Open University of Cyprus

Faculty of Economics and Management

Postgraduate Programme of *Enterprise Risk Management*

Master's Dissertation

ESG Risks: Environmental. Statistical Analysis of Certain Environmental Indices for a Certain Sector of Economic Activity

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Summary

This Dissertation aims to explore the aspects of Environmental Social Governance (ESG) risk in the European banking sector. To succeed this, three main "ingredients" were used:

- Detailed description of ESG ecosystem.
- Extensive literature review, both qualitative (how ESG are linked to the risk of businesses) and quantitative (in what ways ESG affect banking risk, if they are good predictors of financial distress or other banking performance indicators like Non Performance Loans and if they are connected and how with operational risks of banks).
- Examining the environmental performance of European banks using statistical approach.

For the statistical approach, environmental data of emissions (scope 1 and scope 2) were collected from the 50 largest European banks, in terms of assets, alongside with financial and operational data (like profits, number of branches, number of countries that banks operate and use of resources like energy water and paper).

With the use of thee statistical techniques (observation method for comparing data, geographical approach and regression analysis), nine interesting conclusions were found which are noted in Chapter 4. The most important are:

- Increase in a bank's profit is not correlated with increase in air pollution (i.e more scope 1 and scope 2 emissions).
- Profit efficiency is even less correlated with either more air pollution or more use of recourses (like energy, water and paper).
- The location of banks affects the ESG culture that they carry.
- Air pollution is associated with the number of branches and the number of countries that a bank operates.

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Chapter 1

1. Introduction – ESG Description

In this Chapter there is an extensive description of the ESG in four sections: Historical review, definition, description of the operating Ecosystem and the reporting.

The scope of this Chapter is to provide complete knowledge of the ESG. In particular: How it started, why it stared, how it is monitored, what are the difficulties that have been observed and how is today's ESG ecosystem being setup (which are the "key players" of the ESG ecosystem).

1.1 History of ESG

During 1920's, a mutual find in USA decided not to include any stocks of companies that were dealing with tobacco, alcohol or gambling, considering those as "sin stocks". This was the first time that investors engaged social criteria in their investment decisions, instead of purely economic ones. Since then, many times the decision making process of investors was taking into account not only the financial aspects but also other criteria like social ones.

Specifically in the 1960's and 1970's, society was changing its perspectives regarding social attitudes due to three major events / phenomena:

- The war in Vietnam.
- The human rights, especially in the USA.
- The Environmental protection

Those phenomena had serious impact in the financial activities because some mutual funds excluded stocks of companies that were involved in the Vietnam War. Instead, companies that showed either, respect on the human rights, or they were implementing positive actions for the environment, were included in mutual funds for investors.

Later on, during the 1970's and 1980's the South African regime of Apartheid became known in the U.S society. The result was a non-investment movement towards the republic of South Africa, which was considered a catalytic event for the termination of this regime.

During 1990's the concept of "globalization" was the hot aspect of the world's economy and the main trigger for the beginning of the globalization era, was the collapse of Soviet Union. Many companies faced the worldwide expansion as a challenge which could establish them globally, not only in financial terms but also in social terms. So, due to the globalization, the need for sustainable development became an issue.

In 1992 the United Nations (UN) Earth Summit was held in Brazil, Rio de Janeiro and the Agenda 21 was presented and it was voted by 178 governments. Agenda 21 is an action plan for the sustainable development and it consists of four units:

- Social and economic dimensions to developing countries.
- Management of resources for development.
- Role of major social groups NGO's, local authorities, etc.
- Development implementation means.

This is the first official guide, which also was globally accepted, that provides guidelines for the sustainable development. It is very important because it is the starting point and since then it has been revised several times (i.e 1997, 2002 and 2012). Its successor is the Agenda 2030, also known as Sustainable Development Goals, which was establish on the UN Sustainable Development Summit in 2015.

The next milestone is the year of 1994 where two important events took place:

- John Brett Elikington, author entrepreneur and authority on corporate responsibility and sustainable development, introduced a three pillar evaluation system for a company's performance, triple bottom line as mentioned in the book of ESG investment in the global economy 2021 by Tadahiro Nakajima · Shigeyuki Hamori · Xie He · Guizhou Liu · Wenting Zhang · Yulian Zhang · Tiantian Liu (pp 3), which is based on economic, social and environmental parameters.
- During this time, Corporate Social Responsibility (CSR) issues begun to be considered with the same perspective globally. The reason was that many stories of child labour or sexual harassments, or low labour rates in some countries, got publicity and became known all over the world because of the available technologies at the time (satellite TV, live broadcasting form around the world, internet, etc). The result was that many investors thought that CSR should be considered in an investment, even if they are not regarded as financial factors but they are regarded as indicators for long term profitability.

In 2000 the UK's Pension Act was reviewed and mentions that apart from financial predications (like the expected risk and return), social, environmental and ethical issues must be considered when investing. This is another critical milestone to the future of ESG establishment, because it is a regulatory link between investments and environmental, social and governance issues (Nakajima, T., Hamori, S., He, X., Liu, G., Zhang, W., Zhang, Y., & Liu, T 2021:3)

During the year 2004 the term ESG (Environmental, Social and Governance) was introduced for the first time. In June 2004, UN in collaboration with 20 Financial Institutions presented a report with recommendations for integrating Environmental, Social and Governance factors in the word of finance (i.e investment, market research and analysis). That was the establishment of the well-known ESG factors. These factors are present for less than 20 years, but with a great impact for the planet and the financial system which can be estimated about more than $30 tn in assets under management.

Finally, in the 27th of April 2006 in the UN's offices in New York, the ex UN Secretary General Kofi Annan presented the Principles for Responsible Investment (PRI). These principles are not legal obligations, but they strongly connect ESG with investing. In particular, in any investment analysis and in any decision making process, the ESG criteria should be taken into account. Also the ESG issues will be included in ownership policies and practices. An appropriate disclosure of ESG issues will be asked to the companies before investing.

1.2 Definition of ESG

Environmental, social and governance (ESG) is a term used to represent an organization's corporate financial interests that focus mainly on sustainable and ethical impacts (Mathis S., Stedman C., 2023).

ESG is a strategic framework for identifying, assessing, and addressing organizational objectives and activities ranging from the company's carbon footprint and commitment to sustainability, to its workplace culture and commitment to diversity and inclusion, to its overall ethos regarding corporate risks and practices (Sarah K. White, 2022)

ESG is a framework designed to be embedded into an organization's strategy that considers the needs and ways in which to generate value for all of organizational stakeholders such as employees, customers and suppliers and financiers (Wikipedia, 2023).

And many more……

Searching for an ESG definition generated many results, maybe due to the fact that is a relatively new concept. According to the author of this Master's dissertation, ESG are indices for measuring company's Environmental, Social and Governance footprint. These are non-financial figures with a great impact in the company's sustainably, including its financial aspects.

Environmental pillar has to do with the preservation of the natural world. In particular, how a company affects climate change while operating. This can be monitored with some measurements like how much energy uses for its operations and what level of emissions are being produced, what level of pollution in air and water is taking place and the amount of natural resources use are the most important measurements.

Social pillar is the firm's impact on society including firm's stakeholders. This includes metrics that have to do with the respect on employee's diversity issues, human rights, stakeholders relations (like customer protection, taking into account opinions of social groups etc).

Governance pillar focuses on the way that a company operates. What is the hierarchy and the procedures that are followed? Is the company compliant according to the laws and the general framework like GDPR, hygiene rules, etc. Some indicative measures might include any fines that were imposed, official complaints, data breech issues, cyber security or physical attacks, etc. So the governance pillar enchases the transparency of a company.

1.3 Description of ESG Ecosystem

In later years the demand of investors for ESG data is continuously rising. ESG information is very important for sustainability as well as for commitment to the national targets and to public issues of interest. So, more and more investors integrate into their decision making process, the ESG parameters. This is shown to the 2019 white paper of the World Economic forum, where in 2016 the amount of $ 22,9 trillion of assets were managed under responsible investment strategies, 25% higher compared with the corresponding amount of 2014.

So the obvious conclusion is that ESG is an important parameter for today's business world because it affects the amount of investments that companies will receive and depends upon their ESG performance. This is a very significant factor of correlation between risk and ESG which will be discussed in the next paragraphs.

But how ESG is working in today's economy and what is the system behind the provision of ESG indices to investors?

The 2019 white paper of the Word Economic Forum gives an extensive of the ESG cycle and the involved parties:

- Companies generate ESG data according to their performance.
- The standard setters publish the guidelines about the ESG reporting.
- The framework developers focus on how an ESG report is structured in terms presenting data, highlighting the important aspects and how to create value.
- The assurance providers help companies on how to disclose data.
- Data providers collect available ESG data and they produce reports with metrics or rankings or indices. Some data providers offer ESG ratings to the investors.
- Investment banks use ESG data in order to make recommendation to investors.
- Investors (like asset managers, private equity firms, etc) decide how to invest their available assets and the level that ESG is taken into account differs from investor to investor.
- Regulators set the ESG discourses in the companies that they regulate. They might ask for the publication of specific ESG indices or data.

Additional key players are ESG focused organisations that offer services to companies related to ESG reporting (e.g how to measure, how to improve their reports, etc).

1.4 ESG Reporting

In order for a company to produce ESG indices, there are many available standards to choose from. The standards provide detailed guidelines about the collection of data, the indices that have to be reported and the way that a report is produced. Also this chapter is important because it proves that the convergence of the financial reporting with the ESG reporting takes place. The main reporting frameworks are the following:

1.4.1 Sustainability Accounting Standards Board (SASB)

Sustainability Accounting Standards Board (SASB) was founded in 2011 by Jean Rogers in the USA. Its aim is to identify the ESG issues of a company that are most relevant with the financial performance and the enterprise value for 77 industries. In particular there are 11 group industries and a specific report per industry is available with the guidelines, as shown in the Table 16 presented in Appendix A.

It is clear that SASB specialises reporting according to the industry that the reporting company operates and in the next sections more details are given for the Commercial Banks category (Raw 17 in Table 16 of Appendix A).

Two milestones of SASB are the merge with the International Integrated Reporting Council (IIRC) and the next and most important is form the 1st of August 2022 the SASB framework is taken into account by the IFRS for the creation of the first International Sustainability Standards Board (ISSB). This is a very important fact, because IFRS which is an International Financial Reporting Standard, takes officially into account the ESG performance alongside with financial performance. This is a strong indication for the investigation of the correlation between ESG and risk as it is examined in the next chapter.

1.4.2 GRI

The next framework is called GRI which is a sustainability reporting standard offered by the Global Reporting Initiative a NGO (Non-Governmental Organisation). The organization was founded in 1997 Boston USA by non-profit organisations with the involvement of the United Nations (UN) environment programme.

The main event that trigged the GRI creation was the major environmental catastrophe of Exxon Valdez oil spill. The first framework (i.e GRI guidelines) was published in 2000 and today is the most common used method for sustainability reporting.

It includes many quantified ESG metrics like CO_2 emissions, working conditions, labour payments, transparency, etc. In 2022 on GRI's 25th anniversary the launch of sector standards for coal, agriculture, aquaculture and fishing were launched.

1.4.3 Task force on Climate-Related Financial Disclosures (TCFD)

The Task force on Climate-Related Financial Disclosures (TCFD) provides information about actions that companies take for risk mitigation on climate change as well as governance actions related to transparency.

This information is available to investors in order to be better informed regarding climate change issues in their decision investment process. It was establish in 2015 by the G20 and the Financial Stability Board after the failure of 2015 Paris Agreement for rise of warming. The framework of TCFD consists of four thematic units: Metrics and Targets, Risk Management, Strategy and Governance. Each thematic unit consists of disclosures as presented in the Appendix 1 Table 17.

An important milestone of TCFD is that on November 2022 the number of their supports reached at 4.000 organisations of 100+ jurisdictions with a market capitalisation of $ 26 trillion.

Also in this framework there is a clear connection between organisation's Risk and Climate Change (Environmental issue of ESG) and financial investing.

1.4.4 Carbon Disclosure Standards Board (CDSB)

The Carbon Disclosure Standards Board (CDSB) is a non-profit organisation established in London in 2007 and it provides information to investors by integrating climate change data to financial reporting.

The objectives of this framework are the provision of environmental and social information which is connected with financial information and is available to potential investors. Standardisation of reporting of environmental and social information in mainstream reports. These reports might provide in a clear, comparable and concise way the environmental and social performance and how it is linked with the organization's strategy, performance and prospects.

They can be used for compliance, assurance or other requirements and they add value to organisation's reporting. Also they enable investors to invest in activities that take into account environmental and social aspects. There are 12 reporting requirements and they are presented in the Appendix 1 table 18.

A milestone of the CDSB is that on the 31st of January 2022 was consolidated by the IFRS for the ISSB, like the SASB (as mentioned above).

1.4.5 AA1000

AA1000 is a framework offered by the non-profit organisation AccountAbility which was established in London in 1995 and its goal is to promote accountability, sustainable business practices and corporate responsibility.

This framework is based on four principles:

- Inclusivity: People should have a say in decisions that impact them.
- Materiality: Decision makers should identify and be clear about the sustainability topics that matter.
- Responsiveness: Organizations should act transparently on material sustainability topics and their related impacts.
- Impact: Organizations should monitor, measure, and be accountable for how their actions affect their broader ecosystems.

1.4.6 ISO Standards

The International Standardization Organisation (ISO) has developed two frameworks the ISO 26000:2010 which is a guidance on social responsibility and the ISO 14001:2015 which is an environmental management system. The ISO 26000:2010 consists of five units:

- Understanding social responsibility.
- Principles of social responsibility.
- Recognising social responsibility and engaging stakeholders.
- Guidance on social responsibility core subjects.
- Guidance on integrating social responsibility throughout an organisation.

