UNIVERSIDADE CATÓLICA PORTUGUESA

The relationship between ESG scores and financial performance

A bi-directional analysis: Evidence from the UK

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2023

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Trabalho Final na modalidade de Dissertação apresentado à Universidade Católica Portuguesa para obtenção do grau de mestre em Finanças

por

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sob orientação de
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Católica Porto Business School, Universidade Católica Portuguesa
Julho 2023

Agradecimentos

Nesta secção, gostaria de expressar o meu mais sincero e profundo agradecimento a todas as pessoas que tiveram um papel crucial no meu percurso académico até agora, e que me ajudaram a concluir este trabalho.

Em primeiro lugar, um especial obrigado ao meu orientador, Professor Paulo Alves, pelo seu apoio, disponibilidade, e orientação imprescindíveis ao longo de todo este processo.

Ao Professor Ricardo Ribeiro, por todas as contribuições prestadas na vertente metodológica deste trabalho.

Aos meus amigos mais próximos, um obrigado pelo constante apoio e motivação, que me ajudou a manter o foco e o otimismo durante esta etapa.

Aos meus pais e irmã, um enormíssimo obrigado por todo o carinho, compreensão e motivação durante esta etapa, principalmente nos momentos mais difíceis, e pelo apoio e confiança que me dão em todas as decisões que tomo na minha vida.

À minha namorada, quero expressar toda a gratidão por estar sempre presente ao meu lado, incondicionalmente, dia após dia, por ser o meu pilar de força, carinho, paciência, e alegria nos momentos de maior cansaço e desgaste, e pela segunda família que me deu.

Aos meus avós, dedico-lhes este trabalho, que finaliza uma das etapas mais importantes do meu percurso académico.

Por último, uma palavra de agradecimento a todos os Professores com quem tive o privilégio de aprender e de adquirir conhecimento nesta área que tanto aprecio durante o decorrer do curso.

Resumo

Esta tese investiga a relação entre o desempenho ambiental, social e governativo (ESG) e o desempenho financeiro (FP). Especificamente, o nosso objetivo é analisar a potencial causalidade bidirecional entre o desempenho ESG e o desempenho financeiro de uma empresa. É utilizado um conjunto de dados de 472 empresas cotadas na London Stock Exchange (LSE) e no Alternative Investment Market (AIM) entre 2010-2021 (período de 11 anos) (2.914 observações empresa-ano). O desempenho financeiro é medido através de medidas contabilísticas e de mercado, o Retorno sobre os Ativos (ROA) e o rácio Preço/Valor Contabilístico (PBV), respetivamente. As pontuações de desempenho ESG são obtidas a partir da base de dados Refinitiv DataStream da Thomson Reuters. Aplicando modelos de regressão de Ordinary Least Squares (OLS) e de Fixed-Effects (FE), os resultados sugerem que não existe um impacto significativo do desempenho ESG no ROA e no PBV, tanto com desfasamentos de 1 ano, como de 2 anos. Verificamos que o ROA tem um efeito negativo no desempenho ESG com 1 ano de desfasamento, enquanto não se observa qualquer impacto significativo do PBV no desempenho ESG subsequente, o que revela resultados mistos. Relativamente às variáveis de controlo, encontramos fortes evidências que indicam um impacto positivo do risco e da dimensão da empresa no desempenho ESG subsequente. Este estudo aprofunda a compreensão da interação entre o desempenho ESG e o desempenho financeiro das empresas no contexto do Reino Unido, durante um longo período temporal.

Palavras-chave: ESG, desempenho ESG, pontuações ESG, desempenho financeiro, responsabilidade social corporativa, valor corporativo, sustentabilidade, lucratividade

Abstract

This thesis investigates the relationship between Environmental, Social, and Governance (ESG) performance and financial performance (FP). Specifically, we aim to analyse a potential bi-directional causality between a firm's ESG performance and financial performance. A dataset of 472 firms listed on the London Stock Exchange (LSE) and Alternative Investment Market (AIM) from 2010 to 2021 (11-year period) is used (2,914 firm-year observations). Both accounting and market-based measures measure financial performance, Return on Assets (ROA) and Price to Book Value Ratio (PBV), respectively. ESG performance scores are obtained from Thomson Reuters' Refinitiv DataStream. Conducting Ordinary Least Squares (OLS) and Fixed-Effects (FE) regression models, the findings suggest that there is no significant impact of ESG performance on ROA and PBV, both at one-year and two-year lags. We find one-year lagged ROA to negatively affect ESG performance, while no significant causal effect of lagged PBV on subsequent ESG performance is observed, which reveals mixed results. Regarding the control variables, we find strong evidence indicating a positive impact of risk and firm size on subsequent ESG performance. This study furthers understanding of the interaction between ESG performance and financial performance of firms within the UK context over a long-term period.

Keywords: ESG, ESG performance, ESG scores, financial performance, corporate social responsibility, firm value, sustainability, profitability

Number of words: 9625

Table of Contents

List of Tables

1. Introduction

In recent years, there has been a considerable rise in the importance and attention given to Environmental, Social, and Governance (ESG) factors. This focus has surged among researchers, investors, managers, and employees, as nowadays, more is needed for businesses to prioritize their capacity to generate profit solely; instead, they must also prioritize and integrate sustainable practices within their daily operations and decision-making process. According to World Business Council for Sustainable Development (2023), after the COVID-19 pandemic, countries around the globe have been facing stricter ESG regulations, political shifts and tensions, supply chain and employee retention challenges, and climate-change issues. This shift in perspective acknowledges the importance of businesses addressing these concerns and meeting the expectations of their stakeholders and the need for firms to engage in sustainable development goals and actively work towards improving their financial performance (FP) and long-term sustainability.

Considering the growing interest in ESG, the debate among academic scholars persists on whether firms' efforts to increase their focus on ESG practices are positively linked to their FP. Since the 20th century, different theoretical frameworks have emerged, focusing on the direction of causality, durability, and sign of the relationship between a firm's ESG performance (ESGP) and FP.

In line with the stakeholder theory, increased ESGP can positively impact a firm's overall performance in several ways. It can attract and retain qualified employees (Turban & Greening, 1996), improve reputation (Orlitzky et al., 2003; Surroca et al., 2010), enhance employee satisfaction and productivity (Valentine & Fleischman, 2008), attract ESG-responsible customers (McWilliams & Siegel, 2001), facilitate access to better financing opportunities and lower the cost of

capital (Kapstein, 2001), reduce risks (McGuire et al., 1988), minimize regulatory actions (Freeman, 1984), and increase market value (Velte, 2017). In parallel, Friede et al. (2015) concluded, based on more than 2,000 empirical studies, most of the studies supported a positive relationship between a firm's ESGP and FP. Additionally, it has also been argued that improved FP potentiates a firm's financial slack, which creates the opportunity to enhance the focus on ESG practices. In turn, this will lead to better ESGP as an outcome based on the slack resources theory (Waddock & Graves, 1997).

On the other hand, several authors have proposed a potential trade-off between ESGP and FP, supporting the trade-off theory principles of a firm. Within this perspective, Friedman (1970) and Jensen (2002) argue that businesses that place significant emphasis on ESG initiatives divert from their main objective, which is to make a profit, thus having to sacrifice generated cash flow and allocate resources away from operations, potentially resulting a decline in their FP.

Overall, the inconsistency of results concerning the relationship between ESGP and FP in literature is notable, which may be a consequence of methodological disparities implemented in previous studies, leading to contradictory and conflicting conclusions (Gillan et al., 2021). Some of these disparities include the variation in control variables incorporated in estimation equations (McWilliams & Siegel, 2000), the lack of consensus on the specific variables to measure both ESG and FP (Gillan et al., 2021), the predominant focus on unidirectional and direct relationships (Gillan et al., 2021), and on short-term time frame testing periods (Aupperle et al., 1985).

Given these discrepancies, this study aims to investigate the relationship between ESGP and FP from both directions within a specific stock exchange, namely the London Stock Exchange (LSE), including its sub-market Alternative Investment Market (AIM), which comprises small and medium growth firms. We

selected the LSE market due to its substantial size, considering it is one of the world's largest stock exchanges today. Moreover, the UK has taken a revolutionary step by becoming the first country to enforce mandatory climate-risk disclosures across the economy. According to the UK Government (2021), the UK became the first major economy to legally commit to achieving net zero greenhouse gas emissions by 2050.

