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ESG Thematic Bonds in Emerging Markets: Risk, Uncertainty, and Ambiguity

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ABSTRACT

We examine the impact of risk aversion, ambiguity, and uncertainty (geopolitical and economic) on the ESG thematic bond markets in emerging countries. We analyze ESG sovereign (both USD and local currency denominated) and corporate bond markets on the aggregate and regional levels. Increasing levels of risk aversion and economic uncertainty are associated with significant declines in both ESG thematic sovereign and corporate emerging bond returns. On the contrary, ambiguity exhibits a positive impact on bond market returns. Finally, geopolitical risk shows a significant negative relationship only in certain regions. The comparison between ESG and non-ESG emerging market bonds reveals that uncertainty sources are generally reflected in bond returns in the same way, regardless of the ESG nature of the bonds.

JEL Classification: G01, G15

1 | Introduction

Our study provides new evidence on the impact of risk, uncertainty, and ambiguity on the ESG thematic bond markets[1] in emerging countries. We build on the foundations of risk aversion, uncertainty, and ambiguity literature (see, e.g., Keynes 1921; Knight 1921; Ellsberg 1961; Bernanke 1983; Bekaert et al. 2022; Izhakian 2017, 2020), emphasizing their essential importance as determinants of financial returns and risk premiums. Furthermore, understanding how various uncertainty sources affect the pricing of sustainable assets is an important aspect of portfolio risk management, given that ESG has become a top priority for governments, corporations, and investors (Hornuf and Yüksel 2024; Feldhütter et al. 2024). Moreover, ESG-focused investments have become an imperative for both corporate and government entities, and consequently attracted increased attention from academics in recent years (e.g., Krüger 2015; Riedl and Smeets 2017; Krueger et al. 2020; Bauer et al. 2021; Inderst and Opp 2025).

Over the past decade, various financial securities, particularly debt instruments, have been introduced to align financial incentives with ESG objectives (Feldhütter et al. 2024). The total amount of green, social, sustainability, and sustainability-linked (GSSS) bonds issued in the market worldwide as of 2024 reached USD 5.7 trillion, with emerging market share accounting for 16% of the total issuance (The World Bank 2024). The highest proportion is attributed to green bonds in both emerging and advanced markets, representing 70% and 66% of overall issuances, respectively. The World Bank anticipates a 7.1% annual growth in the issuance of emerging market GSSS

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bonds for 2025, with green bond growth expected to be even higher at 7.5% (IFC & Amundi 2024). The rapid growth of sustainable finance in emerging markets is reflected in the strong post-COVID recovery of ESG flows and the exceptional volume of green bond issuances (Goel et al. 2022).

In our analysis, we cover a broad spectrum of uncertainties originating from economic, risk aversion, ambiguity, and geopolitical sources. Economic uncertainty and risk aversion are proxied by the measures developed by Bekaert et al. (2022), who created an asset pricing model in which conditional volatility is driven by variation in both economic uncertainty and risk aversion. The economic uncertainty and risk aversion measures, developed by Bekaert et al. (2022), have been used recently by Bianchi et al.2020; Asgharian et al. 2023; Hanauer and Kalsbach 2023. Economic uncertainty reflects shocks originating from fundamental factors. Risk aversion relates not only to shocks from fundamental factors but also to shocks from non-fundamental factors, such as investor sentiment (Baker and Wurgler 2006). In particular, the Economic Uncertainty measure represents a financial proxy for economic uncertainty, and it is based on a calculation of financial variables at high frequency. Time-varying risk aversion measure is represented by the Risk Aversion Index, calculated as a function of 6 financial instruments (the term spread, credit spread, a detrended earnings yield, realized and risk-neutral equity return variance, and realized corporate bond return variance). In the literature on international finance, global risk aversion is identified as a key transmission mechanism of US monetary policy spillovers to foreign countries and a major source of cross-country asset return comovements (Rey 2015; Miranda-Agrippino and Rey 2020).

