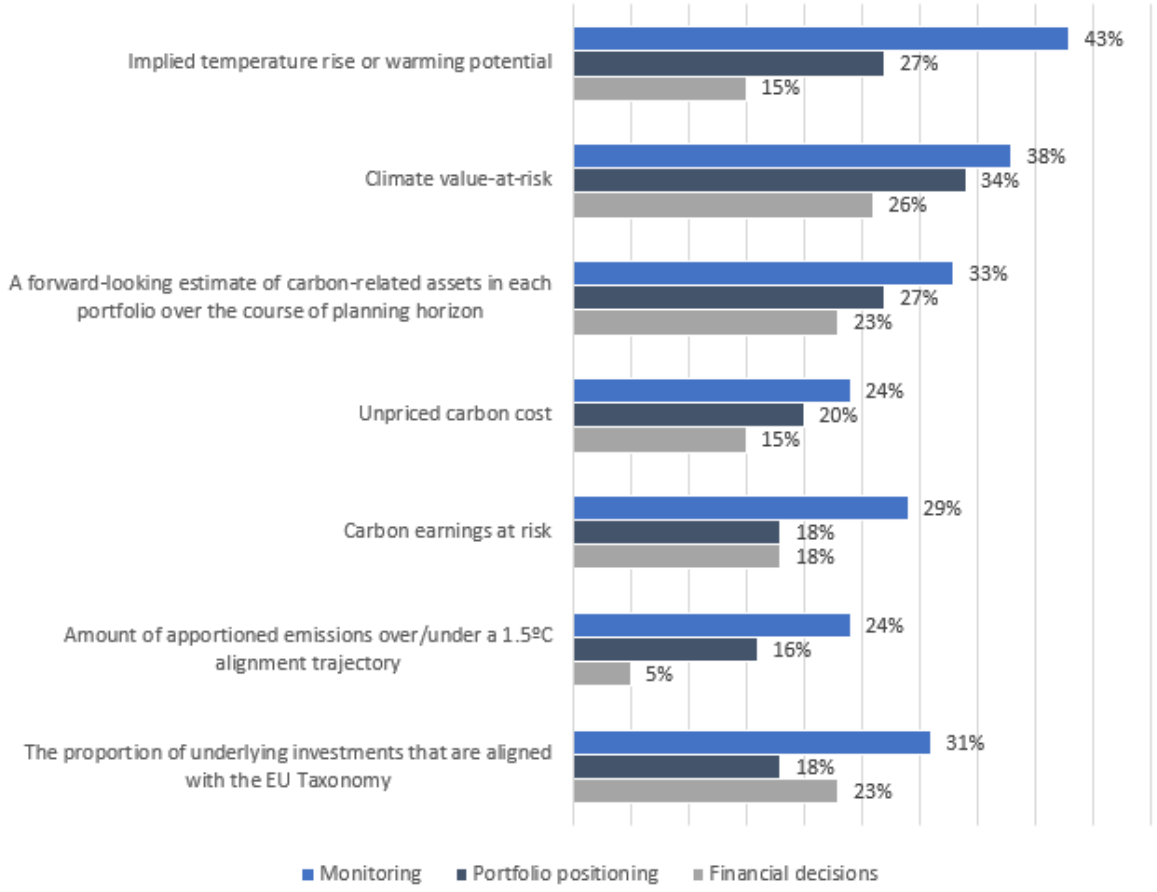

Figure 3.4 Forward-looking metrics used for decision making
Adapted from TCFD Forward Looking Financial Sector Metrics Consultation

is climate scenario sensitive, so it can calculate the percentage loss of value for different temperature rise scenarios. As it is a relatively new indicator there are some debates over the best methodology to be used as base. MSCI ESG Research, the data base used for this indicator, uses four pillars when assessing this climate financial risk. a) Economic Data: Financial Data, Economic Indicators and Emissions (Scope 1,2 and 3); b) Company Data: Patents, Revenue and Location; c) Transition: Climate Pathways, 2ºC Alignment, Policy Scenarios and Technology Scenarios; d) Physical: Extreme Weather Hazards, Coastal Flooding, Wildfires and Fluvial Floodings.

The qualitative and quantitative assessment is then transformed to a percentage loss of company value for a 1.5ºC temperature rise scenario. Companies in industries with high emissions, with this global average mean temperature rise scenario would have bigger losses than companies in more flexible and climate aware sectors. It is expected that mining and oil companies that are proceeding with structural changes, that include biodiversity and ecosystem risk and impact analysis, to be well prepared to internally assess climate related risk in their operations bases. This is a forward-looking indicator focusing on the financial risk arising from the climate change.

The insertion of this indicator in the score aims to differentiate itself from the others as it does not represent a direct consequence on the environment, but on the company itself.

3.6. A note on Data Reliability

While it is important to take these indicators into account when creating the Climate Transition score, as they are focused on the future, they are partly based on historical trends from companies' emissions and carbon data to predict future evolutions and impacts. This raises some reliability questions as some of past and current carbon emissions are still estimated from third parties instead of the firms themselves reporting. From the TCFD Forward Looking Financial Sector Metrics paper, "the share of MSCI world index companies — collectively around 60% of world market capitalization — that disclose their GHG emissions has stalled at around 50% in recent years".

Furthermore, as mentioned earlier, using the remarks from Siew (2015), even with the same underlying data, different tools might give different results because of methodological differences between each other. It then becomes important to research thoroughly each tool and data provider used in this thesis to understand if the methodology is comparable and usable.

The exercise of estimating future temperature pathways, emissions or risk arising from climate change is also uncertain and complex.

3.7. Transition Pathway Initiative

The Transition Pathway Initiative (TPI) helps investors, the corporate sector, and civil society to have an overview of a wide variety of companies' metrics, targets and commitments, calculating scores to assess their transition position.

This indicator considers two dimensions to assess companies: the Management Quality, and the Carbon Performance. The latter, however, presents carbon metrics differentiated by sector, which means that it is not possible to compare different companies if they are in slightly different sectors. For this thesis I will focus on the first dimension, as it represents the commitments made by firms regarding climate change.

Management Quality: the quality of companies' management of their greenhouse gas emissions and of risks and opportunities related to the low-carbon transition. TPI processes the FTSE Russell climate data in its methodology in an universe of 4,100 companies.

