

Louvain School of Management

Exploring the impact of ESG and greenwashing scores on stock valuation ratios.

An empirical evidence of European energy companies

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Foreword

This thesis was written for my master's degree in business administration at the Louvain School of Management. I chose to focus on international finance.

This was a hard but interesting topic for study because it was a mix of the financial and economic fields. This paper would not have been possible without the help of many family members and other people along the way. Leonardo Iania, an associate professor of finance at the Louvain School of Management, has helped me many times with his guidance, suggestions, and generosity.

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I. Introduction

The 2008 financial crisis highlighted the risks associated with a focus on short-term financial performance and emphasised the importance of considering long-term performance and sustainability in corporate vision. In recent years, investors and stakeholders have become increasingly concerned about accessing non-financial information to assess future cash flows and financial risks. (Erkens et al., 2015). However, unlike financial information, non-financial information is not subject to specific accounting rules. Several initiatives and frameworks have been developed at the national and international levels to guide the disclosure of non-financial information, but they frequently fail to include relevant key performance indicators to assess social and environmental performance.

The concept of non-financial information is broad and lacks a clear definition. It has become evident that financial information alone may be insufficient to predict a company's future performance. While investors are recognized as important recipients of environmental, social, and governance (ESG) reports, the actual impact of these reports on companies financial performance and their value to investors remains uncertain. (Cauvin et al., 2006). This uncertainty may be attributed to companies engaging in greenwashing, where they selectively promote positive information about their environmental efforts to maintain their social reputation and legitimacy, while neglecting to disclose negative aspects. (Brammer et al., 2006).

Therefore, the research question we decided to analyze for this thesis is the following one:

Does the inclusion of Environmental, Social, and Governance (ESG) scores and greenwashing scores improve the predictive ability of Price-to-Earnings (PE), Price/Earnings to Growth (PEG), and Price-to-Book Value (PBV) ratios in assessing the financial performance of energy companies in Europe?

First, companies in the energy sector are particularly aware of these reports since investors believe that this sector has a negative environmental impact. This industry, which includes power generation, transmission, distribution, and trade, is presently going through extraordinary changes throughout the entire process. Secondly, incorporating alternative sources of energy can help businesses better serve their customers, stop revenue losses, and

improve financial performance by using sustainable business strategies (Lu et al., 2019). Finally, in areas experiencing significant disruption, such as the energy sector, it is vital for investors to make well-informed decisions. Evaluating business valuation will assist them in determining whether companies are undervalued or overvalued. (Damodaran, 1995).

This research study aims to analyze the relationship between valuation multiples and financial performances, ESG scores and greenwashing scores in Europe. Few articles and research have been published on the business valuation multiples. Furthermore, our focus will be on the energy sector in Europe as a whole, as this approach avoids the need to analyze individual countries. This is because industries within the same country generally have similar sizes and follow similar social norms related to the sector, as observed in prior research (Freedman & Jaggi, 2009). It is worth noting that certain countries may have social norms that are more supportive of ESG reports compared to others. (Ruan and Liu, 2021). Furthermore, our analysis will specifically target the energy sector, known for its significant environmental impact and classification as one of the most polluting industries. As a result, ESG reports are anticipated to exert a stronger influence on investor decision-making within this sector. This study aims to explore the correlation between conventional equity valuation ratios (PE, PEG, and PBV) and sustainability-related factors (greenwashing scores and ESG scores). By analyzing the combined impact of both financial and non-financial metrics, the research seeks to determine if this integration provides more robust insights into the company's financial health and potential growth prospects. The inclusion of sustainability factors can help stakeholders, investors, and policymakers make informed decisions of the financial performance of energy companies.

This report begins by examining the current theories and explanations identified in the literature review. After that, the identification of gaps in existing knowledge will serve as the basis for formulating our own hypotheses. Subsequently, we perform sample detection and provide a description of the data. Next, we develop our models and conduct empirical analysis to validate or reject our hypothesis. To accomplish this, we adopt a linear regression approach as proposed in Damodaran's study (1995). By employing this approach, we can make predictions concerning our ratios and subsequently compare them to their actual values, enabling us to evaluate whether a company is overvalued or undervalued. However, we face

ongoing difficulties comparing a diverse range of companies because of the dynamic nature of the energy sector, leading to variations in risk, growth potential, and cash flow. Finally, we emphasize conclusions drawn from our empirical study and propose potential directions for future research.

II. Literature Review

1. Conceptual framework of ESG, Greenwashing and the Energy Sector

1.1. Environment, Social and Governance (ESG)

1.1.1. The history and evolution of ESG as a concept in CSR

The concept of corporate social responsibility (CSR) has grown over time, with its origins in more general conversations on the social obligations of corporations that started in the 1940s. Institutions began to be perceived at this time as thinking beyond merely profit and considering the impact of their activities on society. But it wasn't until the 1950s that CSR began to fully emerge, with significant formulations identifying it as businessmen's duty to promote those policies that are advantageous in terms of the goals and values of society. (MacNeil et al., 2022).

During the 1990s, the concept of Environmental, Social, and Governance (ESG) emerged as a portfolio risk management strategy tied to financial performance, marking a significant departure from the earlier framework of Corporate Social Responsibility (CSR). Over time, the focus shifted from the external impact of corporate activities to the risk and return implications for financial investors who failed to address ESG issues in their portfolio selection and corporate engagement. According to MacNeil et al. (2022), this evolution in ESG management led to a closer alignment with responsible investment practices.

1.1.2. The different types of ESG data sources.

1.1.2.1. ESG Reports

In the last two decades, the abbreviation ESG, which stands for environment, social, and governance, has had a significant impact on businesses, stakeholders, and shareholders globally. ESG reports offer transparency to stakeholders about a company's ESG performance, including objectives, metrics, and progress over time. Companies can issue ESG reports

voluntarily or be required to do so by regulatory bodies or directives (Pérez et al., 2021). This increasing focus on ESG factors has been further amplified by the introduction of the EU directive and the Green Deal, putting specific EU member states under considerable pressure to enhance both the quantity and the quality of ESG information. (Arvidsson, 2021). Numerous studies have revealed that by taking ESG challenges into consideration, companies are more likely to be conscious of risks (Kotsantonis et al., 2016; EY, 2014; Howard-Grenville, 2021). This increasing focus on ESG considerations arises from the recognition that corporate actions have significant implications for the environment and society.

According to Vollero et al., (2016). Companies in the energy sector are facing increasing demands from stakeholders due to their status as polluting entities. These stakeholders expect the businesses to provide sustainable products and utilize clean energy.

1.1.2.2. Investors ratings and scores.

ESG scores are used to monitor a company's environmental policies and performance and are designed to help investors factor in ESG considerations when constructing their portfolio (Bloomberg, 2021). However, the authors note that the rating agencies use different methods to calculate these scores, which can result in discrepancies and make accurate comparisons difficult (Li & Polychronopilos, 2020). Consequently, investors need to have a clear understanding of the criteria they are evaluating to ensure alignment with their ESG priorities. Diverse assessments of ESG performance across rating agencies lead to inconsistencies, diminishing their effectiveness. (Serafeim & Yoon, 2021) However, agencies such as KLD, MSCI, Thomson Reuters, and Bloomberg have a reputation for being more reliable and successful in predicting future performance. (Yu et al., 2020).

1.1.2.3. Third-party ESG performance

By 2022, there will be over a dozen international frameworks guiding ESG reporting in sustainability reports. However, most firms rely on five main reporting guidelines: GRI, SASB, CDP, IIRC, and CDSB. (Threlfall et al., 2020). Despite some differences, these frameworks overlap, causing confusion for companies and investors. In response, standard-setting organisations pledged to collaborate in 2020 to create a unified reporting standard that integrates financial and sustainability disclosure. While GRI will remain independent, the merger of the other four organisations indicates a trend towards global consolidation of ESG

reporting guidelines, enhancing their robustness. (Cohen, 2021). KPMG's 2015 report revealed that almost 75% of the world's largest companies publishing sustainability reports use the GRI framework. Utilising the GRI framework improves standardisation, adds value, and increases the credibility of sustainability reports. However, certain information within the reports may not be comparable due to its declarative nature. (Farneti & Guthrie, 2009). Energy companies have adopted the GRI framework to enhance their sustainability practises, as they operate in a sector that is both highly visible and associated with significant environmental impact. These companies face greater scrutiny and environmental concerns compared to other industries. (Shahbaz et al., 2020).

1.2. Greenwashing

Greenwashing is defined as an umbrella term for a variety of deceptive communications and practises that intentionally or unintentionally induce false positive perceptions of an organisation's environmental performance (Telukdarie, 2023). Greenwashing is commonly referred to as the gap between symbolic and substantive ESG conduct (Roulet & Touboul, 2015). Firms have learned to communicate their ESG conduct strategically rather than implement it substantively (Walker & Wan, 2012).

According to the European Commission, greenwashing is a problem as it misleads market actors and does not give due advantage to those companies that are making the effort to green their products and activities. (Moodaley et al., 2023).

Greenwashing is a deceptive practise in which companies misrepresent themselves as environmentally friendly when, in fact, they are engaging in environmentally harmful practises. Guo, Zhang, Wang, Li, and Tao (2018) argue that greenwashing involves two corporate behaviours: poor environmental performance and misleading communication about it. In other words, the key element of greenwashing is the use of deception to gain corporate benefits. (Guo et al., 2018).

Stakeholders are particularly sensitive to dishonesty from science companies. When a company engages in greenwashing by selectively choosing which environmental information to communicate and omitting negative information, this can have serious consequences for the company's reputation and investors' trust. (Gatti, 2021). This may lead to an increased

level of scepticism among investors. (Baran et al., 2022). This deceptive practise is predominantly employed by organisations in the energy, chemical, and automotive sectors to market their products as environmentally friendly. Unfortunately, researchers indicate that the energy sector, like other industries, faces a dilemma known as the paradox of corporate social responsibility (CSR). This paradox implies that as organisations actively participate in and promote their CSR initiatives, they face increased scrutiny and criticism for even the slightest mistakes or missteps. (Baran et al., 2022).

1.3. Energy sector

Companies in the energy industry offer energy to a variety of sectors, including households, businesses, and industries. This sector has a substantial environmental impact because it is directly involved in the utilisation of natural resources. As a result, the world's largest energy companies' actions can have serious effects on the planet's ecology (Michelon, Pilonato, & Ricceri, 2015; Stjepcevic & Siksnyte, 2017). The vulnerability of the global economy to changes in raw material prices is exacerbated by the ongoing volatility of fuel-based energy prices, which highlights the worrying reliance of energy companies on fossil fuels like coal and oil for electricity generation, raising concerns among investors and society. The combustion of fossil fuels contributes to climate change, posing challenges for society (Lu et al., 2019).

To address this challenge, utilities can incorporate renewable energies, implement energy-efficient measures, and adopt sustainable business practises. By doing so, they can not only better serve their customers but also avoid revenue losses and improve their financial performance. (Lu et al., 2019).

1.4. Europe

Europe offers a strong global outlook for the energy sector due to its proactive approach to environmental sustainability. The European Commission is leading the implementation of the European Green Deal, which includes initiatives like carbon pricing and the elimination of fuel subsidies. These measures have a significant impact on countries heavily reliant on fossil fuels, encouraging a shift towards cleaner energy sources. (Panibratov et al., 2022).

The European Green Pact, a comprehensive mechanism that facilitates resource reallocation, encourages investments, and offers support for vulnerable sectors during the transition to a low-carbon economy, is at the heart of the European Green Deal. (Panibratov et al., 2022).

By studying Europe as a whole, rather than individual countries, we can observe the collective effort and shared vision that led to a greener and more resilient energy sector. Europe's commitment to sustainable policies, carbon pricing, the elimination of fuel subsidies, and the integration of environmental and social factors into decision-making processes demonstrate a strong dedication to building a sustainable future. This proactive stance sets an example for other regions to follow and promotes a collaborative approach between businesses and governments in addressing environmental challenges, achieving long-term sustainability goals, and enhancing financial performance. (Panibratov et al., 2022).

2. The relationship between ESG and Corporate Financial Performance.

2.1. Theoretical perspective.

In this section, we will review the existing theoretical perspectives on the relationship between ESG and corporate financial performance in the energy sector. Specifically, we will explore the stakeholder theory perspective and the agency theory perspective. This will give us a deeper understanding of the complex and multifaceted relationship between ESG and financial outcomes for firms.

According to the research by Edmans (2011) and Deng et al. (2013), companies that prioritise governance practises aimed at maximising value and consider stakeholder interests rather than solely focusing on shareholder value are more likely to engage in ESG activities. This perspective aligns with the stakeholder theory, which suggests that a firm's long-term success depends on effectively managing relationships with all stakeholders, including those affected by the firm's actions, whether positively or negatively. This theory holds relevance for companies that emphasise environmental protection, social welfare, and community relations. In the energy sector, certain companies may adopt the agency theory perspective, which aligns with Friedman's work (1970) and highlights the potential conflicts of interest between managers and stakeholders arising from ESG practises. (Peng et al., 2020). This perspective suggests that in some countries, due to cultural differences and varying priorities,

the focus may lean towards profit maximisation rather than considering social and environmental goals. Consequently, these companies may not fully embrace stakeholder theory. (Soares et al., 2018). Most companies view stakeholder engagement as a mutually beneficial partnership. Stakeholder engagement is more commonly observed at the local community or country level than on individual projects, according to the company. However, for companies in the energy sector, it is crucial to adopt a proactive and transparent approach to stakeholder engagement to build trust and transparency. (Styazhkin, 2014).

2.2. Empirical evidence to support theoretical evidence

Sustainable business practises have become increasingly recognised for their impact on various aspects of a company's performance in the modern economy. They can influence a company's financial health, operational efficiency, and overall enterprise value. (Aras & Kazak, 2022). However, there is ongoing debate and conflicting views regarding the relationship between environmental, social, and governance (ESG) factors and financial performance. (Lee & Suh, 2022).

Empirical evidence from previous studies has found that ESG performance is positively correlated with operational efficiencies and stock performance. However, it is negatively correlated with systematic risk and the cost of capital. (Lodh's, 2020). These findings highlight the importance of considering ESG factors in business valuation.

The focus of valuation studies often depends on the significance of the sector or industry for the global or regional economy, potential disruptions or transformations faced, and fluctuations in the prices of listed firms. Currently, there is a growing emphasis on valuing the oil and gas industry and the energy sector (Vatistas, 2022).

Operational efficiencies

There have been almost 1,000 empirical research on the relationship between ESG and financial performance. According to 245 studies that were published between 2016 and 2020, 58% of the business studies showed a positive correlation between ESG and financial success (Whelan, Atz, and Clark, 2015). This research concentrated on the operational measures of stock price, ROE (Return on Equity), and ROA (Return on Assets). Additionally, 8% of the research revealed a bad relationship, 21% had mixed results, and 13% showed a neutral effect. (Whelan & Atz, 2021).

