

Environmental, Social and Governance Ratings and Firm Performance in Singapore

Using R Linear Regression to Examine the Effect of Environmental, Social and Governance
Preferences of Investors on the Financial Performance of Companies in Singapore

Marie-Christine Anton

Supervisor: Vladimir Manaev

ESADE

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Abstract

This study examines the relationship between the environmental, social, and governance preferences of investors and the financial performance of companies in Singapore using linear regression analysis in R. The study analyses data from 91 publicly traded companies listed on the Singapore Stock Exchange from 2018 to 2022. The findings of this study indicate that, there is no statistically proven significant relationship between firms' overall sustainability performance or the Environmental, Social and Governance score and the number of stock price jumps. However, some significant results have been found in terms of companies with more revenue having higher Environmental, Social and Governance ratings and for individual Environmental, Social and Governance scores however. Additionally, the study finds that companies that have better financial performances and a bigger revenue will tend to have better Environmental, Social and Governance rankings which aligns with additional studies in determining that there are Environmental, Social and Governance ratings biases. These findings have important implications for investors and companies in Singapore as they suggest that Environmental, Social and Governance considerations should be taken seriously in investment and business decisions. This study also goes further into showing that Environmental, Social and Governance ratings are biased and inconsistent in the Singaporean market.

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Introduction

1.1 Problem Background

According to a 2019 article on the Environment and Society Portal, the concept of sustainability dates back to the 1700s and can be traced back to Hans Carl von Carlowitz, but it has gained greater attention in recent years due to the increasing awareness of environmental issues such as climate change, deforestation, and ocean pollution (Alshehhi et al., 2018). The United Nations have recognised in 2023 that this is due to a growing recognition that our current patterns of consumption and production are unsustainable, and that urgent action is needed to mitigate the negative impact of human activities on the environment and ensure a viable planet for future generations (IPCC, 2022). In 2015, the legally binding Paris Agreement was signed by 196 countries at the United Nations Climate Change Conference, committing to limit global warming to “well below 2°C above pre-industrial levels and [pursuing] efforts to limit the temperature increase to 1.5°C above pre-industrial levels”. This agreement is seen as a crucial step towards achieving a sustainable future (UNFCCC, 2023). Additionally, the United Nations Sustainable Development Goals were adopted in 2015 by all the United Nations Member States, providing a comprehensive framework for sustainable development. The Sustainable Development Goals cover a broad range of issues, including “poverty, hunger, health and well-being, quality education, gender equality, clean water and sanitation, affordable and clean energy, decent work and economic growth, industry, innovation and infrastructure, reduced inequalities, sustainable cities and communities, responsible consumption and production, climate action, life below water, life on land, peace, justice and strong institutions, and partnerships for the goal”. In 2022, the European Economic Area published an article about how the COVID-19 pandemic has highlighted the need for more resilient and sustainable systems and came as an early warning for what is to come. The article further discussed how many countries are now recognising the opportunity for societies and governments to build back a better society and are implementing policies to promote sustainability and resilience.

In recent years in Singapore, sustainability has also become a key focus because the country has been faced with many challenges as a consequence of climate change and has become quite vulnerable due to its geographical positioning. This has driven a commitment from the government to build a sustainable city-state with limited natural resources and placing sustainability at the forefront of the country's long-term development. Despite its small size, Singapore plays an important role in addressing climate change for several reasons. According to the Singaporean government's Green Plan website, Singapore is geographically highly vulnerable to the impacts of climate change, particularly sea level rise, which could threaten the country's infrastructure, economy, and population. Additionally, according to a 2013 report by the Intergovernmental Panel on Climate Change, sea levels are projected to rise by 0.4 to 1.2 meters by 2100, which could result in flooding and saltwater intrusion in low-lying areas of Singapore. Its per capita greenhouse gas emissions are among the highest in the world, according to data from the World Bank. In 2018, Singapore's carbon dioxide emissions per capita were 8.3 metric tons, compared to the global average of 4.8

metric tons (Appendix Figure 1). This is due to Singapore's heavy dependence on fossil fuels, particularly natural gas, for power generation, industry, and transportation (Climate Watch & World Bank, 2020). Singapore has demonstrated a strong commitment to climate action, including the implementation of the first Southeast Asia carbon tax in 2019 (NCCS, 2023), the development of a national climate strategy, and investments in renewable energy and other low-carbon technologies (Singapore Ministry of Sustainability and the Environment, 2023). In 2015, the Sustainable Singapore Blueprint was launched, outlining the country's vision and plans for sustainable development. The blueprint covers six key areas: water, energy, waste, greenery, public health, and transportation. The Sustainable Singapore Blueprint 2015 outlines the country's vision and plans for sustainable development, with targets set for 2030. For example, the target for recycling rate is to increase from 60% in 2019 to 70% by 2030 (CLC & Urban Solutions, 2015).

In addition to government initiatives, many businesses that have been selected for this study in Singapore are also adopting sustainable practices such as reducing carbon emissions, using renewable energy sources, and incorporating circular economy principles. In 2020, The Development Bank of Singapore Limited became the first bank in Singapore to join the RE100 initiative, committing to using 100% renewable energy by 2030. The bank has also pledged to reduce its operational carbon footprint by 30% by 2022 and to finance SGD 10 billion in renewable and other green projects by 2024. In a web article by the Development Bank of Singapore Limited from 2023, it has also introduced sustainability-linked loans and bonds, which tie the cost of borrowing to the company's sustainability performance. Another company that has embraced sustainability is City Developments Limited (CDL), a leading real estate developer in Singapore. In 2021 an article was published in which City Developments Limited had set ambitious targets for reducing its carbon emissions and water consumption, and had also been recognised for its efforts with numerous awards, including 'Most Sustainable Company in the Real Estate Industry' by World Finance, as part of the magazine's Sustainability Awards 2020 (City Developments Limited, 2020).

1.2. Problem Discussion

With regards to the financial sector, the Singapore Stock Exchange has also launched a green bond segment to promote the issuance of green bonds by companies in Singapore (Monetary Authority of Singapore, 2022). According to the Climate Bonds Initiative, Green bonds are bonds that are issued to fund environmentally friendly project. In 2021, the Singapore Exchange Group had also launched Environmental, Social and Governance derivatives and was the first Asia exchange to commit to the goal of the Paris Agreement to limit global warming to 1.5°C above pre-industrial levels. Guidelines for managing environmental risk were released by Singapore's financial regulator, the Monetary Authority of Singapore, in December 2020. This laid out guidelines for asset managers to follow when creating investment portfolios, strategies for setting risk management frameworks to deal with those risks, parameters for environmental risks, and techniques for managing portfolio risks, such as monitoring, scenario analysis, and capacity building. In accordance with the recommendations, asset managers must also uphold standards for

disclosure that are transparent to stakeholders and compatible with worldwide reporting frameworks for corporate conduct related to sustainable business practices. These act as the direction for what would occur. The Singapore Exchange released a standard set of key Environmental, Social and Governance measures to be followed in the market a year later, in December 2021. The four categories that must be reported in the environmental section of the Environmental, Social and Governance are greenhouse gas emissions, energy use, water use, and waste creation. The units of measurement for each of these categories were included in the Singaporean Stock Exchange guidelines for Environmental, Social and Governance metrics, including metric tons of carbon dioxide for greenhouse gas emissions, megawatt hours for energy usage, cubic meters for water use, and metric tons for trash generation. However, there were no limits or cutoffs specified in the paper for these measurements (Asprey, 2022). A classification system with parameters and limitations for releasing greenhouse gases for the energy, transportation, and real estate sectors was introduced by Monetary Authority of Singapore to provide further information. The classification, which was first published by Monetary Authority of Singapore's Green Finance Industry Taskforce in May 2022, will be revised this year to include new sectors and will remain available for public comment until the end of the year with a goal of having it finalised in 2023. Changi Airport Group, which operates Singapore's international airport, has implemented several sustainability initiatives, such as installing solar panels and rainwater harvesting systems, and has set a target of no emissions growth until 2030 (Changi Airport Group, 2021).

Overall, sustainable practices are becoming increasingly important for businesses in Singapore, as companies recognise the need to reduce their environmental impact and meet the expectations of consumers and stakeholders. According to Whelan & Fink in a paper from 2016, when companies decide to adopt sustainable practices, they can not only reduce their carbon footprint and conserve resources, but also enhance their brand reputation and customer loyalty, improve risk management, attract new customers and employees, build better relationships with stakeholders, and create long-term value for them.

1.3 Research Purpose and Research Questions

Correspondingly, stakeholders will be looking at the terms Environmental, Social and Governance investing when choosing the companies they will be interested in investing in. Environmental, Social and Governance factors refers to a set of criteria used to evaluate a company's performance in these areas. According to Diligent Insights, it is also aimed at taking into account stakeholder's opinions while doing business. Environmental, Social and Governance investing can be traced back to the socially responsible investing movement of the 1960s, which focused on avoiding investments in companies that were involved in controversial industries or practices, such as the apartheid regime in South Africa or the production of tobacco (the Morgan Stanley Capital International rating, 2023). In 2004, the United Nations officialised the use of the abbreviation ESG in its 2004 report *Who cares Wins*. Environmental, Social and Governance investing has since evolved to incorporate a wider range of environmental, social, and governance factors, and has become more mainstream. Specifically, the Social and Governance category have seen more important

developments since its origins (Byrne, 2022). Environmental, Social and Governance ratings are a way to assess a company's Environmental, Social and Governance performance and compare it to other companies in the same industry. There are several organisations that provide Environmental, Social and Governance ratings, including the Governance and Transparency Index, the Morgan Stanley Capital International rating, the Moody's rating, the Morningstar Sustainalytics rating, the Standard & Poor's rating and the Financial Times Stock Exchange Russell Group. According to Deloitte in an article from 2023, these ratings take into account a range of factors, such as a publicly available information, company feedback or data validation, risk management, “Environmental, Social and Governance controversies”, data security, minimisation of climate change, transparency and board diversity, and assign a score or rating based on their performance.

