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Evaluating the Impact of ESG Performance on Corporate Financial Outcomes

An Empirical Analysis of the European Energy Sector

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ABSTRACT:

This study examines the relationship between ESG disclosure and financial performance in European energy companies from 2014 to 2023, analyzing 860 firms with 3,691 firm-year observations. The findings reveal that while ESG disclosure shows no significant relationship with accounting performance (ROA), it has a significant negative correlation with market valuation (Tobin's Q). Individual component analysis demonstrates that social disclosure positively affects operational efficiency but negatively impacts market value, while environmental and governance disclosures show consistently negative relationships. Temporal analysis indicates that ESG effects on accounting performance fade after one year, but negative market reactions persist, suggesting structural investor skepticism toward sustainability investments in energy. These results highlight an ESG paradox where operational realities and market perceptions diverge. The study contributes to stakeholder theory by showing that ESG investments may not yield immediate financial benefits in capital-intensive transitional industries and emphasizes the need for sector-specific approaches to sustainability in the energy sector.

KEYWORDS: ESG disclosure, financial performance, energy sector, Tobin's Q, ROA, sustainable finance, energy transition

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Abbreviations

ESG	Environmental, Social, and Governance
ROA	Return on Assets
TQ	Tobin's Q
ENV	Environmental Score
SOC	Social Score
GOV	Governance Score
SIZE	Firm Size
LEV	Leverage
GROWTH	Sales Growth
FE	Fixed Effects
RE	Random Effects
OLS	Ordinary Least Squares
EU	European Union
GHG	Greenhouse Gas
UN	United Nations
SDG	Sustainable Development Goals
EIKON	Thomson Reuters Refinitiv Eikon
CSR	Corporate Social Responsibility
TBL	Triple Bottom Line
VIF	Variance Inflation Factor
GRI	Global Reporting Initiative
TCFD	Task Force on Climate-Related Financial Disclosures
SASB	Sustainability Accounting Standards Board

1 Introduction

The first chapter of this study begins by describing the context under which ESG (Environmental, Social, and Governance) factors have emerged, especially compared to the energy sector's performance. This discussion is grounded in several data points that demonstrate that ESG is gaining significant importance in corporate strategies and stakeholder engagements. Through this chapter, a rationale guiding for ESG research is presented, outlining all the burning questions that need answering in today's global environment around the link between ESG and corporate financial performance. This chapter will then discuss the problem statements, formulate research questions and objectives based on these research problems to further investigate them. Thereafter, the delimitation of the research will be outlined, and the importance of the research indicated on several grounds.

1.1 Research Background

Climate change, biodiversity loss, and pollution have continued to be a significant problem worldwide regarding global warming, which has influenced the shift towards the investments of sustainable development and green technology. Over the years, the European Green Agreement represents the strategic resilient framework aimed at guiding the European Union towards climate neutrality by 2050, promoting green finance initiatives and raising businesses' optimal interest in environmental, social and governance (ESG) practices. By integrating environmental objectives with the principles of social equity and economic policies, the European Green Agreement seeks to position and establish Europe as a global leader in climate action and green innovation. While certain firms utilize Environmental, Social, and Governance (ESG) frameworks to secure a competitive advantage others regard them primarily to satisfy the basic operational standards and requirements. The transition toward sustainability inherently remains dynamic and evolutionary with its far-reaching global impact. Through improved practices in resource allocation and management, ESG integration is projected to significantly strength and

reinforce corporate credibility with long term value creation and operational resilience. Given that the long-term prospects of humanity become increasingly dependent and contingent upon sustainable practices, the integration and consideration of ESG principles into core corporate strategy has become progressively imperative for companies.

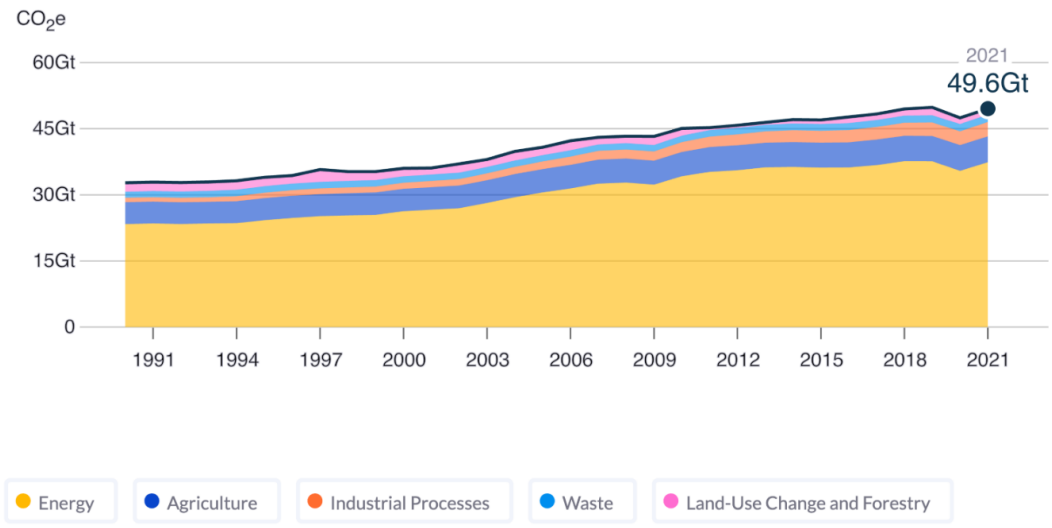

Figure 1. Global Historical Greenhouse Gas Emissions.

Source: Climate Watch (2021)

In this context, the pivotal role of energy consumption stands out as a central area of concern and opportunity for promoting sustainability. Globally, the energy sector is responsible for an estimated 75.6% (37.6 $GtCO_2e$) of global anthropogenic greenhouse gas emissions, thereby reenforcing the dominant contributor of climate change (Climate Watch, 2021). As illustrated in Figure 1, the energy sector comprises a multiple range of activities, which include transportation, electricity and heat generation, building operations, manufacturing and construction, fugitive emissions, and other forms of fuel combustion process. Regionally, as shown in Figure 2 indicated that Europe's total greenhouse gas emissions amounted to 7.38 gigatonnes (Gt) of CO_2 equivalent in 2021, predominantly originating from the energy sector, thereby reaffirming its critical role in the region's climate impact.

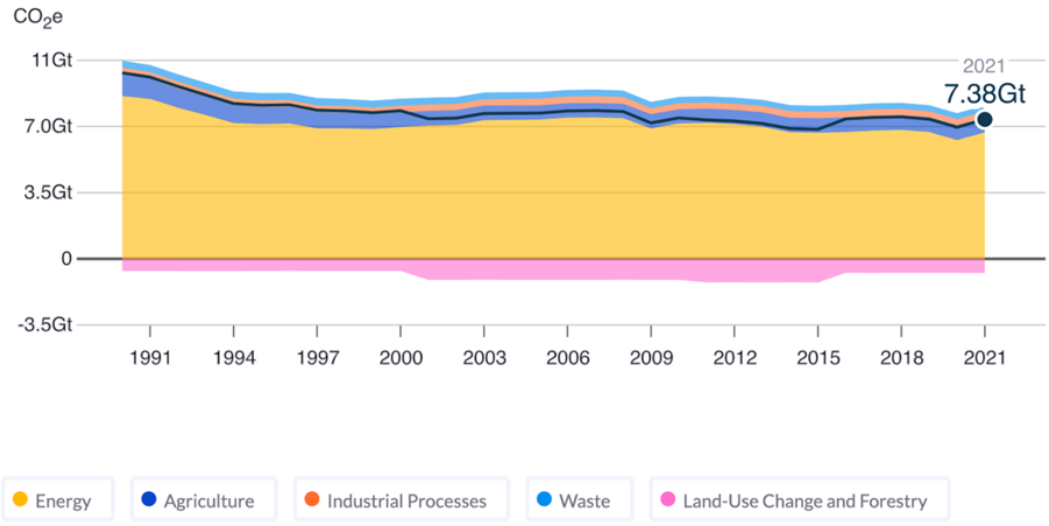

Figure 2. Europe's' Historical Greenhouse Gas Emissions

Source: Climate Watch (2021)

While Europe's overall emissions are significant, examining emission intensity reveals how individual countries differ in their energy profiles and sustainability challenges. Multiple European countries have experienced changes in CO_2 emission intensity levels throughout 1990 to 2010 and until 2022 as shown in Figure 3 which uses the metric of grams of CO_2 equivalent per kilowatt-hour (gCO_2e/kWh). The electricity production in countries like Estonia, Poland and Cyprus heavily depends on fossil fuel usage because these nations demonstrate high emission intensities. Lower emission intensities characterize Sweden along with Luxembourg and France because these countries move forward with renewable energy together with nuclear power as their main electricity sources. The diversity in greenhouse gas emissions illustrates why every nation needs to establish specific sustainable energy solutions that match their economic development and infrastructure.

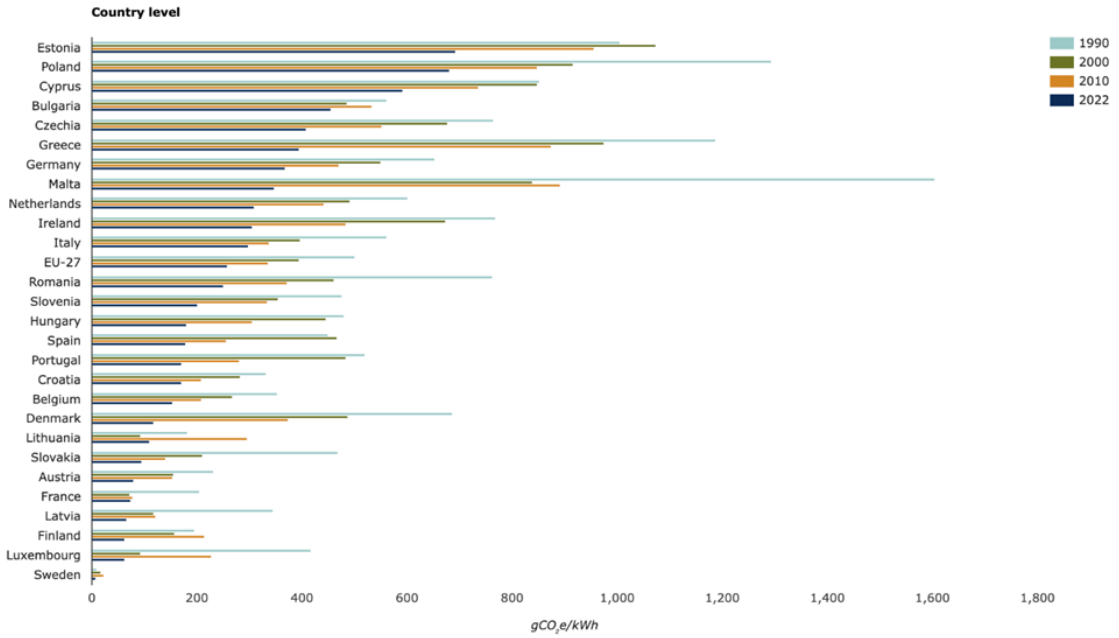

Figure 3. Country-level data on CO2 gas emission intensity.

Source: European Environment Agency (2024)

Beyond emission patterns, differences in the adoption and strength of ESG practices across European countries provide further insight into their overall sustainability performance. The reduction of greenhouse gas emissions requires immediate focus on energy production since energy accounts for roughly two-thirds of all emissions. Energy businesses receive imperative instructions to develop climate change combat strategies alongside recognition of how climatic occurrences influence environmental systems and human populations. All European energy firms have established a leading position by demonstrating sustainability practices (Makridou et al., 2024). Through efficient use of ESG frameworks these companies ensure environmental protection together with stable operation performance.

The growing stakeholder interest in sustainability-driven practices necessitates further examination of the energy sector (Carnevale & Di Tommaso, 2025). Research about the energy sector remains insufficient because previous studies generate conflicting results even though few studies directly focus on this field. Due to its gaming position in

worldwide markets and extensive sustainability-oriented policies the European energy sector becomes an ideal setting to study ESG effects on performance. Through innovative legislative acts the European Union takes a position as a global leader in addressing environmental issues and energy security by reducing greenhouse gas emissions and advancing renewable energy while improving overall energy efficiency standards.

As part of its Paris Agreement commitment the EU created rigorous Nationally Determined Contributions that focus on minimizing greenhouse gas emissions at least 40% below 1990 levels by 2030. Renewable sources are steadily displacing fossil fuels as the primary energy source within European regions although these initial fossil fuel contributors have not been fully eliminated. Building a solid European energy market alongside promoting renewable energy and carbon pricing signals and enhancing energy efficiency and electricity and gas markets has shown substantial development throughout the past few years. European policies create an environment which drives the improvement of ESG performance at energy companies with particular emphasis on environmental initiatives.

Through the analysis of Capece et al. (2013) European energy market features its own unique organizational elements along with market movement patterns and supervisory standards and business entity structure. Independent companies secured entry into the European energy market through its liberalization phase at different stages of supply chain development. New firms can access all production stages of energy through European directives. Energy companies at both the national and regional levels have undergone privatization with increased speed in various member states. Member states have created unified institutions with regulatory systems that have developed a unified energy market. European incentives for climate action alongside its green economy transformation operate to create a market combination of standardized procedures with country-specific characteristics among member states. The adoption of ESG methods by European energy companies together with their resulting operational success is largely affected by these environment-specific elements.

The European energy sector maintains strong physical stability, yet its financial strength withstands substantial pressure from both the Covid-19 pandemic and Russia-Ukraine war developments. European nations strongly support ESG implementation through their established physical and social frameworks alongside their extensive sustainability promoting policies. Among global jurisdictions the EU maintains the position of having among the most stringent compulsory ESG reporting requirements.

Figure 4. ESG and Financial Performance

Source: McKinsey & Company (Delevingne et al., 2020)

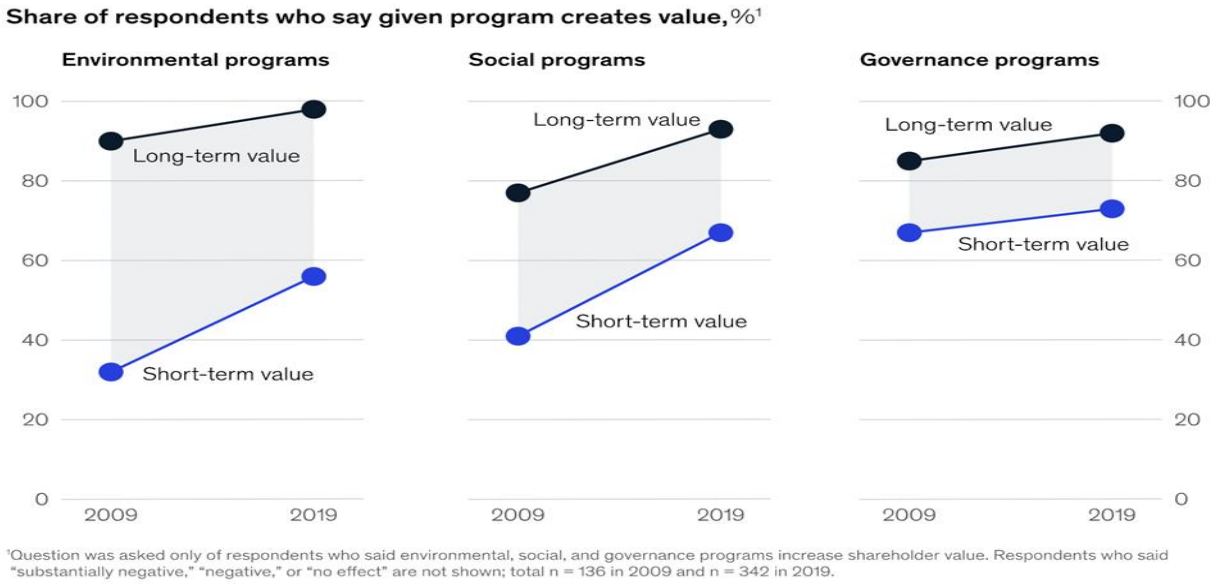

Figure 5. ESG programs and Shareholders Value

Source: McKinsey & Company (Delevingne et al., 2020)

The relationship between ESG practices and financial performance stands clearer through Figures 4 and 5. A McKinsey & Company survey shows top executives and financial professionals understand how ESG matters affect business success while demonstrating strong effects on company revenue and market worth. ESG initiatives face growing financial implications because investors together with consumers and employees and stakeholders are increasing their evaluation standards (Figures 4 and 5). When companies take a proactive stance towards ESG issues they can defeat increasing stakeholder expectations by standing apart from competitors, which leads to increased business value. The survey results demonstrate that customers are willing to pay a higher price for companies with solid ESG practices while linking superior ESG performance to superior corporate management quality. This data suggests that executives along with investors will start incorporating ESG metrics into strategic financial operations. The growing societal appetite for ESG stands to continue elevating its market value according to current market trends. Businesses that delay ESG practice adoption expose themselves to substantial untapped business value opportunities.

