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ESG Performance Impact on Firm's Investment Attractiveness
An Empirical Study for the European Energy Sector

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Abstract

This thesis highlights the ESG impact on firm’s performance. It is based on a sample of dataset for the Energy and Technology Sectors in Europe and the Electrical Vehicle Industry on a global scope. A specific industry analysis is based on two parts. Firstly, a Multiple Linear Regression analysis model is developed, where a significant positive correlation between ESG and Tobin’s q is observed for the energy and technology sector, while the EV industry shows a significant negative relation. Secondly, portfolio analysis was conducted through the analysis of the risk-return relationship, where the CAPM model is deployed to assess excess return compared to the market.

Keywords: ESG Investing, Tobin’s Q, Stock Returns, Sustainable Investing, Valuation

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1. Introduction

ESG investing is becoming an increasingly important topic worldwide. Companies are showing increased awareness and concern towards improving their sustainability practices, as risks associated with the absence of these practices could have a material impact on their long-term success. Not only companies are increasing the sustainability aspects of their businesses, but also investors are integrating ESG concerns in their investment plans. This trend has been gaining increased relevance through the years, where global efforts are being made to raise awareness and promote sustainability across the corporate world. The testimonies of Principle for Responsible Investment (PRI) are higher by 28% (2020) and ESG investing is expected to grow by 84% to reach $33.9T in 2026 (Forbes 2022). ESG Assets Under Management (AUM) CAGR is 12.9% with an expected increase by 53% in Europe and reach $10.5T in the United States by 2026 (PWC 2022).

Numerous regulations are set by the formal institutions in which companies operate such as governments that impose taxes and penalties to contribute to the social welfare of nations and the planet, rating agencies that classify companies according to their ESG scores with low ratings that could convey a negative message to the market and investors about the erratic nature of firms and limit the attractiveness of investing in such sectors and industries. Annual flows to sustainable funds from investment management firms such as Vanguard, American Century, Brown Advisory and BlackRock, Global Sustainable Funds being dominated by Europe with 83% then followed by the US with 11% then the rest of the world with 2% which shows the investor's high interest and demand for the ESG products (Morningstar 2022).

Additionally, various initiatives are being undertaken to foster sustainable development, with significant contributions from intergovernmental organizations, policy changes, financial institutions, and global standards bodies. The United Nations has established the Sustainable Development Goals (SDGs), a blueprint for achieving a more sustainable future. On the policy front, the EU has advanced initiatives such as the European Green Deal and the Eighth Environment Action Programme (8EAP), aiming to make Europe the world's first climate-neutral continent by 2050. In the realm of finance, the introduction of the Sustainable Finance Disclosure Regulation (SFDR) has brought about significant changes by necessitating greater transparency in how financial market participants integrate ESG risks into their investment decisions and advisory processes. To further investigate the ESG relationship with a firm's investment attractiveness, this thesis focus on the Energy and Technology sectors in Europe, and Electrical Vehicle industry worldwide. This relationship is analyzed through two approaches: a Multiple Linear Regression and the comparison of portfolios built based on ESG scores, where their performance is assessed through a risk-return relationship and the Capital Asset Pricing Model.

2. Background

2.1. The Concept of Sustainable Development

John Elkington, an expert, and pioneer of the corporate sustainability movement, highlighted the diverse range of interpretations and meanings associated with the concept of *sustainability*, describing it as a *2+2 = 5, or even 50, game* (1997). The term sustainable development was globally recognized at the United Nations Conference on The Environment (1972), marking the first major attempt to align economic growth and environmental sustainability, two terms that were often perceived as conflicting. (Caldwell 1984, cited by Purvis et al. 2019, 3). This conference led to the publication of the Report of The World Commission on Environment And Development: Our Common Future. This report described sustainable development as the development that meets the current necessities, without compromising the development of future generations (WCED 1987, 8). This (broad) concept of sustainability addresses the environmental consequences of economic activities (Erlich and Erlich 1991, cited by Carter et.

al. 2008), preserving non-renewable resources, also ensuring that fundamental human necessities are met (Carter et. al. 2008). The WCED set Economic and Social goals that shall be defined accordingly in all nations in a coherent manner, with a comprehensive strategic framework to achieve it (WCED 1987, 41). The institutionalization of sustainable development gained momentum through the ‘Rio Process,’ with the issuance of the ‘Rio Declaration,’ “comprising twenty-seven principles intended to serve as a guide for future *sustainable development.* The plan to implement these principles is described in “Agenda 21”. (Purvis et al. 2019). Sustainable development was rigorously discussed by Daly (1996), alongside other authors, who questioned the concept on its capability to offer a clear direction for organizations on how to recognize present and upcoming needs and how to choose suitable technologies and resources to meet them (Gimenez et al. 2012).

2.1.1. Classical and Neoclassical Economics Contributions

The concept of the *stationary state* was first introduced by classical economists during the 18th and 19th centuries. In this stationary state, the economy would produce just enough to meet the basic necessities of the people, with any surplus going to the landowners as rent. With wages set at the subsistence level, there would be no profits left over for the capitalists, who would have no incentive to invest in further growth, constraining economic expansion (Daly and Farley 2011).

Classical economists recognized this as the (natural) limit of human progress and well-being, whereas Mill “welcomed” it, believing that it could provide a higher quality of life for people, if there was continued progress in the “Art of living,” rather than just in the “Art of getting on” (Mill 1848). Mill argued that the surplus generated by the economy could be allocated in a manner that prioritizes social and environmental considerations, challenging the idea that the laws of governing production rigidly determine distribution, suggesting alternative models as being possible and desirable, and emphasized the importance of institutional arrangements to sustainable development, through the regulation of land use and the promotion of public goods (O'Connor and Spash 1999).

The primary contrast between Mill's approach and neoclassical economics about sustainable development is the underlying assumptions about economic growth and the environment.

Neoclassical economic theory starts with "non-physical parameters taken as givens – technology, preferences and the distribution of income," where the physical magnitudes must adjust (Daly 1996). The neoclassical economics theory assumes that markets are efficient mechanisms in allocating resources and argues that as economies grow, the adoption of cleaner technologies and more efficient resource use will enable improved environmental conditions. Thus, sustainable development can be achieved through economic growth, fueled by technological advances (Pearce, Markandya and Barbier 1989).

Daly contends that while the neoclassic theory contributes to the understanding of prices and markets through its theory of value, it may neglect the significance of physical factors, pushing the physical reality "too far into the background" (furthered addressed in 2.1.2.2.).

2.1.2. The Triple Bottom Line: Elkington's Contribution

Elkington (1997) proposed and developed a framework that seeks to address and balance three interconnected 'components' (Du Pisani 2006) that are fundamental to *sustainable development*. This framework, differing from traditional reporting ones (Slaper and Hall 2011), operates from a microeconomic perspective. To achieve sustainable development, Elkington argues that a firm must address social equity, environmental justice, and business ethics, and suggests that business leaders and executives conduct a sustainability audit, a 'necessary, yet challenging,' way to measure progress against sustainability's TBL (1997, 72).

2.1.2.1. The Economic Bottom Line and Eco-efficiency

Elkington starts by acknowledging the traditional bottom-line approach in accounting, which focuses on a company's profit. Traditionally comprised of Physical and Financial Capital, the concept of Economic Capital also accounts for Human Capital, and Intellectual Capital (Edvinsson and Malone 1997, Stewart 1997). The first Shear Zone of the model, between the economic and environmental agendas introduces the concept of eco-efficiency, and the need to achieve *Factor 4* (75%) and *Factor 10* (90%) reductions, sustainability concepts aimed at enhancing economic growth while minimizing environmental impacts.

2.1.2.2. The Environmental Bottom Line and the Concept of Natural Capital

According to Elkington (1997), during the 70's, there has been a shift towards a greater focus on the environmental agenda. The author argues that the first step for a corporation to achieve environmental sustainability is the understanding of the concept of *natural capital*, the 'complex and evolving' notion of the natural wealth supporting ecosystems. Daly and Farley (2011) describe it as the "Earth's natural resources and ecosystems that yield valuable goods and services to people." Costanza et al. (1997), developed a framework to estimate the economic value of seventeen different ecosystem services across sixteen biomes, ranging from climate regulation and water supply to pollination and recreation. The total value of these ecosystems is estimated between $16 and $54 trillion per year (in 1994 $USD). This figure is significantly larger than the world GNP (~$25 trillion) (United Nations, 1995), which highlights the 'immense' value of natural capital and the importance of preserving ecosystems for future generations. Furthermore, Elkington suggests a combination of financial indicators, as well as non-financial, to quantify the environmental bottom line. Financial metrics encompass patterns in adherence to law, allocations for penalties, legal expenditures, and costs related to landscaping, restoration, and abandonment. Non-financial metrics consider public complaints, energy, materials and water usage at manufacturing locations, polluting emissions, environmental threats, and waste production.

2.1.2.3. The Social Bottom Line and the Concept of Social Capital

According to Fukuyama (1995), Social Capital represents the ability for people to collaborate towards shared objectives within groups and organizations. Elkington argues that the degree of trust established between a corporation or industry and their external stakeholders significantly influences long-term sustainability. Therefore, societies with high social capital may be the most innovative (Elkington 1997, Fukuyama 1995). Elkington identifies the main concerns for which performance indicators have been developed, such as minority employment, irresponsible marketing and wages, and working conditions.

Contrary to this perspective, Friedman (1970), Nobel laureate in economics, argues that regardless of a manager's objective – be it profit maximization or establishing an institution for an "eleemosynary purpose", his foremost obligation is to the owners of the organization, rather than addressing (in the capacity of a businessperson, instead of as a principal) external social issues. Having "a social responsibility" as a corporate executive, implies acting in ways that may not align with the employer's best interests, as refraining from increasing prices to mitigate inflation or investing in pollution reduction beyond what is financially advantageous. Friedman (1970) asserts that, in each instance, the corporate executive is spending stakeholders' money. Should the corporate executive allocate these resources in a different manner from the stakeholders' best interests, he is essentially undertaking governmental functions.

Analogously, Friedman shares the skepticism of Adam Smith (1776) regarding the expected benefits that arise from businesses who claim to act for the public good, within the framework of a free market economy.

Despite Elkington's divergent perspective, the author acknowledges the challenges faced by companies, a *complex and political* process, in addressing the social reporting aspect of sustainability. These challenges arise from the absence of a unified framework to comprehend and implement social reporting. The author proposes that the key lies in building upon exemplary models, such as Skandia's "Power of Innovation" report, with "an innovative approach to valuing intellectual and organizational capital," that considers social capital's contributions to value creation and long-term sustainability (Elkington 1997).

2.1.3. Creating Shared Value: Porter and Kramer's Contribution

Porter and Kramer (2011) evidence that business have been adopting an outdated value creation approach, without the acknowledgement of the possible social consequences. The principle of shared value diverts from the traditional CSR redistribution approach, aligning a company's competitiveness with the improvement of its socio-economic responsibilities. Creating shared value is possible through three distinct approaches, reconceptualizing products and markets, revaluating productivity within the value chain, and supporting industry clusters at their locations. The authors argue that creating shared value, discussed in the context of businesses, is equally applicable to governments and non-governmental organizations. Flammer's (2015) study (with the typical literature regress measure of CFP approach (Tobin's Q, ROA, among others, measuring CSR) establishes a causal link CSR and financial performance, supporting Porter and Kramer's CSV framework. Corporate Social Responsibility activities are not only beneficial for society, but also lead to superior financial performance for firms. Flammer's findings suggest that CSR activities significantly impact firm value, increasing its market capitalization and leading to a better long-term financial performance. Critics posit that the strengths of CSV lie in its capacity to elevate social objectives to a strategic level, as a holist framework that debates about "conscious capitalism."

However, CSV's attempt to solve a system-level problem is pointed to be "fundamentally flawed," largely because it remains tethered to the perspective that a company's sole legitimate objective is to generate profits for its shareholders. In effect, the CSV's solution aligns with economic goals, and therefore, can only be upheld by overlooking significant portions of social reality (Crane et al. 2014).

2.1.4. Environmental, Social, and Governance: Financially Quantifying Sustainability

ESG is first coined as a framework for sustainable investing in the "Who Cares Wins: Connecting Financial Markets To A Changing World" Report. ESG investing has transitioned from its early stage to mainstream finance in various OECD reports, with investments reaching $USD 40 trillion (Bloomberg 2021). Sustainable investing assets, from 2016 to 2018, have increased 34%, amounting to $30.7 trillion in developed countries (GSIA 2018). Additionally, by 2019, these assets reached $1.87 trillion in China (China SIF 2019, cited by Boffo 2020). Steinbarth

(2018) argues that ESG practices, when "fit for purpose", can assist financial investors, aiding in risk management while transitioning to more sustainable strategies that focus on the long-term.

Although a relative "consensus" exists regarding the fundamental criteria within the Environmental, Social, and Governance domains, the metrics, methodologies, and weightings used by different rating providers exhibit substantial divergence, resulting in different ESG ratings (OECD 2020, fig. 1 *S&P 500 ratings correlation for different providers*). Such disagreement makes difficult the evaluation of ESG performance and may reduce the incentive to pursue more sustainable practices.

Chatterji et al. (2016) identifies two reasons for the divergence – what providers measure and the consistency of the measurements, termed "theorization" and "commensurability". Berg et al. (2022) findings show that measurement divergence, which authors describe as a circumstance in which rating agencies evaluate the same attribute with different indicators, is the main driver of ESG rating heterogeneity, indicating that disagreements are not solely due to different definitions, but also fundamental differences in underlying data. Furthermore, there is an absence of comparable ESG disclosures by firms, translating into an obstacle to accurately assessing a company's ESG performance on financial returns and societal impacts. Between 2007 and 2015, companies provided only approximately 18% of the recommended SASB disclosure items, according to Christensen et al. 2021 and Grewal et al. 2021. Research conducted by Clarkson, Li, Richardson, and Vasvari (2008) shows that companies with higher environmental performance disclose more information regarding their environmental practices, compared to the companies that have a lower environmental score.

2.1.4.1. An Introduction to ESG Pillars

2.1.4.1.1. Environment

The Environmental pillar represents a critical component in the assessment of an organization's sustainability and ethical performance, referring to its impact on the natural environment. Environmental factors encompass a wide range of issues that pertain to a firm's ecological footprint, resource efficiency, and compliance with environmental regulations. Key metrics within the "E" pillar include GHG Emissions (IPCC 2006), energy consumption (IEA 2022), water utilization, generation of waste (US EPA 2020), biodiversity impact (GRI 2022), environmental compliance, and environmental management systems. The growing importance of the "E" pillar reflects the increasing awareness of environmental challenges and their implications for long-term financial stability and economic growth (Clark, Finer, and Viehs 2015).

2.1.4.1.2. Social

The “S” pillar represents a company’s strategy in managing its relationships with its employees, customers, suppliers, and the community (Goss and Roberts 2011). Social metrics include equitable labor practices, health and safety measures for the employees, principles concerning human rights and diversity and inclusion efforts (Ionannou and Serafeim 2012), supplier social and environmental assessments, responsible sourcing practices and policies addressing force labor and child labor issues, customer satisfaction scores and community investment programs. According to Servaes and Tamayo (2013), it can significantly influence a company’s reputation, stakeholders’ relations, and financial performance. According to Jo and Horjoto (2011), firms with higher CSR performance have increased firm value, attributed to a better corporate governance. Moreover, they also have more access to investment, as it builds stakeholder trust (Cheng, Ionannou and Serafeim 2014).

2.1.4.1.3. Governance

The extensive and comprehensive study of corporate governance has demonstrated the significance of good practices in increasing shareholder value (Shleifer and Vishny 1997, Dimson, Karakas, and Li 2015). Governance metrics include board composition, audit and internal controls, executive compensation, shareholder rights, ethical practices and compliance, and risk management (Bloomberg Terminal ESG Data, CFA Institute, GRI, MSCI).

2.2. Sustainability and Investing

2.2.1. Sustainable Investing Drivers

Sustainable finance is the integration of ESG concerns in the investment process. There is an ongoing debate whether sustainable investing compromises short term returns for the sake of long-term sustainability, or whether companies and investors who are aware of ESG concerns can generate superior returns over the long term. However, under such pressure for change, dictated by climate change and social improvement, investors alongside policymakers are responsive to the risks imposed by this emergent threat (Silvola and Landau 2021). Investments in sustainable assets are increasing yearly across all regions of the globe, having achieved a value of 35,3 trillion dollars in 2020, which represents a growth of 15%, compared to 2018, and 55%, compared to 2016. The regions who contributed the most to this value are Europe and the US (GSIA 2020).

The 2007-2008 crisis has shown how financial markets are vulnerable to weak corporate governance and poor risk management practices (Escrig-Olmedo et al. 2019). In addition, increased evidence has shown that climate change presents a significant risk to economic activity and the well-functioning of financial markets. These two factors combined have led private and public organizations to be more aware of sustainable investing and has increased demand for socially responsible investments (Martini 2021). Furthermore, the covid-19 epidemic has further boosted the demand for SRI driven by two forces: investors preferences, there is a shift from investors to take into consideration companies who are aware and committed to tackle ESG threats, as opposed to only focusing on financial performance; Regulation, many governments are pushing regulatory incentives to increase investment on ESG driven companies, for instance the European Green Deal. (Taylor and Collins 2022).