As such the aim of this paper will be to analyse to what extent do investors' Environmental, Social and Governance preferences affect the financial performance of companies on the Singaporean Stock market?

Literature Review

2.1 Empirical Studies on Environmental, Social and Governance and Firm Performance

Usually, strong Environmental, Social and Governance performance has been linked to outperformance of companies relative to their peers in the long run. Data from Bank of America in 2018 suggested that businesses that had strong Environmental, Social and Governance performances over the previous 3 years were more likely to show higher returns. In 2021, Blackrock also found that, during the first quarter of 2020, 88% of sustainable indexes outperformed their non-sustainable counterparts (Biles, 2021). A study from Axioma in the United States, also confirmed this trend in 2018 (Thompson, 2018). They found that overall, regardless of size, better performing Environmental, Social and Governance companies had a 175 basis points advantage over their peers. ESG Book also conducted its own model with Environmental, Social and Governance top performers and found that the European and the Asia-Pacific region companies were the two most likely to outperform the benchmark when implementing Environmental, Social and Governance friendly strategies (Horton, 2022). As a result, investors are increasingly incorporating Environmental, Social and Governance considerations into their investment processes in order to achieve better financial returns.

2.2 Empirical Studies on Environmental, Social and Governance and Investor Behaviour

Indeed, environmental, Social and Governance ratings and rankings are also playing a role in driving investor behaviour. There is evidence to suggest that investors are increasingly relying on Environmental, Social and Governance performance in their decision making. A survey by the Global Sustainable Investment Alliance found that sustainable investing assets grew by 15% in two years to reach \$30.7 trillion in 2018. Environmental, social, and governance information is increasingly in demand from investors. They are more aware than ever of the need of incorporating Environmental, Social and Governance aspects into their investing decisions in order to reduce risks and find opportunities. According to a McKinsey research published in February 2020, 83 percent of C-suite executives and investment experts anticipate that Environmental, Social and Governance initiatives would increase shareholder value in five years from now. However according to Standard & Poor's Global Ratings in 2023, the bulk of Environmental, Social and Governance information sources lack consistency, engagement, and a forward-looking perspective, which creates significant challenges for investors trying to use these perspectives and incorporate Environmental, Social and Governance elements to achieve a competitive edge. A survey by

Bank of America also found that 94% of generation Z believe that businesses should deal with Environmental, Social and Governance issues. 92% of these would also shift towards a brand that supports these issues (Deloitte, 2023). There is also reason to believe that these will be stocks to look out for in the future based on investors being so interested in them now and their potential for growth. The Hongkong and Shanghai Banking Corporation Limited Singapore found in a 2021 survey, that over 80% of Singaporean investors consider Environmental, Social and Governance as an important factor but because of the lack of non-costly sustainable investment choices only about 26% of the country's investments are considered sustainable. With more progress towards Environmental, Social and Governance investing in the coming years, the percentage share of sustainable investments all around the world is likely to increase.

2.3 Empirical Studies on Environmental, Social and Governance and Biases

Nonetheless, there are also challenges associated with Environmental, Social and Governance ratings and rankings. One challenge is that ESG Ratings are rather costly and inaccessible to many smaller and medium sized companies. The high costs of ESG ratings are felt through the entire management team of an investment and also ultimately they are handed-down at even more expensive management fees to the investor to be able to catch-up on financing the ratings. The Massachusetts Institute of Technology researchers also found that the Environmental, Social and Governance ratings are not always aligned between each other and intentionally keep it that way because of their unique methodologies and the ability for companies to manipulate this system, so they have lower correlation than credit ratings for example (Brackley *et al.*, 2022). There is a general lack of consistency across the ratings. Studies have found that this lack of consistency can be due to many factors. One of these reasons is that there is a lack of standardisation between agencies as they have created these ratings in-house and do not have regulators overseeing the process. Additionally, with each agency having their own methodology, this means that they will also have their own data collection processes and have different ways of engaging in company surveys or statistical models to estimate averages and trends. The lack of common methodology also makes it more difficult for smaller companies to be able to appropriately fill in the information about their Environmental, Social and Governance performance (ERM, 2023). Another challenge is that of ESG ratings bias against Small and Medium sized Enterprises meaning that a company that has higher market capitalisation may have more favourable Environmental, Social and Governance ratings than those with lower ones (Boffo and Patalano, 2020). Companies with higher revenues will be able to pay consultants to achieve higher rankings and lead to a bias between the different sizes of companies with regards to their Environmental, Social and Governance ratings. There can also be a bias between English speaking companies and non-English speaking (ERM, 2023). In 2019, a study was published titled "Aggregate Confusion: The Divergence of Environmental, Social and Governance Ratings", in which the researchers found that the discrepancies in the ratings relied on three main points: the scope divergence, in which companies may choose to focus their

Environmental, Social and Governance measurements on different factors such as greenhouse gas emissions, human rights or lobbying; the weight divergence would mean that you would put more emphasis on one of those factors when doing the performance review; and the measurement divergence focuses on the fact that even while testing for one factor, such as human rights, you may be looking at internal or external human rights and have different bases across companies. In our model, we will try to test for Environmental, Social and Governance biases by looking at each Environmental, Social and Governance rating on two levels. Firstly, by combining them in one function and secondly, by looking at them individually to be able to see if there are truly important discrepancies between ratings.

2.4 Empirical Studies on Environmental, Social and Governance and choice of Indicators

Furthermore, in terms of financial metrics used to assess Environmental, Social and Governance performance, Return on Equity and Earnings per Share are commonly used. A meta-analysis of studies from 2015-2020 by Whelan *et al.*, found that analysis on Environmental, Social and Governance performance versus companies' corporate performance usually relied on Return on Equity and Return on Assets. Similarly a 2022 study by Gao *et al.* showed that accountancy-based performance indicators such as Return on Equity, Return on Assets or Earnings per Share could be used in these analyses. As for the Singaporean Stock Market, one study by Chang *et al.* (2021) found by creating an Environmental, Social and Governance index and running a Partial Least Squares method, that the predictive power of the Environmental, Social and Governance index is greater using fundamental return predictors and still exists after controlling for economic, uncertainty, and fundamental measures.

2.5 Summary of Previous Research

To summarise, investors' Environmental, Social and Governance preferences are evolving over time, driven by factors such as increased awareness of environmental and social issues, growing evidence of the financial benefits of Environmental, Social and Governance performance, and the availability of Environmental, Social and Governance ratings and rankings. However, there are also challenges associated with these trends, and investors need to be aware of these in order to make informed investment decisions.

Scientific Method

In this chapter, we will be looking at an overview of the data collection process as well as the varying sources the data was collected from. We will go over the process of determining the sample size and the selection of variables. The outline of the model will also be determined as well as the data analysis techniques we have been using.

3.1 Choice of the Subject

I was interested in finance as well as sustainability as topics for a final degree project. Before the final decision was made, different topics that were related to these preferences were discussed. After consulting with my supervisor, I had made the choice of integrating data science with Environmental, Social and Governance performance and finance. I am also very interested in pursuing Data Science in the future as well as emerging technologies. The topic itself is new, relevant, interesting and was made after an academic exchange I have made in Singapore during 6 months. Because of this exchange I saw how well Singapore was performing in the financial sector being the biggest financial hub in Asia and also being one of the highest performing countries in terms of sustainability in the world. Also, Environmental, Social and Governance score and stock price information is available in open sources on the Singaporean stock exchange websites which makes this study feasible. Thus, this study topic was chosen as it meets my interests and to expand my knowledge about companies' Environmental, Social and Governance performance and its influence on the Singaporean stock market.

3.2 Choice of the method

Linear regression is a model that allows you to make predictions. From a supervised learning algorithm, a linear relation establishes the relationship between an explained variable and an explanatory variable. Starting from a cloud of points, a simple linear regression consists in determining a straight line passing as close as possible to the points of this cloud. The objective is to determine a so-called explanatory or independent variable on the horizontal axis in relation to a so-called explained or dependent variable on the vertical axis. In a multiple linear regression, there will be at least two explanatory variables. This algorithm may give rise to a learning phase (machine learning), based on a cloud of training points to then make predictions in relation to new points. In this study, we will go through the two phases of linear regressions. A simple linear regression consists in identifying the equation of a straight line explaining the distribution of a cloud of points. It can be written: $y = ax + b$. The goal is to find the values of a (the slope) and b (the y-intercept). To be applied, a linear regression implies several prerequisites: defined variables and explanatory variables.

There must also exist a linear relationship between the two variables studied, for example the rise of a company share on the stock market and the ranking of the company in terms of sustainability. Linear regression makes it possible to correlate different variables. The results obtained remain predictions, or even estimates. Consequently, there remains an area of uncertainty, despite the reliability of the system. The interpretation must therefore consider the linear model as a support for decision-making and not as an established truth (Mali, 2023).