Research focusing on the financial outcomes of ESG performance stands as an essential requirement because energy companies steer ESG discourse. This research examines ESG performance relationships with firm performance of European energy companies. Return on Assets (ROA) together with Tobin's Q will serve as the principal analysis variables following the implementation of a panel regression model. ROA functions as a popular accounting method to evaluate profitability whereas researchers widely use it to analyze ESG performance relations with corporate financial performance (CFP) (Giannopoulos et al., 2022). The financial industry employs Tobin's Q to evaluate market asset valuation through comparing company worth against asset replacement costs. The detailed evaluation of ESG performance necessitates a separate analysis of its environmental, social and governance aspects to determine individual financial performance effects. Furthermore, ESG adoption creates both challenges and opportunities for businesses across the European energy sector.

1.2 Problem Statement

As ESG practices gain attention among managers, investors, and policymakers, they are increasingly seen as valuable for providing insights that go beyond traditional financial data and help support better strategic decisions. A key question still remains: do ESG practices actually help companies gain a competitive edge, or do they simply add more financial burden? Researchers began exploring how sustainability impacts company performance as early as the 1970s (Giannopoulos et al., 2022). The connection between ESG practices and corporate financial success exists as a complicated matter. Research attempts to dissect this relationship by observing ESG scores in total and specific elements according to Alareeni and Hamdan (2020) and Ademi and Klungseth (2022). The unclear outcomes from research studies demonstrate that researchers need to study how ESG factors interact with each other. Studies about ESG dimensions traditionally limit their analysis to single factors despite environmental social and governance elements working together to affect results. Research still presents contradictory evidence about ESG impact on firm performance by studying its parts one at a time (Giannopoulos

et al., 2022). The sector's need for comprehensive ESG analysis becomes clear because ESG factors interact together in such critical industries as energy sector. Studying both ESG composite measures and separate factors helps create a complete understanding of corporate performance outcomes.

The energy industry stands as the major source of concern because it generates 75.6% of global greenhouse gas emissions which amount to 37.6 $GtCO_2e$. Energy corporations experience significant pressure from regulators together with investors and consumers to establish and show their ESG practices while facing growing regulatory scrutiny. The European energy sector continues to produce substantial emissions since it released 7.38 gigatons of CO_2 equivalent in 2021. European energy companies managed to lower CO_2 emissions slightly from 5 to 6 Gt since the 1990s while still producing yearly emissions between 5 and 6 Gt. The present scenario demonstrates a strong need to reconcile environmental preservation with corporate profits. ESG disclosure has become widespread but its relationship between firm performance and value search remains uncertain, especially when examining the energy sector. The correct comprehension of environmental, social and governance aspects that impact ESG factors serves energy companies well when they operate through the complex relationship between sustainability and profitability. The objectives of this study are to: examine the relationship between sustainability (ESG) disclosure and corporate financial performance, as measured by Return on Assets (ROA); assess the link between ESG disclosure and firm value, as measured by Tobin's Q; evaluate the significance of the three ESG components, Environmental, Social, and Governance, in influencing firm value and financial performance. The research results will yield essential knowledge about proper ESG practice implementation by energy companies to boost sustainability and financial performance while delivering important implications for decision-makers including government officials and business managers and financial stakeholders.

1.3 Research Questions

This section presents the primary research questions that investigate the relationship between sustainability (ESG) disclosures and various aspects of corporate financial performance and firm value.

1. To what extent does sustainability (ESG) disclosure influence firm financial performance, specifically as measured by Return on Assets (ROA)?
2. What is the impact of sustainability (ESG) disclosure on firm value, with particular reference to Tobin's Q as a measure?
3. Are the three components of ESG—Environmental, Social, and Governance—differ in their significance in influencing firm value and corporate financial performance?
4. Is there a delayed effect of ESG scores and ESG components on corporate financial outcomes (ROA & Tobin's Q)?

1.4 Research Objectives

The following objectives are intended to structure the examination of the relationship between sustainability (ESG) disclosures, corporate financial performance, and firm value.

1. To assess the relationship between sustainability (ESG) disclosure and firm financial performance, with a particular focus on firm profitability, using Return on Assets (ROA) as the primary financial performance indicator.
2. To evaluate the influence of sustainability (ESG) on firm value, employing Tobin's Q as the measure of indicator of market valuation relative to asset value.
3. To analyze the relative significance of the Environmental, Social, and Governance dimensions of ESG toward shaping firm value and corporate financial performance.
4. To examine whether ESG disclosure and its individual components demonstrate lagged effects on financial performance and firm value.

1.5 Significance of Study

This research offers both theoretical information along with real-world applications, focusing on two main areas: how the energy industry operates and how companies practice sustainability alongside financial goals.

The present research contributes to existing knowledge about stakeholder theory emphasizing stakeholder relationship management as a critical success factor for organizations (Freeman, 2010). It offers clear evidence on how ESG performance relates to financial outcomes, showing that strong stakeholder engagement can lead to better financial performance. Friede et al. (2015) discovered that firms activate better outcomes through their ESG programs. ESG programs operating at high standards allow businesses to develop honest relationships with their stakeholders that strengthen customer loyalty and boost morale among employees while attracting organizational investors. With this research, institutional theory receives new insights about how business environment factors impact ESG applications along with their performance implications.

The study offers practical business insights which corporate managers can use to measure the real advantages of quality ESG approach implementation. The empirical results show how ESG performance creates financial value by linking to ROA and Tobin's Q metrics which proves to stakeholders that sustainable practices yield financial results. The combination of improved reputation with better financial results leads to sustained business operation during long periods.

1.6 Hypothesis Development

Based on the theoretical background and existing literature, this study proposes the following hypotheses:

H0: There is no relationship between ESG disclosures with firm value and performance.

H1: There is a positive relationship between ESG disclosures and firm profitability.

H2: There is a positive relationship between ESG disclosures and firm value.

H3: There is a positive relationship between environmental disclosures and firm profitability.

H4: There is a positive relationship between environmental disclosures and market value.

H5: There is a positive relationship between social disclosures and firm profitability.

H6: There is a positive relationship between social disclosures and market value.

H7: There is a positive relationship between governance disclosures and firm profitability.

H8: There is a positive relationship between governance disclosures and market value.

For each of these relationships, this study also examines whether there are delayed effects of ESG disclosure on financial outcomes. The detailed theoretical foundations and empirical evidence supporting these hypotheses are developed in Chapter 2.

2 Literature Review

The literature review chapter presents a thorough review of the existing literature on the link between ESG disclosures and firm financial performance. Due to growing corporate emphasis on sustainability, knowing the impact of these ESG measures on financial performance is particularly significant for academia and business. Drawing from various theories, empirics, and insights specific to the industry, this chapter utilizes existing literature to present a critical understanding of the role of ESG in firm performance. This description emphasizes the relevancy of sustainability to modern business practice and highlights the role that ESG disclosure practices play in altering corporate financial and market performance.

2.1 Conceptual Review

2.1.1 ESG

Corporate sustainability has become the subject of increasing interest in the past years due to the debate around several environmental problems. Concerns amidst global warming, climate change, pollution, emissions, and smog are for the first time “pressing organizations to attempt protecting the rights of stakeholders in particular society and the environment” (Christensen et al. 2021). In reaction to these increasing concerns, the United Nations’ Principles for Responsible Investment (PRI) included the concept of Environmental, Social, and Governance (ESG). From an even broader perspective, ESG represents the composite of a company’s ecological, social, and economic activities – capturing in a nutshell the move towards sustainable business practices that has been observed by scholars and practitioners (Paolone et al., 2022)

2.1.2 Environmental disclosures

Environmental disclosures are information on natural environment designed to focus on a company's effects on the natural environment and cover a wide variety of dimensions of sustainability (Amel-Zadeh & Serafeim, 2018). These disclosures are increasingly relevant as greater transparency about corporate environmental practices is being requested by stakeholders such as shareholders, consumers, and regulators. Environmental disclosures are particularly centered on carbon emissions (Alessi et al., 2021). Reporting greenhouse gas emissions is important, especially due to the increased societal concern regarding climate change issues and the impact in the environment and communities across the globe.

Apart from transparency about carbon footprints, stakeholders expect companies to provide comprehensive details of planned carbon-cutting measures. An example of this would be the Carbon Disclosure Project (CDP), which has created a well-structured and widely adopted framework for companies to report their environmental impacts (CDP, 2020). Companies that take part in initiatives like these not only meet regulatory requirements but also improve their reputation among environmentally aware stakeholders.

Publicizing carbon emissions reports provide for an organization's transparency in terms of its sustainability dedication, and its preparedness to manage climate related- risk, a view available to stakeholders (Alessi et al., 2021).

Biodiversity has also gained relevance in environmental disclosure. Accountability from companies focuses on the biodiversity and ecosystems affected and means that companies need to report and answer for their strategies and actions related to the conservation of natural habitats, stopping deforestation and generating conservation efforts (BenDor et al., 2014). They have an interest in learning about the impact of operations on local ecosystems and wildlife. They openly engage with biodiversity challenges, by revealing their participation in conservation or habitat restoration, or collaborating with

ecological organizations. This is not just about meeting moral responsibilities, but also about building resilience to possible regulatory risks as well as negative publicity risks because of environmental damage.

2.1.3 Social disclosures

Social disclosures are most significant in revealing how a company treats its different stakeholders, from employees to suppliers, customers and the local community. Disclosure of these informants of the corporation's social responsibility (CSR), are not just a virtue of CSR, but also of trust building and transparency between different stakeholders. Perhaps the most important type of social disclosures relates to labor issues. Labor practices of companies, such as the employee treatment and contribution to diversity and inclusion in the workplace and compliance with labor rights, are now something that companies are required to shed light on (Singhania & Saini, 2023). Indeed, companies with a focus on employee well-being and diversity consistently outperform others in terms of performance, innovation, and lower levels of turnover (Edmans, 2011; Singhania and Saini, 2023). Transparency in how companies treat their workforce can have a salutary effect to increase worker's morale and productivity. In addition, publicly sharing information about efforts around diversity and inclusion can promote a strong company identity, enabling the attraction of talent from a wider talent pool, and leading to a fairer working environment as a whole.

Engagement with communities is another key dimension of social disclosures. Organizational disclosure is increasingly important in providing information about companies' support in the community, which might include their charitable nature as well as how they affect the local population (Dhaliwal et al., 2012). Not only does direct engagement in communities and social issues lead to a positive corporate reputation, it also builds customer and stakeholder support (Porter & Kramer, 2011). Such efforts, including localized education programs, job training, and public health initiatives, also help to create social capital for the firm. Not only will companies be able to strengthen their bonds to

local communities, but they will open up greater avenues for better customer loyalty and a positive image overall by contributing to community development. In social disclosures as well, customer responsibility is one of the highlighted areas. Firms are also coming under growing pressure for responsibility to customers, particularly regarding product safety, consumer privacy, and ethical marketing practices. But brand transparency can be facilitated by clear disclosures of such practices which enable brand integrity through trust building (Lins et al., 2017).

2.1.4 Governance disclosures

Governance disclosures are essential in setting structures and procedures to conduct business ethically and efficiently within a company and they are not only a sign of a firm's ethical responsibility, but they are also a way to build trust with stakeholders and achieve long-lasting sustainability (Amiraslani et al., 2023).

The board structure is a key component of governance disclosures. And so, an important aspect of corporate governance to judge the quality of company's corporate governance, has been to have information on board composition, diversity and independence (Arayssi et al., 2020). A diverse and independent board is often indicative of good governance in that it should reduce managerial opportunism and lead to a more effective oversight and decision-making process (Adams and Ferreira, 2009). According to Arayssi et al. (2020), different boards can provide insights and experience that enrich discussions such as those related to strategic decision making, risk and stakeholders management among others. Also, independent directors will tend to be free of conflicts of interest that may hinder their ability to act in the interests of shareholders, and in the interests of corporate industry and the community. As transparency in this area allows stakeholders to have comfort in the quality of the board in overseeing the company, it also reflects an adherence to fairness and ethical behavior.

Executive pay is another substantial part of governance disclosures. Companies face immense pressure to disclose their policies related to executive pay, with a specific emphasis on how these compensation packages align with ESG goals (Bolton & Kacperczyk, 2021). The idea is that performance-based pay tracks company performance against ESG metrics can motivate responsible corporate behavior and align decision-making with stakeholder interests. This fosters a culture of sustainability at the organization since executives are accountable to meet certain ESG goals. In addition, it reassures the public that income inequality and excessive pay packages will not be present in these types of corporate governance as long as there are transparent disclosures regarding executive compensation. Good ethical practices represent another important category of disclosures about governance. This includes measures to deter corruption, fraud and conflicts of interest, as well as to guarantee transparency in the process of decision making. Strong governance is important for creating trust with stakeholders and enhancing the reputation of the firm (Davis &Thompson, 1994). By establishing this type of ethical company with long-term integrity it is better positioned to face challenges and reduce risk. Organizations can help to strengthen internal and external cultures of accountability and trust by implementing and disclosing strong ethical frameworks.

2.1.5 Firm Financial Performance

Strong financial performance is a key sign of a broader company's health and operational efficiency. It is generally measured by several indicators that provide information on the efficiency in the use of resources by a company to create profits. Two common performance metrics in this regard are Return on Assets (ROA) and Tobin's Q. Firstly Return on Assets (ROA) is a significant indicator to examine as it is referred to essentially capture how well a company generates profit from its assets (Giannopoulos et al., 2022). It is the percentage of which net income is obtained from total assets. It gives a measure of how well investment is being utilized by management to generate profits. A higher ROA is better because it means the company is using its assets more efficiently and shows the company is successful in turning investments into profits. It is especially

beneficial to contrast a given company to others in the same industry to give a view on operational efficiency and efficiency of asset management. So, it has been reported that firms having a higher ROA “tend to be financially more stable and more attractive to investors who are interested in consistent returns” (Delen et al., 2013).

