ESG performance and investment efficiency: The impact of information asymmetry

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1. Introduction

The debate on the financial repercussions of firms' Corporate Social Responsibility (CSR) and Environmental, Social, and Governance (ESG) performance[1] has been continuing over the last 40 years. Some scholars underline the positive aspects of CSR involvement, arguing that firms with better CSR attributes have enhanced corporate value and performance (**Jo and Harjoto, 2011**) and access to capital (**Cheng et al., 2014**), and they have reduced asymmetric information (**Lopatta et al., 2016; Cui et al., 2018**), agency controversies (**Harjoto and Jo, 2011; Eccles et al., 2014**), financial risk (**Bouslah et al., 2013**), and cost of equity (**El Ghoul et al., 2011**).

[1]*This paper uses the "ESG" terminology to refer to how firms incorporate environmental, social, and governance concerns into their policies and business models. The ESG acronym has been developed by 20 financial institutions in "Who cares wins" conference held by UN Global Compact and IFC in 2004, where the concept of ESG was first introduced (**Compact, 2004**). While Corporate Social Responsibility (CSR) can be defined in various ways, it encompasses the actions undertaken by businesses to benefit communities, individuals, and the environment beyond their legal obligations (**Ioannou and Serafeim, 2015**). A slight difference exists between the two terminologies: the ESG concept captures governance explicitly, whereas CSR captures governance-related issues indirectly, as it is more concentrated on the environment and social issues (**Gillan et al., 2021**). Hence, ESG is a more comprehensive measure compared to CSR (**La Torre et al., 2021**).*

In contrast, other scholars highlight that firms' CSR activities create a source of conflict among stakeholders (**Krüger, 2015**), decrease firms' resources and generate unnecessary costs, which might reduce the competitive advantage (**Preston and O'bannon, 1997**).

The investment efficiency literature argues that firms should execute all profitable net present value (NPV) projects (**Modigliani and Miller, 1958; Hayashi, 1982**). They measure investment efficiency as the ability of firms to undertake all projects with positive net present value. Notwithstanding this, a growing body of literature presents evidence of firms that diverge from the optimal investment level. Scholars explain this divergence by reasoning two main concepts: asymmetric information (**Myers and Majluf, 1984; Biddle et al., 2009**) and conflict of interests created by agency issues and free cash flow (**FCF**) (**Jensen, 1986; Guariglia and Yang, 2016**). Excessive free cash flow (FCF) will likely cause overinvestment, whereas information asymmetries can lead to underinvestment.

This study explores the relationship between ESG engagement and corporate investment efficiency. There are two competing perspectives related to the impact of ESG/CSR on investment efficiency. CSR activities can generate conflict between stakeholders (**Friedman, 1970**). The managerial opportunism hypothesis suggests that agency problems could lead firms to overinvest in CSR (**Preston and O'bannon, 1997; Benabou and Tirole, 2010**). Besides, the trade-off hypothesis states that CSR investments reduce company resources, bringing a competitive disadvantage and decreasing firm value and investment efficiency (**Preston and O'bannon, 1997**). However, stronger ESG performance can reduce asymmetric information for firms, enhances stakeholder relationships, and improves the disciplining and monitoring of the management's execution (**Cornell and Shapiro, 1987**). Firms with stronger CSR performance tend to mitigate agency costs (**Krüger, 2015; Renneboog et al., 2014**), face fewer financial constraints, and realize more efficient investments.

This paper examines how firms' overall ESG performance affects their investment inefficiency, focusing on two separate scenarios: overinvestment and underinvestment. Our dataset covers 1,094 nonfinancial firms from 21 countries in Europe, covering the years 2002-2019. We perform our baseline estimations using panel data estimation techniques, including industry, country, and time-fixed effects. To address potential endogeneity issues due to reverse causality, we also implement the instrumental variable (IV) approach, employing two-step estimations. Our results provide strong evidence that firms with stronger ESG performance are likely to be more efficient in their investments, in line with the value-enhancing view of CSR. Our results are robust to alternative estimation techniques to deal with endogeneity, the inclusion of alternative variables, and alternative sample selections. The investigation of the firm-level channels that link ESG performance to investment inefficiency suggests that ESG performance may work through four important channels: reduction in information asymmetry, financial constraints, and cash flow volatility and enhancement in cash flows. We demonstrate that "environmental, social, and governance pillars" and the subcategories' scores significantly enhance investment efficiency. Moreover, our findings are more pronounced for the overinvestment case compared to the underinvestment case, indicating that firms with better ESG performance have significantly less overinvestment issues.

We next explore how information asymmetry moderates the relationship between ESG engagement and investment efficiency. We employ two proxies to measure information asymmetry at the firm level: analyst coverage and the bid-ask spread ratio (**Griffin and Lemmon, 2002; Cho et al., 2013; Samet and Jarboui, 2017; Cheng et al., 2011**). ESG activity is helpful in improving overall investment efficiency and overinvestment for all firms with any level of information asymmetry. In the case of underinvestment, ESG performance enhances underinvestment only in the case of higher information asymmetries. Hence, firms that face higher asymmetric information experience improvements in underinvestment by increasing their transparency with an upsurge in ESG performance.

To gain deeper insights, we perform additional investigations and examine the association between ESG performance and investment inefficiency in extreme cases. Our findings show that firms with very low and very high ESG scores cannot reduce investment inefficiency. This could be because firms with very low ESG scores may not handle CSR requirements very well and become less efficient (**Kytle and Ruggie, 2005**). Meanwhile, firms with very high ESG scores may be overinvesting in ESG and entrench themselves as socially and environmentally responsible managers (**Krüger, 2015; Benlemlih and Bitar, 2018**).

Overall, our paper extends the literature analyzing the association between CSR engagement and investment inefficiency (**Zhong and Gao, 2017; Benlemlih and Bitar, 2018; Samet and Jarboui, 2017**) by focusing on ESG performance, separately considering the overinvestment and underinvestment scenarios, and the impact of information asymmetry. We contribute to the literature in several dimensions. First, to our knowledge, our study is one of the first in the literature to investigate how information asymmetry moderates the relationship between ESG performance and investment efficiency using an enlarged dataset encompassing 21 European countries and an extended time frame spanning from 2002 to 2019. Second, we identify potential firm-level channels through which ESG performance may influence investment inefficiency. We find that firms with higher ESG performance enjoy lower information asymmetries, reduce their financial constraints, and achieve higher levels of cash flow and lower cash flow volatility, which, in turn, leads to better investment management practices. Third, by disentangling the overinvestment and underinvestment scenarios, we are one of the first studies in the literature to provide empirical evidence that the positive impact of ESG performance on investment efficiency is more significant for the overinvestment cases. Notwithstanding this, we provide novel evidence that the level of information asymmetry matters in the underinvestment case; when information asymmetry for a firm is higher, we observe that ESG performance reduces underinvestment. Fourth, we contribute to the extant literature by focusing on European firms as an empirical setting. Primarily, prior literature on this topic has mainly conducted single-country (e.g., **Gomariz and Ballesta, 2014**) or single index analysis (**Samet and Jarboui, 2017**), with most of the studies examining the U.S. market (Benlemlih and **Bitar, 2018; Cook et al., 2019**). Hence, limited research is present for the entire European market. Meanwhile, the European Union (EU) gives utmost significance to incorporating broad principles on disclosure of ESG. EU implemented the directive on "Sustainable Finance Disclosure Regulation" and "Corporate Sustainability Reporting" in 2021. Hence, Europe constitutes an excellent market to analyze our research questions. Moreover, our study provides important firm and macro-economic level implications, as firms' investment level is one of the main determinants of firm growth and overall economic growth.

2. Literature review and hypothesis development

2.1. Theoretical background

Under the **Modigliani and Miller** (**1958**) paradigm, firms that aim to maximize their values are anticipated to invest in all profitable, positive NPV projects and continue investing accordingly (**Abel, 1983; Hayashi, 1982**). Notwithstanding this, in practice, financing constraints and capital market frictions may inhibit companies from commencing all positive NPV projects (**Hubbard, 1997; Bertrand and Mullainathan, 2003; Stein, 2003**), leading to inefficiencies in their investments (**Chen et al., 2017**). This divergence results in two possible investment inefficiency scenarios: overinvestment (more investment than anticipated) and underinvestment (less investment than anticipated) (**Samet and Jarboui, 2017; Gomariz and Ballesta, 2014; Benlemlih and Bitar, 2018**). Firms suffer from overinvestment when self-interested managers invest inefficiently by initiating negative NPV projects

to capture companies' existing resources (**Samet and Jarboui, 2017; Benlemlih and Bitar, 2018**). In contrast, companies experience underinvestment when they cannot accept profitable projects due to higher costs or lack of funds (**Biddle et al., 2009**).

Previous theoretical and empirical studies highlight two main frictions influencing investment efficiencies: information asymmetries and agency problems (**Gomariz and Ballesta, 2014; Chen et al., 2011; Benlemlih and Bitar, 2018**). First, according to **Myers and Majluf** (**1984**) and **Myers** (**1984**), information asymmetries may impact the availability and cost of funds raised for investments and hence the selection of investment projects. Second, studies demonstrate that the agency issues between the management and shareholders and between minority and majority shareholders also significantly affect companies' investment decisions (**Jensen, 1986; Myers and Majluf, 1984**). Self-interested managers, who try to maximize their wealth through undertaking projects with the company's resources, which do not improve shareholders' wealth (**Jensen and Meckling, 1976**), leads to management empire building (**Jensen, 1986**), enhancing overinvestment issues (**Hope and Thomas, 2008; Chen et al., 2011; Samet and Jarboui, 2017**).