Based on 19 indicators the companies are then assessed with a Climate Transition level between 0 and 4:

0: Unaware of climate change as a business issue

1: Acknowledging climate change as a business issue

2: Building capacity

3: Integrated into operational decision-making

4: Strategic assessment exercise of estimating future temperature pathways, emissions or risk arising from climate change is also uncertain and complex.

While not analysing directly quantitative metrics, but rather, commitments, governance structures, integration of sustainability in the decision-making process and strategic assessment, this indicator complements the previous quantitative environmental metrics. It factors in an evaluation that normally would be hard for a single individual to do, that is direct contact with the board of directors from companies through a questionnaire that delves into the sustainability strategic planning. The TPI score is validated through a partnership with the Grantham Research Institute on Climate Change and the Environment at the London School of Economics and went through 3 different phases until reaching the present day methodology: literature review, testing the indicators, and peer review. For this thesis this score provides insights of what companies are currently doing to integrate sustainability in their business and how they are dealing with the challenges of climate change in the future.

3.8. Financial Metrics

Unlike climate metrics, financial figures are disclosed and the object of internal and external assurance with added scrutiny from investors/market and possible country regulations, so there is not the same problem as data reliability of climate related metrics. The FP indicators used are similar to those of Lee (2009), while using standard figures to measure a firms' success in the market. While there are other indicators of companies' success, and positive impact on stakeholders, the profitability indicators used are the most common in academic literature.

To compare company size, I will use market cap ($) to compare firms with similar sizes, as more resources could mean higher flexibility to do structural changes needed and give an advantage against smaller companies.

A usual indicator to assess short term Financial Performance is Return on Equity (ROE), calculated by dividing Net Income per the average Shareholders' Equity. The second return-based metric is Return on Assets (ROA), that uses Net Income divided by Average Total Assets. ROE measures how efficient a firm is in generating profits and growth from its equity financing. ROA is usually used to determine how efficiently a company uses its assets to generate a profit. While focused on the short term these metrics are still extremely relevant to shareholders and investors as a measure of success in the market. Their methodology is consistent throughout different regions and are subject to internal and external validation becoming a reliable source to assess the financial performance of firms.

For a more detailed financial view, I will also look at the Price to Earning (P/E) Ratio (Market Price per Share / Earnings per Share) and the Price to Book (P/B) Ratio (Market Price per Share / Book Value per Share). The P/E ratio is used to determine the relative value of a company's shares. It can help investors determine whether a stock is overvalued or undervalued, having high or low P/E respectively. The P/B ratio is

often looked in conjuction with ROE when investors are searching for a company that is growing while not being overpriced. When a company is growing it is expected that both ROE and P/B increase.

After calculating the Climate Transition score for companies, the data necessary for the FP metrics will be collected from Yahoo Finance that provides ROE, ROA and P/E directly and using the Market Price per share (50 days moving average) and Book Value per share, I am able to calculate the P/B ratio.

4. Methodology and Data

4.1. Objectives

The objectives in this thesis are:

1) Expand the literature related to Sustainability and its links to Financial Performance.

2) Provide a quantitative Climate Transition score to evaluate companies within high emissions industries.

3) Find if there is a link between corporate size and the Climate Transition score.

4) Verify if a higher Climate Transition score translates to a higher or lower Financial Performance.

To accomplish the objectives there is the need to set the model for the analysis as well as the methodology for the CT score. The following subsections approach the decisions that were taken and the scientific backing behind them.

4.2. Model and Hypotheses

After collecting and treating the climate related data, the companies will be divided into two groups dependending on market cap: the large-cap companies (above $10 billion in size) and small/mid-cap companies (below $10 billion in size). The asset size might represent different scales of investments and be an advantage in multi-level strategy changes.

I will also follow a detailed environmental scoring, using the inclusion or not of companies in indices as a sustainability assessment factor, like as in López et al. (2007). Such indices may not be the best indication of an environmental score, especially if we want to tailor the environmental focus on the transition to the future and certain high emissions industry. For example the Dow Jones Sustainability index uses an underlying ESG score as a criteria to include a company in its index, but for my thesis I will be only focusing on the Environment part. Some regular ESG factors might also not be as important for certain industries. While Social metrics and qualitative analysis are important they have less direct impact on the planet and inhabitants than environmental ones when focusing on Oil & Gas companies for example.

As explained in Siew (2015), sustainability reporting tools can be divided in three categories: Frameworks, Standards and Ratings. It is also stated the difficulty of comparing each tool against another as the criteria and methodology are different. One key conclusion is that the incorporation of lots of qualitative criteria raises questions about the accuracy of the tools. To minimize potential mismatches with tools and criteria each company studied is classified with a Climate Transition score (CT), created for the sole purpose of this thesis analysis, that is a weighted average of several sub classifications

of different environmental factors (Transition Pathway Initiative score, Climate Value-at-Risk, Implied Temperature Rise, Science Based Targets initiative (SBTi) Alignment for Net Zero and GHG Emission Reduction, all of these will be explained further into the Methodology section). The companies are then grouped into two different groups depending on the Market Cap of the companies, and a correlation study is carried out to analyse the interaction between the Climate Transition score and financial performance of the companies within it. The next section focuses on presenting the papers on which this comparison is based alongside any pertinent commentary discussing more technical details for this methodology.

The relation between corporate size and Climate Transition score is also tested, similar to Drempetic et al. (2020), to see if there is a higher difficulty making the necessary strategy changes within a firm to prepare for a greener economy if its asset size is smaller. This test will be done within each group that is divided by Market Cap size.

The FP indicators for each company will be collected in order to proceed with the correlation analysis. This will evaluate the link between the different groups and superior/inferior FP results.

The methodology used to test hypotheses H1 (There is a positive correlation between the size of the company and the Climate Transition score), and H2 (There is a positive impact of the Climate Transition score on Financial Performance), will be based on the evaluation of the correlation and statistical relevance between the Climate Transition score and each of the FP metrics and Market Cap. For this, I removed outliers in each group of samples for more robustness in the model.

While a multiple linear regression analysis is the standard when studying ESG or CSR relationship with Financial or Accounting Performance, this thesis revolves exclusively around the environmental side. By dividing the CT score created and analysing each indicator as an independent variable, there would be a high chance of collinearity between the variables, posing a threat to the regression model analysis. Fabac et al. (2016) studied the relationship between CSR and Financial Performance (ROE and ROA) for Croatian listed companies using a simple linear regression model to obtain the correlation between the independent variable (CSR) and the dependent variables (ROE and ROA).