Regarding performance, literature presents divergent conclusions on the relationship between the implementation of sustainable practices within a firm and its financial performance, stemming from the use of different methodologies used when assessing this relationship (Boffo and Patalano 2020; Nirino et al. 2022). However, according to Silvola and Landau (2021), firms with strong ESG disclosure and practices have several advantages when compared to the competition. Namely: a more loyal customer base, even in recession periods; easier access to funding, with lower costs associated; higher valuations in public listings and, over the long term, sustainable companies can generate good returns with a lower level of risk. In addition, effective risk management can only be achieved with the integration of ESG factor, since the materialization of a risk associated with one of the pillars could have a significant impact on profitability.

Albeit mixed evidence on the performance of ESG related investments, policy makers are pushing regulations to promote sustainable investing in the world of finance (Taylor and Collins 2022). One of the earliest international initiatives to promote sustainability was the creation of the Principles for Responsible Investment in 2006, which established six principles for sustainable investing and incorporating ESG analysis in investment decisions (PRI 2023). In 2019, more than three thousand institutional investors had signed this agreement, along with an increase of eighty trillion dollars of assets under management since its beginning (Nirino et al. 2022). More recently, with the Paris Agreement on Climate Change in 2015, the 17 Sustainable Development Goals (SDGs) were introduced. The aim of this initiative is to raise awareness and call to action companies and governments, in a global alliance, to improve aspects addressed in seventeen specific goals, for instance, end poverty, promote quality education or improving gender equality (UN 2022). Even though not very material for the delineation of investment strategies for investors, it signaled a global effort on addressing and tackling sustainability concerns.

Linked to SDGs and to further consolidate the 2030 Agenda for Sustainable Investment, the EU Taxonomy was developed in 2020. It consists of promoting a framework that standardizes assessment of sustainability factors in companies to improve sustainable investment through the increase reliability of information as well as ease of comparison between companies (Radley-Gardner, Beale, and Zimmermann 2016). In this way, ESG information is standardized, being more accurate, which improves investors' confidence on the subject and prevents investors to fall into the pitfall of greenwashing.

With the proliferation of sustainable investing, different strategies were developed to approach ESG factors when making investment decisions.

2.2.2. Investment Strategies

The approach to be followed differs for each type of investor, Silvola and Landau (2022) define two types of investors when addressing sustainable investment: quality investor and growth investor. The main difference between these two is their risk appetite. On the one hand, a quality investor prefers to invest in companies with superior ESG performance, thus exposed to less risk, being able to achieve good and stable returns. On the other hand, a growth investor undertakes a riskier strategy that relies on ESG arbitrage, assessing companies who are undervalued in terms of ESG and through active participation in the company seek an improvement in the value of the company, thus achieving superior returns at a greater risk.

There are many different strategies each investor can take, literature defines seven approaches that are most used in sustainable investing: positive and negative screening, tilting, ESG integration, active engagement and shareholder action, screening based on norms, impact investing and sustainability themed investing. (Boffo and Patalano 2022; GSIA 2020; EUROSIF 2023).

Screening and Tilting

Negative screening consists of avoiding certain companies or sectors related with significant ESG risk. It was one of the earliest strategies to be developed and it consisted primarily in the exclusion of securities from the sin industry, companies from the alcohol, tobacco, gambling, and weapon sectors were excluded from the investor's portfolio (Boffo and Patalano 2022). Nowadays, negative screening was extended to the exclusion of firms which present low ESG scores (Bernow, Klempner and Magnim 2017). Hence, with the increased availability and transparency of ESG scores, it remains an incredibly significant strategy, being the second most used strategy in the last years (GSIA 2020).

Positive screening, as opposed to negative screening, is defined by the preference and integration of firms with superior ESG scores compared to industry peers. Best in class is a specific strategy that consists of choosing the leading companies in terms of sustainability in an industry. (Bernow, Klempner and Magnim 2017, Nakajima et al. 2021).

Portfolio tilting derives from the screening strategy, but instead of excluding companies from investment portfolios, investors attribute portfolio's weights based on ESG performance (Boffo and Patalano 2020). Higher rated companies are overweighted in the portfolio, while lower rated companies are underweighted.

According to Boffo and Patalano (2020**)**, these methods could sometimes prove inefficient. By excluding stocks from bad sectors, one could exclude companies that have great sustainability aspects. For instance, in the energy sector and tobacco sector, the top 20% of firms in terms of sustainable practices score higher than the average MSCI World Index, based on ESG scores. Another factor to have in mind is that scores are developed according to the peer industry. In this sense, a company from a green sector might have a lower score compared to a company from a bad sector, nonetheless, this does not imply that the company from the green sector is less sustainable.

ESG Integration

This strategy is defined as "systematic and explicit inclusion of ESG risks and opportunities in all key aspects of an institutional investors' investment process" (Boffo and Patalano 2022). It consists in assessing quantitively and qualitatively the risk firms are exposed in each dimension of ESG, in this way a more precise risk management practice is achieved. ESG integration is the leading strategy, also presenting the fastest growth, with 25.2 trillion USD assets under management globally (GSIA 2020).

Shareholder Action

A proximity strategy between the investor and the investee that consists of assessing companies who are undervalued in terms of ESG with the opportunity to improve its sustainability aspects. Institutional investors usually acquire a stake in the company that enables them to integrate its board and influence management towards a more sustainable agenda (Bernow, Klempner and Magnim 2017, Silvola Landau 2021). It requires more effort and consistent communication, furthermore, it is a riskier practice but enables great value creation, thus generating superior returns for investors.

Norms-Based Screening

Categorized as a strategy of investing in companies who comply with standards and rules established by international organizations, like UNICEF, UN, and OECD. (Nakajima et al. 2021). It is the fourth most used strategy globally, with Europe leading this type of investment (GSIA 2020)

Impact and Sustainability Themed Investing

Theme investing refers to investments targeted at specific ESG risks, it is focused on the development of sustainability (Eurosif 2023, Nakajima 2021). An example of this strategy is the investment in green bonds, which mobilize debt capital to finance exclusively "green" projects, which has increased significantly since 2013 (OECD 2015).

Impact investing is the investment in companies or funds with the goal of promoting a positive impact in the environment and society aligned with the generation of financial profit (Eurosif 2023). This strategy presents the lowest engagement overall. It differs from philanthropy as investors have a stake within the company, hence expecting a financial return on their investment. This strategy presents the lowest amount invested of all (GSIA 2020), since the returns are expected to be below-to-market.

2.2.3. ESG Analysis Tools

In the past decade, ESG data collection and reporting have been expanding exponentially (Amel-Zadeh and Serafeim, 2017). Most companies release sustainability reports, where environmental, social and governance information is disclosed. In these reports, one could find metrics specific to each letter. For instance, carbon emission and water consumption address environmental issues, while employee compensation and turnover address social issues.

Corporate social responsibility (CSR) ratings are autonomous agencies that evaluate the sustainability of companies. This assessment is made through the collection of information related to each of the ESG pillars (Escrig-Olmedo 2019). This sector has grown rapidly over the last decade, where major players have gained increased relevance: examples of such agencies are Sustainalytics, Bloomberg, MSCI. However, there are differences in the way each agency computes ESG scores, due to: "scope divergence," using categories to assess a dimension of ESG, "measurement divergence," measuring the same categories differently, "weight divergence," attributing different weights to categories (Brandon, Krueger, and Schmidt 2021). Thus, ESG scores frequently differ amongst CSR ratings. Escrig-Olmedo (2019) argues that rating agencies methodologies lack transparency, since these do not specify the criterion used on computing scores, and commensurability, as rating agencies might attribute different weights to the same aspect analyzed when developing the score.

In addition to this, Brandon, Krueger, and Schmidt (2021) demonstrate that differences in scores between rating agencies have a positive impact on a firm's cost of capital. This could be interpreted as differences among rating agencies' scores are viewed by investors as a signal of uncertainty, hence increasing the risk perceived, forcing investors to only hold the stock for an increased return. Due to this positive shock in the rate of return, the company's valuation is driven downwards.

On a final note, there is a relatively low coverage of ESG scores within the market. Twenty-five percent of listed firms in the US have ESG information available on rating agencies, while in EU it is little over 10%. However, when considering the aggregate value of market capitalization, the same companies with ESG information represent 95% and 89% of the total market capitalization, in the US and EU, respectively (Boffo and Patalano 2020). Despite the rapid development of CSR rating industry in the last decade, there are still steps to be taken to make ESG information more accurate and comparable.

2.2.4. Vehicles for Sustainable Investing

Following the strategies used in sustainable investment, it is relevant to understand who the main players are in the universe of sustainable investing. According to GSIA (2020), in 2020, 75% of sustainable investments were executed by institutional investors, while the remaining 25% were attributed to retail investors. Institutional investors consist of asset managers and pension funds. They are characterized for investing on behalf of other investors, whereas retail investors are individuals, hence, liquidity available to institutional investors is far greater. According to a survey conducted by Amel-Zadeh (2019), investors are drawn to sustainable investing for financial reasons, rather than societal. Furthermore, investors believe ESG metrics are better used to assess risk, instead of returns. The financial market is rapidly changing, with this investment vehicles also expand on the concept of sustainability. The four main asset classes available to institutional investors are: stocks, bonds, options, and derivatives, where stocks are the main vehicle of investment.

The focus of this thesis relies on the performance evaluation of stocks based on stock prices, with special focus on returns and risk. To do that, one must understand the underlying assumptions about return, risk and excess return compared to the market, when having an ESG integration approach.

As stated previously, a consensus has not been reached on the relationship between sustainability practices and returns. Following the insights provided by Bernow, Klemoner and Magnin (2017), a correlation between returns and ESG scores is hard to be established, however, through extensive research, it is possible to infer that sustainable investing is uncorrelated with poor returns. A more agreed upon notion is that sustainable investment is closely related to superior risk management. Sassen, Hinze and Hardeck (2016) state that firms with a stronger CSP tend to have inferior total and idiosyncratic risk, while systematic risk, where β is used as a proxy for this metric, is more related with the industry. Furthermore, social scores seem to demonstrate the strongest relation with each of the three types of risk, this implies that a company's reputation with the community is the most significant factor in risk. Environmental issues are a relevant factor in all types of risk for environmentally sensitive sectors, in other sectors this factor only has an impact on idiosyncratic risk.

In terms of abnormal return compared to the market, measured by Jensen's Alpha, there is evidence that lower scored ESG companies tend to have higher positive alphas, whereas higher scored companies tend to have negative alphas. (Boffo and Patalano 2020; Pástor, Stambaugh and Taylor 2021). This is explained by the preference of green securities by investors, which drives up the willingness to pay, reducing the cost of capital.

Bonds are fixed income instruments, it signals an agreement between the borrower and the debtholder, where the borrower pays a fixed interest rate to the debtholder. The appearance of green bonds was a great factor for the development of sustainable investing, since it improves liquidity for impact driven investments. Its popularity has been increasing, and institutional investors have made pledges to increase their holdings in such instruments (OECD 2015). Lastly, options and derivatives are financial contracts used to hedge risk to stocks portfolio, serving as complementary investment vehicle.

2.3.Theoretical Foundation of ESG in Investing

2.3.1. Shareholder Theory

The shareholder theory or the Friedman doctrine was posted in the New York Times by Milton Friedman (1970), it represents a normative theory that aims towards maximizing shareholder's value without imposing the CSR of the firm towards the external environment. He believes that the sole social obligation of the firm is to improve the shareholder's return while complying with the regulatory standards of ethics and law. He also states that it is the duty of the government to ensure the wellbeing of society as they have the expertise and tools to do so and that it is not the company's task as it will have to pay taxes and support different social causes, and this will decrease its profit which is not for the benefit of the owners.

This is a controversial matter when it comes to ESG, as investors and scholars believe that improving social and environmental factors will maximize the shareholder's value in the long term and not doing so is not in their interest as it will be harmful for their reputation and growth. On the other hand, criticism towards this theory highlights that companies prioritize more shareholder value and short-term profit maximization instead of dealing with ESG problems and trying to improve sustainability. Their focus on profiting leads businesses to engage in immoral practices and adopt unsustainable behavior by neglecting the social causes. Some critics towards the theory is that the business needs to take into consideration stakeholder's interest that will benefit the shareholders. This will be further discussed in the next section.

2.3.2. Stakeholder Theory

Considering what is mentioned above and the criticism towards the shareholder theory, good ESG quality can be achieved through not only the shareholder theory but also with the stakeholder theory.

First, stakeholders are classified in two categories, the major or internal stakeholders that are impacted by the firm's actions directly, such as suppliers, clients, shareholders, investors, and employees and the secondary or external stakeholders who are indirectly impacted and are interested in how a company conducts in social business such as the government, local communities, and activist groups. We base our literature on this theory following a chronological order of definitions throughout the years.

First, according to a note on internal business at the Standford Research Institute (1963), a stakeholder is a person essential for the functioning of an organization. Stakeholders were then defined by R. Edward Freeman in 1980s as necessary to the company's survival. It was also defined by Cornell and Shapiro in 1987 and Hill and Jones in 1992 as an exchange relationship between parties. It was then narrowly defined by Clarkson in 1995 as individuals who are voluntary or unvoluntary affected by the firm's risk either through directly investing in the business or as consequences of the firm's activities. This states that no matter the relationship and power the stakeholders exercise over the firm, they have legitimate claims.

Based on the previous definitions, the stakeholder theory highlights that both shareholders' along with stakeholder's interests and values during the decision-making process should be considered as they contribute to businesses' long-term performance.

According to Achaltegger & Burritt in 2005, sustainability management requires the company to engage in the development of the society and economy. This states that sustainability management supports the stakeholder theory through the societal and environmental factors that are interlinked with the company's core activities to satisfy different interests and mutual benefits of each stakeholder to help them create value and profit sharing.

There are several models classifying the stakeholders and relating the ESG factors to them. First, the Salience Model originated by Mitchell, Agle, and Wood that is based on three elements which are the urgency related to time sensitivity and concerns, the legitimacy related to the firm’s activities and procedures and the power. The higher the elements are the more prioritized the stakeholders. The stakeholders in ESG face a high level of urgency regarding the negative effects arising from environmental pollution and social injustice.

In addition to that, environmental organizations and social justice activists face high legitimacy when it comes to society standards concerning climate change, human rights, and social fairness. For the third element, the level of power differs among stakeholders, investors and customers have higher power and can influence the company’s execution regarding ESG actions through law and investment decisions while other stakeholders such as employees have less power but play a role in influencing the social functioning.

2.3.3. Agency Theory

In addition to the previous theories, this thesis defines and emphasizes the importance of the agency theory and its relationship with ESG.

The agency theory is applied in many fields such as accounting, economics, and Finance. The delegation of authority and decision making can lead to the creation of the principal-agent problem. It is the conflict of interest in corporate governance between the principal who represents the shareholder or investor and the agent who represents the corporate manager or board of directors. This arises from the asymmetry of information where one party referred to as the agent is more informed and has more power than the other, the agent can also have different risk tolerance and incentives from the principal’s objective of maximizing the shareholder profit and welfare. To guarantee the agent acts in his best behavior, the principal endures some agency costs such as the monitoring costs to control the agent’s activities and enhance compensation through stock options, the bonding costs of expanding the resources and building trust by gaining more transparency and power over the agent and the residual costs arising from this conflict of interest between the two parties.

Investing in ESG can have positive impact on mitigating the agency problem. It reduces the asymmetry of information with shareholders as the more the management of the firm is engaged in disclosing the ESG the more it increases transparency between the two parties. It solves the conflict of interests between the two parties by encouraging the firms to enhance corporate social responsibility by investing in ESG methods that make the performance of the management transparent to the shareholders. On the other hand, investing in ESG could destroy shareholder's value (Friedman 1970).

It is true that it is beneficial for the managers to invest in ESG practices, but this increases the agency costs as there is competition in the market that makes the stakeholders benefit from the environmental and social factors and increase their profit (Jensen 2010).

2.3.4. Signaling Theory

To further develop and support what was referred to in the earlier theory about the asymmetry of information, this thesis defines the signaling theory and its ESG impact. This theory was developed by Michael Spence in 1973 and aims toward decreasing information asymmetry from having confidential information that can influence how investors and the market react. There are two types of signaling in the Finance field, the positive signaling through issuing equity reveals to the market and investors that the company will be financially stable and less risky in the future and the negative signaling through issuing debt reveals to the market that the company is risk-averse and more conservative to keep away from the dilution of their equity shares. Positive signaling is also implemented in corporate governance as the more diversified and independent the boards are the more, they signal that they are committed to social values of numerous stakeholders (Miller and Triana 2009).

This theory states that ESG disclosures signal to the market and stakeholders that the company is committed toward sustainability management which helps them better assess the company based on its good reputation (Fombrun and Shanley 1990). In addition to that, the greater the company's ESG performance the higher it discloses its information in a transparent manner to positively signal its engagement to the investors which allows it to better access funds (Spicer 1978), this could be achieved through delivering high quality sustainability reports and collaborating with third parties to obtain ESG certifications.