2.2. Investment efficiency and ESG performance

Companies that make higher-quality disclosures improve their transparency and information quality (**Lambert et al., 2007**), delivering a more accurate picture of the company to capital providers and reducing asymmetric information. **Dhaliwal et al.** (**2011**) find that firms with higher CSR disclosure signal their positive non-financial attributes to all stakeholders. Hence, information on CSR features is likely to complement financial data, mainly when the asymmetric information between firms and non-financial stakeholders is high (**Dhaliwal et al., 2011**). Accordingly, companies with better CSR scores are shown to have cheaper equity financing (**Dhaliwal et al., 2012; 2014; El Ghoul et al., 2011, 2018**), lower cost of capital (**Sharfman and Fernando, 2008**), greater access to finance (**Cheng et al., 2014**) and hence improved investment levels (**Stein, 2003; El Ghoul et al., 2017**). Thus, companies' ESG practices are likely to be a vital determinant of strategic investment choices.

The stakeholder theory can also explain the association between ESG performance and investment efficiency. Companies with higher ESG performance consider all of their stakeholders' anticipations, thereby enhancing their financial performance through investment efficiency (**Benlemlih and Bitar, 2018**). Supporting stakeholder theory, the good management hypothesis (**Waddock and Graves, 1997**) also argues that CSR performance has a monitoring role through improving the relationships with vital stakeholders. Managerial skills, which result in enhanced CSR performance, also contribute to improved financial performance. In line with this, the conflict resolution hypothesis argues that CSR practices decrease controversies among all stakeholders, maximizing shareholders' wealth (**Calton and Payne, 2003; Jensen, 2001**). As details on corporations' CSR practices are public, transparency rises, fostering trust between its stakeholders (**Zamir et al., 2022**). Through improving employee relations, product characteristics, and environmental issues (**Benlemlih and Bitar, 2018**) and using governance mechanisms and engaging in social responsibility activities (**Harjoto and Jo, 2011**), taking into consideration all stakeholders' welfare and forming substantial contracts within them (**Benlemlih and Bitar, 2018**), companies are likely to reduce the conflict of interest between stakeholders (**Jensen, 2001; Harjoto and Jo, 2011; Calton and Payne, 2003**). Hence ESG activities are expected to lessen the conflicts among stakeholders and reduce investment inefficiencies.

Furthermore, with the execution of ESG strategies, managers' free cash flow would be limited, which can otherwise be exploited by self-interested managers to accept negative NPV investments (**Jensen, 1986**). Hence, CSR activities also have a monitoring role (**Cook et al., 2019**) and can be used as bonding mechanisms to restrain managerial opportunism (**Attig et al., 2014; Zamir et al., 2022**). Moreover, **Eccles et al.** (**2014**) argue that companies that integrate CSR issues into their strategies tend to incorporate a formal stakeholder engagement procedure, limiting the probability of managers' short-term opportunistic behavior.

The above discussions suggest that stronger ESG performance improves the information environment, reducing asymmetric information for companies (**Al-Hiyari et al., 2023**). Moreover, a commitment to more substantial CSR performance establishes tacit agreements among stakeholders, enhancing the disciplining and monitoring the management's execution (**Cornell and Shapiro, 1987; Cook et al., 2019**). Accordingly, companies are likely to face fewer financial constraints. Companies with higher CSR performance can mitigate agency costs (**Krüger, 2015; Renneboog et al., 2014**) of FCF (**Samet and Jarboui, 2017**) and consequently realize more efficient investments. Therefore, firms with stronger ESG performance are likely to invest more efficiently. Based on the above reasoning, we build our first hypothesis as follows:

H1: ESG performance is positively associated with investment efficiency.

Next, we deepen the analysis of the association between ESG, overinvestment and the underinvestment scenario. Even though we expect ESG performance to improve the overall investment efficiency, the effect of ESG performance can be different for the over and under-investment cases. Overinvestment occurs mainly because of excess funds (**Jensen, 1986; Guariglia and Yang, 2016**). Within the overinvestment scenario, the additional funds are now reserved for ESG activities, resulting in a lower amount of additional funds available for overinvestment. Hence, ESG practices may cause a decline in investment excess and push toward an optimal level of investment in the overinvestment case. Meanwhile, underinvestment mainly occurs due to financial constraints (**Hubbard, 1997; Campello et al., 2010; Shahzad et al., 2018**), likely to stem from information asymmetries (**Myers and Majluf, 1984; Biddle et al., 2009; Gomariz and Ballesta, 2014**). With more powerful ESG performance, companies tend to reveal more, improve corporate transparency, and reduce information asymmetry (**Dhaliwal et al., 2012**), leading to lower financial constraints (**Attig et al., 2014**). Notwithstanding this, the additional costs stemming from becoming superior in ESG activities may also create a financial constraint for firms. Accordingly, the effect of ESG on underinvestment tends to be indefinite. Based on this argument, we anticipate ESG performance to decrease overinvestment more significantly when compared to underinvestment cases.

H2: The impact of ESG performance on investment inefficiency is more pronounced in the overinvestment scenario.

On the other hand, the disclosure of ESG performance tends to provide incremental nonfinancial information about the firm. This additional information is likely to reduce asymmetric information, resulting in increased funding from the capital suppliers. Additional costs are also born from the disclosure and conduct of ESG-related activities. Hence in the underinvestment cases, ESG disclosure is perceived as a "double-edged sword" (Zhong and Gao, 2017): While stronger ESG performance is likely to improve companies' funding opportunities, the firm will also be obliged to incur additional expenses for the incremental ESG demands of non-stakeholders.

Studies show that financially constrained companies tend to have more underinvestment issues (**Hubbard, 1997; Campello et al., 2010; Shahzad et al., 2018**). Moreover, empirical studies suggest that companies' CSR practices lessen asymmetric information (**Dhaliwal et al., 2012; Lopatta et al., 2016;**

Cho et al., 2013). When applied as a control mechanism within companies, CSR practices are expected to improve companies' information quality and transparency (**Lopatta et al., 2016**) and deliver important nonfinancial information (**Attig et al., 2014**). Consequently, companies are likely to become more transparent (**Cui et al., 2018**). The improvement in the overall exposition of nonfinancial information about the firm ultimately leads companies to obtain higher credit ratings and lower financial constraints (**Attig et al., 2014**), reducing underinvestment. The stakeholders already have access to non-financial information on the companies with lower asymmetric information. Thus, they might not be expected to benefit from additional ESG disclosure. Accordingly, we construct our third hypothesis as follows:

H3: ESG performance decreases underinvestment problems only for firms with higher information asymmetries.

3. Research design

3.1. Sample selection

We use firm-level data from 21 European countries for the years between 2002 and 2019. To form our sample, we include all companies from Thomson Reuters Datastream that have complete financial data available for the period spanning from 2002 to 2019. We start with 2002 because Refinitiv started to report firms' ESG scores in 2002. We remove financial companies with SIC codes between 6,000 and 6,999 and include firms with available ESG scores. The final sample comprises 1,094 unique firms publicly listed on a stock exchange, corresponding to an unbalanced panel of 9,522 firm-year observations. **Table 1a** Panel A presents the firm distribution across the 21 countries. 28.2% companies in the sample are from the U.K., followed by 10.7% from France and 10.21% of the from Germany.

Table 1a Panel A. Sample distribution (countries).

Country	No. of Observations	No. of Firms	%
UK	2686	255	28.21 %
France	1018	109	10.69 %
Germany	972	124	10.21 %
Switzerland	593	73	6.23 %
Sweden	576	95	6.05 %
Spain	459	48	4.82 %
Italy	405	57	4.25 %
Norway	367	54	3.85 %
Netherlands	331	35	3.48 %
Finland	319	26	3.35 %
Russia	316	32	3.32 %
Denmark	314	34	3.30 %
Belgium	235	29	2.47 %
Turkey	193	33	2.03 %
Austria	176	19	1.85 %
Poland	143	23	1.50 %
Greece	121	15	1.27 %
Portugal	120	14	1.26 %
Ireland	118	13	1.24 %
Hungary	35	4	0.37 %
Czech	25	2	0.26 %
TOTAL	9,522	1,094	100.00 %

Table 1b Panel B provides the sample distribution across industries (employing two-digit SIC Codes). The sample is dominated by three sectors, namely manufacturing, transportation, and public utilities and services, which make up 43.8%, 19.8%, and 11.2% of the sample, respectively.

3.2. Variables

3.2.1. ESG performance variables

The main independent variables are firms' overall ESG performance, proxied with ESG combined score, and the "environmental, social, and governance pillar scores" and their ten subcategories. Table A1 in Appendix provides the definitions of the ten subcategories. These ratings are widely used by scholars and are constructed to transparently quantify a firm's relative ESG commitment and performance based on company-reported data (**Samet and Jarboui, 2017; Rajesh, 2020; Bătae et al., 2021**).

Our baseline estimations use the ESG combined score as the main independent variable, which provides a more comprehensive assessment of the company's performance and sustainability. The ESG combined score is a multidimensional concept, as firms' ESG engagement is a multifaceted phenomenon. Besides the ESG combined score, we explore the impact of the three pillars and 10 subcategories as our independent variables separately. The details on all variables are provided in **Table 2**.