Stock performance

Recent research has highlighted the importance of managing and disclosing ESG factors in enhancing a firm's financial performance and stock market returns. Several studies have found a positive association between ESG ratings and firms' accounting performance or stock returns. Furthermore, Khan et al., (2016) report that firms with better ESG ratings have superior future stock returns, and institutional investors' higher investment in ESG firms leads to their higher financial performance in the stock market. (Dyck et al.,2019)

Cost of capital

According to the study of Aras & Kazak, (2022), incorporating sustainability measures is believed to lead to increased operating costs, which in turn would result in reduced capital costs. (Aras & Kazak, 2022). Companies that obtain higher ESG scores generally experience lower capital costs compared to those with lower ESG scores. This is likely attributed to the advantages derived from enhanced environmental risk management, social responsibility, and decreased operational expenses associated with the adoption of ESG practices. (Lodh's, 2020).

Earnings per share

Growth in earnings per share of the firm is a significant measure of firm performance regarding its management. It shows how much money a firm is earning from shareholders as it reflects the changes in profit as well as the new shares of the firm. Therefore, the earnings per share of a firm are important in determining the market value and market price of a firm. According to Qiu et al. (2016), their research indicates a favorable influence of earnings per share on stock price.

Reduce risk

According to a study by Sassen et al. (2016), there is a link between poor ESG performance and increased business risk. It is shown in the study, which uses a sample of 8752 firm-year data, that greater corporate social performance (CSP) reduces overall risk. Additionally, social performance has a bad impact on total, idiosyncratic, and systematic risk. The study's initial findings imply that CSP can increase corporate value by reducing company risk. (Sassen et al., 2016)

As sustainable businesses typically have lower volatility and business risk, which increases valuation based on the risk-return trade-off, good ESG performance can minimise risk. Stocks with low ESG scores are thought to be riskier investments and may have greater betas and more volatile stock prices. This could affect a company's capacity to raise stock. (Guido et al., 2019).

Dividend Payout

According to Donaldson and Preston (1995), the dividend payout policy serves as a mechanism to decrease agency costs and acts as a signal that conveys private information to investors regarding the quality of earnings. They emphasise that companies should meet the expectations of all stakeholders, not just shareholders. According to Donaldson and Preston (1995), engaging in ESG activities is considered a means of providing both direct and indirect payouts to all stakeholders, thereby enhancing the reputation of the organisation. (Bilyay-Erdogan et al. 2023)

Broadstock et al. (2021) provide evidence that both "earnings" and "risk" are significant transmission channels through which ESG performance enhances dividend payouts. However, their findings suggest that the risk channel may dominate. In conclusion, firms with better ESG engagement, as highlighted by Broadstock et al. (2021), demonstrate lower income and downside risk, indicating greater resilience, which positively impacts dividend payouts by improving earnings stability, reducing risk, and enhancing the company's reputation among stakeholders.

Valuation Multiples.

According to European data, Schreiner & Spremann (2007) found that equity valuation multiples (P/E, P/BV) are more accurate than enterprise value multiples (EV) such as EV/EBITDA and EV/EBIT. Cheng and McNamara (2000) suggest combining P/E and P/BV multiples for more accurate valuations.

Damodaran (2012) emphasizes the significance of multiples, linking them to fundamental factors like growth, risk, and cash flows. He explores the impact of changes in variables on multiples and emphasizes regression analysis to mitigate differences in risk, growth, and cash

flow indicators. He also emphasizes the importance of considering liquidity, especially in smaller markets.

Easton (2004) analyses P/E and PEG ratios, highlighting the consideration of short-term growth rates and the implicit assumption of capturing future growth. He proposes a simultaneous valuation approach for expected return and growth in earnings.

In conclusion, the integration of ESG factors into business valuation provides valuable insights for investors and companies alike. Sustainable practices can enhance operational efficiency, stock performance, and risk management while signalling quality and reputation. Incorporating ESG considerations in valuation strategies enables companies to adapt to changing market dynamics, gain a competitive edge, and foster long-term success. However, further research is necessary to fully comprehend the intricacies of the ESG and financial performance relationship and address conflicting perspectives. Nonetheless, the growing recognition of ESG's impact underscores the importance of integrating sustainability into business strategies, particularly in the energy markets. Understanding the strengths and limitations of valuation approaches and the challenges of comparing results across studies is crucial.

3. The relationship between Greenwashing and Corporate Financial Performance

3.1. Greenwashing on financial performance

The increased focus on environmental issues and the desire to present a positive image of being environmentally conscious through marketing and advertising have contributed to the growing interest in studying greenwashing as a research subject. (Waler & Wan, 2011). Based on previous literature reviews, the potential impacts of greenwashing on financial performance can be observed in various aspects. Firstly, firms engaging in greenwashing face a decline in investor confidence due to stakeholders growing skepticism towards ESG performance claims. (Torelli et al., 2020). As a result, growing demands for responsibility and transparency in addressing ESG issues have put pressure on companies. As a consequence, businesses now compete with one another to implement the most ESG initiatives. (Torelli et al., 2020).

Secondly, greenwashing can result in reputational risk, especially if customers become disillusioned with the company's products or services due to false ESG claims. This can lead to reduced sales, market share, and ultimately impact the company's financial performance (Delmas and Burbano, 2011; Torelli et al., 2020).

Moreover, customers tend to approach CSR objectives with scepticism, and greenwashing exacerbates this issue by creating a gap between a company's CSR policies and actions. (Ioannou et al., 2022). This discrepancy can result in negative customer evaluations, decreased satisfaction, and loyalty, potentially affecting the company's financial performance. (Schuler & Cording, 2006). In summary, greenwashing can have a range of negative impacts on a company's financial performance, including reduced investor confidence, increased reputation risk, decreased sales and market share and negative customer evaluations. It is therefore important for companies to avoid greenwashing and ensure their ESG communications are accurate and consistent with their actual performance. (Lee & Raschke, 2023).

3.2. Theoretical perspective

In this part, we explore existing theoretical perspectives on the relationship between financial performance and greenwashing and evaluate the influence of misleading communications about environmental issues on stakeholders' perceptions of corporate environmental responsibility and greenwashing. Specifically, we examine the concepts of legitimacy and signalling theory to gain a deeper understanding of the effects of greenwashing on financial performance.

3.2.1. Legitimacy theory

In the context of greenwashing and financial success, legitimacy theory shows how important stakeholder legitimacy is for companies attempting to transition to ESG behaviour. Stakeholder legitimacy is determined by cultural support and is closely tied to a firm's ESG performance, which is influenced by governance and adherence to environmental and social standards. (Hasse & Krucken, 2009, Lawrence, 2014).

Firms recognise the importance of meeting stakeholders' cultural expectations and may employ strategies like greenwashing to appear compliant and meet expectations. However,

as awareness about ESG issues increases, firms must go beyond mere communication and authentically put their efforts into action. (Waler and Wan, 2012). Stakeholder legitimacy theory provides insights on the relationship between legitimate firm practises, ESG performance, and the financial performance of companies by highlighting the significance of societal and cultural factors in shaping organisations. (Lee, 2023).

When firms align their ESG performance with stakeholders' and activists' expectations, they are likely to gain legitimacy. This, in turn, can lead to various benefits, including stronger trade relationships, access to resources, enhanced financial performance, and better job applicants. (Deephouse et al., 2017, Walker and Wan, 2012). However, greenwashing and legitimacy are major concerns in ESG-sensitive sectors like energy. (Delmas and Burbano, 2011; Lyon and Montgomery, 2015). Independent evaluators and oversight groups hold the power to validate or revoke a company's legitimacy based on its adherence to ESG standards, determining whether the company is genuinely fulfilling its ESG responsibilities or engaging in deceptive practices such as greenwashing.

Assessing the quality and intentions of firms' ESG conduct is challenging for the public due to information asymmetry and the lack of reliable information. Despite the prevalence of greenwashing, limited research exists on how it specifically impacts firm financial performance. (Lyon & Maxwell, 2011).

In brief, legitimacy theory reveals the role of stakeholder legitimacy in the relationship between greenwashing, ESG performance, and firm financial performance. It emphasizes the influence of societal and cultural factors on organizations' pursuit of ESG conduct. Substantively implementing ESG initiatives is crucial to gain legitimacy and achieve positive financial outcomes. Ultimately, increased legitimacy leads to improved financial performance, as demonstrated by Deephouse's 1999 study.

3.2.2. Signalling theory

Various approaches, such as signalling theory, are employed to address the issue of asymmetric information and imperfect markets. According to signalling theory, managers possess knowledge about the quality of their company, while investors lack this information and struggle to differentiate between high- and low-quality firms (Lyon & Maxwell, 2011).

Signaling serves the purpose of enabling investors to recognize whether companies are implementing what they claim in their reports (George et al., 2017).

As the number of sustainable companies in the market increases, it becomes more challenging for investors to compare them and determine which ones are genuinely delivering on their environmental commitments (Honon et al., 2007). This difficulty arises from the limited options available for companies to signal their sustainability efforts, making it challenging to identify those engaging in greenwashing or falsely portraying themselves as environmentally friendly (Seele and Gatti, 2017).

Hence, the absence of a standardized framework creates challenges in comparing companies, as stakeholders must rely on company signals that may not accurately reflect their actual ESG performance (Serafeim & Yoon, 2021). To address this issue, Du (2015) and Serafeim & Yoon (2021) propose the necessity of a global framework that enhances transparency, comparability, and reduces the risk of false disclosure.

Another proposed approach for ensuring accurate and transparent reporting is using green labels. However, the effectiveness of these labels has been questioned. Many companies have self-claimed labels that are merely associated with sustainability, making it difficult to distinguish the genuine ones (Yu et al., 2020). For a label to be trusted, it should be issued by an independent body and not subject to the company's internal control. In summary, due to the limited signaling options available, companies engaging in greenwashing are not easily identified (Seele and Gatti, 2017).

In the context of the energy sector, a study reveals that Chinese firms operating in environmentally sensitive industries engage in higher levels of greenwashing compared to their counterparts. The researchers attribute this trend to the increased public pressure faced by these companies. They define environmentally sensitive industries as sectors subject to stricter environmental regulations. This includes oil companies as well as industries with high visibility to the public, such as the food and beverage sector. (Huang & Huang, 2020).

In conclusion, the relationship between greenwashing and corporate financial performance is influenced by various factors. Companies may engage in greenwashing practices if the cost of doing so is lower than taking action to alleviate the cause of environmental impact (Li et

al., 2022). Since information asymmetry exists and stakeholders are bounded rational information processors lacking insights into firms' real activities and business processes (Schons & Steinmeier, 2016; Westphal & Zajac, 1998), stakeholders cannot identify and punish greenwashing. In certain sectors, such as the energy industry, the prevalence of greenwashing may be more pronounced.

However, there is still a gap in the literature in a better understanding of the cost or benefit of greenwashing in the short and long term. Further research is needed to address this gap and inform more comprehensive strategies for addressing the issue of greenwashing (Li et al., 2022).

3.3. Empirical evidence to support theoretical perspective

The market response to ESG initiatives and greenwashing practices in the energy sector is a topic of significant interest, with researchers seeking to understand the relationship between these practices and corporate financial performance (CFP). Empirical research on the relationship between greenwashing and corporate financial performance (CFP) is relatively limited and has produced inconsistent results (Walker, 2012). Some studies, such as Waker et al. (2012), found a negative impact of greenwashing on CFP, while others, like Testa et al. (2018), found no significant relationship or even a positive effect, as indicated by Schons et al. (2016). These discrepancies may be attributed to variations in samples and contexts, highlighting the influence of contextual factors on the greenwashing-CFP relationship (Li, 2022).

The rise of greenwashing as a research area can be attributed to the growing public concern for the environment and the effectiveness of marketing oneself as environmentally friendly (Laufer, 2003; Ramus and Montiel, 2005). However, companies in visibly polluting industries face heightened scrutiny from stakeholders. Consequently, greenwashing is less likely to be effective, more likely to be detected, and ultimately more likely to result in negative consequences (Berrone & Gomez-Mejia, 2009).

However, firms reporting pollution figures to the TRI (Toxic Release Inventory) experienced significant negative returns in stock value within a day. Additionally, significant incidents like

oil spills can have profound effects on firm profitability as investors respond to potential liabilities, fines, penalties, and cleanup costs (Walker & Wan, 2011). Damaging stakeholder relationships through greenwashing ultimately leads to decreased financial performance. Thus, the cost of greenwashing should be carefully considered, as it may be lower than the cost of taking substantial action to address environmental impacts (Li, 2022).

In summary, while empirical research on the relationship between greenwashing and corporate financial performance is still evolving, it suggests that contextual factors, stakeholder perceptions, and substantive environmental actions play significant roles. Further research is needed to better understand the short and long-term costs and benefits of greenwashing in relation to corporate financial performance.

III. Conclusion and hypothesis

The existing empirical research on the relationship between ESG and Corporate Financial Performance presents inconsistent and conflicting findings. Moreover, most of the studies focus solely on the relationship between ROE, ROA and stock prices, while neglecting other potentially relevant financial indicators. Thus, there is a need for further investigation to fill the gaps in the current knowledge and explore the relationship between ESG and other financial performance indicators.

The energy sector's fluctuations and stakeholder demand for clean energy have led to limited research on valuation multiples incorporating financial indicators. Given the sector's ongoing transformations, the lack of attention given to researching valuation multiples incorporating financial indicators is striking. This oversight highlights the importance of valuation as an essential tool for assessing the energy sector's performance. Understanding the relationship between a company's valuation and its stock performance can assist investors in determining whether a company is overvalued or undervalued, enabling them to identify potentially interesting stocks for investment.

To expand our research, we will build upon the previous study conducted by Damodaran (1995). To achieve this, we will analyse the relationship between market value and Price-to-

Earnings Ratio (PE), assess the growth of market value using the Price/Earnings-to-Growth (PEG) ratio, and examine the Price-to-Book Value (PBV) incorporating financial indicators such as Return on Equity (ROE), Beta, Dividend Payout and Growth Earnings per share average over the five years. Therefore, considering the factors discussed earlier, we opted to formulate our first hypothesis.

H1: The PE, PEG and PBV ratios are significant predictors of a company's financial performance, regardless of greenwashing scores and ESG scores.

The literature on corporate investments and funds shows an increasing interest in social and environmental impact beyond mere profitability, indicating a desire to contribute to a better world. (Agoraki et al.,2023). This trend reflects a growing awareness among companies, investors, and stakeholders of the impact of business strategies on the planet and society. Considering this, we contend that integrating environmental, social, and governance (ESG) factors into the business valuation process and addressing the challenges associated with valuation multiples will provide a more comprehensive and accurate assessment of a company's values. This approach enables investors to make informed decisions that consider both financial performance and sustainability aspects.

