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# Impact of Environmentally Sustainable Practices on Corporate Financial Performance

## Empirical Findings from Portuguese SMEs

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## Abstract

Nowadays, we are surrounded by environmental, social, and economic challenges, which have triggered the increasing interest from governments, businesses, and individuals in sustainability. Furthermore, the evidence of the environmental repercussions caused by corporations has intensified the pressures from external and internal entities to shift towards more sustainable businesses. This study aims to assess the relationship between financial performance and the implementation of environmentally sustainable practices. The analysis focuses on Portuguese small and medium enterprises (SMEs) between 2010 and 2017 and intends to understand if financial performance can be an attractive incentive for SMEs to invest in greener practices. A quantitative approach was employed, using a questionnaire database from *Instituto Nacional de Estatística* (INE). The findings indicate mixed conclusions depending on the measure of financial performance considered and also suggest statistically significant relationships between most of the sustainability and financial performance measures. A negative linkage was concluded between environmental performance measured by green investments and financial performance, when measured as the ROA, ROE, sales growth or assets growth. However, when measuring sustainability as energy efficiency or green hiring the findings demonstrate a non-statistically significant but positive correlation with financial performance. Besides, there is a direct relationship between Debt Ratio and green investing, and overall, a company with a better performance regarding the environment is expected to have higher leverage.

**Keywords:** Sustainability; Environmental Performance; Accounting; Corporate Financial Performance; Multiple Linear Regression Models

## Resumo

Atualmente, estamos rodeados de desafios ambientais, sociais e económicos, que têm vindo a despoletar o crescente interesse dos Governos, empresas e indivíduos por temas de sustentabilidade. Para além disso, a clara evidência das repercussões ambientais causadas pelas empresas tem intensificado pressões de entidades externas e internas para tornar os negócios mais sustentáveis. Este estudo pretende avaliar a relação entre a *performance* financeira e a implementação de práticas de sustentabilidade ambiental. Com um foco nas pequenas e médias empresas (PMEs) portuguesas entre 2010 e 2017, intenta-se perceber se a *performance* financeira pode ser um incentivo atrativo para as PMEs investirem em práticas mais verdes. O estudo teve uma abordagem quantitativa, utilizando uma base de dados de questionários do Instituto Nacional de Estatística (INE). Os resultados indicam conclusões mistas, dependendo da medida de *performance* financeira considerada e sugerem ainda relações estatisticamente significativas entre a maioria das medidas de sustentabilidade e *performance* financeira. Concluiu-se uma ligação negativa entre *performance* ambiental avaliada pela dimensão dos investimentos ambientais e a *performance* financeira, enquanto retorno dos ativos, retorno do capital, crescimento de vendas e crescimento de ativos. No entanto, considerando a sustentabilidade como a eficiência energética ou como a contratação de trabalhadores com responsabilidades ambientais, os resultados, apesar de demonstrarem uma ligação não estatisticamente significativa, revelam uma relação positiva com a *performance* financeira. Ainda, existe uma relação direta entre o Índice de Dívida e o investimento verde e, em geral, uma empresa com melhor desempenho em relação ao meio ambiente terá maior alavancagem.

**Palavras-chave:** Sustentabilidade; Desempenho Ambiental; Contabilidade; Performance Financeira Empresarial; Modelos de Regressão Linear Múltipla

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*"Ce qui embellit le désert, c'est qu'il cache un puits quelque part. "*

Antoine de Saint-Exupéry, Le Petit Prince

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# 1 Introduction

There is an emerging interest in various research fields for sustainability, driven by the raising awareness for the environmental, social, and economic issues we face today. These parameters constitute the three pillars of sustainability. Moreover, academics have been exploring the concept of *sustainability* from both macro and micro perspectives. The latter involves the analysis of specific operators in the economy, namely companies, governments, or individuals. Eventually, the clear evidence of the social disruptions and the environmental repercussions caused by corporations, namely the emissions resulting from industrial production, which contribute to speeding Climate Change (Nordhaus, 2019), have encouraged researchers to assess this topic from a corporate view.

Porter and Kramer (2006) define corporate sustainability as "meeting the needs of a firm's direct and indirect stakeholders, without comprising its ability to meet the needs of future stakeholders", implying that corporations' responsibilities extend beyond the company and that companies should be responsive and held accountable for the consequences of their activities. Additionally, environmental and societal issues raise significant economic implications for firms in several sectors, which urges the need to shift towards a sustainable economy. As a result, we observe many companies transitioning to more sustainable business models, complying with more environmentally friendly production processes of services and goods and integrating social responsibility within their strategies.

This article intends to provide positive insights into understanding the financial implications of implementing sustainable practices in Portuguese companies. There are few studies about this relationship for the specificity of this market (Madueño, Jorgea, Conesa, & Martínez-Martíneza, 2016). In Portugal, as in the rest of the European Union, over 99% of firms are small and medium enterprises (SMEs[1]), whereas most of the literature on this subject focuses on traded companies, usually larger enterprises. However, despite the lack of research on this specific topic, the shift of SMEs towards more sustainable practices is crucial to reduce environmental impact due to their significant collective weight on the overall economy

[1] According to the European Commission, SMEs are “enterprises employing fewer than 250 people with either a turnover of less than 50 million euros, or a balance sheet total of less than 43 million euros. They are broken down further into micro, small, and medium enterprises, depending on their turnover, balance sheet total, and levels of employment.”

(Patricio, Axelsson, Blomé, & Rosado, 2018), even though individually their importance might seem marginal.

For a long time, businesses did not perceive adapting themselves for environmental purposes as performance improvements (Walley & Whitehead, 1994) or as a profitable strategy. Nowadays, however, companies are aware of the repercussions of their production activities in the environment and society and are conscious that shifting towards more sustainable practices can positively impact their overall performance. In addition, consumer preferences are moving to products and services developed sustainably, and companies are adapting to these new social demands. Consequently, being sustainable represents opportunities for businesses and potentiates wealth maximisation. Nonetheless, it is crucial to understand that the shift towards sustainable practices to safeguard the society and the environment by mitigating the effects of climate change has to be a collective effort.

Moreover, as ethical reasons may not be enough for businesses to implement sustainability practices, it is pertinent to understand whether appropriate incentives for companies may potentiate these transitions and the existence of potential strategies for governments, individuals, and other businesses. Subsequently, the potential assessment of a positive relationship between corporate financial performance and the implementation of sustainability practices within SMEs, overcoming those barriers, can help enhance incentives for these firms to invest in new technologies and personnel to transform their business strategies and processes to become more sustainable.

The United Nations established the *Sustainable Development Goals*, which pushes businesses to implement sustainability practices (United Nations, 2015). In addition, the European Union (EU) launched strategies to strengthen the relationship between the economy, society, and the environment, promoting sustainable businesses (European Commission, 2018). Furthermore, aligned with the Paris Climate Agreement, many countries, including the EU member states, are committed to producing zero net greenhouse gas emissions by 2050. Therefore, we observe governments promoting the shift towards greener practices and businesses and individuals' consumption of more environmentally friendly products and services. However, there is a tendency to concentrate efforts to promote sustainable practices for larger companies. For instance, only more recently, the European Commission released the *Eco-innovation for SMEs* (Science for Environment Policy, 2020), intending to promote sustainable practices for "eco-innovations" by SMEs to shift to a low-emissions, low-carbon, and circular economy.

To contribute positively to the theoretical framework of environmental practices and financial performance, this analysis used a database built by combining two statistic operations by *Instituto Nacional de Estatística* (INE). The first one is based on a survey on the implementation of environmental practices, called the "Inquérito às Empresas Gestão e Protecção do Ambiente" (IEGPA) – Management and Environment Protection Companies' Surveys. The second includes the accounting data for each company, and the operation is defined as "Sistema de Contas Integradas das Empresas" (SCIE), which translates from Portuguese to Company's Integrated Accounting System.

Furthermore, a multiple linear regression model (MLRM) was employed to conduct the empirical analysis to explore the relationship between corporate financial performance and environmental practices. Five models were built considering various definitions of financial performance used as the dependent variable for the models. These included the Return on Assets, Return on Equity, Sales Growth, Debt Ratio and Assets Growth. In addition, a lead year between the measures of financial performance and the sustainability practices was considered since it is expected that the greener practices implemented would take at least one year to impact the companies' financial performance. Moreover, ten variables for sustainability were built, including seven dummies, which represent the implementation or not of environmental practices, and three quantitative variables, including a weighted measure of green investments, a weighted measure of workers with responsibilities for the environment and a measure of efficient usage of energy by companies. Finally, the models were regressed in different scenarios to control some variables' effects in the outcome. These include no fixed effects, year fixed effects, sector fixed effects, year and sector fixed effects and firm fixed effects.

The results are mixed depending on the measure of financial performance considered for each model. We also found statistically significant relationships between most variables of sustainability and the accounting variables used to measure financial performance.

Green Investments was found to be negatively linked with financial performance when measured as ROA, ROE, sales growth, and assets growth. The variable coefficients also evidenced a statistically significant relationship with financial performance. On the whole, increasing green investments out of total investments harms Return on Assets, Return on Equity, Growth of Sales and Growth of Assets. In contrast, the findings uncovered the opposite relationship between Green Investments and Debt Ratio, confirming that a company will be

more prompt to increase its leverage to allocate a bigger percentage of its investments towards environmental applications.

Additionally, despite not being statistically significant for all the models, overall, the findings evidence a positive relationship between Energy Efficiency and financial performance, as well as Green Hiring and financial performance. Therefore, companies that make more efficient usage of energy, or that increase the number of workers with environmental responsibilities out of total workers tend to enhance their financial performance within one year.

The research is organised in five sections, including the introduction. Section II reviews previous literature on sustainability and the potential relationship between sustainability practices and financial performance, specifically for small and medium enterprises. Section III describes the data, descriptive statistics and the main variables used throughout the research. It also examines the methodology and explains how the variables were built and the data treated as well as how the regressions were modelled. Section IV describes the results obtained from the analysis and provides plausible reasons and explanations for these results. Finally, Section V concludes, presenting potential limitations and shortcomings of the empirical approach and potential future research.

# 2 Literature Review

## *2.1 Sustainability and Sustainable Development*

The broad concept of "sustainability" has become the centre of interest for different levels, including academic and business research, as it can have implications in various dimensions. There can be several definitions or perspectives for this term, including protecting the environment and the ecosystems, or even social or economic considerations. Hence, in this sub-section, we aim to discuss some definitions and explain the approach for sustainability.

Even though the explicit usage of the term "sustainability" is relatively recent as an economic, environmental, and societal principle, throughout history, humans have always been worried about the future of resources, such as food and water.