3.2.2. Dependent variable: Investment inefficiency

Although there is no direct proxy to measure the investment efficiency of a company in the literature, previous studies compute investment inefficiency as the divergence from the anticipated investment level, with an investment model's error term (**Biddle et al., 2009; Chen et al., 2011; Samet and Jarboui, 2017, Shahzad et al., 2018; Phuong et al., 2022; Cook et al., 2019**). Following this approach, we use the investment model in Model 1 below, previously used in the literature by **Biddle et al.** (**2009**), **Benlemlih and Bitar** (**2018**), and **Shahzad et al.** (**2018**), among others. Specifically, we estimate a firm-specific model of investment as a function of growth opportunities (proxied by sales growth), and residuals are used as firm-specific proxies for deviations from the expected level of investment. The investment level in the current year is modeled as a function of growth opportunities in the previous year, as proxied by sales growth, in the following way:

$$Investment_{i,t} = \gamma_0 + \gamma_1 \, Sales\ growth_{i,t-1} + \nu_{it} \quad (1)$$

We define $\text{Investment}_{i,t}$ as the total investments of the firm i in year t (ratio of increase in tangible and intangible assets to lagged total assets) and sales growth as the rate of change in revenue of the company i from year $t-2$ to $t-1$. We estimate the investment model cross-sectionally for each industry and year. We base the industry classification on two-digit SIC codes. The error terms (residuals) in Model 1 show the discrepancy between the anticipated and actual level of investment. We take the absolute value of the residuals to represent our company-specific proxy for investment inefficiency. We name this variable "Investment inefficiency". Hence, a higher absolute value of the residuals signifies increased levels of investment inefficiency. Next, we also categorize companies based on the sign of these residuals: Positive residuals represent cases where the actual level of investment is greater than expected, hence overinvestment scenarios, whereas negative residuals represent cases where the actual level of investment is less than anticipated, thus underinvestment scenarios. We name these variables "Overinvestment" and "Underinvestment" and use them in our regressions separately as dependent variables.

In robustness checks, following **Chen et al.** (**2011**), **Gomariz and Ballesta** (**2014**), and **Samet and Jarboui** (**2017**), we use an alternative proxy for investment inefficiency. To account for the fact that the association between sales growth and investment might change if sales growth is positive or negative, we add two variables into Model 1: $NEG_{\mathrm{i,t-1}}$ and the interaction term between $NEG_{\mathrm{i,t-1}}$ and Sales $growth_{\mathrm{i,t-1}}$, as shown in Model 2 below. $NEG_{\mathrm{i,t-1}}$ is a binary indicator variable that equals one if sales growth is negative and zero otherwise.

$$\text{Investment}_{i,t} = \gamma_0 + \gamma_1 \text{NEG}_{i,t-1} + \gamma_2 \text{Sales growth}_{i,t-1} + \gamma_3 \text{NEG}_{i,t-1} * \text{Sales growth}_{i,t-1} + \nu_{it} \quad (2)$$

Table 1b Panel B. Sample distribution (sectors).

Sector	No. of Obs.	No. of Firms	%
Manufacturing	4172	478	43.81 %
Transportation & Public Utilities	1888	188	19.83 %
Services	1062	170	11.15 %
Retail Trade	838	88	8.80 %
Mining	671	70	7.05 %
Construction	588	60	6.18 %
Wholesale Trade	291	38	3.06 %
Agriculture, Forestry & Fishing	12	2	0.13 %
TOTAL	9,522	1,094	100.00 %

**Table 1a Panel A shows the number of observations, firms, and their % in the sample across countries. Table 1b Panel B shows the industry distributions of the sample comprised of 9,522 observations for the years between 2002 and 2019. The industry distribution is based on two-digit standard industrial classification (SIC). Firms with SIC codes between 6000 and 6999 are excluded from the sample.*

Table 2 Variables.

Variable	Definition	Literature
ESG performance	ESG combined score Varies from 0 to 100, covering 186 data points.	(Cheng et al., 2014; Samet and Jarboui,2017; Shahzad et al., 2018; Naqvi et al., 2021)
Environmental performance	Ranges from 0 to 100 %. Includes 68 indicators: resource use (20), emissions (28), environmental innovation (20).	(Samet and Jarboui, 2017)
Social performance	Varies from 0 to 100 %. Includes 62 indicators: community (14), product responsibility (10), workforce (30), human rights (8)	(Samet and Jarboui, 2017)
Governance performance	Ranges from 0 to 100 %. Consists of 56 indicators: CSR strategy (9), shareholders (12), management (35).	(Samet and Jarboui, 2017)
Investment	Net increase in tangible and intangible assets divided by lagged total assets	(Gomariz and Ballesta, 2014; Samet and Jarboui, 2017;Benlemlih and Bitar, 2018)
Sales Growth$_{i,t-1}$	Rate of change in net sales of company i from year t-2 to t-1	(Shahzad et al., 2018;Benlemlih and Bitar, 2018)
Investment inefficiency	Absolute value of the residuals from the investment model Investment$_{i,t}$= $\gamma_0 + \gamma_1$ Sales growth$_{i,t-1} + \nu_{it}$	(Biddle et al., 2009;Benlemlih and Bitar, 2018)
Underinvestment	Negative residuals from the investment model	(Chen et al., 2001; Gomariz and Ballesta, 2014; Cook et al., 2019; Benlemlih and Bitar, 2018)
Overinvestment	Positive residuals from the investment model	(Chen et al., 2001; Gomariz and Ballesta, 2014; Cook et al., 2019; Benlemlih and Bitar, 2018)
Firm size	Natural logarithm of book value of assets	(Biddle et al., 2009; Chen et al., 2011; Benlemlih and Bitar, 2018; Shahzad et al., 2018)
Firm Age	Natural logarithm of 1 plus the firm age (years between the fiscal year the year of incorporation)	(Biddle et al., 2009; Chen et al., 2011; Shahzad et al., 2018; Gomariz and Ballesta, 2014; Samet and Jarboui, 2017; Cook et al., 2019; Benlemlih and Bitar, 2018)
Tangibility	Net value of property plant and equipment scaled by total assets	(Cook et al., 2019; Chen et al., 2011; Shahzad et al., 2018; Gomariz and Ballesta, 2014; Benlemlih and Bitar, 2018; Biddle et al., 2009)
Financial Slack	Cash and equivalents scaled by total assets	(Biddle et al., 2009; Chen et al., 2011; Benlemlih and Bitar, 2018; Cook et al., 2019)
Tobin's Q	Market value of equity, preferred stock, and debt scaled by the book value of assets	(Chung and Pruitt, 1994; Gomariz and Ballesta, 2014; Benlemlih and Bitar, 2018; Shahzad et al., 2018)
LOSS / LOSS2	LOSS: Dummy variable = 1 if the net income before tax and extraordinary items is negative,0 otherwise LOSS2: Dummy variable = 1 if the net income before tax and extraordinary items is negative for two consecutive periods, 0 otherwise	(Biddle et al., 2009; Shahzad et al., 2018; Chen et al., 2011; Gomariz and Ballesta, 2014; Benlemlih and Bitar, 2018; Cook et al., 2019)
Z-Score	Z-Score = 0.012*X1 + 0.014*X2 + 0.033*X3 + 0.006*X4 + 0.999*X5 where X1: working capital / total assets, X2: retained earnings / total assets, X3: earnings before interest and taxes / total assets, X4: market value of equity/book value of total debt, X5: sales / total assets	(Altman, 1968; Biddle et al., 2009;Benlemlih and Bitar, 2018; Cook et al., 2019; Gomariz and Ballesta, 2014; Shahzad et al., 2018)
Analyst Coverage	Natural logarithm of the number of analysts following the company	(Griffin and Lemon, 2002)
Asymmetric Information (Spread)	Annual mean of the proportion of the daily bid-ask spread to the closing price for each company i in the fiscal year t	(Cho et al., 2013; Samet and Jarboui, 2017; Naqvi et al., 2021)
NEG	Dummy variable = 1 if revenue growth is negative, 0 otherwise	(Chen et al., 2011; Samet and Jarboui, 2017)

This table displays the variables used in the analysis, their description, and previous scholars who used these variables in the literature. The dependent variable is investment inefficiency, overinvestment, and underinvestment. The independent variable is ESG combined score, environmental, social, and governance pillars, and the ten subcategories (environmental product innovation, emissions, resource use, product responsibility, human rights, workforce, community, corporate social responsibility (CSR) strategy, shareholders, and management). We provide the definitions of the subcategories of ESG score in Table A1 in the Appendix.

We estimate Model 2 cross-sectionally for each industry and year and use the residuals as an alternate proxy of investment inefficiency. As a final alternative proxy for investment inefficiency, in robustness checks, we include firm-level control variables in Model (1) to isolate the impact of growth opportunities better and capture investment inefficiency. These control variables are the same as the ones used in ESG performance and investment inefficiency regressions, which include firm size and age, tangibility, financial slack, Tobin's Q, $LOSS$, and **Altman's (1968)** Z-Score.

3.2.3. Control variables

Following the prior literature (Gomariz and Balista, 2014; **Samet and Jarboui, 2017; Benlemlih and Bitar, 2018; Shahzad et al., 2018; Biddle et al., 2009**), we add several firm-specific control variables into the investment inefficiency analysis to isolate the impact of ESG performance on investment inefficiency: firm size and age, tangibility, financial slack, $Tobin's\ Q$, $LOSS$ and **Altman's (1968)** Z-

Score. All variables, their measurement methodology, and the related literature that also uses these variables are summarized in **Table 2**.

3.3. Methodology

Primarily, our first target is to analyze the effect of firms' ESG performance on their investment inefficiency using the following model:

$$InvInEff_{i,t} = \gamma_0 + \gamma_1\ ESG\ Comb.\ Score_{i,t} + \sum_{1}^{18} \gamma_2\ Controls_{i,t} + \eta_i + \eta_t + \eta_c + \nu_{itc} \quad (3)$$

$InvInEff_{i,t}$ represents investment inefficiency of firm i in year t, and the ESG combined score is a firm's overall ESG performance. Controls refer to several company-specific control variables. ηi, ηt, ηc indicate industry, time, and country fixed effects and v_{itc} is the error term.