Furthermore, the choice of using R was also a lengthy one. R was created and developed beginning in 1992, and it was launched in 1995. It would initially simply highlight S and Scheme's core features. The programming language, libraries, and extensions readily accessible, however, would properly support statistics as it expanded further. R is the ideal programming language for objective statistics, mathematical computation, and data visualisation because of everything from its analytical language to the visualisation features provided. The fact that R was created for data scientists, as opposed to other, more broad tools, nevertheless assures that the field's experts favour it. R is still one of the most widely used programming languages in academia even after a long period of use and development. R is utilised in the majority of educational, scientific, and academic settings. As a result, a wide variety of industry followers will want to employ the exact language they utilised and trained with. The R computer environment, commonly referred to as the GNU package, is to some extent self-hosted because it is partly developed using R. The program is available on The R Project for Statistical Computing's website for data scientists, students, and anybody else who is interested. To understand why statisticians have chosen this software as their favourite tool, it is crucial to understand the relationship between the programming language and various statistical disciplines. In fact, in the past, data science was a synthesis of a number of statistical fields. The multidisciplinary discipline of information science focuses on digital information while still using statistical methods. Today's data science enables businesses and organisations to make the most use of data by utilising mathematical algorithms, statistical concepts, and machine learning (R, 2023).

3.3 Data Collection process

With regards to the panel data for this study, it was collected by hand from various sources, including the Singapore Exchange Group, the Financial Times Stock Exchange Russell Group, the Morgan Stanley Capital International rating, the Standard & Poor's Global ratings, the Moody's rating, the Morningstar Sustainalytics rating, and the TradingView platform, as well as the respective pages of each of the 91 companies on the Singapore Exchange investor tool. Most of the data was collected from 2018-2022 when available, allowing for valid comparisons between the Environmental, Social and Governance and stock performance scores. For some of the sources such as The Standard & Poor's rating and the Moody's rating the data was only available in 2022. This will be taken into account later on in the model. There is also available data on several control variables, including company size (measured by market capitalisation), industry sector, and financial performance indicators such as Return on Equity and Earnings per Share for the year 2022.

3.4 Data selection and size determination

For the most part, the Singapore Exchange provided Environmental, Social and Governance scores for 91 companies in the Singaporean stock market. The Singapore stock exchange chose to select these 91 companies because they had at least two Environmental, Social and Governance scores. As such, the sample was given by the Singapore Stock Exchange. Additionally, on the Singapore Exchange investors portal, there was also information about the Government Transparency Index which was added to the database by hand once again.

Importantly, the Singaporean stock Exchange has taken many initiatives to make its platform and users more sustainably aware. The need for global measures to address climate change has rapidly increased with a more important sense of urgency as its impacts become more obvious. Therefore, in accordance with the suggestions of the Task Force on Climate-related Financial Disclosures (TCFD), the Singaporean Stock Exchange has implemented a phased approach to required climate reporting. The financial reporting of listed issuers is supplemented with sustainability reporting. Although sustainability reports of environmental, social, and governance variables illustrate the risks and possibilities within sight, managed for future returns, statements of financial status and comprehensive income give a picture of the present and an account of the previous year. When combined, the financial and environmental sustainability reports allow for a more thorough evaluation of the issuer's management capabilities and future financial prospects. It is necessary to produce an annual sustainability report including: Important Environmental, Social and Governance variables, Climate-related disclosures that follow the TCFD's suggestions, policies, procedures, and effectiveness, Targets, Framework for sustainability reporting, Statement of the Board and related governance framework for sustainable practices and if the issuer is unable to report on any main component, it must make that clear and explain what it does in its place, along with its rationale. Globally recognised standards and disclosure procedures should be given priority by issuers in order to direct their reporting. Corporate reporting procedures tend to converge on international best practice due to the expanding number of borderless markets for products and services as well as for finances. The global nature of Singapore's securities market, both in terms of listed companies and investors, adds to this. It is possible to increase the acceptance of a company's sustainability report in a growing global marketplace by adhering closely or completely to an internationally recognised framework. The issuer may be more readily understood and contrasted with its competitors in Singapore and other international jurisdictions. The Singapore Stock Exchange also advises issuers to utilise a set of 27 basic Environmental, Social and Governance measures (referred to as Core Environmental, Social and Governance Metrics) as a place to start when reporting sustainability. These Core Environmental, Social and Governance measurements are designed to provide a uniform and standardised collection of Environmental, Social and Governance measurements, which will improve alignment between Environmental, Social and Governance information users and reporters. In accordance with the development of international reporting requirements, the Core Environmental, Social and Governance Metrics may be routinely evaluated and amended (the Singaporean Stock Exchange, 2023).

3.5 Methodology of different data providers

For this study, the sample was chosen and the providers of the ratings were also chosen by the Singaporean Stock Exchange. Therefore, the providers of ratings will be described and analysed in this part of the dissertation. It will follow the order of the Financial Times Stock Exchange Russell Group ratings, the Morgan Stanley Capital International ratings, the Standard & Poor's Global Ratings, the Moody's rating scores, the Morningstar Sustainability ratings and the Tradingview platform.

Firstly, the Financial Times Stock Exchange Russell Group ratings are assigned on a scale from 0 to 5, with 5 being the highest rating. Since the Financial Times Stock Exchange 4Good Index Series was introduced in 2001, representing 20 years of innovation as one of the longest running global Environmental, Sustainable and Governance index series, Financial Times Stock Exchange Russell Group has been a pioneer in sustainable investing indexes. Two essential sustainable investing data models are maintained by Financial Times Stock Exchange Russell Group: The operational Environmental, Sustainable and Governance risks and performance of listed firms are evaluated using the Environmental, Sustainable and Governance Ratings and Data Model. The company's revenue exposure to items that provide environmental solutions is classified and measured using the Green Revenues data model. The Environmental, Social and Governance Ratings data from the Financial Times Stock exchange Russell Group Russell is based on information that has been made publicly available. Reports and other disclosures from firms are the main sources of data. They do, however, also provide more data from sources like governments and Non Governmental Organisations. To establish a firm's operational and geographic exposure, an analyst gathers data using documents made accessible to the public by the company. A company's exposure is then cross-referenced using a rules-based approach to determine the relevance of Environmental, Social and Governance indicators. An analyst evaluates a firm using publicly accessible papers and relevant indicators. The analyst contacts the company to ask for more publicly available information that the analyst should take into account (Environmental Finance, 2023).

Secondly, the Morgan Stanley Capital International ratings are assigned on a scale from AAA to CCC, with AAA being the highest rating. The GICS sub-industry or sector's most significant Environmental, Sustainable and Governance risks are identified using the Morgan Stanley Capital International Environmental, Sustainable and Governance Ratings methodology (also known as Key Issues). They have been able to analyse and improve their model to pinpoint the Environmental, Social, and Governance Key Issues that are most important to a business thanks to their over 13 years of live track experience. Environmental, Sustainable and Governance ratings are frequently used by institutional investors, including pension funds, sovereign wealth funds, endowments, and asset managers, to evaluate financial risks during the investing process. These investors have a fiduciary obligation to take substantial investment risks into account. To complement this investing emphasis,

Morgan Stanley Capital International uses a rules-based framework to focus on the confluence of a company's business and the pertinent Environmental, Sustainable and Governance concerns that might generate substantial risks and opportunities for its sector. The most important concerns we evaluate for businesses across 158 sectors are displayed in their searchable Environmental, Sustainable and Governance industry materiality map. Their Environmental, Sustainable and Governance ratings are created expressly for Environmental, Sustainable and Governance integration, which employs ratings to aid in the creation of a robust portfolio with the express goal of boosting long-term risk-adjusted returns. Ratings have accelerated the introduction of Environmental, Sustainable and Governance issues into mainstream investing by assisting institutional investors in incorporating Environmental, Sustainable and Governance into their strategies. Investors can also engage in impact investing, which focuses on financial transactions with quantifiable social or environmental effect goals. Investors may use tools like their Sustainable Development Goals Alignment Tool, which offers a comprehensive assessment of a company's contribution to tackling each of the United Nations Sustainable Development Goals, to pursue such plans. An Environmental, Sustainable and Governance grade would not support a plan that prioritises impact creation over performance (Morgan Stanley Capital International, 2023).

Thirdly, the Standard & Poor's Global Ratings are assigned on a scale from 0 to 100, with 100 being the highest rating. The Environmental, Social and Governance Evaluation by Standard & Poor's Global Ratings is a unique evaluation of a company's Environmental, Social and Governance strategy and capacity to foresee potential future risks and opportunities. Because it offers a long-term, forward-looking assessment of preparation for disruptive Environmental, Social and Governance risks and opportunities, the Environmental, Social and Governance Evaluation is the right instrument for investors. The technique is based on the sector and business experience of our analysts and relies on extensive interaction with corporate management to evaluate significant Environmental, Social and Governance impacts on the firm in the past, present, and future. Assessments of business entities, banks, insurers, and public finance bodies can all be included in the Environmental, Social and Governance Evaluation. The Environmental, Social and Governance Risk Atlas was developed by Standard & Poor's Global Ratings to show the relative environmental, social, and governance hazards that exist around the world. The Atlas, which is presented as a web infographic, represents our findings about the many Environmental, Social and Governance risks that are present in various industries and regions (Standard & Poor's Global Ratings, 2023).