2.3.5. Institutional Theory

The way the institutional environment perceives the organizations makes them pressured to adopt structured, formal rules and norms to show that they act in an adequate manner even if it is not efficient and effective to their performance (Meyer and Rowan 1975). To eliminate the risk of being negatively judged about their conduct by the institutional environment, the companies act in their best behavior for their long-term survival and protection which is referred to as being legitimate (Scott and Layman 1968). This theory was also developed by Powell and DiMaggio in 1991 and described as the new institutionalism which is driven by institutional isomorphism of having different organizations adopting similar structures and procedures to comply with the institutional environment even if it is not suitable for them. It is based on three attributes, being coercive through complying to the rules imposed by powerful institutions such as the government, being normative by changing their behavior to comply with the social values and norms and being mimetic by imitating other comparable successful practices.

Applying this theory to the context of ESG shows that firms are pressured to implement ESG practices to preserve their legitimacy and comply with the institutional environment's standards towards sustainability. This arises from different regulatory requirements and stakeholder activism that pushes the firms to act in their best behavior to meet the expectations of society through being more environmentally responsible. According to this theory, the institutional environment in which the company operates can influence its culture and the way it implements

ESG practices, for some companies which are market oriented they may find financial performance more important than ESG while for other companies which are community oriented, they may prioritize ESG over returns as high performance businesses strategically participate in CSR initiatives to build strong bonds with their stakeholders.

2.4. Hypothesis Development

The literature research reveals that earlier studies have demonstrated the effect of the ESG on financial success. The theories mentioned above show that firms are influenced by their external environment to act in their best behavior and engage in sustainable development practices to maximize their long-term profitability. To better understand this impact from an investor's perspective and knowing that the ESG industry in Europe is growing at a fast rate, this paper focuses on the Energy and Technology sectors and the Electrical Vehicles industry.

First, this paper studies the relationship between the Tobin's Q which is a measure of over-or undervaluation of portfolio stocks and ESG through using the regression analysis method that we will further discuss in the next section. If there is a correlation between both this shows that when ESG goes up Tobin's Q goes up and if not, this means that there is no relationship.

We develop the following hypothesis to evaluate this relationship:

H0[1]: There is no significant correlation between a firm's ESG performance and Tobin's Q

H1: There is significant correlation between a firm's ESG performance and Tobin's Q

H1a: There is significant correlation between a firm's Environmental performance and Tobin's Q

H1b: There is significant correlation between a firm's Social performance and Tobin's Q

[1] Analogous to H0, the same applies to H1a, H1b, and H1c, being the correspondent null hypothesis:
H0a: There is no significant correlation between environmental performance and Tobin's Q
H0b: There is no significant correlation between social performance and Tobin's Q
H0c: There is no significant correlation between corporate governance performance and Tobin's Q

H1c: There is significant correlation between a firm's corporate Governance performance and Tobin's Q

Second, to support the conclusions reached through the MLR, this paper also studies the relationship between superior ESG performing stocks and its performance on the stock market. To do so, the risk adjusted return, measured by the Sharpe ratio, and the excess return compared to the market, measured through Jensen's α, are analyzed, using the Capital Asset Pricing Model. There is an initial assumption that stocks that excel on sustainability aspects are able to achieve higher risk-adjusted return and outperform the average market return, making them more attractive to invest.

3. Methodology

3.1.Methodology: Part I

In part I of the Methodology Chapter, the Data Collection Procedure section (3.1) details the sources and criteria used to collect the dataset, as well as the rationale behind the selection of the Energy, Technology and Electric Vehicle industries. The multiple linear regression analysis is delineated in detail in section 3.2., wherein the motivations for the employment of a MLR are explained (3.2.1.), covering an overview of Tobin's q as the criterion variable (3.2.2.), as well as its transformation and implementation within the model (3.2.3.). The explanatory variables rationale is discussed in section 3.2.4., supported with theoretical framework for each variable. The model is presented in section 3.2.5., considering industry-specific adjustments (3.2.6.). In section 3.2.7., the model assumptions are outlined to establish a solid basis for the empirical findings and interpretation (further addressed in Chapter 4). Finally, in section 3.2.8., the rationale on identifying and handling outliers in the data set is discussed.

3.1.1. Data Collection Procedure and Sample Selection Rationale

ESG Scores

ESG performance data was extracted from Bloomberg, which comprises reported data from 15,000 companies across one hundred countries since 2006 for all sectors (Bloomberg 2023). This thesis focuses on the Energy, Technology and Electrical Vehicle (EV) industries. The Bloomberg disclosure of ESG score is based on collecting data, regularly updating it, and then analyzing it to make sure that it is accurate. Bloomberg collects this data from sustainability reports of companies, regulatory filings, and news articles. Bloomberg scoring system is based on rating the corporate rules, disclosure procedures and performance measures implemented by the companies. In case of unavailability of the data, the platform uses machine-learning: smart or industry-implied models to provide an estimation.

First, the environmental scoring is based on factors such as the company's commitment to lower greenhouse gas emissions which is based on 3 scopes reported from 100,000 private and public firms, boost energy efficiency and employ more renewable energy sources, the procedures implemented pertaining to biodiversity preservation, waste minimization and water management, the company's ability to mitigate chemicals and air pollution where it scores climate risk in 50 scenarios , R&D investment and supply chain and product impact. Second, the governance scoring system is based on factors such as board composition and independence, the transparency of executive compensation, shareholder rights, voting and engagement, quality of audit and financial reports, whether the internal controls are properly implemented and CSR practices. Third, the social scoring system is based on factors such as labor practices, human rights, community relations with satisfying stakeholders and product quality and safety. An industry-specific study is conducted with 400 ESG criterion, it takes into consideration the materiality for each industry where several issues are prioritized and classified under each pillar with a sub-issue collecting the associated quantitative and qualitative ES data. Bloomberg's scoring system is standardized to a 0-100 range where each of these parameters are weighted according to their importance in contributing to the company's ESG performance. We proceeded as the following for the preparation of the data: we extracted the data from Bloomberg by collecting the individual ESG scores according to the member ticker of each company where scores are assigned respectively to each of the individual E, S, G pillars then we proceeded with data cleaning by taking out the missing ESG data. We would like to highlight that the ESG scores range from 0 to 10 with ten being the maximum score. Then, we took the average of Environmental, Social, Governance scores to obtain the independent variable 'ESG.'

3.2. Multiple Linear Regression Analysis

3.2.1. Motivations for Employing MLR Analysis

The primary motivation for employing MLR analysis in this study lies in its capacity to perform *ceteris paribus* analysis. Including multiple independent variables allows to control for additional factors that simultaneously affect the criterion variable (Wooldridge 2012). As more factors are incorporated into the model, a greater proportion of the variation in the criterion variable is explained, resulting in a more robust and accurate model (Chatterjee and Hadi 2015). The second motivation (further addressed in section 3.2.3.) lies in its capability to test for different functional form relationships between the criterion and independent variables. MLR models can incorporate transformations such as *logarithmic*, *exponential*, or *inverse* transformations, allowing for more flexibility (Wooldridge 2012), enhancing the robustness and explanatory power of the model. The present study utilizes IBM SPSS Statistics software to implement MLR analysis.

3.2.2. Tobin's q

To measure the correlation between ESG performance and a firm's investment attractiveness, this study employees Tobin's q as the criterion variable. Introduced by Nicholas Kaldor and further addressed and presented by James Tobin as an alternative to traditional financial measures, q_i serves as an instrumental variable to examine the causal relationship between investment and the ratio of a firm's Market Value of Assets to its Replacement Cost of Assets (Tobin 1968, 1969). This approach is more accurate than accounting for Assets Book Value, particularly in instances where inflation increases the replacement costs (Damodaran 2012).

The Tobin's q ratio is represented as follows:

$$\boldsymbol{q_i} = \frac{Market\ Value\ of\ Assets_i}{Replacement\ Cost\ of\ Assets_i} \tag{1}$$

Tobin's fundamental premise is that if $q_i > 1$, companies would be motivated to invest. The value of a new investment would be greater than its associated cost, and therefore, the market perceives the firm as having higher growth potential. Lindenberg and Ross (1981) argue that q_i may exceed unity due to Ricardian[2] rents, not represented in its replacement costs. On the contrary, a $q_i < 1$ indicates that the market perceives the company as having constrained growth potential, and thus, less attractive to investors.

Despite its potential to influence various aspects of corporate, Cheng and Pruitt (1994) argue that obtaining q data is significantly challenging, due to the complexity to accurately measure the replacement cost of assets. While q as a measure has advantages in theory, Damodaran

[2] Excess profits that a firm earns due to the presence of unique or scarce resources and characteristics that provide a competitive advantage over competitors, such as access to scarce or unique natural resources, specialized knowledge or expertise, patents or intellectual property, and geographical location (Ricardo 1817)

(2012) corroborates Cheng and Pruitt arguments concerning q's practical applications. The variation, q'_i, of Tobin's q ratio, using the sum of Market Value of Equity and Market Value of Debt, and the Book Value of Assets, is represented as follows:

$$\boldsymbol{q'_i} = \frac{(Market\ Value\ of\ Equity + Market\ Value\ of\ Debt)_i}{Book\ Value\ of\ Assets\ _i} \tag{2}$$

3.2.3. Transformation of the Criterion Variable: q(t)

In the present study, the criterion variable, q_i, undergoes a natural logarithm (ln) transformation. Applying a type of *log* transformation can mitigate, if not eliminate, heteroskedasticity and issues related to skewedness (Wooldridge 2012). Moreover, models with log(y) as the dependent variable are more likely to exhibit normality. This transformation is made possible due to the nature of the variable. Although q_i can theoretically range from zero to infinity, a value of 0 remains highly improbable in practical scenarios. A q_i value of 0 would denote that the company's market value is non-existent, as $Replacement\ cost\ of\ assets = 0$. (Tobin 1969). Even in cases of bankruptcy, the company retains residual value within their assets.

The transformed q_i, denoted as $q(t)_i$, is obtained by applying the natural logarithm to the original criterion variable values:

$$\boldsymbol{ln(q_i)} = q(t)_i \tag{3}$$

3.2.4. Explanatory Variables Rationale

The measurement of ESG performance is still flawed and remains inconsistent amongst rating agencies. As stated previously, rating agencies do not have standardized criteria to evaluate ESG performance. Additionally, there are many companies who are still improving their disclosure on ESG, which could result in a sudden change in ESG score from one year to the other (Hoang, Segbotangni, and Lahiani 2020). Hence, the information available is ambiguous and that could signal uncertainty to investors. Furthermore, the change in scores for a company is expected to influence a company's financial performance after a time lag is considered. An improvement in the sustainability aspects of a company in one year is very unlikely to improve the economic performance in that same year, as it takes time for the information to be validated and accepted by investors and other stakeholders. To understand the correlation between ESG performance and firm's value, the ESG variable is lagged by one year, whilst all the other variables correspond to the following year. For instance, the ESG scores from 2020 are compared to the other explanatory variables of 2021.

This section presents the explanatory variables employed in the MLR model and discusses the rationale behind its inclusion in analyzing the correlation between ESG performance and $q(t)_i$. In the present study, a total of eight[3] explanatory variables have been selected, namely (a) *ESG* performance; (b) Leverage, denoted by the Debt-To-Equity Ratio; (c) Liquidity, represented by the current ratio; (d) Research and Development Expenditure (adj.); (e) Market Capitalization; (f) Sales Growth; (g) Total Revenues[4]; and (h) Firm Size, computed as the ln(Total Assets). Subsequent sections will offer an elaboration of the explanatory variables concerning their pertinence to our research and the rationale for their inclusion.

3.2.4.1. Leverage

Leverage, employed in the MLR analysis as the *Debt-to-equity* ratio, accounts for firms' capital structure and financial risk, which may affect its investment decisions and market valuation. The Debt-To-Equity Ratio is particularly valuable to compare the financial leverage of a firm in relation to its industry counterparts (Brigham and Ehrhardt 2016). Moreover, the Debt-To-

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[3] Concerning the weighted average ESG performance model. Concerning the individual performance analysis, this study considers ten explanatory variables (see section 3.2.5.)

[4] Exclusively applied to the Energy industry econometric specification, substituting *Sales Growth* (see section 3.2.6.)

Equity Ratio may also capture agency costs[5] associated with debt financing, influencing a firm's q.

3.2.4.2. Liquidity

Liquidity pertains to the overall financial position of a company in terms of its solvency. Expressed in the present analysis as the Current Ratio, $\frac{Current\ Assets}{Current\ Liabilities}$, it assesses a company's capacity to fulfil its immediate financial commitments. As originally proposed by Keynes (1936), a benefit of maintaining a liquid balance sheet lies in the capacity it bestows upon firms to capitalize on valuable opportunities as they emerge (Almeida, Capello, and Weisbach 2005). In circumstances where a firm experiences financial constraint, its capacity to access external financing is limited, becoming reliant on internal liquidity (cash and cash equivalents) to underwrite operations and investment opportunities. Almeida, Capello, and Weisbach's study posits that financially constrained firms manifest a positive cash flow sensitivity of cash, meaning holding more liquid assets when cash flows are higher. In the context of q, maintaining adequate liquidity empowers financially constrained firms to pursue growth opportunities, which increases a firm's value.

3.2.4.3. Research and Development Expenditure

Studies show that investing in R&D effects the short and long future returns of the firm which results in higher Tobin's q (Hirschey 1985), another evidence to this is the increase in R&D spending to market value ratio that results in higher excess returns (Chan et al. 2001). Increasing R&D spending has a positive signaling effect that increases the prices of shares and their market value (Chauvin and Hirschey 1993).

[5] Costs that result from conflicts of interest between different stakeholders within a firm (Jensen and Heckling 1976)

R&D represents an intangible asset such as patents that their book value is difficult to measure and not included in the company's capital (Hall 1993), including R&D variable helps explaining how the market perceives the effect it has on the firm by the increase of productivity and added value, it also helps mitigate the signaling effect it has on Tobin's q. "Firm's Tobin's q is a function of its intangible assets" (Bharadwaj et al. 1999). Investing in R&D differentiates companies from competitors as it contributes to the creation of innovative goods, better customer service, quality and technologies which attracts the investor's attention to higher profit and growth in the future (Brynjolfsson et al. 2002). Griliches (1981) investigated the intricate connection between the company's market value, as captured by Tobin's q, and R&D investments and patent activity. The author derived a first expression, represented as following:

$$V = q(A + K), \tag{4}$$

Wherein,

V = current market value of the firm

A = current value of the firm's conventional assets[6]

K = Intangible assets of the firm

q = Tobin's q

Griliches findings suggest that unanticipated R&D expenditures[7] and patent activities positively contribute to changes in market valuation. While anticipated R&D investments are already factored into a firm's market valuation, it is the unanticipated components of R&D and patent activities that drive changes in a firm's market value.

[6] Referring to plant, equipment, inventories, and financial assets (Griliches 1981)

[7] Unanticipated R&D expenditures refer to investments in R&D activities that were not expected or predicted based on firm's historical trends, industry norms, or market conditions, resulting from factors such as breakthroughs, regulatory shifts, or emerging market opportunities.

3.2.4.4. Market Capitalization

Market capitalization is a gauge of how worth the company stock shares are valued in the market; it can be overvalued or undervalued. It is determined as the following: current share price * total number of shares outstanding (CFI 2022). It is a measure of the size and financial stability of a firm. We use Market Capitalization as an explanatory variable in our model as it is significant in explaining the output variation in the criterion variable, Tobin's q, it measures the firm's market value of equity which represents the component of Tobin's q numerator of total market value as referred to in section 3.2.2. second equation q'_i. This means that when the market capitalization increases it signals to the market that the firm has future growth and financial stability which increases Tobin's q.

3.2.4.5. Sales Growth

Sales growth is defined as higher sales from one year to another (Kennedy et al, 2013). It measures how much the business revenues are growing over time and gives insights to investors about the profitability and market share of the company in the future. It is also defined as the variation in current and historical sales alongside historical sales (Horne and Wachowicz 2012, 223). This is described as the following formula: (Current sales - prior sales period) / prior sales period *100. The more the company's sales are growing the more it impacts the Market Value of the company and its attraction to investors (Kusumajaya 2011).

3.2.4.6. Total Revenues

Total revenues refer to the total amount of money a firm earns through the selling of its goods and services during a specific period. Revenues may exhibit a correlation with q, as higher revenues indicate that a company is effectively utilizing its assets for income generation, potentially resulting in an increase in the perceived company value. As observed upon conducting initial analysis to examine the performance of the model (section 3.2.6.), *Total Revenues* captures and explains the dynamics and characteristics of the Energy industry in a better way.

3.2.4.7. Firm Size

According to Fama and French 1992, and Lang and Stulz 1994, Firm Size has been acknowledged as a determinant of corporate performance and valuation. As firms can vary widely in size, applying the ln transformation serves to attenuate this disparity, compressing the variable to a comparable scale. Larger firms may have distinctive characteristics that affect their value, such as economies of scale, greater market power, or increased diversification, leading to a higher q (Lang and Stulz 1994). Smaller firms may benefit from greater flexibility and adaptability, which also may contribute positively to firm value. Using this transformation as an approximation to a size of a firm aligns with the findings of previous research and increases the overall MLR model performance.