Furthermore, incorporating ESG factors in the valuation process can have a significant impact on a firm's financial performance and growth opportunities. It can help reduce information asymmetries and adverse selection costs, while also enhancing investors' trust in the firm's long-term strategies (Agoraki et al., 2023). This method provides a comprehensive view of a company's performance, allowing investors to make informed decisions that take both financial indicators and sustainability into account. This is important to our second hypothesis.

H2: Companies with higher ESG scores exhibit higher PBV, PE and PEG ratios, indicating better financial performance.

On the other hand, companies with low ESG scores are more likely to resort to greenwashing to compensate for their poor performance. (Drempetic et al., 2019).

Considering the research by Torelli et al. (2020), it is evident that greenwashing can have negative consequences for a company's financial performance. Firstly, it diminishes investor confidence as stakeholders become sceptical of firms that make claims about their ESG performance. Secondly, greenwashing increases reputational risks for companies. When customers discover that a company's ESG claims do not align with its actual practises, it can lead to a loss of trust and loyalty among customers, resulting in lower sales and market share. Moreover, the study conducted by Ioannou et al. (2022) demonstrated that the phenomenon of greenwashing amplifies the difference between corporate social responsibility (CSR) principles and their implementation, hence fostering a negative opinion among consumers who already have doubts regarding the reliability of CSR goals. The current body of research examining the relationship between greenwashing and financial success has produced inconsistent findings. Consequently, there is a significant study gap in the literature regarding the evaluation of traditional energy sector enterprises. Considering this lack of understanding, it is crucial to highlight the analysis of empirical data to obtain a more precise comprehension of the relationship (Li, 2022). It is significant to note that in this hypothesis, the term "greenwashing score" refers to a measurable indicator of the extent of greenwashing practises used by businesses. The accuracy and transparency of ESG reporting, the congruence between stated policies and actual practises, and the degree of validation or certification attained for sustainability initiatives could all be used as criteria for this measurement. This hypothesis examines whether greenwashing has a significant effect on financial performance metrics by examining companies' greenwashing scores and contrasting them with valuation ratios like PBV, PE, and PEG. As a result, this forms the basis of our third hypothesis.

H3: Companies having greenwashing scores demonstrate better PBV, PE and PEG ratios, indicating enhanced financial performance

IV. Methodology and Data

In our research, we took an example of 523 companies from the Bloomberg database, we select the companies with the highest market capitalization since we consider that they may have the highest impact on the environment. We consider Bloomberg as a valuable resource

for financial and ESG analysis due to its global coverage, real-time data, detailed analysis, ESG information, and search tools. To ensure a more focused analysis, we selected companies from the same sector which share common ESG challenges. Additionally, I chose to analyze companies across Europe as a whole, considering that the impact of environmental, social, and governance (ESG) factors may differ across regions. By including a mix of emerging and developing countries, I aimed to obtain more comparable results. To achieve this, we utilized the Broad Industry Classification System (BICS), a system jointly developed by MSCI and Standard & Poor (S&P) that classifies companies into different industry sectors based on their primary business activities. We selected the energy sector in Europe as an area. Each company is characterized by a comprehensive set of 10 variables for a 5 year-time period, encompassing numerical variables such as ESG disclosure score, Greenwashing score, financial parameters, and fundamentals including ROE, Payout, beta, EPS growth, PE, PEG, and PBV. On the other hand, we consider also categorical variables. Ultimately, this allows for a more robust and comprehensive analysis.

1. Research Design

Traditionally, valuing multiples involves selecting a group of comparable firms and calculating the average value of the multiple for that group. However, this approach often relies on subjective adjustments to account for differences between the estimated and comparable companies, without addressing the underlying variables that contribute to these differences. (Damadoran, 1995).

To address this issue, I employed a regression approach to better understand the factors contributing to the variation in price-to-earnings (PE), price/earnings-to-growth (PEG), and price-to-book value (PBV) ratios among companies in the same sector.

Later, I selected two independent groups to compare if difference in scores has an impact on valuation. To make this possible, I utilized the Mann-Whitney U test on my dataset to assess whether significant differences existed between the two groups being examined. This statistical test allowed me to gain valuable insights and determine if there were statistically meaningful variations between the groups in relation to the research question.

1.1. Descriptive variables:

1.1.1. Dependent Variables:

In our study, we decided to use a combination of accounting measures, rather than market measures, since it is more appropriate for detecting the relationship between ESG (Environmental, Social, and Governance) factors and financial performance. Accounting measures, including EPS (Earnings per Share) and ROE (Return on Equity), are calculated over a period and reflect managerial performance and internal decision-making. This will provide us with better insights into the actual financial results and reflect the impact of ESG strategies on a company's performance. (Kludacz-Alessandri & Cygańska, 2021).

Considering the findings from previous research, we have identified three dependent variables (PE, PEG, and PBV) that may be influenced by the adoption of an ESG strategy. The price-earnings ratio (PE) compares a company's stock price to its earnings per share, reflecting market value and investor sentiment. It serves as an indicator of whether a firm is overvalued or undervalued. A high PE indicates that the market price of the company's stock is quite high, suggesting that it may be overvalued or considered expensive. A high price-to-earnings ratio (PE) signifies some relatively low earnings per share (EPS), hence diminishing the appeal of the company's shares to potential investors. The PEG ratio serves as a supplementary metric to the PE ratio, incorporating the company's potential for earnings growth. This enables investors to obtain a more comprehensive evaluation of a stock's valuation.

The Price to Book Value (PBV) ratio is a financial metric that indicates the book value per share in relation to the current market price of shares in the capital market. The greater the PBV (Price-to-Book Value) metric, the more highly investors assess the company's value. The concept of Price-to-Book Value (PBV) pertains to the extent of public confidence, particularly among investors, in a company, resulting in an upward valuation of the company's shares beyond their initial worth. (Maulana et al., 2023). By incorporating these financial ratios as independent variables, we can analyze their relationship with ESG, greenwashing, and overall financial performance. These ratios enable us to assess the financial health, profitability, and market valuation of energy companies within the European context.

Price to Earnings	PE	$\frac{\textit{price}}{\textit{earnings per share}}$
Price to Earnings Growth	PEG	$\frac{PE}{Geps}$
Price to Book-Value	PBV	$\frac{ROE \times Payout}{r - g}$

1.1.2. Independent variables:

Financial performance indicators

This study focuses on several key factors related to financial performance in the energy sector over the past five years. These factors include ROE (Return on Equity), Payout ratio, Geps (Earnings Per Share Growth), and Beta. All these variables were obtained from the "Bloomberg" database.

ESG scores

These scores range from 0 to 100, where a higher score indicates that the company is performing better than its peers within the same sector, specifically in terms of environmental and social aspects. The governance pillar score is determined based on the company's relative performance compared to the standards of the country of incorporation.

Greenwashing Score

In line with previous studies, the greenwashing score is defined as the gap between the standardized ESG disclosure score from Bloomberg and the ESG performance score (Zhang et al., 2022). A significant distinction between the calculation of the two scores is that the ESG performance score gives its E, S, and G pillars varying weights depending on the number of concerns that are present. ESG Disclosure Scores, in contrast, do not have different weights for its E, S, and G pillars. The likelihood of greenwashing operations is indicated by a score, which may be used to compare businesses and spot potential outliers. A higher score implies a higher likelihood of greenwashing practices. (Shensharma, 2022).

By focusing on the energy sector, the analysis narrows down the scope to examine the ESG performance of companies operating in this specific industry. This sector-specific analysis

allows for a more targeted evaluation of the ESG practices and their impact on financial performance within the energy sector.

The equation (1) represents the calculation of the relative greenwashing scores of firms' peers. It uses the means and standard deviations (σ) of both the ESG disclosure score and ESG actual performance score for the calculation.

$$\text{Greenwashing score}_{i,t} = \left(\frac{ESG_{dis,i,t} - \overline{ESG_{dis}}}{\sigma_{dis}} \right) - \left(\frac{ESG_{real,i,t} - \overline{ESG_{real}}}{\sigma_{real}} \right) \quad (1)$$

2. Empirical model design.

2.1. Descriptive Statistics of our different variables

	N	Minimum	Maximum	Mean	Standard Deviation
PE.Y1	346	-10,48	69,31	3,2561	10,88469
PEG.Y1	405	-3,56	3,07	0,0243	0,64975
PBV	408	-0,53	1,86	0,0199	0,13951
PE.Y2	330	-17,15	64,41	0,9822	9,44047
PEG.Y2	255	-2,72	2,84	0,2263	0,55145
PBV.Y2	380	-0,75	1,2	0,0576	0,2543
PE.Y3	306	-16,43	73,37	2,6442	12,74347
PEG.Y3	304	-3,93	3,72	0,1351	0,659
PBV.Y3	335	-2,01	0,68	0,0107	0,1341
PE.Y4	288	-15,8	74,63	1,778	10,99967
PEG.Y4	315	-3,07	3,76	0,0369	0,70346
PBV.Y4	502	-1,87	9,52	0,0639	0,50072
PE.Y5	272	-17,24	55,72	1,0103	8,19761
PEG.Y5	293	-3,34	3,96	0,0418	0,71796
PBV.Y5	517	-3,05	1,19	0,015	0,24948

Table 1: Statistics of out dependent variable

When analyzing our dependent variable (Table.1), we frequently use metrics such as the (PE) and (PEG) ratios to evaluate the performance of companies. We notice that the company's average price-to-earnings ratio (PE) is positive. This implies that, on average, the stock prices of the companies are higher than their earnings per share. The standard deviation of the PE values over time is relatively high, indicating significant variation. This reflects the dataset's different valuation levels, with some companies considered more positively than others. This can be explained by the fact that when energy costs grew, so did energy company profits. (Carp, 2022). Other companies, on the other hand, make significant investments in renewable energy resources, which has a negative influence on their EPS and can lead in a negative PE. (Fernandos, 2011). However, it's essential to consider that not all companies experience significant growth at the same rate. Some companies might be relatively young or heavily investing in new infrastructure, which can lead to their PE ratio being very high due to fluctuation stock prices, and in some cases, it might even be negative.

As consequence PEG becomes negative too. It is important to note that this may introduce bias into our results, as the absence of growth rates for certain companies affects the overall average. The energy sector has been one of the industries with the most fluctuating earnings over the last five years. (Butters,2023).

Similarly, the average value of the Price-to-Book Value Ratio (PBV) is close to zero, indicating that, on average, companies are valued at a relatively low multiple of their book value. The standard deviation of PBV ratios shows some variation among the companies, but the magnitude of this variation is small.

Looking at our other variables (Appendix 1). Firstly, the ESG Disclosure Score (ESG) shows a moderately positive average, indicating a favorable level of ESG disclosure. However, the small sample size for this variable raises questions about the attention paid to ESG practices by companies without ESG scores. It is recommended to exercise caution when interpreting the average due to the limited availability of information regarding environmental, social, and governance (ESG) practices. Moving on to performance metrics, the Return on Equity (ROE.Y) exhibits a negative average, indicating challenges in generating profits. The wide standard deviation implies varying levels of profitability among the companies. Additionally, the Payout Ratio (Payout.Y1) suggests conservative dividend distribution practices, with some variability among the companies.

In terms of market sensitivity, the Beta value (Beta.Y1) shows a high average, indicating high sensitivity to market fluctuations, since we are facing an uncertain sector. The substantial standard deviation reflects considerable variability in Beta values.

Lastly, the Greenwashing Scores (GW.1) lack contextual information, and the small sample size calls for careful interpretation, only around 30 observations.

Overall, these findings provide valuable insights into ESG factors, performance metrics, market sensitivity, and greenwashing scores of the analyzed companies.

In summary, our findings highlight the complex and dynamic nature of the energy sector and its relationship with valuation metrics and ESG practices. It is essential to consider the specific factors affecting each company when interpreting these results. The inclusion of ESG factors and sustainable practices in the valuation process can provide a more comprehensive assessment of a company's values and financial performance, helping investors and policymakers make more informed decisions in the energy sector.

2.2. Correlation Matrix

	ESG.Y1	ROE.Y	BetaY1	PayoutY1	GW.1	PE	PBV	G	PEG
ESG.Y1	1	0,084	,418**	0,074	,440*	-0,182	0,082	0,016	-0,053
ROE.Y1	0,084	1	,149**	0,072	-0,101	0,102	0,105	,988**	-0,014
Beta.Y1	,418**	,149**	1	0,019	-0,118	-0,112	0,066	,157**	0,021
Payout.Y1	0,074	0,072	0,019	1	0,347	0,09	0,037	0,04	-,204**
GW.1	,440*	-0,101	-0,118	0,347	1	-0,311	0,098	-0,215	0,144
PE.Y1	-0,182	0,102	-0,112	0,09	-0,311	1	-0,043	,154**	,531**
PBV.Y1	0,082	0,105	0,066	0,037	0,098	-0,043	1	0,067	-0,081
Geps.Y1	0,016	,988**	,157**	0,04	-0,215	,154**	0,067	1	0,094
PEG.Y1	-0,053	-0,014	0,021	-,204**	0,144	,531**	-0,081	0,094	1

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed).

Table 2: Correlation matrix of our variables

The Pearson correlation matrix will be analyzed to evaluate the relationships between the different variables. This analysis will help us understand how the dependent and independent variables are interrelated and provide insights into the direction and strength of these relationships. As a result, we'll be able to see if we're in danger of multicollinearity issues, which occur when many variables in a model quantify the same phenomenon. When numerous variables have a strong correlation, this might be problematic since it makes interpretation difficult because it affects the stability and interpretability of regression coefficients. Our matrix can have values ranging from -1 to 1. We have a perfect negative correlation if the value is equal to -1, and a perfect positive correlation if the value is equal to 1. (Table, 2)

In our model, we found a strong correlation between two dependent variables, PE and PEG. This suggests that an increase in the PE ratio is associated with an increase in the PEG ratio. In other words, investors are willing to pay a higher premium (PE) for stocks of companies with perceived higher future growth potential (PEG). However, the dependent variable PBV shows a weak linear correlation with the other variables; this means that the PBV ratio is not strongly influenced by the same factors as the two other ratios. Most of the correlations in our model fall within the range of -0.1 to 0.9, indicating a relatively normal degree of linear association. The highest correlation we observed was 0.988 between ROE and Geps (which is significant), and close to a positive collinearity.

2.3. Multiple regression analysis.

Multiple regression is a statistical method that analyses relationships between multiple variables and predicts an outcome. It involves several independent variables to explain changes in a dependent variable.

The equation for multiple regression is $yi = \beta_0 + \beta_1x1i + \beta_2x2i + \dots + \beta_pxpi + ei$, where yi is the dependent variable, β_0 is the intercept, β_i are slope coefficients, xi are independent variables, and ei is the error term.. This technique assumes a linear relationship between the dependent variable and the independent variables and relies on the assumptions of normal distribution and linearity (Uyanik & Güler, 2013).

Moreover, to make informed decisions and draw meaningful conclusions residual tests provide valuable inside assessing the quality, adequacy and reliability of the regression model.

