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ESG Credibility and stock mispricing: an empirical investigation

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Declaration of Authorship

I, Beatrice Sofia Curcio declare that this thesis titled *"ESG Credibility and stock mispricing: an empirical investigation"* and the work presented in it are my own. I confirm that:

- This work was done wholly while in candidature for a master's degree at this University.
- Where I have consulted the published work of others, this is always clearly attributed.
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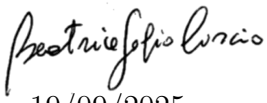
Signed: 

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Abstract

This thesis investigates the relationship between firm-level misvaluation and ESG credibility, defined as the interaction between ESG Scores (endogenous measure) and ESG Controversies Scores (exogenous factor) from the LSEG Workspace. The analysis builds on the valuation model of Rhodes-Kropf et al. (2005) to isolate firm-specific misvaluation from growth and industry effects, using a balanced panel of 214 MSCI World Index firms over 2015–2023.

Results show that ESG credibility has a complex and apparently ambiguous effect on market valuations. Correlation evidence suggests that credibility mitigates extreme deviations from fundamentals for both undervalued and overvalued firms, while regression analysis indicates that strong ESG performance, particularly when not contradicted by controversies, may at times amplify overvaluation. Additional analysis reveals that ESG credibility ultimately realigns market prices to intrinsic values, supporting initial expectations. These findings are further supported by two robustness checks.

Overall, the study suggests that ESG credibility may play a crucial role in shaping market efficiency, offering new insights for both academic debate and financial practice.

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Chapter 1

Introduction

This chapter introduces the research, providing a general overview of the study and positioning it within the broader debate on Environmental, Social, and Governance (ESG) factors and capital markets. The first section presents the background, highlighting the relevance of ESG considerations, the main findings of the literature, and the research gaps that motivate this work. The second one defines the purpose of the research, formulating the guiding question and offering a concise overview of the dataset and variables selected.

1.1 Context and relevance

The role of ESG factors in global capital markets has gained prominence over the past two decades, attracting increasing attention from academics, investors, and policymakers. ESG metrics, developed by rating agencies, are designed to capture firms' non-financial performance and their exposure to sustainability-related risks and opportunities. Their widespread diffusion reflects the recognition that sustainable practices can shape access to capital, risk management, and long-term value creation. Regulatory initiatives and disclosure frameworks, particularly within the European Union, have further consolidated the importance of ESG, embedding it into corporate strategies and investment processes.

The empirical literature has extensively investigated the relationship between

ESG and financial outcomes. Findings suggest that ESG engagement may support firm valuation by reducing financing costs (Raimo et al., 2021; Apergis et al., 2022), lowering systematic risk (Giese et al., 2019; Albuquerque et al., 2019), and building reputational capital (Lins et al., 2017). Yet, a parallel body of work highlights that ESG information can also contribute to market distortions, as investor sentiment, limited attention, and rating divergence can generate persistent valuation errors (Berg et al., 2022; Barka et al., 2023; Baker et al., 2024). In particular, controversies have been shown to trigger asymmetric market reactions, with negative events producing sharper adjustments than positive disclosures (Krüger, 2015; Capelle-Blancard and Petit, 2019). This duality reflects an unresolved tension: while credible ESG performance may reduce information asymmetry, inconsistencies and greenwashing practices can exacerbate deviations from fundamentals.

Despite the growing body of research, two important gaps remain. First, most contributions rely exclusively on ESG scores produced by rating agencies, which are largely based on firms' own disclosure practices. By neglecting external and event-based indicators such as controversies, prior studies risk overstating the credibility of sustainability ratings, especially when high scores coexist with recurrent negative incidents. Second, existing research seldom distinguishes between endogenous signals — ratings derived from firms' reported information — and exogenous shocks, such as controversies revealed through media coverage. This lack of conceptual separation prevents a comprehensive understanding of how disclosure-based assessments and independent reputational events interact in shaping market valuations.

1.2 Purpose of the research

This work addresses the gaps identified above by introducing the concept of ESG credibility, defined as the interaction between ESG Scores (endogenous disclosure) and ESG Controversies Scores (exogenous shocks). High ESG ratings not contradicted by controversies are interpreted as credible signals, whereas the coexistence of high ratings and recurrent controversies indicates weak credibility. The central

research question is therefore formulated as: *How does firm-level misvaluation vary with ESG credibility?*

The empirical analysis employs the valuation model proposed by Rhodes-Kropf et al. (2005) to measure firm-specific misvaluation, excluding the components attributable to growth opportunities and industry effects. The explanatory variables include ESG Scores and Controversies Scores provided by the LSEG Workspace, their interaction, and both contemporaneous and lagged ESG changes, complemented by financial controls such as leverage, profitability, firm size, investment intensity, and risk. The dataset is constructed from the iShares Core MSCI World ETF, which ensures broad coverage across 23 developed markets. After standard exclusions and cleaning, the panel consists of 214 companies observed over the period 2015–2023, for a total of 1,864 firm-year observations.

Overall, the study contributes to the literature by providing an experimental framework directly linking ESG scores, controversies, and misvaluation. In doing so, it advances the understanding of how sustainability disclosures and reputational signals jointly influence valuation outcomes, offering insights relevant to investors, regulators, and corporate managers.

Chapter 2

Theoretical Background

This chapter covers the theoretical ground of the study and positions it within the broader field of sustainable finance. Section 2.1 introduces the conceptual foundations. It first clarifies the definition, scope, and relevance of ESG, followed by a discussion of ESG ratings and their challenges. It then elaborates on the concept of stock mispricing, its definitions, measurement approaches, and drivers, before examining how ESG considerations can be integrated into asset pricing frameworks. Section 2.2 provides a literature review, synthesizing the empirical evidence on the link between ESG and financial outcomes. The review is organized along four strands: (i) ESG and stock performance, (ii) ESG and firm valuation, (iii) ESG and mispricing, and (iv) ESG-related reputational risks. Finally, Section 2.3 develops the hypotheses guiding the empirical analysis, building on both the theoretical concepts and the literature insights to establish a logical framework for the research design.

2.1 Conceptual foundations

2.1.1 ESG: definition, scope, and relevance

The acronym ESG — standing for Environmental, Social, and Governance — refers to a comprehensive framework for assessing corporate performance beyond traditional financial indicators, incorporating environmental stewardship, social

responsibility, and sound governance practices. The concept was first popularized in the 2004 United Nations report *Who Cares Wins*, which encouraged financial markets to integrate environmental, social, and governance factors into investment analysis (International Finance Corporation, 2008). Unlike the earlier concept of Corporate Social Responsibility (CSR), which mainly relied on voluntary commitments and qualitative reporting, ESG integrates measurable and comparable criteria that allow investors, regulators, and stakeholders to assess companies' sustainability performance and long-term resilience (The Corporate Governace Institute, 2023). The notion gained prominence in the early 2000s, pushed by global initiatives such as the United Nations Global Compact, the 2015 Paris Agreement, and the adoption of the Sustainable Development Goals (SDGs).

ESG encompasses three interrelated dimensions. The environmental pillar addresses the efficient use of natural resources, the mitigation of climate change, the reduction of pollution, and the transition towards a low-carbon economy. The social dimension focuses on respect for human rights, fair labour conditions, diversity and inclusion, employee well-being, and the company's positive impact on communities. The governance component covers corporate ethics, transparency, board composition and independence, anti-corruption measures, and the effectiveness of internal controls. [1]

In contemporary markets, ESG has evolved from a reputational add-on to a strategic necessity, influencing access to capital, risk management, and competitive positioning. Regulatory frameworks, particularly within the European Union — including the Corporate Sustainability Reporting Directive (CSRD) and the Sustainable Finance Disclosure Regulation (SFDR) — are progressively embedding ESG criteria into mandatory disclosure requirements. Likewise, global reporting standards and frameworks, such as the Global Reporting Initiative (GRI), the Sustainability Accounting Standards Board (SASB), and the Task Force on Climate-related Financial Disclosures (TCFD), provide guidance for consistent and transparent ESG reporting.

[1] The lists of aspects under each ESG pillar are not exhaustive, but rather indicative of the main areas commonly emphasized in the literature.

Within this theoretical framework, ESG serves as a foundation for understanding how sustainable business practices can create long-term value, address systemic risks, and align corporate strategies with broader societal and environmental objectives. This perspective is central to the subsequent analysis presented in this study.

2.1.2 ESG Ratings

ESG ratings are evaluative scores or assessments assigned to companies that reflect their performance across environmental, social, and governance dimensions, as well as their exposure and responsiveness to corresponding risks and opportunities. Their primary purpose is to provide investors, regulators, and other stakeholders standardized and comparable insights into a firm's sustainability profile, complementing traditional financial analysis and therefore facilitating informed capital allocation and corporate engagement (CFA Institute, 2024). [2]

ESG ratings aim to capture both a firm's operational practices and its governance structures. They typically combine quantitative metrics — such as greenhouse gas emissions, water consumption, gender pay gap, or board independence ratios — with qualitative assessments, including policy commitments, supply chain oversight, and controversy management (OECD, 2025). These factors are then aggregated into numerical scores, percentile ranks, or letter grades for practical and unambiguous interpretation. The weighting of each indicator often depends on sector-specific materiality considerations, meaning that the same ESG factor may be deemed critical in one industry but marginal in another (OECD, 2025).

Key providers in the ESG rating landscape include MSCI ESG Research, Sustainalytics (Morningstar), S&P Global ESG Scores, Bloomberg, Refinitiv, and ISS ESG. Despite a shared goal of assessing ESG performance, these providers differ significantly in methodology, data sourcing, indicator weighting, and use of industry- or region-specific benchmarks, leading to notable inconsistencies across ratings for the same company (see Table 1).

[2] In this thesis, the words *ratings* and *scores* are used interchangeably; while scores denote numerical values, ratings may also include ranks or letter grades (CFA Institute, 2024).

Table 1: ESG comparison: Correlations

	MSCI	S&P	Sustainalytics	CDP	ISS	Bloomberg
MSCI		35.7%	35.1%	16.3%	33.0%	37.4%
S&P	35.7%		64.5%	35.0%	13.9%	74.7%
Sustainalytics	35.1%	64.5%		29.3%	21.7%	58.4%
CDP	16.3%	35.0%	29.3%		7.0%	44.1%
ISS	33.0%	13.9%	21.7%	7.0%		21.3%
Bloomberg	37.4%	74.4%	58.4%	44.1%	21.3%	

Source: CFA Institute, *Enterprising Investor, ESG Ratings: Navigating Through the Haze*, August 2021.

The emergence of ESG ratings in the early 2000s responded to the growing demand for tools that could quantify nonfinancial risks — especially those linked to climate change, social license to operate, and governance quality — at a time when corporate sustainability disclosures were largely voluntary and inconsistent. Ratings were intended to bridge the informational gap between companies self-disclosures and investor needs for standardized, decision-useful data.

However, the rapid proliferation of ESG ratings has brought several critical challenges. First, there is often limited transparency in the methodologies, making it difficult for users to fully understand how scores are calculated. Second, the dependence on self-reported corporate data raises concerns over accuracy and susceptibility to selective disclosure. Third, inconsistencies between providers, as highlighted above, can undermine the comparability of ratings, potentially leading to market confusion. Finally, the system is vulnerable to greenwashing, where high scores may mask weak or superficial sustainability practices (OECD, 2025).

At the heart of debate lies the concept of materiality. Certain rating systems adopt a single materiality approach — emphasizing ESG factors that are financially material to company performance — whereas others use a double materiality framework that also considers a firm's broader societal and environmental impacts, irrespective of immediate financial consequence (Baumüller and Sopp, 2022; Mezzanotte, 2023). This divergence in approach greatly affects comparability and interpretation of ratings, with profound implications for investment decisions, regulatory compliance, and corporate reporting.

In line with this debate, the ESG ratings disagreement issue has recently become a central research topic in the ESG landscape, with several studies exploring its links with stock returns (Gibson Brandon et al., 2021), mispricing (Yun et al., 2024), voluntary reporting and disclosure transparency (Christensen et al., 2022; Kimbrough et al., 2024).

2.1.3 Stock mispricing: definitions and drivers

Shifting the focus to the financial perspective, the following section introduces the concept of stock mispricing, which represents a central notion for the analysis presented in this study.

Stock mispricing refers to a persistent deviation of a firm's market value from its underlying fundamental value. According to the Efficient Market Hypothesis (EMH) (Fama, 1970), prices should fully incorporate all available information, leaving no room for systematic valuation errors. In practice, however, a large body of empirical evidence challenges this assumption. Well-documented anomalies such as momentum effects, value versus growth premiums, and post-earnings announcement drift reveal systematic deviations from the EMH, suggesting that frictions, bounded rationality, investor sentiment, and limited attention can distort stock prices away from fundamentals (Shleifer, 2000).

The drivers of mispricing can be very diverse. On the behavioral side, investor sentiment, overreaction to news, and limits to arbitrage play a central role (Shleifer and Summers, 1990; Baker and Wurgler, 2007). On the informational side, limited or asymmetric disclosure can prevent investors from correctly assessing firm value, while idiosyncratic shocks may temporarily distort prices. These elements position misvaluation as a central concept in asset pricing research, serving as a perspective for examining how additional, non-financial information — such as ESG performance — interacts with market efficiency.

Mispricing can manifest as overvaluation or undervaluation and is typically corrected over time as new information is incorporated into prices. The speed and completeness of this adjustment depend on market frictions, the credibility of

information, and the attention it receives from market participants.

Empirical measures of mispricing rely on both intrinsic and relative valuation approaches, each capturing different dimensions of potential inefficiencies. Intrinsic valuation methods, such as discounted cash flow (DCF) and residual income models, estimate the underlying worth of a firm by discounting future cash flows or excess earnings relative to the required return on equity, thereby providing a benchmark against which market prices can be assessed (Ohlson, 1995; Kruschwitz and Löffler, 2006). In contrast, relative valuation employs comparative ratios that position a firm's value within its industry or peer group. Widely used measures include the price-to-earnings (P/E) ratio, often based on forward estimates, the price-to-book (P/B) ratio, particularly relevant for financial firms or for identifying speculative components in market valuations, and enterprise value-to-EBITDA (EV/EBITDA), which adjusts for differences in capital structure and capital intensity across firms and sectors (Liu et al., 2002; Lie and Lie, 2002). Yield-based indicators, such as dividend, earnings, or free cash flow yields, further enrich these tools by linking observed prices to potential investor returns. Taken together, intrinsic and relative approaches highlight the diverse nature of mispricing. While intrinsic models seek to anchor valuations in the firm's own fundamentals, relative measures capture deviations from industry or peer-group benchmarks, emphasizing the importance of context when interpreting signals of misvaluation. Ratios and yields, however, cannot be applied in isolation: their explanatory power emerges only when used in comparison with comparable firms or industries, since growth prospects, capital structures, and sectoral dynamics vary widely. Ultimately, no single metric can fully capture mispricing, but the combined use of intrinsic and relative frameworks provides a robust basis for analyzing inefficiencies in asset prices. A more detailed discussion of the different valuation methodologies and their limitations is provided in Section 3.1.2.

2.1.4 ESG in Asset Pricing Theory

Environmental, Social, and Governance factors have increasingly been integrated into asset pricing frameworks as potential determinants of risk – both systematic and idiosyncratic – and return (Sassen et al., 2016). In traditional models such as the CAPM or Fama–French multifactor frameworks, expected returns are driven by financial risk exposures (Sharpe, 1964; Fama and French, 1996). However, ESG characteristics may influence these exposures by affecting a firm's cost of capital, cash flow stability, and long-term growth prospects. Specifically, ESG performance has been shown to shape both systematic and firm-specific vulnerabilities to market-wide shocks and adverse events (e.g., tail risk), respectively, thereby linking sustainability to different layers of financial risk (Giese et al., 2019).