As seen in the literature review, there is not a definitive answer to "Are good ESG companies ahead of the competition" as some papers point to a negative effect, others a positive effect or even a neutral one. As the focus of the analysis are high emissions industries, that require a great deal of investment to align themselves to a green economy, the expectation is that companies with a better Climate Transition score are behind in FP terms.

In the following subsections the indicators and calculations for the Climate Transition score will be explained followed up by the Financial Performance metrics to assess the companies' perceived market short term success.

4.3. Climate Transition score calculation

ESG scores, or similar scores with the objective of classifying a company's commitment to sustainability, are in abundance and new scores are launched every year with different nuances (there are some that just use quantitative metrics, others with qualitative and quantitative on equal weight, and scores tailored just to analyse a sector or in a particular national context). All of these are prone to be questioned by their choice in methodology and the score created for this thesis is no different. There is no correct classification in any of the existent scores. Some ESG scores give equal weight for the 3 pillars, some give greater importance to one of them, there is no "right" answer and all depends on the context, objective, literature review or advisement. The Climate Transition score created for this thesis is based in some part by existing literature, detailed in the corresponding chapter where I mention the importance of the Environmental pillar in particular and use of relevant and more reliable data sources, and with my work experience working on similar scoring processes for equity and corporate bonds within investment funds.

To have a comprehensive Climate Transition score composed of forward looking metrics, I will calculate a weighted average with some of the indicators mentioned in the last subsections to create a score between 0 and 100. This interval will facilitate the correlation test instead of a smaller score scale. Companies will be classified as either Green or Grey, where the first are companies that are already implementing, at least, some degree of strategy change, that is reflected by the Climate Transition score being greater than or equal to 50 on a 0 to 100 scale, or good climate performance, while the second are companies that seem to continue in a business-as-usual path and have a score lower than 50.

While most metrics used in the score are quantitative, for a more "real" and accountable impact in the environment the TPI score helps to assess the changes that the firms commit themselves to, as well as to understand the risks behind Climate Transition per sector. With its 19 indicators, it also helps to assess a more qualitative task of direct contact with the company board of administration and understanding if they are aligned to a future green economy and possible strategy direction changes. There are asset managers, mainly focused on sustainability, that use the functionalities and scores from TPI in their equity assessment and inclusion. The TPI score is divided between 0 and 4, therefore it will be linearly transformed to a 0-100 division, with a TPI score of 1 translating to 25, TPI of 2 to 50, TPI of 3 to 75 and finally TPI of 4 to 100.

Table 4.1 Transition Pathway Inititiave indicator scoring

TPI Score	Attributed Score
0	0
1	25
2	50
3	75
4	100

Climate VAR goes from 100% (gain) to -100% (loss) associated with the Climate Transition risk/opportunity for companies in a 1.5°C global average mean temperature rise scenario. As the Climate VAR is the expected loss of company value and is not bound by any regulation or guideline, to set ideal limits or thresholds the approach taken in the thesis is an uniform distribution between -100% and -20% loss in value. The thresholds also seem to be in line with historical losses in the market. Disruption events like wars and pandemics have shown that companies are able to withstand losses of around 50%-60% without filing for bankrupcy. Stress tests, that take into account unlikely but devastating events, are also generally conducted within companies in order to draft and implement risk mitigation measures. As the sectors analysed are traditionally polluters and emitters it is not expected to have companies with positive change in value nor a total adaptation to all the risks encompassed in the MSCI ESG methodology for this indicator.

Table 4.2 Climate Value-at-risk indicator scoring

Climate VAR	Attributed Score
VAR≤-80%	0
-80%<VAR≤-60%	25
-60%<VAR≤-40%	50
-40%<VAR≤-20%	75
-20%<VAR	100

The ITR metric from MSCI is quantitative and divided between 1°C to 10°C rise above pre-industrial levels. As of now, the world is experiencing mean temperatures 1.2°C above pre-industrial levels with the Paris Agreements aiming a warming well below 2°C, and pursuing efforts to limit warming to 1.5°C. A threshold is used to analyse possible results between 5 divisions. A company associated ITR figure between 8°C and 10°C is classified with 0 as their business is based on an environmental destructive and unsustainable model, between 6°C and 8°C with 25, 4°C and 6°C with 50, 2°C and 4°C with 75 and below 2°C, the company is classified with 100 as it would mean that the company is aligned with the latest pledges presented in Paris. It also indicates that they have at least began their strategic path towards limiting their negative effects on the planet.

While the low temperatures rise seem ambitious for the industries analysed, it is important to underline the expected effects of a global mean temperature rise of just 1.5°C. From the Intergovernmental Panel on Climate Change (IPCC) special report on global warming, chapter 1 “Framing and Context”[5], it is clear that different parts of the world are affected drastically in a different proportion by climate change. A 1.5°C rise is not equally worldwide, with some areas like the Mediterranean, Southern Africa, Southern

[5]IPCC Special Report on Global Warming "Framing and Context", https://www.ipcc.ch/site/assets/uploads/sites/2/2022/06/SR15_Chapter_1_HR.pdf

America and Australia facing extreme droughts occurring more often than in other areas. The temperature is also non uniform, with the Polar areas potentially having temperature rises at night over 6°C in a global mean temperature rise scenario of just 1.5°C. These are a limited set of examples of many more challenges that are to come with one of the best-case scenarios.

Table 4.3 Implied Temperature Rise indicator scoring

Implied Temperature Rise (°C)	Attributed Score
ITR≥8°C	0
6°C≤ITR<8°C	25
4°C≤ITR<6°C	50
2°C≤ITR<4°C	75
ITR<2°C	100

The SBTi alignment indicator is a simple binary option, assuming 0 if the companies targets have not been SBTi approved and 1 if they have, that is then transformed into 100 for the weighted average calculation.

Table 4.4 Science Based Target initiative indicator scoring

SBTi Alignment	Attributed Score
0	0
1	100

I will be looking at GHG emissions at Scope 1 and 2 levels, since they are the most reliable and the biggest contributions for the industries in study. Scope 3 emissions are still scarce and unreliable. To make a quantitative comparison between companies, I will be looking at a 3-year decrease, or increase, in GHG emissions between the end of the fiscal years 2018 and 2020, as some companies are still auditing and confirming their 2021 numbers. As emissions are influenced by company size, the bigger the operation the higher we expect emissions to be. This calculation will assess present day commitments and actual reductions that are important to align themselves to a carbon neutral future. Most global companies disclose their Scope 1 and 2 emissions publicly over the last years, so it is possible to build this decarbonization pathway.