3.2.5. Model

This study adopts a nuanced approach by examining not only ESG overall performance, but also ESG individual performance. Therefore, the multiple linear regression analysis consists of two econometric specifications. The first econometric specification, $q(t)_i$, with the ESG overall performance as the key explanatory variable, is represented as follows:

$$\boldsymbol{q(t)_i} = \alpha + \beta_1 ESG_i + \beta_2 LEV_i + \beta_3 SIZE_i + \beta_4 MKTCap_i + \beta_5 RD(adj.)_i + \beta_6 LIQ_i + \beta_7 SG_i + \varepsilon_i \quad (5)$$

The second econometric specification, $q'(t)_i$, with the individual contribution of each ESG pillar as separate independent variables, is represented as follows:

$$\boldsymbol{q'(t)_i} = \alpha + \beta_1 E_i + \beta_2 S_i + \beta_3 G_i + \beta_4 LEV_i + \beta_5 SIZE_i + \beta_6 MKTCap_i + \beta_7 RD(adj.)_i + \beta_8 LIQ_i + \beta_9 SG_i + \varepsilon_i \tag{6}$$

Wherein,

Concerning the ESG overall performance econometric specification (5),

$ESG_i =$ Weighted average of each ESG factor of firm i

Concerning the ESG individual performance econometric specification (6),

E_i = Environmental Performance of Firm i

S_i = Social Performance of Firm i

G_i = Corporate Governance performance of Firm i

Analogously to both econometric specifications (5) and (6),

$q(t)_i = ln(q_i)$

$LEV_i = (\frac{Debt}{Equity})_i$

$SIZE_i = ln(Total\ Assets_i)$

$MKTCap_i = number\ of\ outstanding\ shares_i * share\ price_i$

$$RD(adj.)_i = Reported\ R\&D\ exp._i + Amortization\ of\ capitalized\ R\&D_i E - Capitalized\ R\&D\ exp._i$$

$LIQ_i = (\frac{Current\ Assets}{Current\ Liabilities})_i$

$SG_i = \left(\frac{Total\ Revenue_{i,t} - Total\ Revenue_{i,t-1}}{Total\ Revenue_{i,t-1}}\right) * 100$

3.2.6. Industry-specific Model Adjustments

Upon conducting preliminary analysis examining model performance, it was observed that the independent variables 'sales growth (SG)' and 'revenues (REV)' demonstrated distinct levels of effectiveness in explaining the criterion variable 'q(t)' across the three industries. In the Technology and Electric Vehicle (EV) industries, sales growth was found to be a better fit for the model, while in the Energy industry, revenues emerged as a more suitable choice. The disparity in the explanatory significance of SG and REV for the Technology and EV Sectors vs. the Energy Industry may stem from its distinct industry characteristics (further addressed and developed in 4.1). Thus, and driven by preliminary model performance observation, a variation, $q(vt)_i$, of the econometric specification for the model was formulated for the Energy industry, both for the overall and individual ESG performance:

$$\boldsymbol{q(vt)_i} = \alpha + \beta_1 ESG_i + \beta_2 LEV_i + \beta_3 SIZE_i + \beta_4 MKTCap_i + \beta_5 RD(adj.)_i + \beta_6 LIQ_i + \beta_7 REV_i + \varepsilon_i \tag{7}$$

$$\boldsymbol{q'(vt)_i} = \alpha + \beta_1 E_i + \beta_2 S_i + \beta_3 G_i + \beta_4 LEV_i + \beta_5 SIZE_i + \beta_6 MKTCap_i + \beta_7 RD(adj.)_i + \beta_8 LIQ_i + \beta_9 REV_i + \varepsilon_i \tag{8}$$

Wherein,

REV_i = Total Revenues of firm i

3.2.7. Model Assumptions

3.2.7.1. No Autocorrelation

Autocorrelation refers to the presence of correlation between the error terms of the model. To assess the no autocorrelation assumption, the Durbin-Watson test is employed. This test serves as a diagnostic tool to identify the existence of first-order autocorrelation in the model residuals. The Durbin-Watson test ranges between 0 and 4, with a value of 2 indicating the absence of autocorrelation in the residuals. In the absence of autocorrelation, the differences between successive residuals are expected to be random and collectively sum to ≈ 0, due to, under the null hypothesis of no autocorrelation, each residual is statistically independent of its predecessors and successors. Consequently, the ratio of the sum of squared differences to the sum of squared residuals should hover around the unity. The DW statistic is defined as twice this ratio, i.e., 2. If DW is significantly less than 2, this indicates the presence of positive autocorrelation. Also known as serial correlation, it occurs when errors terms in a time series transfer from one period to another is a systematic manner. Therefore, it indicates that the error term in one period is positively related to the error term in the preceding period, resulting in the underestimation of standard errors. If DW exhibits a value significantly greater than 2, this indicates the existence of negative autocorrelation. A positive error term is likely to be followed by a negative error term, and vice versa, leading to an overestimation of standard errors.

3.2.7.2. Normality

The normality assumption is assessed through visual inspection of the Histogram of the Residuals and the Normal P-P Plot of Regression Standardized Residuals of the criterion variable. The Histogram of the Residuals should ideally display a Gaussian curvature, with the majority of residuals congregating around the mean, symmetrically extending into both tails. Simultaneously, the Normal P-P Plot of Regression Standardized Residuals offers a more rigorous method for affirming normality, comparing the observed cumulative probabilities of residuals, x-axis, against their expected cumulative probabilities under a normal distribution, y-axis. If residuals follow a normal distribution, the points should closely align along the diagonal line in the Normal P-P Plot, and thus, the assumption of normality of the residuals is satisfied.

3.2.7.3. No Multicollinearity

To evaluate the presence of multicollinearity, the Variance Inflation Factor (VIF) Statistics, as well as the Collinearity Diagnostics Table are observed. The VIF for an explanatory variable is calculated as the reciprocal of the proportion of the variable variance that is not explained by the other explanatory variables. A VIF value of 1 implies that there is no correlation between the given explanatory variable and the remaining predictors, meaning that there is no multicollinearity. In this study, we adopt two levels of stringency, first evaluating against the standard threshold of 10, and a more conservative approach, with a threshold of 3. The second element of our approach involves the examination of the Collinearity Diagnostics Table. We evaluate the Condition Index, CI, against a threshold of 30. The CI is computed for each dimension of the model and identifies the extent to which explanatory variables are linearly dependent. A $CI > 30$ alone does not confirm the presence of multicollinearity. However, it indicates that the data structure allows for its potential existence. To further examine the potential presence of multicollinearity flagged by a high CI value, Variance Proportions are investigated against a threshold of 0.5. Two or more explanatory variables within the same dimension exceeding a VP of 0.5 may indicate substantial multicollinearity.

3.2.7.4. Linearity and Homoscedasticity

The evaluation of Linearity and Homoscedasticity is undertaken through visual inspection of the ZRESID vs ZPRED scatterplot. To further reinforce the visual assessment, each explanatory variable is also plotted against the criterion variable, to see if there is a clear linear relationship between each explanatory variable and the criterion variable. In a model adhering to the assumptions of Linearity and Homoscedasticity, the Residuals vs. Fitted values scatterplot would display an evenly dispersed, random pattern, between the range of -3 to 3, for both x and y axis. A discernible pattern, such as a funnel shape, or a clear curve, would suggest that the assumptions of Homoscedasticity or Linearity, respectively, are not met.

3.2.8. Outlier Detection and Treatment

This section discusses the methodology used to identify and handle outliers (further addressed in Chapter 4, concerning industry-specific analysis). Outliers and influential observations ought not to be indiscriminately eliminated or systematically down weighted, as they are not necessarily errors in the observations. On the contrary, they may be the most informative points in the data (Chatterjee and Hadi 2015). Initially, the interquartile range (IQR) method was applied to identify potential outliers in our dataset, with observations falling below $\boldsymbol{Q1 - 1.5.IQR}$ or above $\boldsymbol{Q3 + 1.5.IQR}$ being flagged as outliers. When applying the IQR method, a considerable number of outliers were identified for the criterion variable across all industries, primarily concerning the upper bound. Removing these values would lead to a loss of valuable information, crucial to understanding the underlying relationships being studied. An alternative approach based on the 1st and 99th percentiles of the data distribution was adopted, trimming the extreme values from both ends of the distribution. The application of this method effectively mitigated the influence of extreme values, while simultaneously preserving valuable information contained in the observations.

3.3. Methodology: Part II

In part II of the Methodology chapter, for each of the industries portfolios of stocks will be developed based on ESG performance, the scope and data collection procedures are explained in section 3.3.1.

A brief explanation of Portfolio theory (3.3.2) based on Markowitz’s theory is presented, while laying out the steps for calculating portfolio’s expected return and volatility.

CAPM’s assumptions are presented and a proxy for systematic risk is established, the market β, a metric that is used to compute the portfolio’s equilibrium expected return given through CAPM (3.3.3). Finally, three main metrics are defined to assess portfolios’ performance: Jensen’s Alpha, Sharpe ratio and Treynor ratio (3.3.4), while the steps for optimizing the weights of the portfolio are also defined.

3.3.1. Portfolio Selection and Stock Return

For each industry, 4 pairs of portfolios are built based on ESG performance: one pair addressing the aggregate ESG score and three pairs each addressing an individual dimension of ESG. Each pair of portfolios consists of two separate portfolios, where one is composed of the best stocks in the sustainability aspect analyzed of the data set, while the other portfolios is composed of the worst stocks for the same aspect analyzed. The average of scores of the last three years, retrieved from Bloomberg, were used to define the top and worst stocks of each category.

Having defined the stocks for each portfolio, the monthly adjusted share prices were also retrieved from Bloomberg, from January 2015 to December 2022. Companies that lack data on share price for one year or more were excluded from the portfolio creation and replaced by the following stock matching the criteria stipulated.

Upon gathering the monthly adjusted share price for each stock, the monthly return is computed, using the arithmetic returns approach, which has the following formula:

$$r_t = \frac{P_t - P_{t-1}}{P_{t-1}} \tag{9}$$

Wherein:

r_t= Total stock return realized at t month

P_t= Adjusted closing stock price at t month

Share prices for the energy and technology sectors are expressed in euros, since the regional focus of these sectors is the European market. As for the electric vehicle industry, stock prices are presented in USD. Nonetheless, since return is a ratio, this would not be impacted by using different currencies.

3.3.2. Portfolio theory

Markowitz (1952) introduced the concept that exists an interconnection between risk and return, meaning between two portfolios with similar levels of risk, the investor should opt for the one with the highest expected return. In the same line of thought, if two stocks present the same level of expected return, investors will prefer the stock with the lowest risk. Thus, Markowitz's model is defined as "mean-variance model" (Markowitz 1991) and it relies on several assumptions, namely: no transactions costs, no taxes, a single-period, investors are price takers, information is available to all, and investors behave similarly aside from their risk appetite and their initial investment (Elbannan 2014; Singh and Yadav 2021).

Bearing this risk-return relationship in mind, an efficient frontier can be defined, as investors will maximize return for a certain level of risk. This frontier represents the line of efficient portfolio, while portfolios below or to the right of this line are feasible portfolios. Since it is a "mean-variance model," investors will not hold a riskier portfolio for a specific level of risk, hence they will hold portfolios in the efficient frontier, as other feasible portfolios do not provide the optimal combination of risk and return (Markowitz 1991).

Portfolios are a combination of stocks with specific weights for each of the stocks. Important to notice that the sum of weights in any given portfolio is always one. Having attributed the weights, it is then possible to compute the portfolios expected return and volatility, bearing in mind that the volatility of the portfolio is influenced by each stock's individual volatility and the correlation between themselves. This correlation is useful to be analyzed, since bundling portfolios with low correlation between stocks can lead to lower overall volatility, which is defined as the diversification effect (Markowitz 1991; Sharpe 1964; Elbannan 2014)

A portfolio with n securities expected return is computed through the following equation (Singh and Yadav 2021):

$$R_p = \sum_{i=1}^{n} w_i R_i \tag{10}$$

Wherein,

R_p= Portfolio's return

w_i= Weight of security i in the portfolio

R_i= Return of security i

To compute the portfolio's variance the following equation is used (Singh and Yadav 2021):

$$\sigma_p^2 = \sum_{i=1}^{n} w_i^2 \sigma_i^2 + \sum_{i=1}^{n} \sum_{j=1}^{n} \sigma_i \, \sigma_j \rho_{ji} \ (i \neq j) \tag{11}$$

Wherein,

σ_p^2 = Portfolio's variance

w_i = Proportion of investment in security i relative to the portfolio's total investment

w_j = Proportion of investment in security j relative to the portfolio's total investment

σ_i = Standard Deviation of security i

σ_j = Standard Deviation of security j

ρ_{ij} = Correlation Coefficient between security i and j

In this thesis, portfolios' risk is analyzed through its average annual standard deviation, hence the square root is applied to the portfolio's variance to derive the appropriate risk measure.

3.3.3. CAPM

The capital asset pricing model (CAPM) was developed by Sharpe (1964) and Lintner (1965) and further developed the model created by Markowitz with the introduction of two new assumptions. Investors have the possibility to borrow and lend without restrictions at the Risk-Free rate and there is "homogeneity" in investors' expectations, this means, investors share the same distribution of returns for a given period and take similar decisions.

The risk-free asset represents a minimum level of return for no risk. Generalizing, every investor will have a combination between their risky portfolio and the risk-free rate, as lending and borrowing is allowed, they can choose the preferred combination between the two of them, so that they match their desired level of return. They can lend at the risk-free rate, holding a position of lower risk and expected return, or borrow at the risk-free rate, so they can reach a position with higher expected return, at the expense of extra risk.

The market portfolio is also introduced in the model to compare the performance of a specific portfolio in relation to the overall market. The market portfolio is defined as a well-diversified efficient portfolio with all the stocks in the market. In practical terms, such market portfolio is unfeasible to get accurate information, hence a benchmark index is a representation for the market portfolio. In this thesis, the benchmark index used for the energy and technology sector is the STOXX 600 Europe, while the index used for the electric vehicle industry is the STOXX 1800.

The volatility of a portfolio, or the total risk, can be split into two types of risk: systematic risk, which signals the exposure a portfolio is subject to the overall economic cycle, and idiosyncratic risk, which represents firm specific risks. A well-diversified portfolio mitigates specific risk, whereas systematic risk is undiversifiable, meaning portfolios will always be affected by this risk (Sharpe 1964; Elbannan 2021)

A proxy for measurement of systematic risk is the market beta (Elbannan 2021), this illustrates the magnitude in variability on a stock's return compared to the variability occurred in the overall market. In other words, a market beta lower than one signals a low correlation with the market, meaning it is anti-cyclical, when the market has an increase of 1%, the stock is expected to increase by less than 1%. Whereas a market beta above 1, signals a pro-cyclical stock, where a shock in the market will create a shock of higher magnitude on the stock's return.

$$\beta_i = \frac{cov(R_i, R_m)}{\sigma^2(R_m)} \tag{12}$$

Wherein,

β_i = Market Beta of stock i

$cov(R_i, R_m)$ = Covariance between stock i's return and market return

$\sigma^2(R_m)$ = Variance of the market portfolio

By extension, the β of a portfolio is the weighted average of each individual stock's β (Singh and Yadav 2021), the proportion of amount invested in each stock relative to the total investment in the portfolio is defined as the weights for each stock in the portfolio.

Having the risk-free and the β, the expected return according to CAPM is computed using the following formula, for both stocks and portfolios (Elbannan 2014):

$$E(R_i) = R_f + \beta(R_M - R_f) \quad (13)$$

Wherein,

$E(R_i)$ = Expected return through CAPM

R_f = Risk-free asset return

β = Market beta of the stock or portfolio

R_M = Return of the market portfolio

3.3.4. Portfolio Performance Analysis

Jensen's Alpha is a key metric when analyzing the performance of a stock or a portfolio, it is given by the following formula:

$$\alpha = R_p - E(R_p) \quad (14)$$

Wherein,

α = Jensen's Alpha

R_p = Realized Return of portfolio

$E(R_p)$ = Expected Return of portfolio according to the CAPM

A non-zero alpha implies abnormal performance of the portfolio compared to the market index. A positive alpha signal an outperformance, meaning the portfolio is underpriced. While a negative alpha means the opposite, thus overpriced. Alpha compares not only the outperformance compared to the market, but also the investors preference. A negative alpha, on one hand, might signal underperformance, on the other hand, it could translate in a more attractive portfolio, as many investors are holding this portfolio, thus creating overvaluation (Nguyen et al. 2022).

Another important metric to assess performance is the Sharpe ratio (SR), which can be computed through the following equation:

$$SR = \frac{\left(R_p - R_f\right)}{\sigma_p} \tag{15}$$

Wherein, σ_p = Standard deviation of the portfolio.

This ratio measures the risk adjusted excess return of the portfolio (Sharpe 1964). Since the risk-free rate acts as an opportunity cost, to analyze portfolios it is necessary to deduct this rate to the realized return of the portfolio. It is one of the most important metrics to analyze the performance of a portfolio since it expresses the direct relationship between risk and return (Scholz and Wiikens 2005; Vidal-Garcia and Vidal 2021). It can be interpreted as the slope of the line that is drawn between the risk-free rate and the portfolio, in the graph with risk represented in the x-axis and return in the y-axis. Investors will prefer portfolios with a higher Sharpe ratio, in addition, investors usually set a target Sharpe ratio, where portfolios that have a ratio above the target are invested, while portfolios below the target are avoided. Furthermore, by maximizing this ratio one could achieve the optimal combinations in the weights for the portfolio: the tangency portfolio. By doing such, it would turn the portfolio into an efficient portfolio which lays in the efficient frontier (Lintner 1965; Zakamulin 2011). Investors would then hedge this efficient portfolio with the risk-free rate, and depending on their risk appetite and utility function, they choose a point along the efficient frontier that best suits them.

