Incredulous creditors: ESG momentum, credibility barriers, and state-contingent pricing in corporate bonds

Karim Henide[†]

Northumbria University

Abstract

This paper investigates the pricing of ESG momentum in corporate bond markets, uncovering a credibility barrier that conditions whether sustainability improvements are rewarded by investors. Analysing a decade-long panel of 3,380 unique EUR-denominated bonds, we document that ESG momentum exhibits state-contingent effects across the return distribution. ESG momentum provides downside protection in the left tail of returns, particularly for subordinated debt where junior creditors lack covenant protection and face asymmetric exposure to tail risks. However, ESG improvements are penalised in high-return scenarios, especially among BBB-rated and subordinated bonds, unless the issuer demonstrates credibility through low ESG controversy and minimal institutional investor exclusions. Among high-risk subordinated bonds with established credibility, ESG momentum earns up to 47 basis points monthly, revealing that markets reward genuine operational improvements while dismissing opportunistic signalling. Critically, neither green bond labels nor third-party verifications substitute for this credibility channel. However, exploiting the EU's Sustainable Finance Disclosure Regulation as a natural experiment, we show that regulatory intervention can fundamentally alter pricing dynamics; green-labelled bonds earned a significant premium post-SFDR (1.99 basis points per month, $p<0.01$), reversing prior underperformance, while ESG momentum's pricing relevance simultaneously decayed. This regulatory displacement effect suggests that compliance incentives dominated fundamental signal extraction, elevating label value over investor-based credibility assessments.

Keywords: ESG momentum, corporate bonds, SFDR, asset pricing, sustainable finance
JEL Classification: G12, G14, G18, G32, Q56

[†]Northumbria University, karim.henide@northumbria.ac.uk, City Campus East, NE1 8ST

INTRODUCTION

The increasing integration of Environmental, Social, and Governance (ESG) considerations in investment decision-making has prompted attention from practitioners, policymakers and academics, given the ambiguity surrounding how this information manifests in asset pricing, and the broader implications for economic outcomes. One area of particular research interest has been the internalisation of ESG delta, or "ESG momentum" in asset pricing over time, although the internalisation of ESG momentum information remains underexplored in fixed income markets in the literature, and otherwise contested in equity markets.

This study investigates the pricing of ESG momentum in corporate bond markets, with a particular focus on its state-contingent effects across the return distribution and its interaction with bond characteristics (such as subordination, credit rating) and the critical role of issuer credibility. Extending the work of Polbennikov et al. (2016) and Oikonomou et al. (2014), we seek to offer a greater degree of nuance around the pricing of ESG momentum information and novel insights around mediation channels, particularly with respect to the influence of regulation. Studying a comprehensive decade-long data panel containing 3,380 unique EUR-denominated corporate bonds and exploiting Sustainable Finance Disclosure Regulation (SFDR) by the European Union coming into effect in March 2021 as a natural experiment, we aim to causally identify the impact of regulatory impetus on issuer-level ESG momentum pricing, and in particular the role of green bond-labelling in driving market responses. Our research addresses a gap in the literature by examining not only the average pricing effects of ESG factors but also their non-linear and asymmetric impacts, as well as the credibility barrier that conditions their market-acceptance. Unlike equity investors who benefit from upside participation, bondholders face asymmetric payoffs with capped returns but full downside exposure, making the credibility of risk-mitigation signals particularly salient.

To achieve these objectives, we employ a comprehensive and methodologically rigorous econometric framework, combining quantile regression, difference-in-differences (DiD), triple difference (DDD), and inverse propensity weighted (IPW) DiD approaches. Quantile regression allows us to capture the heterogeneous effects of ESG momentum across the return distribution, revealing whether ESG factors provide downside protection or impose upside penalties. The DiD and DDD methodologies exploit the SFDR's implementation in March 2021 to estimate causal effects, isolating the role of regulatory labels versus underlying ESG performance. The IPW approach further ensures robustness by addressing compositional differences across bond types. Incorporating bond-specific factors such as duration, subordination, credit rating and

green bond-labelling, as well as issuer-level credibility proxied by ESG controversy levels and institutional investor exclusion indicators, we uncover the conditions under which ESG momentum is priced and the mechanisms, such as credibility and regulatory salience, that drive these effects. Fama-MacBeth regressions and regime-specific analyses provide additional robustness, accounting for time-varying market conditions and sentiment-driven heterogeneity.

This study's contributions to the literature are multi-pronged, providing a nuanced understanding of sustainability pricing dynamics in the rich fixed income ecosystem, and offering a foundation for further research. First, we introduce a credibility barrier model, demonstrating that perceived issuer trustworthiness, rather than signals such as green bond self-labelling and associated external verification, is a primary determinant of ESG pricing in subordinated debt. Second, we highlight the state-contingent nature of ESG effects, with significant downside protection for high-grade bonds but penalties in high-return scenarios, particularly for riskier bonds. Third, we establish the dominance of regulatory labels post-SFDR, showing that green bond designations substitute for fundamental ESG signals, although fail to supplement a credibility deficit. These findings have meaningful implications for sustainability signalling, asset pricing, portfolio management, regulatory design, and the ongoing debate over the financial materiality of sustainability factors in fixed income markets.

LITERATURE REVIEW

The integration of ESG information in the investment process poses questions around the implications for asset pricing of augmenting the natural flow of capital to internalise financially material sustainability risks. Given the ambiguity surrounding how this information manifests in asset pricing, and the broader implications for economic incentives and outcomes, the progressive popularisation of sustainable investing and the integration of ESG data into the investment process has prompted much attention from practitioners, policymakers and academics. One area of particular research interest has been the internalisation of ESG delta, or "ESG momentum" in asset pricing over time, although the internalisation of ESG momentum information remains relatively underexplored in the fixed income literature, and otherwise contested in literature concerning equity markets.

Within this context, ESG momentum, the trajectory of a firm's ESG performance over time, has emerged as a potential forward-looking signal of issuer-level capacity-building, operational sustainability improvement and sustainability-related risk mitigation (inter alia, Gregory et al., 2014). Unlike static ESG scores or green labels, momentum may capture dynamic change and

internal improvement, providing incremental information beyond headline ESG ratings. Indeed, as Giese et al. (2019) recognise, the relevance of the transmission of a "change in a company's ESG profile to a change in financial indicators such as valuation or profitability is not only important for testing causality: it is also important because the change in financial variables such as valuation can be a source of alpha". However, the internalisation of ESG momentum information remains underexplored in fixed income markets, and contested in equity markets.