On the other hand, Tobin’s Q is a market-based indicator calculating the market value of an enterprise to the replacement cost of its assets (Chung & Pruitt, 1994). Market-to-book is calculated as the market value of a firm’s assets (equity market capitalization + debt) over the replacement cost of the assets. Finally, Tobin´s Q larger than one indicates that the market value of the company is above the cost of replacing its underlying assets, hinting positive growth potential and confidence in the firm. In contrast, a Tobin's Q lower than one may indicate that the market believes that the company's assets are overvalued, or it is not achieving the maximum level of performance (Tobin, 1969). It is a key metric to consider when making long-term investment decisions and determining whether a company is executing correctly to maximize shareholder wealth. In this sense both ROA and Tobin’s Q are interesting for the study of Corporate Financial Performance, but they aim to analyze different phenomena. ROA measures a firm’s profitability and operational efficiency compared to asset utilization, while Tobin’s Q measures market performance and future growth as compared to the replacement cost of the assets. These are relevant for investors, managers, and all stakeholders who wish to evaluate a company’s financial wellbeing in order to make investment, strategic, and other decisions.

2.2 Empirical Review

2.2.1 ESG Disclosure and Firm Financial Performance

Environmental, Social, and Corporate Governance (ESG) is a leading way to measure corporate behavior and evaluates on a tri-pillar non-financial basis of sustainability and ethics. ESG investing focuses on environmental responsibility, social well-being, and good

corporate governance in order to improve the performance and investment appeal of a firm.

With the popularity of this approach, the pressure on companies to engage in communication and disclosure of their ESG initiatives also grows. These disclosures are likely to represent an attempt of the company to show the support of sustainable behavior that would in turn can lead to better performance of the firm (Edmans, 2011). The direct benefits of ESG reporting to firms, subsequently in the form of increased financial performance, have been an ongoing debate.

While the emphasis on ESG has been increasing, the relationship between ESG disclosure and firm performance remains unclear. Though it's common practice to use ESG scores of corporate sustainability in investment decisions, in fact, the most well-known rating agencies always deliver scores, however many investors continue to doubt about the accuracy of these ratings. Evidence shows that investors mistrust the idea that high ESG scores lead to better performance for firms. According to (Gibson et al., 2021) the performance of the ESG-focused funds had no significant difference from the performance of the generally focused funds between 2004 and 2018, which implies that the relationship between ESG scores and the financial results is not clear. As a result, some people have begun to question whether ESG ratings are reliable and whether they can predict long-term financial performance.

From the side of corporations, ESG is more mixed. Though the concept of ESG is becoming more accepted among companies, the degree of commitment remains inconsistent. Limited surveys performed in 2021 found that only 48% of companies are all in on ESG practices and only 20% of C-suite executives feel their efforts have a global impact on ESG goals (Krueger et al., 2020). This lack of confidence demonstrates the inherent difficulties companies are experiencing in trying to infuse ESG into a fundamental business strategy. As ESG becomes more relevant, although it offers many benefits, firms must

face not only the inevitable regulatory environment but also the evolving investor expectations and different demands of consumers.

Arguably the most important issue with respect to this debate is the relationship between ESG disclosure and firm profitability and value. On the other hand, proponents suggest that ESG disclosures, by increasing transparency and trust between firms and stakeholders, can increase the company's financial performance. Those companies that specifically advocate to their ESG activities will be perceived more as drivers of social responsibility and innovation, and so they may become favored by a variety of stakeholders, including consumers, employees and regulators. In addition, companies with strong ESG performance are generally better equipped to mitigate risks, eliminate operational waste, and take advantage of new market opportunities. Given these factors, it is possible that ESG disclosure may lead to increase profitability of the company and overall firm value (Arif et al., 2021; Barko et al., 2022).

However, critics argued that the expenses of implementing ESG initiatives, especially in high-risk environmental industries or in developing regions with weaker regulatory structure, can outweigh the benefits. For companies involved in energy-intensive industries, making the switch to greener practices usually involves big upfront costs — in technology, energy efficiency, or supply chain changes. This can be quite significant, especially for smaller companies with limited resources, where justifying ESG-related expenses in the short term becomes an arduous task. Thus, ESG can be considered for some companies as a mere compliance matter instead of an area with strategic upside potential to drive growth and create additional market value (Christensen et al. 2021)

In addition, ESG is being perceived more and more as a source of long-term financial value by investors. Studies have showed that companies with solid ESG disclosure generally have higher stock prices, meaning that investors have confidence in their ability to sustain financial performance. ESG focused companies are seen as lower risk investments as they are less affected by changes in regulations, markets and stakeholders

because they are more prepared to manage these issues. Hence, companies that are not transparent regarding their ESG initiatives could be in a weaker position to access capital and growth prospects on the long term (Christensen et al. 2021)

Yet, it is important to note that ESG disclosure and financial performance do not correlate in all cases. The impacts of ESG practices on the bottom line are influenced by industry-specific characteristics, geography, and firm size. For example, firms in higher risk industries, such as energy or mining, may have a higher cost to implement ESG programs, or companies in regions with less regulation may have less incentive to focus on sustainability. These differences show the necessity for a more nuanced understanding of the effects of ESG disclosure on various types of firms in different contexts. But, despite the perceived difficulties, there is increasing evidence that ESG disclosure can improve reputation, stakeholder relations, and investment in the firm, which can translate into long-term financial benefits. With the growing global trend towards sustainability, companies effectively communicating ESG practices will have better access to capital, lower operating risks, and a stronger market position. Investors are also starting to favor companies that show a commitment to ESG, considering them better positioned to deal with the new business environment. Thats why more research is required to understand what makes ESG effective and what are the best ways to integrate ESG in the corporate strategy. This can only prepare firms to take advantage of opportunities that the environment of sustainable investing can offer.

2.2.2 Environmental disclosure and firm financial performance

In terms of the environmental side of corporate governance, there is an increased focus on companies being environmentally responsible that businesses are starting to see the need to be more environmentally sensitive. These efforts are not just about compliance; they are about being good corporate citizens as well as increasing competitiveness and building better relationships with stakeholders. Environmental sustainability can be a source of competitive advantage and of improved performance and reputation, in

addition to being a long-run determinant of firms' success and profitability (Flammer, 2013).The relationship between environmental practices and financial performance, however, is not straightforward. The financial commitment to realize sustainable investments is imperative and may not be equally appreciated by all stakeholders (Hartzmark & Sussman, 2019)**.**

Despite these difficulties, most of the literature seems to at least favor the hypothesis that environmental performance and stakeholders' expectations are beneficial. Through the alignment of this strategy, firms can reduce risk, innovate, and add value, which altogether contributes as a competitive sustainable advantage over competitors (Goss & Roberts, 2011). Plus, it has been observed that environmental performance affects the speed of adjustment (SOA) towards the target than social and governance performance (Chava, 2014). It reinforces the need for a stakeholder orientation in the formulation of corporate strategy, where companies integrate stakeholders' expectations, in order to achieve beneficial environmental and financial results.

ESG's environmental criteria refers to a firm's respect for the natural environment and how it determines practices for waste management, emissions reductions, efficient energy utilization, and mitigating climate change. More recently, firms have recognized the importance of environmental sustainability as a result of increasing pressure from stakeholders and, more importantly, as a means to achieve better financial performance. Increasingly, there is evidence that environmental responsibility and financial success are positively related. For example, proactive environmental firms may actually perform better financially given that reducing waste incorporates efficiencies in innovation and other business processes (Hart & Ahuja, 1996).

On the contrary, low environmental performance may result in heavy, reputational and financial, costs (Karpoff et al., 2005). Firms with weaker environmental performance may be subject to legal actions, fines and other possible regulatory consequences that may affect their financial position. Also, the reputation risk of unsustainable practices may

also hamper sales, profitability and share value in the long run. As a growing number of businesses understand the importance of sustainability, more and more are moving towards responsible environmental practices along the entirety of their supply chain. Among these, green supply chain practices reduce risks and costs as well as enhance financial performance (Sharfman & Fernando, 2008)**.** On top of that, corporate social responsibility, which includes environmental initiatives, has been found to impact consumer response to firms (Sen & Bhattacharya, 2001). Investors are also paying more attention to ESG factors in their investment decisions, which encourages companies to contribute in environmental terms as well.

Worldwide, firms have been adopting green practices to reduce emissions and looking for how this can be profitable for them (Albuquerque et al., 2019). Studies have demonstrated mixed results in the relationship between environmental performance and firm financial performance. Contradictorily, while some research finds a positive relationship between environmental practices and firm performance (Endrikat et al., 2014), other work also suggests that environmental efforts may in fact have a negative effect. In fact, Arslan-Ayaydin and Thewissen (2016) found that, “firms that engage in environmental responsibility do not outperform the market and do not yield significantly positive returns especially in high uncertainty environments”. They also found no need to lose profitability in some types of activities, like energy, to make space for environmental concerns.

2.2.3 Social disclosure and firm financial performance

The link between social disclosure and economic performance of the firm has been extensively studied, with reference also to the stakeholder theory (Pedrini and Ferri, 2019). According to this theory, firms that are proactive in their relationship with stakeholders and have a commitment to social responsibility will have superior financial performance. The benefits of these outcomes are improved public perception, easier modes of operation, and a competitive edge from the “goodwill and trust that ethical and responsible

business practices generate among the stakeholders". Its social capital can indeed mitigate some risks and increase operational efficiency (Pedrini & Ferri, 2019). Yet, this positive correlation is not without its complexities. Its impact may differ according to firm size, industry, regional context and the kind of social initiatives that are implemented (El Ghoul et al., 2011).

The empirical research has yielded a variety of insights into the relationship between social and financial performance. Maqbool and Bakr (2019), indicate a positive association between increased social performance and improved financial performance. Often, this is explained by the fact that socially responsible practices develop a better corporate reputation and create higher levels of stakeholder satisfaction. For instance, Servaes & Tamayo (2013) demonstrated that social performance has a direct positive impact on firm performance, especially in consumer-oriented sectors, where corporate reputation could directly affect revenues and profitability. In such areas consumers are more likely to patronize companies that show strong dedication to social responsibility.

The beneficial impact of social disclosure is not constant across all industries. On the other hand, Barnett & Salomon (2012) offer a note of caution, indicating the possibility of social programs leading to negative results over the long run. They claim that social responsibility activities may create a positive impact on financial performance in the short run but when the amount of funds invested in these activities is too high then the costs can outweigh the benefits. This is of particular interest in markets where consumer demand for social initiatives is not as prevalent, as firms are likely to find it more difficult to continue to invest in social responsibility.

Social aspect of ESG performance refers to company's social relationships with employees, customers, suppliers, and the society at large (Becchetti et al., 2012). Strong social performance includes labour standards, health and safety, engagement with communities, and customer relations, among others. Companies that have strong commitment to social practices typically benefit from greater employee morale, lower turnover, and

more customer loyalty, which in turn lead to better financial performance. Also, companies that engage in positive relationships with the community may even have a better public image, which translates into higher sales and profits (Malik, 2015). On the other hand, ignoring social responsibilities can also cause negative effects like strikes, lawsuits, or negative brand image. For example, bad labor practices can yield decreased productivity and legal problems (Dahan et al., 2023) and inaction to customer and community issues can result in lost sales and market share (Werther & Chandler, 2005).

While there is a general consensus that social responsibility can lead to enhanced financial performance, some researchers suggest that the relationship is not that simple, nor necessarily motivated by financial incentives. As McWilliams and Siegel (2000) have indicated, companies could behave in a socially responsible manner even without the profit maximizing motive, for reasons such as legislation or stakeholder activism. As explained by Barnett and Salomon (2006) the relationship between social performance and financial performance may be on a U-shaped curve. For firms with social performance at a moderate level, the financial returns may not be as clear.

The effects of CSR on financial performance have been much debated with mixed results. (Margolis et al., 2009) emphasize that although most of the existing research sustains the belief that CSR activities result in superior financial performance some other research has found non-significant or negative results. For example, Blasi et al. (2018) provide evidence in favour of a general positive relationship between CSR expenditure and financial performance as a result of a firm reputation and investment inflows. Likewise, Okafor et al. (2021) indicated that companies with robust CSR activities are more likely to be able to attract a greater number of investors and are likely to enjoy better financial performance. This is congruent with (Orlitzky et al., 2003) findings, indicating that CSR is a relevant factor in the financial performance of the companies analyzed.

However, other research has found the opposite. For instance, Peng and Yang, (2014); Akben Selcuk and Kiymaz, (2017); and Alareeni and Hamdan, (2020) did not find any

relevant, or even found some negative, correlation between CSR and financial performance, indicating that the financial return on CSR is not always the case. These mixed results highlight how the relationship between social programs and financial performance is contingent on several factors including industry type, level of CSR involvement, and specific market conditions.

2.2.4 Governance disclosure and firm financial performance

Corporate governance is the set of processes and structures by which a corporation is directed and controlled. This includes such critical elements as board composition, executive pay practices and shareholders' rights. Good corporate governance is important in improving decision making, lowering the risk of scandals and building shareholder and stakeholder trust. For example, de Villiers and Dimes (2021) found that firms with good governance mechanisms often obtain better access to capital markets and lower costs of capital. On the contrary, weak governance is associated with mismanagement, financial irregularities and a big loss of confidence among shareholders, as Velte (2023) points out. At the far end of the spectrum, governance failures can lead to scandals that destroy shareholder value and tarnish an organization's reputation for years to come.

Good governance means having stakeholder-oriented governance practices that contribute to better firm performance. Having ethical codes, encouraging partnerships and stakeholder participation, and being transparent can all make corporate governance more effective. These practices create trust, lower agency costs, and allow for more efficient resource allocations in the organization (Gompers et al., 2003). Also, boards that are more concerned with diversity and strategic composition will be able to better respond to the heterogeneous needs and expectations of stakeholders, with positive consequences on firm performance (Simionescu et al., 2021). But it is important to note that the link between governance and performance is not universal and contingent to different organizational, cultural and regulatory settings (La Porta et al., 2002).

There is empirical evidence to support the notion that high governance firms are better able to make well-informed investment decisions, have higher operational performance, and make strategic decisions that are conducive to creating long-term value for their stakeholders. For example, Elamer & Boulhaga (2024) showed that well-governed firms are more operationally efficient than their peers. But it is not to be forgotten that the link between governance and performance has context specificities, which may depend on, among other things, the size of the firm, industry sector, prior legal and regulatory environment. For instance, (Aggarwal et al., 2009) argues that the positive effect of governance on firm performance is magnified under conditions of strong investor protection.

There is also a well-established relationship between good corporate governance and better financial performance. Arora and Sharma (2016) and find a positive impact of corporate governance in general on firm performance in different industries. Financial performance is positively affected by specific governance mechanisms, such as independent boards, board quality, and shareholder strength (Stanwick & Stanwick, 1998). In addition, the adoption of efficient corporate governance has been related to better financial performance. Corporate governance is also positively related to corporate sustainability performance which can positively affect financial performance as well. Ntim and Soobaroyen (2013) argue that as firms improve their governance practices, they are more likely to develop socially responsible agendas and thus engage in more corporate social responsibility (CSR) activities. Such a combination of CSR with governance practices has a higher positive impact on corporate financial performance than CSR alone.

The importance of corporate governance has received much attention, particularly after the economic crises of 2008-2009. Various research studies have examined the impact of corporate governance (CG) on different measures of firm financial performance with diverse outcomes. Although governance quality has often been said to have a positive relationship with financial performance, some studies find mixed or even negative results. For example, (Bhagat & Bolton, 2008) found a positive impact of governance on performance of institutions in the Nordic financial sector, indicating that good

governance leads to more profits by better utilizing assets. Contrarily, there are studies such as Conca et al. (2020) which find a negative impact of corporate governance over financial performance. These mixed results, notwithstanding, there is a general agreement that corporate governance does have a positive effect on the firm's financial performance.

2.2.5 Temporal Dimensions of ESG Performance and Financial Outcomes

ESG performance may affect financial outcomes differently across time periods. Many sustainability initiatives require extended periods before generating returns. Researchers now recognize that ESG investments often involve significant upfront costs. The benefits of these investments may only appear after a delay (Eccles et al., 2014; Fatemi et al., 2018).