It is expected, when collecting the data to see a decrease in emissions throughout most companies as a consequence of economic stagnation via COVID-19. Regardless, as they are absolute emissions to the atmosphere, it presents real-life impact in decreasing the concentration of GHG in the air and therefore should be accounted for. However, one must exert caution while creating thresholds during a period of unstable market and policies with companies halting production for the majority of 2020 leading to lower emissions, an unprecedent event meaning no guidelines from any organization would best

fit the threshold values. The scores threshold were partially based on the data extracted from MSCI. Any rise in emissions during the period will result on null score, given all regions commitment in the Kyoto protocol to reduce emissions and is relatively in line with the average of the data extracted, that is a 3% increase, in a 226 companies' sample. If a global disruptive event like the COVID-19 pandemic had not happened in 2020, the thresholds would be based on existing targets. IPCC targets a 43% reduction until 2030 using 2010 as the baseline year, meaning, assuming a linear decrease, an anual reduction of -2.77% (geometric mean). Using the 3 year window considered in the analysis would mean an accumulated -8.08%. That would be the minimum companies should do to align with the Paris Agreement. However the lockdowns have restricted economic and industrial activities and as such this pathway was not chosen. Instead a direct analysis to the GHG emissions data was done to estabilish what reductions took place by the companies. The second threshold is based on the sample data median, after extraction from the MSCI platform that presents a 6% reduction. The 25th best percentile shows a reduction of around 16%, so the third and fourth threshold were based on the uniform division of that result (6% up to 11% and 11% to 16%) while any company showing a reduction superior to 16% is classified with the best score. Table 4.5 below summarizes the thresholds mentioned for the GHG Emissions Reduction.

Table 4.5 GHG Emissions Reduction indicator scoring

Emissions Reduction (Scope 1 and 2, %)	Attributed Score
Red.$\leq$0%	0
0%$<$Red.$\leq$6%	25
6%$<$Red.$\leq$11%	50
11%$<$Red.$\leq$16%	75
Red.$>$16%	100

As mentioned before the target is to calculate a Climate Transition score using a weighted average calculation of the metrics stated above:

$$Score = \sum_{i=1}^{5} Score_i \times Weights_i \tag{0.1}$$

Where Score$_i$ represents the attributed score on each indicator and i stands for the following climate indicators: 1) TPI score, 2) Climate VAR, 3) Implied Temperature Rise, 4) SBTi Alignment and 5) GHG Emission Reduction.

The rationale for each weight is explained in Table 4.6. All ESG scores face the same challenge in this part as it is hard to justify completely why an indicator has a given weight. Decisions are often based on the expert judgment of those responsible for the methodology as it is the case in this thesis.

Table 4.6 Climate Transition weighted score

Metric	Weighting	Rationale
TPI Score	40%	The TPI score assesses a qualitative part that would be hard to study just by looking at public statements of companies. It studies strategic transition plans while being assured by the company itself through interviews.
Climate VAR (%)	10%	This indicator serves to quantify the possible loss that high emitters companies might face in a few years' time if they do not create or update their strategic plans to mitigate the effects of climate change in their operations. The methodology behind the calculation, however, depends on companies' present path making it harder to assess possible changes if firms already have targets and are proceeding with internal changes.
Implied Temperature Rise (°C)	15%	The ITR metric might be the most punishing for the high emissions related companies, but it is important to understand how the current trajectory is for the companies analysed and their expected impact.
SBTi Alignment	20%	Working together with an independent organization, while having their reduction targets approved shows the company commitment in changing their strategy and valuing their stakeholders' growing concerns regarding climate.
GHG Emissions Reduction	15%	While the SBTi targets approaches medium to long time horizons we can evaluate short term decarbonization to complement the SBTi metric.
Total	**100%**	

5. Data

5.1. Climate Transition data

The first piece of data extracted refers to the Transition Pathway Initiative scores. The sample is divided into 5 sectors, all of them associated with high GHG emissions. This initial data gathering contains the TPI score for 234 companies, 41 of them in the Cement sector, 41 in Coal Mining activities, 14 in Diversified Mining, 80 in Electricity Utilities and 58 in the Oil & Gas sector. As mentioned before, the TPI score goes from 0 to 4 with the latest being associated to companies that recognize climate change as an urgent matter and are actively pushing for a Climate Transition policy within their strategy. In this sample there are some repeated companies (Vale in Coal Mining and Diversified Mining, South32 in Coal Mining and Diversified Mining, BHP in Coal Mining and Diversified Mining, Glencore in Coal Mining and Diversified Mining, Teck in Coal Mining and Diversified Mining and Eneos in Coal Mining and Oil & Gas) as they have multiple fields of activities. These lines were then merged so they are not double counted in the analysis.

The remaining data related to the Climate Transition score comes from MSCI ESG platform which provides updated metrics for the majority of the 234 companies with TPI scores. Companies with one or more missing data fields were excluded from the analysis given the existence of no satisfactory proxy alternatives.

Table 5.1 shows the distribution between sectors, with the number of companies with satisfactory data, after the sample collection from TPI and MSCI ESG:

Table 5.1 Number of companies in each sector extracted from TPI and MSCI ESG

Sector	Sample from TPI	Sample from MSCI ESG
Cement	41	40
Coal Mining	41	38
Diversified Mining	14	14
Electric Utilities	80	78
Oil and Gas	58	56
Total	**234**	**226**

5.2. Financial Performance data

From Yahoo Finance it is possible to collect the 4 FP indicators that I use in the analysis. The extracted data from the platform refers to the period between 22nd and 31st of May 2022. There are some instances of companies that have undergone mergers in recent times and as such the FP data is not available. Others have constraints making

them unusable. Table 5.2 shows a summary of the companies with satisfactory data using as base the 226 available companies from the last interaction.

Table 5.2 Number of companies in each sector extracted from Yahoo Finance

Sector	Sample from Yahoo Finance
Cement	36
Coal Mining	33
Diversified Mining	14
Electricity Utilities	68
Oil and Gas	48
Total	**199**

6. Analysis

6.1. Classification of companies

After calculating the Climate Transition score, using the methodology explained in the previous chapter, I classify each company into two categories: Green if the score is superior to 50 or Grey if it is below 50.