Geopolitical risk is proxied by the news-based measure of global geopolitical risk developed by Caldara and Iacoviello (2022). The literature acknowledges geopolitical uncertainty as a relevant factor in emerging financial markets (Zaremba et al. 2022; Andresen and Sturm 2024). Furthermore, the literature also suggests that geopolitical risk could potentially hinder the growth of the green bond market in particular (Fiorillo et al. 2024; Mertzanis and Tebourbi 2025). The geopolitical environment is also playing a significant role in emerging markets as emerging countries tend to be more dependent on political uncertainties compared to developed markets (Lehkonen and Heimonen 2015; Zaremba et al. 2022). Changes in government, policy shifts, and regulatory reforms can impact investor sentiment and the perceived risk associated with emerging market bonds. Uncertainty regarding the stability of the political environment can lead to higher risks and higher yields demanded by investors (Huang et al. 2015).

While literature provides broad evidence on geopolitical risk and economic uncertainty (Bernal et al. 2016; Brogaard et al. 2020; Bali et al. 2021; Ioannidis and Ka 2021; Costantini and Sousa 2022; Leippold and Matthys 2022; Tao et al. 2022; Mertzanis and Tebourbi 2025), the understanding of ambiguity remains puzzling (Yang et al. 2025). Ambiguity differs from the concepts of risk and uncertainty, as ambiguity arises when the probability distribution of outcomes is unknown, leaving investors not only uncertain about potential outcomes but also without sufficient information to estimate their likelihood (Ellsberg 1961). Despite the theoretical distinction between risk and ambiguity in the context of asset pricing, the empirical literature has been limited due to the challenge of measuring ambiguity empirically (Epstein and Schneider 2008; Şahin and Danışoğlu 2022). Izhakian (2017, 2020) introduces a practical, empirically and experimentally applicable approach to quantifying market ambiguity, which we utilize in our study. Izhakian (2017) presents a decision-making model for handling uncertainty by expanding upon the Bayesian method to address uncertain probabilities. Further, Izhakian (2017) links attitudes towards uncertainty to probabilities, defining ambiguity attitudes as responses to changes that maintain the average probability. The majority of empirical studies examining the impact of ambiguity on asset pricing focus on developed equity markets (Brenner and Izhakian 2018), while the evidence from bond markets is limited, especially in emerging market settings.

Uncertainty might impact emerging market bonds, including ESG thematic bonds, due to their higher vulnerability to market volatility and risk perceptions. Uncertainty leads to increased risk aversion among investors (Bloom 2009). This is well documented in the emerging debt market setting (Piljak and Swinkels 2017) and for small open economies (Bonciani and Ricci 2020). Investors may perceive emerging market bonds as riskier due to factors such as political instability, regulatory uncertainties, economic volatility, and currency risks (Duyvesteyn et al. 2016; Agur et al. 2019; Boubaker et al. 2019; Chaieb et al. 2020).

Furthermore, uncertainty can affect capital flows to emerging markets, which impacts the availability of funds for bond issuers (Koepke 2019; Choi et al. 2023). During uncertain times, investors may withdraw capital from emerging markets and seek safe haven opportunities during the 'flight-to-quality' phenomenon (Bernanke et al. 1996; Baur and Lucey 2009; Baur and Schulze 2009; Baele et al. 2020; Dimic et al. 2021). Therefore, uncertain times can reduce liquidity in the market, making it more challenging for emerging market bond issuers to raise funds or refinance existing debt. One important feature of emerging market bonds and ESG thematic emerging bonds, as their subset, is that they are frequently denominated in local currencies, which exposes investors to currency risk. Consequently, we analyse ESG thematic bonds nominated in both USD and local currencies.

It is essential to note that, despite the aforementioned challenges, ESG thematic emerging market bonds can also provide attractive investment opportunities. Given the unique characteristics of emerging market ESG thematic bonds, examining their potential as a hedge against broad uncertainty stemming from ambiguity, geopolitical stability, risk aversion, and economic environment may have important implications for portfolio diversification. Furthermore, understanding how uncertainty affects the behaviour of ESG thematic bonds is particularly relevant due to the recent growth in green and sustainable bond issuance (Mertzanis 2023; Caramichael and Rapp 2024; Mertzanis and Tebourbi 2025).