Research indicates the ESG-financial performance relationship follows a dynamic pattern. Wang and Sarkis (2017) found ESG practices needed at least a two-year lag before positively affecting financial performance. Their study showed immediate ESG implementation creates short-term costs. Financial benefits emerge later as stakeholder relationships strengthen. Krüger (2015) observed strong negative market reactions to ESG events in the short term. These reactions moderate over time.

Stakeholder theory helps explain this dynamic relationship. Building stakeholder relationships through ESG initiatives takes time. Eventually, these relationships yield financial benefits (Brooks & Oikonomou, 2018). Gregory et al. (2014) found CSR investments initially reduced cash flows. Later, they improved growth opportunities and reduced firm risk. Industry-specific factors influence these temporal dynamics. Energy and other capital-intensive industries often require longer periods to generate returns from sustainability investments. This delay occurs due to substantial infrastructure requirements. Environmental initiatives show the strongest lagged effects in high-environmental-impact

industries. Initial compliance costs eventually translate to operational improvements (Galema et al., 2008).

The concept of "ESG momentum" emphasizes time-based effects. Nagy et al. (2016) found changes in ESG ratings associated with subsequent stock returns. This suggests improvement of trajectories matter more than static performance. Markets reward firms demonstrating commitment to improving ESG performance over time. Artiach et al. (2010) identified lag structures between sustainability and financial outcomes. Sustainability leadership often followed financial outperformance rather than preceded it. This raises questions about causality in the ESG-financial performance relationship.

Market-based measures show persistent ESG impacts. Luo and Bhattacharya (2009) found corporate social performance influenced firm value for up to two years. Market reactions evolved as information asymmetry decreased. El Ghoul et al. (2011) demonstrated ESG performance had sustained effects on cost of equity capital. These benefits accumulated over time.

Understanding temporal dimensions proves particularly important during energy transition. Firms face pressure to make substantial sustainability investments. These investments may initially reduce financial performance. Later, they could yield competitive advantages (Horváthová, 2012). Examining only contemporaneous effects may lead to incomplete conclusions about ESG initiatives (Sassen et al., 2016).

Prior research indicates that ESG effects often follow distinct temporal patterns. Initial ESG investments frequently show neutral or negative short-term financial impacts. These impacts typically transform over time. Environmental initiatives particularly demonstrate delayed benefits, with initial compliance costs eventually yielding operational efficiencies. Social initiatives show mixed temporal patterns, sometimes producing immediate reputational benefits but requiring longer periods for operational

improvements (Luo & Bhattacharya, 2009). Governance changes often demonstrate the most rapid financial effects, though these too evolve over time (El Ghoul et al., 2011). The energy sector presents unique temporal challenges due to its capital-intensive nature and regulatory environment. Sustainability investments in this sector may require particularly extended periods before generating returns (Galema et al., 2008). Market reactions to ESG initiatives also demonstrate temporal evolution, with initial skepticism sometimes giving way to recognition of value as initiatives mature and prove their worth (Krüger, 2015). Understanding these time-dependent patterns is essential for accurately assessing the relationship between ESG disclosure and financial outcomes, particularly in sectors undergoing significant sustainability transitions (Sassen et al., 2016).

2.3 Theoretical Framework

2.3.1 Stakeholder Theory

According to stakeholder theory, successful organizations are those that can manage and reconcile the diverse interests of a variety of stakeholders, such as employees, customers, suppliers, communities, and investors (Freeman, 2010). It calls for a transition from the shareholder centered paradigm to a more inclusive paradigm of creating value and behaving ethically. This will in turn push organizations to view the concerns of stakeholders in a more comprehensive manner that encompasses all aspects and desires of all stakeholders as important for the long-term sustainability and success of the organization. The role of stakeholders in creating a space for continuing with operations and expansion processes cannot be overstated (Clarkson, 1995).

It is the perceptions of stakeholders that can have an impact on a firm's ESG conduct. A favorable perception by stakeholders will increase the reputation of a firm, attract and maintain customers, as well as investor confidence, which is essential in gaining competitive advantage and achieving higher financial performance levels (Eccles et al., 2014). Alternatively, negative attitudes may produce boycotts, divestment, and reputational

harm and, ultimately, harm the firm's long- term viability. This makes understanding and engaging with stakeholders essential for firms that wish to customize their ESG strategy to be in line with stakeholders' desired outcomes.

In the investor's point of view, a company's ESG performance shows their commitment to long-term sustainability and doing the right thing (Dimson et al., 2015). Investors may use high levels of ESG performance as a proxy for a firm's commitment to sustainability and in turn impact investment decisions and the cost of capital. As for the performance of companies, there is empirical evidence supporting a positive association between ESG practices and performance, while, from a theoretical point of view, stakeholder theory provides some explanations by stressing the relevance of trust, loyalty and cooperation among multiple stakeholders.

Given the motivation behind this study, stakeholder theory is an adequate baseline to analyses the relationship between ESG disclosure and corporate financial performance, particularly in terms of Return on Assets (ROA). In this way, the ability of stakeholder engagement to affect ESG performance can help the present study in determining the cost of disclosure of ESG information. On top of that, the value of the firm, as proxy by Tobin's Q, can be interpreted using the expectations of the stakeholders and how well the firm has met these expectations and how such fulfillment of the expectations can have a positive impact on the market valuation.

2.3.2 Institutional Theory

This theory maintains that the institutional context, which includes the regulatory environment, culture, and social norms and expectations, has a profound effect on the behaviors, strategies and overall success of firms (Huang & Sternquist, 2007). Institutional Theory states that organizations must comply with external norms and rules to gain legitimacy, resources and survival for business- Regarding the ESG, this theory highlights

that companies are driven by internal purposes and external pressures to engage in sustainable and socially responsible activities.

The first research goal is to investigate the relationship between the level of disclosure on sustainability (ESG) issues and the financial performance of companies, in terms of profitability as measured by Return on Assets (ROA). Institutional Theory has supported analyses on ESG and firm performance by proposing that firms are not only driven by internal motivations and by the market but also by external institutional pressures (Iatridis & Kesidou, 2018). Formal regulations, standards and policies as well as informal norms and stakeholder expectations, are some of the pressures. Strong regulation and good governance are part of the higher quality institutional environment that is required in order to encourage the adoption and success of ESG practices. Firms that operate in a more heavily regulated environment are more likely to engage in ESG activity because of the higher compliance standards in such an environment and the associated high costs of non-compliance.

The second objective of this research is to determine the effect of sustainability (ESG) disclosure on firm value, where Tobin's Q is leveraged as the market value of the firm's assets relative to their book value. From a theoretical perspective, it has been suggested that, in countries with well- established regulation and efficient governance, companies are more likely to integrate a full set of ESG measures because of high levels of compliance and accountability (Singhania & Saini, 2023). This supportive environment sensitizes firms to the effects and benefits of ESG initiatives on firm performance. When policies are effective in reducing uncertainty and risks in investing in ESG, firms can allocate resources to sustainable activities and practices (Singhania & Saini, 2023).

The third objective of this study is to determine the weight of each of the three ESG pillars- environmental, social and governance- in the determination of firm value and corporate financial performance. Institutional Theory also brings the idea of institutional

isomorphism, which argues that, in the same institutional environment, firms tend to adopt similar practices to obtain legitimacy and to adhere to societal norms.

In considering the relevance of external institutional environments in the effectiveness of ESG practices, Institutional Theory offers a broader perspective. In this sense, this research contributes to the existing literature by investigating the role of regulatory quality and government effectiveness in the ability of ESG practices to improve firm performance in Europe. This vision is important as it highlights the role that institutions can have in fostering a culture and offering incentives for a sustainable business model.

This time-dependent perspective, research objective four, enriches the framework by acknowledging that ESG effects may not be immediately observable but might emerge over subsequent periods. The concept of "ESG momentum" further emphasizes this dynamic aspect, suggesting that improvement trajectories in ESG performance may be more financially relevant than static scores. For energy companies undergoing sustainability transitions, understanding these temporal patterns is particularly crucial, as market valuation may initially respond skeptically to ESG investments before recognizing their long-term value. By incorporating both contemporaneous and lagged measures, the framework provides a more comprehensive view of how ESG disclosure translates into financial outcomes across different time horizons.

2.4 Research Framework

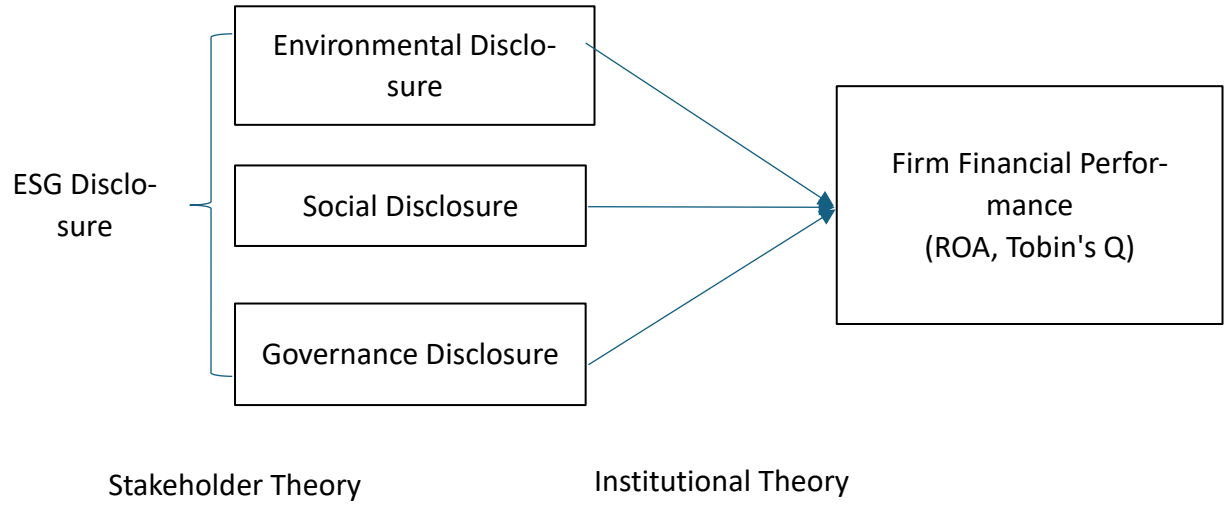

Figure 6. Research Framework

The research model provides a general overview of the relationships between Environmental, Social, and Governance (ESG) disclosures, corporate financial performance, and firm value (Figure 6). This approach is consistent with the research goals of examining the relationship between ESG disclosure and firm financial performance, understanding the effect of ESG disclosure on firm value, looking at the differential relevance of the three pillars of ESG, and exploring the differential impact that ESG scores have on financial performance and firm value.

At the center of the framework is ESG Disclosure, defined as the degree to which firms disclose information on their sustainability practices and performance to stakeholders. This is important as it helps to formulate the first research objective, which seeks to analyse the relationship between ESG disclosures and corporate financial performance, as measured by Return on Assets (ROA). The established literature indicates that corporations that are more transparent about their ESG practices perform better financially, because stakeholders are increasingly demanding that they be accountable and act ethically. Strong ESG disclosure shows the market that the company is well managing its risks

and is committed to sustainable behavior and can thus lead to better financial performance.

The framework links to Corporate Financial Performance based on ESG disclosures. It is a straight reflection of a company's efficiency in using its assets to produce income. The second research objective explores the effect of ESG disclosure on firm value, operationalized via Tobin's Q, which measures market value over asset value. Firms that are successful in conveying the ESG actions they have taken are expected to be valued higher in the market, as investors are more willing to invest in the companies that are in line with their value systems (Lins et al., 2017). This suggests that strong ESG practices not only drive financial performance but are also value creating activities that attract investor confidence and long-term growth strategies.

The research framework also highlights the role of Stakeholder Engagement. This section emphasizes the varied interests of employees, customers, suppliers, investors and the local community among others in determining corporate ESG behavior. This understanding is necessary to reach, understand, and comprehend and fulfill the needs and expectations of these groups and effective stakeholder engagement is fundamental for that. Solid ESG initiatives can also translate into enhanced brand reputation, customer loyalty and investor confidence driven by good stakeholder perceptions (Bellucci et al., 2019). These dynamics are consistent with the second and third objectives of the study, which are concerned with the impact of ESG practices on financial performance and firm value. Another important component of the framework is the Institutional Context which includes the external forces that shape corporate behaviour such as regulations, cultural values and social expectations (Huang & Sternquist, 2007). The third research objective attempts to understand the role of each component of ESG, environmental, social, and governance, in determining firm values and corporate financial performance. Firms in areas with strong regulation and governance are more likely to engage in meaningful ESG activities. This results in better performance outcomes as organizations are forced to abide by the set standards promoting sustainability (Singhania & Saini, 2023).

2.5 Research Gap

Although there has been a growing focus on Environmental, Social, and Governance (ESG) concerns, there are still several areas in the literature that could be further developed. The first one refers to the ambiguous and sometimes contradictory results of the large body of research that has been conducted in an attempt to understand the link between ESG practices and the financial performance of firms (Giannopoulos et al., 2022; Alareeni and Hamdan, 2020; Ademi and Klungseth, 2022). Most of these works on particular ESG dimensions, which could potentially create a skewed vision of the interrelatedness of these factors. Plus, the lack of research on the effects of a composite ESG score relative to its individual dimensions calls for additional studies that explore the interrelations of these different aspects and their joint effects on firm performance.

Second, and the most significant, is the absence of focused research looking at the energy sector – a pivotal contributor to global greenhouse gas emissions. This is particularly important in the case of the energy sector, responsible for 75.6% of the world's emissions (37.6 $GtCO_2e$) as it is necessary to know the impact of ESG sustainability practices in financial performance. These specific challenges and pressures that energy companies face in the adoption and disclosure of ESG practices are not well articulated in existing research.

Finally, the impact of ESG on firm value and financial performance has not been widely researched in the energy sector. Despite the existing research on the individual components of ESG, "the combined effect of these three dimensions on firm's performance and market valuation is not yet clear" (Singhania& Saini, 2023). This cut-off is particularly pertinent for energy firms as they must manage their sustainability initiatives along with their financial performance, while being under increasing scrutiny by regulators and stakeholders.

Addressing these research gaps will provide a more refined view on the relationship between ESG practices and corporate performance in general, particularly for those companies in the energy sector. This research seeks to address this gap by exploring ESG factors collectively and their role in shaping financial outcomes in the energy sector.

3 Data and Methodology

This chapter describes the methodological framework to analyze the association between Environmental, Social and Governance (ESG) disclosure and financial performance in European energy companies. This chapter begins with a detailed presentation of the research approach followed by the data collection procedures and sample selection criteria. Then, reports the variable measurements and model specifications that are used to test the research hypotheses statistically. This chapter ends with the limitations and validity issues specific to this particular study.

3.1 Research Approach

This is a quantitative research study that investigates the relationship of ESG disclosure and financial performance in European energy companies. This quantitative approach is appropriate as variables can be statistically tested (Creswell & Creswell, 2018). It also allows to study the cause-and-effect relationship among variables as well as generalizing findings to a population of interest (Saunders et al., 2019).

This study follows a positivist philosophical approach that suggests reality can be empirically observable and tested through objectively (Bellucci et al. 2019). This view is consistent with the study's purpose in providing an empirical investigation of the relationship between ESG disclosure practices and financial performance indicators. In addition, the research is deductive, starting from theory and moving towards data through hypothesis development and tests based on existing theoretical frameworks, especially stakeholder theory and institutional theory (Bryman & Bell, 2022).