Besides investment inefficiency, we also use overinvestment and underinvestment as our dependent variables. For overinvestment, we consider the positive departures from the anticipated level of investment (positive residuals from Model 1). Accordingly, higher values of overinvestment coincide with higher levels of inefficiency. For underinvestment, we consider the negative residuals from Model 1. Higher values of underinvestment (i.e., values close to 0) signify a lower underinvestment problem, hence a lower level of investment inefficiency.

To identify which specific pillar and specific subcategory significantly impact investment efficiency, we also employ separately the three pillars and 10 subcategories as additional independent variables.

To estimate model 3, we implement panel data estimation techniques, including fixed effects verified by the Hausman tests. We incorporate industry-fixed effects because there are industry-specific factors that are time-invariant and are critical determinants of investment efficiency. The industry fixed effects are built on the first two digits of their SIC codes. To control heterogeneity between countries and account for potential issues related to omitted country-level variables that may be correlated, we also employ country-fixed effects (**Chen et al., 2011; Doidge et al., 2007**). We also incorporate year-fixed effects to incorporate the outcome of the altering economic environment in individual years. The industry, year, and country fixed effects are represented by "ηi", "ηt" and "ηc" in Model 3 and v_{itc} is the error term.

As for the robustness checks, alternative estimation techniques are used to address potential endogeneity issues due to reverse causality. We utilize an instrumental variable approach, employing two-step estimations. We perform the two-step estimations using $2SLS$ (two-stage least squares), $LIML$ (limited-information maximum likelihood), and GMM estimators. We consider ESG activity as endogenous and use two instruments for ESG scores, following **El Ghoul et al.** (**2011**), **Attig et al.** (**2014**), **Samet and Jarboui** (**2017**), and **Benlemlih and Bitar** (**2018**). We use the industry-year mean of the ESG scores as the first instrument and the second is a firm's initial level of ESG score. The "initial "ESG score" is the score a firm gets when it initially appears in the sample. Two instrument variables are positively correlated with the current ESG score. We run the specification tests to validate the relevance and strength of our instruments. In the first stage of the two-stage regression analysis, we take the ESG combined score as the dependent variable and the predetermined instruments as the independent variable, along with the control variables. In the second stage, investment inefficiency is the dependent variable, with the estimated values of the ESG score being the independent variable.

3.4. Descriptive statistics

We provide the summary statistics of the main variables in **Table 3**. Within the three pillars of the ESG score, the lowest mean and median value belong to the environmental pillar compared to the social pillar's highest mean and median values. Furthermore, the mean values of investment inefficiency, overinvestment, and underinvestment stand at 0.089, 0.12, and —0.074, respectively, consistent with previous studies (**Gomariz and Ballesta, 2014; Samet and Jarboui, 2017**). About 63.6% of our sample (5,715 observations out of 8,980) represents the underinvestment case. Hence, the listed firms in Europe are more likely to suffer from underinvestment as compared to overinvestment. This fact is attributable to the frictions in the market and difficulties in securing external financing, which is in line with the findings of **Chen et al.** (**2011**).

We provide the summary statistics on 10 subcategories' score in Table A2-Panel A in the Appendix. Among the ten subcategories, the Community score has the highest average in our sample (67.66), followed by the Emissions Score (52.26). We also provide the mean values of key variables across countries in Table A2 - Panel B in the Appendix. In our sample, Spain has the highest (56.66), and Poland has the lowest (34.06) average ESG combined scores.

Table A3 - Panel A and B in the Appendix provide the pairwise correlation coefficients for the main variables used in the analysis. As predicted, the correlations between the ESG combined score, its pillars, and investment inefficiency are significantly negative. Multicollinearity does not constitute a problem for the analysis, as none of the correlations between the independent and the control variables are very high.

4. Results and discussions

4.1. Baseline estimations

In this section, we perform our baseline estimations and initially investigate whether firms' ESG performance affects their investment inefficiency, testing Hypothesis 1. We use panel data estimation techniques, including industry, country, and time-fixed effects. Robust standard errors are clustered at the company level. Estimations in **Table 4** support that ESG performance negatively and significantly affects firms' investment inefficiency ($\gamma = —$ 0.001, $p <$ 1%) (Column 1), suggesting that firms that prioritize their ESG performance tend to invest more efficiently, which is in line with our anticipation: firms with stronger ESG performance tend to have less asymmetric information, less financial constraints, reduced cost of financing and consequently improved access to finance, all of which contribute to enhancing investment efficiency.

One standard deviation increase in ESG performance (19.049) reduces investment inefficiency by 2% (0.001 x 19.049), corresponding to a 22% decrease compared to the sample average investment inefficiency. Our conclusions, which are coherent with the outcomes of **Benlemlih and Bitar** (**2018**) and **Cook et al.** (**2019**), support Hypothesis 1 (H1). We differ from these studies in that both studies employ CSR ratings from $MSCI\ ESG\ STATS$, covering only the environmental and social perspectives, excluding the governance perspective. As opposed to this, we use ESG ratings from Refinitiv, covering all three perspectives, i.e., environmental, social, and governance, and bringing a more comprehensive measure compared to CSR.

Table 3 Summary Statistics.

	Obs.	Mean	min	p25	Median	p75	max	Std. Dev.
ESG combined score	9522	47.614	8.26	33.12	47.88	61.98	86.38	19.049
Environmental Pillar	9514	46.417	0	23.97	47.64	70.19	95.17	27.899
Social Pillar	9514	51.582	4.31	31.64	51.66	72.2	95.39	24.386
Governance Pillar	9520	50.462	6.1	32.555	50.84	68.64	92.93	22.307
Investment Inefficiency	8980	0.089	0.001	0.022	0.049	0.099	0.857	0.129
Overinvestment	3266	0.12	0.001	0.018	0.048	0.116	1.332	0.211
Underinvestment	5715	-0.074	-0.468	-0.092	-0.05	-0.024	-0.001	0.08
Firm Size	9503	15.6	7.428	14.274	15.515	16.873	19.289	1.834
Firm Age	8274	3.248	0	2.639	3.219	4.06	4.913	0.991
Financial Slack	9429	0.085	0	0.028	0.058	0.111	0.872	0.092
Tangibility	9499	0.307	0	0.113	0.263	0.456	0.898	0.228
Tobin's Q	9311	0.257	0	0.132	0.244	0.356	1.048	0.172
Z-Score	8699	0.933	-0.137	0.533	0.805	1.16	20.562	0.649
Analyst Coverage	8819	2.557	0	2.197	2.708	3.091	4.007	0.767
Spread	9,293	0.0034	0	0.001	0.0019	0.0041	0.0254	0.0041

*This table displays the summary statistics for the key variables used in the analysis. The definitions of all variables are provided in **Table 2**.*

Next, we provide empirical support in **Table 4** that individual scores of environmental, social, and governance pillars also negatively and significantly (at 1% level) impact investment inefficiency (Columns 2, 3, and 4, respectively). These findings suggest that all activities that improve firms' environmental, social, or governance performance also contribute positively to firms' realization of efficient investments. Studies show that combining the different categories of social and environmental responsibility may suppress the confounding individualistic effect of the categories (**Galema et al., 2008; Bouslah et al., 2013**). Accordingly, we replace the ESG combined score with its ten subcategories, repeating the estimations. The findings are displayed in Table A4 in the Appendix, indicating that all categories generally contribute positively to corporate investment efficiency.

For the control variables, we find that age negatively influences investment inefficiency. As a firm gets more mature and gains more experience, investment efficiency is enhanced, in line with **Samet and Jarboui** (**2017**) and **Benlemlih and Bitar** (**2018**). Financial slack and tangibility also have a significant and negative impact on investment inefficiency, suggesting that firms with more financial slack and more tangible assets tend to invest more efficiently, which is aligned with the findings of **Zhong and Gao** (**2017**), **Cook et al.** (**2019**) and **Shahzad et al.** (**2018**). Tobin's Q, measuring a company's growth opportunities, has a significant positive impact on investment inefficiency, in line with the findings of **Benlemlih and Bitar** (**2018**). Enhanced Tobin's Q suggests higher growth opportunities and higher levels of investment, which may result in overinvestment. Loss positively and significantly affects investment inefficiency, suggesting that firms who incur losses tend to have more investment inefficiencies, conforming to **Biddle et al.'s** (**2009**) findings. Finally, the Z-score, which shows the financial distress of a company, negatively and significantly affects firms' investment inefficiency, suggesting that as the financial distress of a firm declines (i.e., as the Z-score increases), firms make more efficient investments, in agreement with **Shahzad et al.'s** (**2018**) findings.

Besides investment inefficiency, we next analyze two separate scenarios in **Table 4**: First, the overinvestment scenario, where we only take the positive deviations compared to the anticipated level of investment (Columns 5-8 in **Table 4**). The second is the underinvestment scenario, where we only take the negative deviations compared to the expected level of investment (Columns 9-12 in **Table 4**). Our findings demonstrate that ESG performance significantly and negatively impacts overinvestment ($\gamma = -0.001$, $p < 1\%$). This finding reveals that firms with higher ESG scores are likely to experience lessened overinvestment issues (Column 5 in **Table 4**), supporting Hypothesis 2. Overinvestment is likely to occur because of excess funds. When firms are engaged in ESG investments, excessive funds are used for ESG activities, resulting in a lower amount of additional funds available for

overinvestment. Accordingly, ESG practices reduce excessive investments and help companies reach an optimal investment level. Moreover, environmental, social, and governance pillars individually decrease overinvestment (Columns 6-8 in **Table 4**). Their coefficients are significantly negative. Conversely, the ESG combined score has no significant impact on underinvestment (Column 9 in **Table 4**). Hence, the effect of ESG performance on investment inefficiency is more pronounced in the overinvestment scenario. This is in line with **Ho et al.** (**2022**) that show that corporate social performance reduces investment inefficiency only in overinvestment scenarios. Furthermore, within the ESG pillars, only the environmental pillar (Column 10) significantly and positively affects underinvestment.