The issue of pricing differences between green and brown bonds is a current debate in the literature on fixed-income securities, as the evidence offers inconclusive results regarding the existence of a greenium (negative excess return on green assets compared to similar conventional assets). One stream of the literature documents negligible pricing differences between green and brown bonds (Hachenberg and Schiereck 2018; Larcker and Watts 2020), while the other stream finds the existence of a negative green bond premium of various

magnitudes (Baker et al. 2022; Gianfrate and Peri 2019; Zerbib 2019; Wang et al. 2020). Our study provides new insights into this debate by examining whether there are differences between ESG and non-ESG bonds of emerging markets in their response to uncertainty sources.

Our paper makes several contributions to the literature. First, we extend the literature on uncertainties in the bond market (Bernal et al. 2016; Brogaard et al. 2020; Bali et al. 2021; Costantini and Sousa 2022; Leippold and Matthys 2022; Mertzanis and Tebourbi (2025) by examining how different uncertainty sources (risk aversion, economic and geopolitical uncertainty, and ambiguity) affect ESG thematic bonds in emerging markets. Previous literature on emerging bond markets in the ESG domain has mainly focused on green bonds and corporate market segments (Long et al. 2022; Caramichael and Rapp 2024), whereas our study incorporates not only green bonds but the entire ESG thematic bonds universe across both corporate and sovereign segments. In addition, we examine the currency aspect of sovereign ESG thematic bonds. We also provide a comparison of ESG thematic bonds vs. non-ESG bonds in emerging markets, contributing to the debate in the literature on fixed-income securities regarding the differences between green and conventional bonds. The novelty of our study is in linking all these aspects of ESG thematic bonds in emerging markets with various uncertainty sources.

Second, by applying recently developed measures from Izhakian (2017, 2020), we complement existing literature on ambiguity in asset pricing. To the best of our knowledge, our study is the first one to link Izhakian's (2017, 2020) measure of ambiguity with returns in sovereign and corporate international bond markets.

Third, we investigate the relationship between uncertainty and bond market returns at the aggregate emerging markets bond level and the regional level, by providing evidence from the following regions: Asia, Africa, Europe, EMEA, the Middle East, and Latin America. The regional perspective offers new insights into the literature on emerging bond markets, as those markets represent a heterogeneous group with compelling differences in terms of sovereign credit ratings, market integration, and capital flow dynamics (Christopher et al. 2012; Piljak 2013; Posedel Šimović et al. 2016; Tillmann 2016; Agur et al. 2019; Chaieb et al. 2020). Thus, we contribute to this stream of literature by focusing on regional heterogeneity in the context of ESG thematic bond markets in emerging countries.

We find that increases in risk aversion and economic uncertainty are associated with significant declines in ESG sovereign emerging bond market returns (both USD-denominated and issued in local currency) and in corporate bond returns. Therefore, investments in emerging market ESG thematic bonds might be negatively affected following changes in investors' risk aversion and general market conditions. On the contrary, our results indicate a mainly positive relationship between the recently invented measure of market ambiguity and emerging market bond returns. Finally, geopolitical risk, in general, does not play a significant role in affecting the returns of ESG thematic sovereign (USD-denominated and local currency) and corporate emerging market bonds on the aggregate level. However, the regional perspective reveals a heterogeneous effect of the geopolitical risk across the regions. The comparison between ESG and non-ESG emerging market bonds reveals that the ESG nature of the bonds does not significantly influence the reaction of bond returns to uncertainty sources. Moreover, we corroborate our results with further analyses of maturity-specific sub-indices for ESG and non-ESG bonds, country-specific geopolitical risks as specific sources of uncertainty, uncertainty induced by COVID-19, and different data frequencies (daily vs. monthly). Finally, we disentangle the effects of each uncertainty measure by using sub-samples where other uncertainty measures are below the median.

The remainder of the paper is organized as follows. Section 2 presents a literature review and hypothesis development, while Section 3 describes our data and methodological framework. In Section 4, we discuss our empirical results. Finally, Section 5 concludes.

2 | Related Literature and Hypotheses Development

Our paper is closely related to three interwoven strands of financial economics literature and their applications to emerging markets. The first strand is the literature examining risk attitudes and how their perceptions are uncovered in emerging bond markets. The second strand addresses the implications of various uncertainties in financial markets with an emphasis on emerging markets. Third, we review the literature on ambiguity in the Knightian sense (Knight 1921) and as a broad source of uncertainty. Finally, we connect this literature with ESG investing in emerging debt markets.