3.2 Research Design

This study uses a panel data design, analyzing the association between ESG disclosure and financial performance during multiple periods of time. In many ways, panel analysis is a hybrid, cross-sectional and time-series analysis; however, it is generally considered to have certain strengths compared to pure cross-sectional and time-series approaches (Wooldridge, 2016). Such advantages are more degrees of freedom, less collinearity between the explanatory variables and the ability to control unobserved heterogeneity between firms (Hsiao, 2014).

The research design involved the use of both descriptive and inferential statistics. Descriptive statistics provide a summary of the basic characteristics of the data, while inferential statistics are used to test the research hypotheses and infer the relationships among the variables (Fama & French, 2020).The panel regression analysis is performed to analyze the effects of various levels of ESG Disclosure on financial performance measures (Tobin's Q and Return on Assets) in relation to the environmental, social and governance dimensions while controlling potential omitted variables that may bias the results.

3.3 Population

The population of this study is all energy companies listed in the European stock market. This sample is selected for the relevance of the energy sector to greenhouse gas emissions, as discussed in chapter 1, and the growing regulatory pressure on European energy firms to implement and report on ESG policies. The European context is particularly relevant for this study because the continent's energy policies have been more aggressive and innovative in terms of sustainability and because "12.7% of the EU's greenhouse gas emissions are coming from the energy sector" (Liesen et al., 2017).

The sample of this study is all publicly traded energy firms in Europe from 2014 – 2023. This period is chosen in order to have the most up to date trends in ESG disclosures and to have available aggregate ESG data. This particular time frame is also useful to observe ESG disclosure strategies prior and post- actual European sustainability legislations such as the European Green Deal.

The sample has been chosen according to a purposive sampling technique, looking at energy companies that are publicly traded in major European stocks exchanges. The criteria to include in the sample are:
The core business of the company must be in energy (oil and gas, electricity, or renewable energy).
The company must be publicly listed in a European stock exchange.
The firm must have complete financial information for the purposes of the sample period.
The company should have ESG disclosure scores from reputable ESG rating agencies.

In order to have a clearer view of how the energy sector is organized for the present research study, Table 1 presents a compilation of the main subsectors within the energy industry. This encompasses representation of established fossil fuel energy companies as well as electric, utilities and renewable energy companies at large.

Table 1. Overview of the Energy Sector

Oil, Gas and Coal	Electricity and Utility Services
Exploration & production	Power generation & grid management
Refining & marketing	Gas, water, and multi-utility services
Storage & transportation of oil & gas	Renewable and alternative energy technologies
Coal & other consumable fuels	

(Source: Thomson Reuters Refinitiv Eikon, 2024).

This selection aims to provide a sample that is representative of the European energy sector and guarantees to collect as much complete data as possible on ESG disclosure and financial performance. The specificity of the sample regarding companies falling within different subsectors of the energy sector provides a better understanding on whether ESG practices and their financial implications might vary for traditional fossil fuel operations or renewable energy providers, thus capturing the ongoing European energy transition (Friede et al., 2015).

3.4 Sample Size

The initial dataset covers the years from 2014 to 2023 and includes 5,579 unique firms conducting energy activities in Europe (Thomson Reuters Refinitiv Eikon, 2024). From this, 2,797 observations are from the oil and gas segment, and the remaining 3,038 are from electricity, utilities, and renewable energy firms. The panel is unbalanced due to firm years without ESG reporting or lacking financial data, resulting in variation in firm coverage across years. The final analytic sample used in regression analyses contained 3, 691 firm-year observations from 860 unique firms after listwise deletion to deal with missing values on the dependent and main independent variables. This last sample provides adequate power for statistical tests and is consistent with previous studies using panel data to investigate ESG effects in the energy sector (Dyck et al., 2019).

This sample size complies with recommendations from methodological literature indicating that the analysis of panel data is robust when there are enough cross-sectional units and time periods (Wooldridge, 2016). The final data set offers sufficient statistical power to run fixed and random effects panel regression models as encountered in this study (Greene, 2018). The sample is also of a similar size to recent empirical studies in the area (e.g., Giannopoulos et al., 2022; Aouadi & Marsat, 2018) expanding the external validity and generalizability of the results to the entire European energy market.

3.5 Data Collection and Source

This study is conducted based on secondary data in terms of ESG disclosures and different financial metrics. The use of secondary data is justified by the fact that these can offer unbiased, reliable, and complete information in the variables of interest (Zikmund et al., 2013).

The sources for this data collection are:
The ESG disclosure scores is collected from a well-known ESG rating agency such as Refinitiv (formerly Thomson Reuters ESG). These ESG ratings are generated by an agency that issues overall ESG scores, which are derived through a process of systematically analyzing environmental, social, and governance behavior within companies (Berg et al., 2022). Financial variables such as Return on assets (ROA), market capitalization, total assets, and total debt is obtained from Thomson Reuters Eikon. The same financial databases are used for collecting information regarding the control variables, such as firm size, growth and industry leverage.

3.6 Variable Measurement

The variables studied can be grouped into dependent variables, independent variables associated to ESG disclosure, and control variables that capture possible effects from other factors. A summary of all variables employed in the study, their measurement, and relevant references from the literature is provided in Table 2.

Table 2. Variables Description, Measurement, and References

Variable Type	Variable Name	Description	Measurement	Reference
Dependent Variables	ROA	Return on Assets	Net Income / Total Assets	(Atan et al., 2018)
Independent Variables	Tobin's Q	Market-to-Book Value	(Market Capitalization + Total Debt)/Total Assets	Chung & Pruitt (1994)
	ESG	Overall ESG Score	Composite ESG rating (0–100)	Eccles et al. (2014)
	ENV	Environmental Score	Environmental rating (0–100)	(Drempetic et al., 2020)
	SOC	Social Score	Social rating (0–100)	Singhania & Saini (2023)
	GOV	Governance Score	Governance rating (0–100)	Arayssi et al. (2020)
Control Variables	SIZE	Firm Size	Natural logarithm of Total Assets	Alareeni & Hamdan (2020)
	LEV	Leverage	Total Debt / Total Assets	Buallay, A. (2019)
	GROWTH	Sales Growth	Percentage change in annual sales	Ademi & Klungseth (2022)

3.7 Dependent Variables

Two main indicators of financial performance are used in the present study as dependent variables:

Return on Assets (ROA):

It represents the operational efficiency of a company in generating profits from its assets (Giannopoulos et al., 2022). Consistently with prior financial studies, ROA is computed as net income divided by total assets. In contemporary fiancé research ROA is a very common performance metric in ESG studies by offering information on the operational implications of sustainability activities on financial performance (Alareeni & Hamdan, 2020).

(1) Return on Assets (ROA) = $\frac{Net\ Income}{Total\ Assets}$

Tobin's Q:

It measures the market valuation of a firm in relation to its asset replacement cost and is a market-based indicator. Following Chung and Pruitt (1994), Tobin's Q is calculated as market capitalization plus total debt divided by total assets. By consideration of the market on the firm's future growth opportunities and on its intangible value, Tobin's Q is a good measure to understand how ESG practices affect investor's valuation.

(2) Tobin's Q = $\frac{Market\ Capitalization+Total\ Debt}{Total\ Assets}$

3.8 Independent Variables

Divided into different dimensions, the key independent variables to ESG information disclosure are as follows:

ESG score:

An aggregate metric of the relative ESG performance of a firm, sourced from leading ESG rating agencies. An ESG score can be understood as an assessment of a firm on the three pillars of sustainability, namely the environmental, social, and governance (Eccles et al. 2014)

Environmental Score (ENV):

This score more precisely represents companies' environmental performance related to energy use and emissions, water use, and climate change **(**Drempetic et al., 2020). This point is particularly relevant for oil companies due to the extensive level of environmental externalities associated with their industry.

Social Score (SOC):

It is an assessment of the social impact of a company based on labor practices, human rights, community, and product responsibilities (Singhania & Saini,2023) Needless to say, it is a metric of how a company manages its stakeholders.

Governance Score (GOV):

The governance score summarizes the quality of corporate governance with respect to its board structure, executive compensation, shareholder rights, and business ethics (Arayssi et al., 2020). But that is particularly needed when it comes to environmental and social programs that will have to be implemented.

3.9 Control Variables

To reflect the effect of ESG disclosure on financial performance, three key control variables were considered.

Firm Size (SIZE):

Measured by the natural logarithm of total assets to control for scale effects that may affect ESG disclosure and also financial performance (Alareeni & Hamdan, 2020). Big companies are likely to have more capital to spend on ESG initiatives and may also have scale of implementation to get sustainability at lower costs. Firm size has been linked to ESG engagement and performance repeatedly in literature (e.g., Giannopoulos et al., 2022).

(3) Size=Ln(Total Assets)

Leverage (LEV):

This proxy measures the effect of capital structure on financial performance and risk profile and is calculated as the ratio of total debt to total assets Buallay, A. (2019). Firms that are highly leveraged might be less able to invest in ESG initiatives because they must

pay their debt. Additionally, it needs to clarify that leverage affects a firm's risk exposure, which can influence both market valuation and operational performance (Jiraporn et al., 2014). This is an important variable in the energy industry, especially because capital structure can vary so greatly between different sub- sectors.

(4) Leverage $= \frac{Total\ Debt}{Total\ Assets}$

Growth (GROWTH):

It is defined as the annual sales growth in percentage to account for the effect of growing operations on the firm's financial performance and investment opportunities (Ademi & Klungseth, 2022). It is an important control variable because growing firms may have different ESG priorities and investing patterns than mature firms. Also, growth opportunities can have an important impact on market valuations, one of which is Tobin's Q (Friede et al., 2015).

(5) Growth = $\frac{Net\ Income_{i,t} - Net\ Income_{i,t-1}}{Net\ Income_{i,t-1}}$

3.10 Model Specification

This study utilizes panel regression models to assess the relationship between ESG disclosure and corporate financial performance. Two main specifications are developed corresponding to the two dependent variables: Return on Assets (ROA) and Tobin's Q.

3.10.1 Financial Performance (ROA)

To examine the effect of ESG on accounting-based performance, the following fixed/random effects model is specified:

(6) $ROA_{it} = \alpha + \beta_1 ESG_{it} + \beta_2 Size_{it} + \beta_3 Leverage_{it} + \beta_4 Growth_{it} + u_i + \varepsilon_{it}$

3.10.2 Firm Value (Tobin's Q)

For the market-based measure of firm value, the model is specified as:

(7) $TobinsQ_{it} = \alpha + \beta_1 ESG_{it} + \beta_2 Size_{it} + \beta_3 Leverage_{it} + \beta_4 Growth_{it} + u_i + \varepsilon_{it}$

Where:

i indexes' firms

t indexes time (year)

u_i captures unobserved firm-specific effects

ε_{it} is the idiosyncratic error term.

For extended analysis, the ESG score is decomposed into its three components --- Environmental, Social, and Governance --- to test their individual effects:

(8) $ROA_{it} = \alpha + \beta_1 ENVS_{it} + \beta_2 SOC_{it} + \beta_3 GOV_{it} + \beta_4 Size_{it} + \beta_5 Leverage_{it} + \beta_6 Growth_{it} + u_i + \varepsilon_{it}$

(9) $TobinsQ_{it} = \alpha + \beta_1 ENVS_{it} + \beta_2 SOC_{it} + \beta_3 GOV_{it} + \beta_4 Size_{it} + \beta_5 Leverage_{it} + \beta_6 Growth_{it} + u_i + \varepsilon_{it}$

These models are estimated using fixed-effects or random-effects techniques, with model selection based on the results of the Hausman test.

3.10.3 Lagged Effect Models

To examine the potential delayed effects of ESG disclosure on financial performance and firm value, the following lagged models are specified:

Lagged Effects on Financial Performance (ROA):

(10) $ROA_{it} = \alpha + \beta_1 ESG_{i(t-1)} + \beta_2 Size_{it} + \beta_3 Leverage_{it} + \beta_4 Growth_{it} + u_i + \varepsilon_{it}$

Lagged Effects on Firm Value (Tobin's Q):

(11) $TobinsQ_{it} = \alpha + \beta_1 ESG_{it} + \beta_2 Size_{it} + \beta_3 Leverage_{it} + \beta_4 Growth_{it} + u_i + \varepsilon_{it}$

Disaggregated ESG Lagged Effects on ROA:

(12) $ROA_{it} = \alpha + \beta_1 ENVS_{i(t-1)} + \beta_2 SOC_{i(t-1)} + \beta_3 GOV_{it(-1)} + \beta_4 Size_{it} + \beta_5 Leverage_{it} + \beta_6 Growth_{it} + u_i + \varepsilon_{it}$

Disaggregated ESG Lagged Effects on Tobin's Q:

(13) $TobinsQ_{it} = \alpha + \beta_1 ENVS_{i(t-1)} + \beta_2 SOC_{i(t-1)} + \beta_3 GOV_{it(-1)} + \beta_4 Size_{it} + \beta_5 Leverage_{it} + \beta_6 Growth_{it} + u_i + \varepsilon_{it}$

3.11 Estimation Technique

3.11.1 Panel Model Specification

Using static panel data analysis, this study investigates the relationship between ESG disclosure and financial performance in European energy companies. This panel model analysis is suitable for this research as they control heterogeneous unobserved variables that do not vary across firms while measuring the contemporaneous effects of ESG disclosure on financial performance (Wooldridge, 2016).

There are several reasons why the static panel model is justified. At first, the relationship between ESG disclosure and financial performance is more stable in the short to medium term with less dynamic effects (Giannopoulos et al., 2022). Furthermore, unlike financial investments or decisions about capital structure which may demonstrate high path dependencies, ESG disclosure practices and their effects in terms of financial performance typically occur in the same period or with minor lags (Velte, 2017).

Secondly, using static panel models provides a robust framework for controlling both unobserved and observed heterogeneity between firms. The static panel model specification with fixed-effects, effectively controls time invariant unobserved factors that affect both ESG practices and financial performance (potential omitted variable bias) (Greene, 2018). This is especially important for ESG research, as firm-specific characteristics (like corporate culture and management philosophy) may simultaneously impact sustainability and financial outcomes.

Finally, the static panel method is consistent with the leading ESG-financial performance research in literature. Broadstock et al. (2021) used static panel models to study the link between ESG performance and firm value, confirmed that using this approach is sufficient since the association is contemporaneous. Similarly, Elamer & Boulhaga (2024) studied the effect of ESG disclosure on financial performance measures by using static model specification and argued that it is the most appropriate methodology for accounting data that displays both cross-sectional and time-series variation.

The dynamic panel model is appropriate for understanding potential feedback effects and lagged relationships, but a static panel approach in this study is based on the theoretical expectation of ESG disclosure that influences financial performance mainly in the same period and this is widely supported in the recent literature (Friede et al., 2015). In addition, the methodological approach is consistent with the research questions and objectives outlined in Chapter 1, that is, the contemporaneous relationship between ESG

disclosure and financial performance rather than the dynamic or long-term adjustment processes.

3.11.2 Estimation Technique

This study employs several panel data estimation techniques to analyze the relationship between ESG disclosure and financial performance. The following estimation methods were implemented:

Diagnostic Tests

Breusch-Pagan Lagrangian Multiplier Test is conducted to determine whether random effects estimation is appropriate compared to pooled OLS regression. The significant test statistics (chi-bar2(01) values of 491.91 and 1868.24 with p-values of 0.0000) confirmed the presence of random effects, justifying the use of panel estimation methods.

Hausman Specification Test is performed to decide between fixed effects and random effects models.

Robust Standard Errors were employed with both FE and RE models to address potential heteroskedasticity and autocorrelation in the panel data. For fixed effects models with robust standard errors, the "vce(robust)" option is utilized, while for random effects models, "vce(cluster firm_id)" is used to account for within-firm error correlation.

Extended Model Specifications were implemented by disaggregating the composite ESG score into its three component pillars (Environmental, Social, and Governance) to examine their distinct effects on financial performance measures.