The ISO 14001:2015 consists of 8 units and each one carries principles:

- Terms and definitions
    - Terms related to organisation and leadership.
    - Terms related to planning.
    - Terms related to support and operation.
    - Terms related to performance evaluation and improvement.
- Context of the organisation

    - Understanding the organisation and its content.
    - Understanding the needs and expectations of interested parties.
    - Determining the scope of the environmental management system.
    - Environmental management system.
- Leadership
    - Leadership and commitment.
    - Environmental policy.
    - Organisational roles, responsibilities and authorities.
- Planning
    - Actions to address risks and opportunities.
    - Environmental objectives and planning to achieve them.
- Support
    - Recourses.
    - Competence.
    - Awareness.
    - Communication.
    - Documented information.
- Operation
    - Operational planning and control.
    - Emergency preparedness and response.
- Performance evaluation
    - Monitoring, measurement, analysis and evaluation.
    - Internal audit.
    - Management review.
- Improvement
    - General.
    - Non conformity and corrective action.
    - Continual improvement.

1.4.7 ESG reporting concerns

It is clear that ESG are of a high importance for the investors, for the economy, for the society and for the environment. But despite their necessity and usefulness, there are some concerns that must be dealt by the stakeholders.

The concerns (with respective proposals) were noted in the 2019 white paper of the World Economic forum titled as: Seeking return on ESG. Advancing and reporting ecosystem to unlock impact for business and society.

In particular, the concerns are:

- Complexity and burden of ESG reporting (especially for the social factors).
- Incompatibility of the ESG data between companies due to different metrics.
- Poor understanding (and interaction) with the ESG rating agencies due to lack of transparency and unclear methods used.

For dealing those issues the proposals were:

- Improve transparency across the ecosystem.
- Enable effective cross system dialogue including investors to company management and intercommunity dialogue for the important ESG issues.
- Change (tight and align) the methodologies for metric measurement. This is a necessary action in order to improve the comparison of ESG indices between companies which is of high importance in the decision making process of investment.

The Word Economic forum offers a great help in the issues above by being used as platform for dialogue between stakeholders and by channelling community insights for improving metrics.

Other proposed aspects for the issues are:

- Up to which point ESG reporting mirrors financial reporting and how it is regulated.
- The way that the funding flows like donations and membership fees affect the ecosystem.
- How the new technology (like Artificial Intelligence) can be used for improvements on ESG reporting.
- To identify any ways that will drive the Boards of the companies to give a greater focus on ESG.
- To identify improvements for the measurement of “S” (Social) issues.

The proposed issues already have started be in the resolving process. In the website of the World Economic Forum there is an ESG Ecosystem map available and updated which was discussed in the previous paragraph. So the World Economic Forum already functions as a dialogue platform for the ESG involved parties.

Regarding the issues of the incomparability of the ESG data and the way that are used as a mirror for financial reporting, as it is stated in the above paragraphs, a new framework of International Sustainably Stands Board (ISSB) is in progress.

The ISSB is created by the IFRS foundation which is financial reporting institution but is consolidated with SASB and SDSB, frameworks that are ESG related. So the convergence of financial reporting and ESG reporting has already started, which is very positive the ESG stakeholders, particularly for the investors.

Another important aspect for the incomparability of the ESG data, is that many regulators have started to ask for specific publications of ESG indices in a specific way.

An example is the guide published by the Athens Stock Exchange which describes analytically the reporting of ESG data of the companies that trade their stocks in the Athens Stock Exchange. This guide was published for first time in 2019 and it was revised in 2022.

According to the last revision of 2021, the companies that trade their stocks in the Athens Stock Exchange Market are obliged to publish core metrics, advanced metrics and sector-specific metrics of environmental, social and governance issues.

In particular, for the environmental core metrics like the Scope 1 emissions, Scope 2 emissions and Energy consumption and productions, there are clear instructions about the calculation. For instance, scope 1 emissions are the gross direct Scope 1 GHG emissions, measured in tons of CO2 equivalent (tCO2e). These are emissions deriving from generation of electricity, heating, cooling and steam, physical or chemical processing, transportation of materials, products, waste, employees and passengers and fugitive emissions. They are calculated using the Greenhouse Gas Protocol Corporate and Accounting Standard.

Scope 2 emissions are also measured in in tons of CO2 equivalent (tCO2 e) according to same standard. They are defined as the GHG emissions that stem from the generation of purchased electricity consumed by the organization.

The companies are instructed to report on the emissions from the generation of purchased electricity that is consumed within its operations or owned/controlled equipment as Scope 2.

Chapter 2

2. ESG Literature Review

This Chapter focuses on the aspects that ESG is connected to risk of business and to banking sector.

This study was achieved by performing literature review and the main findings are given in the next sections.

2.1 ESG and Risk

Despite the ESG reporting concerns that were mentioned in the previous chapter, there is a strong connection between an organization's risks and the ESG performance. This section presents the link between ESG and risk both in terms of arguments and some empirical evidence that were found.

2.1.1 Financial risks

As it has been already stated, investors take into account to the decision making process the ESG results and sustainable investing rose by 68% between 2014 and 2019 (Uzsoki 2020: 3). So the companies with poor ESG results face a threat of limited capital access. Also there is a threat of losing customers and revenues for companies with poor ESG results (Henisz, Koller, Nuttall 2019: 4).

On the other hand, companies with good ESG scores face an opportunity of better capital access which also causes lower interest rates for borrowing, so lower costs. Another gain is that consumers prefer to buy more sustainable products, so this can be a competitive advantage against competition.

Long term sustainable investments of profits will be preferred instead of short run investments with risk on environmental issues. So the company's long term financial viability is enhanced.

2.1.2 Operational Risks

As far as the operational risks are concerned, high ESG scores contributes to the production continuity and to the decrease of production costs (Henisz, Koller, Nuttall 2019: 4).

After the war in Ukraine many companies were affected by the sharp rise in the energy prices. The prices of oil, gas and electricity scored high-record prices. So the companies had to face either production costs that were dramatically higher, or they had to stop or reduce production. On the other hand businesses that were using alternative sources of energy, like solar or wind, were not affected so dramatically and they faced less financial problems.

High ESG performance is a deterring factor for accidents or regulatory sanctions, because compliance to environmental laws and to labor laws leads to higher ESG score.

Also in sustainable working environments, labor is motivated to uplift its performance so production is uplifted (Henisz, Koller, Nuttall 2019: 4). If labor laws are applied and concepts like diversity are supported, then employees are happier and tend to work more efficiently. Also, a good reputation as employee, attracts more skillful labor.

2.1.3 Reputational Risks

ESG tends to enhance company's reputation. The society appreciates companies that protect the environment and this can be shown by a sales increase or by inviting a company to operate in a community. Respect, listen and contribute to the society, being transparent and apply the labor laws enjoy better reputation.

On the other hand, companies with low ESG scores do not enjoy a good reputation, so this is a risk issue.

2.1.4 Strategic Risks

ESG is a tool that can be used in the strategy too. It provides the development of opportunities like establishing business abroad (either for growth or for moving a part of the production) because local authorities tend to grant licenses relatively easier to a company with high ESG score.

Also, a strategy against competition due to high ESG can be followed since the social trends create great strategic impacts.

2.2 ESG and banking

Why banks? Traditionally banks are the society's lenders, so now that there is a change in the investing criteria (include ESG factors), banks ought to chance their traditional operations. Instead of approving a loan based solely on financial indicators, ESG indicators should be considered as well.

Also banks, as any other company, ought to take into account their ESG performance, not only for reputational reasons, but also for transforming their operations to a more effective model in terms of environmental, social and governance approach. But what are the ESG risks that a bank will face and how can do about them?

The regulators of the Banks like the European Central Bank (ECB) and the European Banking authority (EBA), have already started to give focus on the sustainable finance and EBA's action plan for sustainable finance, is expected to be published soon. So the banks will face new rules for incorporating sustainability in their operations. This new framework presents threats and opportunities. Some ESG risks that banks face, according to the 2021 paper ESG Risks in Banks by KPMG, are presented in the following sub-chapters:

2.2.1 Environmental Risks in banks

Collapse of the supply chain, floods, droughts, rise of sea level, fires, changes in the demand and supply, changes imposed by the regulator in the production process. An examples is imposing limits on emissions etc.
An environmental risk example is the following: Due to climate change, disasters might affects bank's assets (e.g warehouses or branches), or ever harm its personnel.

2.2.2 Social Risks in banks

Non-compliance with regulation, lack of assurance in product safety, inadequate labor payment.

A Social risk example that banks might face is possible to appear outside of a bank. In particular an important supplier might be non-compliant with the law and this will cause a reputation risk which will affect the bank too.

2.2.3 Governance Risks in banks

Non-Compliance with rules and regulations, face corruption, data breaches.

Regarding governance risk case that a bank might face, might be the following:
Regulators may take action for emissions or the energy consumption (like imposing fines), so the bank might face fines. Also in case of an event where a bank's executive is implicated in a scandal, this will definitely affect the bank's reputation.

Also there are financial risks because the default rates may rise if companies go out of business due to natural disasters. On the other hand, there are opportunities for gaining customers by adopting ESG criteria for the approval of new loans.

So, the ESG factors may affect bank's risks severely. It is clear that banks should embed ESG risks in their policies in order to be prepared for the new era in which the whole economy will be more dependent to ESG factors.

2.3 Literature review of ESG in the banking system

Till today there has been an extensive research of the ESG to the banking industry. Many papers have been published especially in the last years that try to find the connection of ESG to the bank's operations. Some of the most important areas that were analyzed are given in the next sub chapters.

2.3.1 ESG vs Performance

Amina Buallay from Brunel University in Oxbridge UK, in 2018 published an article which presents empirical evidence that ESG have a positive significant effect on bank's performance. The author used data of 235 European banks for 10 years (2007-2016) and the performance measured is upon the return on assets, the return on equity and the Tobin's Q index (ratio between asset's market value over replacement value). However, if the ESG variable is divided per Environmental, Social and Governance,

then the results are different. Environmental have a positive effect on return on assets and Tobin's Q index, social has negative effect in all three categories and the governance has negative effect on the return on assets, the return on equity and positive effect on the Tobin's Q index.

A similar empirical research was published in 2022 by Elisa Menicucci and Guido Paolucci, regarding the effect of ESG to performance of Italian banks. Their sample was 105 banks and the performance is set as in the previous article (return on assets, return on equity and Tobin's Q index) plus the stock market return.

Their conclusion is that ESG as a single variable is a significant positive predictor on return of equity and a non-significant predictor on the other three performance indicators. If the ESG variable is split, then the environmental aspect of efficient use of resources has a positive effect on return on assets, return on equity and stock market return. The other environmental aspects are neutral (emissions and innovation) like all social aspects (workforce, human rights and community).

The governance aspect of management and oversight has a positive effect on return on assets and return on equity and the aspect of product responsibility has a negative effect on return on assets, return on equity and strategy has negative effect on stock market return.

Mohammad Hassan Shakil, Nihal Mahmood, Mashiyat Tasnia and Ziaul Haque Munim used 61 environmental, 51 social and 54 governance indicators from 93 banks based in emerging countries (i.e countries with a potential to become developed in the near future) along with return on assets and return on equity. They resulted that there is a significant positive effect of environmental and social performance to bank's financial performance but this relationship does hold for governance performance.

Some other resources state that the adoption of ESG criteria might rebuke bank's profitability in the short run, but the relationship between ESG and bank's profits is U-Shaped suggesting positive correlation between profits and ESG in the long term (Yen, Ngo, Lee, Ho 2022: 12).

2.3.2 ESG vs risk and reputation

In 2023 Simona Galletta, John W. Goodell b, Sebastiano Mazzù and Andrea Paltrinieri published a paper that uses data from banks of 35 countries from 2011 to 2020 and proved that bank ESG score is negatively related to operational risk. Furthermore, higher ESG scoring motivates the addition of reputational risk to the financial risk portfolio.

Two out of the four previous authors, Simona Galetta and Sebastiano Mazzu a year before (2022) had published an extensive research about the positive relationship between of less ESG controversies and taking less risks in the banking sector. Their sample consists of 8.430 observations of banks between the years 2011 to 2020 and their method was the use of a Z – Score = ((return on assets + (equity / total assets)) / standard deviation of return on assets.

Also they used the RWA (Risk Weighted Assets) indicator which is used in the Basel capital regulation standards. The ESG controversies index is an explanatory variable for 23 ESG topics like human rights controversies, consumer controversies, environmental controversies, wages or working conditions controversies, etc. The findings of this article are very important because they prove that the banks that are more "ESG compliant" take less risks. So it proves the negative relation between risk and ESG.

Caterina Di Tommaso and John Thornton published an article in 2020 where they performed a research in banks of 19 European countries and they concluded that banks with higher ESG scores were less risk takers. Also they concluded that higher ESG scores reduced bank's value, probably because they were avoiding high return investments due to high risk.

Another interesting research that was perfumed using data form Eurozone banks, reveals that there is a negative relationship between ESG scores and idiosyncratic risk. This negative relationship varies between risk levels and becomes stronger as risk increases (Izcan, Bektas 2022: 1).

Also, in the case of Italian banks, there are evidence that lower ESG scores are related with a greater probability of sanctions and facing sanctions is a negative effect to bank's reputation (Bittucci, Mango, Marzioni, Mure, Spallone 2020: 265).

2.3.3 ESG as a financial distress predictor

Another interesting article is the one of Alberto Citterio and Timothy King according to which ESG may be used as a financial distress predictor of a bank. Their conclusion is that the inclusion of ESG reduces the likelihood of misclassifying distressed banks as healthy. Their method was the use of Z- Score (see above) in a sample of 328 banks from USA and EU.