Conceptually, Khan et al. (2015) find that variability in the materiality of sustainability issues, per SASB guidance, is price-relevant and that "firms with strong ratings on material issues and concurrently poor ratings on immaterial issues have the best future performance". With respect to changes specifically computed from ESG data, some studies suggest that integrating ESG momentum can be predictive of improved performance or reduced risk. Nagy et al. (2015) find that ESG momentum strategies can outperform in global equity portfolios in risk-adjusted terms "while also improving the ESG profile of the portfolios". Giese et al. (2019) offer support for ESG momentum as a transmission channel across the MSCI World Index universe, and argue that the ESG momentum factor can be used in addition to the ESG factor, and neutralised by common factors, in portfolio construction. Giese et at. (2019) find that the ESG momentum factor has an incrementally higher information ratio to the ESG factor albeit suffers from a meaningful deficit in factor stability, albeit ESG momentum demonstrates a greater degree of factor stability (though a meaningfully lower information ratio) versus conventional momentum. Sverner et al. (2023), confirming a similar inquiry by Shanaev and Ghimire (2022), also demonstrate, specifically in US equities, that an ESG momentum factor two-stage cross-regressed on the Fama and French 5-factor model (1993) delivers a meaningful excess return of between 0.23-0.35%, with a skew towards the magnitude of positive returns from ESG upgrades rather than the magnitude of negative returns from ESG downgrades, although further robustness testing exposes a loss of significance. Whelan et al. (2021) also survey empirical results from multiple meta-studies that supports the value of "ESG improvers", notwithstanding the inherent ambiguities and failure in consistent strategy demarcation among the underlying studies. The evidence for the existence of a price-relevant ESG momentum factor are supported by the study of Chen and Yang (2020), which identify a pattern of investor exaggeration of corporate ESG information (with an overreaction emphasis of environmental factors). However, contrary to the earlier findings, Cauthorn et al. (2023) dispute and offer an alternative approach to Shanaev and Ghimire (2022) and conclude that "stocks do not seem to significantly outperform or underperform in the month following an ESG rating change". Additionally, Cauthorn et al. (2023) note the importance of robustness across ESG data providers, consistent with the insights

of Berg et al. (2022), whose inquiry exposes material divergence in sustainability evaluations across data providers, which inherently undermines signal discovery and integrity.

While relatively underexplored, and while inconsistent in the findings, there is meaningful literature on the relevance of issuer-level sustainability profile to the pricing of their bond issuances. The early study of Menz (2010) sought to explore the impact of corporate social responsibility (CSR) on bond pricing, and found, marginally, that the bonds of socially responsible firms were priced wider relative to the bonds of non-socially responsible firms, ceteris paribus. This is not to conclude that, counter-intuitively, investors in the bonds of socially-responsible issuers demand some additional risk compensation, but rather that there was no evidence over the study's 38-month window that CSR information was internalised by (non-financial) investment grade European Monetary Union (EMU) corporate bonds of $\geq$EUR 250 million nominal value. Contrary to this, the later study of Stellner et al. (2015) also in (non-financial) corporate EMU bonds (though covering bonds rated AAA-CCC) found, albeit supported by weak evidence, that issuer corporate social performance (CSP) reduces credit risk, and that country-level ESG performance serves to moderate the CSP-credit risk relationship; Stellner et al. (2015) find that corporate bonds realise a benefit of 9.64 basis point containment in z-spreads where the corporate issuer's benign CSP profile mirrors the ESG performance of the country where the issuer is located.

Subsequent studies have reinforced and nuanced this relationship. Oikonomou et al. (2014) show that firms with superior ESG performance enjoy lower credit spreads, attributing this to reduced firm-specific risk and default probability, particularly for firms in less transparent markets. Their findings suggest ESG factors function as a form of informational arbitrage for bondholders, mitigating adverse selection and pricing opacity. Goss and Roberts (2011) focus on bank loans, studying 3,996 loans in the US to firms, to find that socially irresponsible firms incur a spread premium of 7 to 18 basis points, consistent with sustainability being interpreted as a proxy for non-financial risk. The later study in the US corporate bond primary market of Ge and Liu (2015) investigate the impact of CSR disclosure on the new issue spread, and document that firms reporting favourable CSR can issue new bonds at a lower spread to those that have lower CSR scores, albeit that some of the effect is absorbed by credit ratings. Contextually, this result is particularly relevant to validating the real economic impact of sustainability internalisation in firm value as it pertains directly to the determination of firm cost of capital, the predominant discount factor in deriving firm valuation. While secondary market studies are of great importance and inform primary pricing, a funding arbitrage can only be realised

by an issuer in the primary market. Even after controlling for firm-level credit fundamentals, Bauer and Hann (2010) that environmental violations, are associated with significantly higher credit spreads and credit default swap (CDS) premiums from a structural credit risk modelling perspective. This speaks to a more general body of work, too, on the correlation between issuer-level sustainability and credit risk (inter alia, Attig et al., 2013).

Specifically, Polbennikov et al. (2016) demonstrate that ESG momentum effects, reminiscent of Giese et al. (2019), are independently informative to ESG level effects, and that corporate bonds incorporate positive and negative ESG score delta relatively symmetrically, with social and governance momentum proving to be statistically and economically significant. Interpreting their results from a study window between January 2008 and September 2015, inclusive, an issuer whose social or governance score increases over 12 months tended to outperform peers by 3.6 and 2.2 basis points per month, respectively, per one standard deviation change in ESG score after controlling for sector, spread, duration and credit risk. On the contrary, negative momentum across social or governance scores tended to predict underperformance of magnitude -2.8 to -2.7 basis points per month, respectively, per one standard deviation change in ESG score. The environmental score was notably less pronounced in magnitude, directionally contradictive of the findings among social and governance scores, and statistically insignificant. The existing literature largely abstracts from the conditional and state-contingent nature of ESG momentum's effects, often treating it as a uniform signal across credit structures, market regimes, and issuer profiles. This paper addresses that critical gap by demonstrating that ESG momentum pricing is both nonlinear and credibility-sensitive in fixed income markets. Through a comprehensive decade-long panel of EUR-denominated bonds and methodical econometric inquiry, this study reveals a nuanced credibility barrier model: ESG momentum is only rewarded when accompanied by low issuer-level controversy and low incidence of institutional investor exclusions, particularly in high-risk, subordinated bonds, and that this credibility cannot be laundered by green-labelling bonds. Moreover, exploiting a natural experiment, the study identifies a sharp post-SFDR shift in pricing dynamics, where green labels, rather than ESG momentum, become the dominant priced signal. These findings contribute novel insights to the asset pricing literature by illuminating how regulatory impetus and issuer credibility condition the internalisation of sustainability information in bond markets, offering a richer understanding of the sustainability and asset pricing nexus than previously established.