In this regard, ESG considerations may influence returns through both systematic and idiosyncratic risk channels. On the one hand, high ESG performance can reduce exposure to regulatory, reputational, and operational risks, leading to more stable cash flows and lower cost of capital (El Ghoul et al., 2011). On the other hand, investor preferences for sustainable assets may create excess demand, temporarily inflating valuations and potentially compressing expected returns (Pástor et al., 2021). This duality reflects the broader debate between the value-creation perspective — where ESG enhances firm competitiveness and innovation — and the risk-mitigation perspective, which emphasizes downside protection and lower volatility. Specifically, from a risk-mitigation perspective, strong ESG performance can reduce exposure to regulatory penalties, reputational damage, and operational disruptions, thereby lowering systematic risk (Albuquerque et al., 2019). From a value-creation perspective, ESG engagement can enhance brand reputation, attract capital from socially responsible investors, and foster innovation, potentially increasing expected cash flows.

Another channel relates to the role of ESG disclosure as a signal. From an endogenous perspective, firms may strategically disclose ESG information to differentiate themselves and reduce information asymmetry, thereby lowering capital costs. Incomplete or inconsistent ESG disclosure, however, can contribute to un-

certainty and valuation dispersion across firms. On the other hand, from an exogenous perspective, rating agencies and third-party providers create ESG scores that serve as external signals, albeit with considerable divergence and inconsistency across providers (refer to Section 2.1.2). This divergence introduces the risk of mispricing, as markets may not uniformly interpret or value ESG information.

Finally, the intersection of ESG and asset pricing accentuates the tension between market efficiency and behavioral deviations. In efficient markets, ESG should be priced to the extent that it affects fundamentals or systematic risk. In reality, investor preferences for "green" assets, limited attention to negative ESG signals, or temporary enthusiasm around sustainability themes can contribute to overvaluation or undervaluation. Recent equilibrium models explicitly incorporating investor preferences for sustainability suggest that ESG is not merely a side-constraint but a priced dimension of risk and return (Pástor et al., 2021). Yet, the presence of greenwashing and inconsistent disclosure underlines that ESG may also be a source of misvaluation within classical asset pricing frameworks.

In summary, the conceptual foundations outlined above establish the theoretical premises for examining the relationship between ESG performance and firm-level misvaluation. While the principles of market efficiency suggest that asset prices should fully incorporate both financial and non-financial information, behavioral deviations, informational frictions, and inconsistent ESG signals create fertile ground for persistent valuation errors. The dual role of ESG — as a potential source of systematic or idiosyncratic risk, and as both a value-creation and risk-mitigation mechanism — highlights the ambiguity surrounding its integration into asset pricing models.

Building on these theoretical insights, the next section reviews the empirical literature that has investigated the interplay between ESG factors, financial performance, valuation, and mispricing. This review provides the necessary context to identify existing gaps and to position the present study within the broader field of sustainable finance.

2.2 Literature review

2.2.1 ESG and stock performance

The relationship between ESG performance and stock returns has been extensively investigated in both finance and management research. Early studies suggested that incorporating social and environmental considerations could represent a constraint on firm strategy and reduce shareholder value (Vance, 1975; Renneboog et al., 2008). However, subsequent empirical evidence has provided a different perspective, frequently documenting positive or at least non-negative associations between ESG and corporate financial performance (CFP). For instance, early work by Derwall et al. (2005) demonstrates that portfolios of eco-efficient firms outperformed less efficient peers over 1995–2003, indicating an initial market underpricing of environmental performance. Similarly, Edmans (2011) find that high employee satisfaction — an "S" pillar factor — was associated with long-term abnormal returns, consistent with markets undervaluing intangible human capital. From a materiality perspective, Khan et al. (2016) show that firms with high ratings on material sustainability issues – as defined by the Sustainability Accounting Standards Board (SASB) framework – significantly outperform firms with poor ratings. Moreover, their study demonstrates that only ESG dimensions classified as financially material generate positive abnormal returns, while immaterial dimensions do not.

More recent contributions further refine these insights. Sverner et al. (2023) highlight the role of ESG momentum: firms with significant improvements in ESG ratings earn abnormal monthly returns of 0.23%–0.35% after controlling for conventional risk factors, suggesting that markets respond more strongly to changes in ESG quality than to static levels. In a complementary perspective, Cho et al. (2023) show that investors reward firms that simultaneously achieve high ESG standards and strong financial results ("higher highs"), while severely penalizing those with both weak ESG and poor financial performance ("lower lows"). These results suggest that ESG effects are context-dependent and interact with financial

fundamentals.

In addition, empirical studies consistently document that high-ESG firms tend to exhibit lower idiosyncratic and downside risk, which translates into more stable return distributions and reduced exposure to extreme losses (Albuquerque et al., 2019). This volatility-mitigating role, already discussed in Section 2.1.4, is often attributed to stronger risk management, reputational capital, and stakeholder relations, which can buffer firms against shocks and limit the likelihood of severe negative events.

At the aggregate level, meta-analytic evidence confirms the overall tendency towards positive or at least non-negative ESG–CFP relations. Friede et al. (2015), based on more than 2,000 empirical studies, conclude that the large majority of results indicate positive ESG impacts on CFP, which often appear stable over time, while also noting substantial heterogeneity across markets, time horizons, and ESG dimensions.

Taken together, this body of research suggests that ESG performance is not a marginal "non-financial" issue. Rather, it exerts a measurable influence on stock returns and volatility, both directly and through its interaction with firm fundamentals. These findings lay the groundwork for a deeper analysis of how ESG considerations affect valuation mechanisms and potential mispricing, which will be examined in the following sections.

2.2.2 ESG and valuation

The impact of ESG on firm valuation has been extensively investigated across different methodological frameworks, reflecting the multiple channels through which sustainability considerations can affect financial outcomes.

A first stream of evidence concerns relative valuation by multiples, which captures investors' expectations about growth and risk. Glavas (2023) proposes ESG-adjusted valuation multiples, claiming that integrating ESG into multiples is becoming a common practice among professionals as ESG scores are increasingly viewed as indicators of quality and resilience. He reports evidence showing that

firms with stronger ESG ratings trade at consistently higher multiples, partly due to investor demand and partly due to operational outperformance. For example, a study by Deloitte Switzerland (2023) finds that a ten-point difference in ESG score is associated with a 1.2 times higher EV/EBITDA multiple and that an increase in ESG by 10 points pushes this result to 1.8 times. Rahat and Nguyen (2024) extend this evidence to emerging markets, documenting that the fundamental valuation, measured by Tobin's Q, positively responds to lagged ESG scores, whereas relative multipliers (EV/Sales) are more sensitive to contemporaneous ESG performance.

A second and more widely studied channel is the cost of equity, where strong ESG performance is generally associated with lower required returns. Giese et al. (2019) show that ESG characteristics reduce both systematic and idiosyncratic risk. Using MSCI data and a factor-based approach, they demonstrate that firms with high ESG ratings experience lower drawdowns during market stress, reduced volatility, and lower costs of equity. Further empirical support is provided by Albuquerque et al. (2019), who show that high-ESG firms have lower systematic and downside risk, leading to a lower cost of capital, and Pellegrini et al. (2019), who report that a better sustainability performance generates a reduction in the cost of equity for oil and gas companies between 2002 and 2008.

From a more skeptical perspective, Cornell and Damodaran (2020), in their influential paper *Valuing ESG: Doing Good or Sounding Good?*, argue that there is little to no evidence of causality between ESG and firm performance, emphasizing that ESG actions affect firm value only insofar as they change either expected cash flows or discount rates. Even though they agree that socially responsible behavior may reduce firm-specific risks such as litigation or reputational damage, thereby lowering equity risk premia, they also caution against overstating the case, noting that "being good" does not automatically translate into better valuations unless there is a measurable effect on risk or profitability.

The evidence on the cost of debt is more mixed. Apergis et al. (2022) show that for S&P 500 firms between 2010 and 2019, higher ESG scores are associated with lower bond spreads, suggesting more favorable borrowing conditions.

Similarly, Raimo et al. (2021) document, on a sample of 919 firms from 2010 to 2019, that "companies with greater levels of transparency in the dissemination of ESG information benefit from accessing third party financial resources at better conditions", remarking the importance of ESG disclosure. However, Gonçalves et al. (2022) find an opposite relation, with better ESG performance being linked to a higher cost of debt, while simultaneously reducing the cost of equity. These opposite views underscore the heterogeneity in creditor perceptions of sustainability initiatives. In addition, Maaloul et al. (2023) highlight the mediating role of corporate reputation, showing that ESG performance and disclosure improve reputation, which in turn lowers the cost of debt.

The third major approach integrates ESG into discounted cash flow (DCF) frameworks, where value depends on expected cash flows and discount rates. Inard (2023) argues that DCF is particularly suited to ESG integration because "it explicitly processes forecasts using both short-term and long-term horizons, thus enabling consistency of ESG effects over time [...] not only does DCF account for the individual ESG strategy embedded in the company's forecasts but also for the industry-systematic risk, which can be ESG-sensitive through the cost of capital". Moro-Visconti (2022) extends this perspective, contrasting the traditional profit-centric paradigm ("Father Profit") with a sustainability-oriented approach ("Mother Nature"), in which "sustainable capital is counterbalanced by mostly intangible assets, as they reflect immaterial features consistent with ESG patterns". These contributions emphasize both the potential and the methodological complexity of embedding ESG into fundamental valuation.

In sum, these findings illustrate how ESG can affect firm valuation through multiple, interconnected channels. While higher multiples, lower cost of equity, and favorable DCF adjustments often support the value-enhancing role of ESG, mixed results on debt financing and disclosure dynamics highlight the importance of credibility, reputation, and methodology. This complexity underscores the need to further examine ESG credibility as a determinant of whether sustainability contributes to accurate pricing or instead to systematic misvaluation.

2.2.3 ESG and mispricing

While much of the literature emphasizes the potential of ESG to enhance firm value, a parallel stream of research points to the risk that ESG information may also contribute to systematic mispricing. From a theoretical perspective, the Efficient Market Hypothesis, already discussed in Section 2.1.3, suggests that all publicly available information, including sustainability-related disclosures, should be correctly incorporated into asset prices (Fama, 1970). However, behavioral finance has repeatedly shown that investor sentiment, limited attention, and heterogeneous interpretations of information may generate persistent valuation errors (Shleifer, 2000). In the context of ESG, mispricing can occur if markets underreact to ESG-related information (positive or negative) or misinterpret its implications for firm value and risk. These dynamics are particularly relevant given the complexity and divergence of available ESG ratings.

One important mechanism through which ESG can affect mispricing is disclosure. Wang et al. (2023), studying the Chinese A-share market, find that ESG disclosure can both mitigate mispricing by reducing information asymmetry, and at the same time fuel mispricing when investors overreact to non-material signals. Specifically, they report that higher ESG disclosure is associated with a lower level of mispricing, showing that greater transparency decreases pricing deviations through signalling and enhanced monitoring. At the same time, when information quality is low or inconsistent across rating agencies, disclosure can even worsen market mispricing. The test of the single pillars – E, S, G – showed that environmental disclosure can restrain the overvaluation, social disclosure can mitigate the undervaluation, and corporate governance disclosure has no significant impact on the mispricing.

Nevertheless, the demand side of capital markets introduces additional distortions. Baker et al. (2024) quantify the premium investors are willing to pay for ESG-labeled funds, reporting that over the sample period it rose from 3 basis points (bps) in 2019 to 17 bps in 2020, before turning negative and reaching –33 bps in 2023. They attribute much of the investor demand to "the ESG label

itself, which may leave investors susceptible to greenwashing". This unstable pattern underscores how investor sentiment and preference-driven demand shocks can generate cycles of temporary valuation distortions around sustainability themes. In a complementary study, Pástor et al. (2021) develop a general equilibrium model showing that investors' non-pecuniary preferences for sustainable assets can shift demand curves and produce valuation effects independent of cash flow fundamentals. They conclude that sustainable investing generates both lower expected returns and higher current prices for green firms, a pattern consistent with demand-driven overvaluation.

A smaller but growing strand of literature examines the direct link between ESG and misvaluation. Barka et al. (2023) examine 221 French firms over the period 2002–2021. They document that "ESG scores increase equity misvaluation by exacerbating (mitigating) equity overvaluation (undervaluation)" and that this effect is particularly strong for firms with low analyst coverage, where information asymmetries are most pronounced. Interestingly, they also find that portfolios of firms with moderate ESG scores yield positive abnormal returns, outperforming the market by about 0.3% per year, whereas portfolios with the highest ESG scores do not exhibit systematic outperformance. This pattern suggests that ESG can generate a "halo effect", improving perceived attractiveness and thus contributing to valuation deviations from fundamentals.

Finally, the dispersion of ESG ratings further amplifies mispricing risks. Berg et al. (2022) document the divergence of ESG scores across providers, noting that differences in measurement and scope undermine the consistency of ESG as a pricing signal and create scope for valuation errors. As they put it, rating divergence produces "aggregate confusion" that limits the informativeness of ESG data for investors and asset pricing models. Adding on this, Yun et al. (2024) provide evidence from China that greater disagreement among ESG ratings is associated with systematic mispricing — in the form of overvaluation in some periods and undervaluation in others — mediated by investor sentiment, disclosure practices, and managerial awareness.

In essence, the literature on ESG and mispricing reveals a complex picture. While financially material ESG information and credible disclosure can reduce mispricing by lowering information asymmetry, inconsistent ratings, investor sentiment, and halo effects can amplify valuation errors. The challenge, therefore, lies in distinguishing between substantive ESG performance and superficial signaling to understand whether ESG contributes to more accurate pricing or instead exacerbates systematic misvaluation.

2.2.4 ESG-related reputational risk

Beyond financial performance, valuation, and mispricing, ESG has also been studied in connection with reputational risk — the risk that adverse events, controversial news, or stakeholder perceptions damage a firm's legitimacy, trustworthiness, and ultimately its market value. Reputational risk is particularly important in ESG contexts, where sustainability commitments are often scrutinized by regulators, investors, and more broadly by society, and where failures can rapidly translate into financial penalties, consumer backlash, and capital market sanctions. Some widely used metrics to capture reputational risk in ESG analysis are the RepRisk Index and Refinitiv's Controversies Score. The Refinitiv Controversies Score measures ESG-related incidents identified through global media, with lower scores indicating more severe or frequent controversies (Refinitiv, 2022). The RepRisk Index (RRI), developed by RepRisk AG, quantifies a firm's daily exposure to ESG and business conduct risks on a scale from 0 to 100, supplemented by indicators such as the Peak RRI (two-year maximum), RRI Change (short-term variation), and the RepRisk Rating (RRR), a letter-based assessment (AAA to D) of overall reputational exposure (RepRisk AG, 2021).