In our analyze, we construct nine models, each applied to five different years (2018-2022), this will enable us to assess the relationship between valuation (dependent variable) and financial indicators (independent variables) outlined in our hypothesis and ultimately provide answers to our research questions. (Table, 3).

Model 1	PE	$\beta_0 + \beta_1(\text{Beta}) + \beta_2(\text{Geps}) + \beta_3(\text{Payout}). + \beta_n(X_n) + \epsilon$
Model 2	PEG	$\beta_0 + \beta_1(\text{Beta}) + \beta_2((\ln)\text{Geps}) + \beta_3(\text{Payout}). + \beta_n(X_n) + \epsilon$
Model 3	PBV	$\beta_1(\text{Beta}) + \beta_2(\text{Geps}) + \beta_3(\text{Payout}). \beta_4 (\text{ROE})+ \beta_n(X_n) + \epsilon$
Model 4	PE	$\beta_0 + \beta_1(\text{Beta}) + \beta_2(\text{Geps}) + \beta_3(\text{Payout}). + \beta_4(\text{Esg scores}) + \beta_n(X_n) + \epsilon$
Model 5	PEG	$\beta_0 + \beta_1(\text{Beta}) + \beta_2((\ln)\text{Geps}) + \beta_3(\text{Payout}). + \beta_4(\text{Esg scores}) + \beta_n(X_n) + \epsilon$
Model 6	PBV	$\beta_0 + \beta_1(\text{Geps}) + \beta_2(\text{Beta}) + \beta_3(\text{ROE})+ \beta_4(\text{Payout})+ (\text{Esg scores}) + \beta_n(X_n) + \epsilon$
Model 7	PE	$\beta_0 + \beta_1(\text{Beta}) + \beta_2(\text{Geps}) + \beta_3(\text{Payout}). + (\text{GW scores}) \beta_n(X_n) + \epsilon$
Model 8	PEG	$\beta_0 + \beta_1(\text{Beta}) + \beta_2((\ln)\text{Geps}) + \beta_3(\text{Payout}) + (\text{GW scores}) + \beta_n(X_n) + \epsilon$
Model 9	PBV	$\beta_0 + \beta_1(\text{Geps}) + \beta_2(\text{Beta}) + \beta_3(\text{ROE})+ \beta_4(\text{Payout})+ + (\text{GW scores}) + \beta_n(X_n) + \epsilon$

Table 3 : Multiple regression models

V. Analysis and Discussions

Given that we have a sample of 536 companies whose results are divided into 5 years (2018, 2019, 2020, 2021 and 2022), we decided to split our database into 5 and perform a multiple linear regression for each of the 5 years and for each of our three ratios. Through this analysis, we aim to explore the connections between financial ratios and ESG scores, greenwashing

scores, or no scores, and their potential influence on the financial performance of European energy companies. Additionally, this study will provide insights into the trends over the past five years within the sector.

1. Multiple regression analysis on our financial ratios without any scores.

Our research builds on the ideas of Aswath Damodaran (1995), who proposed a linear regression model that incorporates variables such as expected growth in EPS/net income over the next 5 years (GEPS), beta, payout ratio, and return on equity. The models aim to estimate the equity valuation for European companies. In our study, we aim to apply a similar multiple regression analysis to our own sample European companies from the energy sector and determine the relevance of our independent variables in predicting the dependent variable, while excluding the influence of ESG scores and greenwashing scores. This will provide us with deeper insights to either accept or reject our initial hypothesis (H1), which states that financial ratios such as PBV, PE, and PEG are significant predictors of company performance, regardless of greenwashing scores and ESG scores.

H0: There is no significant relationship between the company's financial performance (X1, X2, X3) and PE, PEG, and PBV (Y1, Y2, Y3) ratios regardless of greenwashing scores and ESG scores.

H1: Company's financial performance (X1, X2, X3), significantly predicts the price-to-earnings ratio (PE), earnings-to-price ratio (PEG), and price-to-book value ratio (PBV), irrespective of greenwashing scores and ESG scores.

1.1. Price-to-earnings ratio (PE) on financial fundamentals (1)

Our first ratio is the price-to-earnings ratio calculated by price divided by the earnings per share. We consider ways in which we can expand the number of comparable firms by looking at an entire sector. This could be more precise as the number of comparable firms increases. This helps us to pinpoint when firms in a small sub-group are under or overvalued relative to the sector or the market. The simplest way to do this is a multiple linear regression. Later, by examining the coefficients for each year, we can observe some variations, indicating a dynamic relationship between the independent variables and the PE ratio over time. Part of

the reason for these shifts is that earnings are volatile, and the price to earnings ratio reflects this volatility. Looking at different sub-groups in the energy sector for the year 2022.

By comparing our actual Price-to-Earnings (PE) ratio with the predicted PE, we gain valuable insights into the behavior of sub-categories in the upcoming year. This analysis allows analysts to improve their valuation models, identify any potential discrepancies, and make well-informed investment choices. Additionally, it provides a deeper understanding of the market's outlook on the company's future earnings potential and growth prospects, as well as how investors are valuing the company in comparison to its industry peers.

$$\text{Predicted PE} = 3,836 - 1,404 * \text{Beta} + 0,023 * \text{Geps} + 0,864 * \text{Payout}.$$

Company	Sub-Sector (Medians)	PE	Predicted PE)	Under or overvalued
Neste	Biofuels (11.43)	18.8	11.13	69%
EDF renewables	Renewable Energy (2,16)	7.13	18.49	-61%
BP PLC.	Oil and Gas (2,62)	-8.2	4.2	-295%
Bluenord EQUITY	Exploration and production (14,7)	14.29	19.03	-25%
Total energies	Integrated oil and Gas (2,62)	11.8	7.18	64%
Vestas Wind System	Renewable energy equipment. (2,16)	-49	1,28	-3928%

Table 4 : Comparing PE and Predicted PE

According to our database, most companies with low Price-to-Earnings (PE) ratios or negative Earnings Per Share (EPS) are in the oil and gas sector, including prominent players like BP, a leading company in the oil and gas industry based in the UK. This trend may be attributed to the impact of Covid-19, which significantly affected these subgroups. Despite their current challenges, these low PE ratios present an intriguing investment opportunity as we anticipate these companies will grow and become more profitable in the future.

Vestas Wind Systems, a renewable energy company, has shown a high negative P/E ratio, indicating substantial losses compared to its current value. This negative ratio can be explained by the higher production costs associated with renewable energy, resulting in lower profit margins and, consequently, a lower PE ratio. (Garland and Pruyn, 2023). Additionally, renewable companies often make significant investments in Research and Development, which can temporarily impact their PE ratio, this can explain the low median of this sector.

However, it's essential to note that these negative PE ratios are typically short-term, and these companies are optimistic about better growth prospects in the future. Even well-established companies like Total energies have also experienced negative PE ratios in 2020 (PE = -28).

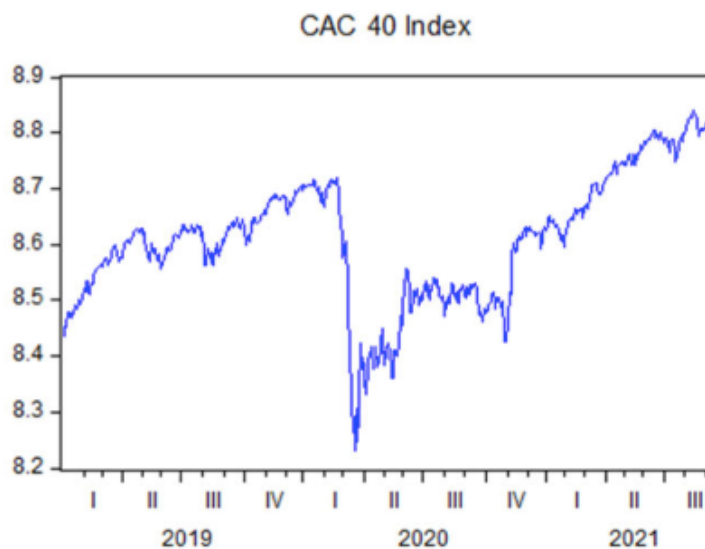


Figure 1: Fluctuating prices CAC 40 index

The most significant companies in our database are included in the CAC 40 index, as can be seen by examining more closely at our database. As we can see in figure 1, the CAC 40 index fluctuated significantly during the Covid-19 period, and this volatility may have been affected by changes in crude oil futures, which were thought to be reliable indicators of stock market volatility. The relationship between the price of crude oil and stock market activity may have contributed to the index's swings during that time. (Ding et al., 2023). Since beta has an impact on uncertainty, it can be shown that a lower beta results in a larger PE ratio. This tendency can be explained by the assumption that higher-beta stocks are linked to greater uncertainty and potential price volatility.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
2022	(Constant)	3,836	0,876		4,38	<,001		
	Beta.Y1	-1,404	1,093	-0,056	-1,285	0,199	0,987	1,013
	Geps.Y1	0,023	0,008	0,13	2,977	<,003	0,986	1,014
	Payout.Y1	0,864	0,68	0,055	1,27	0,205	0,998	1,002
2021	(Constant)	3,068	0,916		3,351	<,001		
	BetaY2	-2,601	1,142	-0,097	-2,279	0,023	0,999	1,001

	Geps2	0,039	0,008	0,212	4,914	<,001	0,984	1,016
	Payout.Y2	0,213	0,086	0,106	2,47	0,014	0,984	1,017
2020	(Constant)	4,582	2,024		2,264	0,024		
	BETA.Y3	-2,211	2,425	-0,051	-0,912	0,363	0,935	1,07
	Geps.Y3	0,047	0,024	0,109	1,984	0,048	0,974	1,027
	Payout.Y3	3,033	1,381	0,122	2,196	0,029	0,955	1,047
2019	(Constant)	5,745	1,335		4,304	<,001		
	BETA.Y4	-4,596	1,562	-0,132	-2,942	<,003	0,996	1,004
	Geps.Y4	0,104	0,023	0,2	4,44	<,001	0,998	1,002
	Payout.Y4	0,274	0,294	0,042	0,93	0,353	0,994	1,006
2018	(Constant)	1,752	0,966		1,813	0,071		
	BETA.Y5	-1,232	1,136	-0,049	-1,084	0,279	0,999	1,001
	Geps.Y5	0,074	0,013	0,252	5,505	<,001	0,99	1,01
	Payout.Y5	2,13	0,653	0,149	3,26	0,001	0,99	1,011

Table: 4: Multiple regression over the 5 years PE with no scores

In addition, the table demonstrates an important relationship between Growth EPS and PE over a 5-year period (p 0.001). According to this research, businesses with better EPS growth typically have higher PE ratios, which shows that investors are ready to pay more for businesses with consistently strong earnings growth. This means that for 2022, when Geps increases by one unit, the predicted PE will increase by 0.023 units.

Furthermore, it was established in the fourth year that there exists a negative correlation between the Price to Earnings ratio and Beta. This means that as Beta increases by one unit, the predicted PE will decrease by -4,596. Additionally, the VIF and tolerance analyses show that the absence of multicollinearity problems strengthens our model.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
2022	,148 ^a	0,022	0,016	9,45964
2021	,245 ^a	0,06	0,054	8,45401
2020	,163 ^a	0,027	0,018	12,24701
2019	,243 ^a	0,059	0,053	10,15131
2018	,310 ^a	0,096	0,09	7,05942

Predictors: Constant, Beta, Payout and Geps.

Table: 5: R squared models PE without scores

Over the past five years, the R-squared values have always been low, which shows that the factors used have little effect on making the model more accurate. Geps is the only one of the independent factors that can explain why the dependent variable varies. This means that the R-squared value needs to be raised by adding more important variables to the model. Different factors may come into play, influencing the PE ratio differently in each year. PE ratios vary across time, markets, industries, and firms because of differences in fundamentals.

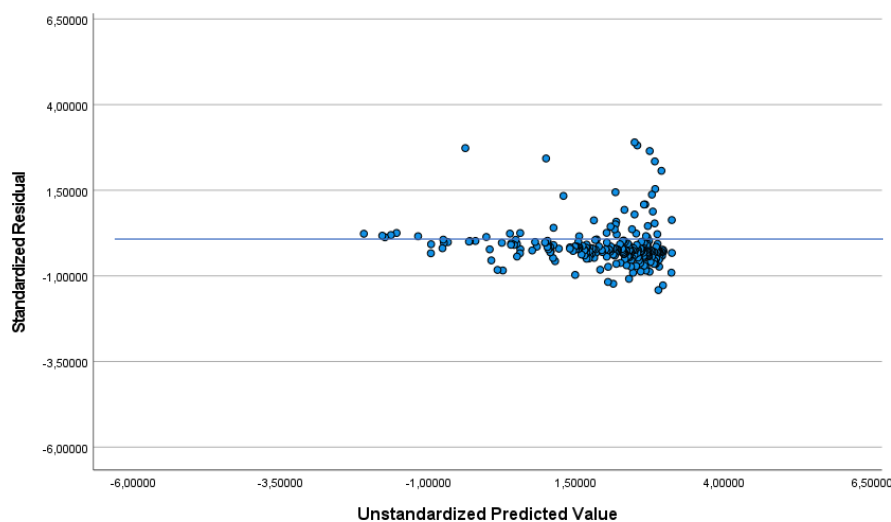


Figure 2: Plots of residuals model PE

By examining the leaf plot (figure, 2), we observe that our regression model can be verified as 95% of the residuals lie within the range of -2 to 2. The positive and negative residuals should be near zero since most residuals are concentrated around zero. (Figure, 2).

In conclusion, our initial model indicates that Geps and the PE ratio exhibit statistical significance and a positive correlation, with the exception of year 4 where beta shows a negative correlation. Because additional variables lack statistical significance, we cannot, in general, reject the null hypothesis. We should add more pertinent variables to our model to make better predictions and provide investors with clearer guidance regarding the performance of the companies.

1.2. PEG on financial fundamentals:

After examining the PE, we focus on the PEG ratio: In our study, we examine how the price-to-earnings growth (PEG) ratio is affected by changing a firm's riskiness (Beta). The relationship between Beta and the PEG ratio is obvious: the PEG ratio decreases as risk

increases. (Figure,3). This suggests that riskier companies, even those operating in the same industry, typically have lower PEG ratios than safer companies, suggesting that they may be undervalued. Our data notably demonstrates that negative Beta values result in positive PEG ratios. (Damodaran, 1995).