Overall, our findings indicate that although firms with higher overall ESG scores and higher environmental, social, and governance cores are more efficient in their overall investments, this is more pronounced for the overinvestment case than the underinvestment case.

Table 4 Baseline Estimations.

	Investment Inefficiency				Overinvestment				Underinvestment			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ESG Comb. Score	-0.001***				-0.001***				0.0001			
	(-5.746)				(-5.556)				(1.633)			
Environmental Pillar		-0.0004***				-0.001***				0.0001**		
		(-5.91)				(-4.822)				(2.375)		
Social Pillar			-0.0004***				-0.001***				0.0001	
			(-5.095)				(-4.835)				(1.618)	
Governance Pillar				-0.0002***				−0.0005**				0.00001
				(-2.678)				(-2.535)				(0.191)
Firm Size	−0.001	−0.0001	−0.001	-0.003**	0.006*	0.007**	0.006*	0.001	0.003***	0.002*	0.003**	0.003***
	(-1.107)	(-0.101)	(-0.824)	(-2.463)	(1.773)	(1.963)	(1.788)	(0.162)	(2.865)	(1.959)	(2.501)	(3.307)
Firm Age	-0.007***	-0.007***	-0.007***	-0.008***	-0.011**	-0.01**	-0.011**	-0.013***	0.005***	0.004***	0.004***	0.005***
	(-4.451)	(-4.278)	(-4.492)	(-5.024)	(-2.402)	(-2.305)	(-2.511)	(-2.952)	(3.768)	(3.626)	(3.741)	(3.916)
Financial Slack	-0.053**	-0.052**	-0.051**	-0.055**	-0.293***	-0.289***	-0.285***	-0.293***	-0.033*	-0.033*	-0.034*	-0.033*
	(-2.386)	(-2.368)	(-2.285)	(-2.455)	(-6.324)	(-6.199)	(-6.165)	(-6.297)	(-1.772)	(-1.776)	(-1.802)	(-1.747)
Tangibility	-0.047***	-0.043***	-0.048***	-0.05***	-0.138***	-0.131***	-0.141***	-0.146***	0.016**	0.014**	0.016**	0.016**
	(-5.128)	(-4.65)	(-5.209)	(-5.376)	(-5.725)	(-5.394)	(-5.844)	(-6)	(2.261)	(2.011)	(2.274)	(2.318)
Tobin's Q	0.036***	0.034***	0.036***	0.034***	0.088***	0.08***	0.085***	0.081***	−0.006	−0.005	−0.006	−0.005
	(3.427)	(3.258)	(3.42)	(3.239)	(3.138)	(2.87)	(3.046)	(2.88)	(-0.679)	(-0.655)	(-0.698)	(-0.633)
LOSS	0.037***	0.038***	0.037***	0.039***	0.049***	0.051***	0.049***	0.053***	-0.043***	-0.043***	-0.043***	-0.043***
	(6.902)	(7.07)	(6.943)	(7.226)	(2.755)	(2.895)	(2.784)	(2.971)	(-10.987)	(-11.037)	(-10.944)	(-11.123)
Z-Score	-0.03***	-0.029***	-0.03***	-0.031***	-0.076***	-0.076***	-0.077***	-0.079***	0.009***	0.008***	0.009***	0.009***
	(-10.451)	(-10.26)	(-10.419)	(-10.521)	(-9.568)	(-9.564)	(-9.601)	(-9.753)	(3.949)	(3.808)	(3.917)	(3.967)
Constant	0.194***	0.165***	0.184***	0.211***	0.233***	0.186***	0.216***	0.287***	-0.139***	-0.128***	-0.136***	-0.144***
	(9.268)	(7.491)	(8.565)	(9.836)	(4.571)	(3.5)	(4.208)	(5.547)	(-8.5)	(-7.242)	(-7.879)	(-8.633)
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7197	7197	7197	7197	2630	2630	2630	2630	4568	4568	4568	4568
R-squared	0.106	0.106	0.105	0.103	0.144	0.141	0.142	0.136	0.168	0.168	0.168	0.167
Adj. R-squared	0.100	0.100	0.099	0.096	0.127	0.124	0.125	0.119	0.158	0.159	0.158	0.158

*This table displays the findings from the baseline regressions of investment inefficiency on the ESG combined score and its pillars, i.e., environmental, social, and governance scores over the years 2002-2019 for the 7,197 firm-year observations in the sample. In Columns 1-4, the dependent variable is investment inefficiency (proxied with the absolute value of the residuals of the investment model). In Columns 5-8, the dependent variable is overinvestment (proxied with the positive residuals of the investment model). In Columns 9-12, the dependent variable is underinvestment (proxied with the negative residuals of the investment model). The independent variables are ESG combined score (Columns 1, 5, and 9), the environmental pillar (Columns 2, 6, and 10), the social pillar (Columns 3, 7, and 11), and the governance pillar (Columns 4, 8, and 12). The control variables are firm size, firm age, financial slack, tangibility, Tobin's Q, Loss, and Z-Score. We include industry, year, and country-fixed effects in all the models. The industry fixed effects are based on two-digit Standard Industrial Classification (SIC) codes. We exclude all financial firms (SIC codes between 6000 and 6999) from the sample. We adjust the error terms for heteroscedasticity at the company level. Robust t-statistics are displayed in parentheses. Statistical significance at 1%, 5% and 10% are indicated with ***, ** and *, respectively.*

Table 5 Robustness tests.

	Alternative Methodologies Instrumental variable approach (2SLS)		GMM	Alternative proxy for investment efficiency	Alternative proxy for ESG performance: Overall ESG score	Alternative Sample (Excluding U.K.)	Additional Control Variables
	First stage (1)	Second stage (2)	(3)	(4)	(5)	(6)	(7)
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7197	7197	6479	7193	7205	4927	7197
R-squared	0.544	0.104	Hansen test(p-value): 0.189 AR(2) (p-value): 0.442	0.09	0.081	0.095	0.119
First-stage F statistic	1336.86***						
First-stage F statistic p-value	(0.000)						
Wu-Hausman F statistic		5.310**					
Wu-Hausman F statistic p-value		(0.021)					

Table 5 (continued)

	Alternative Methodologies Instrumental variable approach (2SLS)		GMM	Alternative proxy for investment efficiency	Alternative proxy for ESG performance: Overall ESG score	Alternative Sample (Excluding U.K.)	Additional Control Variables
	First stage (1)	Second stage (2)	(3)	(4)	(5)	(6)	(7)
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7197	7197	6479	7193	7205	4927	7197
R-squared	0.544	0.104	Hansen test(p-value): 0.189 AR(2) (p-value): 0.442	0.09	0.081	0.095	0.119
First-stage F statistic	1336.86***						
First-stage F statistic p-value	(0.000)						
Wu-Hausman F statistic		5.310**					
Wu-Hausman F statistic p-value		(0.021)					

*This table displays the results from the robustness tests. In all Columns (except for Column 1), the dependent variable is investment inefficiency (proxied with the residuals of the alternative investment model). The control variables are firm size, firm age, financial slack, tangibility, Tobin's Q, Loss, and Z-Score. In Columns 1-2, we implement instrumental variable (IV) approach, employing two-step estimations. In Column 1, we present the first stage estimations; the dependent variable is the ESG score, and ESG-industry and ESG-Initial are used as instruments, respectively. In Columns 2, we present the second stage findings, using two-stage least squares (2SLS). In Column 3, we employ GMM methodology. In Columns 4 and 5, we use alternative definitions for investment inefficiency and ESG scores, respectively. In Column 6, we create an alternate sample by excluding the U.K. from the sample. In Column 7, we include additional control variables (ROA, financial constraints and sales growth). We include industry, year, and country-fixed effects in all the estimations. The industry fixed effects are based on two-digit Standard Industrial Classification (SIC) codes. We exclude all financial firms (SIC codes between 6000 and 6999) from the sample. We adjust the error terms for heteroscedasticity at the company level. Robust t-statistics are displayed in parentheses. Statistical significance at 1%, 5% and 10% are indicated with ***, ** and *, respectively.*

4.2. Robustness checks

In this section, we perform various robustness checks for the main finding that ESG engagement is positively associated with investment efficiency.

4.2.1. Instrumental variable (IV) estimation

To deal with potential endogeneity issues due to reverse causality, we use an alternative estimation methodology, the instrumental variable (IV) approach, employing two-step estimations. We use two instruments, which tend to be exogenous to the ESG score, following **Samet and Jarboui** (**2017**) and **Benlemlih and Bitar** (**2018**). The first instrument is the industry-year mean of the ESG scores (**Benlemlih and Bitar, 2018; Samet and Jarboui, 2017; El Ghoul et al., 2011**). The second instrument is the primary level of a company's ESG score (**Benlemlih and Bitar, 2018; Samet and Jarboui, 2017; Attig et al., 2014**). In the first stage of the two-stage regression analysis, we take the ESG combined score as the dependent variable and the predetermined instruments as the independent variable,

along with the control variables. The first-stage regression results demonstrate that the two instruments positively and significantly affect ESG combined scores (**Table 5** - Column 1). In the second stage, investment inefficiency is the dependent variable, with the estimated ESG values being the independent variable. We employ two-stage least squares ($2SLS$) methodology. The second-stage findings are displayed in Columns 2 in **Table 5**. The coefficient of the ESG combined score load negatively and significantly ($\gamma = -0.001$, $p < 1\%$), showing the robustness of our findings. We display the reliability and validity of the test statistics for the IV estimation at the bottom of **Table 5**. We use the first-stage F statistics as a test for weak instruments, which tests the correlation between the instruments employed in the analysis and the endogenous variable. The coefficient of the first-stage F statistics is significant at the 1% level. Hence, we reject the null hypothesis that the instruments used in the analysis are weak. Then, we employ the Wu-Hausman F statistics for endogeneity. The coefficient of Wu-Hausman F statistics is significant at the 5% level, rejecting the null hypothesis that the industry-year mean of ESG scores and the primary ESG scores, are exogenous, and accordingly, our model is correctly specified.