A key insight from the literature is that ESG controversies can erase or even reverse the benefits of strong sustainability scores. Rahat and Nguyen (2024) show that ESG controversies, measured through the RepRisk index, negatively impact firm value for both fundamental and multiple-based valuation proxies. Interestingly, Krüger (2015) demonstrates that, while markets react negatively

and significantly to events that reveal irresponsible behavior, they respond weakly negatively to positive events, underscoring the asymmetric effect of ESG news on reputation. Moreover, according to the research, investors only value initiatives that "offset" previous corporate social *irresponsibility*. Capelle-Blancard and Petit (2019) further confirm the asymmetric market response, analyzing over 33,000 ESG news: negative ESG events induce strong valuation penalties, while positive events generate weak reactions only. The study also distinguishes between different source types, highlighting how on average market participants are more responsive to the media than to companies' press releases, indicating how actual behaviors play a crucial role in shaping public perceptions.

Other contributions emphasize the role of reputational assets as buffers in times of crises. Lins et al. (2017) find that during the global financial crisis, firms with higher social capital — measured through CSR and stakeholder trust — experienced superior stock performance, profitability and growth, highlighting that reputational assets provide downside protection when trust in markets collapses. Similarly, Aouadi and Marsat (2016), in a cross-country study, find that ESG controversies significantly and negatively impact firm performance overall, but also note that when firms possess strong pre-existing corporate social performance controversies can paradoxically increase firm value. These results, however, only hold for high-attention firms (i.e., "those which are larger, perform better, receive more investors' attention, or are located in countries with greater levels of press freedom"), possibly because such firms are better able to manage the narrative and leverage the visibility associated with the event, and therefore ESG controversies not only do not harm them but even play the role of an attention-grabbing event. This finding points to the heterogeneity in how markets interpret ESG events, depending on prior credibility.

At the same time, the literature warns against the risks of greenwashing, whereby firms seek reputational benefits from ESG communication without substantively improving their practices. Marquis et al. (2016) document how firms selectively disclose favorable sustainability information to maintain legitimacy, a

strategy that may expose them to reputational backfire if stakeholders later perceive inconsistency or opportunism. This reputational fragility underscores why controversies often carry outsized market reactions compared to positive ESG news.

Overall, the literature highlights the double-edged nature of reputation, which emerges as a critical dimension of ESG. On one hand, credible ESG performance builds reputational capital that cushions firms in times of crisis and lowers financing costs. On the other, negative ESG events — especially when amplified by media coverage — can trigger sharp valuation penalties. This duality in market responses underscores the importance of ESG credibility: while genuine commitment generates trust and resilience, superficial disclosure and controversies expose firms to severe reputational shocks.

The literature reviewed in this section highlights the multifaceted ways in which ESG interacts with financial markets. Research on stock performance has shown that ESG may influence both systematic and idiosyncratic risk, while valuation studies demonstrate its impact through multiples, cost of capital, and cash flow expectations. Yet, findings on mispricing and reputational risk reveal that ESG is not always priced efficiently: disclosure can mitigate or exacerbate valuation errors, investor sentiment and rating disagreement amplify market reactions, and controversies can trigger sharp reputational losses. At the same time, credible ESG practices and stakeholder trust can serve as buffers in times of stress, underscoring the dual role of ESG as both a stabilizer and a potential source of misvaluation.

Building on these insights, the next section develops the hypothesis of the study, linking firm-level misvaluation with ESG credibility. By integrating evidence from asset pricing, disclosure theory, and reputational dynamics, the hypothesis aim to clarify whether ESG credibility enhances pricing efficiency or instead fuels systematic deviations from fundamentals.

2.3 Hypothesis development

The empirical literature reviewed above highlights the ambiguous role of ESG in shaping market valuations. While strong ESG performance can reduce information asymmetry, lower financing costs, and build reputational capital, inconsistencies in ESG ratings, investor sentiment, and negative ESG events may instead amplify mispricing. Most existing studies on ESG and market efficiency, however, share one important limitation.

The prevailing emphasis has been on ESG scores or disclosure quality, both of which are largely derived from firm-reported information and thus represent an endogenous channel of sustainability signaling. By contrast, controversy-related metrics — which incorporate environmental accidents, corporate scandals, or governance failures — have received far less attention, despite constituting exogenous shocks that challenge a firm's sustainability profile and directly affect investor perceptions through media exposure and reputational spillovers. Overlooking controversies not only risks overstating the informational value of ESG scores, but also neglects the distinction between endogenous and exogenous signals. Indeed, ESG scores originate from firm-level disclosure and reflect internal reporting practices. For this reason, they may enhance valuations if investors perceive them as signals of long-term value creation. ESG controversies, on the other hand, stem from external events, news coverage, and reputational shocks beyond the firm's control. Consequently, while ESG scores can be strategically managed or even inflated, controversies provide corrective signals that reveal inconsistencies between corporate reporting and actual practices. Furthermore, these two channels can have distinct implications for mispricing: endogenous signals may be incorporated gradually as investors assess credibility and relevance, whereas exogenous shocks can cause immediate price adjustments, sometimes overshooting fundamentals.

The issue just discussed constitutes a relevant research gap: extant studies maily focused on endogenous ESG signals while largely overlooking exogenous factors. Including both perspectives would enable a more comprehensive understanding of how ESG factors influence market efficiency and asset valuation

through distinct informational mechanisms. Building on this, the present study contributes to the literature by explicitly combining these two dimensions into a single measure of ESG Credibility, defined as the interaction between ESG scores and controversies scores. A high ESG score that is not contradicted by controversies signals genuine sustainability engagement and should reduce valuation errors. Conversely, a high ESG score accompanied by frequent controversies reflects weak credibility, increasing the risk of overvaluation through greenwashing or halo effects.

Accordingly, the research question guiding this analysis is:

> **RQ.** *How does firm-level misvaluation vary with ESG credibility?*

From this, the central hypothesis is derived:

> **H.** *Misvaluation is negatively associated with ESG credibility, measured as the interaction between ESG score and controversies score.*

The expectation is that credible ESG signals mitigate the extent of misvaluation by aligning market perceptions with underlying fundamentals, while low credibility amplifies deviations. This framework advances prior literature by integrating both endogenous reporting-based measures and exogenous event-based signals, thereby capturing the dual role of ESG as both a stabilizer and a potential source of market inefficiency.

Figure 1 illustrates the conceptual framework adopted in this study, outlining how ESG factors, through disclosure and reputational channels, shape the information flow that ultimately affects market reaction and mispricing adjustment.

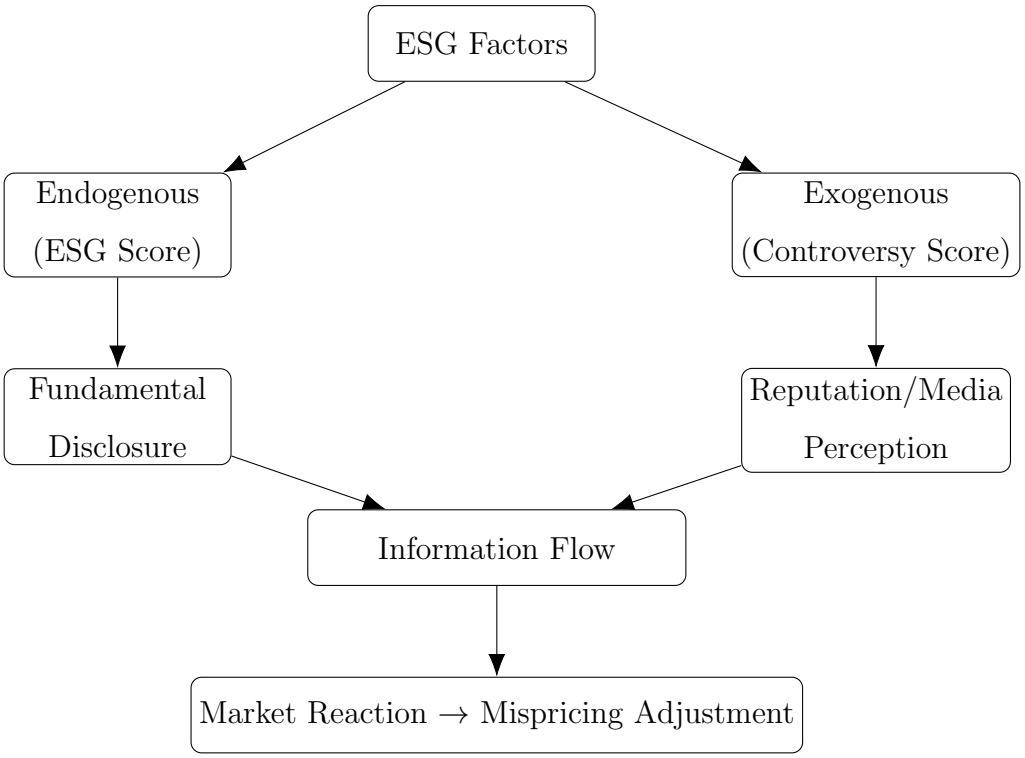


Figure 1: Conceptual framework linking ESG dimensions to mispricing. Source: self-elaboration.

Chapter 3

Methodology

This chapter describes the methodological approach adopted in the empirical analysis. The structure follows four steps: first, the sample selection and data collection procedure; second, the definition of dependent, independent, and control variables; third, the econometric models used for estimation; and finally, the theoretical framework linking explanatory variables to the response.

3.1 Data collection and cleaning

3.1.1 Sample selection

The initial dataset was constructed starting from the constituents of an Exchange Traded Fund (ETF) replicating the *MSCI World Index*, namely the iShares Core MSCI World ETF (ticker: SWDA[1]). This ETF was selected because of its broad and diversified coverage of equity markets: it comprises a wide range of global companies within 23 developed countries, including firms from North America, Europe, and Asia-Pacific, representing about 85% of the listed equities in each country. Indeed, it provides a balanced and representative sample of large and mid-cap companies in developed countries, making it an ideal foundation for studying global dynamics, ESG practices, and reputational controversies across sectors and geographies.

[1]Source: https://www.ishares.com/uk/individual/en/products/251882/?referrer=tickerSearch

From the extracted tickers list, all non-equity securities were excluded to ensure that the sample consisted solely of individual firms. ESG scores as well as accounting and financial variables were collected from the LSEG Workspace (ex Refinitiv) for the sample period 2013-2024, with 2013 and 2014 intended for the construction of other variables. In line with extant literature (Barka et al., 2023; Bottazzi et al., 2023; Rahat and Nguyen, 2024), financial sector firms (SIC codes 6000-6999) were excluded from the sample. Their balance sheet structure and regulatory constraints, indeed, differ markedly from industrial firms', making them not directly comparable when estimating firm value using accounting variables.

3.1.2 Variables description

The primary objective of this study is to evaluate whether and how companies' ESG characteristics – and in particular ESG Credibility – influence their market valuation, with a specific focus on mispricing.

Consequently, the explanatory variables selected for this research are the ESG Score and the ESG Controversies Score, which are useful to assess not only the firms' declared commitment to sustainability but also their actual reputation in the market regarding sustainability matters. These are complemented by a set of financial control variables traditionally employed in valuation models (Aouadi and Marsat, 2016; Barka et al., 2023), as well as measures of changes over time.

As anticipated in Section 2.1.2, the ESG Score is a composite indicator reflecting a firm's overall performance, commitment, and effectiveness across the following three dimensions: environmental responsibility, social impact, and governance practices. LSEG computes it by assigning individual scores to the three pillars (E, S, G) based on companies' self-reported data, and then aggregating them into a composite score, which reflects how firms choose to present their sustainability efforts to the public and to investors. The score range goes from 0 (ESG laggards) to 100 (ESG leaders), depending on the relative ESG performance and the degree of transparency in reporting material ESG data publicly (Refinitiv, 2022).
On the other hand, LSEG's Controversies Score captures ESG-related incidents

– and especially scandals – identified through global media sources. This score ranges from 0 to 100, with lower values indicating more severe or frequent controversies (Refinitiv, 2022). Unlike the ESG Score, the Controversies Score is exogenous to firm communication strategies and reflects the actual occurrence of adverse ESG events. As such, the two indicators jointly offer a view of both ESG disclosure and ESG conduct. Following the literature (Sverner et al., 2023; Glavas, 2023), contemporaneous and lagged ESG changes were included to account for dynamic other than static levels.

To isolate the effect of ESG on misvaluation, every model controls for standard firm-level characteristics that may influence market mispricing. These include leverage (LEV), which reflects the firm's capital structure; investment intensity (INV), calculated as capital expenditures over total assets; profitability, measured by return on assets (ROA); firm size (SIZE), proxied by the natural logarithm of total assets; and operational risk (RISK), computed as the standard deviation of ROA on a three-year rolling basis.

As anticipated, firm Misvaluation ($MISV_{it}$) represents the response variable of this study. In the literature, misvaluation has been approached through several methodologies that attempt to capture deviations between market and fundamental values. As outlined earlier in Section 2.1.3, traditional valuation techniques, such as discounted cash flow (DCF) models, estimate intrinsic value by discounting expected future cash flows at an appropriate cost of capital, and misvaluation is then inferred from the difference between this intrinsic value and observed market prices (Damodaran, 2012). Similarly, relative valuation approaches based on market multiples (e.g., P/E, EV/Sales, etc.) have been employed to benchmark firms against comparable peers, with residual differences interpreted as evidence of over- or undervaluation (Lie and Lie, 2002).

Other commonly employed proxies for misvaluation include ratios such as the market-to-book (M/B) and Tobin's Q, which are frequently adopted in empirical research as indicators of firms' growth opportunities or potential mispricing (Rahat and Nguyen, 2024). Tobin's Q, originally defined as the ratio between the

market value of a firm's assets and their replacement cost, is typically approximated using the market value of equity plus liabilities divided by the book value of assets. Yet, this approximation is subject to substantial measurement challenges, and the simplified version of the ratio — often referred to as "Simple Q" — has been criticized for its limited accuracy in capturing firms' true fundamental value (Lang and Stulz, 1994; Chung and Pruitt, 1994; Bartlett and Partnoy, 2020). Both M/B and Tobin's Q thus risk to confuse genuine growth expectations with valuation errors, which reduces their effectiveness in disentangling fundamentals from mispricing. To address these limitations, Rhodes-Kropf et al. (2005) introduced a residual-based methodology (hereafter, RRV) that starting from M/B derives firm-level misvaluation as the portion of market value not explained by valuation models grounded in accounting fundamentals. By explicitly separating the fundamental component from the residual, their approach provides a more rigorous framework to distinguish value drivers from market mispricing.

Indeed, to proxy the response variable chosen for the analysis (i.e., misvaluation), the present study follows the procedure proposed by Rhodes-Kropf et al. (2005), which decomposes the market-to-book ratio (M/B) into market-to-intrinsic value (M/V) and intrinsic value-to-book value (V/B). This allows to separate equity market misvaluation from growth expectations. Furthermore, the RRV further distinguishes the misvaluation component between firm-specific misvaluation and industry-specific misvaluation. Ultimately, the methodology yields three distinct components: (i) firm-specific misvaluation, (ii) industry-level misvaluation, and (iii) growth opportunities.

The RRV approach is summarized in Eq. 3.1.

$$m_{it} - b_{it} \equiv \underbrace{m_{it} - v(\theta_{it}, \alpha_{jt})}_{\substack{\text{Firm–specific component} \\ (i)}} + \underbrace{v(\theta_{it}, \alpha_{jt}) - v(\theta_{it}, \alpha_j)}_{\substack{\text{Industry–specific component} \\ (ii)}} + \underbrace{v(\theta_{it}, \alpha_j) - b_{it}}_{\substack{\text{Growth component} \\ (iii)}}, \quad (3.1)$$

where

$m = \log(ME)$,

$b = \log(BE)$,

$v =$ fundamental value,

$\theta =$ firm–specific accounting information,

$\alpha =$ conditional accounting multiples.