In the 19th century, the term "sustainable yield" started being used in the English vocabulary and was the literal translation of the German word *Nachhaltigkeit*[2]. However, before that, documents show little evidence of the word's usage. Moreover, the perception of the negative repercussions of the Industrial Revolution prompted the utilisation of the term and the rise of several movements supporting environmental protection. These repercussions included ecological concerns, such as pollution, the destruction of landscapes, the depletion of natural resources, and societal issues, namely diseases, overpopulation, and wealth disparity.

By the end of the 20th century, the awareness for responsible usage of resources was more evident and grew intensively ever since. As a result, the concept of *sustainability* became a 'buzzword', referred to in numerous articles, books, and publications and has become the core of many conferences, meetings, and political actions.

In 1987, the United Nations Brundtland Commission published their report, *Our Common Future*, which included the definition of 'sustainable development' as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." This is one of the most universally accepted and quoted definitions of *sustainable development*; nonetheless, it allows ambiguous interpretations and different perspectives concerning *sustainability*. Consequently, a series of international conferences occurred to discuss sustainability, mainly analysed as an environmental cause. These translated into several

[2] The German term was tracked to have been firstly used in 1713 in a German book regarding harvesting - The 'Sylvicultura oeconomica'. It was used as an idea of not 'harvesting more than the forest could regenerate'.

actions and programmes aiming at sustainable development. More recently, in the 2005 World Summit of the United Nations, the efforts to enhance sustainability promoted the integration of three components, including environmental protection and economic and social development, further considered the three pillars for *sustainability*. The inclusion of these three dimensions expanded the definition of sustainability beyond environmental concerns.

In 2010, the Academic Advisory Committee for Sustainability at the University of Alberta defined *sustainability* as "the process of living within the limits of available physical, natural and social resources in ways that allow the living systems in which humans are embedded to thrive in perpetuity" (University of Alberta, 2013).

### *2.2 Implementation of Sustainability in the Business Model of Corporations*

There is a growing interest in literature to include sustainability in Corporations' Business models. These must be held accountable for their activities' repercussions on the environment and society. However, it is not a recent topic of interest. According to Milton Friedman (1970), the only social responsibility of businesses was to "increase profits". Therefore, companies should focus only on maximising the gains for their shareholders. Contrarily, many academics defended other doctrines that include a broader group of stakeholders and not solely the shareholders. McDonald and Puxty (1979) were pioneers in supporting that corporations should be available for shareholders and operate within society. On that account, companies carry responsibilities towards society, and there should be a shift for increased accountability over their actions. We expect organisations to act as "better citizens" (Orsato, 2006). Cruz et al. (2006) argue that companies should adopt sustainability activities as a core corporate strategy to achieve long-term benefits. Nevertheless, there could still be numerous reasons to explain why companies engage in more sustainable practices. Artiach et al. (2010) analysed US firms to understand the incentives to engage in sustainability practices utilising the Dow Jones Sustainability World Index (DJSI) as a proxy. They demonstrated that the level of growth, profitability and firm size are significant factors, but contrary to their hypothesis, generating higher free cash flows and having lower leverage was not substantial to having higher sustainability performance.

Some academics have associated Sustainability and Corporate Social Responsibility (CSR) and have advocated that these are synonyms (Marrewijk, 2003). Barnett (2007) describes CSR as "any discretionary corporate activity intended to further social welfare". According to Aras and Crowther (2008), corporate sustainability is built on efficient transformation processes and

equitable effects. In addition, Belu (2009) perceives it as a transformative process: we modify the inputs and transform them into environmental and socially *sustainable* outcomes. Porter and Kramer (2006) define corporate sustainability as meeting the needs of a firm's direct and indirect stakeholders and simultaneously not compromising the ability of the firm to meet the needs of its future stakeholders. Furthermore, they favour the idea that, even though companies should enhance their activities' environmental and social impacts, corporations should direct their efforts to the business and strategy. Accordingly, the concept of *sustainability* for business practices will be considered as the implementation and adoption of procedures and operations that mitigate the adverse effects of their activities on society and the environment, to which they are accountable and responsible, but that also focuses on promoting positive development.

Goyal et al. (2013) contend that all research regarding corporate sustainability relies on classifying three parameters: social, environmental, and economical. Nikolaou et al. (2019) advance the multiple applications and dimensions for corporate sustainability, such as environmental, financial/economic performance, corporate governance, or social impact, reflected in the variety of frameworks applied to measure corporate sustainability literature.

Previous research has shown the inexistence of a universally accepted framework to measure sustainability. Some of these frameworks consider each parameter or dimension in isolation. Concerning the environmental-based frameworks, some academics have included carbon emissions, biodiversity and ecosystems loss, global warming, and waste management in the metric. Veleva et al. (2003) use a five-level indicator of sustainability based on environmental dimensions to measure the progress towards sustainable production. Ilinitch et al. (1998) consider existing metrics to assess their appropriateness to measure corporate environmental performance. Concerning the socially based frameworks, Wood (2010) applies existing frameworks of corporate social performance into a theoretical context. Delmas and Chen (2011) propose a new methodology to compute Corporate social arrangements based on relative efficiencies of companies. Finally, Schaltegger et al. (2012) propose an innovative business model framework that promotes social and environmental actions to maximise wealth creation to compute economic sustainability. The main contribution to the existing literature is the understanding that the business models' transformations must be ongoing and continuous processes, as inherent elements of the business activities. The commitment to business model innovation aims to exploit the full potential of the business case drivers, which contribute positively to sustainable development and the success of businesses. Some academics make critiques on studies that proxy sustainability by applying uni-dimensional indicators. Rowley

and Berman (2000) argue that a one-dimensional model cannot represent the entire picture for sustainability, complicating the potential comparison of different studies.

In this sense, many studies focus on combining the three dimensions, creating multidimensional frameworks. For example, Veleva and Ellenbecker (2001) provide a complete framework for sustainability based on sustainable production indicators. The implementation of the framework occurs at different levels within a firm, and they provide detailed guidance for applying the methodology and adaptation to production-specific indicators. Similarly, Labuschagne et al. (2005) propose other criteria to integrate each dimension in the framework for effectively addressing business sustainability at the operational level for the manufacturing sector. In addition, it is also possible to form indicators for sustainability based on composite indexes. However, they consider these subjective: they use unsystematic methods to implement the indicators, and aggregation problems arise from combining different units and estimates for weight factors to integrate the individual dimensions into a single index (Sridhar & Jones, 2013).

### *2.3 Measuring Financial Performance*

Financial performance is a subjective quantifier of a firm's financial "health" over a certain period (Investopedia, 2021) and is used to compare similar firms or aggregated sectors. Further, there are several forms to calculate financial performance and several perspectives to assess it since it can be computed based on market- or accounting-based metrics.

On the one hand, academics gauge financial performance as a measure of profitability by evaluating return on assets, return on investment, return on equity, gross profit margin and sales growth; of liquidity based on the debt ratio, quick ratio or working capital; and of solvency, with the current ratio (Vijfvinkel, Bouman, & Hessels, 2011). On the other hand, others assess it from a growth perspective, for example, measuring assets, sales, and market share growth. Furthermore, some studies estimate financial performance using Tobin's Q, Earnings Yield, or the stock returns from a market stance. Finally, many defend that financial performance should not be analysed from a single measure but as an aggregate, through the combination of several measures (Jayeola, 2015).

### *2.4 Financial Performance and Implementing Sustainability Practices*

There can be different reasons to support the implementation of sustainability practices in businesses that could have implications for the financial performance of firms. Hart (1995) defended that with the increased awareness for the environment safeguard and preventing

pollution, sustainable development would be a source of competitive advantage. These competitive advantages can emerge from either cost reductions or differentiation/reputation. Regarding the cost advantages, Porter and van der Linde (1995) pointed out that pollution results from inefficient production processes, as it represents economic waste. Moreover, reducing pollution is a way to implement "cost savings" in the manufacturing process, as the process requires fewer inputs, which then becomes more efficient (Schmidheiny, (1992); Dechant and Altman, (1994)). Differentiation concerns the product characteristics, which reflects better sustainable practices. The most significant advantages resultant from differentiation are the ability to increase selling prices and enlarging the units sold from the product/service as a consequence of a better reputation. Both lead to higher revenues keeping all else constant (Dechant and Altman, (1994); Stead and Stead, (2008)).

Epstein and Roy (2001) advance that sustainability represents an opportunity for firms to align their daily business operations with governments' regulations since complying with these limitations and requirements generates the necessary conditions to reach vital sustainability goals. However, there can be negative implications of implementing sustainability practices on businesses. When including sustainable practices, firms could be incurring in higher expenses which interfere with the purpose of firm value maximisation (Jensen, 2002). Also, the trade-off theory suggests a negative impact of the implementation of these practices to direct the resources towards sustainable activities which are less profitable or even not profitable at all (Edrikat et al., (2014); Rivera et al., (2017)).

Thus, despite having a vast number of academic works conceptualising the potential relationship between sustainability and financial performance, there is no certainty regarding the nature, the signal, or the significance of this relationship as the findings that emerged are mixed. Some plausible explanations for the disparity in the conclusions would include the variety of operationalisations of the variables, namely, to measure sustainability and financial performance; the conceptualisation of the linkage when defining the dependent and independent variable; the variation in the models applied to estimate the relationship; and the geographical area where the study focus.

Financial performance can be measured using either accounting or market information. Hence, according to Lee et al. (2015), using accounting-based measures as proxies of financial performance, there is no link between sustainability and financial performance. Contrarily, computing financial performance on market-based figures results in a statistically positive

relationship between financial performance and sustainability. They developed a model of fixed effects, assessing a 362 firms' dataset from 2003 to 2010, to investigate how environmental R&D – which is a measure that incorporates firms' environmental commitment – affects CFP. They find that the carbon emissions diminish the value of firms and that firms with negative environmental performance are "punished" by the market more than the ones with positive performance are beneficiated.

López et al. (2007) concluded that firm performance, computed as the growth of profit before tax (PBT), was negatively correlated in the short term with sustainability. They analysed a sample of 110 companies, using variation between two groups and considered the Dow Jones Sustainability Index (DJSI) and Dow Jones Global Index (DJGI) as sustainability performance measures. His study explains a link between the Dow Jones Sustainability Index (DJSI) in corporate social responsibility policies. Atan et al. (2018) appraised the potential impact of environmental, social and governance (ESG) factors on various financial indicators, including profitability, cost of capital and firm value for public companies in Malaysia from 2010 to 2013. According to their study, sustainability factors do not impact profitability nor the firm's value individually or combined. Nevertheless, the impact on the cost of capital is significant as combined, whereas individual elements do not have any significant effect.