2.1 | Risk in Emerging Bond Markets

The literature on sustainability in emerging bond markets builds on the broad segment of the literature attempting to understand risk and returns in emerging markets (Bekaert and Harvey 1995; Harvey 1995) and the specific segment of the literature examining emerging bond markets (Dittmar and Yuan 2008; Ağca and Celasun 2012; Burger et al. 2012; Brooks et al. 2020; Konstantinov 2022).

The literature examining ESG emerging bond market investment is limited, and it primarily focuses on green bonds as a segment of ESG bonds. The primary focus is on understanding the pricing of green bonds and the differences between green and conventional bonds, mainly in the Chinese market. In particular, Wang et al. (2020) provide evidence that the pricing premium of corporate green bonds in China is most pronounced for new issues from high corporate social responsibility (CSR) issuers and underwriters. Xu et al. (2022) examine the effects of greenwashing on green bond pricing in the Chinese market and find that green bonds have higher credit spreads than traditional bonds. Uddin et al. (2022) investigate the risk spillover relationship between green and non-green (black) bonds in Asian markets (China Mainland, Hong Kong, India, Japan, Philippines, and Singapore) and show that there is heterogeneity across the countries in terms of the risk profile of green and black bonds. In particular, green bonds have higher levels of risk than black bonds in Hong Kong, India and the Philippines. Guo et al. (2023) demonstrate that Chinese green bonds have the potential to diversify portfolios and improve long-term returns effectively. Tang et al. (2023) examine the

relationship between the economic policy uncertainty (EPU), geopolitical risk (threat and actual), crude oil prices, and green bond returns. They find that the return on green bonds is negatively affected by an increase in EPU and geopolitical actual risk in the short run, as well as by an increase in geopolitical threats in the long run. The recent study by Mertzanis and Tebourbi (2025) provides evidence of global green market expansion, including emerging countries.

2.2 | Uncertainty in Emerging Markets

The literature documents that various forms of uncertainty (political, macroeconomic, economic policy, geopolitical) play an essential role in financial markets (Julio and Yook 2012; Pástor and Veronesi 2013; Jurado et al. 2015; Baker et al. 2016; Bekaert et al.2016; Ioannidis and Ka 2021; Wang et al. 2024; Leippold and Matthys 2022; Caldara and Iacoviello 2022). Furthermore, risk aversion has been identified as an important factor in international portfolio management (Uppal 1993; Xu 2019; Asgharian et al. 2023). The prominence of uncertainty is especially evident in emerging markets (Piljak 2013; Huang et al. 2015; Dimic et al. 2016; Duyvesteyn et al. 2016; Balcilar et al. 2021; Zaremba et al. 2022). In particular, Piljak (2013) documents that global bond market uncertainty is an important factor in emerging bond markets, while Dimic et al. (2016) find that global financial market uncertainty affects both stock and bond markets in emerging countries. Huang et al. (2015) and Duyvesteyn et al. (2016) document the importance of political risk in government bond markets, both developed and emerging. Balcilar et al. (2021) point out that global and advanced market economic policy uncertainty EPU have predictive power for emerging markets' bond spreads. In a similar vein, literature recognizes geopolitical risk as a threat to financial stability in emerging markets (Zaremba et al. 2022). Specifically, Zaremba et al. (2022) find that geopolitical risk is a priced factor in emerging stock markets.

Several studies utilize aggregate green bond indices (which include companies from China and other emerging markets as constituents) to examine the relationship between the green bond market and uncertainties. Pham and Nguyen (2022) provide evidence of time-varying and state-dependent connections between green bonds and different sources of uncertainties, namely EPU, VIX, and oil price uncertainty. Long et al. (2022) examine the spillover effects between uncertainties and green bond markets in the United States of America, Europe, and China, and find that the connectedness between green bonds and uncertainties is time-varying, with asymmetric spillover effects at the extreme upper and lower quantiles. On the contrary, Piñeiro-Chousa et al. (2021) show that stock market uncertainty (measured by the VIX) does not affect green bond indices. Moreover, Wei et al. (2022) document that EPU does not impact green bonds in the short run, but in the long run, there is a positive relation to green bonds.