To ensure a comprehensive analysis of this relationship over an extended period, we collected a data sample of nearly 3,000 firm-year observations concerning to 472 firms across multiple industries from 2010 to 2021. Following recent studies such as Velte (2017), and Ademi and Klungseth (2022), we care to employ both accounting (Return on Assets) and market-based (Price to Book Value Ratio) variables to measure a firm's FP, to examine possible differences between the relationship of each type of measure with ESGP. We constructed one and two-year lagged relationships, in line with previous studies (Preston & O'Bannon, 1997; Waddock & Graves, 1997; Fischer & Sawczyn, 2013; Velte, 2017). Additionally, we incorporated control variables incorporated in previous research. Regarding ESGP, we collected Refinitiv DataStream's aggregate ESGP scores, and all other data.

Regarding the ESGP-FP causal direction relationship, we conducted Ordinary Least Squares (OLS) regression models. The findings indicate no effect of ESGP scores on subsequent PBV, and a slightly positive impact on subsequent ROA. However, the inclusion of a Fixed-Effect approach (FE) with industry and firm-fixed effects revealed that their omission in the OLS regression models was biasing the OLS estimate results. Based on the incorporated firm-fixed effects, which are the most suitable in this analysis, we find no empirical evidence supporting a causal effect of ESGP on subsequent FP, when measured by ROA and PBV. Moreover, we provide evidence for a negative relationship between

risk and FP, mainly when measured by ROA, and a negative effect of size on PBV.

Regarding the FP-ESGP causal direction relationship, we conducted OLS and FE regression models considering both one and two-year lagged FP variables. The results indicate that ROA to negatively effect one-year lagged ESGP, while PBV did not have a significant effect on ESGP for both one-year and two-year lags, thus presenting mixed results, depending on the type of measure used for FP. Furthermore, we find robust evidence of a positive relationship between the control variables, risk and size, with ESGP. On the other hand, we observe a negative link between R&D expenditure and ESGP. Therefore, these findings suggest that factors such as firm size, risk, and R&D expenditure may be more influential in shaping the relationship between ESGP and FP.

This study is structured as follows. We begin by providing a theoretical framework of the ESG definition, the ESGP-FP relationship, and a comprehensive review of past empirical evidence, which serves as a fundamental basis for formulating our study hypothesis. Furthermore, we detail the selected data sample, the methodology employed for empirical examination, the main variables, and the regression models put in place. To conclude, we present the empirical results of our analysis, along with remarks on the findings and limitations of the study, and suggestions for future investigation.

2. Literature Review

2.1 ESG and Financial Performance

The analysis of the ESG performance (ESGP) impact on a firm's financial performance (FP) has been subject to an intense debate over numerous decades among academics and scholars. Between 1970 and 2015, the ESGP-FP link was investigated by more than 2,000 individual studies, with a significant increase in the research since the 21st century (Friede et al., 2015).

From the view of businesses, the rising interest in ESG in recent years explains the current trend in literature research made on the topic. According to Morgan Stanley (2020), 80% of asset owners had incorporated sustainable investing into the investment process, and 80% believe that companies engaging in ESG activities could have higher long-term profitability, proving how much ESG investing is nowadays perceived as a crucial factor within firm's investment and long-term strategy.

Furthermore, according to Global Sustainable Investment Alliance (2021), the value of ESG assets surpassed $35 trillion in 2020, representing a 15% increase from 2018, and 35.9% of all assets under management across the U.S., Canada, Japan, Australia, and Europe. Bloomberg Intelligence (2021) estimates that such value could exceed $50 trillion by 2025 worldwide.

The first objective of this chapter is to provide a comprehensive explanation of the origins and evolution of the ESG definition and its relevancy for corporate sustainable investing. Consequently, several notable studies that investigated the ESGP-FP link will be highlighted. Hence, this chapter cares to present an objective analysis of past ESG research.

2.1.1 Defining ESG

The term ESG was officially introduced in a 2004 report titled "Who Cares Wins" under the United Nations Global Compact initiative (United Nations Global Compact, 2004). As the report suggests, ESG refers to the extent to which corporations take actions related to ESG matters and incorporate them into business strategy. Still, we have to go back in the 20th century to find the earliest mentions of other but similar terms such as socially responsible investing (SRI), responsible investing (RI), sustainable investing (SI), and particularly corporate social responsibility (CSR), as identified by Daugaard (2019) and as Li et al. (2021).

Dodd (1932) began to emphasize the importance of considering the welfare of employees and consumers to enhance stockholders' long-term profitability. Going forward, CSR would become a topic of major interest worldwide in the decade of 1960 (Wang et al., 2016). After the occurrence of several economic crises (e.g., the OPEC oil crisis in 1973) and political controversies, the increase in social expectations and demands on CSR issues was reflected by imposed regulations related to environmental protection, consumer protection, and human rights (Wood, 1991).

Since then, researchers have disagreed on the definition of CSR. According to Malik (2015), some view it as a firm's behaviour towards customers, suppliers, regulators, employees, investors, and communities, while others see it as multidimensional discretionary ESG actions. Nevertheless, the CSR dimensions predominating in literature converge with the perspective of CSR involving social, ethical, and legal expectations, including environmental matters (Carroll, 1979).

Considering that CSR is a complex concept that becomes difficult to measure, Corporate Social Performance (CSP) came across in the literature as a measurable

variable that could be capable of assessing the application of CSR (Marom, 2006; van Beurden & Gössling, 2008). As Waddock (2004) refers, CSP offers a framework for evaluating the degree to which a firm's activities are aligned with stakeholders, the environment, and society. Moreover, ESG aspects may be seen in the CSP definition developed by Wood (1991). According to the author, CSP represents "a business organization's configuration of [environmental and social] responsibility principles, processes of [environmental and social responsiveness], and policies, programs, and observable outcomes as they relate to the firm's society interactions" (p. 693).

Taking everything into account, we can refer that ESG principles cover a broad range of matters related to the environment (e.g., climate change, pollution, carbon emissions), social responsibility (e.g., human rights, health and safety, employee wellbeing), and corporate governance (e.g., board diversity, transparency, corruption, shareholder protection) (Galbreath, 2012; Duuren et al., 2016). Therefore, it is no surprise that many researchers consider ESG and CSR interchangeable terms. Gillan et al. (2021) and Flammer (2015) go further, arguing that ESG is a broader terminology than CSR since it directly includes corporate governance issues. In this study, we then use ESG as a concept that encompasses CSR as well as sustainable development (SD) and corporate responsibility (CR), following Mervelskemper and Streit (2017), Garcia et al. (2017) and Li et al. (2021).

2.2 Relationship between Environmental, Social, and Governance Performance and Financial Performance

Various theoretical frameworks have explored the causality and direction of the relationship between ESGP and FP. Some propose that increased ESGP may impact FP, others vice versa. Furthermore, some suggest a bi-directional causal relationship (Preston & O'Bannon, 1997; Surroca et al., 2010). According to Gillan

et al. (2021), Many find the relationship negative, neutral, or positive. In the next subchapter, we summarize the key arguments and findings of these hypotheses based on considerable previous research.

2.2.1 Theoretical standpoint

Milton Friedman's doctrine (1970) became a pioneer theory for research in the field, as it triggered the intense debate on the relationship between ESGP and FP (Griffin & Mahon, 1997). Friedman (1970) emphasized that a business's primary objective is to allocate its resources and pursue activities that generate profit as long as it adheres to the established regulations and guidelines. According to Waddock and Graves (1997) and Preston and O'Bannon (1997), theorists of the neo-classical view argue that corporations, by prioritizing social responsibility, divert attention away from stakeholder interests, incurring substantial costs that will not be covered by the limited financial benefits, leading to reduced profits and shareholder's wealth. Based on the principles of the trade-off theory, Preston and O'Bannon (1997) argue that socially responsible activities incur costs, reducing the firm's profitability, thus creating a competitive disadvantage compared to less socially active peers (Friedman, 1970; Aupperle et al., 1985). Moreover, Jensen (2002) suggests a negative relationship between ESGP and FP, stating that social welfare is maximized when firms focus on a firm's value. Hence, these authors claim that the relationship between ESGP and FP is negative.

On the other hand, stakeholder theory scholars defend that CSR performance and FP are positively correlated in the long run (van Beurden & Gossling, 2008). According to Freeman (1984), firms should consider the interests of shareholders and any group or individual who can influence or be impacted by the organization's goals. As a result, firms with stakeholder management practices prioritize the relationships among key stakeholders, including shareholders,

employees, consumers, investors, and communities, as they consider these expectations when making business decisions (Donaldson & Preston, 1995; Frooman, 1997).