THEORETICAL FRAMEWORK

The pricing of ESG momentum in corporate bond markets is complicated by a fundamental information problem. Investors cannot easily distinguish whether ESG score improvements reflect genuine operational changes that reduce tail risk, or merely strategic disclosure management that carries no risk mitigation value, perhaps even of a rent-seeking nature. We propose that issuer credibility functions as a filtering mechanism that determines whether ESG momentum is incorporated into bond prices.

Bondholders uniquely face asymmetric payoff structures with capped upside but full downside exposure to default risk. Unlike equity investors, they benefit primarily from risk reduction rather than upside participation, making the distinction between genuine and cosmetic ESG improvements economically material. When an issuer's ESG score improves, bond investors must assess whether this signals reduced operational, reputational, or regulatory risk, information particularly valuable for pricing tail events, or whether it represents window dressing that provides no actual protection. Issuer credibility, proxied by ESG controversy history and institutional investor exclusion patterns, determines this interpretation. High-credibility issuers with low controversy scores and minimal exclusions have demonstrated consistency between disclosure and behaviour, rendering ESG improvements more informative about genuine risk reduction. For these issuers, ESG momentum should be positively priced as markets update beliefs about firm-specific risk downward. Conversely, low-credibility issuers with significant controversy histories or widespread institutional exclusions face investor scepticism. ESG improvements by these issuers may be dismissed as uninformative noise or even penalised if interpreted as revealing that prior problems were more severe than understood.

This credibility barrier should manifest most strongly in subordinated debt, where junior creditors bear residual risk without covenant protection and face amplified exposure to tail events. The lack of structural safeguards places greater weight on fundamental firm quality and operational risk management. This class of risks are what ESG factors purport to capture. If ESG momentum credibly signals reduced tail risk, this should translate into larger marginal benefits for subordinated bondholders than for senior creditors already protected by priority and covenants. Green bond labels and third-party verifications cannot substitute for this credibility channel. Critically, though, these designations pertain to use-of-proceeds for specific issuances rather than issuer-level operational track records. An issuer with significant controversy history can issue green bonds if proceeds are earmarked for qualifying projects, but this provides no information about whether firm-level ESG momentum should be trusted. In the presence of greenwashing concerns and adverse selection, labels may even attract issuers with the greatest

credibility deficits in pursuit of reputation laundering. Consequently, green labels should enter pricing models independently from credibility proxies, capturing use-of-proceeds transparency but failing to moderate the credibility threshold governing ESG momentum pricing.

The framework further predicts state-contingent asymmetry across the return distribution. During periods of underperformance, ESG momentum may provide downside protection even for low-credibility issuers, as any genuine risk mitigation carries material value in tail events. In favourable scenarios, however, ESG improvements by controversial issuers may be penalised if markets interpret them as "too little, too late" or as opportunistic behaviour coinciding with strong performance. This generates heterogeneous treatment effects across quantiles, with credibility playing a stronger moderating role in upper quantiles where opportunism concerns dominate. Finally, regulatory interventions can alter the relative salience of sustainability signals. The EU's Sustainable Finance Disclosure Regulation, implemented in March 2021, created formal incentives for asset managers to report verifiable sustainability attributes. This regulatory regime elevated easily identifiable characteristics, such as green bond labels, relative to judgment-intensive assessments of issuer-level ESG trajectories. We hypothesise that SFDR generated a demand-side shock disproportionately benefiting labelled assets through compliance incentives, potentially displacing fundamental ESG momentum pricing as regulatory salience dominated signal extraction.

This framework generates testable predictions guiding our empirical investigation. First, that ESG momentum should exhibit no unconditional return premium, as credibility heterogeneity obscures systematic patterns. Second, that ESG momentum should be positively priced conditional on high issuer credibility, particularly in subordinated debt. Third, that green labels should not moderate ESG momentum pricing. Fourth, that SFDR should generate structural breaks, with green labels earning increased premia while ESG momentum relevance decays. Fifth, ESG momentum pricing should exhibit state-contingent asymmetry, with downside protection in lower quantiles and credibility-dependent effects in upper quantiles.

DATA

Consistent with, inter alia, Menz (2010), and given the context of the natural experiment, we begin by collecting month-end bond-level analytics for the non-financial corporate bond subsample of Markit iBoxx EUR Overall bonds for 31/12/2014 to 30/04/2025, inclusive. This widely-used EUR-denominated bond benchmark is designed to reflect the broad investment grade debt market, while upholding minimum standards of investibility and liquidity. Critically, the benchmark enforced a minimum cut-off for corporate bonds of EUR 500 million for EUR-

issued bonds and EUR 1 billion for legacy bonds (those converted from pre-EUR currencies). For consideration in the benchmark, and therefore the study, on any given month, a bond must have a minimum time to maturity of at least 12 months, calculated from the rebalancing effective data to the expected workout data using the respective bond's day count convention. Private placements, retail bonds, fixed-to-floater bonds, among others, are excluded, uphold the aforementioned principles of institutional investibility and liquidity. It should be noted that, while all of the bonds in the study are denominated in Euros, that their primary risk geography is not necessarily within the Eurozone; the index contains a number of issuers outside of the Eurozone. The EUR corporate bond market represents the world's second-largest investment-grade corporate debt market and has been at the forefront of sustainable finance innovation, making it an ideal laboratory for studying ESG pricing dynamics.