2.3 | Ambiguity and Emerging Markets

Formal reasoning and understanding of unknown probabilities/ambiguity are thought to be crucial concepts in modelling the behaviour of financial agents (Keynes (1921), Knight (1921)). Ellsberg (1961) posits that new tools are needed to understand ambiguity properly. Early formal modelling of ambiguity began with Gilboa (1987) and Gilboa and Schmeidler (1989) and was extended in the works of Easley and O'Hara (2009) and Bossaerts et al. (2010). Fundamental to our paper is the research developed by Izhakian (2017), Brenner and Izhakian (2018), and Izhakian (2020), which provides the foundations of ambiguity measurement that we utilize in our paper.

Kim and Byun (2021) utilize an ambiguity measure from Izhakian (2017) and Brenner and Izhakian (2018), examining equity returns for 21 global markets and two segments (developed and emerging). They report that, on average, participating investors require a risk premium and a conditional ambiguity premium. Furthermore, the degree of risk aversion and ambiguity is directly related to opaque financial disclosure. Yang et al. (2025) also apply the ambiguity measure of Brenner and Izhakian (2018) to understand the impact of ambiguity on market anomalies in the Chinese market. They concur that the presence of ambiguity has a moderating role for investors' sentiment, indicating irrational investment choices. Şahin and Danışoğlu (2022) test the above measure in the context of the Turkish equity market and demonstrate that ambiguity should be a component of the total risk. The overview of the literature attests that there is no application of Izhakian (2017) and Brenner and Izhakian (2018) ambiguity measurement in the context of emerging bond markets, which opens an avenue for the utilization of this measure in our study.

2.4 | Hypotheses Development

Building on the asset pricing literature, we develop a theoretical framework that connects various sources of uncertainty—namely, risk aversion, economic uncertainty, ambiguity, and geopolitical risk—with the returns of ESG thematic bonds from emerging markets. It is important to note that emerging markets' ESG thematic bonds, while developed to account for the sustainability preferences of investors, belong to financial markets where traditional risk factors play a crucial role.

Emerging market bonds in general exhibit 'equity-like' characteristics (Panchenko and Wu 2009), which makes their responses to uncertainty distinct from those of conventional developed market sovereign and corporate bonds. While developed market bonds may benefit from a 'flight-to-quality' effect, bonds issued by emerging markets behave more like equities under stress conditions (Baur and Lucey 2009), experiencing increased yield spreads and volatility. ESG thematic emerging market bonds are no exception: although they offer sustainable features, they remain subject to the macro and political instability typical of emerging markets.

Investor risk aversion, particularly during global market downturns, has a well-documented impact on capital flows to emerging markets. As risk aversion rises, capital flows away from emerging markets, regardless of asset label. Campbell and Cochrane (1999) model habit-based preferences to explain countercyclical risk aversion, and empirical work by Pástor and Veronesi (2013) shows that investor sentiment shifts away from risky exposures in uncertain times. In periods of elevated global risk aversion, investors tend to rebalance away from risky assets.

Pástor et al. (2022) demonstrate that investor preferences, including aversion to climate and political risks, can result in substantial shifts in asset demand and pricing. In particular, ESG preferences tend to reduce during financial stress episodes. Furthermore, Pedersen et al. (2021) develop a model in which investors are optimizing portfolios along an ESG-efficient frontier. While ESG-motivated investors may accept lower Sharpe ratios for higher ESG scores, such behaviour is likely suppressed under heightened risk aversion, especially in unstable regions such as emerging markets.

Hypothesis 1. *Increases in global investor risk aversion are associated with lower returns on ESG thematic bonds in emerging markets.*

Economic uncertainty reflects the unpredictability of macroeconomic fundamentals. Given the equity-like nature of emerging market bonds, they are likely to behave more like risky assets during periods of heightened economic uncertainty. As uncertainty rises, investors may reduce exposure to emerging market bonds, leading to price declines and higher yields. This is consistent with the precautionary savings and financial frictions channels discussed in Carroll and Samwick (1997) and Gilchrist et al. (2014), as well as the empirical findings of Jurado et al. (2015), which indicate that uncertainty shocks depress investment and output.