Additionally, Cornell and Shapiro (1987) argue that failing to meet implicit stemming from stakeholder expectations results in higher costs, negatively impacting a firm's value. They argue that firms with a strong CSR perception face lower-cost implicit claims, and enhance their reputation, ultimately benefiting their FP. Furthermore, Orlitzky et al. (2003) found a positive relationship between CSR and FP, driven by improved reputation and goodwill, in a meta-analysis of 52 studies. Surroca et al. (2010) identified an indirect relationship between CSR and FP, positively mediated by intangible resources, including reputation, technology, human resources, and culture. Furthermore, the instrumental stakeholder theory defends that the impact of CSR stems from good management practices that strengthen relationships among the key stakeholders of a firm. This way, CSR becomes an instrumental pillar of FP (Jones, 1995).

Another strand of literature that defends a positive ESGP-FP association is the slack resources theory, which states that the casual relationship runs from FP to ESGP and not vice versa. The hypothesis suggests that improved FP allows firms to have excess resources, enabling them to prioritize and invest more in ESG practices (Waddock & Graves, 1997).

Many scholars believe that investing in ESG brings a wide range of benefits to firms by: i) attracting and retaining highly qualified employees (Moskowitz, 1972; Turban & Greening, 1996); ii) improving employees' morale and productivity (Parket & Eilbirt, 1975; Valentine & Fleischman, 2008); attracting ESG-responsible customers (McWilliams & Siegel, 2001; iii) Dhaliwal et al., 2011); iv) providing access to more and cheaper financing (Kapstein, 2001; Cheng et al., 2014); v) reducing risk (McGuire et al., 1988; Orlitzky & Benjamin, 2001); vi) reducing the likelihood of facing regulatory actions (Berman et al., 1999; Hillman

& Keim, 2001); vii) reducing demand's sensitivity to price fluctuations (Milgrom & Roberts, 1986; Navarro, 1988); and viii) enabling more efficient use of resources and waste (Russo & Fouts, 1997).

However, several authors have identified nonlinearity effects of ESG investment on FP. Elsayed and Paton (2005) analyzed the environmental performance of 227 UK firms from 1994-2000, using ROA, ROE, and Tobin's q as measures of FP. They found a neutral relationship between environmental performance and FP, suggesting that although companies that invest in long-term environmental performance may have better FP, such investments' marginal cost and benefit eventually reach an equilibrium.

Similarly, Barnett and Salomon (2006) propose a curvilinear link between SR and FP, as they argue that a critical level of SR maximizes FP, and that additional increases in SR may decrease returns from that point. In line with Barnett and Salomon (2006), Margolis and Walsh (2003) also argue that examining the consequences of ESGP on FP is more crucial than exploring the motivations behind ESG investing of firms.

Based on all views mentioned above, the following section highlights the main empirical findings of past research in analysing the ESGP-FP relationship.

2.2.2 Historical evolution

Despite the tremendous effort scholars have put into finding empirical evidence of the ESGP-FP linkage, the results are frequently incongruent, leading to disagreement among researchers.

McGuire et al. (1988) examined FP with accounting and market-based measures. Using Fortune's reputational ratings as a proxy for CSR, the authors found a firm's FP to be a better predictor of subsequent CSR than a firm's CSR to subsequent FP, supporting the slack resources theory. The study also suggested a significant association between risk measures and CSR across firms.

Later, Waddock and Graves (1997) also found evidence supporting the slack resources theory, using KLD independent ratings of S&P 500 firms as the CSP measure and accounting-based measures for FP, such as return on equity, return on assets, and return on sales, while size, risk, and industry were used as control variables. The authors found a positive relationship between CSP and prior FP, as well as subsequent FP, using one-year lagged data for both causal directions, suggesting the presence of a virtuous circle, where better FP predicts improved CSP, and vice versa. This finding was supported by Orlitzky et al. (2003) in a meta-analysis of 52 studies, which indicated a positive relationship between firm reputation and FP, suggesting a simultaneous and bi-directional causal relationship between both.

McWilliams and Siegel (2000) addressed the inconsistent results in previous studies by demonstrating a specification error in the equation estimated by Waddock and Graves (1997), which may bias the estimate, and fails to isolate the impact of CSR on FP. The authors found R&D and advertising expenses to be strongly correlated with CSP. The authors also used size, risk, and industry as control variables, concluding that CSR has a neutral impact on FP when properly specifying the estimation model by including R&D.

Surroca et al. (2010) followed the misspecification identified by McWilliams and Siegel (2000). The authors found a positive relationship between CR and FP within 599 firms from 28 countries using Tobin's q as the FP measure. Still, an effect was only observed for firms with high intangible resources. This way, intangible resources, including innovation, human capital, reputation, and culture, served as mediators in establishing a positive and bi-directional relationship between CFP and CSP, constituting a virtuous cycle between both, driven by the development of intangibles.

Flammer (2015) observed a minor yet positive effect of narrowly passed CSR proposals on shareholder value. These proposals also positively impacted sales

growth, labour productivity, and operating performance measures. Moreover, Friede et al. (2015) conducted a meta-analysis of over 2,000 empirical studies and identified a positive relationship between ESG variables and FP, with environmental considerations having the most impact. Furthermore, the authors identified this impact to vary across regions, industries, and periods.

Velte (2017) analyzed 412 firm-year observations from 2010 to 2014 for German-listed firms and found the ESGP-FP association to be positive. Using one-year lagged accounting (ROA) and market-based (Tobin's q) measures of FP, while controlling for R&D expenses, risk, size, and industry, the authors found each ESG score to have a positive effect on FP. Similarly, Fischer and Sawczyn (2013) also focused on German-listed firms, although they only used ROA to measure FP. While controlling for firm size, risk, and industry, the authors found a positive association of one-year lagged relationships between CSP and FP in both directions, only for larger firms.

Duque-Grisales and Aguilera-Caracuel (2019) explored 104 firms across five Latin American countries between 2011 and 2015. The researchers examined the impact of individual and aggregate ESG scores on FP, and a negative relationship was observed for all cases. In contrast to prior studies, the authors posed a potential trade-off between ESG investment and FP, in line with Friedman (1970), Vance (1975), Aupperle et al. (1985), and Jensen (2002), who argue that firms that heavily invest in ESG initiatives sacrifice their cash flow and allocate resources away from operations, leading to a decline in their FP.

Ahmad et al. (2021) investigated the impact of ESGP on the FP of FTSE350 firms (2002-2018) and found a positive impact of total ESGP on market value and earnings per share of firms, moderated by firm size. The authors also found ESGP individual dimensions to positively impact FP, although it differed between high and low ESGP firms.

Ademi and Klungseth (2022) studied 150 S&P 500 firms (2017-2020). They observed a positive link between superior ESGP, and both return-on-capital-employed and Tobin's q of firms while controlling for firm size and debt-to-equity ratio.

Even though a lack of consensus is observed, most authors provide empirical evidence supporting a positive link between ESGP and FP, despite some studies suggesting negative effects. Therefore, the prevailing view is a non-negative relationship between ESGP and FP (Brooks & Oikonomou, 2018).

2.2.3 Inconsistency of results

The inconsistency in findings regarding the link between ESGP and FP may be attributed to methodological disparities in previous studies (Gillan et al., 2021; Ademi & Klungseth, 2022). This section highlights the reasons why mixed evidence persists in previous research.

One reason could be the variability in the control variables included in estimation equations (Ullman, 1985; Russo & Fouts, 1997; McWilliams & Siegel, 2000). Many empirical studies have identified industry, size, risk, and R&D expenditure as variables that affect such relationships (Griffin & Mahon, 1997; Waddock & Graves, 1997; Margolis & Walsh, 2003; McWilliams & Siegel, 2000; Udayasankar, 2008; Ghoul et al., 2011; Orlitzky & Benjamin, 2001; Ahmad et al., 2021). For instance, Andersen and Dejoy (2011) found that controlling for industry, size, risk, R&D expenditure, and advertising expenses resulted in the best model specification for the CSP-CFP link. Still, the authors highlighted the need for further research to fully understand the role and capture the impact of control variables.