Following, the Moody's rating scores are assigned on a scale from 0 to 100, with 100 being the highest rating. Scores assessing a company's social and environmental effect as well as its corporate governance processes are included in this data. All sizes of public and private multinational, national, and subnational businesses are covered by Environmental, Social and Governance data. Customers get access to the underlying data for 59 Environmental, Social and Governance and Climate measures as well as well over 300 million modelled Environmental, Social and Governance Scores. Customers also get access to 5,000 Environmental, Social and Governance ratings and the supporting information for publicly traded firms as part of this data bundle. The modelled scores' approach is taken from the analyst-led Environmental, Social and Governance evaluations' methodology (Moody's

Analytics, 2023). For investors, public and private organisations, it is an independent global source of environmental, social, and governance (Environmental, Social and Governance) research and services. It conducts risk analyses and assesses the extent to which sustainability issues are incorporated into organisational strategy and operations. A division of Moody's Corporation called Moody's Environmental, Social and Governance Solutions caters to the rising demand for Environmental, Social and Governance and climate information throughout the world. Businesses are better at managing interactions with their stakeholders when they have higher Moody's Environmental, Social and Governance Solution scores. Due to a failure to take into account and satisfy their stakeholders' expectations, they are less likely to incur business interruption or miss chances. In turn, this can put businesses in a better position to manage risks and provide long-term value for shareholders (Deutsche Bahn IR, 2023).

Subsequently, the Morningstar Sustainalytics ratings are assigned on a scale from 0 to 100, with 100 being the highest rating. Institutional investors and businesses may use Morningstar Morningstar Sustainalytics' high-quality, analytical environmental, social, and governance research, ratings, and data. The company has dedicated more than 30 years to providing cutting-edge solutions that have made it possible for the top institutional investors in the world to recognise, comprehend, and manage Environmental, Social and Governance-driven risks and opportunities. We are stepping up our efforts to provide practical Environmental, Social and Governance information to investors of all sorts across various asset classes at the business and fund level now that Sustainalytics is a member of Morningstar. To assist them in taking sustainability into account in their policies, procedures, and capital projects, Morningstar Sustainalytics' Corporate Solutions branch collaborates with hundreds of businesses and their financial intermediaries. By calculating the amount of an organisation's unmanaged Environmental, Social and Governance risk, the rating provides precise insights into company-level Environmental, Social and Governance risk. This is evaluated using a distinct set of MEIs, so it only takes into account problems that might significantly affect the economic worth of the firm. From insignificant to high risk, the ranking evaluates the Environmental, Social and Governance performance of more than 14,000 firms. Corporate governance, MEIs, and idiosyncratic concerns (black swans) are the three main building pieces that make up the grade (Morningstar Sustainalytics, 2023).

Finally, TradingView provides various financial and technical indicators for stocks, including price performance, volume, market capitalisation, price-to-earnings ratio, and dividend yield and was also a tool used to collect the data for the 2022 year. Real-time data on financial markets, including stock prices, indices, exchange rates, and cryptocurrencies, are offered via the professional-grade trading platform TradingView Pro which is the one that has been used to retrieve the data for this study. Several data sources, including exchanges, brokers, and market data suppliers, supply the real-time data for TradingView Pro. To aid traders in making educated judgments based on the real-time data, the platform also provides sophisticated charting tools and analysis functions (TradingView, 2023).

Moreover, the financial indicators included in the study, and retrieved between the Tradingview platform and the Singapore Stock exchange platform, were: Return On Equity, Earnings Per Share Growth, Net Profit Margin Growth, Operating Margin Growth, Change in Percentage, Technical Rating, Volume, Volume times Price, Market Capitalisation, Price to Earnings, Earnings per Share basic, Number of Employees, Beta, 3 month performance, 6

month performance, 5 year performance, all time performance, Cash & Equivalents (Full Year), Debt to equity, Current Ratio, Dividends Per Share, Earnings Before Interest Taxes Depreciation and Amortisation, Net Income, Net Margin, Operating Margin, Price to Book, Price to Free Cash Flow, Price to Research Ratio, Quick Ratio, Return On Assets, Return On Invested Capital, and Revenues.

3.6 Selection of variables

As mentioned previously, we used a linear regression model with the R function `lm()` to analyse the relationship between Environmental, Social and Governance performance and stock performance for these companies. Our dependent variable was stock performance, measured as a combination of the financial indicators listed above, while our independent variable was Environmental, Social and Governance performance, measured as a combination of the ESG indicators listed above. As a second step, we have also put the Environmental, Social and Governance indicators as our dependent variable and the financial performance as our independent variable as we wanted to verify the claims of Boffo, and Patalano from 2020 about Environmental, Social and Governance ratings being higher for companies with higher Market Capitalisation with regards to the Singaporean market and therefore leading to bias in the results.

3.7 Data analysis techniques

First, we cleaned and prepared the data by converting all necessary columns to numeric values so that all the values are standardised, as the rankings for example were often categorical values. The data was not removed in case of non-available data as it is a time-series analysis on one part and some columns only have values for 2022 this would have removed all existing data. What we did instead was to filter by the 2022 year when doing the analysis of these variables. As such, the model was divided into two parts. Firstly we analysed the data from a time-series point of view from 2018 to 2022 when the data was available. In a second part, we analysed the data solely for the 2022 year. We also removed any duplicates in the dataset with the use of the `drop_duplicates` function in R: `df[! duplicated(df),]`. To clean the data from outliers we used 3D scatterplots for the Return on Equity, the Net Profit Margin Growth, the Operating Margin Growth and the Earnings per Share Growth to remove the points that are the farthest away from the best fitting hyperplane which corresponds to the best fitting linear model. We do this for all the financial indicators against the Morgan Stanley Capital International rating and the Standard & Poor's. For Return on Equity, these values were 1157% with the Top Glove Corporation and -539% Return on Equity growth with the First Reit. For Net Profit Margin Growth, this is the Keppel Reit company with 7.196.745%. For Operating Margin Growth, we take out the minimum -3.793.993% of SIA company. Finally, for Earnings per Share Growth, we will not be taking any values out as there is no clear outlier (Appendix figures 2-6).

To assess the model's goodness of fit, various metrics such as R-squared, adjusted R-squared, and F-statistic will be used. Additionally, the significance of the independent variables will be tested using t-tests and their corresponding p-values.

Empirical Results

4.1 Descriptive Statistics

In the time-series analysis, we have performed the regression analysis in two ways. Firstly, we regressed individually the Return on Equity, the Revenue Growth, the Net Profit Margin Growth, the Operating Margin Growth and the Earnings per Share Growth over a combination of the Morgan Stanley Capital International rating, the Standard & Poor's rating, the Governance and Transparency Index and the factors by sector and year.

We found that for Return on Equity, the sectors that were the most accurate predictors of growth were the ones of Financial and Insurance activities and Professional Scientific and Technology with confidence intervals of 95% and 99%, respectively. Additionally, the t-value for these two were higher than 1 which showed additional statistical significance. Overall, all sectors' estimates grew with the Return on Equity except for the Real Estate activities and Transportation and Storage sectors.

4.2 The Morgan Stanley Capital International Rating as a predictor for ROE

Firstly, when we looked at the Morgan Stanley Capital International rating we could see that it was also a predictor of growth in the Return on Equity with a t-value of 1.569 and a confidence interval of 88%. However, when the Standard & Poor's rating and the Governance and Transparency Index rating increased the Return on Equity was negatively impacted, although the statistical significance was higher for the Standard & Poor's rating at a 95% confidence interval. Overall, this model showed strong statistical significance with an R squared not too far off the Adjusted one and at 0.517. Additionally, the F-statistic was at 4.61 which was a strong indicator of fitness of model (Appendix [figure 7](#)).

4.3 The Morgan Stanley Capital International Rating as a predictor for EPSG

For the Earnings per Share Growth, we found that the Morgan Stanley Capital International rating negatively impacted Earnings per Share Growth at a confidence rate of 90% and the Standard & Poor's rating and Governance and Transparency Index positively impacted it. This showed another correlation that the Morgan Stanley Capital International rating had a negative impact on the growth of Earnings per Share and in turn a positive return metric for investors, as they are technically looking for their Earnings per Share to stay as low as possible. Another important remark is that the Year 2020 negatively impacted the Earnings per Share growth as a whole. (Appendix [figure 8](#))

4.4 The Morgan Stanley Capital International rating as a predictor of Revenue Growth, Net Profit Margin Growth, Operating Margin Growth

Admittedly, we did not find much statistical correlation for Revenue Growth, Net Profit Margin Growth and Operating Margin Growth all at around 0,1 - 0,2 in R squared, but we will still subsequently be looking to see what these results were.

As for the Net Profit Margin Growth it was impacted at 0.22 correlation with the Morgan Stanley Capital International rating, the Governance and Transparency Index and the Standard & Poor's rating over the years. It was mostly impacted in the sector of Transportation and Storage at a 95% confidence interval. It also had similar attributes to the Earnings per Share with the Morgan Stanley Capital International rating having negatively impacted it, and so did the Governance and Transparency Index rating. However, the Standard & Poor's rating positively impacted it (Appendix [figure 9](#)).

In the case of analysing how Revenue Growth was impacted by the Morgan Stanley Capital International rating, the Governance and Transparency Index, the Standard & Poor's Global Ratings and by factoring by Year as well, we found that this did not have a statistically significant correlation at 0,12 and it also did not have any remarkable correlation per subgroup analysed. In this case, the Morgan Stanley Capital International rating and the Standard & Poor's Global Ratings both had negative impacts on the Revenue growth but the Governance and Transparency Index had a positive impact. Once again, the year 2020 had a negative impact on Revenue Growth in this specific linear model (Appendix [figure 10](#)).

4.5 Ratings Bias based on Firm's performance

In a second analysis, we tried to see how the Morgan Stanley Capital International rating grew in accordance with higher financial performance in order to see whether there was bias in the Environmental, Social and Governance ratings. Basically, we wanted to see if as earnings grew the companies had stronger ratings. This would have been a bias for Environmental, Social and Governance rating companies to have given better ratings to companies with more revenue. As such, we found that there was a strong statistical significance in this linear regression model for the sectors of Information and Communication Services, Financial and Insurance activities at 95% and Transportation and Storage at 90%. These sectors had the highest influence on the Morgan Stanley Capital International rankings variations.