All statistical analyses is conducted using Stata software, with panel regression commands "xtreg" with appropriate options for fixed effects ("fe") and random effects ("re") specifications.

4 Results and Analysis

This chapter describes the results of the relationship between ESG disclosure and firm financial performance for European energy companies for the years 2014 to 2023. The purpose of the analysis is to provide answers about the research questions discussed in chapter 1, namely: (1) What is the relationship between ESG disclosure and firm financial performance as proxied by the Return on Assets (ROA); (2) What is the influence of ESG disclosure on market value of a firm using Tobin's Q as a measure; and (3) What is the relative importance of the three E, S and G individually in driving firm performance.

4.1 Descriptive Statistics

Table 3 provides descriptive statistics for all study variables based on 3734 firm-year observations of 860 European energy companies, from 2014 to 2023.

Table 3. Descriptive Statistics

Variable	Mean	Std. Deviation	Minimum	Maximum	Median
ROA	3.113	11.554	-63.36	119.6	3.39
Environment Pillar Score	62.447	22.89	1.11	97.07	66.92
Governance Pillar Score	59.397	21.864	1.24	98.76	61.18
Social Pillar Score	65.564	21.523	0.52	96.76	70.07
ESG Score	62.891	18.59	5.74	94.73	66.61
Tobin's Q	0.962	2.204	0.06	55.239	0.743
Size	17.359	2.617	9.514	26.39	16.975
leverage	0.337	1.508	0	54.862	0.267
Growth	15.555	46.06	-1.014	325.031	-0.64

European energy companies reported an average return on assets (ROA) of 3.113%, indicating significant dispersion with a standard deviation of 11.554% during the study period. The minimum ROA is -63.36%, while the maximum reached 119.6%, indicating considerable diversity in profitability across the sample.

For ESG metrics, companies in the sample show relatively high average scores, with the mean ESG composite score at 62.891 (out of 100). Among the three ESG pillars, Social performance had the highest average score (65.564), followed by Environmental (62.447) and Governance (59.397). All three components show substantial variation across firms, as evidenced by their standard deviations, suggesting diverse ESG practices within the European energy sector.

The average Tobin's Q value of 0.962 indicates that, on average, the market value of European energy companies is slightly below their replacement cost, suggesting potential undervaluation. However, the maximum value of 55.239 demonstrates that some firms are highly valued by the market relative to their asset base.

The mean firm size (natural logarithm of total assets) is 17.359, with a standard deviation of 2.617, indicating a diverse range of company sizes in the sample. The average leverage ratio (leverage) is 0.337, suggesting moderate debt levels overall, although the maximum of 54.862 indicates that some firms are highly leveraged. Average sales growth is 15.555%, but with considerable variation (standard deviation of 46.06%), reflecting the dynamic nature of the European energy market during the study period.

4.2 Correlation Analysis

Table 4 presents the correlation matrix for all variables used in the analysis.

Table 4: Correlation Matrix

Variable	ROA	ENV	GOV	SOC	ESG Score	Tobin's Q	Size	lever-age	Growth
ROA	1								
Environ-ment Pillar Score	0.048	1							
Govern-ance Pillar Score	0.011	0.355	1						
Social Pil-lar Score	0.082	0.777	0.412	1					
ESG Score	0.056	0.905	0.636	0.908	1				
Tobin's Q	0.117	-0.098	-0.073	-0.059	-0.096	1			
Size	0.205	0.293	0.168	0.273	0.303	-0.114	1		
Risk or lev-erage	0.023	-0.023	-0.024	0.01	-0.015	0.804	-0.021	1	
Growth	0.011	-0.014	0.016	0.001	0.001	-0.019	0.01	-0.011	1

The correlation matrix reveals several notable relationships among the variables. First, the correlations between ROA and the ESG variables are weak but positive, with coefficients ranging from 0.011 (Governance) to 0.082 (Social), suggesting a potentially modest positive relationship between ESG performance and accounting-based financial performance.

In contrast, Tobin's Q shows weak negative correlations with all ESG measures, ranging from -0.059 (Social) to -0.098 (Environmental), indicating a possible negative relationship between ESG performance and market valuation in the European energy sector.

Among the ESG components, strong positive correlations exist between the Environmental and Social pillars (0.777) and between each pillar and the composite ESG score (ranging from 0.636 to 0.908). This suggests that companies performing well in one ESG dimension tend to perform well in others, although the correlation between Governance and the other pillars is more moderate.

Firm size (Size) shows moderate positive correlations with all ESG measures (ranging from 0.168 to 0.303), suggesting that larger energy companies tend to have better ESG performance. Size also has the strongest correlation with ROA (0.205) among all explanatory variables, indicating that larger firms may achieve better profitability.

Notably, there is a very strong positive correlation between Tobin's Q and leverage (0.804), suggesting that more highly leveraged energy companies tend to have higher market valuations relative to their asset base. This relationship warrants careful consideration in interpreting the regression results.

The correlation coefficients among the independent variables are generally not excessive (below 0.8, except for correlations between ESG components and the composite score), suggesting that multicollinearity is not a major concern in the regression models. However, the high correlations between the ESG score and its individual components justify analyzing their effects separately, as done in the subsequent regression analyses. These descriptive and correlation analyses provide context for understanding the regression results presented in the following sections, highlighting the complex relationships between ESG performance and financial outcomes in the European energy sector.

4.3 Panel Regression Results

4.3.1 Effect of Composite ESG Score on Financial Performance (ROA)

This section examines the relationship between ESG disclosure and firm financial performance as measured by Return on Assets (ROA), addressing the first research question: "To what extent does sustainability (ESG) disclosure influence firm financial performance, specifically as measured by Return on Assets (ROA)?"

Model Selection and Diagnostic Tests

The analysis began with diagnostic tests to determine the appropriate panel estimation approach. The Breusch and Pagan Lagrangian multiplier test strongly rejected the null hypothesis that pooled OLS regression is appropriate (chibar2(01) = 491.91, p = 0.0000), confirming the presence of significant unobserved heterogeneity across firms that necessitates panel estimation methods.

The Hausman specification test is conducted to determine whether fixed or random effects estimation is more appropriate. The test yielded a chi2(4) statistic of 8.13 with p = 0.0870. Since this p-value exceeds the conventional 0.05 threshold, the null hypothesis that the random effects estimator is consistent cannot be rejected. Therefore, the more efficient random effects estimator is selected for examining the relationship between ESG disclosure and ROA.

To address potential heteroskedasticity and autocorrelation that commonly occur in panel data, cluster-robust standard errors were employed in the random effects regression, clustering at the firm level. This approach produces consistent estimates of the covariance matrix even in the presence of heteroskedasticity and within-firm error correlation over time, following established practices in panel data econometrics (Wooldridge, 2016).

Random Effects Regression Results

Table 5 presents the results from the random effects panel regression model examining the relationship between the composite ESG score and ROA, with cluster-robust standard errors.

Table 5. Effect of ESG Disclosure on ROA

Variable	Coefficient	Cluster-Robust Std. Error	z	P>|z|	[95% Conf. Interval]
ESG_Score	-0.01096	0.01329	-0.83	0.409	-0.03701, 0.01508
Size	0.9261021***	0.1196531	7.74	0	0.69158, 1.16061
leverage	0.1694563	0.332614	0.51	0.61	-0.48245, 0.82136
Growth	0.002163	0.002488	0.87	0.385	-0.00271, 0.00703
_cons	-12.35459***	2.280759	-5.42	0	-16.824, -7.88438
R-sq: within	0.0056				
R-sq: between	0.0892				
R-sq: overall	0.043				
Wald chi2(4)	62.50***				
Number of observations	3,691				
Number of groups	860				

Note: *** p<0.01, ** p<0.05, * p<0.1.

4.3.2 Interpretation of Results

The random effects regression results reveal several important findings regarding the relationship between ESG disclosure and financial performance as measured by ROA:

ESG Score: The coefficient on ESG_Score is negative (-0.010967) but not statistically significant (z = -0.83, p = 0.409). This suggests that there is no significant relationship between a firm's ESG disclosure score and its accounting-based financial performance in

the European energy sector during the period studied. The 95% confidence interval (-0.0370165, 0.0150825) includes zero, further confirming the non-significant relationship.

Control Variables: Firm size emerged as the only significant predictor of ROA, with a positive and highly significant coefficient (0.9261021, $p < 0.001$). This indicates that larger energy companies tend to achieve higher returns on assets, possibly due to economies of scale, market power, or better access to resources. Neither leverage nor growth demonstrated statistically significant relationships with ROA, although both coefficients were positive.

Model Fit: The overall explanatory power of the model is modest, with an overall R-squared of 0.0430, suggesting that approximately 4.3% of the variation in ROA is explained by the model. The Wald chi-square statistic (62.50) is highly significant ($p < 0.001$), indicating that the model as a whole has significant explanatory power.

4.3.3 Discussion in Relation to Hypothesis and Literature

These findings do not support Hypothesis H1, which proposed a significant relationship between ESG disclosure and firm profitability as measured by ROA. The absence of a significant relationship suggests that in the European energy sector, investment in ESG initiatives and their subsequent disclosure neither significantly enhances nor detracts from accounting-based financial performance. This result may reflect the balancing effect of potential benefits from improved stakeholder relations and potential costs associated with implementing ESG practices, resulting in a net neutral impact on profitability.

The non-significant relationship between ESG disclosure and ROA is in line with the considerable amount of literature written on the topic. A recent study by Alareeni and Hamdan (2020) of S&P 500 companies did not show a significant relationship between ESG performance and accounting-based financial performance. Likewise, Duque-Grisales and Aguilera-Caracuel (2021) discovered no statistically significant relationship

between ESG and financial performance in their Latin American sample highlighting that this phenomenon is not only confined to the European markets.

Nirino et al. (2021) showed that the relationship between ESG performance and financial performance is complex, and at best moderated by other factors, ESG performance does not lead to significantly improved financial performance. Maqbool and Zameer (2018) studied the impact of CSR on financial performance of the banking sector specifically and found that there is no direct significant relationship between CSR activities and ROA in the short run. In their extensive meta-analysis, Friede et al. (2015) highlighted that although many studies find a positive ESG-financial performance relationship, a significant body of research has also reported neutral results for both shareholder value and accounting-based performance.

More relevant for this study, Christensen et al. (2021) found that energy companies may have higher implementation costs that offset some of the potential economic gains of implementation, leading to a neutral impact on accounting performance measures. Conca et al. (2020) additionally provided evidence for these increased costs of ESG compliance across energy-intensive sectors. He clearly stated that governance mechanisms did not significantly improve financial performance in such sectors.

This is also consistent with the findings of (Orlitzky et al., 2003) who examined EU firms, which suggests a scarce effect of environmental and social performance on financial performance, and no statistically significant relationship between ROA and the overall ESG score. This indicates that each component of the ESG framework may cancel each other out of the end on the long-term value of a company by creating a neutral move. Similarly, Batae et al. (2021) also found that ROA and ESG performance were not significantly related to each other in the European banking sector, and such neutral association can be also true for several European industries.

The absence of significant association between ESG disclosure and ROA in this research reinforces the views of McWilliams and Siegel (2000) under the logic of "offsetting effects", implying that the likely advantages posed by ESG practices are neutralized by their associated costs of execution. This view has been further supported by more recent studies such as Xie et al. (2019) who suggest that ESG activities might contradict in nature and act simultaneously on financial performance thereby leading to a non-significant relationship between ESG and financial performance (ROA).

Theoretically, these results can also be explained by stakeholder theory, according to which firms need to strike a balance among the competing interests of different stakeholders (Freeman, 2010). The costs of ESG initiatives can easily outweigh the limited benefits they may yield in terms of short-term financial performance, especially in the resource-heavy energy sector, despite strengthening relations with certain stakeholders (e.g., communities, regulators). The absence of a significant relationship reflects the interaction between pressures for ESG adoption and their financial implications across the European context.

4.3.4 Effect of Composite ESG Score on Firm Value (Tobin's Q)

This section analyses the link between ESG disclosure and firm value (proxied by Tobin's Q), responding to the second research question: RQ2 − What effect does sustainability (ESG) disclosure have on firm value (with Tobin's Q as a measure)?

Model Selection and Diagnostic Tests

The analysis began with preliminary tests to determine the appropriate estimation approach. The Breusch and Pagan Lagrangian multiplier test strongly rejected the null hypothesis that pooled OLS regression is appropriate (chibar2(01) = 1868.24, p = 0.0000), confirming the presence of significant unobserved heterogeneity across firms that must be accounted for through panel estimation techniques.

The Hausman specification test yielded a chi2(4) statistic of 6.02 with p = 0.1973. Since this p-value substantially exceeds the conventional 0.05 threshold, the null hypothesis that the random effects estimator is consistent cannot be rejected. Therefore, the more efficient random effects estimator is selected for examining the relationship between ESG disclosure and Tobin's Q. To address potential heteroskedasticity and autocorrelation that commonly occur in panel data, cluster-robust standard errors were employed in the random effects regression, clustering at the firm level.

Random Effects Regression Results

Table 6 presents the results from the random effects panel regression model examining the relationship between the composite ESG score and Tobin's Q, with cluster-robust standard errors.

Table 6. Effect of ESG Disclosure on Tobin's Q

Variable	Coefficient	Cluster-Robust Std. Error	z	P>|z|	[95% Conf. Interval]
ESG_Score	-0.00570***	0.00108	-5.28	0	-0.00782, -0.00358
Size	-0.03131	0.02366	-1.32	0.186	-0.07770, 0.01507
leverage	0.96327***	0.01414	68.08	0	0.93553, 0.99100
Growth	-0.00022	0.00014	-1.48	0.138	-0.00051, 0.00007
_cons	1.58365***	0.39431	4.02	0	0.81080, 2.35649
R-sq: within	0.5684				
R-sq: between	0.5569				
R-sq: overall	0.6596				
Wald chi2(4)	4736.29***				
Number of observations	3,691				
Number of groups	860				

Note: *** p<0.01, ** p<0.05, * p<0.1. Cluster-robust standard errors in parentheses (clustered at firm level)

4.3.5 Interpretation of Results

The random effects regression results reveal several important findings regarding the relationship between ESG disclosure and firm value as measured by Tobin's Q:

ESG Score: The coefficient on ESG_Score is negative (-0.0057068) and highly statistically significant (z = -5.28, p < 0.001). This suggests that higher ESG disclosure scores are associated with lower firm value in the European energy sector during the period studied. The economic significance of this relationship is also noteworthy – a one-point increase

in ESG score is associated with approximately a 0.57% decrease in Tobin's Q, holding other factors constant.

Control Variables: Leverage (Leverage) shows a positive and highly significant relationship with Tobin's Q (0.9632715, $p < 0.001$), suggesting that more leveraged energy companies tend to have higher market valuations relative to their asset base. Firm size demonstrates a negative but statistically non-significant relationship with Tobin's Q (-0.0313158, $p = 0.186$), indicating a tendency for smaller energy companies to be valued more favorably by the market, although this effect is not statistically significant. Growth shows a negative but non-significant association with Tobin's Q (-0.0002211, $p = 0.138$).

Model Fit: The overall explanatory power of the model is substantial, with an overall R-squared of 0.6596, indicating that approximately 65.96% of the variation in Tobin's Q is explained by the model. The Wald chi-square statistic (4736.29) is highly significant ($p < 0.001$), confirming that the model as a whole has significant explanatory power.

4.3.6 Discussion in Relation to Hypothesis and Literature

These findings do not support Hypothesis H2, which proposed a positive impact of ESG disclosure on firm value as measured by Tobin's Q. In fact, the results suggest the opposite - a significant negative relationship between ESG disclosure and firm market valuation in the European energy sector.