Previous studies also exhibit significant differences in the interpretation and measurement of both ESGP and FP (Gillan et al., 2021). Various approaches have been used, including disclosure documents, such as 10-K reports (Webb et al.,

2009), reputation ratings (Vance, 1975; Griffin & Mahon, 1997), independent ratings from large-scale databases that cover a wide range of firms and ESG/CSR dimensions, such as the Kinder, Lynderberg, and Domini (KLD) database (Choi & Wang, 2009; Andersen & Dejoy, 2011), and more recently, the Thomsom Reuters' Refinitiv Eikon Datastream (Velte, 2017; Duque-Grisales & Aguilera-Caracuel, 2019) as well as the Bloomberg database (e.g., Alareeni & Hamdan, 2020).

Furthermore, the divergence persists regarding the appropriate metrics to measure a firm's FP. Many authors utilize accounting-based variables, such as ROA, ROE, and ROS (e.g., Waddock & Graves, 1997; Duque-Grisales & Aguilera-Caracuel, 2019), while others focus solely on market-based variables, such as Price per Share, Tobin's *q*, Earnings per Share, and Price/Book Value Ratio (e.g., Andersen and Dejoy, 2011; Ahmad et al., 2021). Additionally, several studies have used both types of FP's measures to examine potential discrepancies in their relationship with FP (e.g., Velte, 2017; Li et al., 2018). Research shows discrepancies in predicting FP when using accounting or market-based measures, which could be attributed to the different aspects of a firm's value and profitability that they capture (Orlitzky et al., 2003; Salzmann et al., 2005).

Accounting-based measures provide a retrospective view of a firm's FP, showcasing its internal efficiency (Cochran & Wood, 1984). However, their reliability and trustworthiness have been questioned by several authors, considering that they did not reflect the expectations of stakeholders and market participants of a firm's future value. They can be susceptible to subjective judgments and managerial bias within accounting procedures and policies, thereby portraying the internal decision-making abilities of businesses rather than external market reactions to organizational actions (Orlitzky et al., 2003).

On the other hand, market-based measures reflect real-time market participants' expectations regarding a firm's future value. They reflect

shareholders as the primary stakeholder group whose perception and sentiment directly impact a firm's business and its overall value (Cochran & Wood, 1984). However, their accuracy is also questioned, considering that they may be subject to short-term's volatility of stock prices and information asymmetry. Therefore, they may reflect factors beyond a firm's FP alone (Shane & Spicer, 1983; Salzmann et al., 2005).

To conclude, this inconsistency can also be attributed to previous research's focus on unidirectional relationships and the need for more analysis of bi-directional relationships (Gillan et al., 2021). According to the authors, understanding the causal direction is crucial for a comprehensive understanding of the relationship. In order to ensure the robustness of the analysis, it is crucial to gather a substantial data sample spanning multiple years and firms (Brammer & Millington, 2008).

As demonstrated, previous studies have shown mixed and conflicting results, indicating different causal directions between ESGP and FP (Friede et al., 2015; Gillan et al., 2021), mainly due to methodological differences constructed in the analysis. This study addresses these gaps by investigating the ESGP-FP relationship in both directions, using lagged variables and incorporating controls for other influencing factors within a specific stock exchange and over a long-term time frame.

3. Methodology

3.1 Data sample collection

For the data sample selection, we decided to examine firms listed in the UK's London Stock Exchange (LSE) and in the Alternative Investment Market (AIM), which includes small and medium-growth firms. The UK market is one of the largest stock exchanges globally, ranking as the second-largest stock exchange in Europe[1], just behind Euronext, which comprises 7 economies, including Oslo, Lisbon, Paris, Dublin, Brussels, Amsterdam, and Milan. Firms listed in the LSE are evaluated by ESG rating agencies and are subject to strict regulations related to reporting disclosures, which cover not only financial aspects, but also ESG considerations. Consequently, data availability and adherence to regulatory standards within the UK context contribute to the quality and credibility of the analysis.

All ESGP and FP data was obtained from Thomson Reuters' Refinitiv Eikon DataStream, a large and multidimensional database widely used in previous research (e.g., Garcia et al., 2017; Ahmad et al., 2021). The database encompasses a vast collection of information, covering more than 12,500 global companies across 74 countries, with over 630 sustainability metrics and data dating back to 2002.

In line with Velte (2017) and Yoon et al. (2018), we opted to exclude firms operating within the financial sector[2], considering their specific regulatory

[1] Ranking data as of October 2022, in billion U.S. dollars, according to Statista – leading German provider of business data and market insights: https://www.statista.com/statistics/693587/stock-exchanges-market-capitalization-europe/

[2] Banking, insurance, real estate, investment, loan and personal loan, and brokerage corporations.

environment and distinctive capital structure, which could lead to bias in the regression model estimations.

Following Preston and O'Bannon (1997) and Moore (2001), that indicate the importance of considering long-term testing periods to support potential causal directions between ESGP and FP, our study aims to examine year-lagged relationships between ESGP and FP on both causal directions over a long-term period, as we collected data spanning from 2010 to 2021. To ensure data completeness, we only included firms with available data for all variables considered, for at least two consecutive years, within the defined timeframe. The final data sample comprised 2,914 firm-year observations, representing 472 unique firms from 23 industries, as detailed in Table 1.

3.2 Measures and main variables

3.2.1 Environmental, Social and Governance Performance

Refinitiv DataStream's ESG scores (ESGS) are used to measure ESGP, which reflect the overall performance score of each firm across three major dimensions: environmental, social, and governance. These 0 to 100 scores provide an aggregated measure that considers performance indicators associated with diverse ESG aspects[3]. Additionally, we adopt the approach established by Waddock and Graves (1997) and Cheng et al. (2014) by employing aggregated ESG/CSR[4] performance scores assuming equal weights to each ESG dimension.

[3] Examples of these indicators include carbon emissions and energy consumption for the environmental dimension, human rights and labour standards for the social dimension, and board compensation and anti-corruption policies for the corporate governance dimension.
[4] Although Waddock and Graves (1997) relied on KLD's database data rather than Refinitiv DataStream, their approach of assigning equal weights to each pillar within CSR aligns with our methodology.

3.2.2 Corporate Financial Performance

Aiming to provide a more comprehensive analysis of the ESGP-FP link, we employ both accounting and market-based measures of FP, in line with many previous studies (e.g., Elsayed & Paton, 2005; Velte, 2017; Ademi & Klungseth, 2022).

For the accounting-based proxy, we use ROA. It is calculated by dividing the firm's net income by its average total assets, thus serving as an indicator of profitability and how effectively it utilizes its assets to generate profits. For this reason, ROA has been used by plenty of studies in this area (e.g., Fischer & Sawczyn, 2013; Velte, 2017; Duque-Grisales & Aguilera-Caracuel, 2019).

Considering the difficulty in determining asset replacement values of firms in order to estimate Tobin's *q*, which measures a firm's market value relative to the replacement cost of its assets, researchers often use alternative methods for the market-based measure selection of FP. One common approach is to compare a firm's market value with its respective book value (Elsayed & Paton, 2005; Velte, 2017; Ademi & Klungseth, 2022). Following this perspective, this study employs the Price-to-Book Value ratio[5] (PBV) as a market-based proxy, which is obtained by dividing a firm's Market Price per Share by the Book Value of Equity per Share.

3.2.3 Control variables

Following the findings of studies already mentioned in subchapter 2.2.3, we include 3 of the most common control variables in the study: the firm's risk, size, and R&D expenditure.

[5] The numerator represents the current market price of a firm's stock, while the denominator reflects the firm's common equity divided by the total number of shares outstanding.

Prior studies have provided evidence indicating that firms exhibiting higher levels of ESGP are often perceived as less risky. As a result, these firms may encounter fewer capital constraints and access more and cheaper financing, leading to a lower cost of debt capital (McGuire et al., 1988; Orlitzky & Benjamin, 2001). Therefore, we utilized the ratio of total debt to total assets as a proxy for firm risk, following Velte (2017).

Firm size has also been proven to influence the ESGP-FP link. Ahmad et al. (2021) found the firm size to be a moderator in this relationship, while Kim and Li (2021) found a stronger positive impact of ESGP in FP for larger firms compared to smaller firms. Udayasankar (2008) found varying motivation levels for implementing ESG initiatives based on firm size. According to Elsayed and Paton (2005) and Xie et al. (2018), larger firms may benefit from economies of scale to enhance their market value and FP, considering their increased resource availability and capacity for investments. We then adopt the approach of Elsayed and Paton (2005) by using the natural logarithm of total assets as a proxy for size.

Concerning R&D expenditure, McWilliams and Siegel (2000) and Surroca et al. (2010) found R&D intensity to be strongly positively correlated with CSP . They argued that omitting this variable could lead to biased results in the examination of the ESGP-FP relationship. This way, we include the ratio of a firm's R&D expenditure to its total sales as a control variable. In cases where R&D expenditure data is missing in our sample, we define the variable as 0 to ensure data completeness.