The financial performance indicators that positively impacted the Morgan Stanley Capital International ranking were Return on Equity at a lower confidence interval at about 75% interval of confidence, Net Profit Margin Growth and Operating Margin Growth with the second highest confidence intervals at a little lower than 90% confidence interval. This

meant that as Return on Equity, Net Profit Margin Growth and Operating Margin Growth grew so did the Morgan Stanley Capital International rating. On the other hand, Revenue Growth and Earnings per Share Growth negatively impacted the Morgan Stanley Capital International rating. For Earnings per Share, this also made sense because you would ideally want your Earnings per Share to be lower, between 5 and 30. Additionally, 2 sectors had the most positive impact on the Morgan Stanley Capital International rating, meaning that they got good ratings from the MSCI rating in terms of financial performance. These were the Financial and Insurance Services and Information and Communication Services sectors with 95% confidence intervals for the both of them. Another interesting factor was that the Year 2022 was the one that most negatively impacted the ratings (Appendix [figure 11](#)).

For the Standard & Poor's rating, we saw how the data from the year 2022 was more representative of the Standard & Poor's rating at 95% rather than the other years, probably because of the impacts of the COVID-19 post-pandemic recovery. The year 2020 just after the pandemic started was the least representative one, following 2021 being the year of moderate comeback post-pandemic, and finally, the year 2022 having a ninefold impact from 2020 on the ratings in this model. This was a pattern that we had found throughout the study and it is also important to mention it. In a similar 2022 study by Khoury et. al., they found that Environmental, Social and Governance scores were not statistically significant during the pandemic and that many sectors were affected differently. This also could have had an impact on the outcomes of this study. The F-statistic was also quite strong around 2 and showed statistical significance as well as the intercept at a confidence interval of 95%. In this rating, we could also see that the most statistically significant sector is the sector of Financial and Insurance activities with a confidence interval of 95% (Appendix [figure 12](#)).

Finally, for the year 2022 models we started by looking at the linear regression model of Return On Invested Capital by the Environmental, Social and Governance performance scores of the Financial Times Stock Exchange Russell Group, the Morningstar Sustainalytics rating, the Morgan Stanley Capital International rating, the Governance and Transparency Index. We could see, in that case, that the Morningstar Sustainalytics rating had a positive correlation with the Return on Invested Capital growth with a 90% confidence interval and a t-value of 1,826. Additionally, the Governance and Transparency Index had a negative impact on Return on Invested Capital with the same confidence interval and a t-value of |2,024|. For the year 2022, Electricity Gas Steam and Air have had the most significant impact on Return on Invested Capital growth (Appendix [figure 13](#)).

4.6 Environmental, Social and Governance factors over Firm's performance in 2022

This second analysis helped us see that it was harder to predict the Environmental, Social and Governance rankings from financial performance than the opposite. For the analysis of the impact of the Financial Times Stock Exchange Russell Group, the Morningstar Sustainalytics rating, the Morgan Stanley Capital International rating and the Governance and Transparency Index on Earnings Before Interest Tax Depreciation and

Amortisation for the year 2022, we found a correlation of 0,4 which was not very high and it did not have much statistical significance with regards to sectors or ratings (Appendix [figure 14](#)).

For the analysis of the impact of the Financial Times Stock Exchange Russell Group, the Morningstar Sustainalytics rating, the Morgan Stanley Capital International rating and the Governance and Transparency Index on Return on Assets for the year 2022, we found a correlation of 0,5227 which was a little higher than over Earnings Before Interest Tax Depreciation and Amortisation. This also showed us the divergence of impacts of different ratings and how they do not always align with each other. There is a lack of uniformity within the ratings and this can clearly be observed through the different correlations we have found between different ratings. The Sector of Wholesale and Retail Trade had the highest statistical significance, in this context, at a 95% confidence interval rate. In this case, the Morningstar Sustainalytics rating was also the one that had the most correlation with the Return on Assets factor with a positive impact and a statistical significance of 95% of confidence interval (Appendix [figure 15](#)).

Through this regression model, we have seen the impact of the Financial Times Stock Exchange Russell Group, the Morningstar Sustainalytics rating, the Morgan Stanley Capital International rating, and the Governance and Transparency Index on the growth of the Dividends per Share and that a good Governance and Transparency Index is significantly correlated at a 90% confidence interval with a good Dividend Per Share ratio which is also an attractive feature for investors. Additionally, for the Dividends per Share, we have also seen that the Wholesale and Retail Trade sector was the most statistically significant at 90% confidence interval in this scenario (Appendix [figure 16](#)).

Conclusion

5.1 Conclusion

Through this research we have seen how Environmental, Social and Governance performance is linked to financial performance on the Singaporean stock market. There were important discrepancies between the five different Environmental, Social and Governance ratings we have chosen to analyse. This confirms the lack of uniformity between ratings and the divergence in the results we have found when analysing for different ratings. Additionally, we have found that although Environmental, Social and Governance ratings is somewhat correlated to financial performance there was not a statistically significant impact on the financial performance of companies. Our research concludes that it is harder to predict the Environmental, Social and Governance rankings from financial performance than the opposite. This means that, in Singapore, there is more evidence to suggest that when the companies are larger the Environmental, Social and Governance rating companies have a tendency to rank these businesses more favourably.

The findings of this research could provide valuable insights for investors who are interested in Environmental, Social and Governance investing in Singapore. The results could also be useful for companies who are looking to improve their Environmental, Social and Governance practices and enhance their financial performance. Overall, this study aims to contribute to the growing body of research on Environmental, Social and Governance investing and its impact on financial markets.

5.2 Recommendations for further research

The environmental ranking performance of companies as a linear regression model of the financial performance depends very heavily on the sector of activity, so it would firstly be interesting to take into account the sector differences and find a way to standardise these effects or to look specifically at one sector in Singapore. Secondly, it will be valuable to explore Environmental, Social and Governance information in other assets or developing markets. Thirdly, it would be useful to investigate how its predictive power could be further improved with other new methods. It would also be interesting to apply this model in the future when there will be more data available on Environmental, Social and Governance ratings historically and also when there will be more regulation on the topic. As Environmental, Social and Governance ratings are a relatively contemporary topic of research that have not been around for long, it would also be interesting to see this application in a future model which is neither affected by the pandemic as well as in another model where it is affected by the pandemic to be able to realise how big of an impact it has had in Singapore specifically.

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Appendix

Figure 1

CO2 emissions (metric tons per capita) - Singapore, Climate Watch, 2020

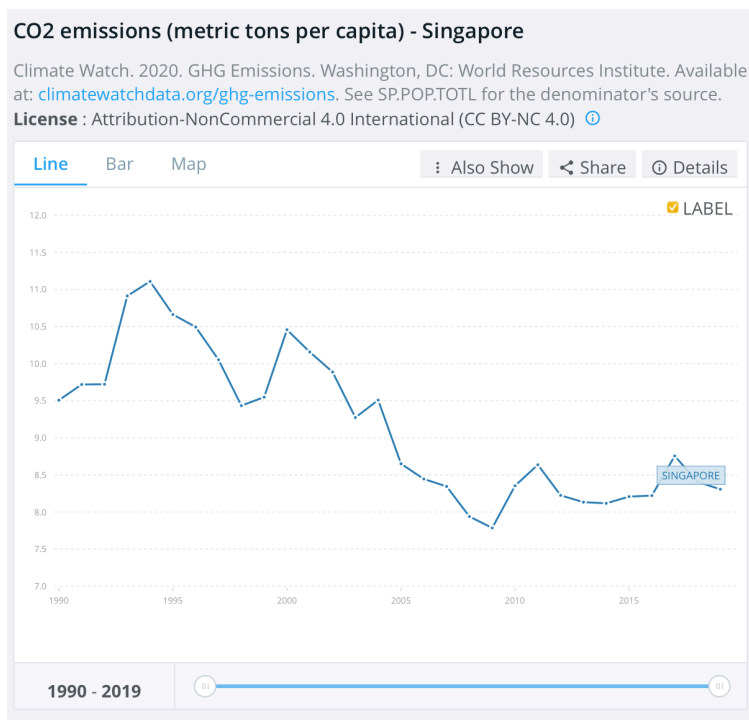


Figure 2

3D Scatterplot of outliers for Net Profit Margin Growth over the Standard & Poor's Global Ratings

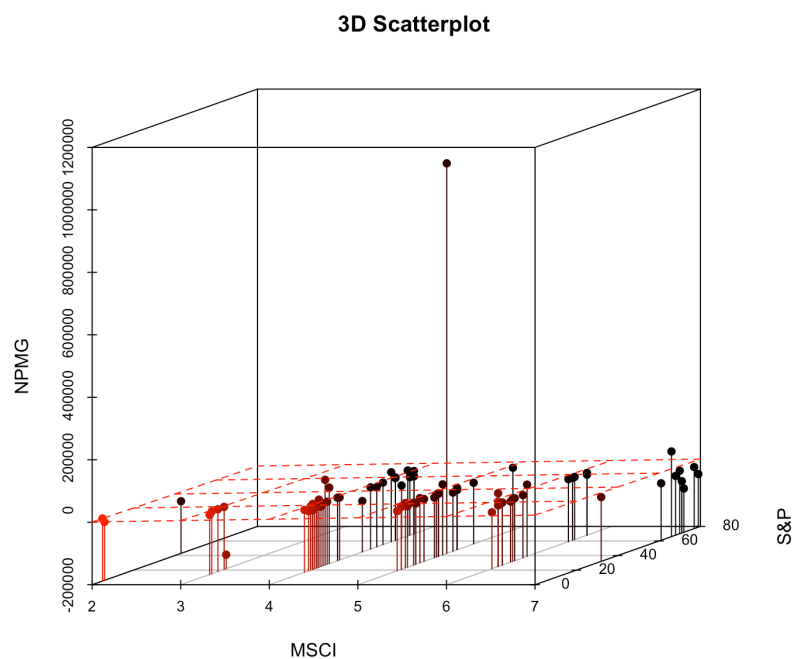


Figure 3

3D Scatterplot of outliers for Return on Equity over the Standard & Poor's Global Ratings