2.3.4 ESG vs NPL's (Non-Performing Loans)

Suyi Liu, Justin Jin and Khalid Nainar will publish an article (article in press) which investigates the association of ESG performance a bank's NPL's. They used data of US commercial banks and they concluded that the banks with higher ESG score had smaller ratio of NPL's.

This negative relationship between ESG scores and NPL's has also been proved for EU Banks accoriding to a 2021 research (David Kiss, Lippai-Makra, Szladek, Toth 2022: 429).

2.3.5 ESG vs Diversification

Abdulazeez Y.H. Saif-Alyousfia, Asish Sahac and Turki Rashed Alshammarid used data from 1.385 bank from 89 in order to examine the if ESG affect bank's diversification. Their article was published in 2023 and they resulted that there is a nonlinear relationship between ESG and diversification.

Environmental and social factors separately, have a significant negative relation with bank diversification, while governance has a significant positive impact. The same results generated when the authors conducted separate analyses for developed and developing countries with a difference that ESG have a greater effect on bank's diversification located in developed countries.

Chapter 3

3 Statistical approach of environmental indices in European banking

The goal of this chapter is the statistical analysis of bank's environmental indices in relation with its financial and operational performance. Therefore environmental, financial and operational data were collected and analyzed in order to examine the factors that affect bank's environmental performance.

Before the presentation of the statistical approach and the results, there is a short description in the next section of the reasons for choosing to examine the environmental indices.

3.1 Importance of environmental factors

Environmental factors have significant impact on the planet's ecosystem which in turn, affects the health of every living organization in the planet. Specifically, the negative impact to the environment is depicted to the climate change (causing higher temperatures, floods, droughts, etc), to air pollution (causing serious health problems to humans), to acid rain (causes destruction of the environment and the extinction of species) and the damage to the ozone layer (makes earth more vulnerable to solar radiation).

The main cause of these phenomena is the emissions. This is why they are used as environmental indices in this statistical analysis. It is important to examine what causes emissions in the banking sector and how can they be reduced.

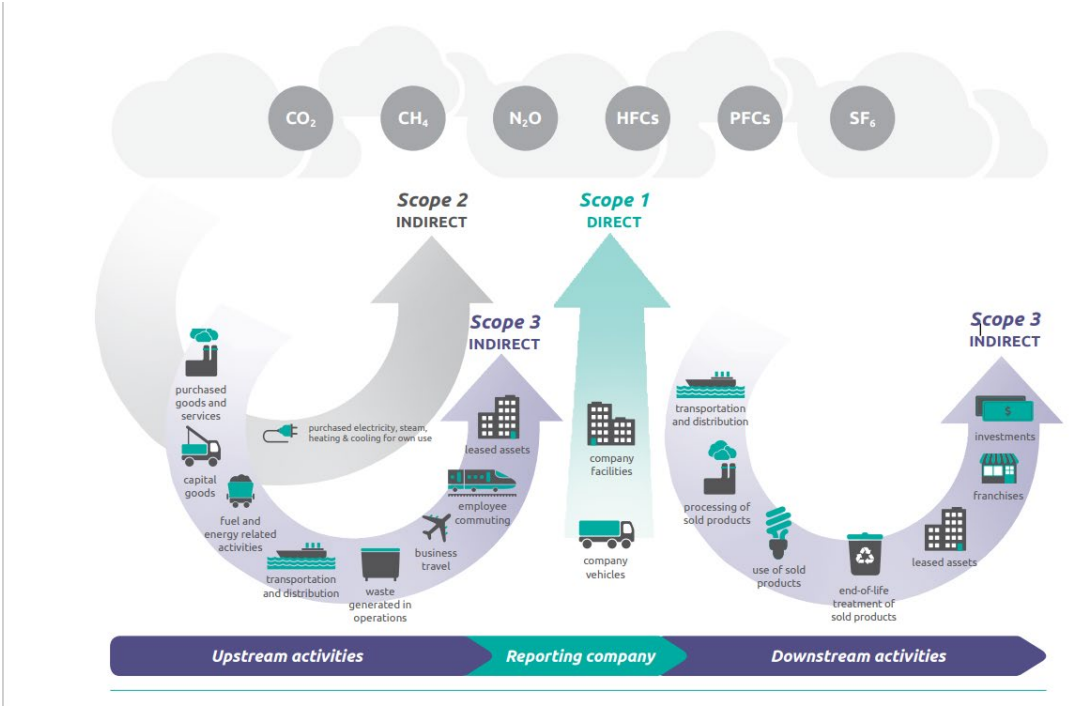
In particular, there are three kind of emissions and their definition according to the Environmental Protection Agency of the USA (website accessed on April 2023) are:

Scope 1: Direct greenhouse (GHG) emissions that occur from sources that are controlled or owned by an organization (e.g., emissions associated with fuel combustion in boilers, furnaces, vehicles).

Scope 2: Indirect GHG emissions associated with the purchase of electricity, steam, heat, or cooling. Although scope 2 emissions physically occur at the facility where they are generated, they are accounted for in an organization's GHG inventory because they are a result of the organization's energy use.
Scope 3: The result of activities from assets not owned or controlled by the reporting organization, but that the organization indirectly affects in its value chain. Scope 3 emissions include all sources not within an organization's scope 1 and 2 boundary.

In order to understand better the effect of emissions to the environment, the following picture is presented which was found in the website of Greenhouse Gas Protocol:

Picture 1: Greenhouse Gas protocol- Effect of emissions to the environment



The reporting unit of emissions is CO_2 (usually in tones) and the Greenhouse Gas Protocol has issued guidelines regarding the reporting of emissions. Also the ESG standards mentioned in the previous chapters provide guidance about reporting.

While the reporting of scope 1 emissions is relatively clear, for scope 2 emissions there two ways of reporting. Accoriding to the Executive summary of GHG Protocol Scope 2 guidance published on 2015 by Greenhouse Gas Protocol written by Mary Sotos, the scope 2 emissions can be reported by:

- A location-based method which reflects the average emissions intensity of grids on which energy consumption occurs (using mostly grid-average emission factor data).
- A market-based method which reflects emissions from electricity that companies have purposefully chosen (or their lack of choice). It derives emission factors from contractual instruments, which include any type of contract between two parties for the sale and purchase of energy bundled with attributes about the energy generation, or for unbundled attribute claims.

In the dataset that follows, scope 1 emissions were collected and scope 2 emissions separately reported on marked based or location based.

Even though the scope 3 emissions might count for 65-95% of most companies' carbon impact (accoriding to Emma Cox and Casey Herman of PWC in their article: Tackling the scope 3 challenge, which was publish in 2022), practically there is not unified way of measuring due to the following reasons: The collection of scope 3 emissions is time consuming and resource incentive.

A model based collection of scope 3 emissions might not be accurate so the produced results will not help the management to take the right decisions for reducing them because companies might not have enough statistical expertise in order to use a sample of data or they might have enough statistical expertise, but they lack of organizational structure and processes to oversee the estimations.

As Deloitte UK states in the article Zero in on scope 1, 2 and 3 emissions what you need to know, reporting of scope 3 emissions is tricky because this category includes emissions associated not with the company itself but is indirectly responsible.

For the above reasons, the scope 3 emissions were not collected in the following dataset.

3.2 Dataset description

The S&P Global publishes every year list with the 50 largest European banks by assets. In 13th of April 2022 the list was published for the year 2022 according to the total assets that were reposted for the financial year of 2021.

The published list is shown in the picture below:

Picture 2: S&P global 50 largest European banks 2022 publication

Current rank^	Previous rank^^	Current vs. previous	Company (ticker-exchange)	Headquarters	Accounting principle	Total assets (€B)
1	2	▲	HSBC Holdings PLC (HSBA-LSE)[1]	U.K.	IFRS	2,597.14
2	1	▼	BNP Paribas SA (BNP-ENXTPA)[2]	France	IFRS	2,554.20
3	3	NC	Crédit Agricole Group[3]	France	IFRS	2,351.61
4	5	▲	Barclays PLC (BARC-LSE)	U.K.	IFRS	1,648.16
5	4	▼	Banco Santander SA (SAN-BME)	Spain	IFRS	1,595.84
6	7	▲	Groupe BPCE	France	IFRS	1,516.02
7	6	▼	Société Générale SA (GLE-ENXTPA)	France	IFRS	1,464.45
8	8	NC	Deutsche Bank AG (DBK-XTRA)	Germany	IFRS	1,323.99
9	9	NC	Intesa Sanpaolo SpA (ISP-BIT)	Italy	IFRS	1,069.00
10	10	NC	Lloyds Banking Group PLC (LLOY-LSE)	U.K.	IFRS	1,055.52
11	13	▲	Crédit Mutuel Group[4]**	France	IFRS	1,021.33
12	14	▲	UBS Group AG (UBSG-SWX)	Switzerland	IFRS	982.34
13	11	▼	ING Groep NV (INGA-ENXTAM)	Netherlands	IFRS	951.29
14	15	▲	NatWest Group PLC (NWG-LSE)	U.K.	IFRS	931.06
15	12	▼	UniCredit SpA (UCG-BIT)	Italy	IFRS	916.67
16	17	▲	La Banque Postale SA	France	IFRS	772.31
17	16	▼	Credit Suisse Group AG (CSGN-SWX)	Switzerland	U.S. GAAP	729.04
18	20	▲	Standard Chartered PLC (STAN-LSE)	U.K.	IFRS	727.90
19	19	NC	Banco Bilbao Vizcaya Argentaria SA (BBVA-BME)[5]	Spain	IFRS	719.45
20	18	▼	CaixaBank SA (CABK-BME)	Spain	IFRS	680.04
21	21	NC	Rabobank	Netherlands	IFRS	639.58
22	22	NC	DZ BANK AG Deutsche Zentral-Genossenschaftsbank Frankfurt am Main	Germany	IFRS	627.27
23	23	NC	Nordea Bank Abp (NDA SE-OM)	Finland	IFRS	570.35
24	24	NC	Danske Bank A/S (DANSKE-CPSE)	Denmark	IFRS	529.35
25	26	▲	Sberbank of Russia (SBER-MISX)	Russia	IFRS	482.37
26	25	▼	Commerzbank AG (CBK-XTRA)[6]	Germany	IFRS	471.96
27	27	NC	ABN AMRO Bank NV (ABN-ENXTAM)	Netherlands	IFRS	399.11
28	28	NC	KBC Group NV (KBC-ENXTBR)[7]	Belgium	IFRS	345.34
29	31	▲	Nationwide Building Society (NBS-LSE)*	U.K.	IFRS	332.52
30	29	▼	Svenska Handelsbanken AB (publ) (SHB A-OM)	Sweden	IFRS	325.46
31	30	▼	Skandinaviska Enskilda Banken AB (publ) (SEB A-OM)	Sweden	IFRS	321.32
32	33	▲	Erste Group Bank AG (EBS-WBAG)[8]	Austria	IFRS	308.52
33	32	▼	DNB Bank ASA (DNB-OB)[9]	Norway	IFRS	301.57
34	34	NC	Landesbank Baden-Württemberg	Germany	IFRS	282.34
35	37	▲	Raiffeisen Gruppe Switzerland	Switzerland	Swiss GAAP	274.41
36	35	▼	Swedbank AB (publ) (SWED A-OM)	Sweden	IFRS	267.48
37	36	▼	Bayerische Landesbank	Germany	IFRS	266.55
38	41	▲	Banco de Sabadell SA (SAB-BME)	Spain	IFRS	251.95
39	42	▲	VTB Bank PJSC (VTBR-MISX)	Russia	IFRS	244.42
40	38	▼	Nykredit A/S	Denmark	IFRS	225.07
41	39	▼	BFA Tenedora de Acciones S.A.U.**	Spain	IFRS	206.50
42	44	▲	Banco BPM SpA (BAMI-BIT)	Italy	IFRS	200.49
43	43	NC	Belfius Bank SA	Belgium	IFRS	192.15
44	46	▲	Raiffeisen Bank International AG (RBI-WBAG)[10]	Austria	IFRS	188.51
45	45	NC	Zürcher Kantonalbank	Switzerland	Swiss GAAP	185.30
46	47	▲	OP Financial Group	Finland	IFRS	174.11
47	-	▲	BPER Banca SpA (BPE-BIT)[11]	Italy	IFRS	158.66
48	49	▲	Bank of Ireland Group PLC (BIRG-ISE)	Ireland	IFRS	155.27
49	48	▼	Banca Monte dei Paschi di Siena SpA (BMPS-BIT)	Italy	IFRS	137.87
50	-	▲	AIB Group PLC (A5G-ISE)	Ireland	IFRS	127.88

This table consists of 7 columns:

- Current ranking.
- Previous ranking.
- Ranking comparison of current vs previous year (up, down or unchanged).
- Bank name.
- County where the bank's headquarters are located.
- Accounting principle that the Bank uses for its financial reporting.
- Amount of total assets given in Billons of €.

This article is a part of the worldwide bank raking series that S&P publishes and other publications are the world's 100 largest banks, 50 largest banks by assets in Latin America and Asia – Pacific, in USA and other publications that are read by millions of readers in the world.

S&P Global Market Intelligence is a world leading provider of financial information services including data and analytics, enterprise technology, expertise and advisory via web platforms. Its customers include banks, insurance companies, governments, regulatory agencies, investment firms, etc.