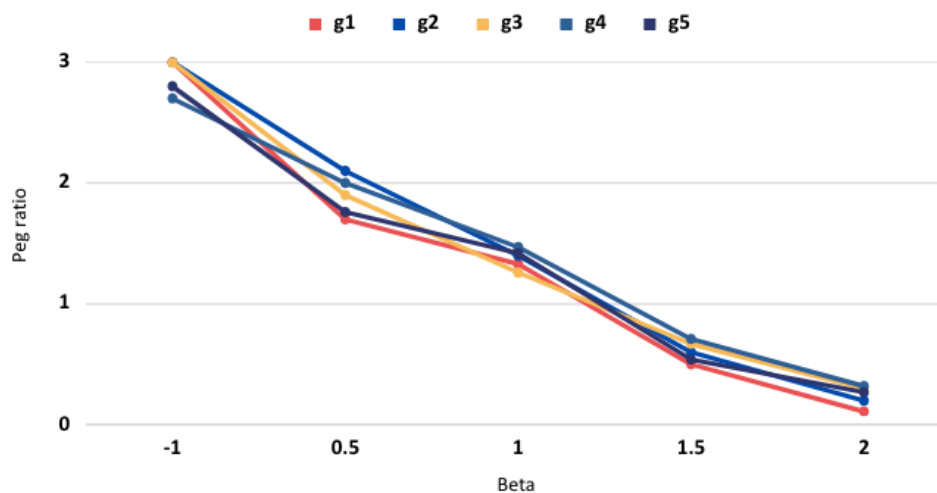


Figure 3: Correlation of PEG and Beta

There is a link between return on equity (ROE), payout, and earnings growth (Geps). Firms with greater ROE should have higher PEG ratios for a given growth rate, indicating that they can earn larger profits and are expected to continue growing in the future. In actuality, the formula for the anticipated growth rate is: $\text{Growth Rate} = (\text{Return on Equity}) (1 - \text{Payout Ratio})$.

After defining our PEG ratio, we analyze the cross-sectional distribution of PEG ratios across all European companies in Figure 4. The PEG ratios are estimated based on the analyst's projections of earnings per share growth over the next 5 years, combined with the current PE ratio. In our observation, the sector exhibits negative PEG ratios, indicating that the data reflects either negative earnings per share or a lack of analyst estimates for expected growth.

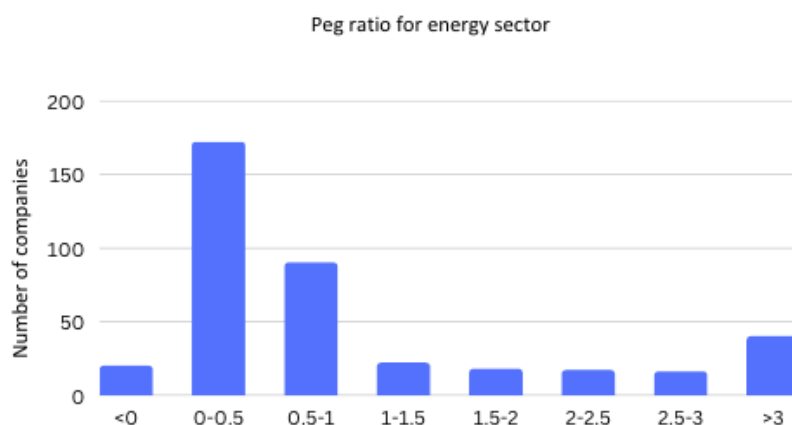


Figure 4 : Cross-sectional distribution

When identifying inexpensive and overvalued firms, portfolio managers and analysts frequently compare the PE ratio to the predicted growth rate. Relative value is measured using the PEG ratio, which is the ratio of PE ratio to growth rate. To classify companies in our sample as being undervalued, overvalued, or not monitored due to missing EPS growth, we use a dummy variable. Our sample's dummy variable yields a result of 198 undervalued companies, 143 overvalued companies, and the other companies were not tracked since their EPS growth was missing or their EPS was negative.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,250 ^a	0,062	0,052	0,33624
1	,222 ^a	0,049	0,031	0,67693
1	,204 ^a	0,042	0,022	0,45359
1	,167 ^a	0,028	0,003	0,56354

Table 6: R squared model PEG with no scores

Furthermore, the R-squared value is relatively low (table, 6), meaning that the model explains around 5% of the variation in PEG. Additionally, the coefficients were analyzed to determine the influence of each factor on the criterion variables. The varying coefficients observed over the years can be explained by the absence of growth rates and the economic situation in the oil and gas industry for every company. As we could see in our previous model, we faced companies having different levels of growth. To achieve a more comparable growth rate, we

applied a transformation to the expected growth rate using logarithm. This modification led to a notably enhanced linear relationship, as demonstrated in the accompanying figure.

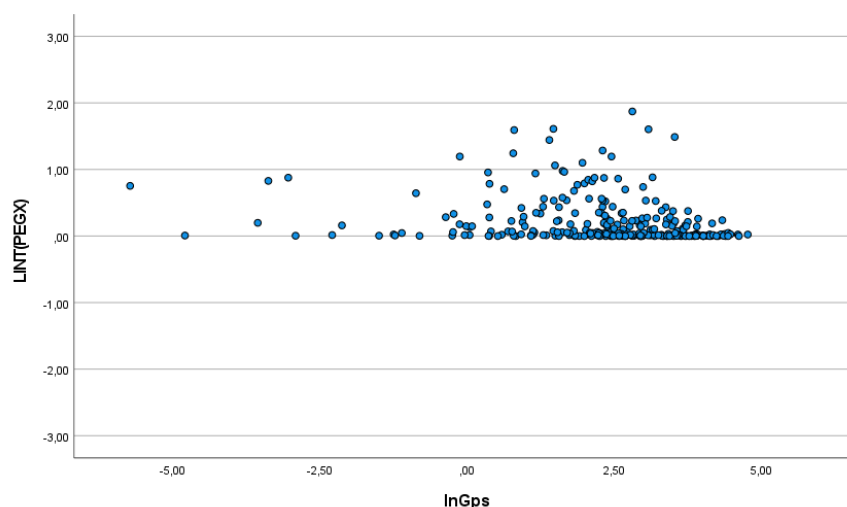


Figure 5: Scatter-plot PEG and Log Geps

Moreover, by analyzing the table we can see that none of the independent variables showed significant predictive power for PEG, as indicated by all p-values being greater than 0.05, unless loggeps, which is close to 0.05. This suggests that none of the three financial performance factors have a substantial impact on PEG.

Model		Unstandardized Coefficients		Standardize	t	Sig.	Collinearity Statistics	
		B	Std. Error	d Coefficients Beta			Tolerance	VIF
2022	(Constant)	0,356	0,056		6,361	<,001		
	Beta.Y1	-0,01	0,06	-0,01	-0,166	0,868	0,971	1,03
	logGps	-0,051	0,013	-0,236	-3,993	<,001	0,965	1,036
	Payout.Y1	-0,197	0,089	-0,134	-2,229	0,027	0,937	1,067
2021	(Constant)	1,01	0,286		3,526	0,001		
	BetaY2	-0,675	0,344	-0,319	-1,959	0,058	0,779	1,284
	loggps2	-0,141	0,071	-0,375	-1,988	0,054	0,581	1,72
	Payout	-0,399	0,305	-0,272	-1,31	0,199	0,478	2,093
2020	(Constant)	0,25	0,205		1,221	0,224		
	Beta.Y3	0,32	0,225	0,114	1,424	0,156	0,986	1,014
	lnGps3	-0,103	0,04	-0,207	-2,536	0,012	0,946	1,057
	Payout.Y3	-0,062	0,226	-0,022	-0,276	0,783	0,954	1,048

2019	(Constant)	0,325	0,125		2,608	0,01		
	Berta.Y4	-0,022	0,136	-0,014	-0,165	0,869	0,938	1,066
	lnGps4	-0,05	0,027	-0,161	-1,867	0,064	0,9	1,111
	Payout.Y4	0,142	0,137	0,09	1,042	0,299	0,903	1,108
2018	(Constant)	0,399	0,175		2,275	0,025		
	BETA.Y5	-0,069	0,196	-0,032	-0,353	0,725	0,974	1,027
	lnGps5	-0,051	0,03	-0,158	-1,71	0,09	0,962	1,039
	Payout.Y5	0,04	0,182	0,02	0,218	0,828	0,95	1,052

Table 7: Linear regression PEG, no scores

This lack of significance could be attributed to the presence of missing variable errors, meaning that important variables may have been omitted from the model. In short, firms that look undervalued based on direct comparison of the PEG ratios may in fact be firms with higher risk or lower returns on equity that are correctly valued. Investors should be cautious and consider other factors, such as profitability and overall finance health while evaluating the true value of these firms, rather than relying solely on the PEG ratio for investment decisions. In conclusion, our findings do not reject hypothesis H0. (Table, 7).

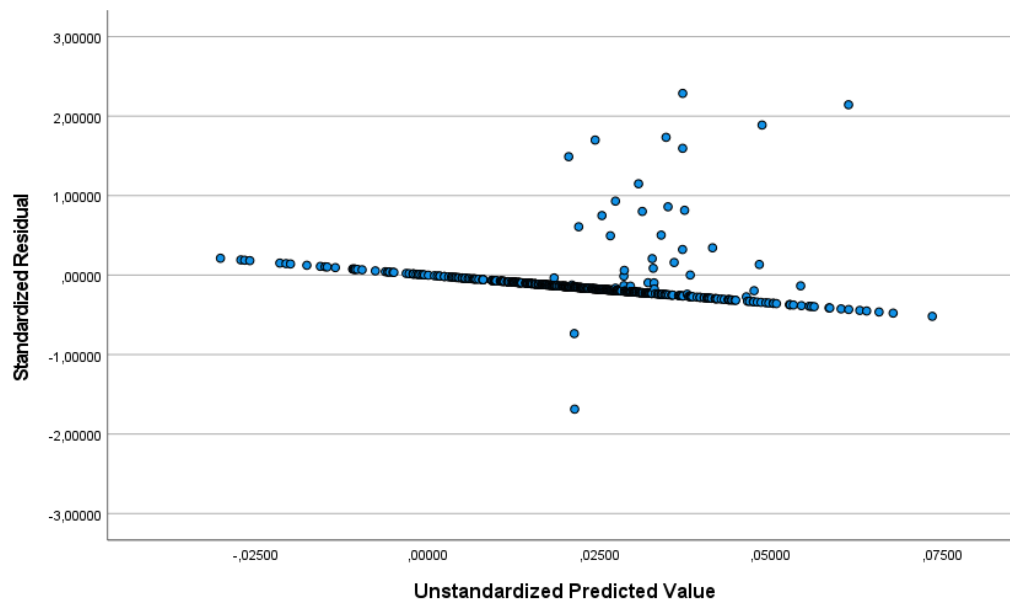


Figure 6: Scatter-plot PEG, no scores

After analyzing the leaf plot (refer to Figure 6), we can validate our regression model since approximately 95% of the residuals fall within the range of -2 to 2. The positive and negative residuals are expected to be close to zero as the majority of residuals cluster around zero.

To conclude the price-earnings ratio is not the best ratio for firms with negative earnings per share. Other multiples, such as the price-to-sales ratio, can be a better predictor for these firms. So, the PE ratio in our analysis can show biases approaches. Since we have found disquieting findings, Damodaran (1995), suggested using price to book value, that tend to be better behaved models with negative earnings per share.

1.3. Price-book value on financial performance.

We analyzed the Price-book-value (PBV) ratio as our third model. We conducted a regression analysis with PBV as the dependent variable and Geps, Beta, Payout, and ROE as predictor variables. Upon comparing PBV with other independent variables related to financial performance, we found that none of the variables were significant. Moreover, the obtained R-squared value in the analyze is relatively low (0.014). The percentage of Y (1.4%) explained by the independent variables is low, given that our variables are not statistically significant this indicates that the independent variables have limited explanatory power and can only account for a small portion of the variation observed in the dependent variable.

Modèle		Unstandarized Cof.		Standardized Cof.		Sig.
		B	Erreur standard	Bêta	t	
2022	Constant	2,163	0,353		6,122	<,001
	Beta.Y1	0,087	0,421	0,015	0,207	0,836
	G	0,078	0,046	1,514	1,693	0,092
	PayoutY1	0,005	0,193	0,002	0,027	0,978
	ROE.Y	-0,077	0,045	-1,51	-1,686	0,093

Dependent variable: PBV

Table 8 : Multiple linear regression PBV, no scores

$$PBV = 2,163 + 0,087 * \text{Beta} + 0,078 * \text{Growth} + 0,005 * \text{Payout} - 0,077 * \text{Roe}$$

The initial model yielded insignificant results, prompting us to choose an alternative approach. We sought to identify companies with low price-to-book (PB) ratios, yet high returns on equity (ROE) and low risk. To achieve this, we employed a simple measure called

the median test. By calculating the sector's median, we could assess whether companies were undervalued or overvalued.

Subsequently, we conducted another regression analysis focusing on companies with the highest market capitalization, primarily Russian firms. This new regression model entailed PBV (price-to-book value) as the dependent variable, while ROE and the standard deviation of stock prices served as the independent variables.

$$\text{Predicted PBV} = 2,063 - 2,512E-5 * \text{Standard Deviaton} - 0,001 * \text{ROE}$$

$$\text{Predicted PBV(Rosneft)} = 2,063 - 2,512E-5 * (232,75) - 0,001 * (17,27) = -57,42$$

Company name	PBV	Predicted PBV	ROE	Median 1,17	Under-over valued
ROSNEFT OIL CO PJSC	0,86	2,02	17,27477264	Undervalued	-57,42574257
NOVATEK PJSC	2,53	2,03	24,63755989	Overvalued	24,63054187
LUKOIL PJSC	0,94	1,96	17,90779686	Undervalued	-52,04081633
GAZPROM PJSC	0,25	1,99	7,661003113	Undervalued	-87,43718593
BASHNEFT PJSC	0,6	2,01	16,24735069	Undervalued	-70,14925373
KOC HOLDING AS	1,31	0,94	65,54735565	Overvalued	39,36170213
TUPRAS-TURKIYE PETROL RAFINE	2,85	2,07	95,95218658	Overvalued	37,68115942
TRANSNEFT PJSC	0,09	0,02	5,34629488	Undervalued	350
VESTAS WIND SYSTEMS A/S	9	8,17	-40,68323135	Overvalued	10,15911873
AKER BP ASA	1,81	2,02	21,92156601	Undervalued	-10,3960396
SHELL PLC	0,81	1,05	23,3468895	Undervalued	-22,85714286
TOTALENERGIES SE	1,18	1,24	18,37107277	Undervalued	-4,838709677

Table 9 : Comparing PBV with different methods

Upon analysing the table 9, it becomes evident that a significant portion of these companies belong to the oil and gas subsector, which experienced the impacts of the COVID-19 pandemic. However, this sector is anticipated to witness future growth, making it potentially appealing to invest in undervalued companies that are likely to see an increase in stock prices in the coming years.

One notable company, Vestas Wind Systems, stands out as overvalued. This could be attributed to its involvement in the wind turbine industry, where companies heavily invest in

Research and Development (R&D), which may affect their profitability and result in a high Price-to-Book Value (PBV) ratio.