Building on this framework, an annual panel of firm–year observations was constructed, and for each observation the following four core variables were computed:

1. Log market equity:

$$\log ME_{it} \;=\; \ln\bigl(\text{market capitalization}_{it}\bigr).$$

2. Log book equity:

$$\log BE_{it} \;=\; \ln\bigl(\text{book equity}_{it}\bigr).$$

3. Net income components: the positive part of net income,

$$\log NI^{+}_{it} \;=\; \ln\bigl(\max(NI_{it}, 0)\bigr),$$

   together with a binary indicator for net losses

$$I_{NI<0,it} = \begin{cases} 1, & NI_{it} < 0, \\ 0, & \text{otherwise.} \end{cases}$$

4. Leverage ratio:

$$LEV_{it} \;=\; \frac{\text{total debt}_{it}}{\text{total assets}_{it}}.$$

All firms were then assigned to one of the twelve Fama–French industry groups based on their four-digit SIC codes, according to the industry-mapping intervals specified by Fama and French (1997), reported in Appendix 1.

Within each year–industry cell (j, t), the following ordinary least squares regression was estimated:

$$\log ME_{it} = \alpha_{0,jt} + \alpha_{1,jt} \log BE_{it} + \alpha_{2,jt} \log NI_{it}^{+} + \alpha_{3,jt} I_{NI<0,it} + \alpha_{4,jt} LEV_{it} + \varepsilon_{it},$$

yielding contemporaneous coefficient estimates $\hat{\alpha}_{k,jt}$ for $k = 0, \ldots, 4$.
Long-run industry coefficients $\hat{\alpha}_{k,j}$ were then computed as the time-series means of $\hat{\alpha}_{k,jt}$ across all sample years.

By merging the contemporaneous $\hat{\alpha}_{k,jt}$ and long-run $\hat{\alpha}_{k,j}$ estimates back into the original panel, the fitted valuation measures

$$\hat{v}_{jt} = \sum_{k=0}^{4} \hat{\alpha}_{k,jt} X_{it}^{k}, \qquad \hat{v}_{j} = \sum_{k=0}^{4} \hat{\alpha}_{k,j} X_{it}^{k}$$

were calculated for each firm–year. Finally, the three components were derived as follows:

1. Firm-specific misvaluation: $\log ME_{it} - \hat{v}_{jt}$,
2. Industry-level misvaluation: $\hat{v}_{jt} - \hat{v}_{j}$,
3. Growth opportunity: $\hat{v}_{j} - \log BE_{it}$.

Chen et al. (2021) extended the RRV model by regressing the misvaluation component on the growth opportunity component, thereby extracting the orthogonal residual that excludes any potential correlation between the two. This orthogonal component is then employed as a proxy for misvaluation. In the present study, this approach was tested but the regression did not yield statistically significant results, indicating that our measures of misvaluation and growth opportunities are not correlated. Consequently, firm-specific misvaluation as defined by Rhodes-Kropf et al. (2005) is adopted as the proxy for misvaluation throughout the analysis.

Table 2 summarizes the variables used in this study.

Table 2: Variables and Definitions

Variable	Definition
Response	
Misvaluation (specific)	$\log ME_{it}$ - $\hat{v}_{jt}$
Predictors	
Lagged ESG	ESG Score in year $t-1$
Lagged Controversies	Controversies Score in year $t-1$
Δ ESG (t vs t-1)	ESG_t - ESG_{t-1}
Δ ESG (t-1 vs t-2)	ESG_{t-1} - ESG_{t-2}
Δ Controversies (t vs t-1)	Controversies_t - $\text{Controversies}_{t-1}$
Δ Controversies (t-1 vs t-2)	$\text{Controversies}_{t-1}$ - $\text{Controversies}_{t-2}$
Controls	
LEV	total debt / total assets
INV	net capital expenditures / total assets
SIZE	ln(total assets)
ROA	net income / total assets
RISK	standard deviation of ROA on a 3-year rolling basis
Others	
log(BE)	ln(book equity)
log(ME)	ln(market equity)
log NI^+	ln(positive net income)
$\text{I}_{NI<0}$	dummy for negative net income
Misvaluation (market)	$\hat{v}_{jt} - \hat{v}_j$
Growth opportunity	$\hat{v}_j - \log BE_{it}$

3.1.3 Data cleaning

Before moving on to the core analysis, data exploration and cleaning were performed to ensure a balanced panel and to reduce noise in the subsequent models.

Specifically, observations with missing values (NA) or infinite values were systematically removed and year 2024 was dropped because of excessive data incompleteness. Years 2013-2014, as mentioned before, were used only for the computations of lagged variables and standard deviations, and were therefore deleted. Moreover, to ensure robustness in panel data analysis and to minimize bias from missing observations, only firms with complete yearly data across the full period were retained.

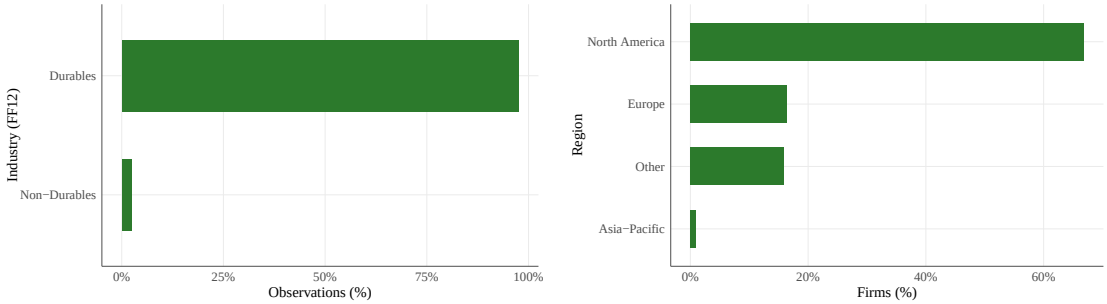
The final panel dataset consists of 214 publicly listed companies in a time frame of 9 years (2015-2023), for a total of 1864 observations.

To provide further insight into the structure of the final dataset, the sample composition was analyzed across industries, years, and geographical areas (see Figure 2 and Figure 3). The distributions reveal some clear imbalances across sectors and regions. In terms of industry composition (Fama–French 12 Industry classification), most of the observations belong to the category of durables, while the remaining ones are recorded in the non-durable sector. Although this concentration may represent a limitation, it is worth noting that within these broad groups the firms cover a wide variety of SIC codes, thereby ensuring some degree of heterogeneity in terms of business models and activities. Moreover, the predominance of durables is consistent with the sectoral composition of the MSCI World index itself, where consumer discretionary and industrial firms are structurally overrepresented, while financials — excluded from the analysis for methodological reasons — would otherwise account for a considerable share of the index (MSCI Inc., 2025).

The geographical distribution also mirrors the structure of the MSCI World: firms are predominantly located in North America, followed by Europe and other regions, with Asia–Pacific accounting for a marginal share of the sample. This outcome is consistent with the weight of developed markets in the Index.

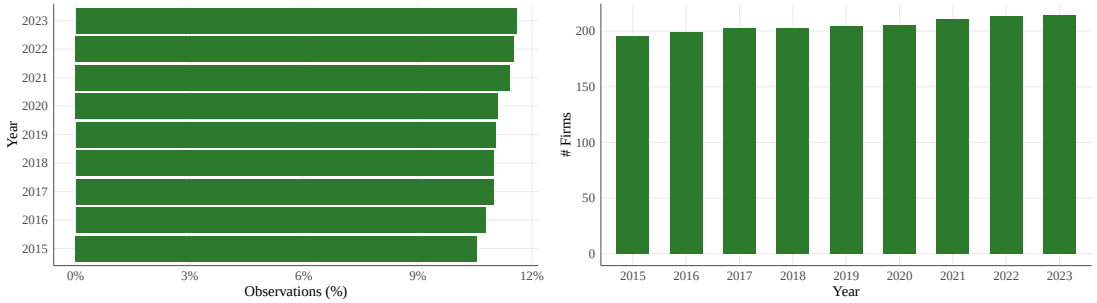
Finally, the time dimension appears well balanced. The number of firms remains relatively stable over the whole sample period, and the percentage distribution of observations across years confirms a fairly even temporal coverage. This pattern is mainly driven by the evolution of data availability over time, without generating strong concentration in specific subperiods.

Overall, while the dataset exhibits sectoral and regional skews inherent to the SWDA composition, it still provides a sufficiently broad and representative setting for the purposes of the analysis. Nonetheless, the absence of several industries should be acknowledged as a potential limitation when interpreting the results.



(a) Sample industry distribution. (b) Sample geographical distribution.

Figure 2: Sample composition. Source: self-elaboration



(a) Sample year distribution. (b) Number of firms per year.

Figure 3: Temporal distribution of the sample. Source: self-elaboration

3.2 Model specification

3.2.1 Econometric approach

To examine the link between firms' ESG profiles and market misvaluation, the following regression model was estimated:

$$\begin{aligned} MISV_{it} = \beta_0 &+ \beta_1 ESG_{i,t-1} + \beta_2 ControversyGroup_{i,t-1} \\ &+ \beta_3 \big(ESG_{i,t-1} \times ControversyGroup_{i,t-1}\big) \\ &+ \beta_4 \Delta ESG_{it} + \beta_5 \Delta ESG_{i,t-1} \\ &+ \beta_6 LEV_{it} + \beta_7 INV_{it} + \beta_8 SIZE_{it} \\ &+ \beta_9 ROA_{it} + \beta_{10} RISK_{it} + \varepsilon_{it} \end{aligned} \tag{3.2}$$

where $MISV_{it}$ represents firm-specific misvaluation for firm i in year t. The key regressors are the lagged ESG score ($ESG_{i,t-1}$), the lagged controversy group indicator ($ControversyGroup_{i,t-1}$), and their interaction term, which captures

heterogeneous effects of ESG depending on firms' reputational exposure. The controversy group indicator is a dummy variable derived from the Controversies Score, taking the value "NoControversies" for firms not involved in any incident (score = 100) and "Controversies" for firms with at least one incident (score < 100). A more detailed discussion of this variable is provided in Section 4.3.2. Two additional regressors account for short-term ESG dynamics: the contemporaneous ESG change (ΔESG_{it}) and its lag ($\Delta ESG_{i,t-1}$). These are meant to explore the potential role of ESG rating improvements. As mentioned in Section 3.1.2, control variables include leverage (LEV), investment intensity (INV), profitability (ROA), firm size (SIZE), and risk (RISK).

The model was estimated using several panel data techniques. First, a pooled OLS specification provided a baseline comparison. Second, fixed-effects and random-effects estimators were implemented to address unobserved heterogeneity across firms. Third, a fixed-effects regression with firm-level clustered standard errors was employed to account for serial correlation and heteroskedasticity in the error terms.

3.2.2 Theoretical link between variables

From a theoretical standpoint, the dependent variable – misvaluation – captures the degree to which market prices deviate from firm fundamentals. ESG performance may influence misvaluation through two main channels. First, higher ESG scores and good disclosure quality can reduce information asymmetry, increasing investor trust and thus lowering the gap between intrinsic value and market price (Lins et al., 2017; Wang et al., 2023). Second, investors may attribute valuation premiums to sustainable practices, or be subject to halo effects, leading to systematic overpricing or underpricing depending on market sentiment (Pástor et al., 2021; Barka et al., 2023; Baker et al., 2024).

Controversy exposure adds a reputational dimension: firms with recurrent negative events are expected to face downward valuation adjustments due to perceived risks, while firms with no controversies may not fully capitalize on their ESG dis-

closure if markets underreact to such information (Krüger, 2015; Capelle-Blancard and Petit, 2019; Rahat and Nguyen, 2024). The interaction term between ESG and the ControversyGroup – i.e., ESG Credibility – therefore aims to test whether the market distinguishes between greenwashing (i.e., strong ESG disclosure but poor reputation) and genuine sustainability performance, and whether such credibility is reflected in more accurate pricing or instead amplifies valuation distortions.

In addition to the main objective of the study, the inclusion of ESG changes (ΔESG) acknowledges that investors may react more strongly to improvements or deteriorations in sustainability profiles than to static levels, consistent with the concept of ESG momentum effects (Sverner et al., 2023; Glavas, 2023). Finally, the set of financial controls ensures that the ESG–misvaluation link is not driven by firm fundamentals such as profitability, leverage, or risk exposure, which are well-known determinants of valuation in the corporate finance literature (Aouadi and Marsat, 2016; Barka et al., 2023).

Chapter 4

Results

This chapter presents the results of the empirical analysis conducted to test the hypothesis formulated in Chapter 2 – i.e., whether firm-specific misvaluation is negatively associated with ESG credibility.

The first section provides a comprehensive overview of the dataset, including the main characteristics of the sample and the distributions of the key variables. Exploratory analysis represents a crucial step to familiarize with data and highlight any features that may influence subsequent modelling.

The second part explores bivariate relationships between the variables of interest through correlation analysis. This step offers preliminary evidence on the direction and strength of associations and allows for the identification of potential multicollinearity issues.

The third section introduces the main findings of the multivariate analysis, where the proposed models are estimated.

Finally, robustness checks are performed to evaluate the stability of the results across alternative model specifications or settings. This ensures that the conclusions drawn are not contingent upon specific analytical choices or driven by anomalous observations.

4.1 Descriptive statistics

To provide a preliminary understanding of the sample, this section presents the main patterns identified for the selected variables of this study.

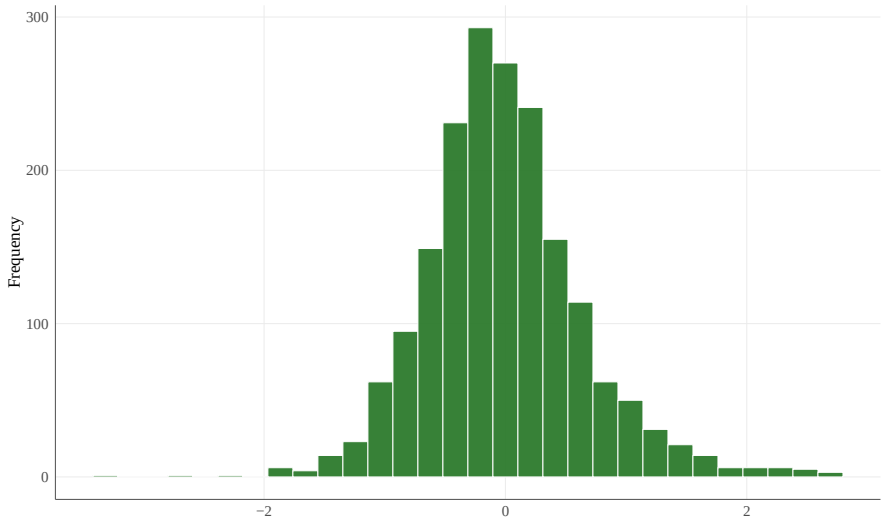


Figure 4: Misvaluation distribution. Source: self-elaboration

To start, in order to get a first glimpse of the variables of interest, their distributions are analyzed. Firm-specific misvaluation, depicted in Figure 4, appears to be centered around zero, with most observations concentrated between –2 and 2. This suggests that firms tend to oscillate around their intrinsic value, and that extreme over- or undervaluations are relatively rare. Nonetheless, the fat tails (leptokurtic shape) indicate wide dispersion, ranging from considerable undervaluation to pronounced overvaluation, implying strong heterogeneity across firms.