Aupperle et al. (1985) highlighted non statistically significant linkages between sustainable development and financial performance employing a factor analysis. Consequently, having a committee for corporate social responsibility does not guarantee that a firm is more profitable than another. Besides, Nunes et al. (2012) pointed to the inexistent differences between sustainable companies and the others in terms of accounting variables, namely ROA, ROE, asset turnover, and net margin, regarding the energy and banking sectors. The analysis employed the Mann-Whitney test, a non-parametrical statistical hypothesis test that assesses the independence of samples using the method of the variation between two groups.

Ameer and Othman (2012) find significant higher financial performance, represented by sales growth, return on assets (ROA), profit before tax (PFT) and cash flow from operating activities, for companies that emphasise sustainable practices. Also, their findings suggest that the higher financial performance of sustainable companies has been increasing over the sampled timeframe and a bi-directional relationship between corporate financial performance and corporate social responsibilities.

Marti et al. (2015) explore the impact of corporate social strategies on corporate financial performance in different time horizons – short and long run. They apply a panel data methodology of random and fixed effects, which is improved for heteroskedasticity, serial correlation, and cross-sectional dependence. The measures of financial performance include ROA, ROE and Tobin's Q. Overall, their findings propose higher financial performance for companies that promote sustainable development.

Madaleno and Vieira (2020) examined a sample of Portuguese and Spanish listed companies between 2010 and 2017 to understand the implications of several factors on the quality of environmental disclosure, using the GMM model. First, they find that sustainability initiatives increase financial performance and the other way around. However, they understand that the implementation of sustainability practices is highly dependent on the company's financial situation, which raises several questions regarding the effectiveness of existing regulations that force companies to engage in specific sustainability-focused measures.

Pham et al. (2021) show a positive relationship between sustainability and financial performance, using both market- and accounting-based measures, including earnings yield, ROA, ROE and ROCE for 116 listed Swedish companies in 2019. Nevertheless, their results were inconclusive for Tobin's Q's market-based measure. They measured sustainability based on several indicators, including the Dow Jones Sustainability Index, the compliance with Global Compact, the Global Reporting Initiative - represents a company's involvement in sustainability-related initiatives -, and the disclosure of Corporate Social Responsibility information.

Yilmaz (2021) revealed a positively significant linkage between financial and sustainability performances. Nonetheless, these results were only effective when accounting for the total ESG score, as the individual scores for each dimension (environmental, economic, and social) produced insignificant results.

Endrikat et al. (2014) reviewed 149 studies using a meta-analytic analysis. They concluded that the relationship between financial performance and environmental engagement is positive and partially bidirectional and can become more substantial given a proactive strategic approach. Pan et al. (2014) proved a positive impact of sustainability on a firm's profits, which is proxied by ROA, ROE and Earnings per share (EPS), in their analysis on 228 Chinese mineral firms. Hang et al. (2019) reviewed 142 studies about the relationship between financial and environmental performance and the potential causality effects. Their results showed that the

causality effect is dependent on the time frame considered and that the financial resources the firm owns can improve environmental performance for the short run but has no effect in the long run. Finally, a review paper from Alshehhi et al. (2018) identifies that 78% of the 132 documents considered in the analysis reported a significant positive relationship between financial performance and corporate sustainability. However, they concluded that literature focuses more on one dimension of corporate sustainability, measured by a narrower CSR, and focuses less on the environmental and economic dimensions. Also found that studies focused on developed countries were scarce.

### *2.5 Sustainability Practices in SMEs and Impact on Financial Performance*

The concept of Small and Medium Enterprises encloses a vast scope of definitions and measures that vary from country to country or economic zones. Therefore, this report will consider the European Union definition for SMEs, defined in the EU recommendation 2003/361 (European Commission, 2021).

Accordingly, two main factors characterise Small and Medium Enterprises (SMEs): (i) the staff headcount and (ii) either the total balance sheet or the turnover. The following table defines the thresholds that apply to individual firms:

**Table 1: SMEs definition according to the European Commission**

| Company Category | Staff Headcount | Turnover | or | Balance Sheet Total |
|---|---|---|---|---|
| Medium | < 250 | ≤ €50M | | ≤ €43M |
| Small | < 50 | ≤ €10M | | ≤ €10M |
| Micro | < 10 | ≤ €2M | | ≤ €2M |

SMEs constitute over 99% of all the businesses in the EU. Furthermore, declaring an enterprise to be an SME has benefits, as it reduces fees for EU administrative compliance and enables support programmes for the companies. Additionally, according to the World Bank, access to financing sources is crucial for these businesses to grow (The World Bank, 2020). Hence, SMEs are more improbable to obtain bank loans than larger companies and usually depend on internal funds or cash from family or friends to launch and initialise businesses.

Regarding the implementation of sustainability practices by SMEs, some academics have identified significant barriers, namely: (i) perception of individual insignificance, (ii) lack of expertise to address the environmental problematics and (iii) high cost of environmental investments that do not have financial benefits (Ammenberg & Hjelm, 2003). In this sense, it

is essential to incentivise SMEs to invest in "greener economies", thus overcoming those potential barriers. Cantele and Zardini (2019) tested a model for implementing sustainability practices in businesses. It is composed of a multistep process that combines internal and external pressures and opposing forces to moderate it: the negative influence of the perceived barriers and the positive effect of the recognisable benefits of sustainability. The study corroborates the relevant contributions of the perceived advantages and a negligible effect of the perceived barriers. Moreover, in a study by Crossley et al. (2021), it is shown that social engagement, reputation/image, differentiation, and environmental practices strongly impact SMEs performance. These findings highlight an extension of the moral purpose of companies going greener and showcase relevant incentives for adopting sustainable practices within businesses from a pragmatic perspective.

Bartolacci et al. (2020) conducted a literature review for a 20-year dataset focused on sustainability and financial performance of small and medium enterprises. They verified a positive relationship between sustainability practices and the performance of SMEs. Additionally, this study demonstrates that the interest in researching CSR in SMEs only became more prominent starting from 2008; it also reveals a lack of focus on specific kinds of sustainable behaviours, such as environmental, societal, or ethical and their positive impact on financial performance. Ultimately, they advance how future research results can positively impact the economic system and extend their utility beyond managers and companies. Policymakers can take advantage of the results by developing strategies and incentives to improve companies' sustainability performance. Conclusively, Vijfvinkel et al. (2011) addressed the relationship between environmental sustainability and the financial performance of SMEs regarding profit and revenue development, using data from 337 Chinese and Dutch firms. They uncovered a significant positive association between firm performance and environmental sustainability; however, the three different environmental sustainability indicators exhibited contrasting relationships with the two performance measures.

# 3 Data and Methodology

The following sub-sections describe the target population, including the database sources; the detail of the variables employed in the analysis; the database's treatment; the descriptive statistics; and the development of the regression models used for the analyses.

## *3.1 Target Population*

The target population used for this analysis includes active companies exerting activities related to producing goods and services in Portugal for each year between 2010 and 2017. Insurance and financial companies and all entities not oriented to the market, namely not-for-profit organisations, Public Administration and Financial entities were excluded. Therefore, the dataset includes the following industries and for each industry the following number of obeservations:

**Table 2: Observations for each Industry**

| Industry | N | Industry | N |
|---|---|---|---|
| *Computer, Electrical Equipment* | 1 418 | *Electricity, Water and Gas* | *1 671* |
| *Extractives* | 1 783 | *Food, Drinks and Tobacco* | 4 486 |
| *Leather and Leather Products* | 1 457 | *Metallic Products* | 2 973 |
| *Metallurgical* | 700 | *Minerals, non-metallics* | 1 968 |
| *Oil and Chemicals* | 1 360 | *Other Transforming Industries* | 5 039 |
| *Paper and Paper Paste* | 1 842 | *Rubber and Plastics* | 1 402 |
| *Textiles* | 4 715 | *Transport Material* | 1 600 |

The database is divided into two parts based on the sources used to withdraw the information. First, the sustainability data was extracted from yearly surveys made to each Portuguese company regarding the implementation of sustainability practices. The survey was conducted by "Instituto Nacional de Estatística" (INE) – The Portuguese Statistics Institute. The statistics operation is defined as the "Inquérito às Empresas Gestão e Protecção do Ambiente" (IEGPA) – Management and Envrionment Protection Companies' Surveys. This data includes both qualitative and quantitative values. Second, the financial data from the companies was also collected by INE, based on the company's financial statements from 2010 to 2017. The INE defined this statistics operation as the "Sistema de Contas Integradas das Empresas" (SCIE) – Company's Integrated Accounting System.

## *3.2 Financial Performance*

Financial performance is a way to evaluate a company's financial position or financial "health". Howbeit, the conceptualisation of financial performance varies among academics, as it is used to evaluate the firm's position in different categories, including its assets, leverage, profitability, or equity. Also, it can be measured based on accounting or market data. Nevertheless, since the survey database is constituted primarily by small and medium enterprises which are not public, it would not be appropriate to proxy financial performance in market figures as this data is non-existent for those firms. Consequently, only accounting measures were considered for this purpose for financial performance. Accordingly, this information was withdrawn from the financial statements as mentioned above.

Financial performance was computed in accounting terms for three categories: profitability, leverage, and assets. Relatively to profitability, the study will incorporate the return on assets (ROA), which represents the relative profitability regarding the usage of assets, the return on equity (ROE), that measures the firm's management of debt; and sales growth, that evaluates the yearly change of the revenues generated. Furthermore, the debt ratio was used as a leverage measure and the assets' growth was considered to evaluate the firm's assets position. Table 3 describes the computation of each variable. In addition, it is appropriate to underline that all these measures capture the short-term performance, as they are accounting measures.

**Table 3: Financial Performance Measures**

| | | |
|---|---|---|
| Profitability | ROA | Return on Assets = Net Income / Total Assets |
| | ROE | Return on Equity = Net Income / Shareholders' Book Equity |
| | Sales Growth | Sales Growth = [Sales(t) / Sales(t-1)] - 1 |
| Leverage | Debt Ratio | Debt Ratio = Total Debt / Total Assets |
| Assets | Assets Growth | Assets Growth = [Assets(t) / Assets(t-1)] - 1 |

## *3.3 Sustainability Indicators*

Sustainability is a broad concept that can encompass several dimensions. Besides, universally accepted standards for sustainability and models to measure a company's progress regarding the implementation of sustainability practices are still inexistent. However, academics have applied non-quantifiable sustainability models (Székely & Knirsch, 2005) and indices (López, Garcia, & Rodriguez, 2007).