Table 6.1 Number of companies grouped and classified in each sector

Sector	Green	Grey
Cement	13	23
Large	6	4
Small/Mid	7	19
Coal Mining	11	22
Large	10	8
Small/Mid	1	14
Diversified Mining	8	6
Large	8	5
Small/Mid	0	1
Electric Utilities	50	18
Large	43	9
Small/Mid	7	9
Oil and Gas	17	31
Large	16	28
Small/Mid	1	3
Total	**99**	**100**

MSCI ESG platform also indicates the Market Cap ($) at the end of 2021 of each company making it possible for companies to be divided by Market Cap size. The large-cap ("L") companies (above $10 billion in size) and small/mid-cap ("S/M") companies (below $10 billion in size). The model will then evaluate the correlation between each group's Climate Transition score and the Financial Performance metrics as well as Market Cap.

Table 6.2 Number of companies grouped by Market Cap

Market Cap size	Green	Grey	**Total**
Large	83	54	**137**
Small/Mid	16	46	**62**
Total	**99**	**100**	**199**

6.2. Statistics

By removing the outliers, using the interquartile range approach, associated with the FP metrics and Market Cap (MC), it reduces the sample of each group to 98 and 44 companies respectively. The outlier removal was needed given different financial scenarios in such a global sample. As companies are also restricted to the financial market where they are located it can sometimes give non comparable results to other similar companies in the same sector but different regions. Abnormaly low or high results in the FP may also indicate more disruptive business decisions such as mergers or near bankrupcies. The table below showcases descriptive statistics about the data that will be used in the correlation tests.

Table 6.3 Statistics of each group's Climate Transition score after outlier removal

CT score	Large companies	Small/Mid companies
count	98	44
mean	53.44	37.81
std	20.57	17.50
min	10.00	0.00
25%	38.45	26.25
50%	53.75	37.50
75%	65.00	48.75
max	100.00	83.75

Table 6.4 Statistics of each group's FP indicators after outlier removal

	Large companies					**Small/Mid companies**				
FP Indicators	ROE	ROA	P/E	P/B	MC $m	ROE	ROA	P/E	P/B	MC $m
count	98	98	98	98	98	44	44	44	44	44
mean	0.14	0.05	16.11	1.88	30,630	0.13	0.05	14.21	1.43	4,379
std	0.07	0.03	9.12	1.04	18,778	0.10	0.03	10.61	1.11	2,333
min	0.00	0.01	3.01	0.03	10,421	0.00	0.00	1.98	0.02	936
25%	0.09	0.03	8.57	1.01	16,364	0.08	0.03	5.86	0.61	2,380
50%	0.13	0.04	15.16	1.90	24,809	0.10	0.04	10.92	1.04	4,254
75%	0.18	0.07	22.30	2.46	40,399	0.17	0.06	18.28	1.92	5,715
max	0.34	0.13	42.75	4.51	87,946	0.44	0.12	44.56	4.32	8,837

As expected, when comparing the CT score mean, of the Large and Small/Mid groups, the first is notably higher than the smaller market cap companies as seen in Table 6.4. This difference might be because of the companies resources to transition or tighter regulations that have made them align to a more sustainable path when compared with smaller firms. However to prove the hypothesis set out earlier the correlation study will be conducted within each group to prove that higher asset size is positively linked to sustainability efforts in Climate Transition.

Figures 6.1 to 6.5 show the plots using the above samples to view if there is any visual link between the Climate Transition score (X axis - independent variable) and the FP indicators and Market Cap (Y axis - dependent variable) for the group of Large companies.