The distribution of the 50 largest European banks per country is given in table 1:

Table 1: Distribution per country – No of Banks

#	Country	Number of Banks	Percent	Cum. Percent
1	France	6	12,00%	-
2	UK	6	12,00%	24,00%
3	Germany	5	10,00%	34,00%
4	Italy	5	10,00%	44,00%
5	Spain	5	10,00%	54,00%
6	Switzerland	4	8,00%	62,00%
7	Netherlands	3	6,00%	68,00%
8	Sweden	3	6,00%	74,00%
9	Austria	2	4,00%	78,00%
10	Belgium	2	4,00%	82,00%
11	Denmark	2	4,00%	86,00%
12	Finland	2	4,00%	90,00%
13	Ireland	2	4,00%	94,00%
14	Russia	2	4,00%	98,00%
15	Norway	1	2,00%	100,00%
	Total	**50**	100,00%	

The 50 largest European banks hold their headquarters in different 15 countries where in France and UK hold the most of them, counting 6 for each country. More than half headquarters (27 out of 50) are located in five countries: France, UK, Germany, Italy and Spain.

In terms of assets the distribution per country is as follows:

Table 2: Distribution per country – Assets

#	Country	Sum of Assets per Country (Bn €)	Percent	Cum. Percent
1	France	9.679,92	27,82%	-
2	UK	7.292,30	20,95%	48,77%
3	Spain	3.453,78	9,92%	58,69%

#	Country	Sum of Assets per Country (Bn €)	Percent	Cum. Percent
4	Germany	2.972,11	8,54%	67,23%
5	Italy	2.482,69	7,13%	74,37%
6	Switzerland	2.171,09	6,24%	80,61%
7	Netherlands	1.989,98	5,72%	86,32%
8	Sweden	914,26	2,63%	88,95%
9	Denmark	754,42	2,17%	91,12%
10	Finland	744,46	2,14%	93,26%
11	Russia	726,79	2,09%	95,35%
12	Belgium	537,49	1,54%	96,89%
13	Austria	497,03	1,43%	98,32%
14	Norway	301,57	0,87%	99,19%
15	Ireland	283,15	0,81%	100,00%
	Total	34.801,04	100,00%	

More of the half assets of the 50 banks are located (in terms of headquarters) in three countries: France, UK and Spain (58,69%). Also the total assets of these banks are summed to € 34,8 Trillion Euros which is more than double of EU's GDP for 2021 (14,45 Trillion euros).

The above numbers indicate that this sample represents one of the highest assets industries in Europe and in the following paragraphs there is a trial to examine its environmental performance and connect it with the profitably and the operational model.

3.2.1 Environmental data

Every year most of the banks publish either a sustainability report with their ESG performance or they publish these data in the website. For the particular banks the following environmental indices were collected:

- Scope 1 emissions
- Score 2 emissions market based and
- Score 2 emissions location based.

The data were collected either from sustainability reports that banks published or from the websites of the banks. The number of data found is satisfactory as shown in the following table:

Table 3: Environmental data

#	Emissions	Found	Missing	Total
1	Scope 1	44	6	50
2	Scope 2 Market based	35	15	50
3	Scope 2 Location based	33	17	50

In this analysis the data unit is in tonnes of CO_2. In case that they had been reported in a different unit they were transformed in tonnes of CO_2.

3.2.2 Financial data

The financial data that were collected are the profits before tax and profits after tax. They were found in the bank's sustainability reports or in the financial reports or in their website. In particular. Profit was collected form the income statement or the consolidated income statement (which applies in most cases) or the websites of the banks. Data were found for 48 out of 50 banks and it is the most complete category of the dataset.

The amount of assets was also collected and it was used as a check point with the S&P's list. It was confirmed in all cases.

All amounts are reported in Billions of euros and if they were published in different currency, they were converted in euros by using the exchange rates of the 19th February 2023, the 5th of March 2023 and the 19th of March 2023.

3.2.3 Operational data

The third category of data collected, is the operational data. These are:

- Energy consumed.

- Water consumed.
- Paper consumed.
- Number of employees.
- Number of counties in which bank operates.
- Number of branches that bank operates.

For this category the data were found are presented in the following table:

Table 4: Operational data

#	Data category	Found	Missing	Total
1	Energy	39	11	50
2	Water	27	23	50
3	Paper	24	26	50
4	Employees	47	3	50
5	Countries	48	2	50
6	Branches	39	11	50

The main sources for the operational data are the sustainability reports or the Bank's websites. The unit of the energy consumed is kwh (kilo watt hours), for the water is m^3 and for the paper is tonnes. In case that the data were reported in different scale, there was conversion in the above units.

For the employees the actual number was reported or the FTE (Full Time Equivalent). In case that both were given the number of actual employees was reported.

3.2.4 Other remarks on the dataset

The period of the data is for the year 2021 (01/01/20231 – 31/12/2021) apart from Nationwide (a British building society) which reports for the period of April to March. So in this case the data that were used were referring to the period of 01/04/2021 to 31/03/2022.

The environmental data of Sabadell (Spanish Bank) were excluded because Sabadell operates in three countries but their sustainability report contained data only for the two out of three countries. The financial figures were included because they were reported for all the countries that operates.

Same applies for ABN (Dutch Bank) because out of 14 countries that operates, it published environmental data only for the Netherlands.

After the completion of the dataset, the following variables were created:

- Profit before tax per employee (Amount of profits before tax / number of employees).
- Energy per employee (Amount of energy consumed / number of employees).
- Sum of Scope 1 and Scope 2 location based emissions per bank.
- Sum of Scope 1 and Scope 2 market based emissions per bank.
- Emissions per employee location based ((Scope 1 + Scope 2 location based) / number of employees)).
- Emissions per employee market based ((Scope 1 + Scope 2 market based) / number of employees)).

The data were collected in an excel file and the analysis took place with the use of SPSS (including the creation of new variables) and excel (for the creation of the following tables).

Last note is that in case of missing data, no value is used (empty).

3.3 Dataset analysis by observation

Given the dataset range (contains 50 observations) it is possible to detect some results by the observation method.

The first observation is that there are variations in some variables, probably unexpected because the dataset is not random. It comes from the 50 largest European banks in terms of assets, so the expected result would be not to have large variations.

Given this observation, an analysis was performed to some variables and the results are presentenced in the table 5:

Table 5: Data variations

#	Variable	Min	Max	Mean	St. Deviation
1	Scope 1 emissions	1	115.000	16.481	21.437
2	Scope 2 emissions loc. based	1.914	481.000	77.576	101.477
3	Scope 2 emissions mar. based	0	307.000	26.581	54.333
4	Energy consumed per employee	4,38	11.933	5.388	2.434
5	Profit before tax per employee	-12.093	562.409	98.632	93.370

Table Notes: 1. the value of 0 to the minimum of Scope 2 market based emissions has been reported as actual value. It does not imply unavailable data.

2. The value of -12.093 refers to the Credit Suisse Bank that bankrupted in 2023. The next minimum value is 3.827 euros.

So in the 50 richest European banks, there is one that produces only one tonne of scope 1 emissions CO_2 per year and there is another bank that produces 115.000 tonnes of scope 1 emissions CO_2 per year.

This large variation is also observed to the scope 2 emissions (either market based or location based). Apart from the comparison of minimum and maximum values, the standard deviation of emissions proves high variation. In all three variables the value of standard deviation is higher than the mean.

Another interesting fact is that there is one bank that consumes very small amount of energy, just 4,38 kwh per employee per year and on the other hand, there is one bank that consumes 11.933 kwh per employee per year.

The same variation applies to the profit before tax per employee per year. It ranges from -12.093 euros (or the next lower value of 3.827 euros) to the amount of 562.409 euros.

This observation has led to the following questions: Is higher profit associated with increased pollution (i.e more emissions)? Is it possible to increase profits but being at the same time environmental friendly? What are the factors that burden environmental pollution (i.e emissions)?

Given the dataset, profit vs scope 1 emissions can be examined by comparing their ranking. In particular Table 6 contains the profit before tax ranking (highest to lowest) vs scope 1 emissions (highest to lowest) per bank.

Table 6: Profits vs Scope 1 emissions ranking

#	Bank	Profit ranking	Emissions Scope 1 ranking
1	HSBC	1	11
2	Sberbank	2	1
3	Santader	3	9
4	BNP Paribas	4	2
5	UBS	5	21
6	Barclays	6	12
7	BBVA	7	3
8	Societe Generale	8	10
9	Lloyds	9	7
10	ING	10	22
11	Caixabank	11	23
12	Credit Mutuel	12	8
13	Natwest	13	15
14	Nordea	14	35
15	Rabobank	15	16
16	Intesa san paolo	16	4
17	Deutsche Bank	17	6
18	KBC Group	18	14
19	Standard chartered	19	32
20	DZ Bank	20	34
21	Handelsbanken	21	43
22	Swedbank	22	39

#	Bank	Profit ranking	Emissions Scope 1 ranking
23	Danske Bank	23	38
24	ABN	24	30
25	Raiffeisen Bank	25	27
26	Nationwide	26	31
27	Estre Group Bank	27	13
28	Raiffeisen Gruppe	28	25
29	Unicredit	29	5
30	Belfius	30	26
31	Bank of Ireland	31	28
32	OP	32	42
33	Commerzbank	33	17
34	Zurcher	34	33
35	Banco BPM	35	19
36	Landesbank Baden	36	37
37	Bayern LB	37	36
38	DNB Bank	38	40
39	SEB	39	44
40	BPER Banca	40	20
41	AIB	41	29
42	Nycredit	42	41
43	Siena	43	24
44	Credit Suisse	44	18

Table Notes: 1. six banks were excluded due to lack of data. Either the Scope 1 emissions was missing or the profit before tax or both.

2. Banks in blue fond have raking difference between profits and scope 1 emissions lower or equal than positions.

Although in some cases ranking of profits tends to be similar with the ranking of Scope 1 emissions, this is not a clear pattern since in most of the cases there is different ranking scale. In particular, 20 out of 44 banks have ranking difference lower or equal to five positions (blue highlight in the table 6), while in the rest 24 banks the ranking difference is higher than 5 positions. So higher scope 1 emissions does not imply higher profits before tax.

The same analysis for the scope 2 location based emissions generated the following results:

Table 7: Profits vs Scope 2 location based emissions ranking

#	Bank	Profit ranking	Emissions Scope 2 loc. based ranking
1	Sberbank	1	1
2	Santader	2	2
3	BNP Paribas	3	4
4	UBS	4	7
5	Barclays	5	8
6	BBVA	6	3
7	Societe Generale	7	9
8	Lloyds	8	13
9	Caixabank	9	16
10	Natwest	10	14
11	Nordea	11	27
12	Intesa san paolo	12	6
13	KBC Group	13	19
14	Standard chartered	14	10
15	Handelsbanken	15	29
16	Swedbank	16	23
17	Danske Bank	17	25
18	ABN	18	30
19	Raiffeisen Bank	19	17
20	Estre Group Bank	20	15
21	Unicredit	21	5
22	Belfius	22	32
23	Bank of Ireland	23	26
24	OP	24	22
25	Commerzbank	25	12
26	Banco BPM	26	18
27	Landesbank Baden	27	24
28	DNB Bank	28	33

#	Bank	Profit ranking	Emissions Scope 2 loc. based ranking
29	SEB	29	31
30	BPER Banca	30	21
31	AIB	31	28
32	Siena	32	20
33	Credit Suisse	33	11

Table Notes: 1. Seventeen banks were excluded due to lack of data. Either the Scope 2 location based emissions were missing or the profit before tax or both.

2. Banks in blue fond have raking difference between profits and scope 2 location based emissions lower or equal than positions.

The results are similar to the above comparison. In particular in 18 out of 33 banks the ranking difference is lower or equal than five positions whereas to the rest 15 cases the ranking difference is higher than five positions. Note that the same threshold (five positions) has been used in this table as above but in this case there are 33 observations instead of 44.

Similar results appear in the analysis of profit ranking vs scope 2 market based emission as shown in the following table:

Table 8: Profits vs Scope 2 market based emissions ranking

#	Bank	Profit ranking	Emissions Scope 2 mar. based ranking
1	HSBC	1	1
2	Santader	2	5
3	UBS	3	22
4	Barclays	4	16
5	BBVA	5	2
6	ING	6	17
7	Caixabank	7	27
8	Credit Mutuel	8	13
9	Natwest	9	18
10	Nordea	10	24
11	Rabobank	11	8

#	Bank	Profit ranking	Emissions Scope 2 mar. based ranking
12	Intesa san paolo	12	9
13	Deutsche Bank	13	4
14	KBC Group	14	21
15	Standard chartered	15	3
16	DZ Bank	16	25
17	Handelsbanken	17	23
18	Swedbank	18	19
19	Danske Bank	19	26
20	Raiffeisen Bank	20	7
21	Nationwide	21	14
22	Estre Group Bank	22	11
23	Raiffeisen Gruppe	23	28
24	Unicredit	24	6
25	Bank of Ireland	25	34
26	OP	26	10
27	Commerzbank	27	12
28	Banco BPM	28	20
29	Bayern LB	29	30
30	DNB Bank	30	32
31	BPER Banca	31	31
32	AIB	32	33
33	Nycredit	33	29
34	Siena	34	35
35	Credit Suisse	35	15

Table Notes: 1. fifteen banks were excluded due to lack of data. Either the Scope 2 market based emissions were missing or the profit before tax or both.

2. Banks in blue fond have raking difference between profits and scope 2 market based emissions lower or equal than positions.

The next step is to examine emissions vs an efficiency indicator instead of just using the profits before tax. This efficiency indicator is the profit per employee which is calculated by dividing bank's pre-tax profits by the number of employees.