The survey focused on an environmental dimension, primarily assessing how companies adapt their businesses to become more green-friendly. Thus, the environment will be the central independent variable. Environmental Sustainability is intended to be quantified based on the firm's performance regarding implementing these practices. Moreover, considering the review paper from Alshehhi et al. (2018), this study is expected to contribute to the literature for developed countries, as it is centred on the environmental dimension of Portuguese SMEs.

The survey database incorporates extensive parameters on companies' adoption of green practices. The database is divided into two different fields: (i) the examination of the action/adoption of a particular practice; (ii) the assessment of the weighted impact of the action on the overall operations of the company. For (i), seven different dummies were assessed, and are described in table 4, which will be either zero or one, whether the answer to the question is "no" or "yes", respectively. The dummies will be referred to using the acronyms presented in the last column of the table.

Furthermore, for (ii), two variables were developed by combining the survey data with the accounting data, resulting in the "weighted green investment" and the "weighted green team". Finally, a third field was generated using accounting data only. This category includes one variable, which represents the company's efficiency regarding energy consumption, and is represented as the gross value added per unit of energy expenses. These variables are described in Table 5.

### *3.4 Firm Characteristics*

In addition to the sustainability variables, firm characteristics' variables were built to estimate the actual effects of sustainability in a firm's financial performance, based on the accounting data retrieved from the financial statements. These factors, which impact a company's performance, were considered primarily to reduce potential biases in the outcome and endogeneity issues. Moreover, as in Choi et al. (2010), the model included firm size as a control variable, calculated as the natural logarithm of total assets.

Additionally, as in previous literature, namely Choi et al. (2010) and Marti et al. (2015), R&D investment was considered and computed as the natural logarithm of the sum of total Research and Development expenditures at the end of each year. Finally, the two control variables are represented in Table 6.

**Table 4*:* Sustainability Qualitative Variables Definitions and Acronyms**

| | | |
|---|---|---|
| Dummy 1 | Adoption of strategy to reduce greenhouse gas emissions? | RGG |
| Dummy 2 | Implementation of measures to reduce carbon dioxide emissions? | RCD |
| Dummy 3 | Adoption of environmental measures in daily activities? | EPA |
| Dummy 4 | Investment in technology/equipment to reduce environmental impact? | ITE |
| Dummy 5 | Inclusion of a board role for Environmental Issues? | BRE |
| Dummy 6 | Training employees for sustainable practices adopted within the organisation? | TEE |
| Dummy 7 | Support expenses for actions of control, prevention, and reduction of pollution? | CPR |

**Table 5: Sustainability Quantitative Variables Definitions**

| | |
|---|---|
| Green Investment Weight | Green Investment / Total Investment |
| Green Team Weight | Environmental responsibilities' Employees / Total Employees |
| Energy Efficiency | Production Gross Value Added / Energy Expenses |

**Table 6*:* Firm Characteristics Variable Definitions**

| | |
|---|---|
| Firm Size | Natural log of firm's total assets in the current calendar year |
| R&D | Natural log of firm's total R&D investments |

## *3.5 Data Treatment*

Including outliers in research can generate substantial distortions on the statistic estimates when using parametric or nonparametric tests (Zimmerman, 1998). Therefore, even though there are many available definitions for outliers, this analysis will consider it a data point that falls far outside the norm for a variable or population ( (Stevens, 1984); (Jarrell, 1994)). Moreover, Dixon (1950) defined outliers as values that are "dubious in the eyes of the researcher", and Wainer (1976) described them as population contaminants. Additionally, outliers can have detrimental effects on statistical analyses: (i) outliers generally increase error variance and diminish the statistical power of tests and (ii) they can bias or influence the estimates of interest (Osborne & Overbay, 2004).

In this sense, for the analysis, considering the existence of extreme results in the dataset that were not representative of the overall population, the database was transformed to limit the adverse effects of these outliers on the regression analyses. The Winsorising method was used to replace the outliers with the lowest and the highest value for a specified percentile. Thus, the one and ninety-ninth percentile were computed for the following numerical variables: Return on Assets, Return on Equity, Sales Growth, Assets Growth, Debt Ratio, Green Investment Weight, Green Team Weight and Energy Efficiency. Furthermore, the values below the first percentile were replaced with the first percentile value, and those above the ninety-ninth percentile were switched to the value of the ninety-ninth percentile.

## *3.6 Descriptive Statistics*

The results for the Descriptive Statistics for each variable are reported in Table 7, divided in Panel A and Panel B. Panel A includes the summary statistics for the quantitative variables used in the model, including the dependent variables of Financial Performance and the independent variables such as Firm Size, R&D, Green Investments, Green Team and Energy Efficiency. Panel B describes the seven dummy variables incorporated within the model.

### 3.6.1. Financial Performance Measures

#### a. Profitability

The average ROA within our sample is -0,3%, and the standard deviation is 16,91%. The values range from -105% to a maximum of 35%. "Rubber and Plastics" is the sector holding the highest value for the mean and the "Extractives" has the lowest.

The average ROE is 12,84%, and the standard deviation is 74,25%. The values range between -230,07%, and 497,41%. "Electricity, Gas and Water" is the sector with the highest mean value and "Minerals, non-metallics" has the lowest.

The mean value of sales growth is 3,75%, and the standard deviation is 34,22%. The values range between -82,82% and 181,22%. "Extractives" has the lowest value for the average growth of sales and "Materials Transportation" has the highest.

Overall, a positive tendency is observable within the sample data: the mean value for the ROA, ROE and sales growth increased between 2010 and 2017 for the first two, and 2011 to 2017 for the latter. Also, the standard variation increased slightly, but not significantly.

**b. Leverage**

The average Debt Ratio is 70,03%, and the standard deviation is 48,74%. The minimum value is 5,95%, and the maximum is 366,83%. The median is 44,34%. Since it is lower than the mean this reflects a positively skewed sample.

There is a constant tendency, as the average values for each year do not vary significantly. However, the standard deviation increases significantly from 2010 to 2017.

"Textiles" has the highest mean, and "Rubber and Plastics" has the lowest mean for debt ratio.

**c. Assets**

The mean value of Asset Growth is 6,14%, and the standard deviation is 28,84%. The values range between -56,24% and 161,71%. The value of the median is 6,76%. Since it is higher than the average, the distribution for Assets Growth is negatively skewed.

Between 2011 and 2017, the mean value of assets growth increased significantly, from 1,64% to 10,30%, showing a positive tendency. "Minerals, non-metallics" is the sector with the lowest average value, and "Materials Transportation" has the highest for assets growth.

### 3.6.2. Sustainability Measures

The average Green Investment is 24,24% out of total investments, and the standard deviation is 85,43%. The minimum value is 0%, and the maximum is 100%.

The mean Green Team is 8,23% out of total workers, which means that, on average, 8% of the workers have environmental responsibilities. The standard deviation is 17,86%. The values range between 0% and 100%.

The mean Energy Efficiency is 25,26%, and the standard deviation is 53,16%. The values range from the minimum value of -11,58% to the maximum value of 419,58%. The values for energy efficiency remained constant over the time frame, reflected in the mean, which did not vary significantly throughout the years.

Regarding the dummies, the mean values show that only 22% of the observations in the sample have implemented strategies to reduce greenhouse gas emissions and that only 29% has implemented strategies to reduce Carbon Dioxide Emissions. Besides, only 10% invests in technologies to mitigate the impact of their activities on the environment, and 24% has a Board Role for Environmental Issues. Additionally, 73% of the variables in the sample implement environmental practices on the daily activities, 31% train their employees on green practices, and 38% support activities to control, prevent and reduce pollution.

Relatively to the industries, "Extractives" holds the minimum average value for most dummy variables, including RCD, RGG, EPA and CPR. It means that this sector has the lowest compliance rate for these green initiatives. The "Textiles" sector has the minimum average values for ITE and TEE. The minimum value for BRE is referent to the "Leather and Leather products" sector. Moreover, "Computer and Electrical Equipment" has the highest average for RCD, "Rubber and Plastics" for EPA, "Transport Material" for ITE and TEE and "Oil and Chemicals" for RGG, CPR and BRE. These maximum average values represent the industries with the highest compliance rate for the green initiatives represented by each variable.

### 3.6.3. Firm Characteristics

The average logarithmic Firm Size is 14,50, and the standard deviation is 2,14. The median value is 13,25 and reflects a positively skewed distribution. The minimum value registered is 2,20, and the maximum is 23,77. There is a constant value in average size between 2010 and 2017 measured by the logarithm of total assets. The "Electricity, Gas and Water" sector has the highest firm size average, and the "Other transforming Industries" sector has the lowest.

The average logarithm of R&D is 10,06, and the standard deviation is 2,50. There is a slight decrease between 2010 and 2017 in the average value for each year, evidencing a contraction of R&D investments. The minimum value is 0, and the maximum is 26,10. The median value is 10,02, lower than the mean, suggesting a positive skewness of the dataset. The sector with the highest average value was "Electricity, Gas and Water", and the lowest was "Leather and Leather products".

### 3.6.4. Correlation Matrix

The existence of no multicollinearity problems has been confirmed between the independent variables, which can be observed in the correlation matrix correlation presented in Table 8, as there is no occurrence of high correlations among the variables.

## Table 7: Summary descriptive statistics

The table shows the descriptive statistics of our sample from 2010 to 2017. The descriptive statistics are reported for the entire timeframe of the database, which means that even if a company was only active for a limited time within the timeframe considered, the whole observation period is included in the table.

**Panel A – Quantitative Measures [Financial Performance, Sustainability Performance and Firm Characteristics]**

The values for ROA, ROE, Sales Growth, Debt Ratio, Assets Growth, Green Investment weight, Green Team Weight and Energy Efficiency are presented in %. The variables Firm Size and R&D are the logs of total assets and R&D investments, respectively, and are expressed in euros.

| | N | Mean | Median | Std. Dev. | Min | Max |
|---|---|---|---|---|---|---|
| ROA | 33 702 | -0,26 | 1,38 | 16,91 | -105,17 | 35,09 |
| ROE | 33 461 | 12,84 | 1,50 | 74,25 | -230,07 | 497,41 |
| Sales Growth | 33 924 | 3,75 | 10,53 | 34,22 | -82,82 | 181,22 |
| Debt Ratio | 33 702 | 70,03 | 44,34 | 48,74 | 5,95 | 366,83 |
| Assets Growth | 33 226 | 6,14 | 6,76 | 28,84 | -56,24 | 161,71 |
| Green Investment | 34 782 | 24,24 | 19,87 | 44,43 | 0,02 | 100 |
| Green Team | 34 782 | 8,23 | 7,75 | 39,36 | 0,00 | 100 |
| Energy Efficiency | 28 507 | 25,26 | 12,85 | 53,16 | -11,58 | 419,58 |
| Firm Size | 33 702 | 14,50 | 13,15 | 2,14 | 2,20 | 23,77 |
| R&D Investments | 28 277 | 10,06 | 10,02 | 2,50 | 0,00 | 21,10 |

**Panel B – Qualitative Measures [Dummy Variables]**

The variables presented are dummies, so the values are either 0 or 1. The values are in units.