The PBV ratio serves as a metric to measure how the stock market perceives a company's value compared to its stated asset value on paper. Therefore, investors should carefully consider these factors when making investment decisions. (companiesmarketcap, n.d)

In summary, our research does not strongly support our initial hypothesis (H1) that the financial ratios PBV, PE, and PEG can significantly predict company performance, regardless of ESG scores and greenwashing scores. The low R-squared values and lack of significance for most variables suggest that other factors not included in our model likely have a more substantial impact on financial performance. This means that we are facing insufficient data to reject our null hypothesis (H0).

To address this limitation, one potential solution is to incorporate additional explanatory variables related to Y. Moreover, relying on a linear relationship between PE ratios and fundamentals is inappropriate as it may not be stable, and predictions from the regression equation may become unreliable over time.

Considering these challenges, the regression approach remains a valuable tool in the search for true value, but it should be complemented with other techniques. Using squared or natural logs for independent variables could be a potential solution to improve the analysis. For instance, analyzing price-to-sales and considering negative EPS in calculations may provide valuable insights into the company's financial performance.

2. Multiple regression analysis on PE, PER and PEG over 5 years with ESG SCORES.

In our database of 526 companies, we examined the presence of ESG Scores. Out of these companies, a subset ranging from 60 to 114 observations received an ESG score, while the remaining companies were not included in the analysis due to the absence of an ESG score. The descriptive statistics, depicted in the figure, provide insights into the minimum and maximum ESG scores observed. Based on the mean ESG score, we categorized the database

into two groups: companies with high ESG scores (>40) and companies with low ESG scores (<40). We don't take the other companies into observation because we consider that they are young or companies that do not demonstrate a commitment to sustainable and responsible business practices.

H0: There is no relationship between ESG scores and PBV, PE, and PEG ratios.

H1: Companies with higher ESG scores have higher PBV, PE, and PEG ratios.

2.1. ESG scores on PE Ratio

Before determining whether to conduct a parametric or non-parametric test, we will examine the normality assumption using the Kolmogorov test and the Shapiro-Wilk test. (Table,10) This will help assess the suitability of the data for parametric analysis.

H0 = data has a normal distribution

H1 = data does not have a normal distribution

Model	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PE	.460	460	<.001	.068	460	<.001
PE2	0,405	517	<.001	0,192	517	<.001
PE3	.459	390	<.001	.071	390	<.001
PE4	.458	373	<.001	.086	373	<.001
PE5	.396	343	<.001	.311	343	<.001

Table 10: Test of Normality PE with ESG scores

After having applied for the Kolmogorov test and the Shapiro-Wilk test. We can observe that the p-values associated with the test are less than 0.001, providing strong evidence to reject the null hypothesis of normality. In other words, the data does not follow a normal distribution, we could also see it through our normal Q-Q plot. (Figure, 7).

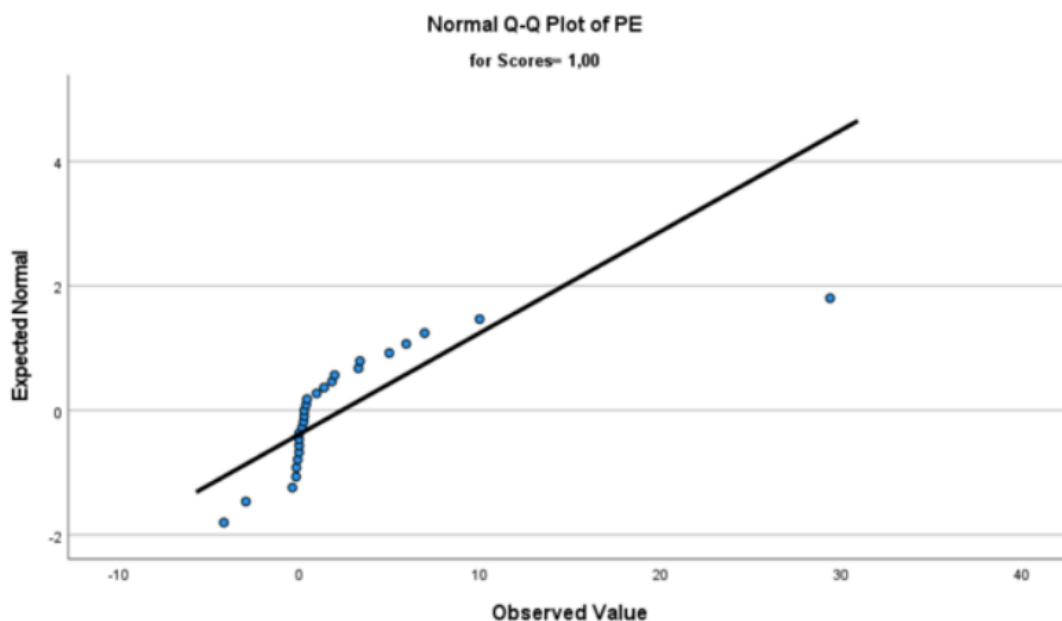


Figure 7: Q-Q plot PE with ESG scores

Because our model deals with unequal variances, we adopt an alternative method which is the Mann-Whitney U test. (Fig 9). This is a non-parametric test that compares the distribution of two independent groups without assuming equal variances. This is a better choice in this situation to compare the central tendencies of groups accurately. It compares the median of two groups, making it more robust to outliers and less influenced by skewed data.

H0: The median of group 1 is equal to the median of group 2.

H1: The median of group 1 is not equal to the median of group 2.

Years	2022	2021	2020	2019	2018
Total N	68	122	113	100	80
Mann-Whitney U	405.500	1692,000	1.808.000	1.337.500	865.000
Wilcoxon W	784.500	5520,000	3.578.000	3.048.500	2.191.000
Test Statistic	406.500	1692,000	1.808.000	1.337.500	865.000
Standard Error	81.210	176,667	173.972	143.188	99.916
Standardized Test Statistic	-.580	0,959	1.236	.835	1.256
Asymptotic Sig.(2-sided test)	.562	0,337	.217	.404	.209

Table 11: Independent- Samples Mann-Whitney U test PE with ESG scores

Regarding the comparison of means, the Mann-Whitney U test yields a test statistic ranging from 865.000 to 1.808.000 and standardized test statistic values between -0.505 to 1.256.

The associated bilateral p-values are greater than 0.05. As a result, the results do not provide sufficient evidence to reject the null hypothesis.

Consequently, we conclude that there is no statistically significant difference in the PE ratio between companies with high ESG scores and companies with low ESG scores in the energy sector in Europe. This leads us to suggest that the medians of the two groups are likely equal.

However, due to the non-significant results, we cannot confidently assert that the higher PE ratio among companies with high ESG scores is solely due to their strong ESG initiatives or a positive investor perception towards sustainable practices. The lack of statistical significance indicates that other factors might be influencing the observed PE ratio differences between the two groups of companies.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
2022	(Constant)	4,432	1,467		3,022	0,003
	Beta.Y1	-1,808	1,182	-0,071	-1,529	0,127
	Payout.Y1	0,856	0,711	0,055	1,204	0,229
	Geps.Y1	0,026	0,009	0,138	2,997	0,003
	Disc.Esg.Y1	0,001	0,033	0,002	0,038	0,97
2021	(Constant)	1,01	0,286		3,526	0,001
	Beta.Y2	-0,675	0,344	-0,319	-1,959	0,058
	loggps2	-0,141	0,071	-0,375	-1,988	0,054
	Payout.Y2	-0,399	0,305	-0,272	-1,31	0,199
	Disc.ESG.Y2	0,005	0,004	0,194	1,065	0,294
2020	(Constant)	5,291	2,594		2,04	0,042
	BETA.Y3	-2,436	2,46	-0,056	-0,99	0,323
	Geps.Y3	0,054	0,025	0,121	2,179	0,03
	Payout.Y3	3,126	1,418	0,125	2,204	0,028
	disc.scoreY3	-0,01	0,044	-0,013	-0,239	0,811
2019	(Constant)	4,784	1,771		2,701	0,007
	BETA.Y4	-4,732	1,571	-0,136	-3,011	0,003
	Geps.Y4	0,102	0,023	0,196	4,354	<,001
	Payout.Y4	0,28	0,295	0,043	0,949	0,343
	Disc.score.Y4	0,027	0,033	0,037	0,827	0,409

2018	(Constant)	1,156	1,472		0,786	0,432
	BETA.Y5	-1,457	1,165	-0,058	-1,251	0,212
	Payout.Y5	2,073	0,66	0,146	3,143	0,002
	Geps.Y5	0,081	0,015	0,248	5,345	<,001
	disc.ESG.Y5	0,018	0,025	0,034	0,735	0,463

Table 12: Multiple regression PE with ESG scores

In our models spanning the period from 2018 to 2022, none of our variables show statistical significance except Growth earnings per share. When PE increase by one-unit Geps will have a positive increasing ratio. However, all the p-values of the other ratios are above 0.05, indicating that our model includes some missing data. As a result, we have an unclear correlation between ESG factors and a company's returns, and the current findings are associated with a significant level of uncertainty, so we cannot properly draw a conclusion.

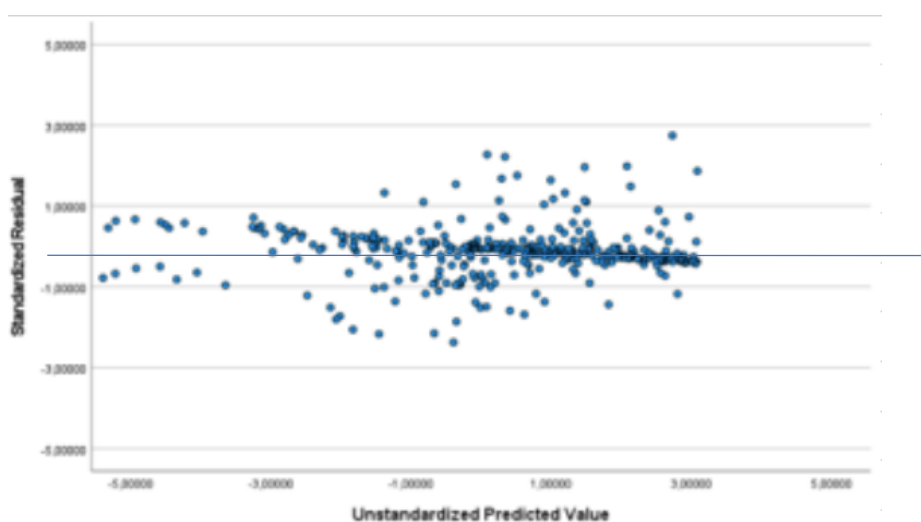


Figure 8: Scatter-plot PE and ESG scores

By examining the leaf plot (figure, 1), we observe that our regression model can be confirmed because 95% of the residuals fall between -2 and 2. Since most residuals are centered around zero, the positive and negative residuals should be close to zero.

The study found no significant relationship between ESG scores and the PE ratio. Therefore, ESG scores do not provide guidance on whether a company's stock is overvalued or undervalued based on the PE ratio. Other factors should be considered for investment

decisions. The current results are characterized by a considerable degree of uncertainty, preventing us from drawing a definitive conclusion.

2.2. PEG Ratios and ESG scores.

H0 = data has a normal distribution

H1 = data does not have a normal distribution

Prior to commencing our analysis, we conducted a frequency test, revealing that out of our total observations, 459 were missing values, leaving us with only 68 valid observations. This limited sample size may introduce potential bias into our analysis.

Model	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PEG	.483	457	<.001	.068	457	<.001
PEG2	0,459	470	<.001	0,082	470	<.001
PEG3	.422	354	<.001	.118	354	<.001
PEG4	.409	371	<.001	.122	371	<.001
PEG5	.463	341	<.001	.121	341	<.001

Table 13: Normality test PEG with ESG

After conducting the Kolmogorov test and the Shapiro-Wilk test, we have obtained highly significant p-values (less than 0.001). This compelling evidence leads us to reject the null hypothesis that assumes normality. In simpler terms, the data does not exhibit a normal distribution. (Table,13).

H0: The median of group 1 is equal to the median of group 2.

H1: The median of group 1 is not equal to the median of group 2.

Total N	66	122	109	98	78
Mann-Whitney U	444.000	1487,000	1.567.000	1.274.000	730.000
Wilcoxon W	940.000	5315,000	3.337.000	2.985.000	2.056.000
Test Statistic	444.000	1487,000	1.567.000	1.274.000	730.000
Standard Error	77.833	176,667	164.444	138.347	95.212
Standardized Test Statistic	-1.266	-0,201	.559	.824	.436
Asymptotic Sig.(2-sided test)	.206	0,841	.576	.410	.663

Table 14: Independent-Samples Mann-Whitney U test

After we processed our normality test, we made a Mann-Whitney U test. The P-value obtained from the test was 0.206 which is greater than the significance level of 0.05 based on this result, we fail to reject the null hypothesis. This means that there is not enough evidence to conclude that there is a significant difference in the distribution of PEG between the categories of high and low ESG scores. (Table, 14).

Model		Unstandardized Coefficients		Standardized Coefficients		Sig.
		B	Std. Error	Beta	t	
2022	Constant	0,525	0,137		3,832	<,001
	Beta.Y1	0,064	0,095	0,055	0,669	0,504
	lnGps	-0,103	0,03	-0,287	-3,383	<,001
	Payout.Y1	-0,357	0,149	-0,211	-2,392	0,018
	ESG.Y1	-0,001	0,002	-0,038	-0,48	0,632
2021	Constant	7,421	2,74		2,709	0,008
	BetaY2	-7,336	2,537	-0,258	-2,891	0,005
	Geps.Y2	0,033	0,021	0,135	1,537	0,127
	Payout.Y2	0,285	0,152	0,164	1,875	0,063
	ESG.Y2	0,015	0,038	0,034	0,386	0,7
2020	Constant	0,319	0,23		1,384	0,168
	BETA.Y3	0,352	0,234	0,124	1,503	0,135
	lnGps3	-0,103	0,042	-0,2	-2,423	0,017
	PayoutY3	-0,007	0,243	-0,002	-0,027	0,978
	ESG.Y3	-0,003	0,004	-0,061	-0,701	0,485
2019	Constant	0,382	0,144		2,649	0,009
	BETA.Y4	0,005	0,14	0,003	0,033	0,974
	lnGps4	-0,046	0,027	-0,148	-1,679	0,095
	Payout.Y4	0,193	0,151	0,122	1,277	0,204
	ESG.Y4	-0,002	0,003	-0,075	-0,789	0,432
2018	Constant	0,581	0,23		2,525	0,013
	BETA.Y5	-0,078	0,198	-0,036	-0,393	0,695
	lnGps5	-0,057	0,03	-0,174	-1,859	0,066
	Payout.Y5	0,078	0,187	0,04	0,421	0,675
	Esg.Y5	-0,004	0,004	-0,109	-1,155	0,25

Dependent Variable: PEG

Tableau 15: Multiple regression PEG with ESG scores

The research indicated no difficulties with collinearity among the variables, resulting in more reliable coefficient estimations and enhanced interpretability. This robustness reinforces our findings and enables us to precisely analyse the independent impacts of each predictor variable. Despite the fact that the coefficients are stable across years, none of the independent variables (x) had a substantial impact on the dependent variable (Y) PEG. With the exception of Geps in 2022, it has been shown that a rise of one unit in the PEG ratio is associated with a negative change of -0.103 units in the GEPS variable. These findings indicate the need for further investigation into additional variables that could potentially impact the modification of (Y) PEG.