So, new the tables of ranking between profits per employee vs emissions are given below:

Table 9: Profits per employee vs Scope 1 emissions ranking

#	Bank	Profit per employee ranking	Emissions Scope 1 ranking
1	DZ Bank	1	34
2	BNP Paribas	2	2
3	Handelsbanken	3	43
4	Belfius	4	26
5	Zurcher	5	33
6	Nordea	6	35
7	Swedbank	7	39
8	Bank of Ireland	8	28
9	UBS	9	21
10	Caixabank	10	23
11	Lloyds	11	7
12	Raiffeisen Gruppe	12	25
13	Rabobank	13	16
14	ING	14	22
15	Barclays	15	12
16	Danske Bank	16	38
17	Bayern LB	17	36
18	Nycredit	18	41
19	ABN	19	30
20	Nationwide	20	31
21	OP	21	42
22	Natwest	22	15
23	KBC Group	23	14
24	HSBC	24	11
25	Landesbank Baden	25	37
26	DNB Bank	26	40
27	BBVA	27	3

#	Bank	Profit per employee ranking	Emissions Scope 1 ranking
28	Santader	28	9
29	AIB	29	29
30	Societe Generale	30	10
31	Credit Mutuel	31	8
32	Sberbank	32	1
33	SEB	33	44
34	Banco BPM	34	19
35	Intesa san paolo	35	4
36	Deutsche Bank	36	6
37	Raiffeisen Bank	37	27
38	BPER Banca	38	20
39	Standard chartered	39	32
40	Estre Group Bank	40	13
41	Commerzbank	41	17
42	Unicredit	42	5
43	Siena	43	24
44	Credit Suisse	44	18

Table Notes: 1. Six banks were excluded due to lack of data. Either the Scope 1 emissions was missing or the profit before tax or both.

2. Banks in blue fond have raking difference between profits per employee and scope 1 emissions lower or equal than positions.

Table 6 (Profits vs Scope 1 emissions ranking) indicates that there is not a clear relationship between profits and scope 1 emissions, Table 9 (Profits per employee vs Scope 1 emissions ranking) provides more impressive results:

- Only 4 out of 44 banks have a ranking difference of 5 or lower positions and
- 9 out of the top 10 banks in terms of profit per employee are ranked below the 20 first places of the banks that generate most scope 1 emissions.

These results are strong indicator that the efficiency in terms of profit per employee is associated with environmental efficiency (i.e less scope 1 emissions).

Similar results are generated for Profits per employee vs Scope 2 location based and market based emissions rankings, as shown in the following tables:

Table 10: Profits per employee vs Scope 2 location based emissions ranking

#	Bank	Profit per employee ranking	Emissions Scope 2 loc. Based ranking
1	BNP Paribas	1	4
2	Handelsbanken	2	29
3	Belfius	3	32
4	Nordea	4	27
5	Swedbank	5	23
6	Bank of Ireland	6	26
7	UBS	7	7
8	Caixabank	8	16
9	Lloyds	9	13
10	Barclays	10	8
11	Danske Bank	11	25
12	ABN	12	30
13	OP	13	22
14	Natwest	14	14
15	KBC Group	15	19
16	Landesbank Baden	16	24
17	DNB Bank	17	33
18	BBVA	18	3
19	Santader	19	2
20	AIB	20	28
21	Societe Generale	21	9
22	Sberbank	22	1
23	SEB	23	31
24	Banco BPM	24	18
25	Intesa san paolo	25	6
26	Raiffeisen Bank	26	17

#	Bank	Profit per employee ranking	Emissions Scope 2 loc. Based ranking
27	BPER Banca	27	21
28	Standard chartered	28	10
29	Estre Group Bank	29	15
30	Commerzbank	30	12
31	Unicredit	31	5
32	Siena	32	20
33	Credit Suisse	33	11

Table Notes: 1. Seventeen banks were excluded due to lack of data. Either the Scope 2 location based emissions were missing or the profit per employee before tax or both.

2. Banks in blue fond have raking difference between profits and scope 2 location based emissions lower or equal than positions.

Table 11: Profits per employee vs Scope 2 market based emissions ranking

#	Bank	Profit per employee ranking	Emissions Scope 2 mar. Based ranking
1	DZ Bank	1	25
2	Handelsbanken	2	23
3	Nordea	3	24
4	Swedbank	4	19
5	Bank of Ireland	5	34
6	UBS	6	22
7	Caixabank	7	27
8	Raiffeisen Gruppe	8	28
9	Rabobank	9	8
10	ING	10	17
11	Barclays	11	16
12	Danske Bank	12	26
13	Bayern LB	13	30
14	Nycredit	14	29
15	Nationwide	15	14
16	OP	16	10

#	Bank	Profit per employee ranking	Emissions Scope 2 mar. Based ranking
17	Natwest	17	18
18	KBC Group	18	21
19	HSBC	19	1
20	DNB Bank	20	32
21	BBVA	21	2
22	Santader	22	5
23	AIB	23	33
24	Credit Mutuel	24	13
25	Banco BPM	25	20
26	Intesa san paolo	26	9
27	Deutsche Bank	27	4
28	Raiffeisen Bank	28	7
29	BPER Banca	29	31
30	Standard chartered	30	3
31	Estre Group Bank	31	11
32	Commerzbank	32	12
33	Unicredit	33	6
34	Siena	34	35
35	Credit Suisse	35	15

Table Notes: 1. fifteen banks were excluded due to lack of data. Either the Scope 2 market based emissions were missing or the profit per employee before tax or both.

2. Banks in blue fond have raking difference between profits and scope 2 market based emissions lower or equal than positions.

The same applies for comparing profit per employee with the sources of energy, water and paper as it is noted in the Tables 12-15:

Table 12: Profits per employee vs energy consumption ranking

#	banks	profit per employee rank	energy rank
1	DZ Bank	1	34
2	Handelsbanken	2	27

#	banks	profit per employee rank	energy rank
3	Zurcher	3	36
4	Nordea	4	25
5	Swedbank	5	29
6	Bank of Ireland	6	33
7	UBS	7	8
8	Caixabank	8	13
9	Lloyds	9	10
10	Raiffeisen Gruppe	10	30
11	Rabobank	11	22
12	ING	12	14
13	Barclays	13	7
14	Danske Bank	14	24
15	Bayern LB	15	35
16	Nycredit	16	37
17	ABN	17	26
18	Nationwide	18	28
19	OP	19	20
20	Natwest	20	11
21	KBC Group	21	16
22	HSBC	22	4
23	Landesbank Baden	23	31
24	DNB Bank	24	32
25	BBVA	25	6
26	Santader	26	2
27	AIB	27	39
28	Sberbank	28	1
29	SEB	29	38
30	Banco BPM	30	19
31	Intesa san paolo	31	5
32	Deutsche Bank	32	3
33	Raiffeisen Bank	33	17
34	BPER Banca	34	21

#	banks	profit per employee rank	energy rank
35	Standard chartered	35	18
36	Estre Group Bank	36	12
37	Commerzbank	37	15
38	Siena	38	23
39	Credit Suisse	39	9

Table Notes: 1. Eleven banks were excluded due to lack of data. Either the energy consumption was missing or the profit before tax or both.

2. Banks in blue fond have raking difference between profits per employee and energy consumption lower or equal than positions.

Table 13: Profits per employee vs water consumption ranking

#	banks	profit per employee rank	Water consumption rank
1	DZ Bank	1	22
2	Handelsbanken	2	23
3	Nordea	3	21
4	Swedbank	4	24
5	UBS	5	9
6	Caixabank	6	10
7	Lloyds	7	8
8	Raiffeisen Gruppe	8	27
9	ING	9	16
10	Bayern LB	10	26
11	Nationwide	11	17
12	Natwest	12	11
13	KBC Group	13	15
14	HSBC	14	6
15	Landesbank Baden	15	19
16	DNB Bank	16	25
17	BBVA	17	3
18	Santader	18	4
19	AIB	19	18
20	Sberbank	20	2

#	banks	profit per employee rank	Water consumption rank
21	SEB	21	20
22	Banco BPM	22	14
23	Intesa san paolo	23	5
24	Deutsche Bank	24	7
25	Raiffeisen Bank	25	1
26	Standard chartered	26	13
27	Credit Suisse	27	12

Table Notes: 1. Twenty three banks were excluded due to lack of data. Either the water consumption was missing or the profit before tax or both.

2. Banks in blue fond have raking difference between profits per employee and water consumption lower or equal than positions.

Table 14: Profits per employee vs paper consumption ranking

#	Banks	profit per employee rank	Paper consumption rank
1	DZ Bank	1	1
2	Santader	13	2
3	Intesa san paolo	17	3
4	Sberbank	14	4
5	UBS	5	5
6	BBVA	12	6
7	Natwest	9	7
8	Deutsche Bank	18	8
9	Commerzbank	22	9
10	Banco BPM	16	10
11	KBC Group	10	11
12	Raiffeisen Bank	19	12
13	Siena	23	13
14	Caixabank	6	14
15	Credit Suisse	24	15
16	Estre Group Bank	21	16
17	Handelsbanken	2	17

#	Banks	profit per employee rank	Paper consumption rank
18	Swedbank	4	18
19	Zurcher	3	19
20	Raiffeisen Gruppe	7	20
21	Landesbank Baden	11	21
22	SEB	15	22
23	BPER Banca	20	23
24	Bayern LB	8	24

Table Notes: 1. Twenty six banks were excluded due to lack of data. Either the paper consumption was missing or the profit before tax or both.

2. Banks in blue fond have raking difference between profits per employee and paper consumption lower or equal than positions.

So the efficiency index of profit per employee is not only associated with increased environmental efficiency (i.e less emissions) but also with efficient use natural resources (energy, water and paper).

3.4 Geographical approach

Given that the dataset contains the information of headquarters per bank a geographical analysis can be performed. The goal of this analysis is to examine if there are any differences in the way that banks operate, or most importantly in their culture, that depends on their location.
Banks can be divided in three groups:

- Northern Europe, for the banks with headquarters based in UK, Finland, Ireland, Denmark, Norway and Sweden.
- Central Europe, for the banks with headquarters based in Germany, Austria, Switzerland, Belgium and Netherlands.
- Southern Europe, for the banks with headquarters based in Italy, Spain and France.

Each of the geographical groups contains 16 banks and the remaining 2, are the Russian ones which will be excluded from this analysis because for the VTB bank no data were found, so there is only one bank left (Sberbank).

Data were further analysed with the use of SPSS and Excel.

The first analysis examines reporting, an important factor in terms of enhancing transparency.

Table 15: Responses per geographical group

	Central	Northern	Southern
Scope 1	16	16	11
Scope 2 loc. based	9	13	10
Scope 2 mar. based	12	14	9
Energy	15	16	7
Water	10	11	5
Paper	12	4	7
Employees	16	16	14
Profit	16	16	15
Branches	14	13	11
Countries	16	16	15
Sum of responses	**136**	**135**	**104**

Central and Northern areas provided more responses compared to Southern area. Their sum of responses is almost identical (136 for Central and 135 for Northern), while Southern provided only 104 responses.

The three most responded variables are the profit the number of operating countries (47 out of 48 max. responses each) and the number of employees (46 out of 48 max. responses).

The three least responded variables are the paper consumption (23 out of 48 max. responses), the water consumption (26 out of 48 max. responses) and the scope 2 location based emissions (32 out of 48 max. responses).

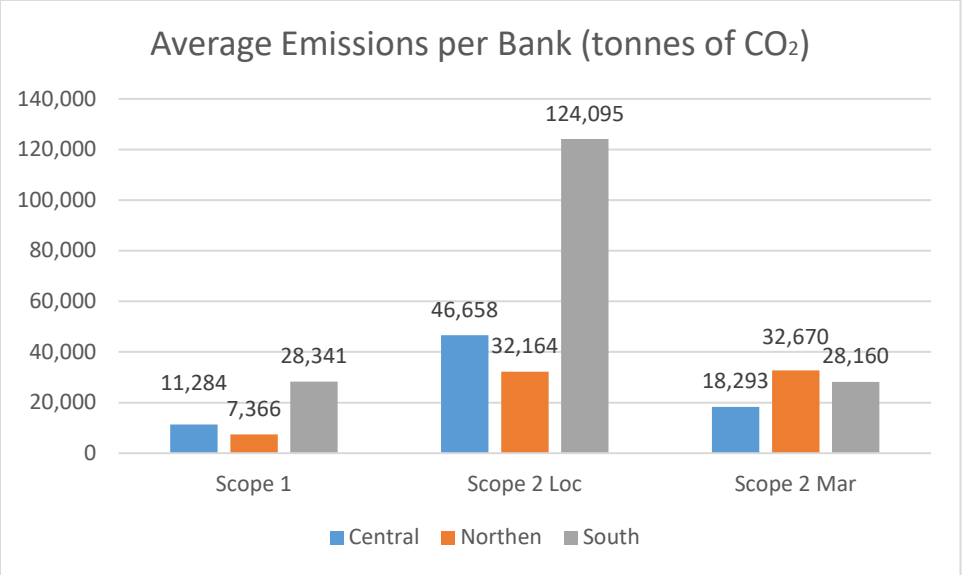
Regarding environmental data (i.e emissions) which are the most important variables for the particular Master's dissertation, Central and Northern areas responded 100% to the scope 1 emissions, while Southern area responses were at about 69% (11 out of 16). The 5 no-responses came from 3 French and 2 Spanish banks. The scope 2 marked based emissions gathered 35 out of 48 max responses.

The best environmental reporting region is the Northern. There were collected 43 out of 48 max responses for the scope 1 emissions and the scope 2 location and market based emissions. The Central region comes second with 37 responses and finally the Southern with only 30 responses.

Apart from the reporting differences, the geographical approach is very helpful in order to investigate for dereferences in the environmental performance.

Graph 1 depicts the average scope 1 and scope 2 emissions (location based and market based) per bank.