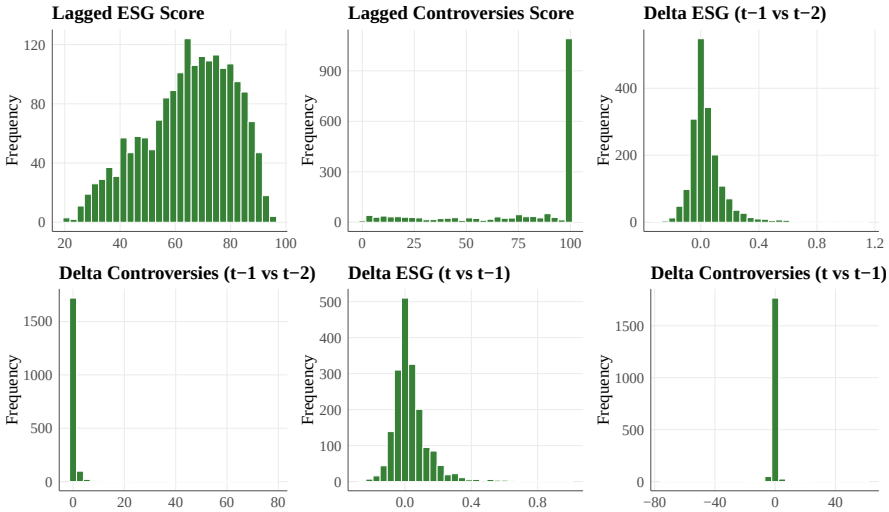


Figure 5: Explanatory variables' distribution. Source: self-elaboration

Regarding the ESG-related variables, shown in Figure 5, lagged ESG Scores exhibit a left-skewed distribution, with a substantial proportion of firms achieving relatively high ESG ratings. In contrast, the lagged Controversies Score is strongly polarized, with most of the observations reporting no controversies (score equal to 100) while the remaining ones appearing almost evenly distributed across lower values.

Year-on-year variations in ESG and Controversies scores are narrowly distributed around zero, suggesting that ESG profiles and controversy levels tend to be persistent over time, changing gradually rather than experiencing substantial shifts. However, while variations in ESG scores are sufficiently dispersed and capture gradual improvements and deteriorations, the distributions of the changes in Controversies present almost solely a peak at zero. These two latter variables will be therefore excluded from the analysis from now on because of their limited informative power.

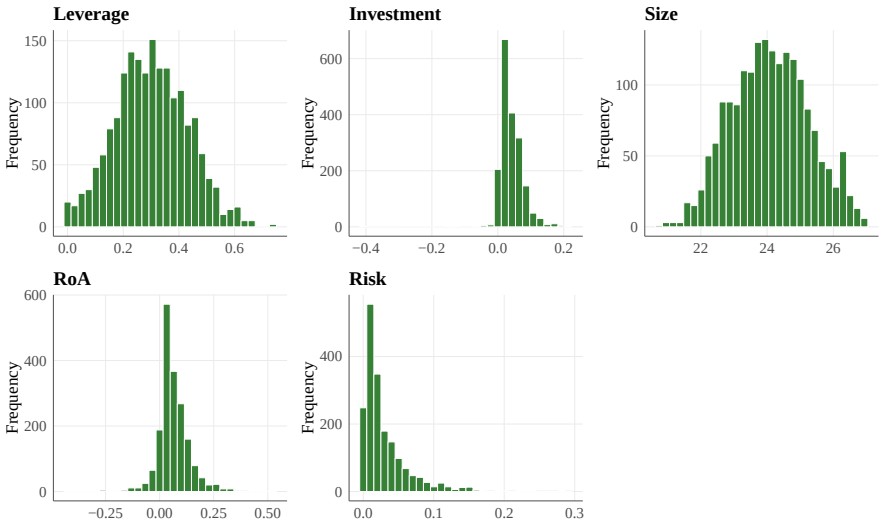


Figure 6: Control variables' distributions. Source: self-elaboration

Control variables present distributions consistent with expectations for listed firms (see Figure 6). Leverage is concentrated at low levels and displays a peak at around 30%, implying that most firms maintain modest debt ratios. Investment intensity is generally low, tightly clustered around zero, while firm Size shows a spread unimodal distribution, suggesting a relatively homogeneous set of companies in terms of scale, ranging from medium to large firms[1]. Return on Assets shows a narrow, moderately positive central tendency, reflecting generally stable profitability across the sample though highlighting some degree of dispersion. Risk, on the other hand, is markedly right-skewed, with most firms maintaining low volatility but a subset showing substantially higher risk profiles.

Table 3 summarizes the descriptive statistics for the variables included in the analysis, reporting measures of central tendency, dispersion and range. The summary statistics confirm the central tendencies already visible in the distributions, while also providing a clearer picture of the degree of dispersion in the data. Lagged ESG and Controversies scores show relatively wide ranges, pointing to meaningful differences across firm-year observations. By contrast, the year-on-year changes in ESG scores, both contemporaneous and lagged, exhibit very limited variation, which is likely to pose challenges in the panel regressions, as it reduces

[1]Recall that firm size was built on a logarithmic scale.

Table 3: Descriptive Statistics for Selected Variables

Variable	N. Obs	Mean	Median	Std Dev	Min	Max
Response						
Misvaluation	1864	-0.02	-0.07	0.65	-3.33	2.68
Predictors						
Lagged ESG	1864	64.92	66.80	16.10	20.81	95.57
Lagged Controversies	1864	78.85	100.00	31.68	0.74	100.00
Delta ESG (t vs t-1)	1864	0.03	0.01	0.11	-0.26	0.98
Delta ESG (t-1 vs t-2)	1864	0.04	0.02	0.12	-0.30	1.12
Controls						
Leverage	1864	0.30	0.30	0.13	0.00	0.74
Investment	1864	0.04	0.03	0.03	-0.41	0.21
Size	1864	24.09	24.08	1.16	20.84	27.04
RoA	1864	0.06	0.05	0.07	-0.44	0.51
Risk	1864	0.03	0.02	0.04	0.00	0.29

the explanatory power of these indicators and makes it more difficult to detect statistically significant effects.

Overall, despite these limitations, the dataset retains sufficient heterogeneity across the main variables and the controls to provide a solid basis for the empirical investigation.

4.2 Correlations

Before turning to the multivariate analysis, it is useful to explore the pairwise associations between the main variables of interest. First, the correlation analysis provides preliminary evidence on how ESG dimensions and firm characteristics are related to each other, thereby offering insights into potential mechanisms linking sustainability to valuation outcomes. Second, complementary analysis is conducted to assess whether multicollinearity could represent an issue for the regression framework, potentially biasing the estimation of individual effects. To this end, Pearson correlation coefficients were computed across all independent and control variables, followed by the calculation of Variance Inflation Factors (VIFs). In addition, scatterplots are employed to visualize the bivariate relation-

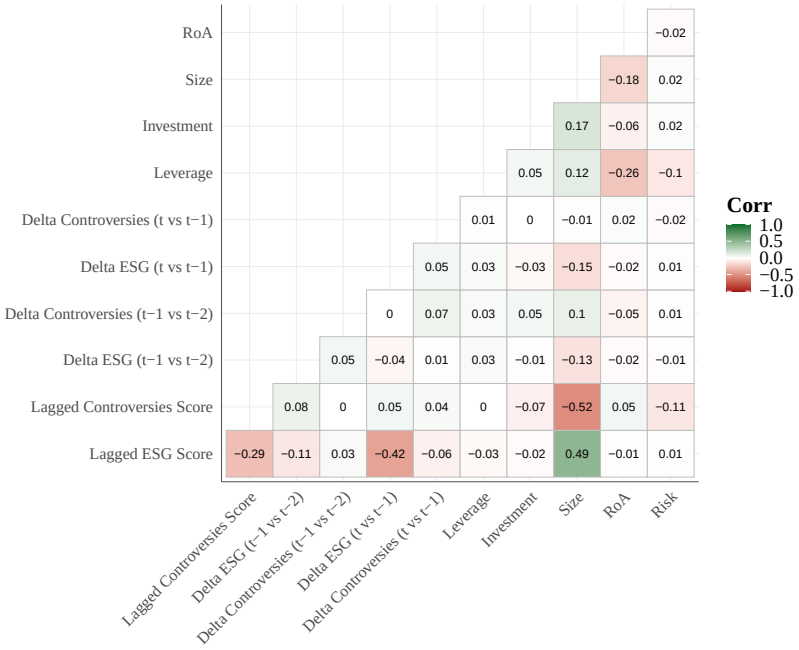


Figure 7: Correlation matrix for key variables. Source: self-elaboration

ship between firm-level misvaluation and ESG credibility.

The correlation matrix in Figure 7 provides a first overview of the associations among the explanatory variables. The strongest relationship is observed between firm Size and the lagged Controversies Score (–0.52), followed by Size and the lagged ESG Score (+0.49), and contemporaneous ESG change and the lagged ESG Score (–0.42). These values, while moderate, are consistent with theoretical expectations. Larger firms tend to disclose more extensively on sustainability issues and to receive higher ESG assessments, while at the same time being more frequently associated with severe controversies. The negative association between improvements in ESG ratings and their lagged levels suggests instead that rating upgrades are more likely for firms starting from weaker positions. Importantly, no correlation exceeds conventional thresholds that would raise concerns.

As shown in Table 4, the VIFs highlight the absence of multicollinearity, as their values remain close to 1 for all regressors.

Table 4: Variance Inflation Factor for Selected Variables

Variable	VIF
Predictors	
Lagged ESG	1.62
Lagged Controversies	1.40
Delta ESG (t-1 vs t-2)	1.03
Delta ESG (t vs t-1)	1.24
Controls	
Leverage	1.10
Investment	1.05
Size	1.82
RoA	1.11
Risk	1.03

Figure 8: Correlation between ESG Score x Controversies Score and Misvaluation. Source: self-elaboration

Moving beyond pairwise associations, Figure 8 plots firm-specific misvaluation against the interaction term between ESG and Controversies Scores. At the aggregate level, the relationship appears almost flat around zero, with only a mild downward slope, suggesting that misvaluation is not systematically driven by ESG Credibility when considered as a whole. However, a different picture emerges once the sample is split between overvalued and undervalued firms. In this case, separate trend lines reveal that both groups converge towards zero as the interaction term increases, suggesting that higher ESG credibility mitigates extreme devia-

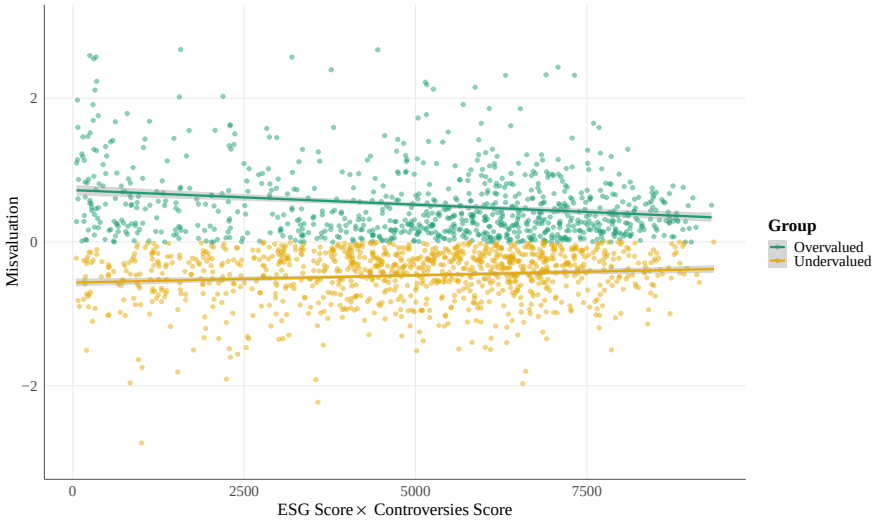


Figure 9: Correlation between ESG Score x Controversies Score and Misvaluation for Overvalued vs Undervalued firms. Source: self-elaboration

tions from fundamentals on both sides. This finding is reinforced when focusing on the two subgroups separately, as shown in Figure 9, where the attenuation of valuation errors becomes even more evident. Taken together, these preliminary insights are consistent with the theoretical framework outlined in Chapter 2, according to which credible ESG signals reduce information asymmetry and guide market prices closer to intrinsic values.

Overall, the correlation analysis provides useful preliminary insights into the relationships among the explanatory variables, while the VIFs confirm that the regression framework is not affected by multicollinearity. The scatterplots further suggest that ESG credibility may play a role in attenuating extreme valuation errors, although the aggregate relationship appears weak. Building on these initial observations, the next section turns to a multivariate setting, where the impact of ESG credibility on firm-level misvaluation is formally tested while controlling for additional firm characteristics.

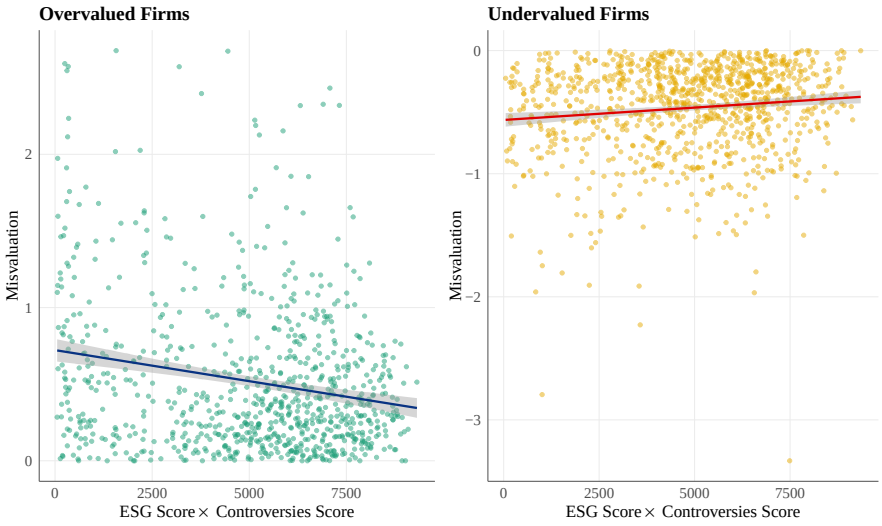


Figure 10: Detail of correlation between ESG Score x Controversies Score and Misvaluation for Overvalued vs Undervalued firms. Source: self-elaboration

4.3 Multivariate analysis

4.3.1 Preliminary evidence

Before proceeding with the main regression analysis, it is worth examining how the response variable evolves over time and across groups defined by the main predictors, as well as highlighting some preliminary multivariate patterns.

Figure 11 illustrates the evolution of the two key explanatory measures over the sample period: average ESG Scores remain relatively stable, displaying a modest upward trajectory until 2022, followed by a slight decline thereafter; in contrast, average Controversies Scores reveal a downward trend, suggesting an increasing frequency of ESG-related incidents affecting the firms included in the sample.