Several factors could explain the negative relationship between ESG disclosure and Tobin's Q in the European energy sector. Investors may first see ESG investments in the energy sector as costly diversions from core business activities that do not bring sufficient compensating benefits. Humphrey et al. (2012) points out that ESG initiatives usually require capital expenditures that may not generate financial returns in the short to medium term and, therefore, might lower firm value in the short to medium term.

Secondly, the European energy sector is going through the energy transition, which is also accompanied by regulatory pressure. Fossil fuel firms, in particular, may be looking at market skepticism of their ESG initiatives as reactive rather than proactive, as suggested by Gonenc and Scholtens (2017) since their business models are inherently carbon intensive. In this sector, investors might fail to see ESG spending as a value creating strategy, but as a sustainable compliance cost.

Third, experts' suspicions about firms' ESG claims result in a 'greenwashing discount' faced by industry investors in environmentally contentious industries. In line with Mahoney et al. (2013), the markets may negatively react to ESG disclosures that are considered as symbolic rather than substantive, particularly in industries with large environmental impacts.

This study's significant negative relationship corroborates Nirino et al. (2021), which demonstrated that corporate controversies can also moderate the relationship between ESG performance and firm value in the energy sector where the relationships are more susceptible to corporate controversies. Lucas and Noordewier (2016) also discovered that the relationship between environmental management practices and financial performance is conditional on industry pollution related factors such that highly polluting industries may have lower returns to ESR investments.

From a theoretical standpoint, there is something interesting that opposes the conventional reading of stakeholder theory. Stakeholder theory implies that by considering the interests of different stakeholders one can create long term value, but the results show that in the European energy sector such initiatives may not be rewarded in the market. In this way, the actions that could be beneficial to different stakeholders may not be conducive to the shareholders from the short term perspective, especially in industries that are undergoing their structural transitions, as described in the 'stakeholder-shareholder paradox' by Freudenreich et al. (2020).

In summary, these findings suggest that in the European energy sector, higher ESG disclosure is correlated with lower market valuations. This implies that investors may perceive ESG investments in this sector as expensive non–financial value because of the sectoral challenges associated with the energy transition, regulatory pressures and basic business models. These questions are highly relevant for companies in carbon intensive industries as they show the need to have ESG implemented and communicated in an industry specific way, and the difficulties that companies face in communicating the value of their sustainability initiatives to investors.

4.4 Effects of Individual ESG Components on Financial Performance and Firm Value

The third research question addressed in this section is: Are the three components of ESG—Environmental, Social, and Governance—differ in their significance in influencing firm value and corporate financial performance?

Model Selection and Diagnostic Tests

For analyzing the disaggregated effects of ESG components on financial performance (ROA), the Hausman test yielded a chi2(6) statistic of 14.34 with p = 0.0261. Since this p-value is less than the conventional 0.05 threshold, the null hypothesis that the random effects estimator is consistent is rejected. Therefore, the fixed effects estimator is preferred for examining the relationship between individual ESG components and ROA.

For the Tobin's Q model with disaggregated ESG components, the Hausman test resulted in a chi2(6) statistic of 9.55 with p = 0.1447, suggesting that the random effects estimator is more efficient. Therefore, the random effects model is selected for analyzing the relationship between individual ESG components and Tobin's Q.To address potential heteroskedasticity and autocorrelation in the panel data, robust standard errors were employed in both models. For the fixed effects model (ROA), the standard errors were

adjusted for clusters at the firm level, while for the random effects model (Tobin's Q), cluster-robust standard errors were used.

4.4.1 Disaggregated ESG Components and ROA: Fixed Effects Results

Table 7 presents the results from the fixed effects panel regression examining the individual effects of Environmental, Social, and Governance components on ROA.

Table 7. Fixed Effects Panel Regression Results - Effect of ESG Components on ROA

Variable	Coefficient	Robust Std. Error	t	P>|t|	[95% Conf. Interval]
Environment_Pillar_Score	-0.06830***	0.01975	-3.46	0.001	-0.10708, -0.02953
Social_Pillar_Score	0.08011***	0.01591	5.03	0	0.04887, 0.11135
Governance_Pillar_Score	-0.04107***	0.01157	-3.55	0	-0.06378, -0.01836
Size	1.47933**	0.6519	2.27	0.023	0.19982, 2.75883
leverage	0.22522	0.42125	0.53	0.593	-0.60158, 1.05203
Growth	0.00368	0.00231	1.59	0.112	-0.00006, 0.00823
_cons	-21.23249**	10.77456	-1.97	0.049	-42.38004, -0.0849372
R-sq: within	0.0157				
R-sq: between	0.0861				
R-sq: overall	0.0471				
F(6,859)	7.59***				
Number of observations	3,691				
Number of groups	860				

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses (clustered at firm level).

4.4.2 Disaggregated ESG Components and Tobin's Q: Random Effects Results

Table 8 presents the results from the random effects panel regression examining the individual effects of Environmental, Social, and Governance components on Tobin's Q.

Table 8. Effect of ESG Components on Tobin's Q

Variable	Coefficient	Cluster-Robust Std. Error	z	P>|z|	[95% Conf. Interval]
Environment_Pillar_Score	-0.00046	0.00092	-0.5	0.615	-0.00228, 0.00135
Social_Pillar_Score	-0.00264***	0.00091	-2.88	0.004	-0.00443, -0.00084
Governance_Pillar_Score	-0.00243***	0.00067	-3.59	0	-0.00376, -0.00110
Size	-0.03319	0.02411	-1.38	0.169	-0.08046, 0.01406
leverage	0.96294***	0.01432	67.23	0	0.93487, 0.99102
Growth	-0.0002134	0.0001476	-1.45	0.148	-0.00050, 0.00007
_cons	1.60700***	0.40209	4	0	0.81891, 2.3951
R-sq: within	0.5692				
R-sq: between	0.5556				
R-sq: overall	0.6589				
Wald chi2(6)	4632.76***				
Number of observations	3,691				
Number of groups	860				

Note: *** p<0.01, ** p<0.05, * p<0.1. Cluster-robust standard errors in parentheses (clustered at firm level).

4.4.3 Interpretation of Results

The disaggregated analysis of ESG components reveals nuanced relationships with financial performance measures:

Effects on ROA:
The Environmental score shows a negative and statistically significant relationship with ROA (coefficient = -0.0683088, p = 0.001), suggesting that higher environmental disclosure is associated with lower accounting-based financial performance in the European energy sector.

The Social score demonstrates a positive and highly significant relationship with ROA (coefficient = 0.080114, p < 0.001), indicating that better social performance contributes positively to profitability.

The Governance score exhibits a negative and highly significant relationship with ROA (coefficient = -0.0410734, p < 0.001), suggesting that higher governance disclosure is associated with reduced profitability.

Firm size remains a significant positive predictor of ROA (coefficient = 1.479333, p = 0.023), consistent with findings from previous models.
Effects on Tobin's Q:

The Environmental score shows no statistically significant relationship with Tobin's Q (coefficient = -0.0004675, p = 0.615), suggesting that environmental performance does not significantly affect market valuation.

The Social score demonstrates a negative and significant relationship with Tobin's Q (coefficient = -0.0026409, p = 0.004), indicating that investors place a negative value on social responsibility disclosures in the energy sector.

The Governance score exhibits a negative and highly significant relationship with Tobin's Q (coefficient = -0.0024345, $p < 0.001$), suggesting that stronger governance practices are associated with lower market valuations.

Model Fit: Both models demonstrate improved explanatory power compared to the composite ESG score models, with the R-squared values for the Tobin's Q model remaining substantial at 0.6589. The F-statistics for the ROA model (7.59) and the Wald chi-square statistic for the Tobin's Q model (4632.76) are both highly significant ($p < 0.001$), confirming the models' overall significance.

4.4.4 Discussion in Relation to Hypotheses and Literature

These findings provide nuanced insights regarding the study's hypotheses on individual ESG components:

Environmental Component (H3 and H4):
Hypothesis H3 is rejected as Environmental disclosure has a significant negative impact on firm profitability (ROA). This implies that environmental initiatives in the energy sector entail high costs, which have a negative impact on short term financial performance. Hypothesis H4 is rejected as Environmental disclosure does not significantly impact firm value (Tobin's Q), suggesting investors may interpret energy sector environmental initiatives as neither value enhancing nor value destroying.

The results are consistent with the findings of Arslan-Ayaydin and Thewissen (2016) that firms involved in environmental responsibility do not outperform the market, particularly in the energy sector which operates in a highly competitive and uncertain environment. Chen et al. (2018) also noted that environmental initiatives are usually associated with high upfront costs that can negatively impact short term profitability. This is particularly effective for energy companies who have higher implementation costs for environmental improvements.

Social Component (H5 and H6):

Social disclosure is found to have a significant positive impact on the firm's profitability (ROA) and hence supports hypothesis H5 strongly as it suggests that good stakeholder management improves operational performance.

As social disclosure has a significant negative effect on firm value (Tobin's Q), hypothesis H6 is rejected. This implies that investors view social initiatives in the energy sector as expensive ventures that do not add significantly to financial value.

This positive finding is in line with (Kim et al., 2018) who found that social performance has a direct positive effect on operational performance of the firm. This indicates that companies that have good social practices could get higher employee productivity, customer loyalty and reduce operational risks, and, therefore, better financial performance.

However, some previous studies are contrary to this negative relationship between social performance and Tobin's Q, which indicates a disassociation between accounting performance and market valuation in the European energy sector. This may indicate investor skepticism that the long-term financial benefits of social initiatives are to be found in this industry, particularly in the context of the energy transition and greater regulatory pressure.

Governance Component (H7 and H8):

Hypothesis H7 is rejected as Governance disclosure has a significant negative impact on firm profitability (ROA), suggesting that stronger governance practices may create new costs that reduce short-term profitability for the firms.

Finally, hypothesis H8 is rejected as Governance disclosure has a negative impact on firm value (Tobin's Q) which means that strict governance rules are perceived by investors as

limiting the firm's flexibility and subsequent ability to create value in a dynamic and complex energy sector.

Contrary to findings by Arora and Sharma (2016) and that corporate governance has a positive impact on the firm performance, in this study governance disclosure has a negative relationship with both ROA and Tobin's Q. This could be the result of different challenges of the European energy sector that may be constrained by strict governance requirements, which limit operational flexibility and strategic adaptability during the energy transition.

The effects of ESG components on ROA and Tobin's Q are contrasting, which emphasizes the complexity of the ESG-financial performance relationship in the European energy sector. Social disclosure has a positive impact on ROA and a negative impact on Tobin's Q, which indicates that there might be a gap between operational performance and market valuation.

These findings are interesting from a theoretical point of view that they challenge both stakeholder theory and institutional theory. Stakeholder theory indicates that satisfying the interests of different stakeholders should create value, but in this study, it is found that the relation is more complex. Social practices improve operational performance but are possibly seen as a cost by investors. In addition, institutional theory proposes that complying with institutional pressures would increase legitimacy and performance, but the results of this study demonstrate that in the European energy sector, adhering to environment and governance standards could be a costly exercise.

4.5 Delayed Effects of ESG Disclosure

This section addresses the fourth research question: "Is there a delayed effect of ESG scores and ESG components on corporate financial outcomes (ROA & Tobin's Q)?". To examine whether ESG performance demonstrates lagged effects on financial outcomes,

one-year lagged models were estimated for both the composite ESG score and the disaggregated ESG components.

Table 9. Effect of Lagged ESG Disclosure on ROA

Variable	Coefficient	Cluster-Robust Std. Error	z	P>|z|	[95% Conf. Interval]
L1_ESG_Score	-0.00413	0.01601	-0.26	0.796	-0.03553, 0.02725
Size	0.88706***	0.13416	6.61	0	0.62411, 1.15001
leverage	0.0068747	0.4703	0.01	0.988	-0.91489, 0.92864
Growth	0.0051867**	0.00261	1.98	0.047	0.00006, 0.01031
_cons	-11.92206***	2.80642	-4.25	0	-17.42255, -6.42157
R-sq: within	0.0058				
R-sq: between	0.067				
R-sq: overall	0.0488				
Wald chi2(4)	52.29***				
Number of observations	2,994				
Number of groups	701				

Note: *** p<0.01, ** p<0.05, * p<0.1.

Table 9 reveals a persistent negative relationship between ESG disclosure and firm value (Tobin's Q) across both contemporaneous and lagged time periods. The one-year lagged ESG score coefficient (-0.0051, p<0.001) closely resembles the contemporaneous effect (-0.0057, p<0.001), demonstrating that market skepticism toward ESG investments in the energy sector endures over time rather than diminishing. This persistence contradicts the "delayed value recognition" hypothesis and instead suggests structural market concerns about ESG investments in energy companies. Interestingly, the firm size effect becomes more significantly negative in the lagged model (-0.0503, p<0.001) compared

to the contemporaneous relationship (-0.0313, p=0.186), while leverage maintains a consistently strong positive association with market valuation across both time periods.

Table 10. Effect of Lagged ESG Disclosure on Tobin's Q

Variable	Coefficient	Cluster-Robust Std. Error	z	P>|z|	[95% Conf. Interval]
L1_ESG_Score	-0.00507***	0.00145	-3.49	0	-0.00791, -0.00222
Size	-0.05031***	0.01217	-4.13	0	-0.07417, -0.02644
leverage	0.95918***	0.03239	29.61	0	0.89569, 1.02267
Growth	-0.00008	0.00023	-0.38	0.703	-0.00054, 0.00036
_cons	1.83013***	0.26954	6.79	0	1.30183, 2.35843
R-sq: within	0.2291				
R-sq: between	0.7553				
R-sq: overall	0.6571				
Wald chi2(4)	956.91***				
Number of observations	2,994				
Number of groups	701				

Note: *** p<0.01, ** p<0.05, * p<0.1.

The analysis of lagged ESG effects on Tobin's Q (Table 10) reveals a persistent negative relationship between ESG disclosure and market valuation in European energy companies. The one-year lagged ESG score coefficient (-0.0051, p<0.001) remains significantly negative and similar in magnitude to the contemporaneous effect (-0.0057, p<0.001), demonstrating that market skepticism toward ESG investments endures rather than

diminishes over time. This persistence contradicts the hypothesis that markets might eventually recognize ESG value, instead suggesting structural investor concerns about sustainability investments in the energy sector. Notably, firm size exhibits a stronger negative effect in the lagged model (-0.0503, p<0.001) compared to the contemporaneous model (-0.0313, p=0.186), while leverage maintains a consistently strong positive influence on market valuation across both time periods (lagged: 0.9592, p<0.001; contemporaneous: 0.9633, p<0.001), confirming its importance as a determinant of Tobin's Q regardless of temporal considerations.

4.6 Delayed Effects of ESG Components

The analysis of lagged ESG component effects on ROA (Table 11) reveals a striking contrast to contemporaneous effects. While immediate Environmental (-0.0683, p=0.001), Social (0.0801, p<0.001), and Governance (-0.0410, p<0.001) pillars show significant associations with ROA, their one-year lagged effects all become statistically non-significant (Environment: 0.0080, p=0.669; Social: -0.0178, p=0.332; Governance: 0.0094, p=0.393). Most notably, the Environmental pillar's coefficient changes from significantly negative to positive (though non-significant), while the social pillar shifts from significantly positive to negative (though non-significant). This temporal transformation suggests that initial ESG component effects on accounting performance dissipate over time, with any immediate operational benefits or costs being absorbed as firms adjust. Only firm size (0.8819, p<0.001) and growth (0.0052, p=0.048) maintain significant positive relationships with ROA in the lagged model, highlighting that traditional financial factors remain the primary drivers of accounting performance over time.