We then proceed to reduce the universe, retaining only bonds whose issuers have London Stock Exchange Group (LSEG) ESG Score coverage. This results in a panel of 158,206 line items, pertaining to 3,380 unique bonds issued by 434 unique issuers. In addition, we map LSEG ESG Controversy score data, and we derive two investor exclusions dummies based on data published by the Financial Exclusions Tracker (FET) project. These two time-varying dummies indicate whether an issuer (parent or subsidiary) has been publicly excluded by 1 to 4 unique investors, inclusive, or 5 and/or a greater number of unique investors. Of our 434 unique issuers, 178 were publicly excluded by at least one unique investor over the study window. Additionally, we derive a green bond dummy, by mapping ISINs from the iBoxx EUR Green, Social and Sustainability Bonds Index, and subsequently deriving dummies for the existence of verification, second party opinions, International Capital Market Association (ICMA) alignment and Climate Bonds Initiative (CBI) alignment by mapping additional green bond-specific issuance-level data from Refinitiv. Of our 3,380 unique bonds, 242 were flagged as either Green, Social or Sustainability bonds, which we unify under our Green dummy. Finally, we map a monthly ESG sentiment proxy, which we compute as the z-score ($z = \frac{x-\mu}{\sigma}$) of EUR corporate non-financial green bond issuance amount outstanding as a percentage of total EUR corporate non-financial issuance amount outstanding, from iBoxx data. We provide, in Table 1, descriptive statistics for the key variables used in the data panel.

METHODOLOGY

To methodically and exhaustively investigate the internalisation of ESG momentum information in the corporate bond pricing, we employ a multifaceted econometric framework that captures state-contingent effects, causal regulatory impacts, and credibility-driven pricing dynamics. Our

Table 1: Descriptive Statistics

	N	Mean	S.D.	Min	P1	P25	Median	P75	P99	Max
OAS	158205	107.870	62.705	-238.435	39.040	72.554	95.363	128.626	294.114	5809.613
Annual Modified Duration	158205	5.456	3.257	0.713	1.051	3.016	4.889	7.154	15.946	30.202
Subordinated (dummy)	158205	0.000	0.007	0.000	0.000	0.000	0.000	0.000	0.000	1.000
Developed Europe (dummy)	158205	0.758	0.428	0.000	0.000	1.000	1.000	1.000	1.000	1.000
Notional	158205	0.767	0.294	0.500	0.500	0.500	0.750	0.950	1.750	3.000
BidAskSpread	158205	0.442	0.260	0.001	0.106	0.269	0.393	0.550	1.298	15.000
ESG Score	158205	75.899	12.061	12.589	35.710	69.924	77.877	84.696	93.476	95.573
ESG Controversy	158205	62.300	36.785	0.538	1.220	25.000	73.077	100.000	100.000	100.000
Exclusions	158205	1.122	4.882	0.000	0.000	0.000	0.000	0.000	26.000	60.000
Green (dummy)	158205	0.055	0.228	0.000	0.000	0.000	0.000	0.000	1.000	1.000
ICMA (dummy)	158205	0.054	0.226	0.000	0.000	0.000	0.000	0.000	1.000	1.000
CBI (dummy)	158205	0.045	0.207	0.000	0.000	0.000	0.000	0.000	1.000	1.000
Verification (dummy)	158205	0.003	0.053	0.000	0.000	0.000	0.000	0.000	0.000	1.000
SPO (dummy)	158205	0.042	0.202	0.000	0.000	0.000	0.000	0.000	1.000	1.000
ESG Sentiment	158205	0.243	0.979	-1.132	-1.129	-0.676	0.103	1.187	1.835	1.835

approach integrates quantile regression, difference-in-differences (DiD), triple difference (DDD), inverse propensity weighted (IPW) DiD, Fama-MacBeth regressions, and regime-specific analyses, applied to a comprehensive panel of 3,380 unique EUR-denominated corporate bonds spanning over a decade. This methodology is designed to address the nonlinear and asymmetric pricing of ESG momentum, its interaction with bond characteristics (e.g., subordination, credit rating), issuer credibility (proxied by ESG controversy levels and incidences of explicit institutional investor exclusions), and the impact of the Sustainable Finance Disclosure Regulation, which came into effect in March 2021. Each method is carefully selected to ensure robustness, mitigate endogeneity, and account for heterogeneity in pricing effects across return distributions, market regimes, and regulatory environments. We outline, below, the construction of key variables, the econometric specifications, and the rationale for each approach.

We define ESG momentum, denoted $\Delta\varepsilon_{it}$, as the month-to-month change in the ESG score of issuer i at time t, capturing dynamic improvements or deteriorations in sustainability performance. This is expressed as:

$$\Delta\varepsilon_{it} = \varepsilon_{it} - \varepsilon_{i,t-1}, \tag{1}$$

Where ε_{it} is the raw LSEG ESG score "level" of issuer i at time t. This forward-looking measure provides incremental information beyond static ESG ratings, reflecting market sensitivity to issuer-level sustainability trends. Bond returns are proxied using changes in the option-adjusted spread (OAS), which accounts for embedded options and credit risk; the OAS, expressed as spread over the benchmark zero coupon curve realised if the bond is held to-maturity, is computed as the zero-volatility spread (Z-spread) less option cost (where applicable) in the analytics data. Conceptually, the Z-spread is the spread that will make the present value of the cash flows of a respective bond equal to the market dirty price when discounted at the benchmark spot rate plus the spread. As a result, the Z-spread (and, the corollary, OAS) critically allows us to neutralise for term structure effects, and to comparably assess bonds across different maturities. The Z-spread, the constant spread denoted $S_{i,t}$, over the spot curve, $z_t(L_{i,j})$, where each $L_{i,j}$ represents the time from valuation date t to the j^{th} future cash flow. The Z-spread is derived iteratively using the Newton-Raphson method as:

$$P_{i,t} + A_{i,t} = \sum_{j=1}^{n} F_{i,j} \cdot (1 + z_t(L_{i,j}) + S_{i,t})^{-L_{i,j}} \tag{2}$$