In addition to employing the IV $2SLS$ method, we utilize the dynamic panel data method introduced by **Arellano and Bond** (**1991**) to address concerns related to endogeneity, potential biases from omitted variables, and measurement errors. The estimations document that the negative relationship between ESG and investment inefficiency remains significantly negative (column 3).

4.2.2. Alternative proxy of investment efficiency

As a further robustness test, we use an alternative proxy for investment inefficiency. We add two variables into Model 1: $NEG_{\mathrm{i,t-1}}$ and the interaction term between $NEG_{\mathrm{i,t-1}}$ and Sales $growth_{i,t-1}$, following **Chen et al.** (**2011**), **Gomariz and Ballesta** (**2014**), and **Samet and Jarboui** (**2017**). The dummy variable, $NEG_{\mathrm{i,t-1}}$, which gets a value of 1 if sales growth is negative and 0 otherwise, is added to the investment estimation model because the association between sales growth and investment could change if sales growth is positive or negative. We estimate Model 2 cross-sectionally for each industry and year. We employ the residuals from Model 2 as an alternate proxy of investment inefficiency. We estimate Model 3 with the new proxy of investment inefficiency.[2] The results, displayed in **Table 5** - Column 4, confirm our baseline estimations, which document that ESG engagement is positively associated with investment efficiency.

As a second alternative proxy for investment inefficiency, we include firm-level control variables in Model (1) to isolate better and capture investment inefficiency. These control variables are chosen the same as the ones employed in ESG performance and investment inefficiency regressions, which include firm size and age, tangibility, financial slack, Tobin's Q, $LOSS$, and **Altman's** (**1968**) Z-Score. We display the estimations in Column 6 (Table A5). We continue to find that ESG engagement is positively associated with investment efficiency.

[2]For brevity, we only include the robustness tests conducted for investment inefficiency. The robustness tests for overinvestment and underinvestment, which confirm our baseline results, are also available upon request.

4.2.3. Alternative ESG proxies

As a robustness test, we replace the ESG combined score with the overall ESG score. Hence, we want to observe if our findings are robust when we do not consider ESG controversies. The findings are displayed in Column 5 in **Table 5**. We continue to observe that ESG performance negatively affects investment inefficiency, which is in line with our previous findings.

When constructing the sample, we only use the firms with available ESG scores, which could potentially cause a selection bias problem (**Zaman et al., 2021**). To account for this shortcoming, we focus on the whole sample of firms with and without ESG scores. To ensure that we include the firms without ESG scores in the sample, we create a new variable, i.e., ESG dummy - that gets the value of 1 if the firm has an ESG score and 0 otherwise. Then, we re-estimate our main model, replacing the ESG combined score with the ESG dummy variable. Our findings (Column 2 in Table A5) show that the impact of the ESG dummy on investment inefficiency is significantly negative, suggesting that firms with ESG scores are likely to have lower investment inefficiencies, which is in line with our baseline findings.

Table 6 Channel Analysis.

	Information Asymmetry				Financial Constraints				Cash Flow & Firm Risk			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Analyst Coverage	Investment Inefficiency	Spread	Investment Inefficiency	Z-Score	Investment Inefficiency	LOSS2	Investment Inefficiency	Cash flow_sales	Investment Inefficiency	Cash flow volatility	Investment Inefficiency
ESG Comb score	0.007***		-0.00002***		0.003***		-0.001***		0.019**		-0.016***	
	(16.336)		(-2.65)		(5.894)		(-5.023)		(2.472)		(-6.147)	
$\widehat{AnalystCoverage}$		-0.082***										
		(-5.746)										
$\widehat{Spread}$				28.875***								
				(5.746)								
$\widehat{Z-Score}$						-0.191***						
						(-6.165)						
$\widehat{LOSS2}$								0.665***				
								(6.271)				
$\widehat{Cashflow\_Sales}$										-0.03***		
										(-5.738)		
$\widehat{CashFlow\_Volatility}$												0.034***
												(5.738)
Firm Size	0.205***	0.015***	-0.001***	0.041***	-0.11***	-0.021***	-0.013***	0.007***	-0.321***	-0.011***	-0.243***	0.007***
	(37.962)	(4.233)	(-4.317)	(5.14)	(-14.791)	(-6.683)	(-4.981)	(3.052)	(-3.018)	(-6.376)	(-7.407)	(3.237)
Firm Age	0.02***	-0.006***	0	-0.013***	0.069***	0.005*	0.004	-0.01***	-0.916***	-0.035***	-0.178***	-0.001
	(2.577)	(-3.373)	(1.637)	(-7.025)	(7.628)	(1.647)	(1.354)	(-5.943)	(-7.655)	(-7.002)	(-4.259)	(-0.51)
Financial Slack	0.067	-0.047**	0.015	-0.49***	0.095	-0.012	0.09*	-0.107***				
	(0.799)	(-2.139)	(1.01)	(-6.141)	(0.515)	(-0.511)	(1.906)	(-4.416)				
Tangibility	-0.045	-0.051***	0.003***	-0.121***	-0.226***	-0.083***	0.007	-0.051***	5.608***	0.125***	0.684***	-0.067***
	(-1.316)	(-5.509)	(3.927)	(-7.577)	(-4.732)	(-7.296)	(0.373)	(-5.504)	(7.862)	(4.096)	(2.837)	(-6.699)
Tobin's Q	-0.13***	0.025**	0.006	-0.132***	−1.899***	-0.314***	0.2***	-0.087***	0.237	0.046***	0.73**	0.015
	(-2.733)	(2.4)	(1.517)	(-4.316)	(-30.541)	(-5.345)	(7.851)	(-3.738)	(0.237)	(4.37)	(2.328)	(1.316)
LOSS	-0.057***	0.032***	0.001*	-0.004	-0.943***	-0.138***			−10.692***	-0.285***	1.577***	-0.017
	(-2.69)	(5.931)	(1.917)	(-0.469)	(-29.537)	(-4.625)			(−22.609)	(-5.048)	(10.599)	(-1.549)
Z-Score	-0.013	-0.031***	-0.001	-0.004			-0.023***	-0.016***	−7.161***	-0.246***	−1.516***	0.021**
	(-0.98)	(-10.676)	(-1.014)	(-0.757)			(-3.924)	(-4.768)	(-26.433)	(-6.425)	(-19.639)	(2.397)
Constant	-0.933***	0.117***	0.025***	-0.514***	3.685***	0.84***	0.255***	0.036	28.175***	1.025***	8.738***	-0.118**
	(-11.161)	(4.449)	(5.267)	(-4.025)	(31.735)	(7.511)	(6.05)	(0.903)	(16.132)	(7.019)	(16.699)	(-2.041)
Industry F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7150	7197	7416	7197	7844	7612	6982	7197	7575	7245	6892	7245
R-squared	0.507	0.106	0.021	0.106	0.465	0.097	0.074	0.097	0.415	0.105	0.257	0.105
Adj. R-squared	0.503	0.100	0.014	0.100	0.462	0.091	0.067	0.091	0.411	0.099	0.251	0.099

*This table displays the results from the channel analysis. In columns 1-4, the findings from the "information asymmetry" channel (proxied with number of analysts (columns 1-2) and spread (columns 3-4)) are displayed. In columns 5-8, the findings from the "financial constraints" channel (proxied with Altman Z-score (columns 5-6) and $LOSS2$ (columns 7-8)) are displayed. In columns 9-12, the findings from the "cash flow and risk" channel (proxied with cash flow to sales (columns 9-10) and cash flow volatility (columns 11-12)) are displayed. We adjust the error terms for heteroscedasticity at the company level. Robust standard errors are displayed in parentheses. Statistical significance at 1%, 5%, and 10% are indicated with ***, **, and *, respectively.*

Table 7 Moderation effect of information asymmetry.