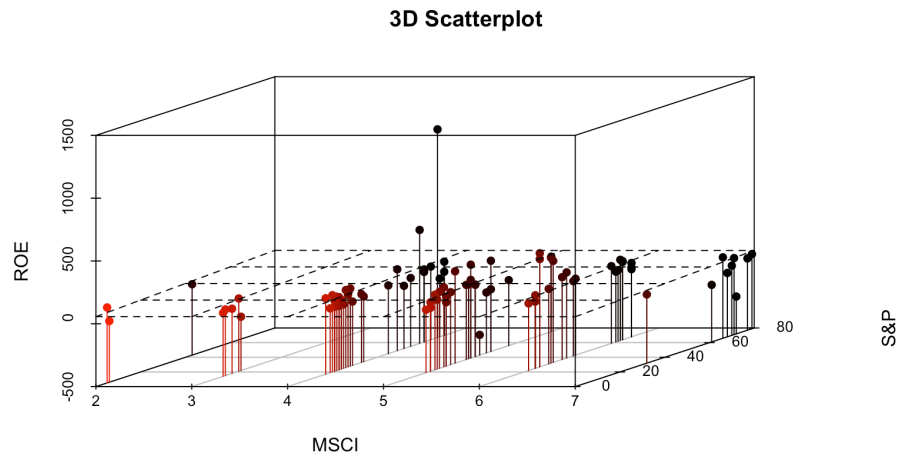


Figure 4

3D Scatterplot of outliers for Operating Margin Growth over the Standard & Poor's Global Ratings

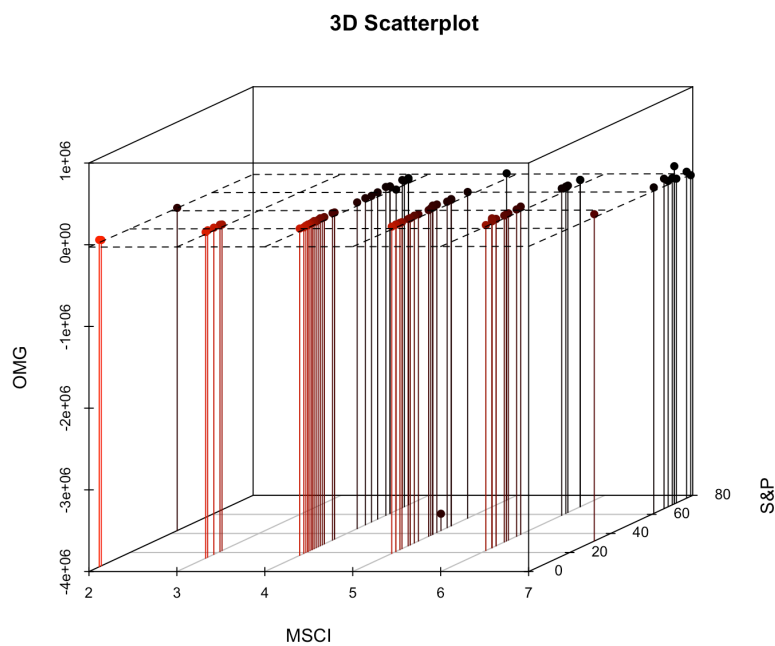


Figure 5

3D Scatterplot of outliers for Revenue Growth over the Standard & Poor's Global Ratings

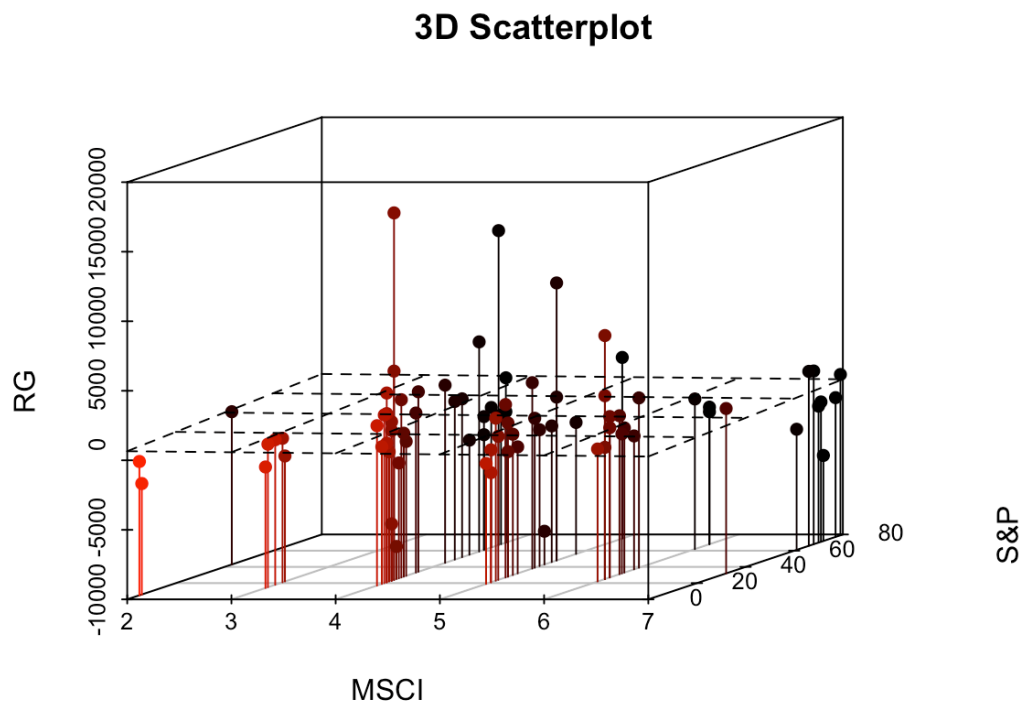


Figure 6

3D Scatterplot of outliers for Earnings per Share Growth over the Standard & Poor's Global Ratings

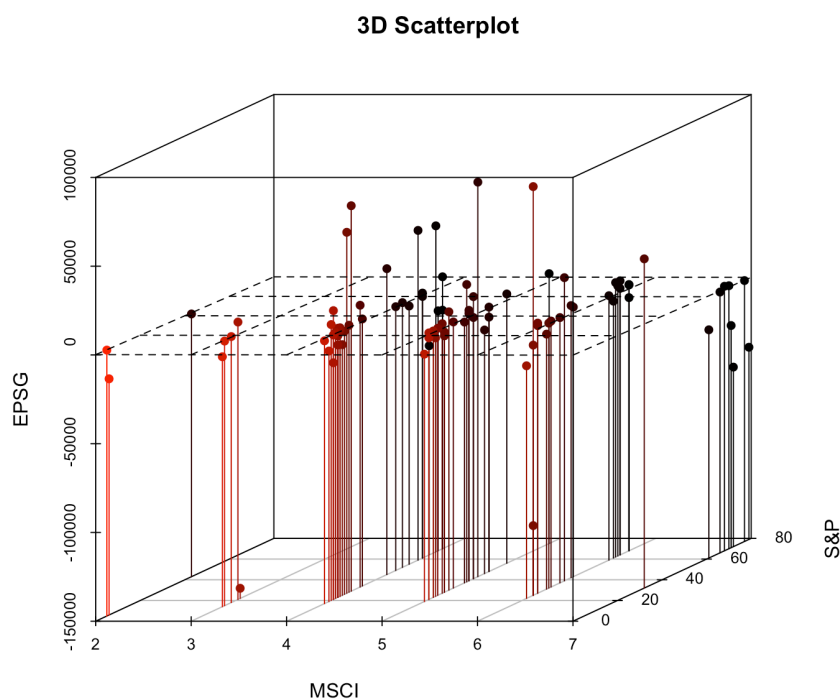


Figure 7

Regression Results for the Return on Equity over the Morgan Stanley Capital International rating

```
> modelROE <- lm(ROE ~ MSCI + factor(Sector...5) + GTI + `S&P` + factor(Year) , data = sgxnew1)
> summary(modelROE)
```

Call:
lm(formula = ROE ~ MSCI + factor(Sector...5) + GTI + `S&P` + factor(Year), data = sgxnew1)

Residuals:

Min	1Q	Median	3Q	Max
-270.752	-30.743	1.087	43.204	201.297

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	13.897310	61.347567	0.227	0.82161
MSCI	20.832975	13.279830	1.569	0.12234
factor(Sector...5)Electricity Gas Steam and Air	99.452500	97.460303	1.020	0.31191
factor(Sector...5)Financial and Insurance activities	142.307224	57.411131	2.479	0.01622 *
factor(Sector...5)Information and Communication Services	22.517368	65.196971	0.345	0.73111
factor(Sector...5)Manufacturing	43.378907	49.314917	0.880	0.38282
factor(Sector...5)Professional Scientific and Technology	198.423102	63.970448	3.102	0.00301 **
factor(Sector...5)Real Estate activities	-6.459773	49.598568	-0.130	0.89684
factor(Sector...5)Transportation and Storage	-83.734966	56.251135	-1.489	0.14221
GTI	-0.004393	0.144711	-0.030	0.97589
`S&P`	-1.718898	0.717864	-2.394	0.02002 *
factor(Year)2020	-30.736317	33.127957	-0.928	0.35749
factor(Year)2021	-28.025434	32.069247	-0.874	0.38590
factor(Year)2022	11.967643	30.292403	0.395	0.69429