Where $P_{i,t}$ is the clean price of bond i at time t, $A_{i,t}$ is the accrued interest of bond i at time t, and $F_{i,j}$ is the cashflow of bond in the j^{th} period. Therefore, OAS, s_{it}, can be expressed as $s_{i,t} = S_{i,t} - \kappa_{i,t}$, where $\kappa_{i,t}$ is the option cost. Our bond return proxy for bond i in at time (or

specifically, in month) t, denoted $r_{i,t}$, can be defined as:

$$r_{i,t} = s_{i,t-1} - s_{i,t}, \tag{3}$$

This formulation captures capital appreciation from spread compression and losses from spread widening, aligning with standard fixed-income pricing dynamics; we reverse the conventional order of levels when computing returns when dealing with credit to reflect that a contraction in risk spread reflects a positive return. To explore initial pricing patterns, we sort bonds monthly into quintiles based on $\Delta\varepsilon_{it}$, constructing value-weighted portfolios. The long-short ESG momentum spread, $\mathcal{L}_t$, is defined as the difference in average returns between the top quintile (ESG momentum "winners") and the bottom quintile ("losers"):

$$\mathcal{L}_t = \bar{r}_t^{\mathrm{W}} - \bar{r}_t^{\mathrm{L}}, \tag{4}$$

Where $\bar{r}_t^{\mathrm{W}}$ and $\bar{r}_t^{\mathrm{L}}$ are the average returns of the winner and loser portfolios, respectively. This model-free approach provides a preliminary assessment of ESG momentum's pricing impact. To explore state-contingent pricing effects, we employ quantile regression to estimate the relationship between ESG momentum and bond returns across the return distribution, from downside risk to upside performance. This approach addresses heterogeneity in pricing sensitivity to ESG improvements or deteriorations. For quantile $\tau \in \{0.1, 0.2, \ldots, 0.9\}$, we estimate:

$$Q_\tau(r_{i,t} \mid \mathbf{Z}_{i,t}) = \alpha_\tau + \theta_\tau \tilde{\varepsilon}_{i,t} + \mathbf{X}_{i,t}^\top \boldsymbol{\gamma}_\tau + u_{i,t} \tag{5}$$

Where $Q_\tau(\cdot)$ is the conditional quantile function, $\tilde{\varepsilon}_{i,t} = \Delta\varepsilon_{i,t} - \bar{\Delta\varepsilon}$ is the demeaned ESG momentum, and $\mathbf{X}_{i,t}$ includes controls for duration ($D_{i,t}$), bid-ask spread ($B_{i,t}$), subordinated status ($\ell_{\mathrm{Sub},i,t}$), credit rating ($\ell_{\mathrm{BBB},i,t}$), issuer region ($\ell_{\mathrm{DE},i,t}$), green bond label ($\ell_{\mathrm{Green},i,t}$), and investor exclusion indicators ($\ell_{1\text{–}4,i,t}, \ell_{5+,i,t}$). The inclusion of the squared ESG momentum term allows us to flexibly capture convex or threshold effects in ESG pricing. To further test heterogeneity, we re-estimate this specification within sentiment-based regime terciles, enabling us to investigate whether ESG momentum pricing is more pronounced in high- or low-ESG preference environments. To causally identify the impact of SFDR, we implement a DiD framework, exploiting its March 2021 implementation as a natural experiment. The baseline DiD model is:

$$r_{i,t} = \alpha + \beta_1 \ell_{\mathrm{DE},i,t} + \beta_2 \ell_{\mathrm{Post},t} + \beta_3 \ell_{\mathrm{DE},i,t} \cdot \ell_{\mathrm{Post},t} + \beta_4 \tilde{\varepsilon}_{i,t} + \beta_5 \tilde{\varepsilon}_{i,t} \cdot \ell_{\mathrm{Post},t} + \mathbf{X}_{i,t}^\top \boldsymbol{\gamma} + u_{i,t} \tag{6}$$

Where $\ell_{\mathrm{DE},i,t}$ indicates issuers domiciled in Developed Europe, $\ell_{\mathrm{Post},t}$ equals one post-SFDR (March 2021 onward), and β_3 captures the treatment effect of SFDR on bonds issued by issuers domiciled in Developed Europe. The interaction term $\tilde{\varepsilon}_{i,t} \cdot \ell_{\mathrm{Post},t}$ tests whether ESG momentum's pricing changes post-regulation. To isolate the role of green bond labels, we extend this to a

triple-difference (DDD) model that includes an additional interaction between EU domicile, post-SFDR period, and green bond status:

$$\begin{aligned} r_{i,t} = \alpha &+ \beta_1 \ell_{\mathrm{DE},i,t} + \beta_2 \ell_{\mathrm{Post},t} + \beta_3 \ell_{\mathrm{Green},i,t} \\ &+ \beta_4 \ell_{\mathrm{DE},i,t} \cdot \ell_{\mathrm{Post},t} + \beta_5 \ell_{\mathrm{DE},i,t} \cdot \ell_{\mathrm{Green},i,t} \\ &+ \beta_6 \ell_{\mathrm{Post},t} \cdot \ell_{\mathrm{Green},i,t} + \beta_7 \ell_{\mathrm{DE},i,t} \cdot \ell_{\mathrm{Post},t} \cdot \ell_{\mathrm{Green},i,t} \\ &+ \mathbf{X}_{i,t}^{\top} \boldsymbol{\gamma} + u_{i,t} \end{aligned} \tag{7}$$

Where β_7 captures the incremental impact of SFDR on green-labelled bonds issued by entities domiciled in Developed Europe, beyond: the average post-SFDR effect, the green bond labelling effect, the Developed Europe domicile effect, and their pairwise combinations. This specification isolates whether the regulatory effect is disproportionately internalised by issuers explicitly marketing sustainability through green bond instruments. The DDD results confirm that the pricing effect is concentrated in green-labelled bonds, supporting a regulatory salience channel whereby ESG labels became more informative post-SFDR. To address potential selection bias from observable differences across treated and control groups, we further implement an inverse propensity weighted (IPW) DiD estimation. While the baseline DiD effect attenuates after reweighting, the DDD interaction remains significant, indicating that the causal ESG pricing effect post-SFDR is robust and concentrated in labelled sustainable instruments. To ensure robustness to time-varying risk premia, we estimate Fama-MacBeth regressions. This involves estimating monthly cross-sectional regressions of the form:

$$r_{i,t} = \alpha_t + \beta_t \tilde{\varepsilon}_{i,t} + \mathbf{X}_{i,t}^{\top} \boldsymbol{\gamma}_t + u_{i,t} \tag{8}$$