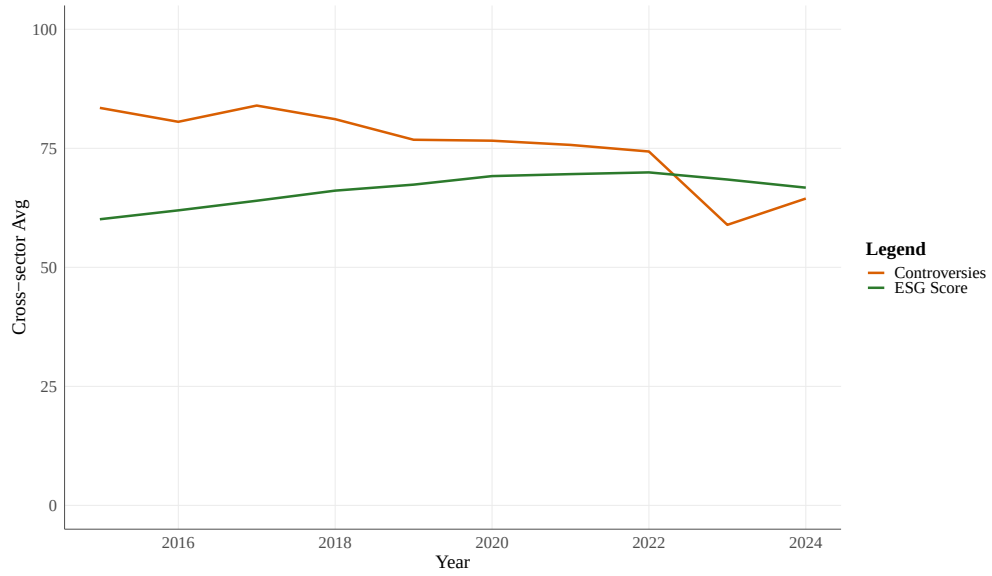


Figure 11: ESG Score vs Controversies Score. Source: self-elaboration

Moving on to the main variable of interest, Figures 12 and 13 illustrate the behavior of misvaluation across different groups of ESG and Controversies scores over time. On average, misvaluation remains close to zero, particularly from 2021 onwards, suggesting that prices have generally converged towards firms' fundamental values. Before this period, however, the prevailing tendency was toward undervaluation.

Figure 12 shows a clear and almost symmetrical pattern between the two ESG groups. Firms with an above-median ESG score tend to be consistently overvalued, whereas those with below-median ESG scores are generally undervalued. This distinction indicates that the market systematically rewards firms with stronger sustainability profiles, even when fundamentals may not fully justify the premium. An opposite picture emerges in Figure 13, which displays the relationship between misvaluation and controversies. Again, the behavior of the two groups appears nearly symmetrical. Interestingly, firms with higher Controversies Scores — meaning fewer or no scandals — tend to be undervalued, while those with lower Controversies Scores — indicating greater involvement in ESG-related incidents — are typically overvalued. One possible explanation lies in the attention-grabbing role of controversies, proposed in literature by Aouadi and Marsat (2016). As high-

lighted in Chapter 2, negative ESG events may attract disproportionate media coverage and investor scrutiny, thereby amplifying market reactions and allowing firms involved in incidents to retain or even increase their valuation premium. Conversely, firms with clean records and consistently high Controversies Scores may fail to capture equivalent levels of investor attention. In line with the notion that markets sometimes underreact to positive signals while overreacting to salient negative news (Krüger, 2015; Capelle-Blancard and Petit, 2019), these companies may remain relatively undervalued despite their stronger ESG conduct. This asymmetry suggests that reputational shocks act as external catalysts for price distortions, reinforcing the idea that ESG controversies function not only as risk factors but also as triggers of mispricing through their visibility in public discourse.

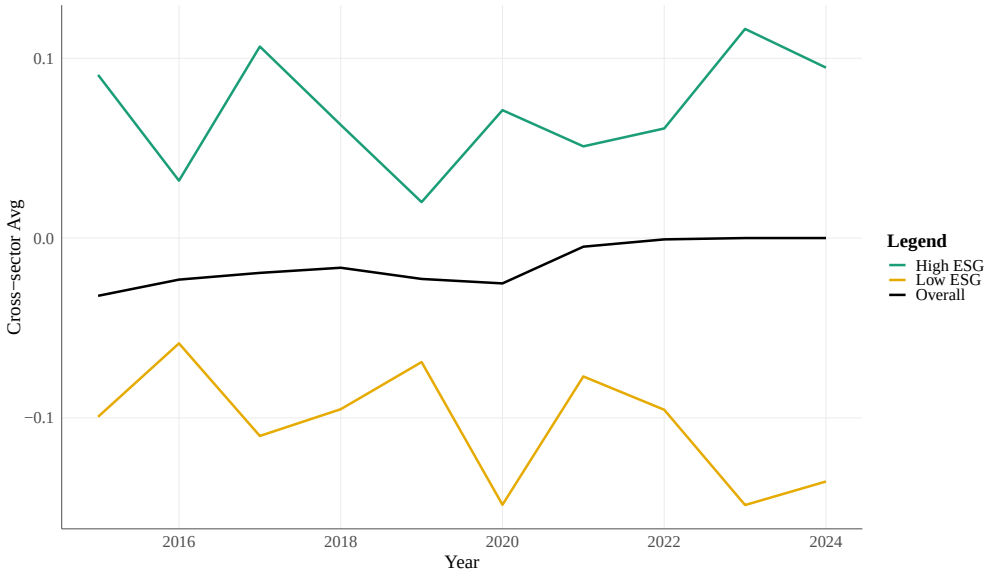


Figure 12: Average misvaluation by ESG Score. Source: self-elaboration

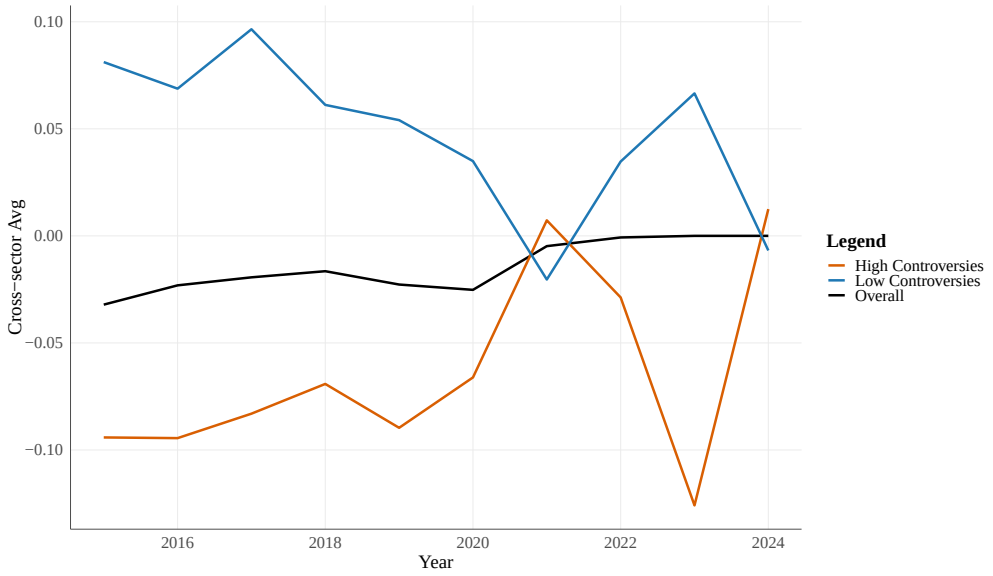


Figure 13: Average misvaluation by Controversies Score. Source: self-elaboration

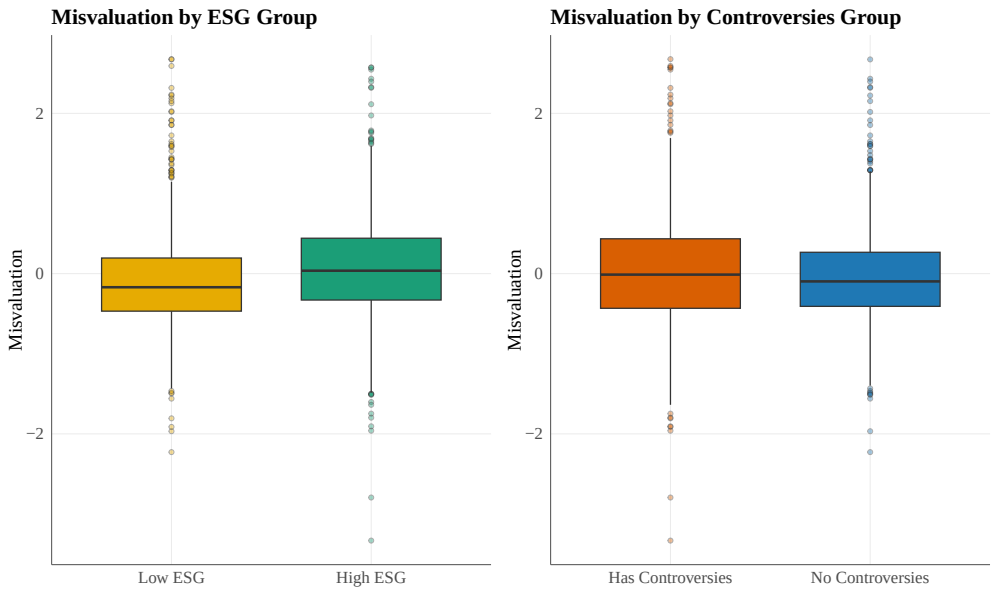


Figure 14: Boxplot of misvaluation across ESG groups and Controversies groups. Source: self-elaboration

The boxplots in Figure 14 visualize the distribution of firm-specific misvaluation across groups of ESG and Controversies Scores, providing indication of systematic differences. The left-hand side further highlights that firms with higher sustainability scores display a distribution shifted upward, with a higher median misvaluation compared to firms with lower scores. Similarly, the right-hand plot confirms

the pattern emerged in Figure 13: companies with no ESG-related incidents exhibit lower values of misvaluation relative to those with recurrent controversies, suggesting once again that reputational risks are not quite penalized by the market. Interestingly, the distribution of the "Has controversies" group is almost perfectly centered around zero and considerably more dispersed, which could indicate that investors react very differently to ESG-related incidents, with some events being largely disregarded while others trigger stronger valuation adjustments. These considerations are supported by the t-tests performed on the different groups. Indeed, the two-sample comparisons confirm the patterns highlighted by the boxplots.

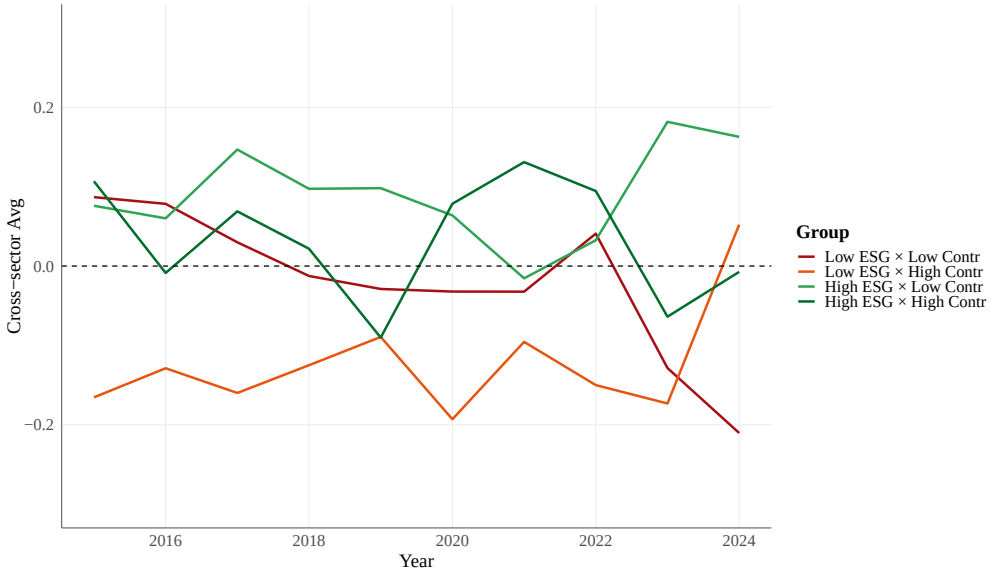


Figure 15: Average misvaluation by ESG Score x Controversies Score. Source: self-elaboration

Turning to the interaction between misvaluation and ESG Credibility (i.e., ESG Score × Controversies Score), Figure 15 highlights more complex dynamics. No strong overall trend emerges, but it is possible to discern certain patterns. For instance, firms in the high ESG × low controversies group tend to be overvalued, suggesting that the market places greater emphasis on formal ESG ratings than on firms' actual behavior. In addition, the low ESG × high controversies group is generally undervalued, implying that strong reputational performance alone is

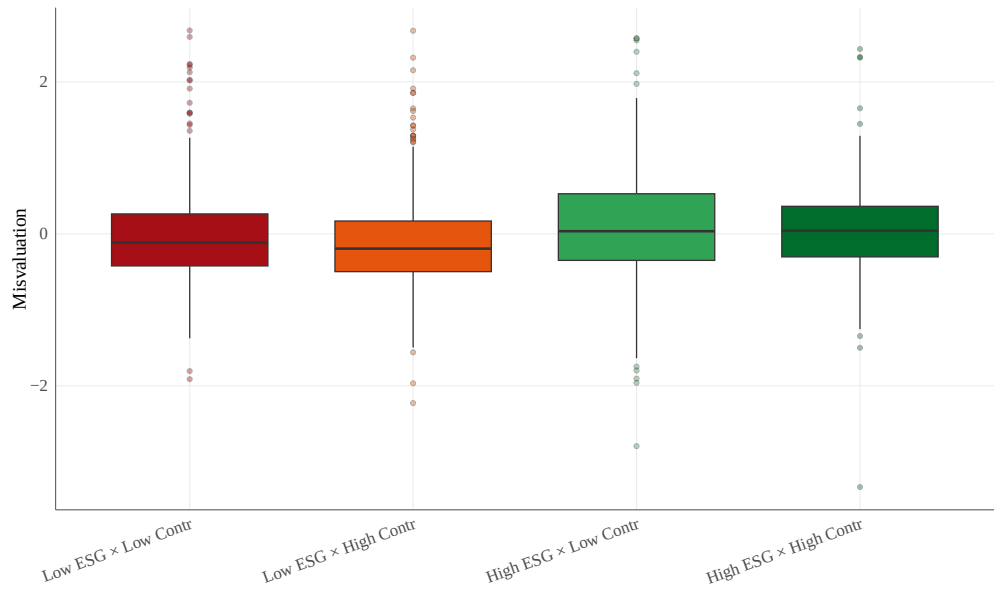


Figure 16: Boxplot of misvaluation across ESG x Controversies groups. Source: self-elaboration

insufficient to compensate for weak ESG ratings. Figure 16 provides a clearer picture of the combined dimensions. While most groups show overlapping distributions, the cluster of firms with both high ESG scores and high controversies clearly stands out, displaying markedly smaller misvaluation values. The ANOVA results confirm that the joint distribution of ESG and controversies significantly explains variation in misvaluation. Post-hoc tests[2] reveal that the group characterized by low ESG scores and high controversies systematically differs from all other clusters, underscoring that the combination of weak ESG performance and the absence of reported incidents does not enhance credibility but rather results in persistent undervaluation. The lack of controversies may reflect limited visibility rather than genuine sustainability quality, preventing firms from building reputational capital and leaving investors more inclined to discount their value. This credibility gap could perhaps explain why these firms are priced below fundamentals compared to all other groups.

Overall, these results reinforce the centrality of ESG credibility in shaping pricing efficiency: credible sustainability profiles appear less exposed to mispricing, as their distributions tend to be more clustered around zero, whereas discrepancies

[2]Bonferroni correction.

between reported ESG quality and adverse events amplify valuation distortions. These impressions are reinforced by the observed distances from zero across the four groups.