Graph 1: Average emissions per bank



The banks from Northern area produce the smallest average amount regarding scope 1 and scope 2 location based emissions, while the banks from Central area have the smallest number of average emissions scope 2 market based.

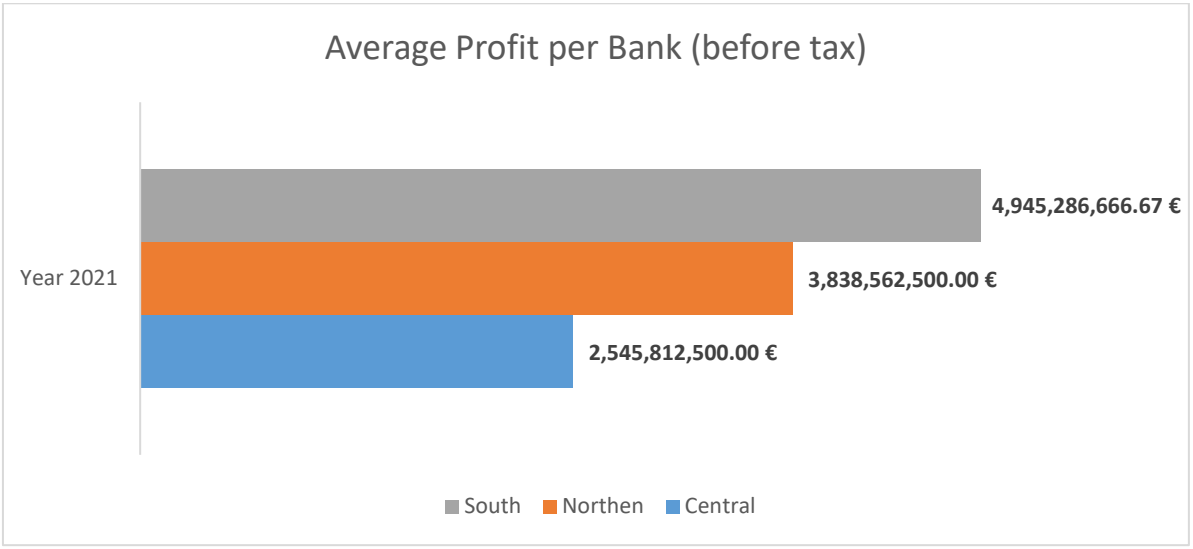
Another important finding is that the banks from Southern region produce average scope 1 and scope 2 location based emissions which count more than the sum of banks from Northern and Central areas. The average number of scope 2 location based emissions from a southern area bank is 124.095 tonnes of CO_2 for the year 2021 which is 2.6 times higher compared to Northern banks and 3.85 higher compared to Central banks.

The Scope 2 market based emissions do not indicate scale differences (i.e. more than double) as the

Scope 1 and Scope 2 location based emissions.

The next geographical analysis is upon profits as shown in graph 2:

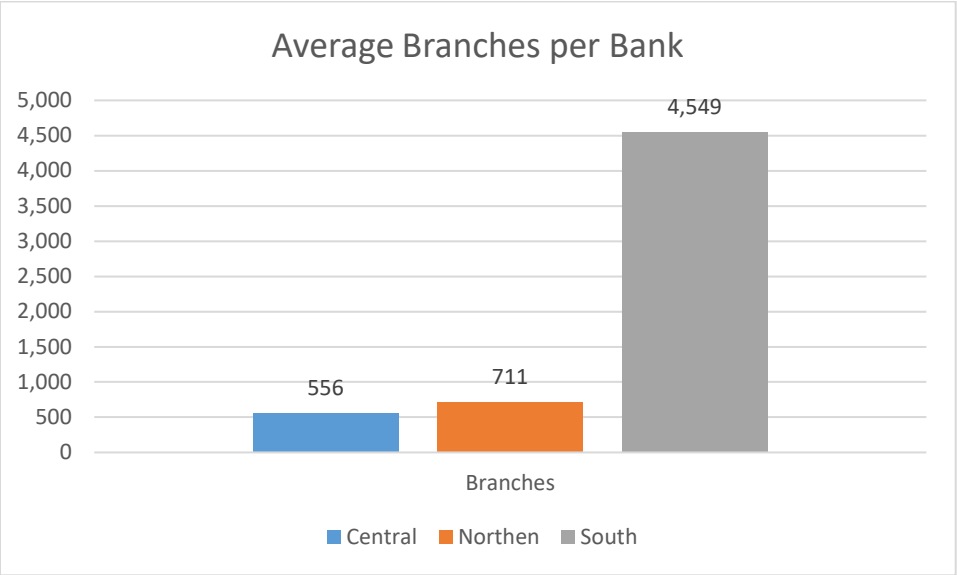
Graph 2: Average profit per bank



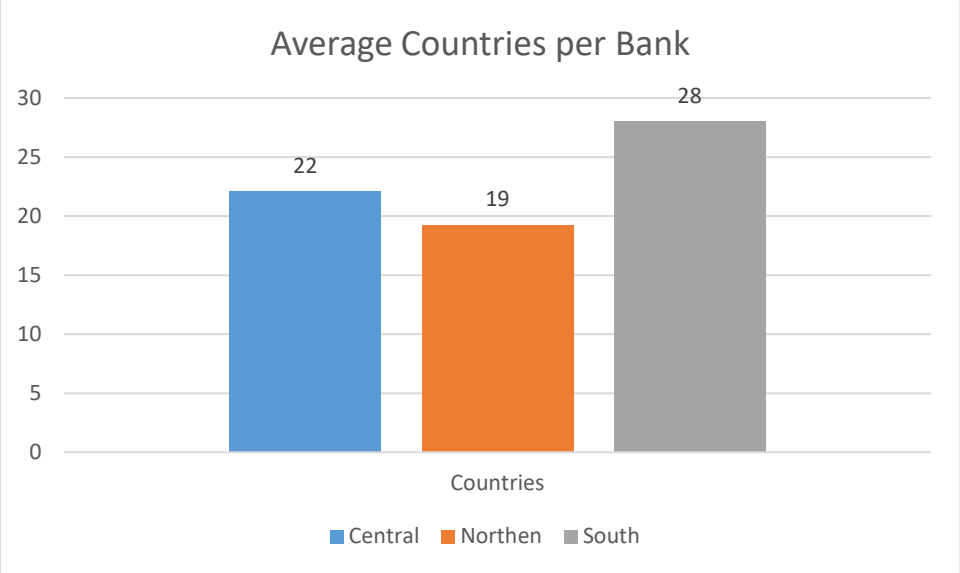
As with the emissions, the average profit per bank differs according to the region that its headquarters are located. Southern banks present the highest average number of profits per bank for the years 2021 counting 4,956 € Bn before tax. In the second place, Northern banks achieved 3,839 € Bn and the Central banks 2,546 € Bn.

Also differences appear in the operating models of the banks. This can be spotted in the analysis of the average number of the branches per bank, the average number of operating countries and the average number of employees as shown in the next thee graphs:

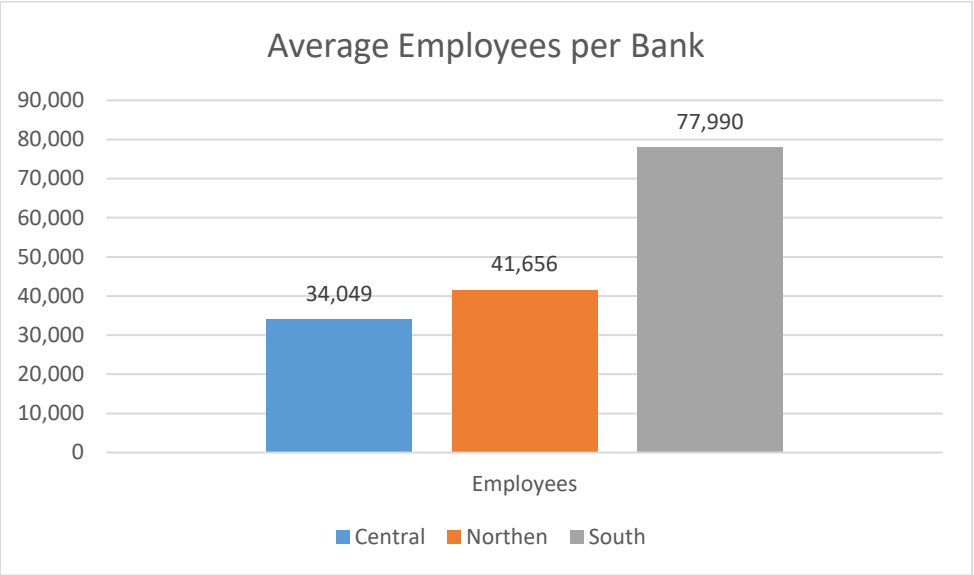
Graph 3: Average number of branches per bank



Graph 4: Average number of operating countries per bank



Graph 5: Average number of employees per bank



The Southern banks have a higher number of average branches per bank, 8 times higher than the Central banks and 6.3 times higher than the Northern ones.

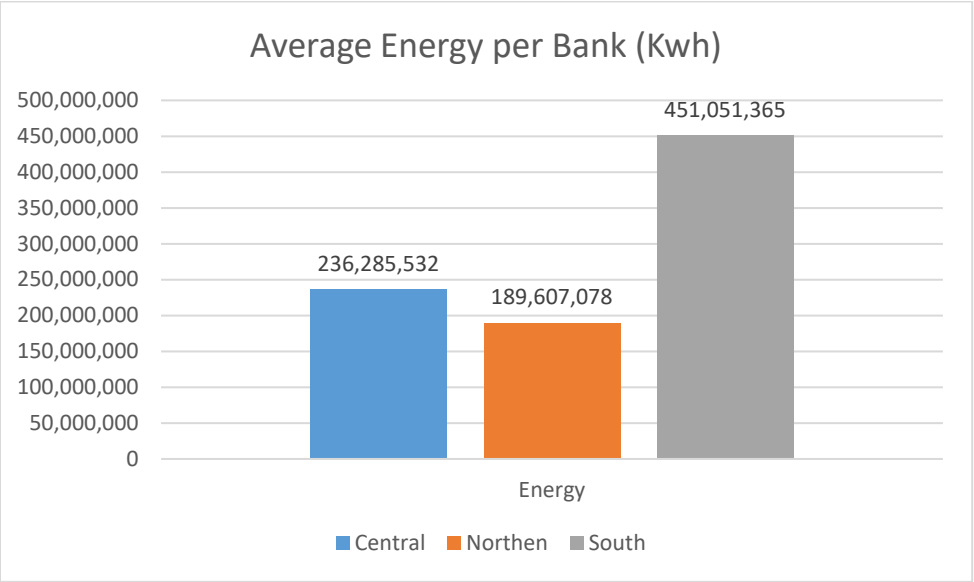
In terms of average number of operating countries, again Southern banks have the largest average number followed by the Central and the Northern banks respectively. Note that the difference in operating countries is not so high as in branches so this is an indicator that the operating model of the Southern banks in based on branches.

On the other hand, central and Southern banks although they hold a number of branches, they probably use more other channels for customer care and product marketing, like the e-banking or digital branches. This can been seen and from the average number of employees per bank, since Southern banks have the largest number which is more than double compared with the Central countries.

Another index that confirms that there are operational differences between geographical areas is the average energy consumption per bank as shown in graph 6. Southern banks need more energy on average compared to Central and Northern banks. In particular, a Southern bank needs more energy than the sum of a central and a Northern bank needs.

An important note for the following graph is that the average energy for the Southern banks was calculated using only 7 out for 16 banks. For the rest 9 banks no data for energy consumption were found.

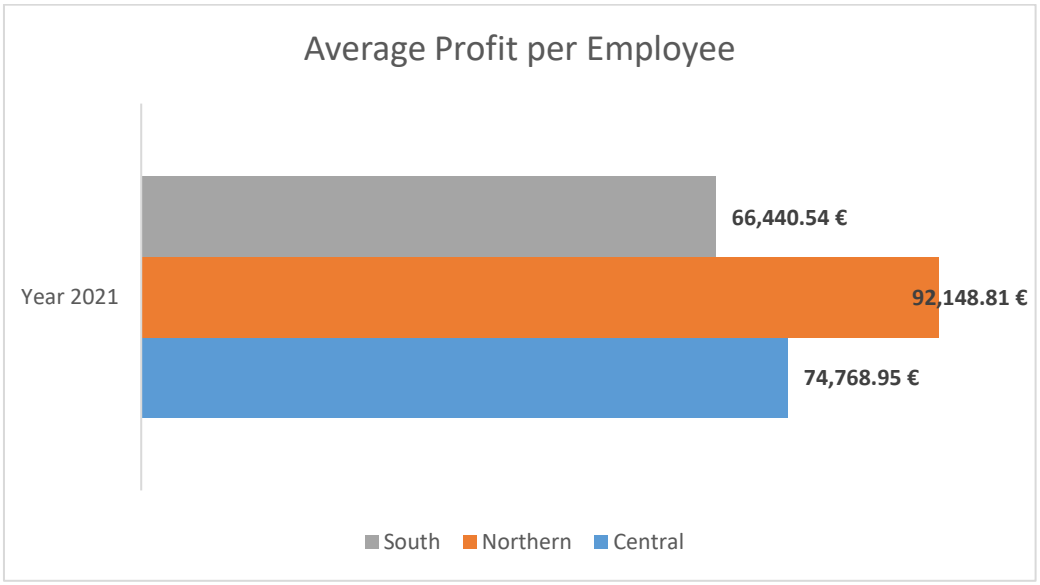
Graph 6: Average energy per bank



The operational differences between geographical locations per bank are also depicted using performance indicators.