	Interaction Analysis for the Whole Sample				Sub-sample Analysis			
	Moderating variable: Analyst Coverage		Moderating variable: Analyst Dummy		Low Information Asymmetry (Low Spread)		High Information Asymmetry (High Spread)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Investment Inefficiency	Overinvestment	Underinvestment	Investment Inefficiency	Overinvestment	Underinvestment	Underinvestment	Underinvestment
ESG Comb score	-0.001**	-0.002	0.001**	-0.001***	-0.001***	0.0003***	-0.00001	0.0003**
	(-2.566)	(-1.593)	(2.529)	(-4.329)	(-3.255)	(2.655)	(-0.105)	(2.511)
Analyst Coverage	-0.023***	-0.035	0.014***					
	(-2.889)	(-1.528)	(2.869)					
ESG*Analyst Coverage	0.0002	0.0003	-0.0002**					
	(1.523)	(0.595)	(-2.288)					
Analyst Dummy				-0.018*	0.004	0.018***		
				(-1.906)	(0.142)	(2.639)		
ESG*Analyst Dummy				0.0001	-0.0004	-0.0003**		
				(0.81)	(-0.806)	(-2.311)		
Firm Size	0.001	0.01**	0.002*	0	0.008**	0.002*	0.004**	0.002
	(0.578)	(2.406)	(1.687)	(0.139)	(2.003)	(1.898)	(2.137)	(1.473)
Firm Age	-0.007***	-0.008*	0.004***	-0.007***	-0.009**	0.005***	0.005***	0.004**
	(-4.02)	(-1.881)	(3.675)	(-4.098)	(-2.016)	(3.709)	(2.999)	(2.264)
Financial Slack	-0.051**	-0.3***	-0.035*	-0.051**	-0.289***	-0.034*	-0.017	-0.049*
	(-2.274)	(-6.473)	(-1.86)	(-2.265)	(-6.218)	(-1.808)	(-0.691)	(-1.742)
Tangibility	-0.049***	-0.147***	0.011	-0.048***	-0.146***	0.012*	0.004	0.018**
	(-5.279)	(-6.113)	(1.645)	(-5.258)	(-6.049)	(1.673)	(0.339)	(2.048)
Tobin's Q	0.037***	0.093***	-0.005	0.038***	0.092***	-0.006	-0.007	-0.001
	(3.394)	(3.257)	(-0.617)	(3.499)	(3.253)	(-0.694)	(-0.559)	(-0.138)
LOSS	0.036***	0.047***	-0.043***	0.037***	0.048***	-0.043***	-0.035***	-0.051***
	(6.652)	(2.629)	(-10.557)	(6.68)	(2.681)	(-10.579)	(-6.807)	(-7.954)
Z-Score	-0.029***	-0.073***	0.008***	-0.029***	-0.074***	0.008***	0.006**	0.01***
	(-9.945)	(-9.023)	(3.782)	(-9.949)	(-9.177)	(3.724)	(2.038)	(3.055)
Constant	0.209***	0.248***	-0.158***	0.171***	0.195***	-0.133***	-0.145***	-0.134***
	(6.665)	(3.048)	(-7.258)	(7.309)	(3.389)	(-7.479)	(-5.38)	(-5.409)
Industry F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6982	2548	4435	6982	2548	4435	2141	2385
R-squared	0.106	0.142	0.166	0.104	0.139	0.165	0.158	0.19

*This table displays the results from the moderation effect of information asymmetry on the association between ESG performance and investment inefficiency, overinvestment, and underinvestment. In all estimations the independent variable is ESG combined score. In columns 1-3, the moderating variable is no of analysts following the firm. In columns 4-6, the moderating variable is analyst dummy (equals 1 if there are analysts following the firm and 0 otherwise). The dependent variables are investment inefficiency (columns 1&4), overinvestment (columns 2&5), and underinvestment (columns 3&6). In columns 7-8, the findings from the sub-sample analysis are displayed. The sub-samples are created based on their level of information asymmetry over the years 2002-2019. We employ daily bid-ask spreads to construct the sub-samples with differing information asymmetries. The dependent variable is underinvestment in columns 7&8. The control variables are firm size, firm age, financial slack, tangibility, $Tobin's\ Q$, $Loss$, and Z-Score. We include industry, year, and country-fixed effects in all the estimations. The industry fixed effects are based on two-digit Standard Industrial Classification (SIC) codes. We exclude all financial firms (SIC codes between 6000 and 6999) from the sample. We adjust the error terms for heteroscedasticity at the company level. Robust t-statistics are displayed in parentheses. Statistical significance at 1%, 5% and 10% are indicated with ***, ** and *, respectively.*

4.2.4. Alternative sample selection

Given that the U.K. accounts for 28% of the firm-year observations in our sample, there is a possibility that the U.K. sample could affect the findings. Hence we drop the firms in U.K. and repeat the estimations. We observe that the findings confirm our baseline results (**Table 5** - Column 6).

Firms that operate in the utilities sector are more exposed to regulations, resulting in these firms behaving differently compared to manufacturing firms (see **Alharbi et al., 2023; Atawnah et al., 2023**). Accordingly, we re-estimate our main model, excluding the firms from the utility sector from the sample (firms with SIC codes between 4900 and 4999) and focusing only on the manufacturing firms. We observe that the impact of ESG performance on investment inefficiency is significantly negative for the alternative sample, conforming to our baseline findings (Column 1 - Table A5 in the Appendix).

4.2.5. Alternative control variables

We introduce additional control variables (financial constraints, sales growth, and profitability[3]), which could impact investment efficiency, following **Benlemlih and Bitar** (**2018**), and **Zamir et al.** (**2022**). After the inclusion of additional control variables, ESG score still has a negative effect on investment inefficiency (**Table 5** - Column 7).

We add other firm-level control variables such as MTB, leverage, and dividend payout ratio, following **Biddle and Hilary** (**2006**) and **Biddle et al.** (**2009**). The findings are presented in Column 3 in Table A5. Moreover, to control for country-level differences in financial reporting quality and governance, we add country-level control variables, i.e., investor protection index (provided by the World Bank), legal enforcement index, and rule of law index (provided by **La Porta et al., 1998**). The findings from all three estimations imply that firms with superior ESG performance are likely to have reduced investment inefficiencies even when we control for other firm-specific and country-specific variables.

4.3. Channel analysis

The next analysis examines the possible channels by which ESG performance influences investment inefficiency.. We test whether ESG activities reduce investment inefficiency through several transmission channels, including information asymmetry, financial constraints, cash flow, and firm risk. Stronger ESG performance is expected to improve firms' transparency and information quality (**Lambert et al., 2007**) and reduce asymmetric information. Environmentally innovative firms attract more analyst following and institutional investors and exhibit less information asymmetry (**Zaman et al., 2021**). Firms with stronger CSR performance tend to mitigate agency costs, are expected to face fewer financial constraints, and are granted better debt conditions (**Atawnah et al., 2023**), which ultimately will positively affect firm investments. Moreover, firms with higher ESG scores are expected to have better financial performance and lower risk, realizing more efficient investments (**Krüger, 2015; Renneboog et al., 2014; Michael et al., 2022**).

Starting with the information asymmetry channel, we employ two separate proxies. Our first proxy is the analyst coverage[4] following **Griffin and Lemmon** (**2002**). Companies that are followed by a greater number of analysts for monitoring purposes tend to exhibit higher levels of transparency, resulting in reduced information asymmetry. We use spread[5] as our second proxy for information asymmetry, following **Cho et al.** (**2013**), **Samet and Jarboui** (**2017**), and **Cheng et al.** (**2011**). In situations where there is greater information asymmetry among market participants, traders who possess information can exploit this advantage. When market makers become aware of this adverse selection problem, they respond by widening the bid-ask spread as a defensive measure against potential losses incurred from trading with informed investors. Accordingly, there is a positive relationship between the level of information asymmetry and the bid-ask spread.

*[3]Financial constraints (an index developed by **Hadlock and Pierce** (**2010**) as "-0.0737*SIZE + 0.043*SIZE^2 — 0.040*AGE"; Sales growth ((Salest -Salest-1) / Salest-1); profitability (Return on assets - ROA: net income / total assets).*

[4]Analyst coverage is the natural logarithm of the number of analysts following the company.

[5]Spread is calculated as the annual mean values of the proportion of the daily bid-ask spread to the closing price.

For the financial constraint channel, we employ two proxies: Altman Z-score[6] and $LOSS2$.[7] Finally, for the cash flow and firm risk channel, we use cash flow to sales ratio and volatility in cash flow to sales ratio (calculated by implementing three-year rolling windows), respectively.

We perform a two-step regression approach for the channel analysis. First, the impact of the ESG combined score on information asymmetry (financial constraints, cash flow, and firm risk) is analyzed. In the second step, we use the predicted values of information asymmetry (financial constraints, cash flow, and firm risk) to estimate investment inefficiency. We present the estimations in in **Table 6**.

Column 1 (3) presents that ESG performance negatively and significantly affects information asymmetry (i.e., as analyst coverage increases (and as spread decreases) information asymmetry declines). In column 2 (4), we show that the predicted values of analyst coverage (spread) negatively (positively) and significantly influence investment inefficiency. These results imply that higher ESG score can decrease information asymmetry, and a reduction in information asymmetry tends to reduce investment inefficiency. These offer novel evidence of how increased ESG performance can decrease investment inefficiency through the information asymmetry channel.

Column 5 (7) demonstrates that firms with superior ESG performance are likely to face less financial constraints (higher Z-scores imply less financial constraints). Moreover, columns 6 (8) show that companies with fewer financial constraints tend to have less investment inefficiency, suggesting that financial constraints is also one of the transmission mechanisms through which ESG performance affects investment inefficiency.

In Column 9, ESG performance is positively associated cash flow. Moreover, the predicted values of cash flow negatively affect investment inefficiency (column 10), implying that firms with higher ESG scores are likely to have higher cash flows, which tend to reduce investment inefficiency. Finally, the effect of ESG performance on cash flow volatility is significantly negative (column 11), and the predicted values of cash flow volatility on investment inefficiency are significantly positive (column 12). These findings demonstrate that superior ESG performance is likely to reduce firm risk, which tends to reduce investment inefficiency.

Overall, these findings imply that ESG performance can reduce investment inefficiency through four important channels: reduction in information asymmetry, financial constraints, and firm risk and enhancement in cash flows.

[6]*The definition of Altman Z-score is provided in **Table 2**.*

[7]*$LOSS2$ is defined as a dummy variable that equals 1 if the net income before tax and extraordinary items is negative for two consecutive periods, 0 otherwise.*

Table 8 Additional analysis: Extreme Cases.