The Treynor's ratio (TR) is also commonly used to evaluate the performance of a portfolio (Vidal-Garcia and Vidal 2021). It differs from the Sharpe ratio in the denominator, where the ratio demonstrates the expected excess return per unit of systematic risk.

Thus, the formula for Treynor's ratio is the following:

$$Treynor's\ Ratio = \frac{(R_p - R_f)}{\beta_p} \tag{16}$$

Relevant to notice that Treynor's ratio is best suited for diversified portfolios since it accounts for the extra excess return relative to risk inherent to the market (Scholz, and Wiikens 2005). If a portfolio is not well diversified this ratio could be biased, since there is a lot of specific risk in the portfolio that is not accounted for in this ratio.

In this thesis, upon building portfolios composed of stocks that are extreme in terms of ESG performance, the return, risk, Jensen's Alpha, and Sharpe ratio are computed and analyzed, assuming an equally distributed portfolio. Furthermore, on the two ESG portfolios, the optimization of the portfolio will be done through the maximization of the Sharpe ratio, where two scenarios are proposed: one where short selling is allowed and one where investors are only allowed to hold long positions on their portfolios' stocks. After finding the optimal combinations of weights, the ratios mentioned above are recalculated for these optimal portfolios.

4. Analysis

4.1. ESG Performance Impact on Firm's Investment Attractiveness: An Empirical Study for the European Energy Sector

4.1.1. ESG in the Energy Sector

Since the 20th century, the Energy sector has been very important in powering economies and societies through the manufacturing, sale, and issue of energy. According to the International Energy Agency, the energy industry accounts for $5 trillion in 2021 with worldwide energy consumption of 22848 TWh in 2019 (IEA 2021) and 37086 PJ in Europe in 2020 (Eurostat). Energy sources are composed of two categories, the non-renewable energy including natural gas, coal, nuclear, diesel fuel, petroleum, oil, and gasoline; and the renewable energy including biofuels, wind, and solar power, hydroelectric and hydropower (Chen 2022).

This sector represents the cause of various damages for the environment, human health, and ecosystems such as climate change due to carbon emissions, pollution, global warming, deforestation, geopolitical problems to access resources, alongside with other consequences. Nowadays, businesses are becoming more conscious about these negative consequences and pressure is being exerted on them to implement cleaner technology and shift toward sustainable energy with a focus on the renewable energy sector that is growing at a fast rate with a global investment of $495B in 2022 (Ruid 2023).

First, companies in the energy industry such as Ørsted in Denmark shifted from using fossil fuel to wind power and is targeting to use 100% carbon neutral by 2025 (Ørsted 2020). Companies are more engaged in setting sustainability goals such as TotalEnergies targeting zero-emissions by 2050 and higher renewable energy portfolio investment by 20% in 2030 (TotalEnergies 2023), Iberdrola lowering its carbon emissions by 150GW in 2030 which is 50%

less than 2007 (Iberdrola 2022) and Enel increasing renewable energy to 120GW by 2030 (Enel 2020).

Second, companies are also concerned about improving their governance performance through board diversity and independence, transparent reporting, and risk management, such as Royal Dutch Shell that is committed to “IPIECA sustainability reporting, Global Reporting Initiative (GRI), discloses against Task Force on Climate-related Financial Disclosures (TCFD), Sustainability Accounting Standards Board (SASB) as well as UN Global Impact (Shell Global 2023). In addition to that, many worldwide regulations are implemented in the energy industry, this includes emissions regulations by the first European Union’s Emissions Trading System (ETS) set in 2005 to limit gas emissions caused by 10,000 power stations, which resulted in lowering them by 35% as of 2021(EU 2021). Renewable energy standards in the US such as California’s Renewable Portfolio Standard (RPS) that imposes 100% of utilities’ electricity to be renewably originated by 2045 (California Energy Commission 2021). The Feed-in Tariff in Germany through the Renewable Energy Sources Act (EEG) to benefit young companies that contribute to the growth of solar and wind power from lower costs and cease of rising electricity prices which resulted in 4.33ct/kWh average level of funding awarded in 2017 (BMWK 2017). Carbon tax pricing in Denmark since 1992, with the government imposing taxes on companies and citizens using non-renewable energy sources, “currently set at 24€/tCO2”.

Third, companies are raising concern toward improving their social performance through engaging in communities, health care and safety, human rights and diversity and inclusion.

Engaging in communities, partnerships between non-profit organization “GRID Alternatives” and energy companies in the US where solar energy projects are being developed on tribal lands to enable 100,000 homes to access electricity, this resulted in $2.38M in tribal revenues and clean-energy job opportunities (Goodluck 2022). Scottish Power, benefiting thirty-six wind farm communities through funding of £50M, better rural transportation services and education programs (Scottish Power 2022). Health and safety, due to the explosion that occurred in Baton Rouge, Louisiana in 2021, the Occupational Safety and Health Administration (OSHA) exerted penalties of $126,600 on ExxconMobil that did not comply with safety management regulations of protecting their employees (OSHA 2011). Human rights, violation of land and resources rights due to the approval of Norwegian Supreme Court to license the Nord Stream 2 gas pipeline that could be harmful for the Arctic ecosystem (Reuters 2020).

ESG is relevant to the energy industry where it plays a significant role in incentivizing companies toward engaging in CSR practices and raising concern about climate change and the drawbacks of this sector through implementing regulations by governments, sustainability management by companies that lead to better ESG performance and creation of stakeholder value.

4.1.2. Data Description

This process includes two data sets, ESG data and other data: size, leverage, liquidity, R&D adjusted, Revenues and market capitalization on one hand that will be used in the MLR method and portfolio data on the other hand that will be used in the CAPM method.

The data collected in the energy industry is based on a Euro currency, 5 years range from 2017 to 2021 for ESG scores and from 2018 to 2022 for other data and portfolio stocks. This is further detailed in section 4.1.2.1. and section 4.4.1.

4.1.2.1. ESG Data Set

ESG dataset for the energy industry is based on the Bloomberg methodology previously described in section 3.1., with a 5 year range from 2017 to 2021.

To collect our ESG data, we based our scope on the following characteristics: Western and Eastern Europe excluding Russia and Ukraine due to the war that may affect our dataset, euros as currency and market capitalization above 1B.

This resulted in an overall sample of 75 companies that resulted in 56 companies after data cleaning. Individual ESG scores were collected according to the member ticker of each of these companies, we then calculated the average of these individual scores for each year with a focus on the current year (2021) ESG average that will be used in running the models.

The sample collected shows that companies with highest average ESG scores are mostly from countries such as Finland, Norway, Italy, and Sweden ranked with their main operations in renewable energy, power, Oil, and gas. While companies with lowest average ESG scores are mostly from countries such as Germany, Greece, Netherlands, Luxembourg, and France with their main operations in electricity and petroleum.

Our finding is supported by the ESG Index that ranks Finland, Norway, and Sweden on top, while ranking Germany and France respectively as 16th and 17th (GRP 2021).

4.1.3. ESG Analysis

4.1.3.1. Descriptive Statistics

We run SPSS to analyze the ESG data in the energy industry, these outcomes as referred to in (appendix Table 1.1.) show 247 observations with a Standard Deviation of 1.17 and an ESG mean of 4.27 which is within the range of {2.857; 4.286} that is classified as an average BB rating (MSCI ESG RESEARCH LLC 2023). The descriptive statistics resulted in an MKT Cap_i mean of 18.61B which is supported by the weight of the energy industry that is composed of large size companies such as Shell PLC with 178B, TotalEnergies SE with 132B and BP PLC with 99B. The mean of LEV_i is 90.97 with a standard deviation of 102.57 which shows that the firms operating in the energy industry use more debt as source of financing than equity. The mean of LIQ_i is 1.4 with a standard deviation of 0.76, which shows that the firms are liquid and have more current assets compared to their current liabilities that enables them to meet their short-term obligations and benefit from growth opportunities. These results (appendix Table 1.1.) for the dependent variable $q(t)_i$i account for an ln transformation with a mean of 0.22 and a standard deviation of 0.32, as mentioned in section 3.2.3., we apply an exponential inverse transformation which resulted in a geometric mean value of 1.24 with is a $q(t)_i$>1, this shows that the market value of assets exceeds their replacement cost. The R&D mean is 155.21 with a standard deviation of 1.17 which shows that there is a significant degree of variation in the amount that the firms invest. The Total Revenues mean is 25.43B which shows that the firms are effectively using their assets for higher earnings and better market value.

4.1.3.2. MLR Assumptions and Validation

Autocorrelation

H0: Linear regression residuals are not autocorrelated.

H1: Linear regression residuals are autocorrelated.

This test is conducted to verify for not having autocorrelation in residuals and the significance of predictors: size, leverage, liquidity, R&D adjusted, ESG, Revenues and market capitalization. Where usually the outcome of this test falls between a range of {0; 4} with 2 indicating no autocorrelation.

Running this test (appendix Table 1.3.) resulted in a Durbin-Watson value of 1.938 being approximatively 2, this proves that explanatory variables cannot be autocorrelated between themselves meaning that they are independent from each other in explaining the dependent variable qt.

Multicollinearity

We assess for the absence of multicollinearity between the previous independent variables to understand their individual impact in explaining the dependent variable q(t)i. The existence of multicollinearity will lower the statistical power of the model, its reliability and impacts the coefficient estimates of the regression analysis. To measure collinearity, Variance Inflation Factors (VIF) are observed. We assume a general principle where a value below 10 results in no collinearity and a value above 10 results in high collinearity (Hair et al., 1995).

This test (appendix Table 1.5.) resulted in a VIF range of {1,10; 7,62} which is below 10 for all the predictors with a value of 1.5 for ESG. Further analysis of the Collinearity Diagnostics Table (appendix Table 1.7.) shows that only Dimension 8 displays a Condition Index exceeding thirty with only $SIZE_i$ having a $VP > 0.5$. This deducts that there is no correlation between the predictors which proves the validity of our model.

Normality

The Normal P-P Plot of Regression Standardized Residuals tests the normality of residuals, this graph (appendix Chart 1.2.) shows that the standardized residuals form a straight line through falling on the normal distribution line, this results in a linear relationship between the observed and expected residuals meaning that the residuals are normally distributed which approves the model assumptions toward explaining the dependent variable q(t)i.

In addition to that, the histogram (appendix Chart 1.1) of the dependent variable q(t)i for the regression standardized residual is symmetric and bell-shaped which demonstrates the data's normal distribution within an interval of {-2,5; 2,5} with a high frequency distribution of more than thirty.

Linearity and Homoscedasticity

The scatterplot (appendix Chart 1.3.) tests for linearity and homoscedasticity of residuals, the plotted points close to the middle of the graph with the y axis "0" are uniformly spread which shows that the dispersion between the regression standardized predicted values and the regression standardized observed values is sustained among all the independent variables including ESG, that makes us conclude about its linear relationship with the dependent variable q(t)i.

4.1.3.3. Model Analysis

ANOVA

H0: Coefficients $a_0...a_n$ of the independent variables are zero.

H1: Coefficients $a_0...a_n$ of the independent variables are different from zero.

The Multiple Linear Regression Analysis of Variance (ANOVA) test resulted in (appendix Table 1.4.) an F ratio of 23,374 with an F distribution {7; 239} described as the following: regression df1=k=7 for the independent variables ESG, revenues, market capitalization, R&D adjusted, liquidity, leverage, and size; residual df2=n-k-1= 239. The p value is significant with a value lower than 0,001, we reject the null hypothesis, this makes us conclude that the explanatory variables and dependent variable q(t)i explaining the model have a linear relationship, which proves the validity of our model.

The F value is also related to R Square which is denoted as the correlation coefficient and described as the following:

F=SSM/SST=10,399/25,588=0.406

R square

From the previous equation and the model result, the R Square (appendix Table 1.3.) is 0.406 which means that the model's independent variables ESG, revenues, market capitalization, R&D adjusted, liquidity, leverage, and size can account for the dependent variable q(t)i's fluctuation of 40.6%. We conclude that ESG is dependent on q(t)i.

4.1.3.4. Results Analysis

The p value of the ESG coefficient is significant (appendix Table 1.5.), it is 0.001 which is below the critical value of 5%. At 95% confidence interval, we reject the null hypothesis as referred to in section 2.4. This proves that the relationship between Tobin's Q and ESG is significant.

The T test value of 3.940 shows the significance of the explanatory variable ESG in the model which is driven by the small standard error value of 0.017 that leads to more accurate model estimates. This relation is described as the following:

t=Bcoeff/Stderror=0.066/0.017=3.94

In addition to that, the B coefficient of log (ESG) is positive with a value of 0.066. This proves that when the explanatory variable ESG goes up by one unit the dependent variable q(t)i goes up by $e^{0,066}$-1=62.83%.

4.1.4. ESG Individual Performance Model Analysis

4.1.4.1. Descriptive Statistics

The results for individual Environmental, Social and Governance descriptive statistics (appendix Table 2.1.), show an Environmental mean of 3.46 with a standard deviation of 2.13. A Social mean of 3.56 with a standard deviation of 1.59 and a Governance mean of 5,8 with a standard deviation of 1.44. These results show that governance scores in average are the highest among the three pillars with the lowest variation, followed by the social scores then environmental scores which could be explained by the nature of the industry in which firms operate, with the importance and impact of the Environmental pillar due to the drawback effects that firms have on the environment as referred to in section 4.1.1., the Governance pillar higher average could be explained by the fact that firms have more disclosure and commitment toward complying with regulations and sustainable practices to improve their scores and market perception.

4.1.4.2. MLR Assumptions Validation

Autocorrelation

The Durbin Watson test (appendix Table 2.3.) is applied to verify for the following predictors size, leverage, liquidity, R&D adjusted, Revenues, market capitalization and E, S, G individually which resulted in a value of 2,041 that is approximately 2.

This shows that there is no autocorrelation in residuals and that these predictors are significant in explaining the criterion variable q(t)i.

Multicollinearity

Statistics variance inflation factor (VIF) outcome (appendix Table 2.5.) of the following explanatory variables market capitalization, revenues, leverages, liquidity, R&D adjusted, size, E, S, G individually resulted in a VIF below 10 within the range of {1.12; 7.79} with E, S, G individual values of 1.51; 1.16 and 1.25, respectively. Further analysis of the Collinearity Diagnostics Table (appendix Table 2.7.) shows that only Dimension 10 displays a Condition Index exceeding 30 with only $SIZE_i$ having a $VP > 0.5$. This shows that there is no collinearity for the predictors used in this model.

Normality

Normal P-P Plot (appendix Chart 2.2.) of Regression Standardized Residual as explained in previous section 4.4.2 shows that the residuals are normally distributed as the observed and expected residuals have a linear relationship which approves the validity of the model assumptions toward explaining the dependent variable q(t)i.

The histogram (appendix Chart 2.1.) of the dependent variable q(t)i for the regression standardized residual is normally distributed within an interval of {-2; 2.5} with a high frequency distribution close to 30.

Linearity and Homoscedasticity

The scatterplot (appendix Chart 2.3.) tests for linearity and homoscedasticity of residuals, the plotted points close to the middle of the graph with the y axis "0" are uniformly spread which shows that the dispersion between the regression standardized predicted values and the regression standardized observed values is sustained among all the explanatory variables including E, S, G, individually and that the relationship between the predictors E, S, G, and the criterion variable q(t)i is linear.

4.1.4.3. Model Analysis

ANOVA

H0: Coefficients a0...an of the independent variables are zero.

H1: Coefficients a0...an of the independent variables are different from zero.

The Multiple Linear Regression Analysis of Variance (ANOVA) test resulted in (appendix Table 2.4.) an F ratio of 19,617 with an F distribution (9,237) described as the following: regression df1=k=9 for the independent variables E, S, G, revenues, market capitalization, R&D adjusted, liquidity, leverage, and size; residual df2=n-k-1= 237.

The p value is significant with a value lower than 0.001, we disregard the null hypothesis and support the alternative one which makes as conclude there is a linear relationship between the explanatory variables and the model in explaining the dependent variable q(t)i, which proves the validity of our model.

The F value is also related to R Square which is denoted as the correlation coefficient and described as the following:

R Square = SSM/SST = 10,924/25,588=0,427

R square

From the previous equation and the model result (appendix Table 2.3.), the R Square is 0.427. The independent variables E, S, G individually, revenues, market capitalization, R&D adjusted, liquidity, leverage, and size are responsible for the model's explanation of the 42.7% variation in the dependent variable q(t)i. We conclude that E, S, G individually are dependent on q(t)i.

4.1.4.4. Results Analysis

The p value of the independent variables E and G coefficients is significant (appendix Table 2.5.), respectively with 0,001and 0,010 which is below the critical value of 5%. At 95% confidence interval, we disregard the null hypothesis and accept the alternate hypothesis as referred to in section 2.4. This proves that there is a relevant correlation between Environmental performance, Governance performance and Tobin's Q.

On the other hand, the p value of the explanatory variable S coefficient is not significant, with a value of 0.678 which is superior to the critical value of 5%. At 95% confidence interval, we fail to reject the null hypothesis as referred to in section 2.4. This proves that there is no correlation between social performance and Tobin's Q.

The respective T test values of 4.135 and 2.609 show the significance of the explanatory variables E and G in the model while the t test negative value of -0.415 shows the non-significance of the predictor S in the model.