Table 5: Average distance from zero of misvaluation by ESG × Controversies groups

Group	Mean distance
High ESG × Low Controversies	0.085
High ESG × High Controversies	0.045
Low ESG × Low Controversies	-0.009
Low ESG × High Controversies	-0.141

Table 6: Average absolute distance from zero of misvaluation by ESG × Controversies groups

Group	Mean absolute distance
High ESG × Low Controversies	0.569
Low ESG × Low Controversies	0.494
Low ESG × High Controversies	0.465
High ESG × High Controversies	0.416

At a first glance, it is evident that a low ESG score is consistently associated with undervaluation, while firms with a high ESG rating are generally overvalued, regardless of their controversies score (see Table 5). This provides strong evidence of the strategic value of ESG ratings as a financial signal. Notably, the most overvalued firms are those with a high ESG score combined with low controversies, meaning that they are more frequently involved in scandals; this pattern suggests that the ESG rating may act as a sort of protective shield against reputational risks. In contrast, the lowest valuations are associated with firms characterized by both a low ESG score and a high controversies score, which is consistent with the rest of the analysis. Finally, it is worth noting that the groups high ESG × high controversies and low ESG × low controversies – the most coherent combinations – exhibit the smallest deviations from zero, indicating that on average these firms are priced closer to their fundamental value. When absolute deviations are considered,

the maximum distance from zero occurs for firms with a high ESG rating but a low controversies score, while the minimum deviation is found among firms with high ESG ratings and high controversies scores, indicating that the credibility of ESG practices may be an important determinant of alignment with fair value.

4.3.2 Regression analysis

The multivariate analysis proceeds by estimating regression models to investigate the link between firms' ESG profiles and firm-level misvaluation. While the descriptive statistics, correlations and trends provided preliminary insights into the patterns and associations among variables, regression techniques allow for the assessment of these relations in a multivariate setting, controlling for firm-specific and financial characteristics. The models are designed to test whether ESG performance and reputational controversies affect misvaluation both independently and interactively, thereby evaluating the credibility of sustainability claims. In this framework, pooled OLS, fixed-effects (FE), random-effects (RE), and clustered standard errors FE estimators are tested to account for potential biases related to unobserved heterogeneity and serial correlation.

Before presenting the main regression results, it is necessary to address a methodological adjustment concerning the measurement of reputational risk. As highlighted in Section 4.1, the distribution of the Controversies Score revealed a substantial imbalance, with the majority of firms recording the maximum value and only a minority reporting lower scores. This concentration risked distorting the estimation of coefficients and the interpretation of the interaction with ESG performance. To overcome this issue, the variable was transformed into a binary indicator, hereafter referred to as ControversyGroup. The dummy takes the value "Controversies" when a firm reported at least one controversy in year $t - 1$ (score < 100) and "NoControversies" when no controversies were recorded (score $= 100$). While the distribution remains slightly unbalanced, the binary coding reduces the distortions generated by the strong concentration of observations at the maximum score and facilitates the interpretation of regression results, particularly in

the interaction with ESG performance.

Table 7: Category distribution for the ControversyGroup variable

Category	**Count**	**Percentage**
Has Controversies	778	41.7%
No Controversies	1086	58.3%
Total	1864	100%

The regression models implemented are presented in the following tables, where the estimated coefficients are reported alongside their levels of statistical significance. Standard errors are displayed in parentheses below each coefficient to facilitate the interpretation of the results.

Table 8 reports the results of the incremental pooled OLS regressions. In the baseline specification, lagged ESG is positively and significantly associated with misvaluation, indicating that firms with higher sustainability performance in the previous year tend to be more frequently overvalued relative to fundamentals. This finding is consistent with prior evidence showing that ESG ratings affect valuation measures with some delay (Rahat and Nguyen, 2024). Moreover, improvements in ESG ratings (both contemporaneous and lagged) are also positively and significantly related to misvaluation, in line with the literature on ESG momentum, which suggests that markets respond more strongly to dynamic changes than to static levels (Sverner et al., 2023; Glavas, 2023). Together, these results imply that ESG-related signals can fuel investor optimism and push valuations above intrinsic values, thereby generating temporary overvaluation.

The introduction of financial controls in the second model does not alter these results: both lagged ESG and ESG improvements remain significant and positive. Among the controls, profitability (ROA) is positively associated with misvaluation, suggesting that higher profits are often accompanied by excess valuations. By contrast, investment intensity (INV) exhibits a negative coefficient, implying that firms with higher capital expenditures tend to be undervalued by the market. This outcome may reflect investors' skepticism towards investment-heavy strategies,

which are often perceived as risky or costly, thus leading to excessive discounting of firm value.

In the complete specification, the interaction between lagged ESG and the controversy dummy emerges as positive and significant for the group "NoControversies". This suggests that the tendency of ESG to generate overvaluation is amplified when no reputational incidents are present, highlighting the role of credibility in shaping market reactions. At the same time, the ControversyGroup itself is negatively associated with misvaluation, showing that firms which are not exposed to controversies are more likely to be undervalued once credibility is taken into account. Contrarily, the "Controversies" group – i.e., the cluster of firms involved in at least one incident – appears to be affected by the changes in ESG Scores only, possibly indicating that the market does not pay much attention to ESG-related incidents and credibility if there are improvements in the reported ESG profile. While these findings are consistent with the heterogeneous investor responses highlighted in the literature, they diverge from the strand of evidence documenting particularly strong market penalties in reaction to negative ESG events. Rather, the results suggest that firms involved in ESG-related incidents simply do not benefit from the positive effect of lagged ESG.

Although the estimates reveal statistically significant relationships, it is worth noting that their interpretation is not straightforward due to the dual nature of the misvaluation measure. Since the variable is centered around zero, positive and negative values respectively capture overvaluation and undervaluation. As a result, the same positive coefficient may be read in two different ways: for undervalued firms it could signal a movement towards fair value, whereas for overvalued firms it would instead imply a further departure from fundamentals. This ambiguity represents a limitation in the interpretation of the results and is further addressed in subsequent analysis. Finally, while the explanatory power of the models remains relatively limited, as shown by the small values of R^2 and adjusted R^2, the second indicator increases across the three specifications. This incremental pattern suggests that the complete model, although far from

exhaustive, provides the best fit and the highest ability to account for the variance in misvaluation so far.

Turning to more complex models commonly employed for panel data (Hsiao, 2022), the analysis now considers specifications that account for unobserved heterogeneity across firms and potential correlation structures in the error term. In particular, the fixed-effects estimator removes time-invariant firm characteristics by relying exclusively on within-firm variation, while the random-effects model assumes that unobserved heterogeneity is uncorrelated with the regressors. Finally, the fixed-effects specification with clustered standard errors corrects for autocorrelation and heteroskedasticity at the firm level. Table 9 reports the results of these alternative estimators alongside the pooled OLS baseline.

Relative to the pooled OLS, the fixed-effects specification substantially alters both the sign and significance of several coefficients. In particular, the ESG-related variables lose explanatory power, while the coefficients of profitability (ROA) and investment intensity (INV) change sign compared to previous models. This outcome reflects the limited within-firm variation in ESG scores and controversies over the sample period, highlighted in Section 4.1, which constrains the fixed-effects estimator's ability to capture systematic associations with misvaluation. The random-effects model partially mitigates this issue, as the signs of most coefficients revert to more plausible directions, but the overall explanatory power remains weak. Interestingly, the interaction term between lagged ESG and the controversy dummy displays marginal significance ($p < 0.1$), indicating weak but consistent support for the OLS model findings. However, the Hausman test consistently favors the fixed-effects model over random effects, indicating that the RE results should be interpreted with caution. The specification with firm-level clustered errors provides results that are largely consistent with the pooled OLS estimates, perhaps suggesting that the main findings are not driven by heteroskedasticity or serial correlation in the residuals. However, the interaction term capturing ESG credibility does not reach statistical significance in this specification, indicating that the baseline evidence on credibility is less robust once autocorrelation is explicitly

Table 8: Incremental pooled OLS estimates

	Baseline	Baseline + Controls	Complete
Dependent variable: Misvaluation			
Lagged ESG	0.006***	0.005***	0.002
	(0.001)	(0.001)	(0.002)
Δ ESG (t-1 vs t-2)	0.212+	0.228+	0.217+
	(0.125)	(0.124)	(0.124)
Δ ESG (t vs t-1)	0.435**	0.424**	0.418**
	(0.150)	(0.149)	(0.149)
Controversy Group (No	−0.038	−0.044	−0.385**
Controversies)	(0.032)	(0.035)	(0.135)
Lagged ESG ×			0.005**
Controversy Group (No Controversies)			(0.002)
LEV		0.152	0.144
		(0.120)	(0.120)
INV		−1.416**	−1.464***
		(0.436)	(0.435)
SIZE		0.016	0.020
		(0.017)	(0.017)
ROA		1.103***	1.077***
		(0.217)	(0.217)
RISK		−0.725+	−0.710+
		(0.424)	(0.423)
Intercept	−0.411***	−0.783*	−0.648+
	(0.081)	(0.391)	(0.393)
Num.Obs.	1864	1864	1864
R2	0.022	0.043	0.046
R2 Adj.	0.019	0.038	0.041
RMSE	0.65	0.64	0.64

+ p <0.1, * p <0.05, ** p <0.01, *** p <0.001

accounted for.

Taken together, these results indicate that pooled OLS offers the most stable and interpretable specification in this setting. The weaker performance of FE and RE estimators further underscores that the dynamics of ESG and controversies are primarily cross-sectional in nature, with limited variation within firms over time. Nevertheless, the implementation of alternative panel models partially reinforces the robustness of the OLS findings, as no conflicting evidence emerges from the comparison.

The regression results presented above do not fully support the central hypothesis that misvaluation is negatively associated with ESG credibility. However, these findings are attributable to the ambivalent role of the main predictor of interest: indeed, while ESG credibility appears to amplify overvaluation, it also seems to reduce undervaluation. This pattern indicates that markets may reward credible ESG signals with great optimism, thereby generating temporary deviations from – or realignments to – fundamentals. For this reason, the results should be interpreted with caution, as the aggregate effect of ESG credibility remains inconclusive. The dual influence of ESG complicates the overall assessment, making it difficult to draw broader implications and determine whether ESG credibility ultimately enhances pricing efficiency or contributes to valuation distortions. To address this ambiguity, the analysis proceeds with an additional investigation designed to clarify the role of ESG credibility in shaping misvaluation. Specifically, the dependent variable was redefined in absolute terms, capturing the magnitude of the deviation of market prices from intrinsic values regardless of its direction. This adjustment allows for the measurement of mispricing in terms of the overall distance from fundamentals, independently of whether the firm is overvalued or undervalued, thus avoiding the confusion in the interpretation of the results.

The empirical strategy follows the same pooled OLS specification adopted in the main regression, including both ESG-related predictors and the set of financial controls. By applying this framework to absolute misvaluation, the analysis isolates the effect of ESG credibility on the extent of market inefficiencies without

Table 9: Tested models comparison

	Pooled OLS	FE	RE	Clustered Err. FE
Dependent variable: Misvaluation				
Lagged ESG	0.002	0.001	0.001	0.002
	(0.002)	(0.002)	(0.002)	(0.004)
Δ ESG (t-1 vs t-2)	0.217+	−0.016	0.030	0.219
	(0.124)	(0.079)	(0.078)	(0.135)
Δ ESG (t-1 vs t-2)	0.418**	0.066	0.111	0.416**
	(0.149)	(0.096)	(0.095)	(0.140)
Controversy Group	−0.385**	−0.124	−0.163	−0.388+
(No Controversies)	(0.135)	(0.101)	(0.101)	(0.228)
Lagged ESG ×	0.005**	0.002	0.003+	0.005
Controversy Group	(0.002)	(0.001)	(0.001)	(0.003)
(No Controversies)				
LEV	0.144	0.703***	0.446**	0.154
	(0.120)	(0.164)	(0.147)	(0.289)
INV	−1.464***	1.423***	0.707+	−1.522+
	(0.435)	(0.420)	(0.403)	(0.822)
SIZE	0.020	0.129***	0.036	0.021
	(0.017)	(0.038)	(0.025)	(0.038)
ROA	1.077***	−2.173***	−1.748***	1.098*
	(0.217)	(0.184)	(0.178)	(0.538)
RISK	−0.710+	−0.650+	−0.537	−0.660
	(0.423)	(0.356)	(0.348)	(0.635)
Intercept	−0.648+		−0.973+	
	(0.393)		(0.568)	
Num.Obs.	1864	1864	1864	1864
R2	0.046	0.123	0.074	0.047
R2 Adj.	0.041	−0.002	0.069	0.037
R2 Within				0.047
R2 Within Adj.				0.042
RMSE	0.64	0.33	0.37	0.64
Std.Errors				by: RIC
FE: year		X		X
FE: industry		X		X

+ p <0.1, * p <0.05, ** p <0.01, *** p <0.001

conflating upward and downward deviations. As shown in Table 10, the results indicate that the interaction term between lagged ESG and the controversy group is negative and statistically significant. This evidence eventually confirms the central hypothesis of the study: firms with higher ESG credibility tend to experience lower absolute deviations from their fundamental values.

From a theoretical perspective, this outcome aligns with the expectation that credible ESG signals reduce informational asymmetries and enhance investor confidence, ultimately limiting the scope for persistent mispricing. Unlike the previous regressions, where interpretation was complicated by the dual nature of the response variable, this additional specification provides clearer support for the central hypothesis of the study. Overall, the findings reinforce the view that credible sustainability signals contribute to aligning market prices with firms' fair values, mitigating valuation errors.

Table 10: Pooled OLS estimates with misvaluation in absolute value

	Baseline	Baseline + Controls	Complete
Dependent variable: Abs(Misvaluation)			
Lagged ESG	0.000	−0.002+	0.000
	(0.001)	(0.001)	(0.001)
Δ ESG (t-1 vs t-2)	0.008	0.046	0.051
	(0.083)	(0.083)	(0.083)
Δ ESG (t vs t-1)	−0.103	−0.106	−0.103
	(0.100)	(0.099)	(0.099)
Controversy Group	−0.099***	−0.050*	0.116
(No Controversies)	(0.021)	(0.023)	(0.090)
Lagged ESG ×			−0.003+
(No Controversies)			(0.001)
LEV		−0.248**	−0.244**
		(0.080)	(0.080)
INV		0.373	0.397
		(0.289)	(0.289)
SIZE		0.042***	0.040***
		(0.011)	(0.011)
ROA		0.347*	0.360*
		(0.144)	(0.144)
RISK		1.281***	1.274***
		(0.281)	(0.281)
Intercept	0.575***	−0.397	−0.463+
	(0.054)	(0.259)	(0.261)
Num.Obs.	1864	1864	1864
R2	0.013	0.041	0.042
R2 Adj.	0.011	0.036	0.037
RMSE	0.43	0.42	0.42

+ p <0.1, * p <0.05, ** p <0.01, *** p <0.001

4.4 Robustness checks

To ensure that the main results are not driven by specific modelling choices or sample composition, robustness checks were carried out. In particular, three complementary tests were implemented: (i) the use of analyst-based misvaluation, (ii) the restriction of the analysis to the U.S. subsample, and (iii) the replication of the model on the European subsample. All tests adopt as dependent variable the absolute value of misvaluation, so as to capture the magnitude of deviations from fundamentals independently of their direction.