	Investment Inefficiency		
	(1)1st-5th	(2)5th-95th	(3)95th-100th
ESG Combined Score	0.001	-0.001***	0
	−0.204	(-4.635)	(-0.256)
Firm Size	-0.015*	−0.001	−0.002
	(-1.674)	(-0.721)	(-0.292)
Firm Age	−0.008	-0.008***	−0.001
	(-0.785)	(-4.44)	(-0.17)
Financial Slack	0.102	-0.066***	0.103
	−1.03	(-2.909)	−1.126
Tangibility	−0.015	-0.055***	0.047
	(-0.227)	(-5.857)	−1.247
Tobin's Q	0.036	0.035***	0.129**
	−0.625	−3.164	−2.259
LOSS	−0.007	0.039***	0.018
	(-0.211)	−6.925	−1.272
Z-Score	0.005	-0.032***	−0.006
	−0.381	(-10.481)	(-0.453)
Constant	0.325**	0.192***	0.086
	−2.132	−8.645	−0.565
Industry F.E.	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes
Country F.E.	Yes	Yes	Yes
Observations	298	6538	356
R-squared	0.241	0.107	0.233
Adj. R-squared	0.099	0.100	0.128

*This table displays the findings from the estimations analyzing the impact of ESG scores on investment inefficiency for extreme scenarios. Columns 1 and 3 analyze 5% and 95% as the limits for the extreme scenarios. Column 2 examines non-extreme cases (5-95%). In all specifications, the dependent variable is investment inefficiency (proxied with the absolute value of the residuals of the investment model), and the independent variable is ESG combined scores. The control variables are firm size, firm age, financial slack, tangibility, $Tobin's\ Q$, Loss, and Z-Score. We include industry, year, and country-fixed effects in all the estimations. The industry fixed effects are based on two-digit Standard Industrial Classification (SIC) codes. We exclude all financial firms (SIC codes between 6000 and 6999) from the sample. We adjust the error terms for heteroscedasticity at the company level. Robust t-statistics are displayed in parentheses. Statistical significance at 1%, 5% and 10% are indicated with ***, ** and *, respectively.*

4.4. The moderating impact of information asymmetry

In this section, we investigate how firm-level information asymmetry moderates the relationship between ESG performance and investment inefficiency, focusing especially on underinvestment scenario. In the previous sections, we find that ESG activity is not significantly associated with underinvestment. Our aim in this section is to understand the circumstances under which ESG performance effects underinvestment problems. For this purpose, our main proxy for information asymmetry is the analyst coverage (as a continuous variable). Higher values of analyst coverage indicate lower levels of information asymmetry. The findings for analyst coverage as the moderating variable are displayed in columns 1-3 in **Table 7**. We include the interaction variable ESG^*Analyst Coverage to explore how information asymmetry moderates the influence of ESG on investment inefficiency, overinvestment, and underinvestment. The interaction coefficient between ESG performance and analyst coverage is significantly negative only for the underinvestment case (column 3). Meanwhile, the coefficient of ESG Combined Score is positive and significant. This shows that the positive impact of ESG performance on underinvestment weakens when firm level information asymmetry increases, i.e., the positive impact is stronger when there is higher information asymmetry. Meanwhile, the moderating impact is insignificant both for investment inefficiency (whole sample) (column 1) and overinvestment (column 2).

Next, for robustness, we use the analyst dummy (gets the value of 1 if there are analysts following the firm and 0 otherwise) as a proxy for information asymmetry in columns 4-6. Higher values of analyst

dummy indicate lower levels of information asymmetry. Similar to earlier findings, the positive association between ESG performance underinvestment is stronger only when information asymmetry is higher (column 6).

We conduct a sub-sample analysis in columns 7 & 8 for a further robustness check. We create the sub-samples based on firms' information asymmetry levels, employing firms' bid-ask spread as the proxy. The spread ratio is at the firm level and is calculated as the annual average of the ratio of the daily bid-ask spread to the closing price (**Cheng et al., 2011; Cho et al., 2013; Samet and Jarboui, 2017**). Comparing a company's level of spread for year t with the median of spread for the sample, we categorize a company as having high or low information asymmetry. We create two separate sub-samples: Firms with low and high information asymmetries. We repeat the same estimations for these sub-samples with underinvestment as the dependent variable, and the results are tabulated in columns 7 & 8.[8] The findings from the sub-sample analysis demonstrate that the impact of ESG performance on underinvestment is insignificant for the low information asymmetry sub-sample (column 7), whereas its impact is significantly positive for high information asymmetry sub-sample. This is in line with our prior finding that ESG performance decreases underinvestment for firms that are subject to higher information asymmetry.

Overall, these results imply that firms with higher asymmetric information benefit from stronger ESG performance as they become more efficient in their underinvestment levels. This enhancement stems from the fact that revealing their ESG scores lets them become more transparent, making it easier for them to find external financing. In contrast, firms with low information asymmetries do not benefit from stronger ESG performance because they are already transparent and do not obtain any marginal benefit from stronger ESG performance. These findings confirm Hypothesis 3 (H3).

4.5. Additional analysis: Extreme cases

Next, we investigate the association between ESG performance and investment inefficiency in extreme cases. Firms with low ESG scores are not expected to handle the complications involved with the environmental, social, and governance requirements. Hence, they are likely to be less efficient in their investments (**Benlemlih and Bitar, 2018**). In contrast, **Godfrey** (**2005**) claims that firms should not surpass their optimal level of philanthropy because, after this optimal level, additional philanthropy expenditures are not likely to produce extra benefits, creating a conflict between shareholders and managers (**Godfrey, 2005**). Accordingly, company insiders who intend to improve their philanthropic reputation at the expense of other shareholders may initiate ESG activities (**Brown et al., 2006; Benabou and Tirole, 2010**). **Ye and Zhang** (**2011**) also show that CSR lessens the cost of financing when a company's CSR score is less than its optimal level; however, CSR surges up the cost of funding when CSR's optimal level is surpassed. We thus expect firms with very low and very high ESG scores not to be associated with investment inefficiency. **Table 8** - Columns 1 and 3 provide the results for very low and very high ESG firms formed at the extreme 5% of the distribution. The impact of ESG performance on investment inefficiency is insignificant for firms with very low (Column 1) and very high ESG scores (Column 3). In contrast, Column 2 displays nonextreme ESG companies' results (ESG score between 5% and 95%). This estimation shows that for non-extreme ESG companies, the effect of ESG score on investment inefficiency is significantly negative ($\gamma = -0.001$, $p < 1\%$). We attribute this to the fact that low ESG-rated firms may not control the complications involved in social and environmental requirements.

[8] The findings for the investment inefficiency and overinvestment scenarios are available upon request.

Therefore, they tend to be less efficient, in line with the findings of **Kytle and Ruggie** (**2005**). Conversely, very high ESG scores may result from managers' inclination towards overinvesting in ESG and entrenching themselves as socially and environmentally responsible managers, in line with the results of **Krüger** (**2015**) and **Benlemlih and Bitar** (**2018**).

5. Conclusion

This study analyzes the effect of overall ESG performance on corporate investment efficiency. Using a large sample of 1,094 firms from Europe over the 2002-2019 period, representing 9,522 firm-year observations, we provide statistically significant results that firms with stronger ESG performance tend to invest more efficiently. We identify four firm-level channels— information asymmetry, financial constraints, cash flows, and risk— that link ESG performance to investment inefficiency. Firms with stronger ESG performance benefit from lower information asymmetries, reduction in financial constraints, increases in level of cash flows, and reduction in cash flow volatilities. Moreover, we provide empirical evidence that three pillars and the subcategories are also positively related to investment efficiency. Our findings are robust to alternative specifications to address potential endogeneity issues (instrumental variables (IV) estimations and GMM), using alternative variables and specifications and using alternative sample selections. We next investigate two investment inefficiency scenarios, overinvestment, and underinvestment cases. We provide empirical evidence that ESG combined scores negatively affect overinvestment, suggesting that firms with better overall ESG performance have less overinvestment issues. In contrast, the impact of overall ESG performance on underinvestment is insignificant, suggesting that the effect of ESG on investment inefficiencies is more pronounced for overinvestment than underinvestment issues.

Furthermore, we investigate how firm-level information asymmetry affects the relationship between ESG activity and investment inefficiency. We provide empirical evidence that for firms with higher information asymmetries, ESG performance reduces underinvestment problems. In contrast, the effect continues to be insignificant for firms with lower asymmetric information since these firms are already transparent. Hence, firms with lower asymmetric information do not obtain any marginal benefit in increasing their transparency with an upsurge in ESG performance. Finally, in additional analysis, our findings demonstrate that the effect of ESG performance on investment inefficiency is insignificant for firms with extreme ESG scores (very low and very high ESG scores) in the European context.

In conclusion, this paper improves our comprehension of the role nonfinancial ESG disclosures play in Europe, where investment efficiency is important for economy, but where agency conflicts and asymmetric information also prevail between insiders of the company and the external investors. Accordingly, our paper contributes to comprehending the economic effects of firms' ESG performance and has significant repercussions for companies, investment society, and policymakers. The positive impact of ESG performance on investment efficiency implies that implementing ESG policies is a valuable approach to protecting all stakeholders' interests and fostering firm growth through improving investment efficiency. Hence, companies incorporating ESG concerns into their businesses are expected to gain a competitive advantage in enhancing their investment efficiencies. Furthermore, we recommend that companies refrain from extreme ESG performance cases, as we empirically demonstrate that for firms with very low and very high ESG scores, ESG performance does not significantly impact investment efficiency. Last, our findings have important implications for policymakers who aim to improve non-financial and ESG disclosure in Europe by showing that better disclosure will also help benefit from better firm-level investment efficiency in the European context.

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