In addition to that, the B coefficient of log (E) is positive with a value of 0.038. This demonstrates that the predictor E and the criterion variable q(t)i have a positive relationship, meaning that when the independent variable E goes up by one unit the dependent variable q(t)i goes up by $e^{0,038}$-1= 3.87%.

B coefficient of log (G) is positive with a value of 0.032. This proves that the predictor G and the criterion variable q(t)i have a positive relationship, indicating that the dependent variable q(t)i increases by $e^{0,032}$-1= 3.25% when the independent variable G goes up by one unit.
On the other hand, the B coefficient of log (S) is negative with a value of -0.004. This proves that the predictor S and the criterion variable q(t)i are not correlated as previously deducted.

4.1.5. MLR Conclusion

We conclude that the MLR model is valid in explaining the correlation of the predictors with the criterion variable q(t)i, this model results show that ESG as well as Environmental and Governance pillars have a significant and positive correlation with Tobin's Q while the Social pillar has non-significant with Tobin's Q.

4.1.6. CAPM Analysis

4.1.6.1. Portfolio Data Set

Company stocks are based on five years monthly stock returns from 31-01-2018 to 30-12-2022 where we calculated the stock's annual average return and annual standard deviation to get the portfolio covariance, volatility, and return.
We built eight portfolios composed each of 5 company stocks which resulted in a total of 40 company stocks as the following: top 5 highest and bottom 5 lowest overall ESG scores; top 5 highest and bottom 5 lowest Environmental scores; top 5 highest and bottom 5 lowest social scores and top 5 highest and bottom 5 lowest Governance scores.
In addition to that, a benchmark with the Stoxx Europe 600 was used to estimate the beta of the CAPM model, it represents the index of European stocks including exchanges with LSE, EPA, SWX with a market cap of €11.8T (2021).

4.1.6.2. Risk and Return Analysis

Environmental Portfolios

The upper portfolio (appendix Table2) has a higher return of 10,14%, lower volatility of 31,55% and lower beta of 1,59 compared to the bottom portfolio (appendix Table 4) with a return of 5,63%, a volatility of 33,65% and a β of 1.68. This proves that the more investors own portfolio stocks with better Environmental scores the better their returns and their portfolio risk compared to the market. “Companies that engage in Environmental responsibility reach better stock returns than their ecologically negligent peers” (Derwall et al. 2004).

Social Portfolios

The upper portfolio (appendix Table 6) has a lower return of 4,98%, higher volatility of 45,75% and higher beta of 1,91 compared to the lower portfolio (appendix Table 8) with a return of 11,61%, a volatility of 32,22% and a beta of 1,63.

Governance Portfolios

The upper portfolio (appendix Table 10) has a negative return of -3,43%, higher volatility of 24.97% and higher beta of 1.18 compared to the bottom portfolio (appendix Table 12) with a return of 10.25%, a volatility of 22.41% and a beta of 0.97. The negative return of higher Governance scores could be explained by the fact that investors seeking risky investments in renewable energy firms target flexible control and not doing so adversely affect the company’s reward (Boldeanu et al. 2022).

ESG Portfolios

The upper portfolio (appendix Table 14) has a lower return of 12.82%, higher volatility of 41.92% and higher beta of 1.98 compared to the bottom portfolio (appendix Table 16) with a return of 22.94%, a volatility of 32.63% and a beta of 1.44.

Conclusion

We would like to highlight that the above portfolio outcomes are resulted from a limited sample.

The higher than one beta values are driven from the volatility of the energy sector, such as fluctuations in oil and gas prices and unavailability of substitutes. These studies show that the Environmental performance is the most important factor and raising concern toward this leads to better financial performance. The S and G bottom portfolios are better performing which could be explained by the benefit from cost savings of more accessible funds such as green loans offered by banks in exchange of conformity with their ESG standards, another way to explain this, is the fact that motivated ESG investors in the energy industry settle for lower return in exchange of upper ESG portfolios with top performing ESG stocks (Pedersen, Fitzgibbons, and Pomorski 2021).

4.1.6.3. Ratio Analysis

4.1.6.3.1. Sharpe Ratio (SR)

Environmental Portfolio

The upper portfolio (appendix Table 2) has an SR of 24.05% which is higher than the bottom portfolio (appendix Table 4) with a value of 9.14%. From an investor's perspective, the higher the SR the better meaning that it is better to invest in the upper portfolio with top performing stocks that have higher returns and lower risk.

Social Portfolio

The bottom portfolio (appendix Table 8) has an SR of 28.11% which is higher than the upper portfolio (appendix Table 6) with a value of 5.29%. From an investor's perspective, the higher the SR the better performance adjusted for risk meaning that it is better to invest in the bottom portfolio.

Governance Portfolio

The bottom portfolio (appendix Table 12) has an SR of 34.36% which is higher than the upper portfolio with a negative value of -23.98%. The same conclusion of the social pillar applies for Governance.

ESG Portfolio

The bottom portfolio (appendix Table 16) has an SR of 62.47% which surpasses the upper portfolio with a value of 24.48%.

The same conclusion of the social pillar applies for ESG.

4.1.6.3.2. Jensen's Alpha

Environmental Portfolio

The upper and lower portfolios (appendixes Table 2 and 4) have both positive Jensen's Alpha values of 6.77% and 2.24% respectively. This shows that the portfolios are undervalued and outperforming the market through achieving higher actual returns than expected.

Social Portfolio

The same previous conclusion is driven to social portfolios (appendixes Table 6 and 8) with Jensen's Alpha values of 1.44% and 8.22% for upper and lower portfolios, respectively.

Governance Portfolio

The upper portfolio (appendix Table 10) has a negative Jensen's Alpha value of -6.59% which shows that the portfolio is underperforming with being overvalued by the market but as mentioned in section 3.3.4 "it could translate in a more attractive portfolio, as many investors are holding this portfolio". On the other hand, the bottom portfolio (appendix Table12) has a positive Jensen's Alpha positive value of 7.2% which shows that the portfolio is outperforming with being undervalued by the market.

ESG Portfolio

The upper and lower portfolios (appendixes Table 14 and 16) have positive Jensen's Alpha values of 9.25% and 19.64% respectively. This shows the outperformance of these portfolios and their undervaluation on the market.

4.1.6.3.3. Treynor Ratio

Environmental Portfolio

The upper portfolio (appendix Table 2) has a higher Treynor value of 4.77% compared to 1.89% for the bottom portfolio (appendix Table 4). This makes us deduce that the investment in the upper portfolio has a better risk return adjusted systematic risk and allows for diversification.

Social Portfolio

The bottom portfolio (appendix Table 8) has a higher value of 5.55% compared to 1.26% for the upper portfolio (appendix Table 6) . This makes us deduce that it is better to invest in the bottom portfolio that has a better risk return adjusted systematic risk.

Governance Portfolio

The bottom portfolio (appendix Table 12) has a higher value of 7.91% compared to a negative value of -5.07% for the upper portfolio (appendix Table 10). The same conclusion as the social pillar is deducted for Governance.

ESG Portfolio

The bottom portfolio (appendix Table 16) has a higher value of 14.07% compared to 5.18% for the upper portfolio (appendix Table 14). The same conclusion as the social pillar is deducted for ESG.

4.1.6.4. ESG Portfolio Optimization

We built four different scenarios to determine the most suitable ones for ESG portfolio optimization as the following:

Upper no-short

This portfolio is suitable for ESG motivated and risk averse investors, this resulted (appendix Table 18) in an upper portfolio composed of two stocks with a return of 16.83%, a volatility of 37.88% and a beta of 1.87.

Lower no-short

This portfolio is suitable for less ESG motivated and risk averse investors, this resulted (appendix Table 20) in a return of 25.87%, a volatility of 30.32% and a beta of 1.16.

Upper short

This portfolio is suitable for ESG motivated investors with high-risk appetite, this resulted (appendix Table 22) in a return of 72.12%, a volatility of 131.36% and a beta of 3.83.

Lower short

This portfolio is suitable for less ESG motivated investors with higher risk appetite, this resulted (appendix Table 24) in a return of 30.87%, a volatility of 33.9% and a beta of 1.2.

ESG Portfolio Optimization Conclusion

From an investor's perspective, the optimal portfolio offers the best possible balance between maximum returns, minimal risk and best ESG scores which is represented by the lower short portfolio. To better assess these criteria and support our analyzes, we further study the ESG portfolio ratios in the following section.

4.1.6.5. Optimal ESG Ratio Analysis

First the SR for the upper short portfolio surpasses the upper no-short portfolio with 52.96% and 37.68% respectively. This is also supported by the positive Jensen's Alpha ratio of 67.6%

and Treynor's ratio of 18.15% compared to 13.31% and 7.59% respectively for upper short and upper no-short portfolios. This makes us conclude that it is better to invest in the upper short portfolio.

Second, the SR for the lower short portfolio is higher than the lower no-short portfolio with 83.54% and 76.91% respectively. This is also supported by the positive Jensen's Alpha ratio of 27.7% and Treynor's ratio of 23.51% compared to 22.72% and 19.97% respectively for the lower short and lower no-short portfolios. This makes us conclude that it is better to invest in the lower short portfolio.

As referred to in section 3.3.4, maximizing the Sharpe ratio would result in constructing the tangency portfolio that lays in the efficient frontier and according to our findings and based on the type of investors, this is represented by many portfolios with the lower short portfolio being more efficient than the upper short portfolio. Given the type of investors funding these portfolios, it will trough on the ESG efficient frontier peak's right side for lower short portfolio investors seeking maximum SR and on the extreme right of the ESG efficient frontier for upper short portfolio investors seeking less SR (Pedersen, Fitzgibbons, and Pomorski 2021).

5. Conclusion

The last Chapter of this thesis concludes the main findings on the relation between a firm's investment attractiveness and its ESG performance in the European Energy Sector, the European technology sector, and in the Electric Vehicle Industry.

5.1. Summary

The current study investigates the impact of a firm's ESG performance on its investment attractiveness. The methodology employed incorporates two distinct analytical approaches: a Multiple Linear Regression analysis and further support analysis trough ESG performance portfolio construction evaluated through the Capital Asset Pricing Model. The study reveals a significant correlation between the ESG Overall Performance and the perceived value of a firm across all three sectors analyzed. In the European Technology and Energy Sectors, this relationship is positive, implying that a higher ESG performance enhances the value of a firm, as measured by Tobin's Q. Conversely, in the Electric Vehicle Industry, a significant negative correlation is observed, suggesting that higher ESG performance might inversely affect firm value. However, this negative correlation appears to be predominantly influenced by the environmental individual performance, as the social and governance individual performance exhibit no significant correlation with Tobin's Q. Consequently, any conclusions drawn about the correlation between ESG Overall Performance and firm value in the EV Industry should be treated with caution. Diving deeper into the individual dimensions of ESG, the social dimension does not exhibit a significant correlation for all industries analyzed, while the environmental dimension shows a significant correlation in each sector. The environmental individual performance is positively associated with firm's value in the European Technology and Energy Sectors, but negatively related in the EV Industry. The governance individual performance displays a significant positive correlation in the European Technology and Energy Sectors, whereas in the EV Industry, this correlation is non-significant. Regarding the CAPM model, it is concluded that portfolios with better environmental performance show lower returns for the EV industry and the European technology sector, which could be attributed to the increased expense in the short term to improve greener practices within a firm. The governance portfolios present higher performance metrics for the technology sector, whilst the opposite happens for the energy sector and EV industry. Finally, optimized ESG portfolios that presents higher ESG scores are more attractive to invest in the technology sector and EV industry, as given by the superior maximum Sharpe ratio. However, in the energy industry the opposite conclusion is reached.

5.2. Further Research

The main findings presented in this study could be further boosted and more accurate models could be developed with the evolution of firms' sustainability reporting, as well as a consolidation on rating agencies methodologies. As ESG is a relatively new concept, many firms still present a low disclosure score of their sustainability practices. Furthermore, rating agencies lack comparability and standardization in the way scores are computed. Hence, an improvement in both these areas will increase the reliability and accuracy in the way ESG performance is measured, leading to more accurate scores that will increase the relevance of the presented models. Furthermore, it is relevant to notice that the EV industry is still far from maturity, meaning there is a high degree of disruption and uncertainty. This has an impact on the investment attractiveness of this industry, as more risk averse investors will not deploy their capital in this industry. The European technology sector presents a high number of "unicorns," which upon the entrance of these companies on the stock market, the dataset available will be expanded, making it possible to realize a more robust analysis. The expansion of the dataset, by either including more companies or increasing the defined range, will result in a higher number of observations, leading to a more robust MRL model.

On a final note, CAPM is a widely used model, but it relies on unrealistic assumptions, the expansion of the dataset through the inclusion of more companies could make possible the use of other models, like Fama-French, which could lead to a better analysis of portfolio performance. In addition, the MLR is a good starting point to observe the relationship between ESG performance and a firm’s investment attractiveness. However, due to the complexity of said relationship, the Generalized Additive Model (GAM) could provide more accurate insights, as it captures the complexity of the explanatory variables by considering non-linear relationships.

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CAPM Appendixes

Table 1

Energy Upper Environmental Portfolio

Company Name	Ticker	Weight	Return	Risk	Beta
NORSK HYDRO ASA	NHY NO Equity	20%	11,06%	43,7%	1,911678
SHELL PLC	SHEL LN Equity	20%	2,82%	28,9%	0,980536
ENI SPA	ENI IM Equity	20%	4,05%	32,0%	1,374011
ALFA LAVAL AB	ALFA SS Equity	20%	11,73%	33,4%	1,516878
AKER BP ASA	AKRBP NO Equity	20%	21,06%	53,0%	2,180708

Table 2

Energy Upper Environmental Portfolio Results

Results	
Return	10,14%
Risk	31,55%
Beta	1,59276
CAPM Er	3,37%
Alpha	6,77%
Sharpe	24,05%
Treynor	4,77%

Table 3

Energy Lower Environmental Portfolio

Company Name	Ticker	Weight	Return	Risk	Beta
SBM OFFSHORE NV	SBMO NA Equity	20%	3,90%	28,4%	0,956428
AKER ASA-A SHARE	AKER NO Equity	20%	22,54%	47,8%	2,052885
TGS ASA	TGS NO Equity	20%	5,27%	53,2%	1,995824
DCC PLC	DCC LN Equity	20%	-8,87%	24,9%	1,010369
TECHNIPFMC PLC	FTI US Equity	20%	5,32%	54,6%	2,125251

Table 4

Energy Lower Environmental Results

Results	
Return	5,63%
Risk	33,65%
Beta	1,628151
CAPM Er	3,4%
Alpha	2,24%
Sharpe	9,14%
Treynor	1,89%

Table 5

Energy Upper Social Portfolio

Company Name	Ticker	Weight	Return	Risk	Beta
SAIPEM SPA	SPM IM Equity	20%	-21,53%	58,1%	1,525761
TGS ASA	TGS NO Equity	20%	5,27%	53,2%	1,995824
HARBOUR ENERGY PLC	HBR LN Equity	20%	16,19%	97,9%	2,929497
AKER BP ASA	AKRBP NO Equity	20%	21,06%	53,0%	2,180708
SBM OFFSHORE NV	SBMO NA Equity	20%	3,90%	28,4%	0,956428

Table 6

Energy Upper Social Portfolio Results

Results	
Return	4,98%
Risk	45,75%
Beta	1,917644
CAPM Er	3,5%
Alpha	1,44%
Sharpe	5,29%
Treynor	1,26%

Table 7

Energy Lower Social Portfolio

Company Name	Ticker	Weight	Return	Risk	Beta
AKER ASA-A SHARE	AKER NO Equity	20%	22,54%	47,8%	2,052885
FUGRO NV	FUR NA Equity	20%	4,02%	53,7%	1,955323
BOLLORE SE	BOL FP Equity	20%	5,39%	22,5%	0,886558
NORDEX SE	NDX1 GR Equity	20%	26,05%	57,4%	2,376546
TESCO PLC	TSCO LN Equity	20%	0,07%	25,7%	0,892625

Table 8

Energy Lower Social Portfolio Results

Results	
Return	11,61%
Risk	32,22%
Beta	1,632787
CAPM Er	3,4%
Alpha	8,22%
Sharpe	28,11%
Treynor	5,55%

Table 9

Energy Upper Governance Portfolio

Company Name	Ticker	Weight	Return	Risk	Beta
TESCO PLC	TSCO LN Equity	0,2	0,07%	25,7%	0,892625
JOHN WOOD GROUP	WG/ LN Equity	0,2	-13,19%	56,7%	2,059304
BP PLC	BP/ LN Equity	0,2	2,01%	28,2%	0,963568
SHELL PLC	SHEL LN Equity	0,2	2,82%	28,9%	0,980536
DCC PLC	DCC LN Equity	0,2	-8,87%	24,9%	1,010369

Table 10

Energy Upper Governance Portfolio Results

Results	
Return	-3,43%
Risk	24,97%
Beta	1,18128
CAPM Er	3,2%
Alpha	-6,59%
Sharpe	-23,98%
Treynor	-5,07%

Table 11

Energy Lower Governance Portfolio

Company Name	Ticker	Weight	Return	Risk	Beta
SUEDZUCKER AG	SZU GR Equity	20%	4,32%	36,4%	0,45663
OMV PETROM SA	SNP RO Equity	20%	12,10%	28,2%	1,176301
TUPRAS	TUPRS TI Equity	20%	10,99%	48,3%	1,053494
AKER ASA-A SHARE	AKER NO Equity	20%	22,54%	47,8%	2,052885
INA INDUSTRIJA	INA CZ Equity	20%	1,32%	9,3%	0,125074