Table 11. Effect of Lagged ESG Components on ROA

Variable	Coefficient	Cluster-Robust Std. Error	z	P>|z|	[95% Conf. Interval]
L1_Environment_Pillar_Score	0.00799	0.01868	0.43	0.669	-0.02863, 0.04461
L1_Social_Pillar_Score	-0.01784	0.01838	-0.97	0.332	-0.05386, 0.01818
L1_Governance_Pillar_Score	0.00943	0.01105	0.85	0.393	-0.01223, 0.03109
Size	0.88191***	0.13361	6.6	0	0.62003, 1.14379
leverage	0.01774	0.46758	0.04	0.97	-0.89869, 0.93419
Growth	0.00517**	0.00262	1.97	0.048	0.00003, 0.01031
_cons	-11.98977***	2.7996	-4.28	0	-17.47689, -6.50265
R-sq: within	0.0071				
R-sq: between	0.0675				
R-sq: overall	0.0479				
Wald chi2(6)	52.23***				
Number of observations	2,994				
Number of groups	701				

Note: *** p<0.01, ** p<0.05, * p<0.1.

The analysis of lagged ESG component effects on Tobin's Q (Table 12) reveals important shifts in how individual pillars influence market valuation over time. While contemporaneous Environmental disclosure shows no significant relationship with firm value (-0.0005, p=0.615), its one-year lagged effect remains non-significant (-0.0008, p=0.393). In contrast, social disclosure maintains a significant negative impact on Tobin's Q in both immediate (-0.0026, p=0.004) and lagged (-0.0027, p=0.013) models with nearly identical coefficients, indicating persistent market skepticism toward social initiatives. Notably, Governance disclosure's negative market impact weakens over time, shifting from highly significant (-0.0024, p<0.001) to marginally significant (-0.0017, p=0.055), suggesting slightly diminishing investor concerns. Firm size (-0.0503, p<0.001) and leverage (0.9594, p<0.001) remain powerful determinants of market valuation in the lagged model, highlighting the enduring importance of traditional financial metrics over ESG considerations in market valuation of European energy companies.

Table 12. Effect of Lagged ESG Components on Tobin's Q

Variable	Coefficient	Cluster-Robust Std. Error	z	P>|z|	[95% Conf. Interval]
L1_Environment_Pillar_Score	-0.00075	0.00087	-0.85	0.393	-0.00247, 0.00097
L1_Social_Pillar_Score	-0.00271**	0.00109	-2.49	0.013	-0.00485, -0.00057
L1_Governance_Pillar_Score	-0.00170*	0.00088	-1.92	0.055	-0.00345, 0.00003
Size	-0.05032***	0.0122	-4.12	0	-0.07425, -0.02639
leverage	0.95939***	0.03238	29.62	0	0.89591, 1.02287
Growth	-0.00008	0.00023	-0.37	0.71	-0.00054, 0.00037
_cons	1.83858***	0.27238	6.75	0	1.30470, 2.37245
R-sq: within	0.2302				
R-sq: between	0.7553				
R-sq: overall	0.6564				
Wald chi2(6)	959.44***				
Number of observations	2,994				
Number of groups	701				

Note: *** p<0.01, ** p<0.05, * p<0.1.

The analysis of concurrent and lagged ESG effects reveals distinct temporal patterns in how sustainability disclosures influence financial outcomes in European energy companies. For accounting performance (ROA), the composite ESG score shows no significant relationship in either time period, but individual ESG components exhibit striking transformations: all three pillars (Environmental, Social, and Governance) lose their statistical significance after a one-year lag, with the Environmental component even changing

direction from significantly negative to non-significantly positive. This suggests that initial operational impacts of ESG initiatives are absorbed as firms adjust over time, with traditional financial factors like firm size remaining the dominant drivers of accounting performance regardless of timeframe.

Table 13. Summary of ESG Disclosure Effects

Model Type	Contemporaneous Effects	One-Year Lagged Effects
Composite ESG Score on ROA	No significant relationship (-0.0110, p=0.409)	No significant relationship (-0.0041, p=0.796)
Composite ESG Score on Tobin's Q	Significant negative relationship (-0.0057***, p<0.001)	Significant negative relationship (-0.0051***, p<0.001)
ESG Components on ROA	• Environment: Significant negative (-0.0683***, p=0.001) • Social: Significant positive (0.0801***, p<0.001) • Governance: Significant negative (-0.0411***, p<0.001)	• Environment: No significant effect (0.0080, p=0.669) • Governance: No significant effect (0.0094, p=0.393) • Social: No significant effect (-0.0178, p=0.332)
ESG Components on Tobin's Q	• Environment: No significant effect (-0.0005, p=0.615) • Social: Significant negative (-0.0026***, p=0.004) • Governance: Significant negative (-0.0024***, p<0.001)	• Environment: No significant effect (-0.0008, p=0.393) • Social: Significant negative (-0.0027**, p=0.013) • Governance: Marginally significant negative (-0.0017*, p=0.055)

Note: *** p<0.01, ** p<0.05, * p<0.1.

For market valuation (Tobin's Q), the negative relationship with composite ESG score persists over time, indicating enduring investor skepticism toward sustainability investments in the energy sector. At the component level, social disclosure maintains a

consistent negative impact on market valuation across both time periods, while Governance disclosure's negative effect weakens slightly over time but remains marginally significant. The Environmental pillar demonstrates no significant relationship with market valuation in either period. These patterns reveal that while ESG's operational effects may dissipate over time, market skepticism—particularly toward social initiatives—endures. This suggests that investors in European energy companies may view certain ESG investments, especially in the social domain, as structurally value-destroying rather than as investments that will give returns over time.

5 Conclusion

This chapter synthesizes and expands upon the empirical findings presented in Chapter 4, which examined the relationship between ESG disclosure and financial performance among European energy companies from 2014 to 2023. The analysis revealed complex and nuanced relationships that challenged conventional wisdom about ESG's financial benefits, particularly in the energy sector. While Chapter 4 provided statistical evidence and initial interpretations aligned with existing literature, this chapter advances the discussion by integrating these findings into broader theoretical and practical contexts. The primary purpose of this chapter is to synthesize the research findings across all four research questions, explore their implications for multiple stakeholders, and position these insights within the evolving landscape of sustainable finance and energy transition.

5.1 Synthesis of Findings

5.1.1 The ESG Paradox in Energy

The empirical results reveal a striking paradox in how ESG disclosure affects financial performance in the European energy sector. While ESG disclosure demonstrates no statistically significant relationship with accounting-based performance (ROA), it exhibits a significant negative correlation with market-based valuation (Tobin's Q). This divergence suggests a fundamental disconnect between operational realities and market perceptions regarding ESG investments in energy companies.

This paradox becomes more complex when examining individual ESG components. Social disclosure positively influences accounting performance but negatively affects market value, indicating that while social initiatives may improve operational efficiency and stakeholder relationships, investors view them as potential value destructors. Consistent with environmental and governance disclosures, negative relationships with accounting performance are also shown, while governance also has a negative impact on market

valuation. Environmental disclosure, uniquely, shows no significant relationship with market value.

These paradoxical findings are partially explained by the theoretical framework of 'off-setting effects' (McWilliams & Siegel, 2000). In the energy sector ESG initiatives may be neutralized for accounting performance costs due to the prospective costs that the market is pricing in that may not be reflected yet in the current financial statements. This is particularly the case in energy intensive industries that are in the midst of structural change, where ESG investments are both potential sources of competitive advantage as well as very costly.

5.1.2 Sector-Specific ESG Dynamics

The characteristics of the European energy sector have a significant influence on the relationship between ESG performance. The European Green Deal, emphasizing an energy transition and mandating this, places a burden on companies in the energy business that has to find a balance between short-term profitability and long-term sustainability goals. This transition context explains why ESG investments might be seen as necessary and costly adaptations rather than value creating opportunities by market participants.

Regulatory pressures specific to the energy sector in fact increase these challenges. ESG initiatives may actually emerge to generate additional immediate financial benefits that could outweigh the short-term financial benefits to meet the European Union's stringent emissions targets and renewable energy mandates is met with compliance costs. There is no doubt that energy companies like oil or gas companies are among the most affected ones as it is very difficult to transition from a fossil fuel-based business model to something else in an environment where the upfront investment is high, and the return is not certain.

The energy sector is different from the others in ESG performance relationships as it is more capital intensive. For digital or service industry, improvements in ESG may come at a relatively affordable price, but for energy companies, such as those that need to spend billions on investments in renewable energy, grid modernization and carbon capture technologies. These large investments hurt current profits. Markets may not fully value these investments due to uncertainty about future returns.

5.1.3 Temporal Dimensions of ESG Effects

The study of time-lagged effects reveals important patterns that how ESG scores affect financial outcomes after one year. For accounting performance (ROA), ESG effects fade over time. The immediate effects of Environmental (-0.0683), Social (0.0801), and Governance (-0.0411) components are all significant. However, after one year, none of these effects remain significant. The Environmental score even changes from negative to positive, though not significantly. This suggests companies adapt to ESG initiatives over time.

For market value (Tobin's Q), negative reactions persist. The immediate ESG score effect (-0.0057) remains similar after one year (-0.0051). This suggests investors maintain their scepticism about ESG investments. This evidence opposes the conventional wisdom that ESG performance improves financial outcomes after an adjustment period. Instead, it suggests markets have structural concerns about ESG investments in energy companies. While operational effects normalize, market scepticism continues. This is especially true for social initiatives, which investors consistently view ESG investment as value-destroying.

5.2 Implications

5.2.1 Strategic Implications for Energy Companies

Energy companies need to rethink their ESG strategies. They should not treat ESG as just a compliance exercise. Instead, they should integrate sustainability into core business transformation. Companies should find synergies between ESG and operational improvements.

ESG strategies must match each company's business model. Renewable energy firms should highlight environmental achievements. Traditional energy companies should focus on social aspects of transition management. This targeted approach helps balance stakeholder expectations while using resources wisely.

Companies must improve their communication about ESG investments. Given market skepticism, they must clearly explain the business case for sustainability. This includes realistic timelines for value creation. Transparency about costs and expected returns can address investor concerns about greenwashing.

Moreover, the temporal findings suggest companies should prepare stakeholders for short-term variability in results after ESG initiatives. They should explain how these effects stabilize over time. Companies should prioritize social practices that show immediate operational benefits.

5.2.2 Investment and Market Implications

The findings of the research challenge some of the fundamental assumptions in sustainable finance and ESG investments. Investors in energy company securities need to be aware that the sector’s dynamics are not fully reflected in traditional ESG scoring frameworks. Markets seem to anticipate substantial costs associated with sustainability

transitions and hence, high ESG scores in energy companies do not necessarily predict superior financial performance.

ESG evaluation methodologies based on a complex energy transition have to be developed by sector as for portfolio managers and analysts. These frameworks should differentiate between those ESG investments that provide direct operational advantages and those that are a long-term positioning for regulatory change and market evolution. Likewise, they should distinguish between companies that are really transforming sustainably and those that are merely doing superficial ESG.

5.2.3 Policy and Regulatory Implications

The findings suggest problems with the current ESG disclosure frameworks for energy companies. Policymakers should consider sector-specific reporting requirements. These should address the unique challenges of energy transition. Requirements should balance standardization with recognition of differences across energy subsectors.

Regulators may need to provide more support for energy companies making ESG investments. This could include transition finance mechanisms, carbon pricing structures, or incentive programs. Current policies may penalize companies pursuing environmental improvements by imposing costs without market rewards.

The persistent negative market reaction to ESG initiatives, even after time lags, suggests market forces alone may not drive energy transition at the desired pace. Policymakers should consider whether additional support is needed to align investor incentives with climate goals. This is especially important during the early phases of transitioning capital-intensive business models.

5.3 Contributions to Knowledge

This study contributes to theoretical understanding of ESG-performance relationships in several ways. First, it challenges stakeholder theory by showing that stakeholder satisfaction does not always create financial benefits. This is especially true in capital-intensive industries undergoing transition. Stakeholder theory should consider sector characteristics, regulatory environments, and transition dynamics.

Second, the study extends institutional theory by showing how regulatory context affects ESG effectiveness. Despite strong regulatory pressure for ESG adoption in European energy, these do not generate financial rewards but instead cause market skepticism. This suggests that predictions about legitimacy benefits should be revised for industries experiencing fundamental structural changes.

Third, the methodology contributes by examining both immediate and lagged effects across aggregate and individual ESG components. This captures nuances missed by studies focused only on composite ESG scores or immediate impacts. The temporal analysis advances understanding of how ESG effects evolve over time. The research shows operational impacts stabilize while market perceptions remain negative.

5.4 Limitations

5.4.1 Contextual Constraints

This study focuses on European energy companies from 2014 to 2023. This limits how widely the findings can be applied to other regions and time periods. European regulatory frameworks, market structures, and attitudes toward sustainability differ from other global contexts. These differences could affect ESG-performance relationships. The study period captures the European Green Deal implementation and energy market disruptions. These may not represent normal market conditions.

The focus on energy companies prevents understanding whether negative market reactions to ESG are unique to energy or common in other transitional industries. Future research should include multiple sectors to provide comparative insights.

5.4.2 Methodological Considerations

The study uses ESG scores from commercial rating agencies. These scores have limitations including subjective weightings, inconsistent methods across providers, and potential bias toward larger companies. These measurement issues may affect the accuracy of estimates.

While this research analyzed one-year lagged effects, ESG initiatives may need longer to generate benefits. The observed timeframe may miss positive effects that emerge after several years. Future research should examine multi-year lags to better capture the full lifecycle of ESG investments in capital-intensive industries.

Finally, the models assume linear relationships between ESG and financial performance. Non-linear relationships may exist where ESG initiatives need to reach certain thresholds before generating benefits.

5.5 Future Research Directions

Future research should extend beyond the current timeframe. Longer studies could better capture the full financial impact of ESG investments in energy companies. These studies may use dynamic panel methods to model adjustment processes and identify thresholds where ESG investments begin generating positive returns. Case studies of successful ESG transformations could provide insights into managing the transition period effectively.

Cross-sector comparative research would help determine whether the findings are unique to energy or common across transitional industries. Studies comparing energy

with automotive, chemical, or manufacturing industries could identify patterns in how markets value ESG during structural transformations.

Research on investor psychology could explain the persistent negative market reactions to ESG in energy. Experimental methods or surveys could reveal whether market skepticism stems from concerns about costs, doubts about management competence, fears of stranded assets, or other factors specific to energy transition.

Future studies should also examine non-linear relationships between ESG disclosure and financial performance. There may be threshold effects where ESG initiatives need to reach certain levels before generating benefits.

5.6 Conclusion

This research challenges common beliefs about ESG benefits in the European energy sector. The findings show that ESG disclosure shows no clear accounting benefits. It often leads to lower market valuations. The ESG-finance relationship is uniquely complex in the energy industry. Different ESG components have varied and sometimes contradictory effects. This suggests companies need component-specific rather than uniform ESG strategies.

The temporal analysis reveals an important pattern. Operational impacts of ESG fade over time as companies adjust. However, market scepticism persists. This challenges the idea that ESG investments simply need time to pay off. Instead, markets fundamentally question the value of certain ESG initiatives in transitional industries.

ESG implementation in the energy sector tests both corporate strategy and investment theory. Sustainability is essential for long-term viability and regulatory compliance. However, companies must navigate persistent market scepticism. The European energy transition offers chances to develop a better understanding of sustainable finance that considers sector-specific dynamics. As climate commitments intensify and energy

security concerns grow, these findings become increasingly relevant. Successful ESG implementation in transitional contexts requires moving beyond simple assumptions about financial benefits. Companies must develop nuanced strategies that balance regulations, operations, market expectations, and stakeholder needs during this critical transformation period.

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