2.3. PBV Ratios and ESG scores.

Model	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PBV	.467	411	<.001	.076	411	<.001
PBV_2	.492	301	<.001	.060	301	<.001
PBV_3	.464	343	<.001	.051	343	<.001
PBV_4	.467	524	.000	.127	524	<.001
PBV_5	.445	523	<.001	.075	523	<.001

Tableau 16: Normality test PBV and ESG

Looking at our frequency table we can see that we have a little sample of around 116 companies out of the 526. The results of the Kolmogorov test and the Shapiro-Wilk test indicate that the p-values obtained are less than 0.001. This provides substantial evidence to reject the null hypothesis that the data follows a normal distribution. In simpler terms, the data does not exhibit a normal distribution.

		B	Std. Error Beta	t	Sig.
2022	Constant	1,914	3,027	0,632	0,547
	Beta.Y1	1,377	3,31	0,173	0,416
	Payout.Y1	4,009	2,551	0,653	1,571
	Geps.Y1	0,001	0,005	0,131	0,302
	ROE.Y	-0,056	0,058	-0,376	-0,972
	ESG.Y1	-0,067	0,071	-0,447	-0,944

Dependent variable: PBV

Table 17: Multiple regression PBV no scores

Upon inspecting the multiple regression for PBV, it is evident that none of the independent variables exhibit significance, despite the normality observed in the Kolmogorov test. To advance our analysis, we proceed by utilizing the provided ratio of the multiple regression and apply it to assess potential differences between PBV with ESG scores and predicted PBV without ESG scores.

$$\text{PBV (2022)} = 1,914 + 1,377 + 4,009 + 0,01 \text{ Geps} - 0,056 * \text{Roe} - 0,067.$$

Subsequently, we perform a comparative assessment between the observed PBV and the predicted PBV. The results indicate that the predictions align closely, especially for Lukoil, displaying similar outcomes. The slight dissimilarities in these figures can be attributed to the limited significance observed in the multiple regression model. ($p > 0.005$).

Company name	PBV	Predicted PBV	PBV with ESG
ROSNEFT OIL CO PJSC	0,86	2,02	4,00
NOVATEK PJSC	2,53	2,03	3,02
LUKOIL PJSC	0,94	1,96	1,92
GAZPROM PJSC	0,25	1,99	0,80

Table 18 : Comparing PBV with ESG to other techniques

Model 2022	Tolerance	VIF
Beta.Y1	0,556	1,799
Payout.Y1	0,557	1,794
Geps.Y1	0,509	1,966
ROE.Y	0,643	1,555
ESG.Y1	0,429	2,328

However, the analysis revealed no issues of collinearity among the variables, as indicated by the variance inflation factors (VIFs) all being below 5. Thus, multicollinearity is not a concern in our model.

In summary, our regression models in the European energy sector did not reveal a significant correlation between ESG ratings and valuation ratios (PBV, PE, and PEG). While some variables in the models showed significance, the overall model fit was weak, with most p-values higher than 0.05. This indicates that ESG scores may not be the sole drivers of valuation criteria in the energy sector. Other factors beyond ESG may also influence valuation ratios. Moreover, we couldn't establish a clear impact of lower or higher ESG scores on equity multiples (PE, PEG, PBV) since some data were missing. As a result, we cannot reject our null hypothesis.

In our study, we primarily focused on equity multiples. However, we recognize that including enterprise value multiples, such as Enterprise value/FCF, could have yielded more meaningful results. One promising approach could have been integrating ESG considerations into the valuation process from the start. By incorporating ESG factors into a Discounted Cash Flow (DCF) or income-based valuation approach, there is a potential to enhance the outcomes of our equity model, especially concerning the influence of price-to-earnings (PE) ratios. (Rodl & Partner, 2023).

3. Multiple regression analysis on PE, PER and PEG over 5 years with Greenwashing scores.

H0: There is no significant difference in PBV, PE, and PEG ratios between companies with greenwashing scores and companies without greenwashing scores.

H1: Companies with greenwashing scores have significantly higher PBV, PE, and PEG ratios compared to companies without greenwashing scores.

3.1. PE and Greenwashing scores

The normality of the "PE" variable was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests over different years. The results indicated a significant deviation from normal distribution Kolmogorov-Smirnov test: $p < 0.001$; Shapiro-Wilk test: $p < 0.001$. Here, we can conclude that the variable "PE" is not normally distributed. By interpreting the Q-Q plot, we can see that the residuals are not roughly normal distributed since they do not fall straight on the 45-degree line. (Figure, 9).

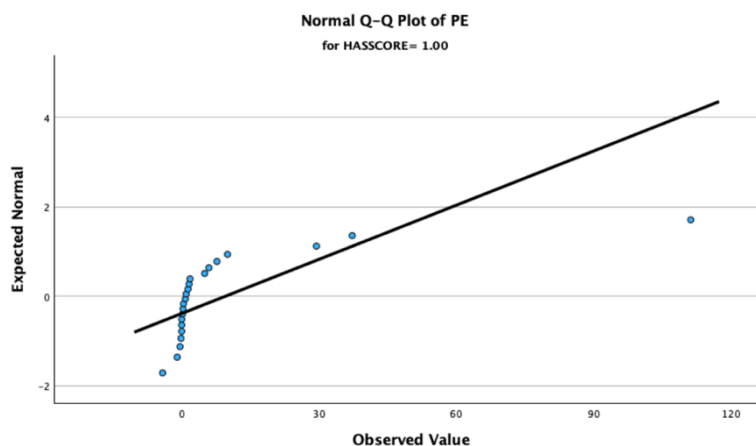


Figure 9: Q-Q plot PE with ESG scores

Since our data is not normally distributed, we will make a non-parametric test. This is the Mann-Whitney U test. We separated our database into two groups those with scores and those without scores. We have only 60 observations for companies with greenwashing scores. By comparing the medians of companies with ESG scores and without ESG scores our results are significant since our bilateral p-value shows us <0.04 . This means that our medians are not equal. Therefore, we can reject H_0 .

	2022	2021	2020	2019	2018
Total N	334	274	321	254	224
Mann-Whitney U	4.709.500	6.355.500	10.216.500	8.198.000	6.450.500
Wilcoxon W	4.962.500	8.125.500	12.046.500	10.028.000	8.161.500
Test Statistic	4.709.500	6.355.500	10.216.500	8.198.000	6.450.500
Standard Error	41.743	539.163	648.235	497.342	424.882
Standardized Test Statistic	2.918	.024	3.682	4.781	3.852
Asymptotic Sig.(2-sided test)	<.004	.981	<.001	<.001	<.001

Table 19: Mann-Whitney U test PE with GW scores

Looking at our regression model over the 5 years (appendix 2), we found two significant factors by particularly looking at our regression model for the year 2018 (Table 19). Based on our findings, we can deduce that Geps (Growth in Earnings per Share) and Payout (Dividend Payout) exert influence on the PE (Price-to-Earnings) ratio. Specifically, for each unit increase in the PE ratio, Geps increases by 0.074, indicating that a rise in the PE ratio is accompanied by an increase in Earnings per Share. Additionally, Payout shows a significant impact on the PE ratio, with every unit increase in the PE ratio leading to a 2.119 increase in Payout. This

suggests that companies with higher PE ratios tend to have higher dividend payouts. Furthermore, the inverse correlation between greenwashing and PE can be clarified by the observation that lower greenwashing scores are associated with better PE ratios. Higher greenwashing scores are perceived as detrimental to society, which helps explain the negative impact on PE ratios.

Model	Unstandardized Coefficients		Standardized Coefficients		Sig.
	B	Std. Error	Beta	t	
Constant	2,323	1,323		1,756	0,08
Beta.Y5	-1,278	1,117	-0,053	-1,144	0,253
Geps.Y5	0,074	0,014	0,246	5,247	<,001
Payout.Y5	2,119	0,624	0,159	3,396	<,001
GW.Y5	-0,597	0,685	-0,041	-0,872	0,384

Dependent variable : PE

Tableau 20: Multiple correlation PEG with ESG

Since our model for 2018 showed some level of significance, we will proceed with comparing the PE estimated using greenwashing scores to the results obtained from other regression models to evaluate the similarity of the findings.

PE = 1/Earnings per shares

Predicted PE = 1,752 – 1,232*Beta + 0,074*Geps + 2,13*Payout

PE with ESG = 1,156 – 1,457*Beta + 0,081*Geps + 2,073*Payout + 0,018*ESGscores

PE with GW = 2,323 – 1,278*Beta + 0,074*Geps + 2,119*Payout – 0,597*Greenwashingscore

Company	PE	Predicted PE	PE with ESG	PE with GW
BP	5,2	5,13	5,81	7,27
Aker BP	3,73	2,53	1,23	4,13
Vestas Wind System	3,17	3	1,18	0,55
Eni	2,99	2,77	1,06	3,47
Maurel&prom	1,63	1,56	0,72	2,22

Table 21: Comparing PE with GW to other models

Although our PE ratios appear to be relatively consistent across the three models, it is important to note that despite the improved accuracy, we are unable to draw a definitive conclusion. The inclusion of greenwashing scores does not seem to significantly enhance the prediction of PE in future years. Future studies should consider incorporating additional variables to gain a deeper understanding of the relationships.

3.2. PEG and Greenwashing scores:

Based on the examination of the "PEG" variable's normality using the Kolmogorov-Smirnov and Shapiro-Wilk tests, it was found that the variable significantly deviates from a normal distribution (Kolmogorov-Smirnov test: $p < 0.001$; Shapiro-Wilk test: $p < 0.001$). Therefore, we can conclude that the "PEG" variable does not follow a normal distribution.

Total N	332	307	319	252	222
Mann-Whitney U	3.125.000	7.165.000	7.876.000	6.196.000	5.567.000
Wilcoxon W	3.335.000	8.818.000	9.587.000	7.907.000	7.163.000
Test Statistic	3.125.000	7.165.000	7.876.000	6.196.000	5.567.000
Standard Error	416.125	604.773	635.358	487.062	415.633
Standardized Test Statistic	.012	.066	.483	1.170	2.211
Asymptotic Sig.(2-sided test)	<.001	.947	.629	.242	.027

Table 22 : Mann-Whitney U test PEG with GW

To test the hypothesis, a Mann-Whitney test was conducted. The resulting p-values were found to be higher than 0.05, indicating that there is insufficient evidence to reject the null hypothesis (H0) that there is no significant difference in PBV, PE, and PEG ratios between companies with greenwashing scores and companies without greenwashing scores. Expect for 2022, where we can reject the null hypothesis. Overall, according to the 5 years, data does not provide strong support for the alternative hypothesis. (H1)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	Constant	0,379	0,114		3,312	0,001
	Beta.Y1	0,098	0,092	0,085	1,072	0,286
	lnGps	-0,151	0,032	-0,42	-4,69	<,001
	Payout.Y1	-0,599	0,158	-0,354	-3,792	<,001
	LINT(GW.1)	0,208	0,058	0,312	3,582	<,001

Dependent variable: PEG

Table 23: Multiple linear regression PEG with GW scores

In the year 2022, we observed significant results in our regression model. Analyzing this model, we discovered a negative relationship between payout and PEG ratio, which can be interpreted as follows. A higher payout ratio signifies that a greater proportion of the firm's earnings are being allocated to shareholders in the form of dividends, resulting in reduced retained earnings available for the company to reinvest in potential avenues for growth. As a result, the company's earnings growth rate may be lower because it has fewer funds available for reinvestment and expansion. With a lower earnings growth rate, the PEG ratio decreases, indicating that the stock may be relatively undervalued compared to its growth prospects. This may explain the negative growth rate as well.

In conclusion, based on the available data and statistical tests, we cannot confidently confirm a significant difference in PE, and PEG ratios between companies with and without greenwashing scores. Further investigation or the inclusion of additional variables may be necessary to obtain a more conclusive answer to the hypothesis.

3.3. PBV and Greenwashing scores:

Upon conducting the Kolmogorov and Shapiro-Wilk tests, we find that the associated p-values are below 0.001. These results strongly suggest rejecting the null hypothesis that the data follows a normal distribution. In other words, the data does not display the characteristics of a normal distribution. (Table, 24).

	2022	2021	2020	2019	2018
Total N	292	332	277	379	378
Mann-Whitney U	2.610.000	3187.000	5.327.500	13.735.000	14.258.000
Wilcoxon W	2.746.000	3377.000	5.957.500	15.565.000	16.028.000
Test Statistic	2.610.000	3187.000	5.327.500	13.735.000	14.258.000
Standard Error	165.015	291.289	261.908	568.488	536.906
Standardized Test Statistic	2.436	.733	4.171	7.326	9.029
Asymptotic Sig.(2-sided test)	.015	.464	<.001	<.001	.000

Table 24: Mann-Whitney U test PBV with ESG

In the presented table, none of our variables demonstrate statistically significant results, as all p-values exceed the 0.05 threshold. This indicates that none of the independent variables (X) significantly influence the dependent variable (PBV). Furthermore, through a comprehensive analysis, we ensured that the coefficients remained stable and consistent across different years.

Modèle		Unstandardized coefficients		Standardized coefficients		
		B	Erreur standard	Bêta	t	sig
1	Constant	3,36	0,579		5,799	<,001
	Beta.Y1	-0,392	0,461	-0,065	-0,852	0,395
	G.Y1	0	0,004	-0,004	-0,051	0,96
	PayoutY1	0,039	0,194	0,016	0,202	0,84
	ROE.Y1	-0,003	0,003	-0,08	-1,033	0,303
	GW.1	-0,837	0,398	-0,161	-2,102	0,037

Tableau 25: Multiple regression PBV with ESG

The analysis of the variables indicated no evidence of collinearity issues as all variance inflation factors (VIFs) were below the threshold of 5. This suggests that there are no concerns of multicollinearity in our model. However, when considering the statistical significance of the variables, we found that all the p-values exceeded the predefined significance level of 0.05. This suggests that none of the independent variables (x) have a significant impact on the dependent variable (Y PBV).

Additionally, we conducted a thorough examination to ensure the consistency of coefficients across different years, and we observed that the coefficients remained stable and consistent.