Table 12

Energy Lower Governance Portfolio Results

Results	
Return	10,25%
Risk	22,41%
Beta	0,972877
CAPM Er	3,1%
Alpha	7,2%
Sharpe	34,36%
Treynor	7,91%

Table 13

Energy Upper ESG Portfolio

Company Name	Ticker	Weight	Return	Risk	Beta
ENI SPA	ENI IM Equity	20%	4,05%	32,0%	1,374011
AKER BP ASA	AKRBP NO Equity	20%	21,06%	53,0%	2,180708
HARBOUR ENERGY PLC	HBR LN Equity	20%	16,19%	97,9%	2,929497
ALFA LAVAL AB	ALFA SS Equity	20%	11,73%	33,4%	1,516878
NORSK HYDRO ASA	NHY NO Equity	20%	11,06%	43,7%	1,911678

Table 14

Energy Upper ESG Portfolio Results

Results	
Return	12,82%
Risk	41,92%
Beta	1,98255
CAPM Er	3,6%
Alpha	9,25%
Sharpe	24,48%
Treynor	5,18%

Table 15

Energy Lower ESG Portfolio

Company Name	Ticker	Weight	Return	Risk	Beta
TUPRAS	TUPRS TI Equity	20%	10,99%	48,3%	1,053494
AKER ASA-A SHARE	AKER NO Equity	20%	22,54%	47,8%	2,052885
NORDEX SE	NDX1 GR Equity	20%	26,05%	57,4%	2,376546
DOGAN HOLDING	DOHOL TI Equity	20%	34,13%	55,5%	0,513534
MYTILINEOS S.A.	MYTIL GA Equity	20%	20,98%	31,4%	1,247481

Table 16

Energy Lower ESG Portfolio Results

Results	
Return	22,94%
Risk	32,63%
Beta	1,448788
CAPM Er	3,3%
Alpha	19,64%
Sharpe	62,47%
Treynor	14,07%

Table 17

Energy Optimized Upper ESG Portfolio with Long-Sell Assumption

Company Name	Ticker	Weight	Return	Risk	Beta
ENI SPA	ENI IM Equity	0%	4,05%	32,0%	1,374011
AKER BP ASA	AKRBP NO Equity	55%	21,06%	53,0%	2,180708
HARBOUR ENERGY PLC	HBR LN Equity	0%	16,19%	97,9%	2,929497
ALFA LAVAL AB	ALFA SS Equity	45%	11,73%	33,4%	1,516878
NORSK HYDRO ASA	NHY NO Equity	0%	11,06%	43,7%	1,911678

Table 18

Energy Optimized Upper ESG Portfolio with Long-Sell Assumption Results

Results	
Return	16,83%
Risk	37,88%
Beta	1,879477
CAPM Er	3,5%
Alpha	13,31%
Sharpe	37,68%
Treynor	7,59%

Table 19

Energy Optimized Lower ESG Portfolio with Long-Sell Assumption

Company Name	Ticker	Weight	Return	Risk	Beta
TUPRAS	TUPRS TI Equity	0%	10,99%	48,3%	1,053494
AKER ASA-A SHARE	AKER NO Equity	11%	22,54%	47,8%	2,052885
NORDEX SE	NDX1 GR Equity	7%	26,05%	57,4%	2,376546
DOGAN HOLDING	DOHOL TI Equity	33%	34,13%	55,5%	0,513534
MYTILINEOS S.A.	MYTIL GA Equity	49%	20,98%	31,4%	1,247481

Table 20

Energy Optimized Lower ESG Portfolio with Long-Sell Assumption Results

Results	
Return	25,87%
Risk	30,32%
Beta	1,167392
CAPM Er	3,2%
Alpha	22,72%
Sharpe	76,91%
Treynor	19,97%

Table 21

Energy Optimized Upper ESG Portfolio with Short-Sell Assumption

Company Name	Ticker	Weight	Return	Risk	Beta
ENI SPA	ENI IM Equity	-434%	4,05%	32,0%	1,374011
AKER BP ASA	AKRBP NO Equity	323%	21,06%	53,0%	2,180708
HARBOUR ENERGY PLC	HBR LN Equity	-57%	16,19%	97,9%	2,929497
ALFA LAVAL AB	ALFA SS Equity	179%	11,73%	33,4%	1,516878
NORSK HYDRO ASA	NHY NO Equity	89%	11,06%	43,7%	1,911678

Table 22

Energy Optimized Upper ESG Portfolio with Short-Sell Assumption Results

Results	
Return	72,12%
Risk	131,36%
Beta	3,831911
CAPM Er	4,5%
Alpha	67,6%
Sharpe	52,96%
Treynor	18,15%

Table 23

Energy Optimized Lower ESG Portfolio with Short-Sell Assumption

Company Name	Ticker	Weight	Return	Risk	Beta
TUPRAS	TUPRS TI Equity	-34%	10,99%	48,3%	1,053494
AKER ASA-A SHARE	AKER NO Equity	21%	22,54%	47,8%	2,052885
NORDEX SE	NDX1 GR Equity	4%	26,05%	57,4%	2,376546
DOGAN HOLDING	DOHOL TI Equity	45%	34,13%	55,5%	0,513534
MYTILINEOS S.A.	MYTIL GA Equity	64%	20,98%	31,4%	1,247481

Table 24

Energy Optimized Lower ESG Portfolio with Short-Sell Assumption Results

Results	
Return	30,87%
Risk	33,9%
Beta	1,20453
CAPM Er	3,2%
Alpha	27,7%
Sharpe	83,54%
Treynor	23,51%

1. **ESG Overall Performance Model**

Energy Industry

Table 1.1. - Descriptive Statistics

	Mean	Std. Deviation	N
qt	,2276	,32251	247
MKT Cap	18616,078138	32540,950759	247
REV	25438,032389	53062,712864	247
LEV	90,9719	102,57667	247
LIQ	1,4384	,76011	247
RD(adj.)	155,21376518	339,19922602	247
ESG	4,2755060729	1,1719051586	247
SIZE	9,4419	1,48180	247

Table 1.2. - Correlations

		qt	MKT Cap	REV	LEV	LIQ	RD(adj.)
Pearson Correlation	qt	1,000	,036	-,161	-,043	,270	,194
	MKT Cap	,036	1,000	,905	-,114	-,116	,542
	REV	-,161	,905	1,000	-,101	-,118	,421
	LEV	-,043	-,114	-,101	1,000	-,135	-,149
	LIQ	,270	-,116	-,118	-,135	1,000	-,037
	RD(adj.)	,194	,542	,421	-,149	-,037	1,000
	ESG	,109	,400	,387	,121	-,089	,442
	SIZE	-,248	,711	,665	-,020	-,354	,368
Sig. (1-tailed)	qt	.	,286	,006	,248	<,001	,001
	MKT Cap	,286	.	,000	,037	,035	,000
	REV	,006	,000	.	,056	,032	,000
	LEV	,248	,037	,056	.	,017	,009
	LIQ	,000	,035	,032	,017	.	,284
	RD(adj.)	,001	,000	,000	,009	,284	.
	ESG	,044	,000	,000	,028	,081	,000
	SIZE	,000	,000	,000	,375	,000	,000
N	qt	247	247	247	247	247	247
	MKT Cap	247	247	247	247	247	247
	REV	247	247	247	247	247	247
	LEV	247	247	247	247	247	247
	LIQ	247	247	247	247	247	247
	RD(adj.)	247	247	247	247	247	247
	ESG	247	247	247	247	247	247
	SIZE	247	247	247	247	247	247

Table 1.2. - Correlations (cont.)

		ESG	SIZE
Pearson Correlation	qt	,109	-,248
	MKT Cap	,400	,711
	REV	,387	,665
	LEV	,121	-,020
	LIQ	-,089	-,354
	RD(adj.)	,442	,368
	ESG	1,000	,449
	SIZE	,449	1,000
Sig. (1-tailed)	qt	,044	<,001
	MKT Cap	,000	,000
	REV	,000	,000
	LEV	,028	,375
	LIQ	,081	,000
	RD(adj.)	,000	,000
	ESG	.	,000
	SIZE	,000	.
N	qt	247	247
	MKT Cap	247	247
	REV	247	247
	LEV	247	247
	LIQ	247	247
	RD(adj.)	247	247
	ESG	247	247
	SIZE	247	247

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	SIZE, LEV, LIQ, RD(adj.), ESG, REV, MKT Cap[b]	.	Enter

a. Dependent Variable: qt

b. All requested variables entered.

Table 1.3. - Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics	
					R Square Change	F Change
1	,637[a]	,406	,389	,25210	,406	23,374

Table 1.3. - Model Summary (cont.)[b]

Model	Change Statistics			Durbin-Watson
	df1	df2	Sig. F Change	
1	7	239	<,001	1,938

a. Predictors: (Constant), SIZE, LEV, LIQ, RD(adj.), ESG, REV, MKT Cap

b. Dependent Variable: qt

Table 1.4. - ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10,399	7	1,486	23,374	<,001[b]
	Residual	15,189	239	,064		
	Total	25,588	246			

a. Dependent Variable: qt

b. Predictors: (Constant), SIZE, LEV, LIQ, RD(adj.), ESG, REV, MKT Cap

Table 1.5. - Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,853	,168		5,087	<,001
	MKT Cap	1,198E-5	,000	1,208	8,782	<,001
	REV	-6,173E-6	,000	-1,016	-8,419	<,001
	LEV	-7,354E-5	,000	-,023	-,447	,656
	LIQ	,055	,023	,129	2,343	,020
	RD(adj.)	4,866E-5	,000	,051	,789	,431
	ESG	,066	,017	,241	3,940	<,001
	SIZE	-,112	,017	-,513	-6,406	<,001

Table 1.5. - Coefficients (cont.)[a]

Model		95,0% Confidence Interval for B		Correlations			Collinearity Statistics
		Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance
1	(Constant)	,523	1,183				
	MKT Cap	,000	,000	,036	,494	,438	,131
	REV	,000	,000	-,161	-,478	-,420	,171
	LEV	,000	,000	-,043	-,029	-,022	,906
	LIQ	,009	,101	,270	,150	,117	,818
	RD(adj.)	,000	,000	,194	,051	,039	,590
	ESG	,033	,100	,109	,247	,196	,663
	SIZE	-,146	-,077	-,248	-,383	-,319	,387

Table 1.5. - Coefficients (cont.)[a]

Model		Collinearity Statistics VIF
1	(Constant)	
	MKT Cap	7,623
	REV	5,859
	LEV	1,104
	LIQ	1,223
	RD(adj.)	1,696
	ESG	1,508
	SIZE	2,584

a. Dependent Variable: qt

Table 1.6. - Coefficient Correlations[a]

Model			SIZE	LEV	LIQ	RD(adj.)	ESG
1	Correlations	SIZE	1,000	,032	,388	,098	-,270
		LEV	,032	1,000	,141	,173	-,224
		LIQ	,388	,141	1,000	,022	-,084
		RD(adj.)	,098	,173	,022	1,000	-,352
		ESG	-,270	-,224	-,084	-,352	1,000
		REV	-,027	,049	,012	,222	-,124
		MKT Cap	-,350	-,007	-,109	-,401	,109
	Covariances	SIZE	,000	9,107E-8	,000	1,055E-7	-7,934E-5
		LEV	9,107E-8	2,711E-8	5,419E-7	1,756E-9	-6,204E-7
		LIQ	,000	5,419E-7	,001	3,191E-8	-3,322E-5
		RD(adj.)	1,055E-7	1,756E-9	3,191E-8	3,807E-9	-3,655E-7
		ESG	-7,934E-5	-6,204E-7	-3,322E-5	-3,655E-7	,000
		REV	-3,403E-10	5,956E-12	2,106E-10	1,003E-11	-1,536E-9
		MKT Cap	-8,334E-9	-1,524E-12	-3,463E-9	-3,374E-11	2,503E-9

Table 1.6. - Coefficient Correlations (cont.)[a]

Model			REV	MKT Cap
1	Correlations	SIZE	-,027	-,350
		LEV	,049	-,007
		LIQ	,012	-,109
		RD(adj.)	,222	-,401
		ESG	-,124	,109
		REV	1,000	-,814
		MKT Cap	-,814	1,000
	Covariances	SIZE	-3,403E-10	-8,334E-9
		LEV	5,956E-12	-1,524E-12
		LIQ	2,106E-10	-3,463E-9
		RD(adj.)	1,003E-11	-3,374E-11
		ESG	-1,536E-9	2,503E-9
		REV	5,376E-13	-8,141E-13
		MKT Cap	-8,141E-13	1,860E-12

a. Dependent Variable: qt

Table 1.7. - Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions			
				(Constant)	MKT Cap	REV	LEV
1	1	5,218	1,000	,00	,00	,00	,01
	2	1,498	1,866	,00	,02	,03	,04
	3	,562	3,048	,00	,01	,04	,21
	4	,461	3,363	,00	,00	,01	,55
	5	,158	5,751	,00	,00	,01	,17
	6	,067	8,837	,00	,80	,85	,00
	7	,032	12,758	,05	,05	,06	,02
	8	,005	32,984	,95	,11	,00	,00

Table 1.7. - Collinearity Diagnostics (cont.)[a]

Model	Dimension	Variance Proportions			
		LIQ	RD(adj.)	ESG	SIZE
1	1	,00	,01	,00	,00
	2	,01	,05	,00	,00
	3	,02	,40	,00	,00
	4	,05	,30	,00	,00
	5	,67	,01	,03	,01
	6	,00	,08	,02	,00
	7	,01	,15	,94	,04
	8	,24	,00	,01	,95

a. Dependent Variable: qt

Table 1.8. - Casewise Diagnostics[a]

Case Number	Std. Residual	qt	Predicted Value	Residual
125	3,305	1,61	,7802	,83327

a. Dependent Variable: qt

Table 1.9. - Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-,3832	1,0862	,2276	,20560	247
Residual	-,56474	,83327	,00000	,24849	247
Std. Predicted Value	-2,971	4,176	,000	1,000	247
Std. Residual	-2,240	3,305	,000	,986	247

a. Dependent Variable: qt

Charts

Chart 1.1 - Histogram

Dependent Variable: qt

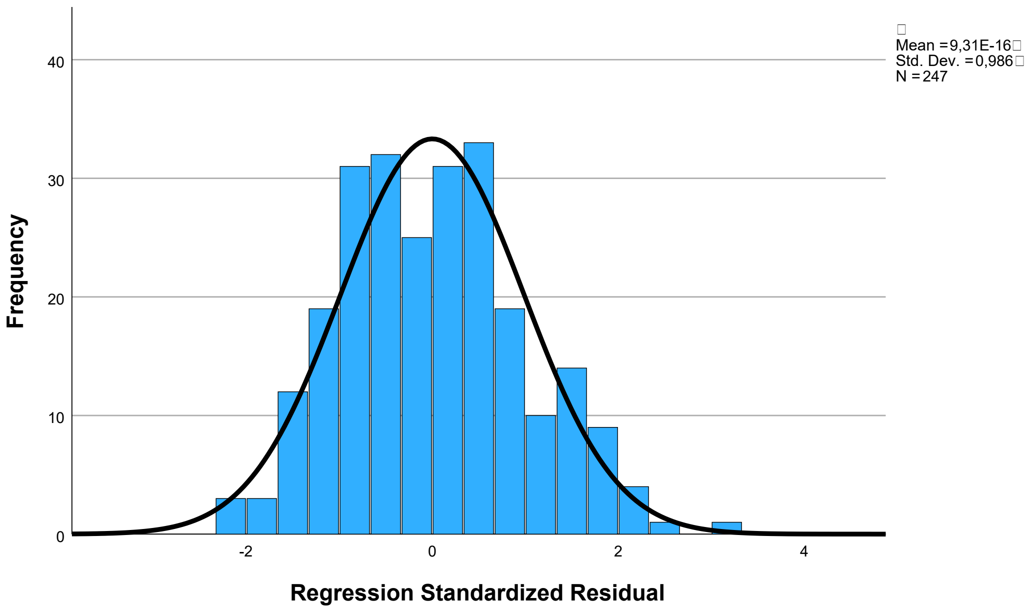


Chart 1.2. - Normal P-P Plot of Regression Standardized Residual Dependent Variable: qt