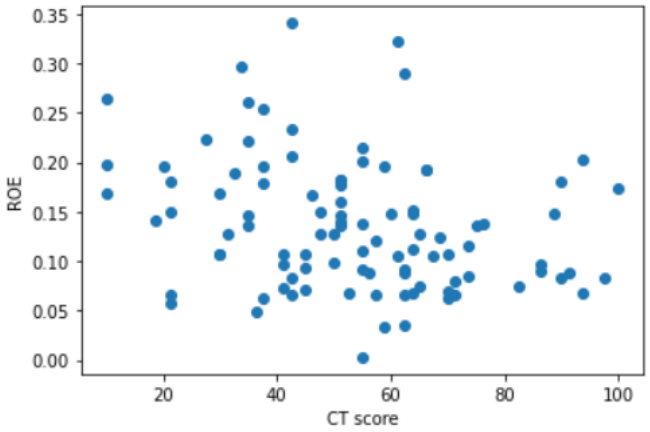

Figure 6.1

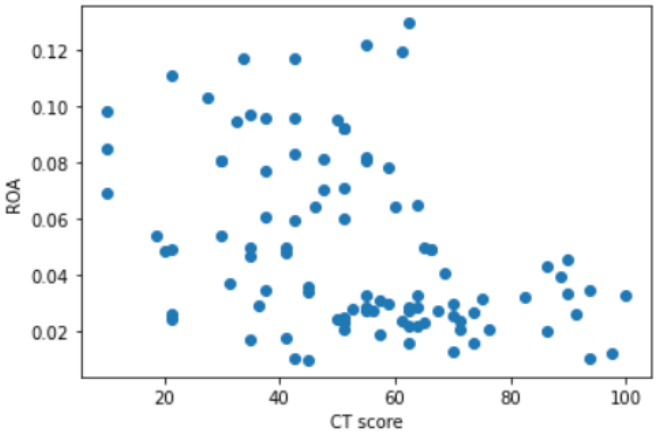

Figure 6.2

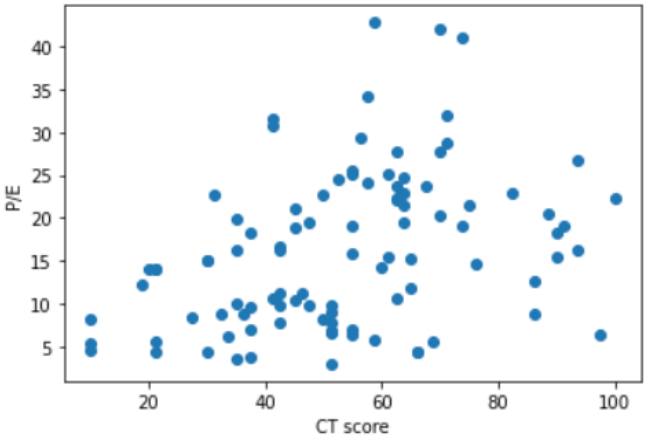

Figure 6.3

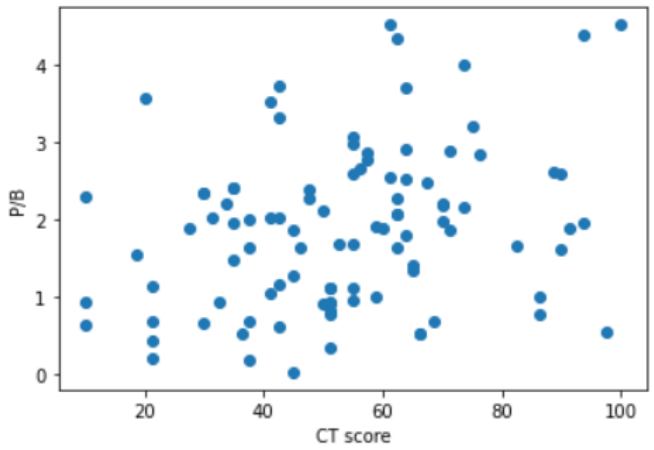

Figure 6.4

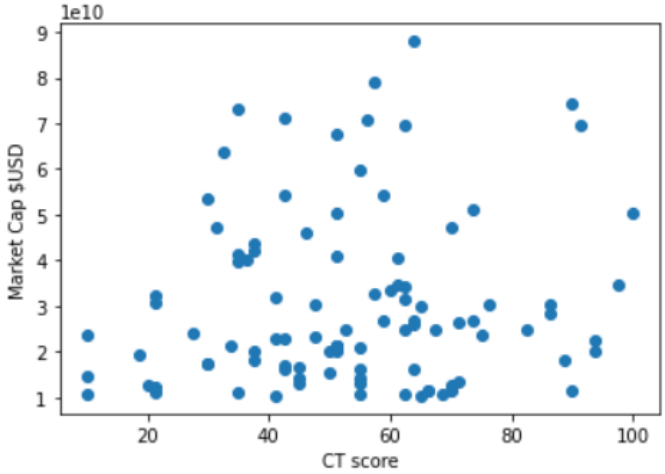

Figure 6.5

The figures seem to indicate that there is a negative link between the Climate Transition score and the ROE and ROA indicators. There is a positive correlation between the score and P/E and P/B, with a rise in the score leading to a rise in the Price to Earnings and Book ratios. Investors traditionally look for high ROE/ROA and for low P/E and P/B in the stock market as a sign of a good investment opportunity. If proven correct, these initial view might indicate that companies that are more aligned with the Climate Transition have lower returns, at least in the short term as seen by these FP indicators.

For the Market Cap correlation with the Climate Transition score it does not seem to be any positive or negative correlation that stands out.

Below is the same visual and statistical exercise for the group of Small/Mid companies.

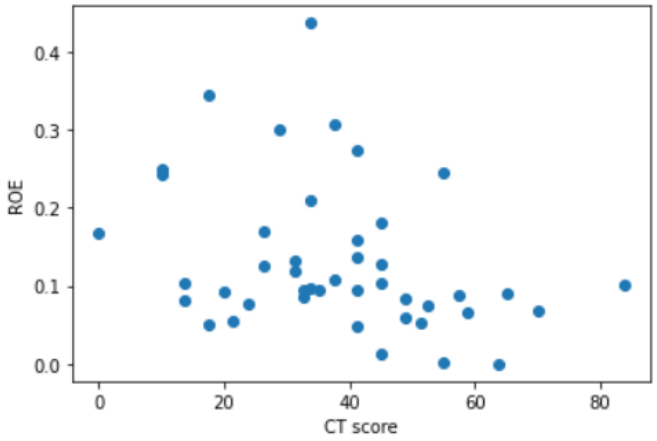

Figure 6.6

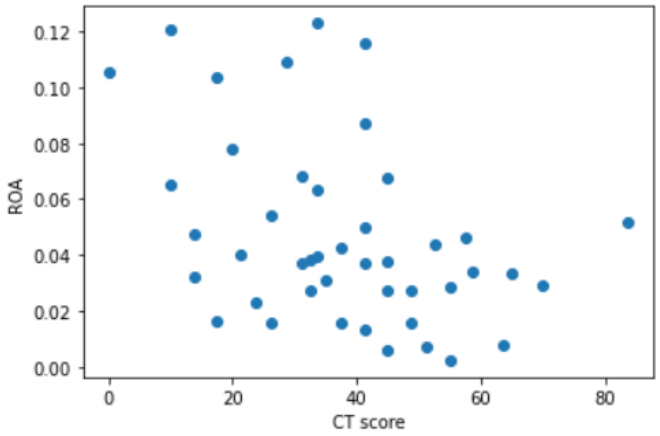

Figure 6.7

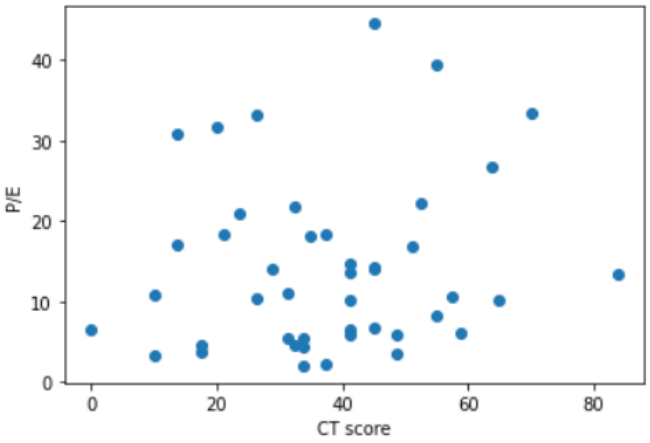

Figure 6.8

For this group of Small/Mid companies the ROE, ROA and P/E indicators seem to follow the same preliminary results, a negative link for ROE and ROA and a positive link for P/E with the Climate Transition score. However, for P/B, eventhough weak, there is a negative link with the rise of the score being associated with a decrease in the P/B