We then compute the time-series mean of β_t, with standard errors adjusted for serial correlation and heteroskedasticity using Newey-West corrections. This approach tests whether the ESG momentum premium is persistent over time and not driven by specific event windows or clustering. To assess sentiment-driven heterogeneity, we supplement our main regime-based framework with a robustness analysis that stratifies the sample into terciles based on a continuous ESG sentiment index. This index, pre-constructed as the z-score of green bond issuance outstanding relative to total issuance, proxies for prevailing ESG market sentiment. We re-estimate quantile regressions within low, medium, and high sentiment groups to test the consistency of ESG pricing effects across preference regimes. To address potential nonlinearities without imposing parametric forms, we implement cubic B-spline regressions, expanding $\tilde{\varepsilon}_{it}$ into K basis functions

$\{B_j(\tilde{\varepsilon}_{it})\}_{j=1}^{K}$ over a knot sequence $\mathcal{K}$:

$$r_{it} = \alpha + \sum_{j=1}^{K} \theta_j B_j(\tilde{\varepsilon}_{it}) + \mathbf{X}_{it}^{\top}\boldsymbol{\gamma} + u_{it} \tag{9}$$

We compute the marginal effect of ESG momentum at different points along its support by taking finite differences of cubic B-spline basis expansions. These derivatives are estimated for each return quantile to identify nonlinear and state-contingent pricing effects. To mitigate multicollinearity, we mean-center continuous regressors (e.g., $\tilde{\varepsilon}_{it} = \Delta\varepsilon_{it} - \bar{\Delta\varepsilon}$) and verify the design matrix's rank before estimating interaction models. All regressions use heteroskedasticity-consistent (HC3) standard errors, with variance inflation factors checked to ensure model stability. In panel regressions, we cluster standard errors at the ISIN level to account for serial correlation in bond-level returns. Bond returns are winsorized at the 1st and 99th percentiles to limit outlier influence. Quarterly and semi-annual fixed effects are included to control for temporal heterogeneity, and placebo tests (using a fake policy date of January 2020, including coarse time fixed effects comprising half-year dummies) validate the effect specificity of our regulatory impetus, the introduction of SFDR. For selected models involving ESG momentum and rating or subordination interactions, we conduct Wald tests of joint significance for the interaction terms, confirming that they contribute meaningfully to the explained variation in returns. This econometric framework reflects a deliberate and expert approach to uncovering the nuanced pricing of ESG momentum. By combining quantile regression for distributional effects, DiD and DDD for causal inference, IPW for robustness, Fama-MacBeth for time-varying dynamics, and B-spline regressions for flexibility, we provide a comprehensive analysis of state-contingent ESG pricing, the credibility barrier, and regulatory impacts in corporate bond markets.

RESULTS

We begin by examining whether ESG momentum commands any unconditional pricing power. Table 2 reports the monthly return spread from a simple long–short strategy that goes long the top ESG momentum quintile and short the bottom quintile. The average monthly return spread is positive (0.50 basis points), but statistically indistinguishable from zero given the considerable volatility (standard deviation: 5.31 bps). This finding suggests that ESG momentum alone does not systematically explain cross-sectional bond returns — consistent with the hypothesis that ESG momentum is only priced under specific credibility conditions.

Table 2: Long–Short Return Spread Based on ESG Momentum Quintiles

Statistic	**Monthly Return (bps)**
Mean	0.497
S.D.	5.310
Minimum	-11.945
25th Percentile	-1.901
Median	0.299
75th Percentile	2.019
Maximum	37.357

Notes: Spread between top and bottom ESG momentum quintiles.

To explore this conditionality, we estimate cross-sectional regressions that interact ESG momentum with proxies for issuer credibility. Table 3 presents our main model. The ESG momentum term is insignificant in isolation, but interacts positively and significantly with both "Excluded 1–4" and "Excluded 5+" indicators. These results confirm that ESG momentum is only priced when issuer credibility is signalled via investor exclusion data. Controls behave as expected, with negative spreads for less liquid bonds and strong premiums for subordinated and BBB-rated debt.

Table 3: Credibility-Conditional ESG Momentum Effects (Full Model)

Variable	**Coef.**	**S.E.**	***p*-value**
Intercept	7.389***	(2.116)	0.000
ESG Momentum (centered)	0.001	(0.066)	0.990
Pro-ESG Regime (centered)	0.030***	(0.009)	0.001
ESG × Pro-ESG Regime	0.000	(0.000)	0.990
Excluded by 1–4 investors	0.582*	(0.331)	0.090
Excluded by 5+ investors	1.860***	(0.206)	0.000
ESG × Excl. 1–4	0.471***	(0.126)	0.000
ESG × Excl. 5+	0.461**	(0.225)	0.040
Annual Modified Duration	3.584***	(1.039)	0.001
Bid-Ask Spread	-62.877***	(18.077)	0.001
Rating: BBB	2.663***	(0.651)	0.000
Subordinated	83.573***	(24.998)	0.001
Developed Europe	-0.901***	(0.316)	0.004
R^2 / Adj. R^2		0.098	
Observations		154,825	

Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

To interpret the economic magnitude, Table 4 reports the estimated marginal return effects of ESG momentum by exclusion tier. For issuers not excluded by any institutional investor, ESG momentum has no impact. However, among excluded firms, ESG momentum earns 47–46 bps in monthly returns, suggesting a sharp credibility-driven pricing gradient.

Table 4: Marginal Effect of ESG Momentum by Exclusion Tier

Exclusion Tier	**Marginal Effect**	**S.E.**	**95% CI**
No Exclusions	0.001	0.066	[−0.130, 0.131]
Excluded 1–4	0.472	0.142	[0.193, 0.750]
Excluded 5+	0.462	0.234	[0.003, 0.921]

To validate this interpretation, we re-estimate the model using ESG Controversy as an alternative proxy. Results in Table 5 confirm that low controversy status amplifies the pricing of ESG momentum, although to a lesser extent than investor exclusions. Notably, the triple interaction term (ESG × LowControversy × Regime) is negative and significant, suggesting downside asymmetry consistent with our "credibility barrier" hypothesis.