Finally, industry-specific factors may also be crucial to the ESGP-FP link. Controlling for industry effects accounts for unique pressures, requirements, and regulations faced by firms across different industries (Fischer & Sawczyn, 2013; Garcia et al., 2017). Garcia et al. (2017) found that firms in sensitive[6] industries

[6] Industries that are subject to more social and political pressures, as well as to more controversial and ethical discussions.

present higher levels of environmental performance. We then incorporate not only industry-fixed effects but also firm-fixed effects as a control measure to capture invariant and omitted industry and firm-related factors that may affect the dependent variable in question.

Based on the existing literature supporting a positive relationship between ESGP and FP, this study formulates two hypotheses. The first hypothesis proposes a positive effect of ESGP on subsequent FP, in line with the stakeholder theory. The second hypothesis proposes a positive effect of FP on subsequent ESGP, in line with the slack resources theory.

3.3 Regression models

To empirically test these hypotheses, we employed a one-year time lag between the main independent variable(s) of interest and the dependent variable(s) in each regression model. For hypothesis 1, we examine the impact of ESGP scores in year *t-1* on ROA and PBV in year *t*. For hypothesis 2, we examine the impact of ROA and PBV (separately) in year *t-1* on ESGP in year *t*. This approach covers both causal directions between ESGP scores and ROA/PBV. To increase the robustness and reliability of our analysis, we employ the same approach with a two-year time lag in each regression model, allowing for a deeper exploration of extended and significant causal relationships between ESGP and FP.

Consequently, four regression models were constructed using a two-step procedure: the OLS method to examine the estimates of the regression coefficients within the considered variables, followed by applying Fixed-Effects (FE) to control for industry and firm-specific characteristics separately.

The first regression model is constructed to test hypothesis 1, using a one-year lag between the main variables of interest, and is presented as follows:

$$ROA_{i,t} = \beta_0 + \beta_1\ ESGS_{i,t-1} + \beta_2\ Control_{i,t} + \varepsilon_{i,t}$$

$$PBV_{i,t} = \beta_0 + \beta_1\ ESGS_{i,t-1} + \beta_2\ Control_{i,t} + \varepsilon_{i,t}$$

Where ROA_{it} denotes the ratio of the net income divided by the average total assets of firm i in year t, PBV_{it} denotes the ratio of the market price per share divided by the book value of equity per share of firm i in year t, $ESGS_{it}$ denotes aggregated ESGP score, from 0 to 100, of firm i in year t, $Control_{it}$ denotes the control variables *Risk* (ratio of total debt to total assets), *Size* (natural logarithm of total assets), and *R&D* (ratio of R&D expenditure to total sales) of firm i in year t, and ε_{it} denotes the error term associated to firm i in year t.

The second regression model is constructed to test hypothesis 2, using a one-year lag between the main variables of interest, and is presented as follows:

$$ESGS_{i,t} = \beta_0 + \beta_1\ ROA_{i,t-1} + \beta_2\ Control_{i,t} + \varepsilon_{i,t}$$

$$ESGS_{i,t} = \beta_0 + \beta_1\ PBV_{i,t-1} + \beta_2\ Control_{i,t} + \varepsilon_{i,t}$$

Where ROA_{it}, PBV_{it}, $ESGS_{it}$, $Control_{it}$, and ε_{it}, have the same interpretation as mentioned in the first regression model.

The third and fourth regression models follow the same approach and objective as the first and second regression models. In this case, we introduce a two-year time between the main variables of interest.

The third regression model is presented as follows:

$$ROA_{i,t} = \beta_0 + \beta_1\ ESGS_{i,t-2} + \beta_2\ Control_{i,t} + \varepsilon_{i,t}$$

$$PBV_{i,t} = \beta_0 + \beta_1\ ESGS_{i,t-2} + \beta_2\ Control_{i,t} + \varepsilon_{i,t}$$

The fourth regression model is presented as follows:

$$ESGS_{i,t} = \beta_0 + \beta_1\ ROA_{i,t-1} + \beta_2\ Control_{i,t} + \varepsilon_{i,t}$$

$$ESGS_{i,t} = \beta_0 + \beta_1\ PBV_{i,t-1} + \beta_2\ Control_{i,t} + \varepsilon_{i,t}$$

Finally, for all regression models described, we apply industry-fixed and firm-fixed effects separately after performing the OLS estimations.

4. Results

4.1 Descriptive statistics

Table 1 presents the overall descriptive statistics for the ESGP, FP, and control variables, and the one-year lagged variables. It includes the mean, median, standard deviation, minimum, and maximum values for all variables. The definitions of each variable are listed in Table 6 (Appendix). In resume, the data sample[7] comprises 2,914 firm-year observations, representing a total of 472 unique firms from 23 industries between 2011 and 2021.

Table 1 - Descriptive Statistics (including one-year lagged variables)

Variables	Mean	Median	Std. Dev.	Min	Max
ROA	0.062	0.060	0.148	-2.279	3.778
LROA	0.065	0.061	0.141	-2.279	3.778
PBV	4.574	2.300	12.136	-9.010	201.600
LPBV	4.319	2.300	10.509	-11.800	201.600
ESGS	51.613	51.520	18.482	1.680	95.950
LESGS	49.437	49.660	19.144	0.880	95.210
Risk	0.232	0.220	0.184	0.000	1.666
R&D	1.940	0.000	10.237	0.000	348.840
Size (natural log)	14.327	14.188	1.582	8.053	19.205

Note: The statistics presented are computed across 2,914 observations from 2011 to 2021.

The mean firm in the data has a market price per share 4.574 times higher than the book value of equity per share, generates a net income equivalent to 6.200% of its total assets (on average), has an ESGP score of 51.613, has a total debt to total assets ratio of 0.232 (23.200%), invests 1.940% of its total assets in R&D, has approximately 1,668,290 thousand of GBP in total assets, and has increased ESGP

[7] The sample pertains to firm-year observations within 2011-2021, which are used to analyze the ESGP-FP relationship in both causal directions with a one-year lag.

score compared to the previous year. Additionally, the overall descriptive statistics within the analysis of the two-year lagged relationships are presented in Table 7 (Appendix). In this instance, the data sample[8] comprises 2,422 firm-year observations, representing a total of 371 unique firms during the period between 2012 and 2021. As we can observe, the results are similar to those presented in Table 1, demonstrating a slight increase in the mean firm's mean ESGP score from 51.613 (Table 1) to 53.514 (Table 7). Moreover, the mean firm's ESGP score also increased compared to its value two years prior.

4.2 Multivariate results

Table 2 displays the empirical results derived from the OLS regressions conducted to examine hypothesis 1. Here, we consider the one-year lagged ESGP (*LESGS*) score as the dependent variable, *ROA*[9] and *PBV* as the main independent variables in all presented equations. Exclusively in equations (2) and (4), we control for *Risk*, Research & Development ratio (*R&D*), and *Size*.

In specifications (1) and (3), we included only the ESGP score as the sole explanatory variable to isolate its impact on the respective independent variables. In this approach, we must acknowledge the risk of omitting other variables that may affect the relationship between the ESGP and FP, potentially leading to biased results. The omission of such variables may indicate endogeneity, where the explanatory variable is correlated with the error term in the regression models. From these equations, ESGP does not significantly impact ROA. Conversely, the ESGP score shows a significant and slight negative impact on PBV (5% level), showing that increased ESGP leads to a lower PBV.

[8] The sample pertains to firm-year observations within 2012-2021, which are used to analyze the ESGP-FP relationship in both causal directions with a two-year lag.
[9] For all regression models estimated in this study, the variable *ROA* is constructed as a percentage.

Table 2 - OLS one-year lag estimation results (ESGP score)

OLS (one-year lag)				
Variables	**ROA (1)**	**ROA (2)**	**PBV (3)**	**PBV (4)**
LESGS	0.009	0.050**	-0.029**	0.184
	(0.014)	(0.019)	(0.012)	(0.016)
Risk		-0.126***		0.848
		(0.016)		(1.293)
R&D		-0.002***		-0.019
		(0.000)		(0.022)
Size		-0.003		-0.580***
		(0.002)		(0.200)
Industry Fixed-Effects	No	No	No	No
Firm Fixed-Effects	No	No	No	No
R-squared	0.010	3.600	0.210	0.510
Overall F-Test	0.410	27.130***	6.000**	3.720***

Note: All specifications include a constant term and are based on 2,914 observations. Standard-errors in parenthesis. *** denotes p-value <0.01, ** denotes p-value <0.05, and * denotes p-value <0.10.