Furthermore, Wang et al. (2024) find that corporate bonds with high exposure to economic policy uncertainty underperform during uncertainty shocks. Pedersen et al. (2021) suggest that ESG preferences operate within a constrained optimization problem. Under high uncertainty, especially in emerging markets, financial considerations often dominate, potentially leading investors to prioritize financial returns over ESG mandates.

Hypothesis 2. *Increases in economic uncertainty are associated with lower returns on ESG thematic bonds in emerging markets.*

Ambiguity refers to situations in which investors lack confidence not only in future outcomes but also in the probabilities associated with those outcomes. In such contexts, especially prevalent in emerging markets, investors often adopt pessimistic expectations and require compensation for bearing ambiguity-related risks. Theoretical models suggest that ambiguity aversion can generate a positive premium in bond returns. Zhao (2020) demonstrates that ambiguity about long-run inflation and growth induces investors to form worst-case beliefs, which result in upward-sloping nominal and real yield curves and predictable excess bond returns. Similarly, Gagliardini et al. (2009) demonstrate that ambiguity aversion introduces distinct, priced components into the term structure of interest rates, which are especially relevant when economic or regulatory environments are uncertain.

In the context of ESG thematic bonds from emerging markets, ambiguity may arise from unclear sustainability regulations, weak enforcement, or unreliable ESG disclosure standards (Tansan et al. 2023). Ambiguity-averse ESG investors are likely to demand a premium for holding such assets, particularly when institutional frameworks in emerging markets are weak or evolving.

Hypothesis 3. *Increases in ambiguity are associated with higher returns on ESG thematic bonds in emerging markets.*

Geopolitical tensions can significantly affect capital flows to emerging economies (Caldara and Iacoviello 2022). While developed market bonds may benefit from a 'flight-to-quality' effect, bonds issued by emerging markets behave more like equities under stress conditions, experiencing increased yield spreads and volatility. ESG thematic emerging market bonds, despite their sustainable features, remain subject to the same macro and political instability typical of emerging markets. Caldara and Iacoviello (2022) show that geopolitical risk negatively correlates with risky asset prices, while Pástor et al. (2022) highlight how investor preferences shift in response to rising environmental and political concerns, affecting asset prices through demand channels. Similarly, geopolitical shocks can trigger 'flight-to-quality', reducing demand for riskier assets.

Hypothesis 4. *Increases in geopolitical risk are associated with lower returns on ESG thematic bonds in emerging markets.*

The hypotheses formulated above pertain to ex-post realized returns. We examine how observed fluctuations in different dimensions of uncertainty (risk aversion, economic uncertainty, ambiguity, and geopolitical risk) are associated with subsequent bond performance in emerging markets. The empirical analysis focuses on realized return dynamics, allowing us to interpret the results as reflecting investors' reactions to changing uncertainty conditions, rather than shifts in expected compensation for bearing risk.

3 | Data and Methodology

Below, we present our data-obtaining process, outline the summary statistics obtained, and explain the methodology used in the empirical analysis.

3.1 | Data

Our data set is primarily based on the J.P. Morgan ESG (JESG) suite of indices, which cover both corporate and sovereign ESG emerging bond market segments. J.P. Morgan is the leading index provider for emerging market corporate and government debt.[2] The constituents are, in principle, the same as for the non-ESG counterparts of the index, but the market cap is adjusted based on the bond issuer's ESG score.[3]

The JESG score is a proprietary score developed by J.P. Morgan, based on sustainability information from RepRisk, Sustainalytics, and the Climate Bond Initiative. These are standard sustainability data sets used in academia and industry.[4] Based on RepRisk and Sustainalytics, each issuer receives a daily ESG score between 0 and 100, and the average of the two is the daily JESG score. The JESG index is the 3-month rolling average of the daily JESG score.

Based on the JESG index, five cohorts are created, ranging from 100 to 80 (most sustainable) to 20–0 (least sustainable), with intermediate categories of 80–60, 60–40, and 40–20. Green bonds, based on the definition of the Climate Bond Initiative, receive a one-cohort upgrade. The index market value for each cohort is then multiplied by a factor: 100% (most sustainable), 80%, 60%, 40%, 0% (least sustainable). The JESG indices further exclude issuers based on ethical considerations: noncompliance with the United Nations Global Compact principles, or revenues from thermal coal, tobacco, weapons, or oil

sands. As a last step, the JESG index is reweighted to add up to 100%. The JESG cohorts are determined at the end of each quarter, while capital market changes such as new issuance are updated monthly. Once an issuer enters the worst sustainability cohort, it remains there for at least 12 months.