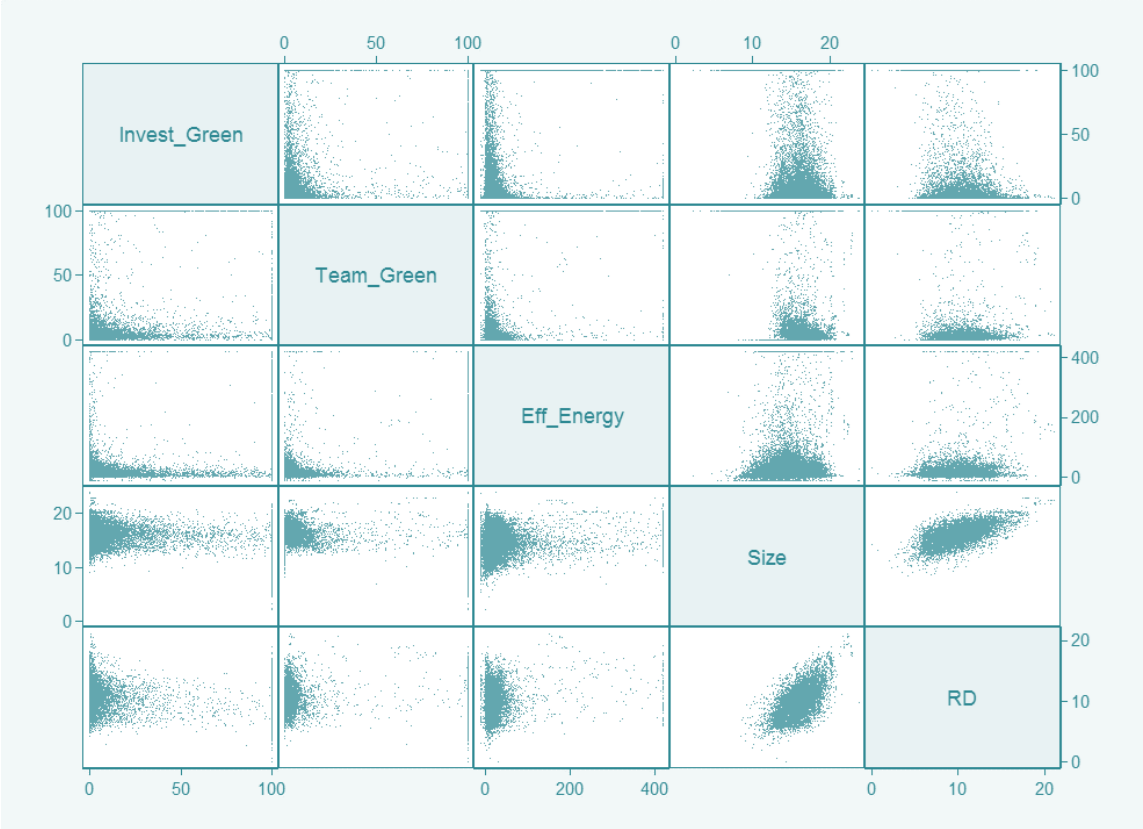
| | N | Mean | Std. Dev. |
|---|---|---|---|
| RGG – Strategies to reduce greenhouse gas emissions | 34 148 | 0,22 | 0,42 |
| RCD – Measures to reduce carbon dioxide emissions | 34 136 | 0,29 | 0,45 |
| EPA – Environmental practices in daily activities | 34 152 | 0,73 | 0,44 |
| ITE – Investment in green friendly technology | 34 192 | 0,10 | 0,30 |
| BRE – Board role for Environmental Issues | 34 136 | 0,24 | 0,43 |
| TEE – Training Employees on green practices | 34 138 | 0,31 | 0,46 |
| CPR – Actions to control, prevent and reduce pollution | 34 192 | 0,38 | 0,49 |

## Table 8: Correlation Coefficients Independent Variables

The table below shows the correlation coefficients for the independent variables considered in our model, using our sample data from 2010 to 2017.

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Green Investment (1) | 1,00 | | | | | | | | | | | |
| Green Team (2) | 0,43 | 1,00 | | | | | | | | | | |
| Energy Efficiency (3) | 0,04 | 0,04 | 1,00 | | | | | | | | | |
| RGG (4) | -0,40 | -0,39 | -0,05 | 1,00 | | | | | | | | |
| RCD (5) | -0,30 | -0,27 | 0,00 | 0,47 | 1,00 | | | | | | | |
| EPA (6) | -0,34 | -0,28 | -0,06 | 0,29 | 0,35 | 1,00 | | | | | | |
| ITE (7) | -0,38 | -0,40 | -0,02 | 0,38 | 0,25 | 0,18 | 1,00 | | | | | |
| BRE (8) | -0,40 | -0,52 | -0,02 | 0,39 | 0,29 | 0,30 | 0,34 | 1,00 | | | | |
| TEE (9) | -0,35 | -0,40 | -0,02 | 0,38 | 0,33 | 0,36 | 0,30 | 0,55 | 1,00 | | | |
| CPR (10) | -0,84 | -0,64 | -0,04 | 0,40 | 0,30 | 0,36 | 0,35 | 0,45 | 0,38 | 1,00 | | |
| Firm Size (11) | -0,44 | -0,46 | 0,15 | 0,41 | 0,28 | 0,29 | 0,36 | 0,47 | 0,41 | 0,47 | 1,00 | |
| R&D (12) | -0,30 | -0,28 | 0,16 | 0,28 | 0,21 | 0,18 | 0,23 | 0,31 | 0,29 | 0,28 | 0,63 | 1,00 |

## Figure 1: Scatterplot Matrix → Independent Variables



### *3.7 Multiple Regression Models*

The empirical analysis will be conducted through multiple linear regression models (MLRM), using the Ordinary Least Squares (OLS) method for the eight years of data, similarly to the methodology applied in a study conducted by Marti et al. (2015). The purpose is to model the linear relationship between the explanatory (or independent) variables (sustainability) and the dependent variable (financial performance). In addition, a lead year between the financial performance measures and the explanatory variables was considered, as it is expected that implementing greener practices would take at least one year to be reflected in the financial performance of firms.

The following baseline equation model is proposed:

$$FP_{i,t+1} = \beta_0 + \beta_1 * GI_{i,t} + \beta_2 * GT_{i,t} + \beta_3 * EE_{i,t} + \beta_4 * RGG + \beta_5 * RCD + \beta_6 * EPA + \beta_7 * ITE + \beta_8 * BRE + \beta_9 * TEE + \beta_{10} * CPR + \delta * Size + \tau * R\&D + \varepsilon$$

The dependent variable, Financial Performance (FP), is represented as the ROA (Return on Assets), ROE (Return on equity), Sales Growth (SG), Debt Ratio (DR) and Assets Growth (AG).

The independent variables are Green Investment (GI), Green Team (GT), Energy Efficiency (EE) and the seven dummies, listed as follows, which will be continually referred to using the acronyms on the last column of Table 8. Each of these variables takes the value of 1 if the company complies with these measures and 0 otherwise.

**Table 9: Dummy Variables Description and Acronyms**

| | |
|---|---|
| Strategies to reduce Greenhouse Gas emissions | RGG |
| Measures to reduce Carbon Dioxide emissions | RCD |
| Environmental Practices in daily activities | EPA |
| Investment in green technologies to mitigate the impact on the environment | ITE |
| Board role for Environmental Issues | BRE |
| Training employees on green practices | TEE |
| Support actions to control, prevent, and reduce pollution | CPR |

Besides, Firm size and R&D are used as control variables, as mentioned in sub-section *Firm Characteristics* and ε is the error term representing the factors not included in the model, i.e., unpredictable elements or omitted variables.

Taking these variables' information into account, the following six sub-models were developed:

$$(1)\ ROA_{i,t+1} = \beta_0 + \beta_1 * GI_{i,t} + \beta_2 * GT_{i,t} + \beta_3 * EE_{i,t} + \beta_4 * RGG + \beta_5 * RCD + \beta_6 * EPA + \beta_7 * ITE + \beta_8 * BRE + \beta_9 * TEE + \beta_{10} * CPR + \delta * Size + \tau * R\&D + \varepsilon$$

$$(2)\ ROE_{i,t+1} = \beta_0 + \beta_1 * GI_{i,t} + \beta_2 * GT_{i,t} + \beta_3 * EE_{i,t} + \beta_4 * RGG + \beta_5 * RCD + \beta_6 * EPA + \beta_7 * ITE + \beta_8 * BRE + \beta_9 * TEE + \beta_{10} * CPR + \delta * Size + \tau * R\&D + \varepsilon$$

$$(3)\ SG_{i,t+1} = \beta_0 + \beta_1 * GI_{i,t} + \beta_2 * GT_{i,t} + \beta_3 * EE_{i,t} + \beta_4 * RGG + \beta_5 * RCD + \beta_6 * EPA + \beta_7 * ITE + \beta_8 * BRE + \beta_9 * TEE + \beta_{10} * CPR + \delta * Size + \tau * R\&D + \varepsilon$$

$$(4)\ DR_{i,t+1} = \beta_0 + \beta_1 * GI_{i,t} + \beta_2 * GT_{i,t} + \beta_3 * EE_{i,t} + \beta_4 * RGG + \beta_5 * RCD + \beta_6 * EPA + \beta_7 * ITE + \beta_8 * BRE + \beta_9 * TEE + \beta_{10} * CPR + \delta * Size + \tau * R\&D + \varepsilon$$

$$(5)\ AG_{i,t+1} = \beta_0 + \beta_1 * GI_{i,t} + \beta_2 * GT_{i,t} + \beta_3 * EE_{i,t} + \beta_4 * RGG + \beta_5 * RCD + \beta_6 * EPA + \beta_7 * ITE + \beta_8 * BRE + \beta_9 * TEE + \beta_{10} * CPR + \delta * Size + \tau * R\&D + \varepsilon$$

Moreover, a fixed-effects analysis was conducted to control for changes within individual-specific groups using panel data, close to an analysis by Lee et al. (2015). The models with fixed effects minimise endogeneity problems kindred to omitted variables by considering variations within specific groups. This model is advantageous, especially when data has industry classifications, as in this database. It is also valuable to control for variations within the same period. Hence, the following fixed effects were included: sector, year, and firm. There will be four fixed effects analyses which will be the combination of the three: (i) year, (ii) sector, (iii) year and sector, and (iv) firm.