The overall F-test assesses whether all coefficient betas, except the constant, are zero in each OLS model. It helps understand whether the set of independent variables in each model is useful in explaining the variation in the dependent variable. In the case of ROA and PBV, the F-tests yield small values (0.410 and 6.000, respectively), with only the one for PBV being statistically significant (5% level). In line with our expectations, this implies no significant relationship between ESGP and ROA in equation (1), thus reflecting potential endogeneity issues that can be addressed by including additional independent variables not considered in the model.

We then include the defined control variables in equations (2) and (4). As anticipated, equation (3) exhibits endogeneity issues, evidenced by the change in the coefficient of the ESGP score in equation (4), as it transitioned from a negative value to a positive one when examining its impact on PBV and is no longer statistically significant. Equation (2) indicates a more positive effect of the ESGP

score on ROA than equation (1). However, in equation (2), the coefficient is now statistically significant (5% level).

The results are mixed regarding the effect of each control variable on FP. In equation (3), the results suggest that both risk and R&D have a significant and negative impact on ROA (1% level). However, in equation (4), neither of these variables significantly impact PBV. In equation (4), size has a significant and negative effect on PBV, while equation (3) shows size does not impact ROA.

Considering the overall lack of significance observed in the impact of ESGP and both FP proxies, Table 2 does not offer sufficient evidence to support hypothesis 1. Therefore, we find no evidence to conclude that a firm's subsequent FP is positively affected by increased ESGP.

The results of Table 8 (Appendix), which introduces a two-year lag based on the regression models of Table 2, reflect clear similarities with the results obtained from Table 2. Equation (20) reaffirms the presence of endogeneity in equation (19), considering the impact of the ESGP score on PBV. Equations (18) and (20) demonstrate consistently mixed results regarding the impact of the ESGP score and control variables on both ROA and PBV, aligning with the findings in Table 2: the impact of risk and R&D on ROA is statistically significant and negative, whereas it is not on PBV; the impact of size on PBV is statistically significant and negative, whereas it is not on ROA; the impact of ESGP score is statistically significant and positive on ROA, whereas it is not on PBV. Therefore, our conclusions remain unchanged, indicating a lack of evidence to support hypothesis 1.

We expand our regression model by incorporating industry and firm-fixed effects for both one and two-year lags. The results of these expanded models are presented in Table 3.

Table 3 - Fixed-effects one-year lag estimation results (ESGP score)

Fixed-Effects (one-year lag)				
Variables	**ROA (5)**	**ROA (6)**	**PBV (7)**	**PBV (8)**
LESGS	0.050**	-0.042	0.006	-0.027
	(0.020)	(0.033)	(0.017)	(0.022)
Risk	-0.146***	-0.309***	-1.463	-0.490
	(0.104)	(0.028)	(1.354)	(1.930)
R&D	-0.002***	-0.000	-0.016	-0.025
	(0.000)	(0.001)	(0.023)	(0.071)
Size	-0.001	-0.004	-0.548**	-0.942*
	(0.003)	(0.007)	(0.212)	(0.486)
Industry Fixed-Effects	Yes	No	Yes	No
Firm Fixed-Effects	No	Yes	No	Yes
R-squared	5.920	39.230	2.570	58.150
Overall F-Test	6.990***	34.200***	2.930**	2.140***

Note: All specifications include a constant term and are based on 2,914 observations. Standard-errors in parenthesis. *** denotes p-value <0.01, ** denotes p-value <0.05, and * denotes p-value <0.10.

By incorporating fixed effects, we are controlling for unobservable industry-specific characteristics that may influence the FP-ESGP relationship, allowing us to isolate and analyze the specific impact of the explanatory variables within each industry or firm respectively.

With the inclusion of industry-fixed effects, equation (5) shows a significance (5% level) and positive impact of ESGP score on ROA, as in the OLS estimation in equation (2). In equation (7), ESGP score has no significant effect on PBV, as in the OLS estimation in equation (4). When examining the control variables, the results continue to offer mixed conclusions. In equation (5), similar to equation (2), the impact of risk and R&D remains statistically significant (1% level) and

negative on ROA. Size has a statistically significant and negative impact on PBV in equation (7), as in equation (4).

Incorporating firm-fixed effects in equations (6) and (8) results indicate no significant effect of ESGP on ROA and PBV, respectively. These findings indicate the presence of endogeneity in equations (2) and (5), where the impact of the ESGP score on ROA was statistically significant and positive. In conclusion, the inclusion of firm-fixed effects does not provide evidence of a positive impact of ESGP on FP, hence not supporting hypothesis 1. Additionally, in equation (6), the effect of risk on ROA is statistically significant and negative (1% level) as in equation (5). In equation (8), the effect of risk on PBV remains negative as in equation (7), but it is not statistically significant anymore. The estimate for size indicates a negative effect on PBV, although it is less statistically significant than in equations (3) and (7).

Based on the fixed-effects regression models in Table 3, we introduce two-year lags in Table 9 (Appendix). We again observe great similarities between the evidence shown in Table 9 and Table 3 (OLS two-year lag estimation). Equation (22) confirms the presence of endogeneity issues in equations (18) and (21), based on the statistically insignificant impact of ESGP score on ROA in equation (22). Equations (23) and (24) present a non-significant effect of ESGP score on PBV, as in equations (7) and (8). Similar to the findings in equations (5) and (6) and in equation (18), risk has a significant (1% level) and negative effect on ROA in equation (22).

For the control variables, in equation (24), we find a negative impact of risk on PBV at the 5% significance level. In equation (24), the estimate for size remains negative at the 1% significance level, which is slightly consistent with the findings in the OLS equation (20) and the fixed-effects equation (8). Furthermore, the impact of size on ROA is statistically insignificant in equation (22), consistent with equations (6) and (18). In equations (22) and (24), R&D has no impact on

both ROA and PBV, aligning with the findings obtained in equations (6), (8) and (20).

In resume, when examining the relationship between ESGP and FP with both one and two-year lags[10], there is no empirical evidence to support hypothesis 1. Firm-fixed effects equations (6), (8), (22), and (24) have a higher number of controlled variables and higher R-squared values, indicating that these regression models are the most suitable for the analysis. Based on these models, we find no impact of ESGP on ROA and PBV. In contrast to the studies of Xie et al. (2018) and Kim and Li (2021), equations (6) and (22) reveal no effect of size on ROA, while equations (8) and (24) demonstrate a negative impact of size on PBV. In line with the findings of Lee et al. (2016) and Xie et al. (2018), we find no impact of R&D expenditure on ROA in equations (6) and (22), and on PBV in equations (8) and (24). Finally, equations (6) and (22) reveal a negative association between risk and both one-year and two-year lagged ROA, and equation (24) shows a negative impact of risk on two-year lagged PBV.

Table 4 presents the empirical results derived from the OLS regressions conducted to examine hypothesis 2. We consider the one-year lagged ROA (*LROA*) and PBV (*LPBV*) as dependent variables and the ESGP score (*ESGS*) as the independent variable of interest in all equations. We incorporate the control variables (risk, R&D, size) exclusively in equations (10) and (12).

Similar to Table 2, we limited the explanatory variables to only ROA and PBV in equations (9) and (11), respectively, in Table 4. As expected, the overall F-test is statistically insignificant in both equations, indicating that neither regression model significantly explains the variation in ESGP scores. This suggests that the models may have a weak relationship with the dependent variable or other important factors are not accounted for in both equations.

[10] No significant multicollinearity issues were found in all the one-year lag regression models examined in this study, as the Variance Inflation Factor (VIF) values remained below 1.82. This evidence suggests that the explanatory variables are not strongly correlated with each other, providing no cause for concern.

We then incorporated the control variables in equations (10) and (12). As anticipated, equation (12) confirms the presence of endogeneity in equation (11), as the PBV estimate becomes positive and statistically insignificant in equation (12).