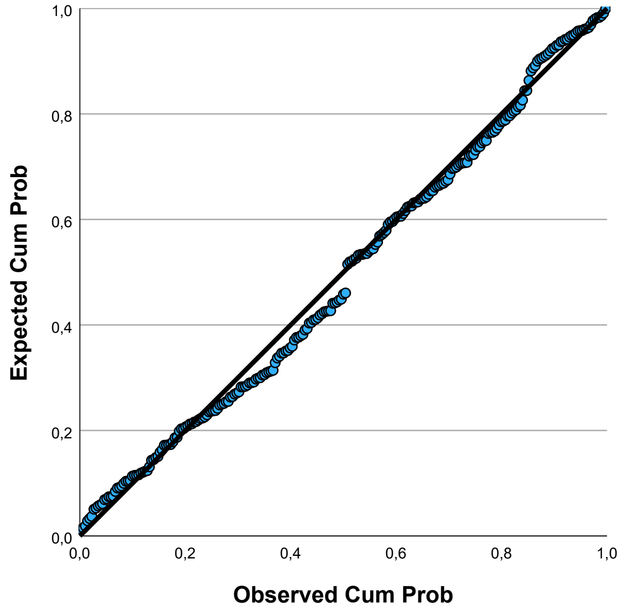
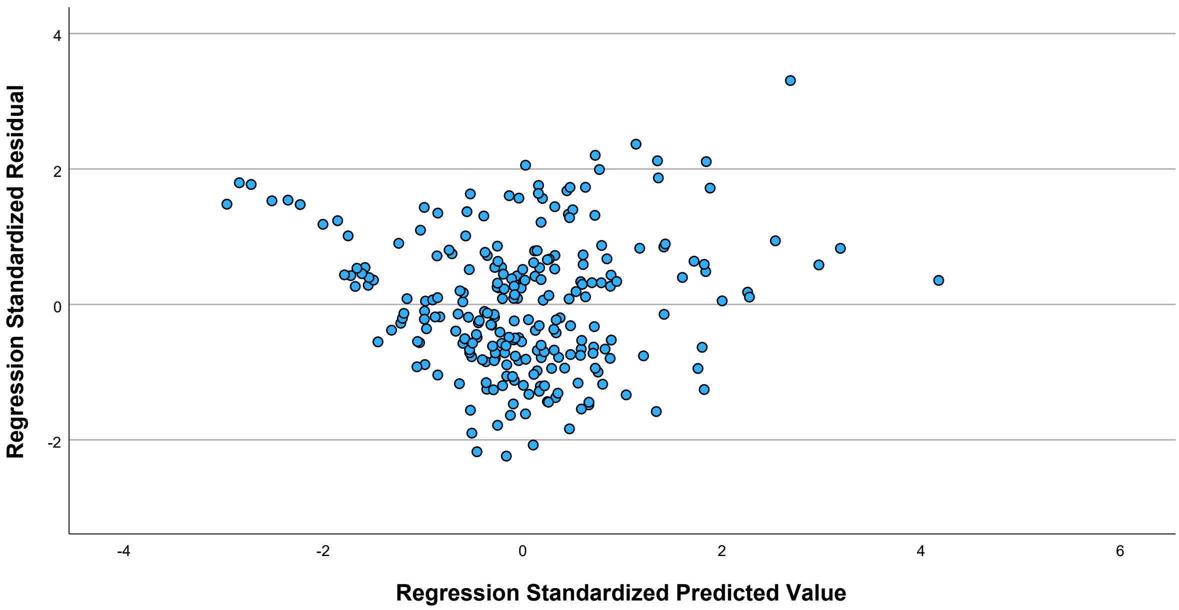


Chart 1.3. - Scatterplot

Dependent Variable: qt



2. ESG Individual Performance Model

Energy Industry

Table 2.1. - Descriptive Statistics

	Mean	Std. Deviation	N
	,2276	,32251	247
MKT Cap	18616,078138	32540,950759	247
REV	25438,032389	53062,712864	247
LEV	90,9719	102,57667	247
LIQ	1,4384	,76011	247
RD(adj.)	155,21376518	339,19922602	247
SIZE	9,4419	1,48180	247
E	3,4639	2,13098	247
S	3,5604	1,59983	247
G	5,8022	1,44344	247

Table 2.2. - Correlations

		qt	MKT Cap	REV	LEV	LIQ	RD(adj.)
Pearson Correlation	qt	1,000	,036	-,161	-,043	,270	,194
	MKT Cap	,036	1,000	,905	-,114	-,116	,542
	REV	-,161	,905	1,000	-,101	-,118	,421
	LEV	-,043	-,114	-,101	1,000	-,135	-,149
	LIQ	,270	-,116	-,118	-,135	1,000	-,037
	RD(adj.)	,194	,542	,421	-,149	-,037	1,000
	SIZE	-,248	,711	,665	-,020	-,354	,368
	E	,141	,347	,339	-,005	,024	,451
	S	-,019	,073	,070	,190	-,030	,136
	G	,077	,381	,366	,092	-,220	,261
Sig. (1-tailed)	qt	.	,286	,006	,248	<,001	,001
	MKT Cap	,286	.	,000	,037	,035	,000
	REV	,006	,000	.	,056	,032	,000
	LEV	,248	,037	,056	.	,017	,009
	LIQ	,000	,035	,032	,017	.	,284
	RD(adj.)	,001	,000	,000	,009	,284	.
	SIZE	,000	,000	,000	,375	,000	,000
	E	,013	,000	,000	,467	,353	,000
	S	,384	,128	,137	,001	,321	,016
	G	,114	,000	,000	,074	,000	,000
N	qt	247	247	247	247	247	247
	MKT Cap	247	247	247	247	247	247

Table 2.2. - Correlations (cont.)

		SIZE	E	S	G
Pearson Correlation	qt	-,248	,141	-,019	,077
	MKT Cap	,711	,347	,073	,381
	REV	,665	,339	,070	,366
	LEV	-,020	-,005	,190	,092
	LIQ	-,354	,024	-,030	-,220
	RD(adj.)	,368	,451	,136	,261
	SIZE	1,000	,399	,172	,314
	E	,399	1,000	,296	,162
	S	,172	,296	1,000	,035
	G	,314	,162	,035	1,000
Sig. (1-tailed)	qt	<,001	,013	,384	,114
	MKT Cap	,000	,000	,128	,000
	REV	,000	,000	,137	,000
	LEV	,375	,467	,001	,074
	LIQ	,000	,353	,321	,000
	RD(adj.)	,000	,000	,016	,000
	SIZE	.	,000	,003	,000
	E	,000	.	,000	,005
	S	,003	,000	.	,293
	G	,000	,005	,293	.
N	qt	247	247	247	247
	MKT Cap	247	247	247	247

Table 2.2. - Correlations (cont.)

		qt	MKT Cap	REV	LEV	LIQ	RD(adj.)
	REV	247	247	247	247	247	247
	LEV	247	247	247	247	247	247
	LIQ	247	247	247	247	247	247
	RD(adj.)	247	247	247	247	247	247
	SIZE	247	247	247	247	247	247
	E	247	247	247	247	247	247
	S	247	247	247	247	247	247
	G	247	247	247	247	247	247

Table 2.2. - Correlations (cont.)

	SIZE	E	S	G
REV	247	247	247	247
LEV	247	247	247	247
LIQ	247	247	247	247
RD(adj.)	247	247	247	247
SIZE	247	247	247	247
E	247	247	247	247
S	247	247	247	247
G	247	247	247	247

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	G, S, LEV, LIQ, E, REV, RD (adj.), SIZE, MKT Cap[b]	.	Enter

a. Dependent Variable: qt

b. All requested variables entered.

Table 2.3. - Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics	
					R Square Change	F Change
1	,653[a]	,427	,405	,24874	,427	19,617

Table 2.3. - Model Summary(cont.)[b]

Model	Change Statistics			Durbin-Watson
	df1	df2	Sig. F Change	
1	9	237	<,001	2,041

a. Predictors: (Constant), G, S, LEV, LIQ, E, REV, RD(adj.), SIZE, MKT Cap

b. Dependent Variable: qt

Table 2.4. - ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10,924	9	1,214	19,617	<,001[b]
	Residual	14,664	237	,062		
	Total	25,588	246			

a. Dependent Variable: qt

b. Predictors: (Constant), G, S, LEV, LIQ, E, REV, RD(adj.), SIZE, MKT Cap

Table 2.5. - Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	,852	,183		4,664	<,001
	MKT Cap	1,197E-5	,000	1,207	8,796	<,001
	REV	-6,328E-6	,000	-1,041	-8,723	<,001
	LEV	-2,682E-5	,000	-,009	-,164	,870
	LIQ	,054	,024	,128	2,291	,023
	RD(adj.)	2,480E-5	,000	,026	,401	,689
	SIZE	-,113	,017	-,519	-6,477	<,001
	E	,038	,009	,251	4,135	<,001
	S	-,004	,011	-,022	-,415	,678
	G	,032	,012	,143	2,609	,010

Table 2.5. - Coefficients (cont.)[a]

Model		95,0% Confidence Interval for B		Correlations			Collinearity Statistics
		Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance
1	(Constant)	,492	1,212				
	MKT Cap	,000	,000	,036	,496	,433	,128
	REV	,000	,000	-,161	-,493	-,429	,170
	LEV	,000	,000	-,043	-,011	-,008	,892
	LIQ	,008	,101	,270	,147	,113	,771
	RD(adj.)	,000	,000	,194	,026	,020	,572
	SIZE	-,147	-,079	-,248	-,388	-,318	,376
	E	,020	,056	,141	,259	,203	,658
	S	-,025	,017	-,019	-,027	-,020	,862
	G	,008	,056	,077	,167	,128	,799

Table 2.5. - Coefficients (cont.)[a]

Model		Collinearity Statistics VIF
1	(Constant)	
	MKT Cap	7,792
	REV	5,891
	LEV	1,121
	LIQ	1,297
	RD(adj.)	1,750
	SIZE	2,660
	E	1,519
	S	1,160
	G	1,251

a. Dependent Variable: qt

Table 2.6. - Coefficient Correlations[a]

Model			G	S	LEV	LIQ	E
1	Correlations	G	1,000	,038	-,137	,165	-,017
		S	,038	1,000	-,202	-,027	-,217
		LEV	-,137	-,202	1,000	,117	-,036
		LIQ	,165	-,027	,117	1,000	-,180
		E	-,017	-,217	-,036	-,180	1,000
		REV	-,068	-,001	,041	,014	-,123
		RD(adj.)	-,095	-,061	,147	,049	-,349
		SIZE	,014	-,108	,016	,411	-,265
		MKT Cap	-,077	,051	,004	-,139	,142
	Covariances	G	,000	4,943E-6	-2,756E-7	4,804E-5	-1,889E-6
		S	4,943E-6	,000	-3,538E-7	-6,756E-6	-2,127E-5
		LEV	-2,756E-7	-3,538E-7	2,680E-8	4,553E-7	-5,366E-8
		LIQ	4,804E-5	-6,756E-6	4,553E-7	,001	-3,929E-5
		E	-1,889E-6	-2,127E-5	-5,366E-8	-3,929E-5	8,416E-5
		REV	-6,095E-10	-1,057E-11	4,863E-12	2,499E-10	-8,200E-10
		RD(adj.)	-7,198E-8	-4,030E-8	1,490E-9	7,270E-8	-1,981E-7
		SIZE	2,996E-6	-2,005E-5	4,527E-8	,000	-4,250E-5
		MKT Cap	-1,285E-9	7,395E-10	9,402E-13	-4,508E-9	1,775E-9

Table 2.6. - Coefficient Correlations (cont.)[a]

Model			REV	RD(adj.)	SIZE	MKT Cap
1	Correlations	G	-,068	-,095	,014	-,077
		S	-,001	-,061	-,108	,051
		LEV	,041	,147	,016	,004
		LIQ	,014	,049	,411	-,139
		E	-,123	-,349	-,265	,142
		REV	1,000	,228	-,023	-,804
		RD(adj.)	,228	1,000	,118	-,407
		SIZE	-,023	,118	1,000	-,366
		MKT Cap	-,804	-,407	-,366	1,000
	Covariances	G	-6,095E-10	-7,198E-8	2,996E-6	-1,285E-9
		S	-1,057E-11	-4,030E-8	-2,005E-5	7,395E-10
		LEV	4,863E-12	1,490E-9	4,527E-8	9,402E-13
		LIQ	2,499E-10	7,270E-8	,000	-4,508E-9
		E	-8,200E-10	-1,981E-7	-4,250E-5	1,775E-9
		REV	5,262E-13	1,025E-11	-2,871E-10	-7,938E-13
		RD(adj.)	1,025E-11	3,825E-9	1,273E-7	-3,425E-11
		SIZE	-2,871E-10	1,273E-7	,000	-8,694E-9
		MKT Cap	-7,938E-13	-3,425E-11	-8,694E-9	1,851E-12

a. Dependent Variable: qt

Table 2.7. - Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions (Constant)	MKT Cap	REV	LEV
1	1	6,826	1,000	,00	,00	,00	,00
	2	1,557	2,094	,00	,02	,03	,03
	3	,577	3,441	,00	,01	,04	,21
	4	,464	3,833	,00	,00	,01	,56
	5	,198	5,879	,00	,01	,00	,11
	6	,161	6,512	,00	,00	,02	,07
	7	,119	7,579	,00	,00	,01	,00
	8	,064	10,305	,00	,81	,88	,00
	9	,030	14,980	,04	,02	,02	,01
	10	,004	39,895	,96	,13	,00	,00

Table 2.7. - Collinearity Diagnostics (cont.)[a]

Model	Dimension	Variance Proportions LIQ	RD(adj.)	SIZE	E	S	G
1	1	,00	,00	,00	,00	,00	,00
	2	,01	,05	,00	,00	,00	,00
	3	,01	,35	,00	,01	,00	,00
	4	,05	,27	,00	,00	,00	,00
	5	,38	,09	,00	,29	,09	,00
	6	,20	,04	,00	,48	,03	,04
	7	,04	,00	,00	,12	,82	,05
	8	,00	,14	,00	,02	,00	,01
	9	,03	,04	,08	,02	,05	,82
	10	,28	,01	,91	,05	,00	,07

a. Dependent Variable: qt

Table 2.8. - Casewise Diagnostics[a]

Case Number	Std. Residual	qt	Predicted Value	Residual
125	3,213	1,61	,8143	,79912

a. Dependent Variable: qt

Table 2.9. - Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-,3900	1,0624	,2276	,21073	247
Residual	-,49632	,79912	,00000	,24415	247
Std. Predicted Value	-2,931	3,962	,000	1,000	247
Std. Residual	-1,995	3,213	,000	,982	247

a. Dependent Variable: qt

Charts

Chart 2.1. - Histogram

Dependent Variable: qt

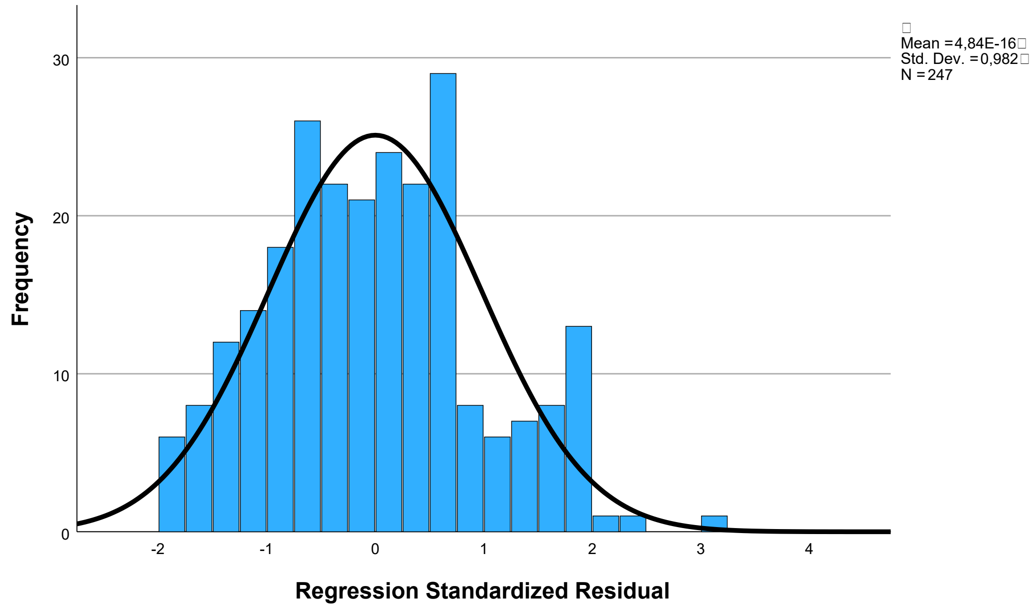


Chart 2.2. - Normal P-P Plot of Regression

Standardized Residual Dependent Variable: qt

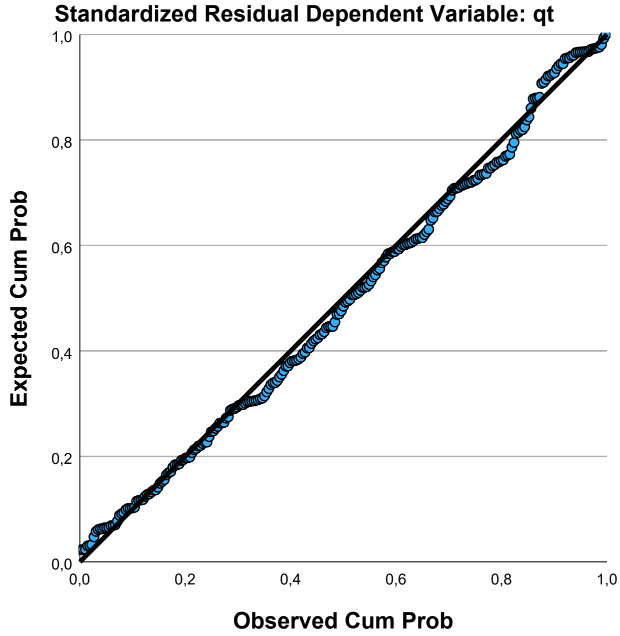


Chart 2.3. - Scatterplot

Dependent Variable: qt