# 4 Results

This section provides empirical evidence on implementing sustainable practices in corporate financial performance. This section is divided into five sub-sections, as each of them analyses the results for each measure of financial performance. Initially, the multiple regressions with no fixed effects were performed for each financial measure and then the four fixed-effects models were implemented accordingly.

Therefore, each sub-section comprises the discussion of the results for each financial performance measure for all the five models and the table with the results, which includes the coefficients and standard errors for all the variables embraced in the model for each financial performance measure.

## *4.1 Return on Assets*

For the model of no fixed effects year fixed effects, sector fixed effects and sector and year fixed effects, Energy Efficiency and Green Investments are statistically significant at a 1% level. Withal, the coefficient for Green Investments is negative, highlighting an inverse relationship between this variable and ROA, while Energy Efficiency has a positive coefficient. The negative coefficient for Green Investments implies that in the 1-year horizon, increasing the companies' investments for green purposes versus other types of investments harms the financial performance of the company.

Moreover, for the same models mentioned above, the t-stats of RGG, ITE, and CPR indicate that these are also statistically significant to explain changes in the ROA at the 1% level since the p-value is lower than 0,01. Still, the coefficients of CPR are negative, which means that an increase in these variables results in a decrease in the ROA; whilst all the others are positive, therefore impacting positively the ROA.

When considering firm fixed effects, only Energy Efficiency and RGG are statistically significant on the 1% level, as no other variable presents explanatory power. Both coefficients are positive, which shows a positive linkage with the dependent variable. Vis à vis, a company that has developed strategies to reduce greenhouse gas emissions and has more efficient energy usage will perform better financially.

Besides, the variable EPA is statistically significant on a 5% level for the no fixed effects and sector fixed effects models. It is also positively correlated with ROA for these two models, as well as the year and year and sector fixed effects. Only for firm fixed effects, this variable has

a negative linkage with ROA. Overall, the effect of implementing Environmental Practices in Daily Activities affects positively financial performance measured by ROA.

In all five models of ROA, R&D investments has a negative correlation with ROA, statistically significant on a 1% level, which evidences that in the short-run (1 year), the potential benefits of investing in Research and Development do not cover the costs of doing so. The size shows the opposite relationship. For all models, Firm Size is positively related to ROA and the variable also shows explanatory power at a 1% level. Therefore, we expect bigger firms, measured by the log of current assets, to have higher ROA for the following year.

## Table 10: Regression Analysis – ROA

A multiple linear regression was performed to analyse the relationship between financial performance, defined in five measures, and sustainability practices for no-fixed effects. Variables are defined as mentioned above. T-stats are displayed in parenthesis below the coefficients. *, **, *** indicate statistical significance of coefficients at the 10%, 5%, and 1% levels, respectively and standard errors are represented in parenthesis.

| | Return on Assets | | | | |
|---|---|---|---|---|---|
| VARIABLES | (1) | (2) | (3) | (4) | (5) |
| Green Investments | -0,041*** | -0,038*** | -0,040*** | -0,036*** | -0,005 |
| | [0,006] | [0,006] | [0,006] | [0,006] | [0,005] |
| Green Team | 0,002 | 0,002 | 0,005 | 0,005 | 0,005 |
| | [0,004] | [0,004] | [0,004] | [0,004] | [0,004] |
| Energy Efficiency | 0,032*** | 0,032*** | 0,035*** | 0,034*** | 0,052*** |
| | [0,002] | [0,003] | [0,003] | [0,003] | [0,006] |
| RGG: Reduce Greenhouse gas | 0,975*** | 0,837*** | 1,015*** | 0,882*** | 0,886*** |
| | [0,317] | [0,316] | [0,315] | [0,314] | [0,312] |
| RCD: Reduce CO2 | -0,317 | -0,638** | -0,231 | -0,556* | 0,175 |
| | [0,288] | [0,289] | [0,287] | [0,289] | [0,285] |
| EPA: Environmental practices | 0,954** | 0,587 | 0,915** | 0,569 | -0,385 |
| | [0,445] | [0,444] | [0,441] | [0,441] | [0,516] |
| ITE: Green friendly technology | 1,108*** | 1,219*** | 1,070*** | 1,196*** | 0,256 |
| | [0,349] | [0,347] | [0,349] | [0,348] | [0,326] |
| BRE: Board role Environment | -0,204 | -0,082 | -0,264 | -0,145 | -0,387 |
| | [0,329] | [0,327] | [0,328] | [0,326] | [0,403] |
| TEE: Training for green practices | -0,094 | -0,029 | -0,243 | -0,184 | -0,552* |
| | [0,313] | [0,311] | [0,312] | [0,311] | [0,322] |
| CPR: Actions on pollution | -3,093*** | -2,645*** | -3,379*** | -2,921*** | -0,133 |
| | [0,596] | [0,595] | [0,597] | [0,596] | [0,599] |
| Firm Size | 0,863*** | 0,903*** | 1,079*** | 1,105*** | 4,169*** |
| | [0,105] | [0,104] | [0,109] | [0,108] | [0,422] |
| RD Investments | -0,417*** | -0,438*** | -0,413*** | -0,438*** | -0,188*** |
| | [0,065] | [0,065] | [0,067] | [0,066] | [0,069] |
| Constant | -5,633*** | -6,106*** | -9,218*** | -10,780*** | -63,590*** |
| | [1,574] | [1,566] | [1,668] | [1,692] | [6,739] |
| Observations | 17 157 | 17 157 | 17 157 | 17 157 | 17 157 |
| R-squared | 0,056 | 0,055 | 0,060 | 0,071 | 0,053 |
| Year Fixed Effects | No | Yes | No | Yes | Yes |
| Sector Fixed Effects | No | No | Yes | Yes | No |
| Firm Fixed Effects | No | No | No | No | Yes |

### *4.2 Return on Equity*

For all models, except for firm fixed effects, the coefficient of Energy Efficiency is statistically significant on a 1% level. Moreover, the coefficient has a positive sign for all the four models, as well as for firm fixed effects, highlighting a positive correlation between efficient energy usage and ROE. Hence, generating more efficient gross value added of production in terms of energy consumption impacts positively Return on Equity.

Additionally, for the no fixed effects, year fixed effects and sector fixed effects models, the variable Green Investments is statistically significant on the 1% level and the negative coefficient reflects a negative correlation with ROE. Therefore, increasing the weighted amount of green investments harms ROE. For the sector and year fixed effects model, the variable is only significant on a 5% level. For firm fixed effects there is no statistically significant relationship. Yet for those models the coefficient remains negative.

Furthermore, despite not being statistically significant on a 5% level, the variable Green Team is positively correlated with ROE for all the models. Hence, increasing the number of workers with green responsibilities improves financial performance.

For the models of no fixed effects and sector fixed effects, RGG is statistically significant on the 1% level, while for year fixed effects and year and sector fixed effects it is on the 5%. The coefficients are positive for all models, therefore reducing greenhouse gas emissions in companies' operations impacts positively the performance of ROE. Furthermore, RCD is statistically significant at the 5% level for no fixed effects and at the 1% level for year fixed effects, year and sector fixed effects and firm fixed effects. For all the models the coefficients are negative, implying that reducing carbon dioxide emissions harms companies' ROE. These results are mixed. CPR is statistically significant for the first four models on the 1% level. The coefficient is negative, which shows that creating actions to control, prevent and reduce pollution destroys financial performance. Additionally, for all models, the coefficients of ITE have p-values lower than 0,05. They are also positive, thus, companies that in general invest in greener technology tend to improve their profitability in the one-year interval.

Lastly, regarding the control variables, Firm Size is positive for all the models. The coefficient is statistically significant on the 5% level for the sector fixed effects and the year and sector fixed effects models. For firm fixed effects it is at the 1%. On the other hand, R&D investment is negative for all the models. It is statistically significant on the 1% level for all models, with exception of firm fixed effects which is only on the 5%.

## Table 11: Regression Analysis – Return on Equity

A multiple linear regression was performed to analyse the relationship between financial performance, defined in five measures, and sustainability practices for no-fixed effects. Variables are defined as mentioned above. T-stats are displayed in parenthesis below the coefficients. *, **, *** indicate statistical significance of coefficients at the 10%, 5%, and 1% levels, respectively and standard errors are represented in parenthesis.

| | Return on Equity | | | | |
|---|---|---|---|---|---|
| VARIABLES | (1) | (2) | (3) | (4) | (5) |
| Green Investments | -0,113*** | -0,094*** | -0,109*** | -0,092** | -0,033 |
| | [0,036] | [0,036] | [0,037] | [0,037] | [0,035] |
| Green Team | 0,003 | 0,004 | 0,018 | 0,017 | 0,020 |
| | [0,024] | [0,023] | [0,023] | [0,023] | [0,026] |
| Energy Efficiency | 0,288*** | 0,285*** | 0,302*** | 0,296*** | 0,070* |
| | [0,015] | [0,015] | [0,016] | [0,016] | [0,036] |
| RGG: Reduce Greenhouse gas | 5,605*** | 4,852** | 5,755*** | 5,020** | 3,092 |
| | [1,960] | [1,955] | [1,961] | [1,957] | [1,988] |
| RCD: Reduce CO2 | -3,669** | -5,136*** | -3,383* | -4,897*** | -8,169*** |
| | [1,777] | [1,786] | [1,787] | [1,798] | [1,853] |
| EPA: Environmental practices | 0,561 | -1,338 | 0,123 | -1,697 | -4,677 |
| | [2,748] | [2,750] | [2,748] | [2,751] | [3,293] |
| ITE: Green friendly technology | 4,843** | 5,340** | 4,535** | 5,125** | 4,689** |
| | [2,155] | [2,148] | [2,172] | [2,166] | [2,070] |
| BRE: Board role Environment | 0,684 | 1,265 | 0,555 | 1,132 | -0,612 |
| | [2,034] | [2,026] | [2,040] | [2,033] | [2,557] |
| TEE: Training for green practices | 0,423 | 0,763 | -0,365 | -0,0499 | -0,219 |
| | [1,935] | [1,927] | [1,943] | [1,936] | [2,037] |
| CPR: Actions on pollution | -12,670*** | -10,480*** | -14,040*** | -11,722*** | -0,366 |
| | [3,690] | [3,685] | [3,724] | [3,722] | [3,804] |
| Firm Size | 0,577 | 0,783 | 1,397** | 1,513** | 14,610*** |
| | [0,649] | [0,647] | [0,678] | [0,676] | [2,840] |
| RD Investments | -1,667*** | -1,799*** | -1,541*** | -1,706*** | -1,067** |
| | [0,403] | [0,402] | [0,414] | [0,413] | [0,434] |
| Constant | 23,570** | 21,620** | 9,365 | 2,839 | -209,50*** |
| | [9,735] | [9,698] | [10,400] | [10,560] | [45,320] |
| Observations | 17 143 | 17 143 | 17 143 | 17 143 | 17 143 |
| R-squared | 0,052 | 0,052 | 0,053 | 0,062 | 0,026 |
| Year Fixed Effects | | Yes | | Yes | Yes |
| Sector Fixed Effects | | | Yes | Yes | |
| Firm Fixed Effects | | | | | Yes |

### *4.3 Sales' Growth*

For all the five models the coefficients of Energy Efficiency and Green Investments are statistically significant at a 1% level. However, the coefficient for Green Investments is negative, highlighting an inverse relationship between this variable and the growth of sales, while Energy Efficiency has a positive coefficient. The negative coefficient for Green Investments implies that in the 1-year horizon, increasing the companies' investments for green purposes has negative repercussions in the financial performance of the company, while the positive sign for Energy Efficiency implies that companies who make more efficient usage of its energy measured by the gross value added of production out of total energy expenses tend to improve their financial performance in the following year.