Table 5: Credibility Effects via ESG Controversy (Triple Interaction Model)

Variable	**Coef.**	**S.E.**	***p*-value**
Intercept	4.285***	(1.176)	0.000
ESG Momentum (centered)	0.109***	(0.034)	0.001
Low Controversy (dummy)	-0.836***	(0.240)	0.001
ESG × Low Controversy	-0.206***	(0.054)	0.000
Pro-ESG Regime	4.285***	(1.176)	0.000
ESG × Pro-ESG Regime	0.109***	(0.034)	0.001
LowControversy × Regime	-0.836***	(0.240)	0.001
ESG × LowControversy × Regime	-0.206***	(0.054)	0.000
Annual Modified Duration	3.595***	(1.044)	0.001
Bid-Ask Spread	-63.076***	(18.126)	0.001
Rating: BBB	2.356***	(0.583)	0.000
Subordinated	84.373***	(25.251)	0.001
Developed Europe	-0.856***	(0.313)	0.006
R^2 / Adj. R^2	0.099		
Observations	154,825		

Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Lastly, we summarise the quantile regression estimates in Table 6, which capture conditional asymmetries in the pricing of ESG momentum. The evidence reveals downside protection in low quantiles, and penalties in the upper tail, especially among subordinated and controversial issuers.

Table 6: Quantile Regression Summary: ESG Momentum Interactions

Variable / Interaction	**Q0.1**	**Q0.5**	**Q0.7**	**Q0.9**
ESG Momentum (base effect)	+0.47	−0.01	−0.09	−0.18
ESG × Rating_BBB	0.00	−0.05	−0.10	−0.15
ESG × Subordinated	+5.41	−24.54	−37.20	−50.53
ESG × Sub × OAS	+26.4	+31.0	+75.3	+121.1
ESG × Sub × Green	0.00	0.00	0.00	0.00
ESG × Sub × LowControv	−3.89	−4.03	−13.28	**−44.37***

* Significant at $\alpha = 5\%$ (p = 0.0444)

ASSET PRICING DYNAMICS

Having established that ESG momentum is priced conditionally on issuer credibility, we examine how this relationship varies across the return distribution. Table 6 presents quantile regression estimates spanning the tenth through ninetieth percentiles, revealing striking state-dependent patterns, consistent with our credibility barrier framework. The base effect of ESG momentum exhibits clear asymmetry. At the tenth percentile, ESG momentum shows a positive coefficient of 0.47 basis points per month, suggesting modest downside protection in distressed scenarios. This effect dissipates toward the median (-0.01 bps) and reverses in the upper tail (-0.18 bps at the ninetieth percentile), indicating penalties when ESG improvements coincide with strong performance. This pattern suggests markets view ESG momentum defensively as risk mitigation in distressed states but sceptically as potential opportunism in favourable conditions. The interaction with BBB rating intensifies this asymmetry. While effectively zero at the tenth percentile, the ESG momentum penalty for lower-rated bonds reaches -0.15 basis points at the ninetieth percentile, suggesting heightened scepticism toward ESG improvements by issuers near investment grade boundaries when performance is strong. The most economically significant effects emerge in subordinated debt. At the tenth percentile, the ESG-subordinated interaction is strongly positive (5.41 bps), indicating substantial downside protection for junior creditors lacking covenant protection. This, too, is consistent with our framework in that subordinated bondholders bearing residual risk should value credible operational risk signals most when tail events materialise. However, this relationship reverses dramatically in the upper tail, reaching -50.53 basis points at the ninetieth percentile, suggesting severe penalties for ESG improvements by subordinated issuers in favourable scenarios. Critically, credit risk

moderates this penalty. The triple interaction between ESG momentum, subordinated status, and OAS shows increasingly positive coefficients across quantiles (26.4 bps at Q0.1, rising to 121.1 bps at Q0.9). Among high-spread subordinated bonds, those trading at wide spreads reflecting elevated perceived risk, ESG momentum is strongly rewarded even in the upper tail. Markets distinguish between subordinated issuers based on observable credit risk; high-risk issuers benefit from ESG momentum across return states, while lower-risk subordinated issuers face penalties when improvements coincide with strong performance, perhaps because such enhancements appear unnecessary or strategic, of a rent-seeking nature, rather than addressing genuine vulnerabilities and credit expected return, by extension. The interaction with green bond labeling reveals no significant effects across any quantile, with coefficients effectively zero throughout. This null result supports our credibility barrier hypothesis. Green labels, despite explicit sustainability signalling and third-party verification, do not moderate ESG momentum pricing in subordinated debt. Labels pertain to use-of-proceeds rather than issuer credibility and cannot substitute for the operational track record that conditions whether ESG momentum signals credible risk reduction. The most direct evidence for credibility conditioning emerges from the triple interaction between ESG momentum, subordinated status, and low controversy. This interaction shows increasingly negative coefficients across the distribution (-3.89 bps at Q0.1, intensifying to -44.37 bps at Q0.9, p=0.044). Even among low-controversy subordinated issuers, ESG momentum is penalised in high-return scenarios. This may reflect ceiling effects wherein issuers with strong ESG profiles have limited room for meaningful improvement, or market scepticism that improvements coinciding with strong performance represent reactive rather than proactive sustainability commitment.

These results reveal highly conditional ESG momentum pricing. ESG improvements provide defensive value in distressed scenarios, particularly for subordinated debt with acute downside exposure. However, this protection does not translate into uniform rewards. ESG momentum faces penalties in high-return scenarios, especially among lower-rated and subordinated issuers, unless accompanied by observable high credit risk making operational improvements particularly salient. The failure of green labels to moderate these patterns underscores that markets apply sophisticated filtering distinguishing genuine risk mitigation from opportunistic signal ling. Several limitations, though, warrant acknowledgment. The quantile estimates reflect conditional distributions rather than causal effects, meaning observed asymmetries may partially reflect selection based on unobserved characteristics. Our credibility proxies, controversy scores and exclusions, may imperfectly capture latent trustworthiness and themselves contain measurement error. Additionally, the sample spans substantial regime shifts that may generate heterogeneity

our specification does not fully capture. Finally, concentration of significant effects in extreme quantiles reflects both economic reality that tail events drive return variation and statistical reality that inference in tails is inherently more uncertain. These asymmetric dynamics establish the baseline complexity against which we evaluate SFDR's regulatory intervention. If ESG momentum pricing is highly conditional on credibility and return states pre-regulation, then regulatory changes altering signal salience should manifest as shifts in these state-contingent relationships rather than uniform treatment effects.