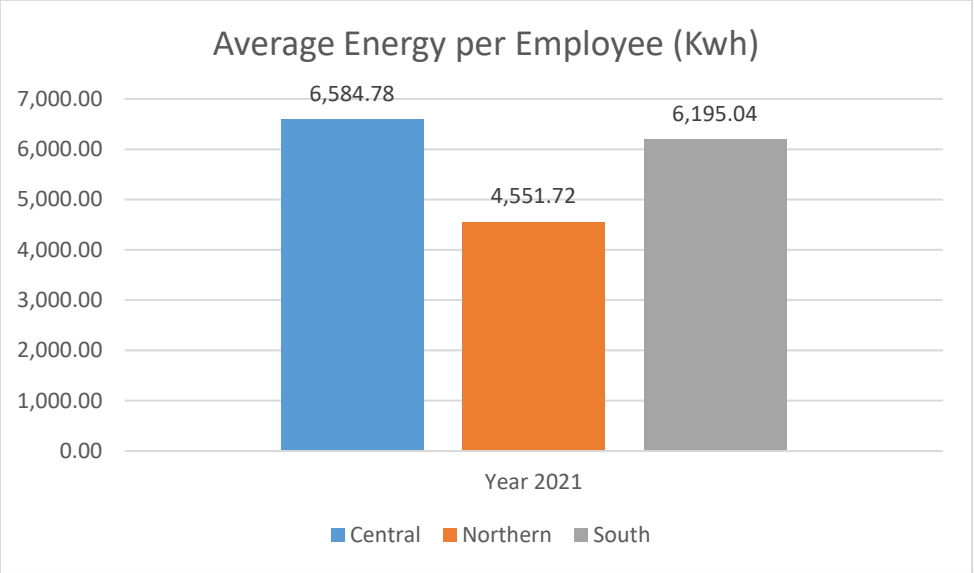
The highest profit per employee is located in Northern banks, while the Southern banks have the smallest (remember that the Southern banks have the largest average profit per banks as mentioned before) and the exact figures are given in the next graph:

Graph 7: Average profit per employee



Regarding the average energy per employee, most efficient are the Northern banks and the performance of central and Southern banks is almost identical (i.e same scale), as it is presented in graph 8:

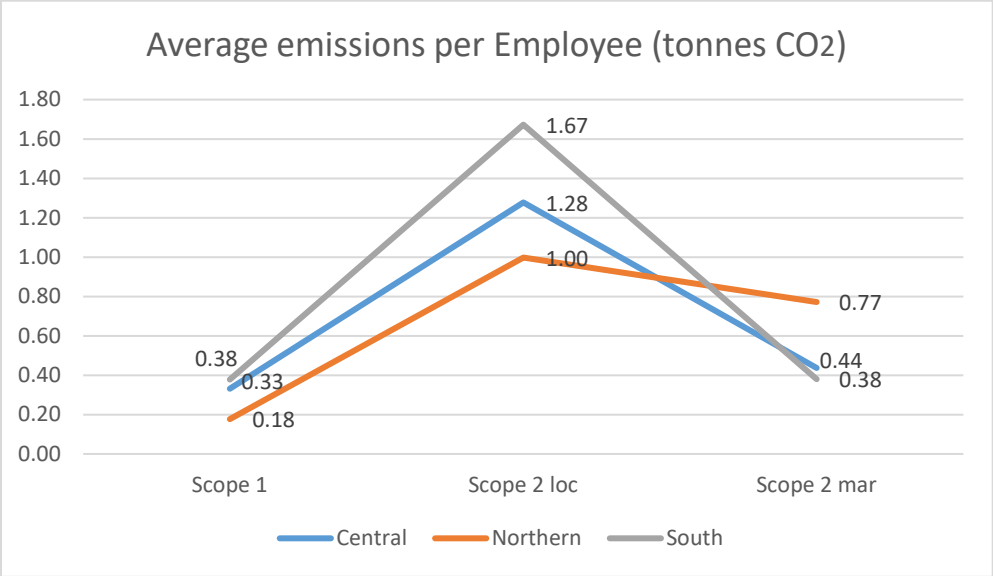
Graph 8: Average energy per employee



Important note for Graph 8: As mentioned before, data for energy consumption were used for 7 out of 16 Southern banks because no data were found for 9 banks.

Finally, the average emissions per employee are given in the graph 9:

Graph 9: Average emissions per employee



Northern banks have the lowest average emissions per employee for the Scope 1 and Scope 2 location based. While the Southern banks have largest average for these two categories of emissions they present the lowest average in the Scope 2 market based emissions and the northern banks the highest average in this category. Central banks scored the middle value in all three kinds of emissions per employee.

An important note for this graph is the number of values used due to lack of data. In particular for the average scope 1 emissions 16 out of 16 values for central and Northern banks were used and 11 out of 16 for the Southern banks.

Lack of data for the average scope 2 location based emissions is high with 9, 13 and 10 out of 16 for Central, Northern and Southern banks respectively and for the average scope 2 market based 12, 14 and 9 out 16 for Central, Northern and Southern banks respectively.

3.5 Regression analysis

After the observational and geographical approaches, the dataset was used for linear regression in order to discover relationships between data that might be expressed in a mathematical way.

The author performed a high number of regressions using SPSS, but most of the results were not reliable due multicollinearity between the variables. This is a statistical phenomenon where the independent variables are highly correlated in a multiple regression equation and this lowers the statistical significance of the independent variables.

This phenomenon appeared by creating a correlation table and the variables that had strong positive correlation (i.e greater than 0.8 out of 1), in the multiple linear regression the results was the opposite: weak negative correlation. So the linear regression could not be used as a good predictor.

In order to solve this problem a relatively new functionality of SPSS was used: The stepwise regression as it is described in SPSS tutorial. In particular after performing Stepwise, Forward and Backwards regressions, a statistically significant model created with the backwards method. According to this method, variables are removed in order to find the model that best gives a relationship between data.

With the use of this method two significant models were created:

3.5.1 Model 1: Scope 1 emissions vs profits, branches and countries

The first model shows that scope 1 emissions depend on the number of branches and the number of

countries that a bank operates. An important observation is that profit before tax was eliminated as statistically insignificant variable.

The regression results are given below:

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	No of countries, No of branches, Profit before tax[b]	.	Enter
2	.	Profit before tax	Backward (criterion: Probability of F-to-remove >= ,100).

a. Dependent Variable: E- Scope 1

b. All requested variables entered.

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,867[a]	,751	,729	11761,057
2	,864[b]	,747	,732	11680,737

a. Predictors: (Constant), No of countries, No of branches, Profit before tax

b. Predictors: (Constant), No of countries, No of branches

c. Dependent Variable: E- Scope 1

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	1121,864	2866,940		,391	,698		
	Profit before tax	-532,405	726,402	-,115	-,733	,469	,308	3,250
	No of branches	6,656	1,046	,908	6,365	<,001	,371	2,697
	No of countries	234,354	106,679	,226	2,197	,035	,712	1,404
2	(Constant)	964,463	2839,361		,340	,736		
	No of branches	6,050	,636	,825	9,514	<,001	,989	1,011
	No of countries	192,989	89,910	,186	2,146	,039	,989	1,011

a. Dependent Variable: E- Scope 1

The model is significant because it can explain the 74,7% of the cases as indicated in the red value of the Model Summary table (R squared). The remaining variables which are the number of branches and number of countries are significant because their significance value is smaller than 0.05 as shown in the second model of the Coefficients table (values <0.01 and 0.039 which are highlighted red).

The profit before tax is not statistically significant for the Scope 1 emissions and it was excluded from the second model. This holds due to the fact that its significance value larger than 0.05 (value of 0.469 in the first model of coefficients table, highlighted red).

3.5.2 Model 2: Scope 2 emissions vs profits, branches and countries

The second model shows that scope 2 location based emissions also depend on the number of branches and the number of countries that a bank operates. As in the first model, the profit before tax was eliminated as statistically insignificant variable.

The regression results are as follows:

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	No of countries, No of branches, Profit before tax[b]	.	Enter
2	.	Profit before tax	Backward (criterion: Probability of F-to-remove >= ,100).

a. Dependent Variable: E- Scope 2 location based

b. All requested variables entered.

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,959[a]	,920	,910	32253,048
2	,958[b]	,917	,911	32128,354

a. Predictors: (Constant), No of countries, No of branches, Profit before tax

b. Predictors: (Constant), No of countries, No of branches

c. Dependent Variable: E- Scope 2 location based

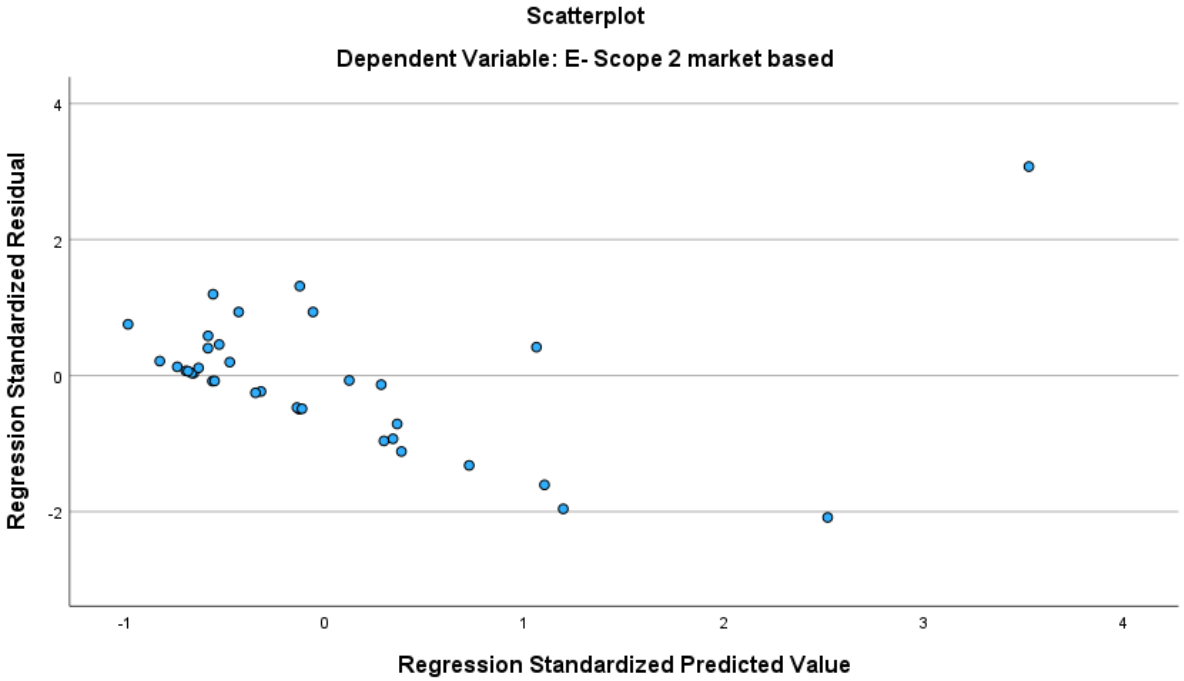
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	-2049,517	9627,282		-,213	,833		
	Profit before tax	2654,187	2954,448	,115	,898	,378	,205	4,881
	No of branches	26,466	3,871	,838	6,838	<,001	,222	4,508
	No of countries	639,891	329,808	,126	1,940	,064	,797	1,255
2	(Constant)	-532,569	9441,401		-,056	,955		
	No of branches	29,532	1,820	,935	16,224	<,001	,995	1,005
	No of countries	772,246	293,932	,151	2,627	,014	,995	1,005

a. Dependent Variable: E- Scope 2 location based

The predictive power of this model is better than the first one because the value of R squared is higher at a level of 0,917 (out of 1) which explains 91.7% of the cases. Again, the profit before tax is insignificant regarding the scope 2 location based emissions, while the number of branches and the number of countries affect the volume of the scope 2 location based emissions.

The same variables and the same method were used for the scope 2 market based emissions but the residuals plot showed a straight line pattern as shown in the graph below:



So, there is a systematic behaviour that this model did not capture.

Regarding the validity tests for the first two models, in the Appendix 2 the normal probability plots and the scatterplots of the residuals are given. Also for the multicollinearity testing, the Statistic VIF measurement was used according to which the accepted values are lower than 10. Some researches might set the acceptance values to 5 but even in this case there is no value larger than 5 in the first two models (as shown in the above coefficients tables).

Regression analysis is a powerful way to discover relationships between the data. In this case the important outcomes are the following:

- There is no significant relationship between profits and Scope 1 and Scope 2 location based emissions. So it cannot be stated that as the profits rise, these kind of emissions rise too.
- The number of branches and the number of countries that a bank operates are positively related with the Scope 1 and scope 2 location based emissions. In particular as branches and operating countries increase, so Scope 1 and scope 2 location based emissions increase.

The results and the conclusions of this analysis are given in the next paragraph.

Chapter 4
4 Conclusions of statistical analysis

In the last years there is a global concern about the actions taken by companies that have negative impact in the Environment (like emissions that cause global warming), the Society (like child labour) and the Governance (like inequality among genders).

These negative events should be taken into account by investors together with financial data as it was proposed by the former President of the UN in 2006 and the term “Responsible Investing” was officially introduced in the business world. Since then, the demand for ESG data has been rising sharply, so an ESG Ecosystem was created.

This ecosystem was presented in the White Paper of the 2019 World Economic Forum. In particular there are companies that collect ESG data, there are standard setters, framework developers, regulators, etc with an incentive of providing clear guidelines about ESG reporting so the available data to be accurate and in the same basis.