Regarding Green Team, only for firm fixed effects, the coefficient is statistically significant on the 5% level. Yet, for all the models the coefficient is positive: increasing the workers with environmental responsibilities out of total workers enhances financial performance.

Moreover, EPA is statistically significant on the 5% level for the models of year fixed effects and year and sector fixed effects. For the five models EPA has negative coefficients; therefore, companies who generally implement environmental practices in their overall activities tend to decrease their sales in the following years. Similarly, CPR, which is statistically significant on the 1% level for all the models except for firm fixed effects, has negative coefficients. Hence, there tends to be a drop in sales for the following years for companies who create actions to control, prevent and reduce pollution. These results are contradictory to the idea of companies' reputation improvement. Also, TEE is statistically significant for firm fixed effects and has a negative correlation with financial performance. Then, companies that use resources to train their employees on green practices suffer a decrease in their sales. On the contrary, ITE, which is significant on the 5% level for no fixed effects and for year fixed effects, is positively correlated, in all models, with sales growth. Thus, investing in greener technology will potentiate an increase in the company sales for the following year.

Firm Size has negative coefficients for all the models and is also statistically significant on a 1% level for no fixed effects, year fixed effects and for sector fixed effects models, while for year and sector fixed effects and firm fixed effects it is at the 5%. On the other hand, R&D investment is positive for all the models and is statistically significant on the 1% level for all models, with exception of firm fixed effects.

## Table 12: Regression Analysis – Sales Growth

A multiple linear regression was performed to analyse the relationship between financial performance, defined in five measures, and sustainability practices for no-fixed effects. Variables are defined as mentioned above. T-stats are displayed in parenthesis below the coefficients. *, **, *** indicate statistical significance of coefficients at the 10%, 5%, and 1% levels, respectively and standard errors are represented in parenthesis.

| | Sales Growth | | | | |
|---|---|---|---|---|---|
| VARIABLES | (1) | (2) | (3) | (4) | (5) |
| Green Investments | -0,091*** | -0,084*** | -0,090*** | -0,084*** | -0,057*** |
| | [0,016] | [0,016] | [0,017] | [0,016] | [0,021] |
| Green Team | 0,007 | 0,005 | 0,015 | 0,012 | 0,035** |
| | [0,009] | [0,009] | [0,010] | [0,010] | [0,016] |
| Energy Efficiency | 0,045*** | 0,044*** | 0,052*** | 0,049*** | 0,186*** |
| | [0,007] | [0,006] | [0,007] | [0,007] | [0,022] |
| RGG: Reduce Greenhouse gas | 0,352 | 0,074 | 0,463 | 0,190 | -1,357 |
| | [0,846] | [0,844] | [0,846] | [0,845] | [1,193] |
| RCD: Reduce CO2 | -0,149 | -0,834 | 0,050 | -0,639 | 0,482 |
| | [0,768] | [0,772] | [0,771] | [0,776] | [1,092] |
| EPA: Environmental practices | -2,098* | -3,003** | -2,163* | -3,024** | -0,843 |
| | [1,194] | [1,195] | [1,193] | [1,194] | [1,990] |
| ITE: Green friendly technology | 2,033** | 2,204** | 1,524 | 1,733* | -1,026 |
| | [0,930] | [0,926] | [0,936] | [0,933] | [1,245] |
| BRE: Board role Environment | 0,740 | 0,860 | 0,616 | 0,728 | -0,966 |
| | [0,877] | [0,874] | [0,879] | [0,876] | [1,537] |
| TEE: Training for green practices | -1,369 | -1,161 | -1,622* | -1,427* | -2,542** |
| | [0,835] | [0,832] | [0,838] | [0,835] | [1,230] |
| CPR: Actions on pollution | -9,070*** | -8,318*** | -9,656*** | -8,876*** | -2,000 |
| | [1,588] | [1,586] | [1,601] | [1,600] | [2,299] |
| Firm Size | -1,100*** | -1,028*** | -0,781*** | -0,744** | 3,647** |
| | [0,284] | [0,283] | [0,296] | [0,295] | [1,627] |
| RD Investments | 0,554*** | 0,525*** | 0,619*** | 0,579*** | 0,359 |
| | [0,176] | [0,175] | [0,180] | [0,180] | [0,262] |
| Constant | 28,700*** | 28,290*** | 22,890*** | 21,610*** | -55,610** |
| | [4,250] | [4,233] | [4,529] | [4,596] | [26,02] |
| Observations | 17 101 | 17 101 | 17 101 | 17 101 | 17 101 |
| R-squared | 0,019 | 0,018 | 0,021 | 0,030 | 0,027 |
| Year Fixed Effects | | Yes | | Yes | Yes |
| Sector Fixed Effects | | | Yes | Yes | |
| Firm Fixed Effects | | | | | Yes |

### *4.4 Debt Ratio*

For models of no fixed effects, year fixed effects, sector fixed effects, and year and sector fixed effects, the coefficients of the variable Green Investments are statistically significant on a 1% level. Furthermore, the coefficients are positive for all models, displaying a positive correlation between the weighted amount of green investments and the debt ratio. These results are aligned with the recent regulations developed by the European Central Bank to protect SMEs from funding disparities. Generally, these outcomes reflect that companies that increase the portion of their means to improve ecosystems and the natural environment, tend to raise their leverage.

The variable Green Team is positively correlated with the debt ratio for all models. Also, for no fixed effects the coefficients are statistically significant on the 1% level and for year fixed effects it is on the 5%. Energy Efficiency is negatively correlated with the debt ratio for all models, with exception of firm fixed effects. Also, for sector fixed effects and year and sector fixed effects, these coefficients are statistically significant on the 1% level.

RCD is statistically significant at the 1% level for firm fixed effects. Only for this model, this coefficient is below zero, translating the negative correlation between existing measures to reduce $CO_2$ emissions and the debt ratio. Still, for the other four models, the coefficient evidences a positive linkage with reducing carbon dioxide emissions and debt ratio. Additionally, RGG is significant on the 5% level for no fixed effects and sector fixed effects. Withal, for all models the coefficients are negative, emphasising that decreasing greenhouse gas emissions in the activities tends to decrease firms' debt ratio. Besides, for all models except for firm fixed effects, the coefficients of CPR are statistically significant at 1% and for the latter on the 5%. Similarly, the coefficients are above zero, translating the positive correlation between implementing actions to control, prevent and reduce pollution and the debt ratio. BRE is positively correlated with debt ratio and for no fixed effects, sector fixed effects and year and sector fixed effects these coefficients are statistically significant on the 5% level. That suggests that companies with Board roles for Environmental responsibilities have higher debt ratios.

As a final remark on these regressions, Firm Size is negatively correlated with the debt ratio for the models and is statistically significant to show changes in the debt ratio on the 1% level. R&D Investments is positively correlated for the models and is also statistically significant on the 1% level for the models, except for firm fixed effects.

## Table 13: Regression Analysis – Debt Ratio

A multiple linear regression was performed to analyse the relationship between financial performance, defined in five measures, and sustainability practices for no-fixed effects. Variables are defined as mentioned above. T-stats are displayed in parenthesis below the coefficients. *, **, *** indicate statistical significance of coefficients at the 10%, 5%, and 1% levels, respectively and standard errors are represented in parenthesis.

| | Debt Ratio | | | | |
|---|---|---|---|---|---|
| VARIABLES | (1) | (2) | (3) | (4) | (5) |
| Green Investments | 0,081*** | 0,074*** | 0,080*** | 0,074*** | 0,010 |
| | [0,016] | [0,017] | [0,016] | [0,016] | [0,011] |
| Green Team | 0,027*** | 0,026** | 0,012 | 0,012 | 0,006 |
| | [0,010] | [0,010] | [0,010] | [0,010] | [0,008] |
| Energy Efficiency | -0,008 | -0,007 | -0,025*** | -0,024*** | 0,010 |
| | [0,007] | [0,007] | [0,007] | [0,007] | [0,011] |
| RGG: Reduce Greenhouse gas | -1,953** | -1,694* | -1,864** | -1,635* | -0,309 |
| | [0,871] | [0,871] | [0,864] | [0,864] | [0,614] |
| RCD: Reduce CO2 | 0,794 | 1,388* | 0,411 | 0,974 | -1,534*** |
| | [0,790] | [0,796] | [0,787] | [0,794] | [0,561] |
| EPA: Environmental practices | -1,567 | -0,875 | -1,220 | -0,613 | -0,608 |
| | [1,221] | [1,225] | [1,209] | [1,214] | [1,015] |
| ITE: Green friendly technology | -0,539 | -0,749 | -0,240 | -0,459 | -0,499 |
| | [0,959] | [0,958] | [0,957] | [0,957] | [0,641] |
| BRE: Board role Environment | 1,932** | 1,711* | 2,048** | 1,847** | 0,307 |
| | [0,903] | [0,902] | [0,898] | [0,897] | [0,791] |
| TEE: Training for green practices | -1,407 | -1,535* | -1,275 | -1,379 | -0,120 |
| | [0,860] | [0,859] | [0,856] | [0,855] | [0,632] |
| CPR: Actions on pollution | 5,242*** | 4,437*** | 6,703*** | 5,940*** | 2,503** |
| | [1,638] | [1,640] | [1,637] | [1,640] | [1,178] |
| Firm Size | -2,412*** | -2,483*** | -3,137*** | -3,179*** | -3,244*** |
| | [0,288] | [0,287] | [0,298] | [0,297] | [0,829] |
| RD Investments | 1,427*** | 1,465*** | 1,257*** | 1,300*** | 0,146 |
| | [0,179] | [0,179] | [0,182] | [0,182] | [0,135] |
| Constant | 78,860*** | 79,640*** | 92,230*** | 95,000*** | 110,10*** |
| | [4,323] | [4,317] | [4,570] | [4,655] | [13,250] |
| Observations | 17 157 | 17 157 | 17 157 | 17 157 | 17 157 |
| R-squared | 0,031 | 0,031 | 0,034 | 0,038 | 0,009 |
| Year Fixed Effects | | Yes | | Yes | Yes |
| Sector Fixed Effects | | | Yes | Yes | |
| Firm Fixed Effects | | | | | Yes |

### *4.5 Assets' Growth*

Concerning the variable Green Investments, the coefficients show, for all models, a negative correlation with the growth of assets. Firms with a higher weighted amount of Green Investments have lower expected growth of assets for the following year. Energy Efficiency's coefficients exhibit that this variable is positively correlated with assets' growth; therefore, improving energy efficiency has benefits in the short term regarding the company's growth of assets. Besides, for the models of no fixed effects, year fixed effects, sector fixed effects and year and sector fixed effects, the coefficients for both Green Investments and Energy Efficiency have explanatory power and are statistically significant on the 1% level.