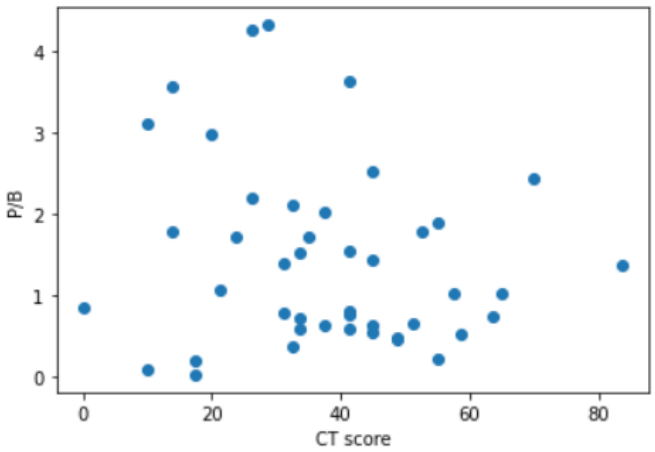

Figure 6.9

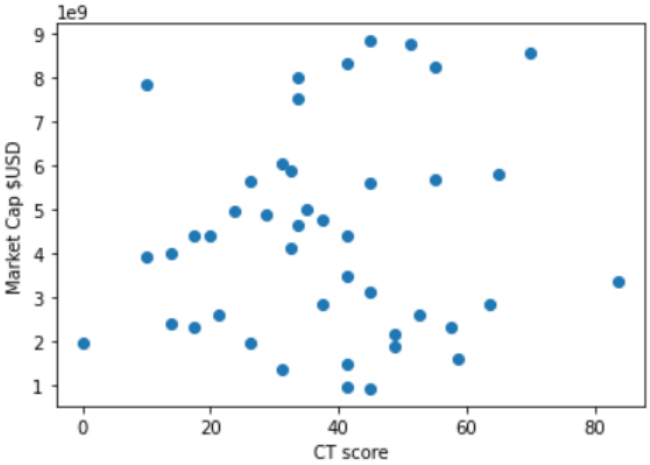

Figure 6.10

ratio. As for the Market Cap, there seems to be a positive correlation, even though these results still need to be materialized and confirmed via significance tests.

6.3. Correlation analysis

To visualize the correlation results, a heatmap was done showcasing the relations between each indicators for each group. Figure 6.11 is representative to the Large companies group while Figure 6.12 represents the Small/Mid companies group.

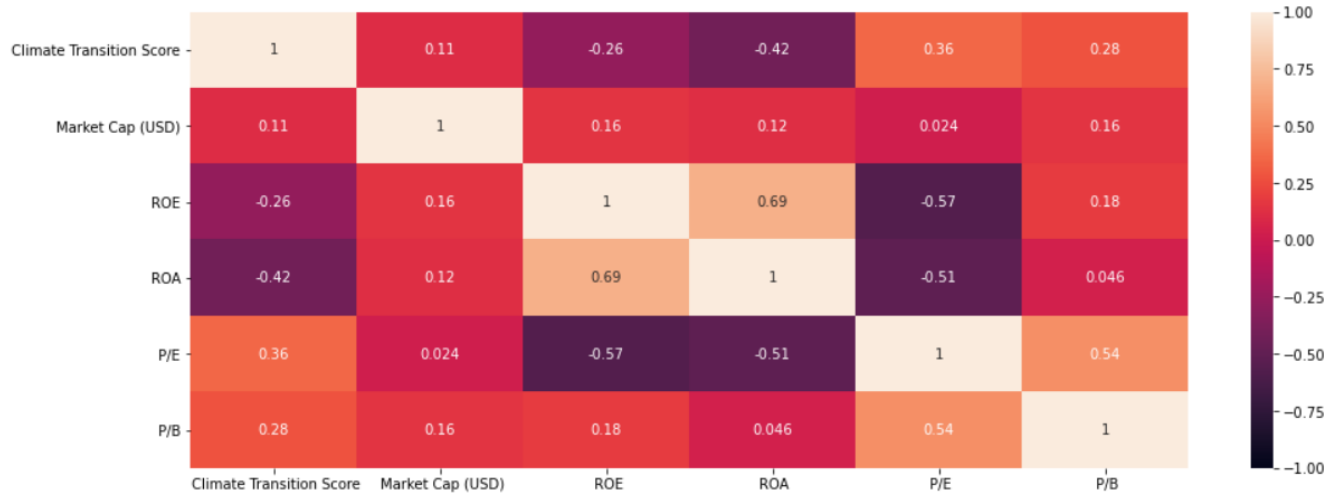

Figure 6.11

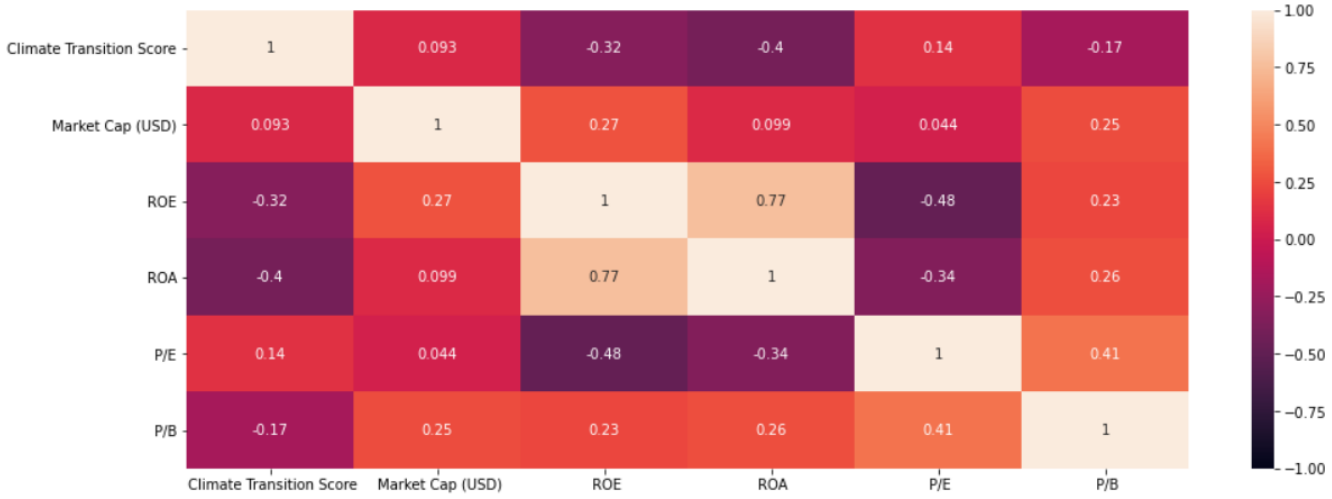

Figure 6.12

Looking at the first line of Figures 6.11 and 6.12 we can see the correlation between the Climate Transition score and relevant indicators. For the Large companies group the heatmaps corroborates the visual chart analysis done before. There is a negative link between the score and the ROE and ROA indicators, and a positive link, for P/E and P/B. As for the Market Cap there seems to exist a positive link, even though it was not so clear in the chart.