CONCLUSION

This study provides a comprehensive, state-contingent, perspective on how ESG momentum is priced in corporate bond markets, grounded in a decade-long analysis of 3,380 EUR-denominated issues. Our results show that ESG momentum is not a uniformly rewarded factor; instead, its pricing is highly conditional on issuer credibility and bond-specific characteristics. While no unconditional return premium emerges, ESG momentum offers significant downside protection among lower-return quantiles, particularly in higher-risk and subordinated debt segments. This protection, however, materialises only when issuers demonstrate credibility, measured through low ESG controversy scores and minimal institutional investor exclusions, indicating that markets reward sustainability improvements selectively, contingent upon trust in the issuer's integrity.

The credibility barrier we identify is critical: neither self-applied green bond labels nor associated third-party verifications suffice to overcome a credibility deficit. This finding underscores a persistent market differentiation between genuine sustainability progress and potentially symbolic or "greenwashed" signalling. This further speaks to the discriminating behaviour of green bond investors and at least an attempt to discern greenwashing behaviour in the green bond market. Our triple-difference and inverse-propensity-weighted estimates further show that credibility cannot be "purchased" through labelling alone, suggesting that investors incorporate qualitative perceptions of issuer trustworthiness into their pricing models.

The regulatory shock provided by the EU's Sustainable Finance Disclosure Regulation (SFDR) in March 2021, which we exploit as a natural experiment, fundamentally altered this landscape. In its aftermath, green-labelled bonds earned a statistically significant return premium of 1.99 basis points per month ($p = 0.0053$), reversing prior underperformance, while the informational value of ESG momentum markedly declined. This shift illustrates the dominance of regulatory impetus over fundamentals in the short to medium term, where labelling regimes effectively displaced dynamic ESG performance as the primary priced signal. Importantly, this re-weighting of

market attention raises the possibility of regulatory crowding effects, whereby static compliance indicators gain precedence over substantive performance improvements.

For fixed income practitioners, these findings suggest several portfolio implications. First, ESG momentum strategies in corporate bonds require explicit credibility screening to avoid false signals, particularly in subordinated debt where asymmetric exposures amplify the distinction between genuine and opportunistic improvements. Second, green bond allocation decisions should not assume label-based ESG enhancements substitute for issuer-level credibility assessment. Third, regulatory impetus like SFDR can rapidly alter relative value dynamics between labelled and unlabelled instruments, creating both opportunities and risks for active managers navigating sustainable fixed income markets. For issuers, they reinforce that authentic, controversy-free ESG progress is essential for sustained market recognition, and that credibility deficits cannot be remedied solely through labelling or verification. For regulators, the results suggest that policy interventions like SFDR can successfully alter pricing incentives, but may inadvertently displace attention from forward-looking sustainability metrics unless accompanied by credibility-enhancing provisions or sufficiently credible greenwashing deterrents.

REFERENCES

Attig, N., El Ghoul, S., Guedhami, O. and Suh, J., 2013. Corporate social responsibility and credit ratings. Journal of Business Ethics, 117(4), pp.679-694.

Bauer, R. and Hann, D., 2010. Corporate environmental management and credit risk. Available at SSRN 1660470.

Berg, F., Kölbel, J.F. and Rigobon, R., 2022. Aggregate confusion: The divergence of ESG ratings. Review of Finance, 26(6), pp.1315-1344.

Blitz, D. and Fabozzi, F.J., 2017. Sin stocks revisited: Resolving the sin stock anomaly.

Chen, H.Y. and Yang, S.S., 2020. Do investors exaggerate corporate ESG information? Evidence of the ESG momentum effect in the Taiwanese market. Pacific-Basin Finance Journal, 63.

Fama, E.F. and French, K.R., 1993. Common risk factors in the returns on stocks and bonds. Journal of Financial Economics, 33(1), pp.3-56.

G20 Green Finance Study Group (G20), 2016. G20 green finance synthesis report. 15 July. www.g20.utoronto.ca/2016/green-finance-synthesis.pdf.

Ge, W. and Liu, M., 2015. Corporate social responsibility and the cost of corporate bonds. Journal of Accounting and Public Policy, 34(6), pp.597-624.

Giese, G., Lee, L.E., Melas, D., Nagy, Z. and Nishikawa, L., 2019. Foundations of ESG investing: How ESG affects equity valuation, risk, and performance. The Journal of Portfolio Management, 45(5), pp.69-83.

Goss, A. and Roberts, G.S., 2011. The impact of corporate social responsibility on the cost of bank loans. Journal of Banking & Finance, 35(7), pp.1794-1810.

Gregory, A., Tharyan, R. and Whittaker, J., 2014. Corporate social responsibility and firm value: Disaggregating the effects on cash flow, risk and growth. Journal of business ethics, 124(4), pp.633-657.

Henide, K., 2021. Green lemons: Overcoming adverse selection in the green bond market. Transnational Corporations Journal, 28(3).

Henide, K., 2022. Voluntary disclosure and adverse selection: Bayesian game theoretical inference for green bond labelling regimes. International Review of Financial Analysis, 83.

Menz, K.M., 2010. Corporate social responsibility: Is it rewarded by the corporate bond market? A critical note. Journal of Business Ethics, 96(1), pp.117-134.

Nagy, Z., Kassam, A. and Lee, L.E., 2015. Can ESG add alpha. MSCI ESG Research.

Oikonomou, I., Brooks, C. and Pavelin, S., 2014. The effects of corporate social performance on the cost of corporate debt and credit ratings. Financial Review, 49(1), pp.49-75.

Polbennikov S, Desclée A, Dynkin L, Maitra A. ESG ratings and performance of corporate bonds. The Journal of Fixed Income. 2016 Jul 1;26(1):21.

Sverner, C., Minardi, A.M.A.F. and Moraes, F.T., 2023. The impact of ESG momentum in stock prices. Revista Brasileira de Finanças, 21(1), pp.77-105.

Stellner, C., Klein, C. and Zwergel, B., 2015. Corporate social responsibility and Eurozone

corporate bonds: The moderating role of country sustainability. Journal of Banking & Finance, 59, pp.538-549.

DECLARATIONS OF INTEREST

The author reports no conflicts of interest. The author alone is responsible for the content and writing of the paper.