Despite not being statistically significant, Green Team has positive coefficients in all models. Overall, firms with a higher number of hirings for Green responsibilities out of total workers or that make more efficient usage of energy, have an expected positive growth of assets for the following year.

Even though these findings are mixed, in general, increasing the allocation of resources towards the environment improves the company's growth regarding its assets.

Regarding the dummies, only CPR is statistically significant on the 1% level for all models. Also, it has an indirect relationship with assets' growth: Companies with actions to control, prevent and reduce pollution tend to have a lower yearly growth of assets.

Most of the coefficients in the models of RGG, RCD, EPA and TEE are negative. Thus, firms with strategies to reduce Greenhouse gas emissions, to reduce $CO_2$ emissions, that implement environmental practices in their daily activities, and with training for green practices have lower growth in their assets in the following year.

Contrarily, for most models, the coefficients of ITE and BRE are positive: Companies that invest in Green friendly technology and have board roles for environmental responsibilities, are expected to have higher yearly growth of assets.

Finally, for all models Firm Size and R&D are statistically significant on the 1% level. The coefficients of size are negative for all models except for firm fixed effects, while R&D is positive for all the models.

## Table 14: Regression Analysis – Assets Growth

A multiple linear regression was performed to analyse the relationship between financial performance, defined in five measures, and sustainability practices for no-fixed effects. Variables are defined as mentioned above. T-stats are displayed in parenthesis below the coefficients. *, **, *** indicate statistical significance of coefficients at the 10%, 5%, and 1% levels, respectively and standard errors are represented in parenthesis.

| | Assets Growth | | | | |
|---|---|---|---|---|---|
| VARIABLES | (1) | (2) | (3) | (4) | (5) |
| Green Investments | -0,077*** | -0,068*** | -0,073*** | -0,064*** | -0,033* |
| | [0,014] | [0,014] | [0,014] | [0,014] | [0,017] |
| Green Team | 0,005 | 0,006 | 0,015 | 0,014 | 0,011 |
| | [0,009] | [0,009] | [0,009] | [0,009] | [0,013] |
| Energy Efficiency | 0,016*** | 0,014** | 0,025*** | 0,022*** | 0,023 |
| | [0,006] | [0,006] | [0,006] | [0,006] | [0,018] |
| RGG: Reduce Greenhouse gas | -0,718 | -1,158 | -0,508 | -0,932 | -0,541 |
| | [0,770] | [0,766] | [0,768] | [0,765] | [0,978] |
| RCD: Reduce CO2 | 0,432 | -0,377 | 0,756 | -0,0517 | -0,206 |
| | [0,698] | [0,700] | [0,699] | [0,702] | [0,911] |
| EPA: Environmental practices | -1,091 | -2,118* | -1,128 | -2,089* | -0,037 |
| | [1,083] | [1,081] | [1,079] | [1,078] | [1,619] |
| ITE: Green friendly technology | 0,661 | 0,980 | 0,037 | 0,391 | 1,462 |
| | [0,847] | [0,842] | [0,851] | [0,846] | [1,017] |
| BRE: Board role Environment | 0,657 | 0,956 | 0,506 | 0,792 | -1,347 |
| | [0,799] | [0,794] | [0,798] | [0,793] | [1,255] |
| TEE: Training for green practices | -0,546 | -0,344 | -0,816 | -0,635 | -1,851* |
| | [0,760] | [0,755] | [0,760] | [0,756] | [1,002] |
| CPR: Actions on pollution | -10,35*** | -9,193*** | -10,870*** | -9,696*** | -5,431*** |
| | [1,446] | [1,441] | [1,454] | [1,450] | [1,868] |
| Firm Size | -1,753*** | -1,654*** | -1,362*** | -1,306*** | 29,140*** |
| | [0,257] | [0,256] | [0,268] | [0,266] | [1,391] |
| RD Investments | 1,020*** | 0,966*** | 1,113*** | 1,044*** | 0,857*** |
| | [0,159] | [0,158] | [0,163] | [0,162] | [0,213] |
| Constant | 35,680*** | 34,660*** | 28,000*** | 23,670*** | -461,80*** |
| | [3,858] | [3,834] | [4,103] | [4,155] | [22,220] |
| Observations | 17 129 | 17 129 | 17 129 | 17 129 | 17 129 |
| R-squared | 0,027 | 0,026 | 0,030 | 0,044 | 0,116 |
| Year Fixed Effects | | Yes | | Yes | Yes |
| Sector Fixed Effects | | | Yes | Yes | |
| Firm Fixed Effects | | | | | Yes |

# 5 Conclusion

The clear evidence of the impact of corporates on the environment emphasises the urge for companies to transition towards more environmentally sustainable practices within their businesses. This proof incentivises research on this topic by academics and increases organisations and governments to implement measures promoting the shift towards greener operations.

Moreover, there is no consensus in previous literature regarding the direction of the relationship between corporate financial performance and environmentally sustainable practices incorporated within business practices. Thus, the focal purpose of this analysis is to understand the direction of this linkage for Portuguese SMEs.

Studies on firms' implementation of environmental practices towards more sustainable businesses are relatively scarce, mainly due to the limited availability of data. Nonetheless, the data collected by INE allowed to surpass this issue and to examine whether firms that incorporate sustainable practices are better financially. The study complements the currently available literature on sustainability and CFP by analysing a specific database composed mainly of unlisted companies from Portugal. In that sense, the assessment focused only on accounting measures of financial performance. However, this measure was analysed using different metrics, namely Return on Assets, Return on Equity, Sales Growth, Debt Ratio and Assets Growth.

As in previous literature, the results were mixed depending on the conceptualisation of the measure of financial performance employed in each model, as well as the perspective of environmental sustainability. Generally, the simple action of implementing environmental practices in daily activities, measured by the dummy EPA, decreases firm financial performance for all the conceptualisations of financial performance except for the Return on Assets, where the opposite relationship was observed.

There is a statistically significant negative linkage for Green Investments and Financial Performance when measured as ROA, ROE, sales growth and assets growth. Thus, increasing the weighted amount of green investments out of total investments harms financial performance during the first year of application, in terms of Return on Assets, Return on Equity, Growth of Sales and Growth of Assets. These results comply with the trade-off theory that proposes a negative impact of investing in environmental practices and financial performance, as

companies that direct their resources towards sustainable activities tend to be less profitable or not profitable at all, as these do not make optimal allocation of resources.

Contrarily, for Debt Ratio, the opposite relationship was uncovered and also a statistically significant one for Green Investments. This means that it can be anticipated that a company will increase its leverage to allocate a bigger percentage of its investments towards environmental applications. These findings are useful into understanding how SMEs that are shifting their businesses towards more environmentally friendly practices are financing themselves and also is in accordance with the regulations developed by the European Central Bank that protect these smaller companies so that they are not subjected to disparities regarding funding constraints (European Central Bank, 2021).

For Energy Efficiency, despite not being statistically significant for all the models, overall, the findings evidence a positive relationship with financial performance. Thus, a company that makes more efficient usage of its energy, measured by the gross value added of production out of total energy expenses, tends to improve its financial performance in the following year. The same was concluded for Green Team; thus, increasing the number of workers with environmental responsibilities out of total workers in a firm will enhance its financial performance within one year.

In particular, we must understand that even though these results are mixed, this analysis in some ways has uncovered an extension of the moral purpose for companies to become greener and can be positively used to potentiate the adoption of sustainable practices by SMEs. Ultimately, Portuguese and European Union policymakers must continue to develop strategies and incentives to improve companies' sustainability performance.

Some limitations should be recognised in this report, despite the results and conclusions withdrawn. Firstly, it is pertinent to understand that the geographical scope considered is bounded, as the analysis focuses only on Portuguese companies. Then, the database incorporates mainly SMEs. Even though SMEs represent over 99% of Portuguese companies, they do not represent the majority of the Portuguese economy, which implies that the sample is not illustrative of the Portuguese economy. Additionally, the database included only accounting data, representing historical performance, which is not forward-looking. Therefore, the results are not indicative of the future financial performance of the companies, even though it is considered a one-year lead for this measure, as the implementation of sustainability measures may impact financial performance in longer horizons.

Furthermore, the measures for environmental sustainability are very subjective and open to different interpretations and perspectives, which can increase the potential risk of biased results obtained in the regressions and do not reflect the sample utilised in this study.

Finally, the data was obtained voluntarily from companies by INE, which may create a bias in the sample database. These biases could be identified since the decision to participate in the survey may have depended on various factors specifically financial performance, environmental performance, company culture, and values.

For future analyses, this research could be extended to broader international contexts, for example, focusing it on the entire European Union. Considering the accessibility to the data an empirical analysis on the topic would imply an increase in the representativeness of the results, which would, however, bring some limitations regarding data collection.

Additionally, a forthcoming analysis could be performed for most Portuguese companies. Increasing the scope of the analysis for different firm types requires efforts from the Portuguese Statistics Institute. It would also have limitations as data collection would take longer, and the analyses would include considerable lags. Besides, participating in the environmental survey should be mandatory, attempting to decrease the biases in the sample data and there would be an increase in companies' pressure to shift towards more green-friendly practices. Also, further studies could consider different time leads for financial performance to assess whether the implementation of environmental practices could take longer than one year to be reflected in improved financial performance.

Finally, the database should include information regarding the accounting financials and market data to have both accounting and market-based measures of financial performance, as the combination of the two would allow for a more pertinent analysis of financial performance for the short and long term. Therefore, it would improve the comprehension of the impact of the implementation of sustainability practices in corporate financial performance.

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