Table 4 - OLS one-year lag estimation results (ROA and PBV)

	OLS (one-year lag)			
Variables	**ESGS (9)**	**ESGS (10)**	**ESGS (11)**	**ESGS (12)**
LROA	0.026	0.039**		
	(0.024)	(0.018)		
LPBV			-0.046**	0.019
			(0.033)	(0.024)
Risk		0.442		0.049
		(1.473)		(1.463)
R&D		0.068***		0.062**
		(0.025)		(0.025)
Size		7.864***		7.879***
		(0.169)		(0.170)
Industry Fixed-Effects	No	No	No	No
Firm Fixed-Effects	No	No	No	No
R-squared	0.040	45.180	0.070	45.100
Overall F-Test	1.120	599.290***	2.020	597.460***

Note: All specifications include a constant term and are based on 2,914 observations. Standard-errors in parenthesis. *** denotes p-value <0.01, ** denotes p-value <0.05, and * denotes p-value <0.10.

Equation (10) indicates a marginal increase in the estimate of the ESGP score compared to equation (9). However, in equation (10), the estimate is now statistically significant (5% level).

The findings reveal striking similarities after comparing the impact of control variables on ESGP scores in equations (10) and (12),. In both equations, the

estimate for R&D exhibits a positive effect of ROA and PBV on ESGP scores and is statistically significant (1% and 5% levels, respectively). The estimate for size is positive and statistically significant at the 1% level, whereas risk is not statistically significant in both equations. To the opposite of equations (9) and (11), equations (10) and (12) exhibit positive and statistically significant F-tests (1% level), with very similar and moderate R-squared values.

The same conclusions can be retrieved from Table 10 (Appendix), in which we incorporate a two-year lag in the regression models in Table 4. The similarities observed between Table 4 and Table 10 indicate that the effects of ROA and PBV on ESGP remain consistent and stable over two years.

We further investigate hypothesis 2 by incorporating industry and firm-fixed effects in the regression model separately for both one-year and two-year lags. The results of these expanded models are shown in Table 5 and Table 12 (Appendix), respectively. Equation (14), which includes firm-fixed effects, reveals the presence of endogeneity in equation (13), which incorporates industry-fixed effects, and equation (10), which reflects the respective OLS estimation. This is indicated by the negative and statistically significant estimate of ROA in equation (14), while in equations (10) and (13), the estimate is positive. Furthermore, equations (15) and (16) demonstrate a neutral impact of PBV on ESGP scores, similar to the findings obtained in the OLS estimation equation (12). Moreover, the R-squared values of 85.260 and 85.240 in both equations (14) and (16) indicate a strong explanatory power of the models in the variation in the dependent variable. In summary, these two firm-fixed effects regression models do not provide evidence of a positive impact of either ROA or PBV on ESGP, therefore not supporting hypothesis 2.

Regarding the control variables, equation (16) presents a negative estimate of R&D at a 1% significance level, suggesting that equation (15) might have omitted important factors in the regression model, in which the R&D estimate is positive.

These findings support the notion that the models, including firm-fixed effects, offer the most suitable fit, providing more reliable evidence for the analysis at hand.

Table 5 - Fixed-effects one-year lag estimation results (ROA and PBV)

Fixed-Effects (one-year lag)				
Variables	**ESGS (13)**	**ESGS (14)**	**ESGS (15)**	**ESGS (16)**
LROA	0.032*	-0.025**		
	(0.018)	(0.013)		
LPBV			0.027	-0.016
			(0.024)	(0.021)
Risk	2.955*	10.746***	2.633*	11.209***
	(1.504)	(1.754)	(1.491)	(1.739)
R&D	0.047*	-0.187***	0.041	-0.185***
	(0.026)	(0.064)	(0.026)	(0.064)
Size	7.884***	7.465***	7.906***	7.465***
	(0.178)	(0.418)	(0.178)	(0.419)
Industry Fixed-Effects	Yes	No	Yes	No
Firm Fixed-Effects	No	Yes	No	Yes
R-squared	49.090	85.260	49.060	85.240
Overall F-Test	107.080***	111.130***	106.940***	110.110***

Note: All specifications include a constant term and are based on 2,914 observations. Standard-errors in parenthesis. *** denotes p-value <0.01, ** denotes p-value <0.05, and * denotes p-value <0.10.

When comparing equations (14) and (16), we observe that all control variables exhibit consistent signs and levels of statistical significance. In both equations, the estimate for risk is significant and positive at the 1% level, the estimate for size is positive and significant at the 1% level, while the estimate for R&D is significant and negative at the 1% level.

In Table 12 (Appendix), we introduce a two-year lag based on the fixed-effects regression models in Table 5. The conclusions drawn from the regression models in Table 5 and Table 12 are very similar. Equation (30) shows the existence of endogeneity issues in equations (26) and (29), given that in equation (30), the coefficient of the ESGP score is negative and statistically insignificant. In parallel, the R&D estimate is negative and statistically significant at the 1% level, the opposite of the respective coefficients in equations (26) and (29). Furthermore, equations (31) and (32) reinforce the conclusion of a neutral effect of PBV on ESGP scores.

The incorporation of firm-fixed effects in equations (30) and (32) does not yield evidence of a positive effect of FP on ESGP, aligning with the one-year lag regression model results, indicating a consistent pattern across both periods. Therefore, these findings do not support hypothesis 2. In fact, equation (30) reveals a slight negative effect of ROA on ESGP at the significance 5% level.

Similar to equations (14) and (16), equations (30) and (32) present consistent signs and levels of significance for the control variables estimates. In both equations, the estimate for risk remains positive, the estimate for size remains positive, and the estimate for R&D remains negative, all significant at the 1% level.

In resume, we also find no empirical evidence to support hypothesis 2. In equation (14), ROA negatively effects one-year-lagged ESGP. Equations (16) and (32) show that PBV does not affect ESGP for one and two-year lags. These findings are inconsistent with the conclusions of McGuire et al. (1988) and Waddock and Graves (1997), which suggested a positive effect of a firm's FP on subsequent ESGP. Therefore, this study does not provide evidence to support the slack resources theory. Regarding the control variables, we find size to have a positive effect on ESGP, in line with the findings of Velte (2017). We find that firm-fixed effects equations consistently demonstrate a strong and positive

association between risk and ESGP and a negative association between R&D expenditure and ESGP.

5. Conclusion

The focus on integrating ESG factors into a firm's business has gained plenty of attention among corporations worldwide. The COVID-19 pandemic triggered a shift in mindset, leading to a greater concern on sustainability issues (Li et al., 2021). Consequently, the number of studies examining firms' ESGP-FP relationship has increased substantially. Although many of the findings are inconsistent, many authors tend to conclude that there is a positive link between a firm's ESGP and FP.

This study examines not only the potential causal relationship between ESG and subsequent FP, but also the impact of FP on subsequent ESGP, following the approach taken by Fischer and Sawczyn (2013). The dataset used comprises 2,914 observations from 472 firms listed in the UK's LSE and its sub-market, the AIM, between 2010 and 2021. Like Fischer and Sawczyn (2013) which analysed one-year relationships of German listed firms, this study examines one-year and two-year lagged relationships between ESGP and FP. ESG measurement is based on using ESG aggregate performance scores. In contrast, the measurement of FP incorporates both accounting and market-based measures, these being ROA and PBV, respectively, following Velte (2017) and Ademi and Klungseth (2022), which emphasize the importance of using these two types of measures to assess FP.

We established two methods in our methodology: the Ordinary Least Squares (OLS) regression and the Fixed-Effects (FE) approach. We observed low R-squared values and mixed results for the OLS regression models for both ESG-FP relationship causal directions, which led us to question the reliability of the results. To address these concerns, we adopted the FE approach by applying industry and firm-fixed effects, aiming to control for industry and firm-specific

factors that could influence the relationship between ESGP and FP, and to address potential endogeneity issues of the OLS estimations.

When employing firm-fixed effects, which proved to be the most suitable approach for the analysis, we found no significant impact of ESGP on ROA and PBV. After controlling for firm-specific factors, the results provide evidence of a neutral relationship between ESGP and subsequent FP. These findings are consistent with the studies conducted by Aupperle et al. (1985) and McWilliams and Siegel (2000), which also suggested a neutral effect of ESGP on FP. Contrary to most studies, we find evidence of a negative effect of size on PBV. Moreover, consistent with previous research, we find that higher levels of risk are associated with lower FP of firms in the following period. Finally, we find no effect of R&D expenditure on subsequent FP.

We also do not find sufficient evidence to support a positive relationship between FP and subsequent ESGP. We find PBV to have a neutral effect on ESGP, and a negative effect of a firm's ROA on ESGP, hence not supporting the slack resources theory, as argued by McGuire et al. (1988) and Waddock and Graves (1997). Additionally, we find strong evidence of a firm's size and risk to positively affect ESGP across all firm-fixed effects equations. Contrary to evidence found by McWilliams and Siegel (2000), we find a negative relationship between R&D expenditure and ESGP for both periods, concluding that increased investments in R&D activities may not necessarily translate into improved ESGP.