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 81.79 on 56 degrees of freedom
(390 observations deleted due to missingness)
Multiple R-squared: 0.517, Adjusted R-squared: 0.4048
F-statistic: 4.61 on 13 and 56 DF, p-value: 2.604e-05

Figure 8

Regression Results for the Earnings per Share Growth over the Morgan Stanley Capital International rating

```
> modelEPSG <- lm(EPSG ~ MSCI + factor(Sector...5) + GTI + `S&P` + factor(Year) , data = sgxnew1)
> summary(modelEPSG)
```

Call:
lm(formula = EPSG ~ MSCI + factor(Sector...5) + GTI + `S&P` + factor(Year), data = sgxnew1)

Residuals:

Min	1Q	Median	3Q	Max
-98525	-5148	-249	5147	83287

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	22009.68	17492.21	1.258	0.2135
MSCI	-7163.45	3786.52	-1.892	0.0637 .
factor(Sector...5)Electricity Gas Steam and Air	18541.19	27789.15	0.667	0.5074
factor(Sector...5)Financial and Insurance activities	195.03	16369.81	0.012	0.9905
factor(Sector...5)Information and Communication Services	-4466.85	18589.81	-0.240	0.8110
factor(Sector...5)Manufacturing	-4404.81	14061.31	-0.313	0.7552
factor(Sector...5)Professional Scientific and Technology	1206.36	18240.08	0.066	0.9475
factor(Sector...5)Real Estate activities	-5442.97	14142.19	-0.385	0.7018
factor(Sector...5)Transportation and Storage	16436.54	16039.05	1.025	0.3099
GTI	50.92	41.26	1.234	0.2223
`S&P`	56.50	204.69	0.276	0.7835
factor(Year)2020	-5473.71	9445.87	-0.579	0.5646
factor(Year)2021	5409.09	9144.00	0.592	0.5565
factor(Year)2022	6182.88	8637.36	0.716	0.4771

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 23320 on 56 degrees of freedom
(390 observations deleted due to missingness)
Multiple R-squared: 0.1621, Adjusted R-squared: -0.0324
F-statistic: 0.8334 on 13 and 56 DF, p-value: 0.624

Figure 9

Regression Results for the NPMG over the Morgan Stanley Capital International rating

```
> summary(modelNPMG)
```

Call:
lm(formula = NPMG ~ MSCI + factor(Sector...5) + GTI + `S&P` +
factor(Year), data = sgxoutliers)

Residuals:

	Min	1Q	Median	3Q	Max
	-186155	-45707	5224	23633	795359

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	37234.2	101892.5	0.365	0.7164
MSCI	-15313.5	22475.3	-0.681	0.4989
factor(Sector...5)Electricity Gas Steam and Air	98885.8	159200.9	0.621	0.5374
factor(Sector...5)Financial and Insurance activities	62265.4	111259.2	0.560	0.5783
factor(Sector...5)Information and Communication Services	39909.4	106447.4	0.375	0.7094
factor(Sector...5)Manufacturing	2367.1	80659.9	0.029	0.9767
factor(Sector...5)Professional Scientific and Technology	8646.0	104301.7	0.083	0.9343
factor(Sector...5)Real Estate activities	35323.9	80927.4	0.436	0.6644
factor(Sector...5)Transportation and Storage	205856.7	91793.4	2.243	0.0296 *
GTI	-143.6	237.1	-0.606	0.5477
`S&P`	605.5	1306.4	0.463	0.6451
factor(Year)2020	2131.7	58949.9	0.036	0.9713
factor(Year)2021	81531.7	56723.6	1.437	0.1571
factor(Year)2022	3360.7	53453.0	0.063	0.9501

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 133200 on 48 degrees of freedom
(398 observations deleted due to missingness)
Multiple R-squared: 0.2265, Adjusted R-squared: 0.01695
F-statistic: 1.081 on 13 and 48 DF, p-value: 0.3972

Figure 10

Regression Results for the Revenue Growth over the Morgan Stanley Capital International rating

```
> summary(modelRG)
```

Call:
lm(formula = RG ~ MSCI + factor(Sector...5) + GTI + `S&P` + factor(Year),
data = sgxoutliers)

Residuals:

	Min	1Q	Median	3Q	Max
	-9546.3	-1294.7	-79.2	1299.3	12677.6

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	1989.733	2744.192	0.725	0.472
MSCI	-160.118	605.311	-0.265	0.793
factor(Sector...5)Electricity Gas Steam and Air	-1309.227	4287.636	-0.305	0.761
factor(Sector...5)Financial and Insurance activities	-2433.804	2996.457	-0.812	0.421
factor(Sector...5)Information and Communication Services	-3306.215	2866.867	-1.153	0.255
factor(Sector...5)Manufacturing	-2387.260	2172.350	-1.099	0.277
factor(Sector...5)Professional Scientific and Technology	-2265.676	2809.076	-0.807	0.424
factor(Sector...5)Real Estate activities	-2352.856	2179.555	-1.080	0.286
factor(Sector...5)Transportation and Storage	-1953.685	2472.202	-0.790	0.433
GTI	4.247	6.386	0.665	0.509
`S&P`	-3.794	35.185	-0.108	0.915
factor(Year)2020	-422.182	1587.651	-0.266	0.791
factor(Year)2021	2247.066	1527.692	1.471	0.148
factor(Year)2022	1403.171	1439.610	0.975	0.335

Residual standard error: 3587 on 48 degrees of freedom
(398 observations deleted due to missingness)
Multiple R-squared: 0.122, Adjusted R-squared: -0.1158
F-statistic: 0.513 on 13 and 48 DF, p-value: 0.9054

Figure 11

Regression Results for the Morgan Stanley Capital International rating over Financial performance indicators

```
> modelMSCI <- lm(MSCI ~ ROE + factor(Sector...5) + RG + NPMG + OMG + EPSG + factor(Year) , data = sgxoutliers)
>
> summary(modelMSCI)
```

Call:
lm(formula = MSCI ~ ROE + factor(Sector...5) + RG + NPMG + OMG + EPSG + factor(Year), data = sgxoutliers)

Residuals:

Min	1Q	Median	3Q	Max
-2.3321	-0.7184	-0.1906	0.6279	2.7272

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	3.721e+00	6.198e-01	6.003	3e-08 ***
ROE	1.493e-03	1.305e-03	1.144	0.2552
factor(Sector...5)Electricity Gas Steam and Air	7.708e-01	7.446e-01	1.035	0.3030
factor(Sector...5)Financial and Insurance activities	1.394e+00	6.947e-01	2.007	0.0474 *
factor(Sector...5)Health and Social Services	2.054e-01	8.086e-01	0.254	0.8000
factor(Sector...5)Information and Communication Services	1.531e+00	7.467e-01	2.050	0.0430 *
factor(Sector...5)Manufacturing	4.819e-01	6.330e-01	0.761	0.4483
factor(Sector...5)Professional Scientific and Technology	-6.076e-01	7.223e-01	-0.841	0.4022
factor(Sector...5)Real Estate activities	6.626e-01	5.996e-01	1.105	0.2717
factor(Sector...5)Transportation and Storage	1.440e+00	7.447e-01	1.934	0.0559 .
factor(Sector...5)Wholesale and Retail Trade	1.404e+00	1.060e+00	1.324	0.1885
RG	-1.396e-05	4.047e-05	-0.345	0.7308
NPMG	8.620e-06	5.360e-06	1.608	0.1109
OMG	2.318e-06	1.435e-06	1.615	0.1094
EPSG	-7.880e-06	5.277e-06	-1.493	0.1384
factor(Year)2020	4.249e-01	3.656e-01	1.162	0.2479
factor(Year)2021	5.220e-01	3.764e-01	1.387	0.1685
factor(Year)2022	-2.073e-02	3.194e-01	-0.065	0.9484

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.141 on 102 degrees of freedom
(340 observations deleted due to missingness)
Multiple R-squared: 0.2435, Adjusted R-squared: 0.1175
F-statistic: 1.932 on 17 and 102 DF, p-value: 0.02306

Figure 12

Regression Results for the S&P over Financial performance indicators

```
> modelSP <- lm('S&P' ~ ROE + factor(Sector...5) + RG + NPMG + OMG + EPSG + factor(Year) , data = sgxoutliers)
> summary(modelSP)
```

Call:
lm(formula = 'S&P' ~ ROE + factor(Sector...5) + RG + NPMG + OMG + EPSG + factor(Year), data = sgxoutliers)

Residuals:

Min	1Q	Median	3Q	Max
-31.299	-11.521	-3.849	8.488	57.688

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	2.261e+01	9.862e+00	2.293	0.0234 *
ROE	-1.969e-02	1.393e-02	-1.414	0.1598
factor(Sector...5)Agriculture and Fishing	-1.187e+01	1.638e+01	-0.725	0.4698
factor(Sector...5)Electricity Gas Steam and Air	5.742e+00	1.451e+01	0.396	0.6930
factor(Sector...5)Financial and Insurance activities	2.759e+01	1.168e+01	2.363	0.0196 *
factor(Sector...5)Health and Social Services	1.664e+00	1.178e+01	0.141	0.8878
factor(Sector...5)Information and Communication Services	2.120e+01	1.338e+01	1.584	0.1155
factor(Sector...5)Manufacturing	1.562e+01	9.976e+00	1.566	0.1196
factor(Sector...5)Mining and Quarrying	-2.671e-01	2.194e+01	-0.012	0.9903
factor(Sector...5)Other service activities	-1.777e+01	2.117e+01	-0.839	0.4028
factor(Sector...5)Professional Scientific and Technology	3.107e+00	1.203e+01	0.258	0.7967
factor(Sector...5)Real Estate activities	8.181e-01	9.745e+00	0.084	0.9332
factor(Sector...5)Transportation and Storage	1.173e+01	1.085e+01	1.081	0.2816
factor(Sector...5)Water Supply	-1.177e+01	2.123e+01	-0.554	0.5802
factor(Sector...5)Wholesale and Retail Trade	-1.058e+01	1.485e+01	-0.713	0.4774
RG	1.612e-04	5.368e-04	0.300	0.7644
NPMG	-8.554e-06	8.607e-05	-0.099	0.9210
OMG	-3.093e-06	2.408e-05	-0.128	0.8980
EPSG	-4.504e-05	5.693e-05	-0.791	0.4302
factor(Year)2020	1.984e+00	4.743e+00	0.418	0.6763
factor(Year)2021	3.577e+00	4.466e+00	0.801	0.4246
factor(Year)2022	9.782e+00	4.753e+00	2.058	0.0415 *

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 18.74 on 135 degrees of freedom
(303 observations deleted due to missingness)
Multiple R-squared: 0.236, Adjusted R-squared: 0.1172
F-statistic: 1.986 on 21 and 135 DF, p-value: 0.01034

Figure 13

Regression Results for the ROIC over different Environmental, Social and Governance ratings

```
> modelROIC <- lm(ROIC ~ factor(Sector...5) + FTSE + Sustainalytics + MSCI + GTI, data = sgxoutliers)
> summary(modelROIC)

Call:
lm(formula = ROIC ~ factor(Sector...5) + FTSE + Sustainalytics +
    MSCI + GTI, data = sgxoutliers)

Residuals:
    Min       1Q   Median       3Q      Max
-1.296e+09 -1.797e+08  0.000e+00  1.542e+08  1.165e+09

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)   -1.419e+09  1.200e+09  -1.182   0.2545
factor(Sector...5)Electricity Gas Steam and Air  1.967e+09  1.056e+09   1.864   0.0808 .
factor(Sector...5)Financial and Insurance activities  1.375e+09  8.003e+08   1.718   0.1050
factor(Sector...5)Information and Communication Services  7.022e+08  8.193e+08   0.857   0.4041
factor(Sector...5)Manufacturing  1.417e+09  7.375e+08   1.922   0.0726 .
factor(Sector...5)Professional Scientific and Technology  2.072e+09  1.005e+09   2.061   0.0559 .
factor(Sector...5)Real Estate activities  8.591e+08  7.406e+08   1.160   0.2631
factor(Sector...5)Transportation and Storage  6.498e+08  7.827e+08   0.830   0.4186
factor(Sector...5)Wholesale and Retail Trade  2.195e+09  8.369e+08   2.623   0.0185 *
FTSE          -4.760e+06  1.505e+07  -0.316   0.7558
Sustainalytics  3.882e+08  2.126e+08   1.826   0.0866 .
MSCI           8.985e+07  1.381e+08   0.650   0.5247
GTI           -3.247e+06  1.604e+06  -2.024   0.0600 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 627100000 on 16 degrees of freedom
(431 observations deleted due to missingness)
Multiple R-squared:  0.5686,    Adjusted R-squared:  0.245
F-statistic: 1.757 on 12 and 16 DF,  p-value: 0.145
```

Figure 14

Regression Results for the EBITDA over different Environmental, Social and Governance ratings

```
> modelEBITDA <- lm(EBITDA ~ factor(Sector...5) + FTSE + Sustainalytics + MSCI + GTI, data = sgxoutliers)
> > summary(modelEBITDA)
Error: unexpected '>' in ">"
> summary(modelEBITDA)

Call:
lm(formula = EBITDA ~ factor(Sector...5) + FTSE + Sustainalytics +
    MSCI + GTI, data = sgxoutliers)

Residuals:
    Min       1Q   Median       3Q      Max
-8.442e+11 -9.955e+10  0.000e+00  7.621e+10  1.494e+12

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)   8.587e+11  1.028e+12   0.836   0.417
factor(Sector...5)Electricity Gas Steam and Air -7.170e+09  8.659e+11  -0.008   0.994
factor(Sector...5)Financial and Insurance activities  1.734e+11  7.034e+11   0.247   0.809
factor(Sector...5)Information and Communication Services  1.040e+11  6.875e+11   0.151   0.882
factor(Sector...5)Manufacturing -1.060e+11  5.962e+11  -0.178   0.861
factor(Sector...5)Professional Scientific and Technology -1.489e+11  8.334e+11  -0.179   0.861
factor(Sector...5)Real Estate activities  1.630e+11  6.212e+11   0.262   0.797
factor(Sector...5)Transportation and Storage  1.071e+12  6.566e+11   1.631   0.125
factor(Sector...5)Wholesale and Retail Trade -1.429e+11  6.998e+11  -0.204   0.841
FTSE          6.630e+09  1.769e+10   0.375   0.713
Sustainalytics -1.386e+11  1.688e+11  -0.821   0.425
MSCI          -9.180e+10  1.187e+11  -0.773   0.452
GTI           -7.881e+08  1.282e+09  -0.615   0.549

Residual standard error: 5.292e+11 on 14 degrees of freedom
(433 observations deleted due to missingness)
Multiple R-squared:  0.4068,    Adjusted R-squared: -0.1016
F-statistic: 0.8002 on 12 and 14 DF,  p-value: 0.6469
```

Figure 15

Regression Results for the ROA over different Environmental, Social and Governance ratings

```
> summary(modelROA)

Call:
lm(formula = ROA ~ factor(Sector...5) + FTSE + Sustainalytics +
    MSCI + GTI, data = sgxoutliers)

Residuals:
    Min       1Q   Median       3Q      Max
-943395025 -173046922      0 105531371 1070276522

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)   -665833561  919207135  -0.724   0.4787
factor(Sector...5)Electricity Gas Steam and Air  1135013678  817784385   1.388   0.1831
factor(Sector...5)Financial and Insurance activities  604048344  625392005   0.966   0.3476
factor(Sector...5)Information and Communication Services  368485022  651817568   0.565   0.5792
factor(Sector...5)Manufacturing  710710164  564196830   1.260   0.2248
factor(Sector...5)Professional Scientific and Technology  447323713  786500051   0.569   0.5770
factor(Sector...5)Real Estate activities  242770929  589392703   0.412   0.6856
factor(Sector...5)Transportation and Storage  28221007  623786361   0.045   0.9644
factor(Sector...5)Wholesale and Retail Trade  1376261378  664740126   2.070   0.0540
FTSE          -1305930    11940625  -0.109   0.9142
Sustainalytics 320761375  154144882   2.081   0.0529
MSCI          -2923965    110867804  -0.026   0.9793
GTI           -1798389     1183933  -1.519   0.1471
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 503300000 on 17 degrees of freedom
(430 observations deleted due to missingness)
Multiple R-squared:  0.5227,    Adjusted R-squared:  0.1857
F-statistic: 1.551 on 12 and 17 DF,  p-value: 0.1985
```

Figure 16

Regression Results for the DPS over different Environmental, Social and Governance ratings

```
> modelDPS <- lm(DPS ~ factor(Sector...5) + FTSE + Sustainalytics + MSCI + GTI, data = sgxoutliers)
> summary(modelDPS)

Call:
lm(formula = DPS ~ factor(Sector...5) + FTSE + Sustainalytics +
    MSCI + GTI, data = sgxoutliers)

Residuals:
    Min       1Q   Median       3Q      Max
-3.984e+09 -1.060e+09 -5.088e+08  1.047e+09  6.931e+09

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)   4.634e+09  6.018e+09   0.770   0.4550
factor(Sector...5)Financial and Insurance activities  1.505e+09  3.844e+09   0.392   0.7017
factor(Sector...5)Information and Communication Services  2.120e+09  4.391e+09   0.483   0.6372
factor(Sector...5)Manufacturing  1.737e+09  3.941e+09   0.441   0.6666
factor(Sector...5)Professional Scientific and Technology  1.298e+09  4.773e+09   0.272   0.7900
factor(Sector...5)Real Estate activities  3.171e+09  4.167e+09   0.761   0.4602
factor(Sector...5)Transportation and Storage  6.584e+09  4.600e+09   1.431   0.1759
factor(Sector...5)Wholesale and Retail Trade  7.891e+09  4.268e+09   1.849   0.0874
FTSE          -5.718e+07  8.057e+07  -0.710   0.4905
Sustainalytics -1.131e+09  1.074e+09  -1.053   0.3117
MSCI          -9.580e+08  8.024e+08  -1.194   0.2539
GTI           1.769e+07  9.760e+06   1.812   0.0931
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 3.301e+09 on 13 degrees of freedom
(435 observations deleted due to missingness)
Multiple R-squared:  0.4521,    Adjusted R-squared:  -0.01142
F-statistic: 0.9754 on 11 and 13 DF,  p-value: 0.5103
```