Model		Statistique de colinéarité	
		Tolérance	VIF
2022	Constante		
	Beta.Y1	0,976	1,025
	G.Y1	0,974	1,027
	Payout.Y1	0,975	1,025
	ROE.Y1	0,97	1,031
	GW.1	0,979	1,022

In conclusion, the results of the normality test revealed that the variables PE and PEG do not follow a normal distribution. Consequently, a non-parametric test was employed in our analysis. The Mann-Whitney U test was utilized to assess the differences in medians between companies with and without greenwashing scores. The results showed that for most of the years, the medians were significantly different for companies with greenwashing scores, leading to the rejection of H₀. Moreover, a regression model was examined, revealing that two significant variables, namely Geps (Growth in Earnings per Share) and Payout (Dividend Payout), exerted an apparent impact on the PE (Price-Earnings) ratio. Furthermore, an inverse correlation was shown between payout and PEG ratio, indicating that larger payout ratios are linked to lower PEG ratios. However, when examining PBV and greenwashing scores, none of the variables demonstrated statistically significant results, and the analysis revealed no significant impact of the independent variables on the dependent variable (PBV).

The study concludes that, based on the available data and tests, there is no sufficient evidence to confidently confirm a significant difference in PBV, PE, and PEG ratios between companies with and without greenwashing scores. Further investigation or the inclusion of additional variables may be required to obtain a more conclusive answer to the hypotheses. Additionally, the analysis confirmed the stability and consistency of coefficients across different years.

VI. Conclusions & Limits

First, as we stated in the literature review, investors are calling for more transparencies through ESG reports, especially in polluting industries. However, the number of sustainable companies in the market has increased, and it becomes more challenging for investors to compare them and determine which are genuinely delivering on their environmental commitments. (Honon et al., 2007). Investors are confronted with information asymmetries, and the absence of standardized frameworks presents challenges in assessing companies, as stakeholders have to rely on company signals that may not truly depict their ESG performance. (Lyon & Maxwell, 2011). In order to enhance our understanding of companies' performance through stock valuation, we conducted a study into the relationship between traditional valuation ratios and sustainability-related variables. The main objective of our research is to identify effective techniques for predicting future stock valuations, offering valuable guidance to investors on whether to invest in overvalued or undervalued companies. Our study primarily focuses on analyzing three essential stock valuation ratios: Price-to-Earnings (PE), Price/Earnings to Growth (PEG), and Price-to-Book Value (PBV).

The disquieting findings of applying multiple regression models fail to provide conclusive evidence of correctly estimating valuation ratios through the selected independent variables within the examined 5-year trend. Our attempts to validate the estimation process remain inconclusive despite the extensive efforts.

This could be explained by the fact that the price-earnings ratio and other earnings multiples, which are widely used in valuation, have the potential to be misused. The price-to-earnings (P/E) ratio, for example, is ultimately determined by the same basic reasons that determine a firm's worth in a discounted cash flow model. Expected growth, risk, and cash flow potential are among these factors. Companies with superior growth potential, lower risk, and higher payout ratios to shareholders are projected to have considerably higher P/E ratios than other companies, providing everything else remains constant. However, it is critical to recognise that these fundamental characteristics fluctuate across countries, all over time, and within businesses. When directly comparing multiples, failing to examine and account for these changes might lead to incorrect conclusions. As a result, it is critical to account for such

variances in order to avoid making incorrect decisions based merely on a comparison of valuation multiples. (Damadoran, 2013).

In our empirical study, we have encountered certain limitations related to the energy sector, known for its high volatility. The sector is heavily influenced by fluctuations in raw material prices, particularly due to the constant instability of fuel-based energy prices, impacting the overall global economy. (Cheng et al., 2023).

Furthermore, one fundamental drawback is that we perceive Europe as a single entity, ignoring the fact that separate countries within Europe have different objectives. Certain European countries continue to prioritize profit maximization over environmental activities, resulting in discrepancies in their policies. This disparity in techniques affects the overall study and may limit the ability to generalize our findings. (Soares et al., 2018).

Moreover, many companies in our analysis are part of the CAC 40 index, which does not disclose the same set of indicators as other companies. This lack of standardized data makes performance evaluation and comparative analysis more challenging and explains our inaccurate or biased results. (De La Brosse et al., 2013).

In addition, some corporations also disclose indicators that suit their stakeholder image. This can spread biased or incomplete information. Companies may greenwash by disclosing only favorable environmental statistics. These firms may perceive it as more cost-effective to engage in deceptive practices or hide unfavorable information rather than proactively addressing environmental concerns. (Gatti, 2021). To enhance the evaluation of ESG performance, it is advisable to replicate the research on ratings from additional suppliers such as MSCI, Refinitiv, and others, rather than solely relying on Bloomberg. Furthermore, collecting ESG or greenwashing scores for each company was not possible in our analysis. Understanding greenwashing has become increasingly important as firms strive to excel in ESG dimensions and present trustworthy ESG data to supplement their financial reports. The current challenges in ESG data disclosure include unaudited sustainability reports, lack of standardization in ESG data disclosure rules, and the absence of a global governing body to ensure the accuracy of reported ESG information. (Yu et al., 2020).

These limitations highlight the complexities involved in analyzing the energy sector and underscore the importance of carefully interpreting and contextualizing the data while considering the specific characteristics and challenges of each company in our study. Through our analysis, we face a lot of negative ratios which makes comparison more difficult. Those negative ratios can be explained by the fact that our world is facing an energy transition from fossil fuel-based energy sources to renewable and sustainable energy sources to reduce carbon emission and mitigate the impact of climate change.

VII. Recommendations

In order to overcome the limitations encountered in our study, we investigate alternative approaches. One potential method involves estimating the PE ratio using earnings before deducting R&D expenses. By excluding R&D expenses from the earnings calculation, the PE ratio would be based on a higher earnings figure, making stock appear more reasonably priced. However, this must be done with caution since it will not fully reflect the company's true financial picture and potential for future profitability. (Damodaran, 1995).

Another potential option concerning ESG valuation is to integrate ESG factors right from the very beginning of the valuation process. By incorporating these factors into a Discounted Cash Flow or income approach, our equity model, in which PE ratios hold importance, can yield enhanced outcomes. This integration can increase a company's transparency, resulting in more comprehensive and insightful findings. (Rodl & Partner, 2023).

Furthermore, in order to appropriately utilize greenwashing ratings, a company's ESG transparency symbol must be matched with its ESG performance (action), because greenwashing could prevent investors from successfully incorporating ESG data into their investment plan. (Yu et al., 2020).

Furthermore, during the past five years, our ratings of the multiples in terms of explanatory power have demonstrated a notable level of stability. However, financial measures used in the analysis such as Dividend Payout or Growth earnings per share, do not encompass all aspects of the company's financial health. It is worth considering that the inclusion of

additional covariates that capture country-specific indicators, such as GDP, interest rates, inflation and sovereign risk, could potentially improve the performance of our regression models and this will help normalize earnings per share. In addition, incorporating liquidity as a variable in regression analysis is crucial for controlling differences, understanding market dynamics, avoiding sample bias, and providing valuable insights for investors and risk management. (Salamanov, 2014)

In conclusion, a potential avenue for advancing our thesis would involve clustering correlations by country and incorporating macroeconomic variables. This approach has the potential to enhance the accuracy and stability of our analysis, reducing bias and improving the quality of the results. To achieve this, expanding the database and refining output accuracy would be necessary.

Despite the challenges, the importance of considering ESG factors in operational planning and company valuations should not be overlooked, as their significance is expected to grow in the future. Although our study provides a starting point for further investigation, more research is needed to fully implement these recommendations and gain a deeper knowledge of this topic.

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IX. Appendix :

Appendix 1: Descriptive Statistics.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
PEG.Y1	457	-6067.22	1057.35	-26.3730	385.87925
PBV.Y1	411	-4.31	12.82	.0405	.68157
PE.Y1	460	-200000.01	142857.14	-382.9817	12127.86909
ROE.Y1	392	-356.1531677246	118.5137252807	-6.94107596605	53.5921528474131
Payout.Y1	460	-6.9230770553	6.3636362897	.028640511532	.6479187789200
Beta.Y1	419	-2.7957137355	90	0	0
Geps.Y1	141	2,756.412353515	20,918.46289062	260.9278250983	2,239.53697942730
Disc.score.Y1	68	1.1769440174	75.1131668091	35.80472625353	18.443819468680
GW.1	22	-.05	2.13	1.2122	.52760
PEG.Y2	470	-139.98	1611.54	70.716	9.588.923
PBV.Y2	301	-24.70	1533.75	79.874	9.699.647
PE.Y2	414	-8620.69	854.70	-832.635	54.161.769
Disc.score.Y2	122	4.545.454.978.94	79.328.033.447.2	42.206.598.758.6	18.438.674.649.629
ROEY.2	358	2.870	65.600	97.500	.600
Payout.2	358	-	-	-	-
Beta.Y2	420	366.300.292.968.	198.484.268.188.	17.328.178.890.1	53.459.259.397.588
GW.Y2	60	750.000	476.000	74.300	.200
PEG.Y3	354	-5.12	84.63	.4738	522.847
PE.Y3	390	-	-	-	-
PBV.Y3	343	40.473.441.345.2	5.905.977.565.43	15.646.065.238.8	288.394.910.316.51
disc.score.Y3	114	99.500	3.660.000	93.400	6.000
ROE.Y3	346	-	-	-	-
Payout.Y3	390	-	-	-	-
BETA.Y3	421	76	470	5710	90
		-	-	-	-
		272.35964965820	155.85263061523	11.21410077320	50.5790381733230
		3100	4380	7372	56
		-	-	-	-
		3.99999999999998	21.500000838190	.2247076841778	1.59828710723975
		00	520	37	2
		-	-	-	-
		.48040548412593	9,223.372036854	37.63625078262	741.600724749900
		1	777000	4840	800

		-			
		9,223.372036854	9,223.372036854	196.3603843690	2,408.96975209105
Geps.Y3	119	777000	777000	65490	5000
GW.Y3	60	-1.11	1.71	.5878	.60558
PEG.Y4	371	-891.14	345.03	-.5683	52.51506
PE4	373	-15384.62	34482.76	23.0028	1983.67904
PBV.Y4	524	-168.09	108.81	-.5486	10.02697
		4.888.844.013.21	74.248.062.133.7	41.808.573.482.0	17.002.756.330.961
Disc.score.Y4	101	4.110	89.000	60.100	.500
		-		-	
		861.24511718750	249.13928222656	13.74752742604	76.6552397960717
ROE.Y4	319	0000	2500	0111	80
		-			
		26.923075909092	6.0000000000000	.0114659307911	1.53168157603844
Payout.Y4	373	436	51	61	3
		-			
		.15913309638502	9,223.372036854	37.26309860580	740.690982388821
BETA.Y4	422	6	777000	7060	200
		-			
Basic.EPS.Average.Y4	116	9,223.372036854	9,223.372036854	45.57116419796	1,406.99614801027
		777000	777000	2850	4500
GW.Y4	60	-1.33	1.78	.4881	.62719
PEG.Y5	341	-927.55	2258.32	11.1497	161.14038
PBV.Y5	523	-19.22	43.46	.0869	2.12996
PE.Y5	343	-2500.00	3067.48	-17.0995	296.20746
		5.8344230651855	74.248062133789	43.74960382485	16.0229866320776
Disc.score.Y5	81	47	060	0965	50
		-		-	
		526.74658203125	163.06871032714	15.61214534349	65.8260108064277
ROE.Y5	307	0000	8440	5076	20
		-			
		4.6351350045186	3.6371440039655	.0964343838425	
Payout.Y5	343	90	30	54	.550537628173597
		-			
		.02598988410661	9,223.372036854	37.13468793273	739.813909587607
BETA.Y5	423	5	777000	0074	000
		-			
		1,055.793090820	4,975.474609375	49.59299624934	504.663271410584
Geps.Y5	107	312500	000000	0960	340
GW.5	59	-1.69	2.10	.3063	.67383

Appendix 1: Descriptive statistics

Appendix 2 : Multiple regression PEG and greenwashing scores

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
2022	Constant	6,526	1,488		4,386	<,001		
	Beta.Y1	-1,644	1,114	-0,07	-1,477	0,141	0,987	1,013
	Geps.Y1	0,022	0,009	0,128	2,636	0,009	0,955	1,047
	Payout.Y1	0,595	0,667	0,042	0,893	0,372	0,997	1,003
	GW.1	-1,888	0,913	-0,1	-2,067	0,039	0,962	1,04
2020	Constant	3,571	2,355		1,517	0,13		
	BETA.Y3	-2,174	2,463	-0,05	-0,882	0,378	0,918	1,09
	Geps.Y3	0,046	0,025	0,103	1,809	0,071	0,907	1,103
	Payout.Y3	3,241	1,403	0,129	2,311	0,021	0,942	1,061
	GW.3	1,582	1,356	0,066	1,167	0,244	0,922	1,084
2019	Constant	4,89	1,689		2,894	0,004		
	BETA.Y4	-3,504	1,753	-0,107	-1,999	0,046	0,968	1,033
	Geps.Y4	0,106	0,027	0,204	3,838	<,001	0,991	1,009
	Payout.Y4	0,236	0,29	0,043	0,812	0,418	0,991	1,01
	GW.4	-0,541	1,05	-0,028	-0,515	0,607	0,968	1,034
2018	Constant	2,323	1,323		1,756	0,08		
	BETA.Y5	-1,278	1,117	-0,053	-1,144	0,253	0,997	1,003
	Geps.Y5	0,074	0,014	0,246	5,247	<,001	0,99	1,01
	Payout.Y5	2,119	0,624	0,159	3,396	<,001	0,989	1,011
	GW.5	-0,597	0,685	-0,041	-0,872	0,384	0,998	1,002

Appendix 2: Multiple linear regression PE with GW

Appendix 3: Multiple regression PBV and greenwashing scores.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
2022	(Constant)	0,379	0,114		3,312	0,001
	Beta.Y1	0,098	0,092	0,085	1,072	0,286
	InGps	-0,151	0,032	-0,42	-4,69	<,001
	Payout.Y1	-0,599	0,158	-0,354	-3,792	<,001
	GW.1	0,208	0,058	0,312	3,582	<,001
2020	(Constant)	0,208	0,239		0,869	0,386
	BETA.Y3	0,337	0,235	0,119	1,435	0,153
	InGps3	-0,104	0,043	-0,202	-2,429	0,016

	Payout.Y3	-0,065	0,229	-0,023	-0,282	0,778
	GW.3	0,04	0,115	0,029	0,351	0,726
2019	Constant	0,317	0,164		1,934	0,056
	BETA.Y4	-0,005	0,156	-0,004	-0,034	0,973
	lnGps4	-0,048	0,036	-0,143	-1,324	0,188
	Payout.Y4	0,107	0,163	0,072	0,658	0,512
	GW.4	-0,008	0,089	-0,009	-0,086	0,931
2018	(Constant)	0,386	0,237		1,628	0,107
	BETA.Y5	0,032	0,247	0,015	0,131	0,896
	lnGps5	-0,101	0,041	-0,272	-2,466	0,016
	Payout.Y5	0,005	0,238	0,002	0,021	0,984
	GW.5	0,056	0,109	0,056	0,51	0,612

Appendix 3: Multiple linear regression PEG with GW

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