As anticipated, in the first step misvaluation was recalculated using analysts' target prices provided by the LSEG Workspace as a proxy for intrinsic value. In this setting, misvaluation is defined as the difference between market price (MP) and target price (TP), where the TP corresponds to "the statistical average of all broker estimates determined to be on the majority accounting basis"[3]. The raw difference was then expressed in percentage terms, in order to account for different scales across firms, and finally transformed into absolute values to simplify interpretation. The results, shown in Table 11, confirm the baseline evidence: while higher ESG scores in isolation are associated with greater valuation errors, the interaction between ESG and the absence of controversies displays a negative and significant coefficient. This implies that credible ESG profiles are linked to lower deviations from intrinsic value, thereby supporting the hypothesis that ESG credibility mitigates misvaluation.

The second and third robustness tests replicate the baseline specification on geographical subsamples, using the RRV-based measure of misvaluation in absolute value (see Table 12). For the U.S. firms (on the left), the interaction term between lagged ESG and the absence of controversies remains negative, although it does not reach statistical significance. This outcome could be somewhat expected, given the largely voluntary nature of ESG disclosure in the United States context and the absence of a harmonized regulatory framework. The heterogeneity of reporting practices tends to introduce noise into ESG ratings, thereby weaken-

[3]Source: https://workspace.refinitiv.com/web

ing the role of credibility. Moreover, the relative maturity of U.S. capital markets and the high level of analyst coverage may imply that ESG-related signals are more rapidly incorporated into prices, leaving less variability for the interaction to explain. In contrast, for the European subsample (on the right), the interaction term is negative and statistically significant, confirming that credible ESG profiles mitigate valuation errors in a context characterized by mandatory sustainability disclosure. Taken together, these results indicate that the effect of ESG credibility is directionally consistent across regions, but more pronounced and robust in Europe.

Such robustness exercises strengthen the main conclusions. Regardless of the misvaluation proxy adopted or the geographical scope of the analysis, the interaction between ESG performance and controversies consistently points to a reduction in valuation errors. This provides additional evidence in support of the central hypothesis: credible ESG signals, rather than ESG scores in isolation, are associated with more efficient pricing.

Table 11: Robustness check: pooled OLS estimates with misvaluation based on analysts' target price

	Pooled OLS
Dependent variable: Abs(Misvaluation) – Method: MP - TP (%)	
Lagged ESG	0.404***
	(0.053)
Δ ESG (t-1 vs t-2)	−6.356
	(3.867)
Δ ESG (t vs t-1)	5.537
	(4.639)
Controversy Group	12.342**
(No Controversies)	(4.197)
Lagged ESG ×	−0.189**
Controversy Group (No Controversies)	(0.061)
LEV	13.280***
	(3.727)
INV	−14.329
	(13.564)
SIZE	−1.424**
	(0.527)
ROA	−9.015
	(6.755)
RISK	−3.853
	(13.182)
Intercept	9.439
	(12.255)
Num.Obs.	1864
R2	0.051
R2 Adj.	0.046
RMSE	19.85

+ p <0.1, * p <0.05, ** p <0.01, *** p <0.001

Table 12: Robustness check: pooled OLS estimates on geographical subsets

	Pooled OLS – US	Pooled OLS – EU
Dependent variable: Abs(Misvaluation) – Method: RRV		
Lagged ESG	−0.002+	0.010**
	(0.001)	(0.003)
Δ ESG (t-1 vs t-2)	0.120	−0.306
	(0.101)	(0.311)
Δ ESG (t vs t-1)	−0.045	−0.001
	(0.122)	(0.338)
Controversy Group	−0.014	0.393
(No Controversies)	(0.113)	(0.291)
Lagged ESG ×	−0.001	−0.006+
Controversy Group (No Controversies)	(0.002)	(0.004)
LEV	−0.226*	0.188
	(0.103)	(0.233)
INV	0.181	2.210*
	(0.364)	(1.012)
SIZE	0.045**	0.006
	(0.015)	(0.034)
ROA	0.525**	1.239**
	(0.180)	(0.434)
RISK	1.334***	0.764
	(0.374)	(0.865)
Intercept	−0.432	−0.549
	(0.346)	(0.798)
Num.Obs.	1141	318
R2	0.050	0.115
R2 Adj.	0.041	0.086
RMSE	0.42	0.44

+ p <0.1, * p <0.05, ** p <0.01, *** p <0.001

Chapter 5

Conclusion

This final chapter brings together the main findings of the analysis and places them within the broader field of sustainable finance. The discussion first reflects on how the study contributes to the understanding of the relationship between firm-level misvaluation and ESG credibility, then addresses the limitations of the research, clarifying the boundaries within which the results should be interpreted. Finally, it provides some concluding remarks, emphasizing the exploratory nature of the work and pointing to avenues for future research that may further advance the comprehension of how sustainability-related information interacts with valuation dynamics.

5.1 Discussion and limitations

The empirical results of this study provide a nuanced perspective on the relationship between ESG credibility — defined as the consistency between reported sustainability and the absence of negative ESG-related events — and firm-level misvaluation. Two main categories of findings can be identified. On the one hand, the evidence emerged supports the central hypothesis that ESG credibility contributes to reducing misvaluation, fostering a realignment of prices with their intrinsic value. On the other, the individual roles of ESG and Controversies Scores reveal distinct but synergetic mechanisms: while ESG ratings operate as a finan-

cial signal and protective shield that can inflate valuations, controversies emerge as potential attention-grabbing events.

Starting with the individual effects, the time-series plots and boxplots illustrate the contrasting impacts of ESG Scores and Controversies Scores on misvaluation. Firms with higher ESG ratings systematically display higher misvaluation values, typically skewed toward overvaluation, whereas those with weaker ESG profiles are persistently undervalued. This pattern highlights the role of ESG ratings as a financial instrument: they appear to act as a form of intangible capital rewarded by investors with a valuation premium, even when fundamentals do not fully justify such optimism. This interpretation is reinforced when considering deviations from zero across groups with different credibility levels. High-ESG firms consistently exhibit overpricing, regardless of their controversies record, suggesting that sustainability scores not only serve as a reputational shield but also function as valuation inflators, amplifying investor optimism.

By contrast, the analysis of controversies reveals an almost opposite dynamic. Firms involved in frequent ESG-related incidents tend to be overvalued, while those with no controversies are often undervalued. This asymmetry can be interpreted through the attention-grabbing hypothesis (Aouadi and Marsat, 2016). Negative ESG events, especially when widely covered by the media, attract disproportionate attention, enhancing visibility and in some cases sustaining valuations despite reputational damage. This interpretation is particularly relevant in the context of the present study, as the sample predominantly consists of large, international firms that naturally receive substantial investor scrutiny. For such firms, controversies do not necessarily result in persistent penalties; rather, they may operate as visibility catalysts, reinforcing the notion that reputational shocks can distort valuations in both directions.

The interaction analysis between ESG and controversies further clarifies these dynamics. The scatterplots reveal that both undervalued and overvalued firms converge toward zero misvaluation as ESG credibility increases, underscoring its role as a corrective factor that realigns prices with fundamentals. Similarly, the

distribution of misvaluation across the four ESG × Controversies groups indicates that the most credible firms — those combining high ESG ratings with clean reputational records — are the only group consistently centered around zero. This finding highlights the stabilizing function of credibility. The analysis of average absolute distances from zero corroborates this interpretation: the high-ESG × high-controversies group is priced closest to fundamentals, whereas firms with high ESG ratings but recurrent controversies exhibit the largest deviations. When considering directional effects, ESG scores appear to offset adverse signals stemming from controversies, allowing firms to capture attention and sustain persistent overvaluation. This evidence reinforces the idea that ESG ratings serve not only as informational tools but also as symbolic assets capable of shielding firms from reputational costs.

The regression analysis provides another layer of interpretation. Pooled OLS estimations reveal positive and significant associations between ESG performance and misvaluation, in line with prior evidence (Barka et al., 2023). This finding is particularly true when ESG interacts with the absence of controversies, indicating that credible ESG signals tend to amplify overvaluation, while simultaneously reducing undervaluation. In other words, markets reward firms with credible sustainability profiles with optimism, but this optimism may temporarily detach valuations from fundamentals. At the same time, the controversy group is negatively associated with misvaluation, suggesting that in the absence of incidents market reactions tend to be more cautious and may even result in undervaluation. These findings suggest that ESG credibility shapes deviations from fair value but does not unambiguously mitigate them.

An important clarification emerges from the additional specification in which misvaluation was expressed in absolute terms. By focusing on the magnitude of deviations from intrinsic value, independently of their direction, this analysis overcomes the interpretative ambiguity of the main regressions. The results reveal that ESG credibility exerts a negative and significant effect on absolute mispricing, thereby supporting the interpretation of a stabilizing function. In other words,

credible ESG signals appear to reduce the extent of valuation errors and to foster a closer alignment between market prices and firms' fundamentals. This evidence – further confirmed by the robustness analyses – provides stronger support to the central hypothesis, as it isolates the role of credibility from the asymmetric dynamics of overvaluation and undervaluation that emerged in the other models proposed.

The explanatory power of the models, as reflected by the low R^2 values, remains limited. However, this outcome should not be interpreted as a weakness of the econometric framework alone but rather as a reflection of the multifaceted and context-dependent nature of misvaluation. Financial markets are influenced by a broad spectrum of factors — macroeconomic shocks, investor sentiment, sectoral dynamics — that cannot be fully captured by a linear specification of ESG indicators and a restricted set of controls. For this reason, low R^2 values could be somehow expected as they are relatively common in asset pricing studies. Moreover, despite the limited variance explained, the chosen predictors – and particularly ESG credibility – exhibit statistically and economically meaningful relationships with valuation outcomes, thereby demonstrating an observable contribution to market dynamics. From this perspective, the models should be regarded as exploratory, providing preliminary but valuable evidence on the phenomenon. Rather than representing a definitive conclusion, the analysis constitutes a starting point for further research. Building on the concepts developed in this study, future work could broaden the scope of investigation and contribute to a deeper understanding of the mechanisms linking ESG credibility to valuation dynamics.

Despite the novel insights offered, several limitations must be acknowledged. First, the sectoral distribution of the sample, derived from the MSCI World Index, is skewed towards the durable goods industry, reflecting the structure of the index but limiting the breadth of sectoral representation. This concentration may bias results if the role of ESG credibility differs systematically across sectors. Second, the panel dataset exhibits limited within-firm variation over time in ESG scores and controversies, which constrains the performance of fixed-effects estimators and

reduces the ability to capture dynamic adjustments in misvaluation. The main findings are therefore more reflective of cross-sectional differences among firms than of temporal changes within firms. Third, the ESG and Controversies Scores employed in this study are provided by a single source, the LSEG Workspace. The literature has repeatedly shown that ESG ratings differ significantly across providers, often due to methodological divergence and inconsistent weighting of indicators (Gibson Brandon et al., 2021; Christensen et al., 2022; Kimbrough et al., 2024). Relying on a single provider may introduce bias and limit the external validity of the results.

Taken together, these considerations suggest that the empirical results should be interpreted with caution, particularly in light of the limitations discussed above. Nonetheless, the analysis provides promising evidence that ESG credibility interacts with valuation outcomes in meaningful and non-trivial ways. While the study does not allow for definitive conclusions about its efficiency-enhancing role, the findings highlight patterns that are worthy of attention and indicate that ESG credibility represents an important factor in understanding equity misvaluation.

5.2 Final remarks

This work aimed at investigating the relationship between firm-level misvaluation and ESG credibility, defined as the consistency between sustainability disclosure (ESG Scores) and behavior as reported by the news (Controversies Scores). The analysis has shown that the interaction between ESG performance and reputational dynamics is far from straightforward, revealing patterns that both align with and diverge from conventional expectations. In particular, the findings highlight how ESG scores may operate simultaneously as financial signals and reputational shields, while controversies can act as attention-grabbing mechanisms, especially for large firms that naturally attract higher levels of scrutiny.

The results underscore the complexity of the phenomenon: ESG credibility appears to reduce undervaluation while amplifying overvaluation, suggesting that credible sustainability profiles are rewarded by markets but may also drive valu-

ations away from fundamentals. This duality reflects the ambiguous role of ESG in asset pricing and calls for further investigation into the mechanisms through which sustainability-related information shapes market efficiency. The additional analysis clarifies this ambiguity, highlighting how ESG credibility is ultimately associated with lower overall mispricing. This final evidence reinforces the idea that ESG credibility may function as a potential stabilizing factor in financial markets.

Overall, the empirical findings of this study have relevant implications for different stakeholders. For investors, these results suggest that credible ESG signals may serve as useful indicators for identifying firms whose market valuations are more closely aligned with fundamentals, thereby reducing the risk of large deviations. For regulators, the evidence points to the importance of improving the transparency and comparability of ESG metrics, as the stabilizing role of credibility emerges only when disclosure quality is matched by the absence of controversies. For corporate managers, the results indicate that building and maintaining credibility in sustainability practices can limit valuation distortions, fostering more reliable access to capital and long-term investor trust.

From an academic perspective, this work also contributes to addressing the gap identified in Chapter 2. In particular, it integrates controversies into the study of misvaluation, thus capturing the reputational dimension often overlooked in prior research. Moreover, by conceptualizing ESG credibility as the interaction between disclosure-based scores and controversy signals, the study combines endogenous and exogenous ESG channels into a single framework. The additional analysis further clarifies the efficiency-enhancing potential of credibility, demonstrating that, when assessed independently of valuation direction, it is associated with smaller deviations from intrinsic value. This approach advances the literature by offering a more profound understanding of how sustainability-related information interacts with market pricing. Nonetheless, it is worth noting that rather than providing a conclusive answer, the present research should be understood as an exploratory step that contributes to the broader debate on the financial implications of ESG. Despite the limitations discussed, the study offers promising evidence and points

to meaningful patterns that deserve further examination. Future research could expand the scope by incorporating multiple rating providers, extending the sample to emerging markets, or adopting alternative econometric approaches. Such extensions would help enhance the comprehension of the dynamics between ESG credibility and misvaluation, ultimately clarifying the role of sustainability in asset pricing.

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Appendices

Appendix 1 –

Fama-French 12 Industry Classification

1. Consumer Nondurables – Food, Tobacco, Textiles, Apparel, Leather, Toys

   0100-0999

   2000-2399

   2700-2749

   2770-2799

   3100-3199

   3940-3989

2. Consumer Durables – Cars, TVs, Furniture, Household Appliances

   2500-2519

   2590-2599

   3630-3659

   3710-3711

   3714-3714

   3716-3716

   3750-3751

   3792-3792

   3900-3939

   3990-3999

3. Manufacturing – Machinery, Trucks, Planes, Off Furn, Paper, Com Printing

2520-2589

2600-2699

2750-2769

3000-3099

3200-3569

3580-3629

3700-3709

3712-3713

3715-3715

3717-3749

3752-3791

3793-3799

3830-3839

3860-3899

4. Energy – Oil, Gas, and Coal Extraction and Products

   1200-1399

   2900-2999

5. Chemicals and Allied Products

   2800-2829

   2840-2899

6. Business Equipment – Computers, Software, and Electronic Equipment

   3570-3579

   3660-3692

   3694-3699

   3810-3829

   7370-7379

7. Telco – Telephone and Television Transmission

   4800-4899

8. Utilities

   4900-4949

9. Shops – Wholesale, Retail, and Some Services (Laundries, Repair Shops)

   5000-5999

   7200-7299

   7600-7699

10. Healthcare, Medical Equipment, and Drugs

    2830-2839

    3693-3693

    3840-3859

    8000-8099

11. Money Finance

    6000-6999

12. Other – Mines, Construction, BldMt, Transports, Hotels, Business Services, Entertainment

Source: Fama and French (1997)