The most important proof of the convergence of Financial and ESG data is the creation of the International Sustainability Standards Board (ISSB) which was created by the International **Financial** Reporting Standard (IFRS), a purely financial reporting standard, by implementing the Sustainability Accounting Standards Board (SASB), a purely ESG reporting standard.

The social role of banks is to control the way that money is disbursed in the society via lending and there is no doubt that banks are among the first companies that should consider ESG criteria in their decision making process of lending / financing a company.

Also banking is one of the richest industries in the world. In particular, during a single year (i.e 2021) the 50 largest European banks generated more than 34 Tn € in profits before tax. This is why it is important to examine the behavior of this industry in terms of its environmental performance.

To succeed this, a dataset was created by collecting environmental, financial and operational data of the 50 largest European banks by assets for the year of 2021, according to the list that was published by the S&P.

After the completion of data collection, a three step analysis was performed: observational, geographical and regression. The main findings are as follows:

- Higher air pollution (i.e emissions) is not correlated with higher profits.
  This finding is proved by the observation method (table 6: Profits vs Scope 1 emissions ranking, table 7: Profits vs Scope 2 location based emissions ranking, table 8: Profits vs Scope 2 market based emissions ranking) and the two regression models for the Scope 1 and the scope 2 location based emissions.
- Higher air pollution (i.e emissions) is even less correlated with higher profit efficiency (i.e profit per employee).
  This finding is proved by the observation method (table 9: Profits per employee vs Scope 1 emissions ranking, table 10: Profits per employee vs Scope 2 location based emissions ranking, table 11: Profits per employee vs Scope 2 market based emissions ranking).
- Higher use of resources (energy, water and paper) is not correlated with higher profit efficiency (i.e profit per employee).
  This finding is proved by the observation method (table 12: Profits per employee vs energy consumption ranking, table 13: Profits per employee vs water consumption ranking, table 14: Profits per employee vs paper consumption ranking).
- Higher scope1 emissions and scope 2 location based emissions are correlated with higher number of branches and number of countries that bank operates.
  This finding is supported by the regression method (1st Model and 2nd Model).
- The operating models of the 50 European largest European banks differ in terms of air pollution, financial efficiency and energy efficiency.
  This finding is proved by the observation method (table 5: Data variations).
- There are cultural differences in terms of ESG reporting according to the area that the headquarters are located.
  This finding is proved by the geographical method (table 15: Responses per geographical group).
- There are differences in the air pollution (i.e emissions) that a bank generates, according to the area that its headquarters are located.
  This finding is proved by the geographical method (graph 1: Average emissions per bank).

- There are differences in the operating model of a bank, according to the area that its headquarters are located.

  This finding is proved by the geographical method (graph 2: Average profit per bank, graph 3: Average number of branches per bank, graph 4: Average number of operating countries per bank, graph 5: Average number of employees per bank, graph 6: Average energy per bank).
- There are differences in the efficiency of a bank, according to the area that its headquarters are located.

  This finding is proved by the geographical method (graph 7: Average profit per employee, graph 8: Average energy per employee, graph 9: Average emissions per employee).

4.1 A remark for future examination

During March 2023, the collapse of Credit Suisse and its buyout from UBS was announced. These two banks were included in the dataset of this Master's dissertation. This fact causes an interesting field to be examined in the future: The ESG implications in cases of mergers and acquisitions in the banking sector. Being bankrupted a high value asset bank like credit Suisse is not usual, so is a chance for studying these implications by the future ESG researcher.

Appendix A
A: Supportive tables of ESG standards

This Appendix contains supportive tables of SASB, TCFD and CDSB.

Table 16: SASB industries

#	Industry group	Industry
1	Consumer goods	Apparel, Accessories & Footwear
2		Appliance Manufacturing
3		Building Products & Furnishings
4		E-Commerce
5		Household & Personal Products
6		Multiline and Specialty Retailers & Distributors
7		Toys & Sporting Goods
8	Extractive and minerals processing	Coal Operations
9		Construction Materials
10		Iron & Steel Producers
11		Metals & Mining
12		Oil & Gas - Exploration & Production
13		Oil & Gas - Midstream
14		Oil & Gas - Refining & Marketing
15		Oil & Gas - Services
16	Financials	Asset Management & Custody Activities
17		Commercial Banks
18		Consumer Finance
19		Insurance
20		Investment Banking & Brokerage
21		Mortgage Finance
22		Security & Commodity Exchanges
23	Food & Beverage	Agricultural Products
24		Alcoholic Beverages
25		Food Retailers & Distributors
26		Meat, Poultry & Dairy
27		Non-Alcoholic Beverages
28		Processed Foods
29		Restaurants
30		Tobacco
31	Health care	Biotechnology & Pharmaceuticals
32		Drug Retailers
33		Health Care Delivery

#	Industry group	Industry
34		Health Care Distributors
35		Managed Care
36		Medical Equipment & Supplies
37	Infrastructure	Electric Utilities & Power Generators
38		Engineering & Construction Services
39		Gas Utilities & Distributors
40		Home Builders
41		Real Estate
42		Real Estate Services
43		Waste Management
44		Water Utilities & Services
45	Renewable resources and alternative energy	Biofuels
46		Forestry Management
47		Fuel Cells & Industrial Batteries
48		Pulp & Paper Products
49		Solar Technology & Project Developers
50		Wind Technology & Project Developers
51	Resource transformation	Aerospace & Defence
52		Chemicals
53		Containers & Packaging
54		Electrical & Electronic Equipment
55		Industrial Machinery & Goods
56	Services	Advertising & Marketing
57		Casinos & Gaming
58		Education
59		Hotels & Lodging
60		Leisure Facilities
61		Media & Entertainment
62		Professional & Commercial Services
63	Technology and communications	Electronic Manufacturing Services & Original Design Manufacturing
64		Hardware
65		Internet Media & Services
66		Semiconductors
67		Software & IT Services
68		Telecommunication Services
69	Transportation	Air Freight & Logistics
70		Airlines
71		Auto Parts
72		Automobiles
73		Car Rental & Leasing
74		Cruise Lines
75		Marine Transportation
76		Rail Transportation
77		Road Transportation

Table 17: TCFD thematic units

#	Thematic unit	Disclosure
1	Metrics and Targets	Metrics to assess climate related risks and opportunities in line with its strategy and risk management process
2		Scope 1,2,3 greenhouse gas emissions and related risks
3		Targets vs performance on climate change risks and opportunities
4	Risk Management	Processes for identifying and assessing climate related risks
5		Processes for managing climate related risks
6		How the processes for identifying and managing climate related risks are integrated to the company's risk management system
7	Strategy	Identification of climate related risks and opportunities
8		Impact of climate related risks and opportunities to the strategy and financial planning
9		Resilience of organisation's strategy to different climate related scenarios like a 2°C scenario
10	Governance	Oversight of climate related risks and opportunities by organisation's Board
11		Role of management in accessing and managing related risks and opportunities

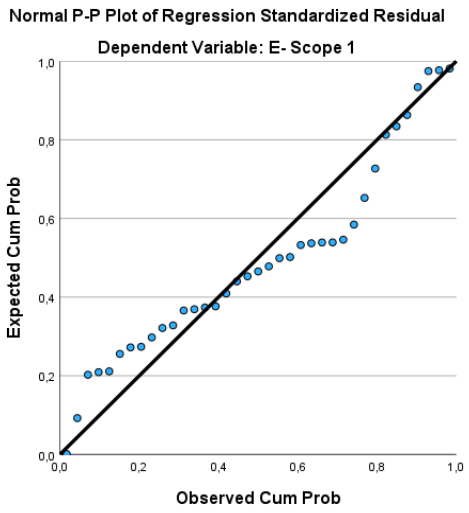
Table 18: CDSB reporting requirements

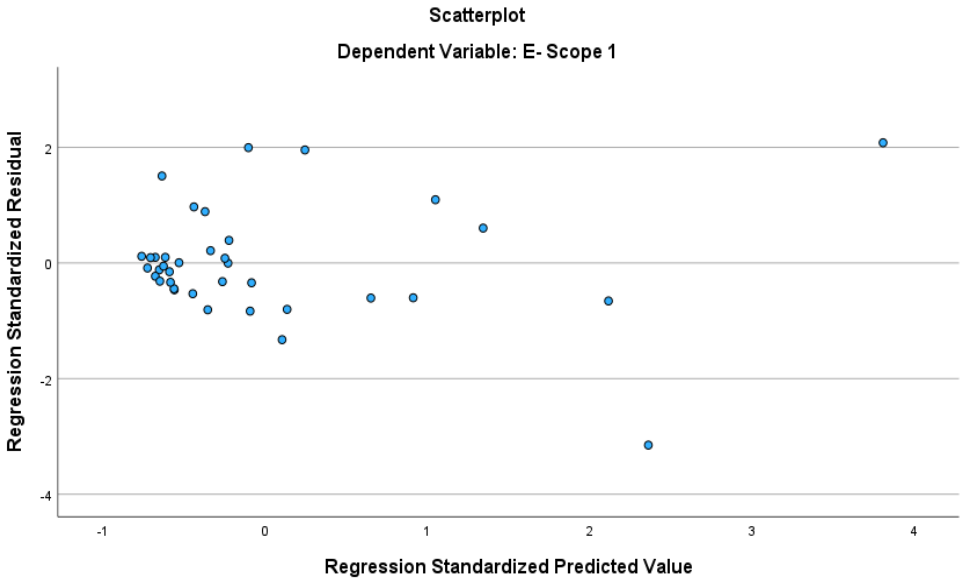
#	Reporting requirement	Description
1	Governance	Environmental and social policies, strategies and information
2	Management's environmental and social policies, strategies and targets	Report management's environmental and social policies, strategies, and targets, including the indicators, plans and timelines used to assess performance
3	Business risks and opportunities	Description of current and anticipated environmental and social risks and opportunities affecting the organization and the processes used to identify, assess and prioritise the risks and opportunities.
4	Sources of environmental and social impact	Quantitative and qualitative results, together with the methodologies used to prepare them, shall be reported to reflect material sources of environmental and social impact.
5	Performance and comparative analysis	Disclosures shall include an analysis of the information disclosed in the previous requirement (4) compared with any performance targets set and with results reported in previous periods
6	Outlook	Summary of Management's conclusions about the environmental effect and social impacts, risks and opportunities on the organisation's future performance and position
7	Organisational boundary	Environmental and social information shall be prepared for the entities within the boundary of the organisation, or group, for which the mainstream report is prepared. Where material, environmental and social information beyond this boundary shall be reported and distinguished. The basis on which the organisational reporting boundary has been determined shall be described
8	Reporting policies	Disclosures shall cite the reporting provisions used for preparing environmental and social information and shall confirm that they have been used consistently from one reporting period to the next
9	Reporting period	Annual basis.
10	Restatements	Report and explain any prior year restatements.
11	Conformance	Conformance statement of with the CDSB Framework.
12	Assurance	If assurance has been provided over whether reported environmental and social information is in conformance with the principles and requirements of the CDSB Framework, this shall be included or cross-referenced in the statement of conformance

Appendix B
B: Regression models - Validity tests

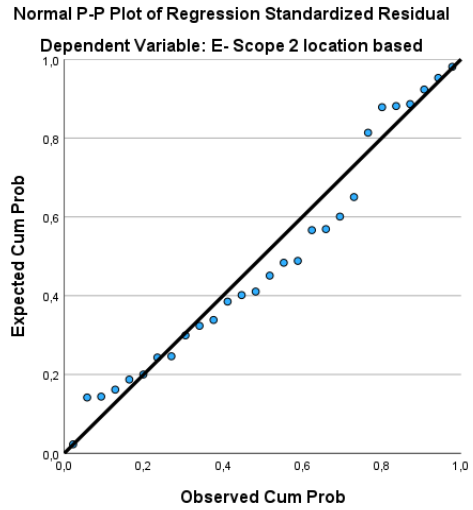
This Appendix contains the validity tests of the two regression models.

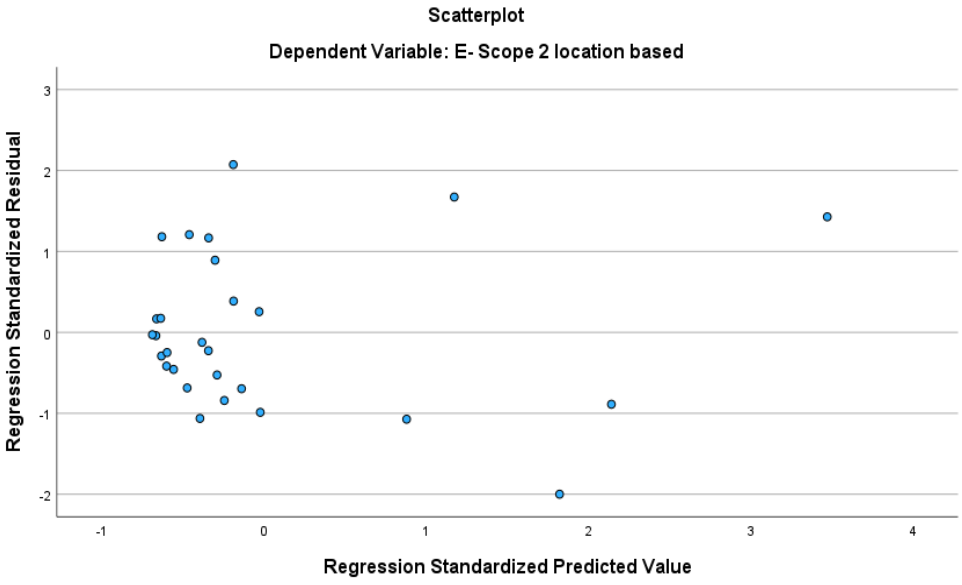
B1: Validity tests of model 1





B2: Validity tests of model 2





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