For the Small/Mid group the results are also in line with what was said before.

To verify if the correlation values are statistically significant the Pearson correlation is applied to the relevant indicators.

Table 6.5 Correlation results using the Pearson correlation

	Large companies					**Small/Mid companies**				
CT score	ROE	ROA	P/E	P/B	Market Cap	ROE	ROA	P/E	P/B	Market Cap
Correlation	-0.262	-0.417	0.364	0.280	0.111	-0.322	-0.402	0.141	-0.175	0.093
***p* value**	0.009	0.000	0.000	0.005	0.275	0.033	0.007	0.363	0.256	0.550

In the Large companies group Table 6.5 shows a significant negative link between the score and the ROE and ROA indicators and a positive link with P/E and P/B. All indicators, except Market Cap and P/B, have a p value under 5%. With these results no conclusion can be reached for the first hypothesis set out in the thesis ("There is a positive link between the size of the company and the Climate Transition score"). Even though the Large companies group has a significantly higher Climate Transition score than the Small/Mid, the same can not be said for companies within the same Market Cap range that are being analysed.

In the Small/Mid group we can see the negative link between ROE and ROA with the score while the other indicators not reaching a significant value, all of them with a p value way over 10%. Similar to the Large group the Market Cap value holds no significance thus leading for a rejection of the hypothesis positively linking Market Cap size with a higher Climate Transition score.

7. Conclusion

From the analysis I can observe that, contrary to the first hypothesis, there is not a positive link between the Climate Transition score and Financial Performance. In fact, the significance study showcases a negative link between ROE and ROA with the score and a positive link with P/E and P/B in the Large companies group. Also with statistical relevance, there is a negative link with ROE and ROA for the Small/Mid companies group. The cost of aligning the company's practices, strategy and business to the Climate Transition might be dragging the short term financial results down for some companies. However, the positive link between the score and P/E and P/B might indicate that investors consider the high financial potential of greener companies. With the rejection of this hypothesis one pertinent question arises: Does sustainability hinder the growth in the short term but is beneficial in a long time horizon? A more in depth study of the FP indicators would need to be done, alongside a non-stationary analysis of the indicators' evolution to understand if the companies with higher Climate Transition scores give up short term profitability for a higher return in the long term. A more granular analysis of different environmental indicators might also be conducted if new and bulkier methodologies arise for the forward looking indicators. As the sustainability and finance areas continue to evolve and be more interconnected, the data needed for this type of long term relationship analysis will become easier to gather. Asset managers that have sustainability linked funds usually look for new ways to evaluate ESG indicators or practices that might be positively linked to performance. With both the interest of the academic world and business needs the area will continue to develop and provide results and insights to all interested stakeholders.

The analysis also grouped companies of different sectors, which are at different states on the climate journey, even if traditionally all of them have negative contributions to the climate. The electric utilities sector, for example, is at a point in the Climate Transition more advanced than the Coal and the Oil and Gas sectors. However it can not be ignored that the latter sectors fight agaisnt change, much because there is a high degree of difficulty to reduce emissions given their main resource used.

The use of more traditional profitability indicators might also benefit companies that still try to maximise profits for shareholders while not providing the same effort for the overall stakeholders like employees, costumers and society. By using dfferent value creation indicators the analysis could show other results. The main challenge is choosing widely accepted methodologies for those value creation indicators as sometimes it is hard to quantify the impact on broader society.

As for the first hypothesis, it is rejected as no positive link was found between the size of the companies, within the same predefined range, and the Climate Transition score.

It should be noted however, that the mean of the score in the Large companies group is significantly higher than the smaller companies group. This might happen because of different regulations in place for bigger companies, concentration of big firms within developed countries more aware of Climate Transition or greater amount of resources needed to align themselves with more sustainable practices.

A potential limitation of this thesis is the use of a univariate analysis, given the choice of using an independent variable that is exclusively environmental. A deeper analysis using multiple factors, such as, broader ESG scoring, company size, region could give more insights on the relationship of Sustainability with financial performance. By understanding what factors affect the company's performance and how impactful that is to stakeholders future studies can be undertaken to add more to this theme.

One possible reason for the correlation not being as strong for the smaller set of companies, when compared to the bigger ones, is the sample size. The Small/Mid group only has 44 companies analysed, post outlier removal, when compared to the 98 larger companies. The P/E and P/B data distribution for the small sample is also more spread out, with the correlation being weaker for these two indicators when compared to the others for the same group. These two factors might explain the lower significance and weaker correlation between the score and indicators.

It should be noted that the theme being studied in this research, sustainability compared to finance, is still underdeveloped even with multiple studies around profitability and ESG ratings, scores, indices and other classification systems with sustainability factors. This is partly due to the fact that the climate and environmental changes have longer time horizons than profits or finance performance. So while major changes can happen over quarters to companies the same can not be said to environmental issues. This mismatch leads to a higher degree of difficulty when combining finance and sustainable aspects into account as seen in this thesis. While the Climate Transition score tried to "look at the future" based on present day commitments and actions, it would be hard to do the same for financial indicators while also taking into account climate-related risks. Another point that needs to be made is the fact that the main focus was profitability, in this case in the short term, while not considering how a more climate aligned company might have better risk management frameworks put in place. As quantifying possible losses in the future given certain extreme events is also prone to uncertainty, the connection between good ownership of climate related issues and lower risk requires more time to have more data points and better disclosed frameworks around risk management. Just as the 2008 financial crisis was a catalyst to the reinforcement of risk management systems the potencial hazards and consequences of climate change might accelerate the integration of environmnental risk into existing frameworks.

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