The findings of this study contribute in several ways to the growing body of literature by providing empirical evidence specific to the LSE, considering the unique sustainability regulation context of the UK. In contrast to most previous studies that solely focus on the impact of ESGP on subsequent FP, this study investigates not only the impact of ESGP on subsequent FP, but also the impact of FP on subsequent ESGP, providing a comprehensive assessment of causality in both directions. To understand if there is a link between ESGP and FP in the

long term, we considered an extended time frame for our analysis. We incorporated both one-year and two-year lags between the main variables of interest. This approach was employed to help establish a temporal sequence and directionality in the relationship. By using accounting and market-based measures for FP, the study cares to gain a more holistic view of FP, by capturing different dimensions of a firm's capacity to be profitable and generate earnings to its stakeholders, thus reducing the dependency on a single measure.

There is way more to discover concerning the ESGP-FP link, as we acknowledge the limitations of this study, and the opportunities for future research. Firstly, this study solely focuses on a specific stock exchange, which may limit the application of the findings to other stock exchanges or countries. Secondly, the study relies on a single measure of ESG, which may only capture some factors of individual ESG dimensions. To conclude, as we did find strong relevancy in the role of the included control variables in the relationship between ESGP and FP, there may be other uncontrolled factors or omitted variables that could affect this link. For future research, this study's findings suggest that scholars to consider a wider range of stock exchanges, countries, or industries and use additional indicators to measure ESGP as a whole or to measure specific ESG dimensions. Additionally, explore different periods beyond the one defined for this study. Regarding the period of time, one method to follow could be the analysis of the same dataset used in this study but focusing on a different period of time of equal length. Considering the relevancy we find in accounting for size, risk, and R&D expenditure as controls within the ESGP-FP relationship examination, it is recommended to incorporate additional variables to improve the understanding and reliability of empirical evidence concerning the ESGP-FP relationship.

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Appendix

Table 6 - List of Variables

Variables	Abbreviation	Description/Definition
Return on Assets	ROA	Ratio of Net Income per Total Assets of firm *i* in year *t*
Return on Assets (one-year lag)	LROA	Ratio of Net Income per Total Assets of firm *i* in year *t-1*
Return on Assets (two-year lag)	LLROA	Ratio of Net Income per Total Assets of firm *i* in year *t-2*
Price to Book Value Ratio	PBV	Market Price per share divided by the Book Value of Equity per share of firm *i* in year *t*
Price to Book Value Ratio (one-year lag)	LROA	Market Price per share divided by the Book Value of Equity per share of firm *i* in year *t-1*
Price to Book Value Ratio (two-year lag)	LLROA	Market Price per share divided by the Book Value of Equity per share of firm *i* in year *t-2*
ESG Score	ESGS	Environmental, Social and Governance performance Score of firm *i* in year *t*
ESG Score (one-year lag)	L ESGS	Environmental, Social and Governance performance Score of firm *i* in year *t-1*
ESG Score (two-year lag)	LL ESGS	Environmental, Social and Governance performance Score of firm *i* in year *t-2*
Risk	Risk	Total Debt/Total Assets of firm *i* in year *t*
R&D to Sales Ratio	R&D	R&D expenditure divided by Total Sales of firm *i* in year *t*
Size	Size	Natural logarithm of Total Assets of firm *i* in year *t*

Note: This table presents all the variables included in this study.

Table 7 - Descriptive Statistics (including two-year lagged variables)

Variables	Mean	Median	Std. Dev.	Min	Max
ROA	0.060	0.058	0.153	-2.279	3.778
LLROA	0.072	0.066	0.140	-2.279	3.778
PBV	4.574	2.300	12.511	-9.010	201.600
LLPBV	4.325	2.400	9.697	-11.800	184.090
ESGS	53.514	53.320	17.852	5.390	95.950
LLESGS	49.468	49.875	18.843	0.880	94.740
Risk	0.236	0.224	0.184	0.000	1.561

R&D	1.702	0.000	7.611	0.000	247.810
Size (natural log)	14.468	14.321	1.540	8.053	19.205

Note: The statistics presented are computed across 2,422 observations from 2012 to 2021.

Table 8 - OLS two-year lag estimation results (ESGP score)

OLS (two-year lag)				
Variables	**ROA (17)**	**ROA (18)**	**PBV (19)**	**PBV (20)**
LLESGS	0.011	0.050**	-0.030**	-0.000
	(0.016)	(0.022)	(0.013)	(0.182)
Risk		-0.125***		0.417
		(0.018)		(1.467)
R&D		-0.002***		-0.031
		(0.000)		(0.034)
Size		-0.003		-0.560**
		(0.003)		(0.230)
Industry Fixed-Effects	No	No	No	No
Firm Fixed-Effects	No	No	No	No
R-squared	0.020	2.790	0.200	0.470
Overall F-Test	0.430	17.370***	4.820**	2.860**

Note: All specifications include a constant term and are based on 2,422 observations. Standard-errors in parenthesis. *** denotes p-value <0.01, ** denotes p-value <0.05, and * denotes p-value <0.10.

Table 9 - Fixed-effects two-year lag estimation results (ESGP score)

Fixed-Effects (two-year lag)				
Variables	**ROA (21)**	**ROA (22)**	**PBV (23)**	**PBV (24)**
LLESGS	0.053**	-0.007	0.005	-0.021
	(0.023)	(0.039)	(0.019)	(0.025)
Risk	-0.146***	-0.306***	-2.121	-4.128**
	(0.019)	(0.033)	(1.539)	(2.053)
R&D	-0.002***	-0.000	-0.023	-0.035

	(0.000)	(0.002)	(0.036)	(0.105)
Size	-0.001	-0.012	-0.521**	-1.357***
	(0.003)	(0.008)	(0.242)	(0.520)
Industry Fixed-Effects	Yes	No	Yes	No
Firm Fixed-Effects	No	Yes	No	Yes
R-squared	5.560	37.360	2.890	63.360
Overall F-Test	5.420***	25.350***	2.740***	4.370***

Note: All specifications include a constant term and are based on 2,422 observations. Standard-errors in parenthesis. *** denotes p-value <0.01, ** denotes p-value <0.05, and * denotes p-value <0.10.

Table 10 - OLS two-year lag estimation results (ROA and PBV)

OLS (two-year lag)				
Variables	**ESG (25)**	**ESGS (26)**	**ESGS (27)**	**ESGS (28)**
LLROA	0.027	0.039**		
	(0.026)	(0.019)		
LLPBV			-0.023**	0.033
			(0.037)	(0.028)
Risk		0.395		0.138
		(1.575)		(1.570)
R&D		0.085**		0.080**
		(0.036)		(0.036)
Size		7.698***		7.711***
		(0.186)		(0.187)
Industry Fixed-Effects	No	No	No	No
Firm Fixed-Effects	No	No	No	No
R-squared	0.040	44.070	0.020	44.010
Overall F-Test	1.060	476.150***	0.370	475.020***

Note: All specifications include a constant term and are based on 2,422 observations. Standard-errors in parenthesis. *** denotes p-value <0.01, ** denotes p-value <0.05, and * denotes p-value <0.10.

Table 11 - Fixed-effects two-year lag estimation results (ROA and PBV)

Fixed-Effects (two-year lag)				
Variables	**ESGS (29)**	**ESGS (30)**	**ESGS (31)**	**ESGS (32)**
LLROA	0.036*	-0.021		
	(0.019)	(0.013)		
LLPBV			0.044	0.020
			(0.027)	(0.024)
Risk	3.043*	10.696***	2.852*	11.001***
	(1.604)	(1.841)	(1.598)	(1.837)
R&D	0.059	-0.338***	0.052	-0.339***
	(0.038)	(0.094)	(0.038)	(0.094)
Size	7.691***	7.239***	7.712***	7.182***
	(0.193)	(0.449)	(0.193)	(0.450)
Industry Fixed-Effects	Yes	No	Yes	No
Firm Fixed-Effects	No	Yes	No	Yes
R-squared	48.710	85.580	48.690	85.560
Overall F-Test	87.480***	90.420***	87.410***	89.950***

Note: All specifications include a constant term and are based on 2,422 observations. Standard-errors in parenthesis. *** denotes p-value <0.01, ** denotes p-value <0.05, and * denotes p-value <0.10.