In particular, the data set includes the sovereign bonds segment of emerging markets, tracked by the J.P. Morgan EMBI Global Diversified (JESG EMBI) and JESG Government Bond Index—Emerging Markets Index (JESG GBI-EM). The J.P. Morgan EMBI Global Diversified (JESG EMBI)[5] is a comprehensive fixed-income ESG benchmark that offers exposure to the USD-denominated sovereign emerging markets asset class, while JESG GBI-EM represents an ESG benchmark that provides exposure to the local currency-denominated sovereign bonds of emerging markets.

The data set also includes the J.P. Morgan ESG CEMBI Index universe on the aggregate and regional levels (tracking liquid, US Dollar-denominated emerging market fixed and floating-rate debt instruments issued by corporates) launched in 2012. The index utilizes an ESG scoring and screening methodology to tilt toward issuers ranked higher on ESG criteria and green bond issues and to underweight and remove issuers that rank lower. We use daily data on total return indices, meaning that they incorporate both bond price changes and coupon payments. The bond returns are calculated as the logarithmic first difference of the bond price indices (Christiansen 2007; Benkraiem et al. 2025).

Overall, we are in a position to examine one of the most comprehensive data sets assembled on the performance of ESG emerging bond markets.

The data on uncertainty includes the following measures tracking particular uncertainty sources: (i) Risk Aversion Index (Bekaert et al. 2022); (ii) Economic Uncertainty (Bekaert et al. 2022); (iii) Ambiguity (Izhakian 2017; Brenner and Izhakian 2018; Izhakian 2020); and (iv) Geopolitical Risk Index (Caldara and Iacoviello 2022). The Risk Aversion Index is calculated as a function of six financial instruments (the term spread, credit spread, a detrended earnings yield, realized and risk-neutral equity return variance, and realized corporate bond return variance). The Economic Uncertainty measure by Bekaert et al. (2022) represents a proxy for economic uncertainty based on a calculation of financial variables at high frequency.[6] Ambiguity measure developed in various works (Izhakian 2017; Brenner and Izhakian 2018; Izhakian 2020) calculates the volatility of probabilities and accounts for the variance of all moments of the outcome distribution. Consequently, this ambiguity serves as a proxy for estimating Knightian 'unmeasurable uncertainty' (Knight 1921), which has remained unattainable to gauge in the literature since then. The Geopolitical Risk Index developed by Caldara and Iacoviello (2022) is perceived as a relevant news-based measure of global geopolitical risk.[7]

Furthermore, our empirical estimations include a set of the following control variables that are consistently used in the standard asset pricing literature of this type:

i. Global bond market returns: Our benchmark for the global bond market is the J.P. Morgan Global Aggregate Bond Index (GABI), constructed by combining 5500 instruments issued in more than 60 countries, denominated in over 25 currencies, collectively representing a total market value of about USD 20 trillion (see, e.g., Dimic et al. 2021).

ii. Global liquidity conditions: Our proxy for the global liquidity conditions is the US federal funds rate. Data are from the Federal Reserve System database. We use the daily data of the US federal funds rate as an indicator of the tightening (loosening) of global liquidity conditions (see, e.g., Hamilton 1997; Ashcraft and Duffie 2007; Boubaker et al. 2019).

iii. Global bond market volatility: The literature provides evidence that uncertainty of the global bond market, as measured by implied volatility, might influence bond markets' returns (Piljak 2013). As a proxy for the bond market volatility, we utilize the daily rate of change in the Merrill Lynch Option Volatility Estimate (MOVE) Index (see, e.g., Zhou 2014). The MOVE index is calculated as the yield curve weighted index of the normalized implied volatility on 1-month Treasury options weighed on 2-, 5-, 10-, and 30-year contracts.

iv. Default spread: The default spread is defined as the difference between Moody's seasoned Baa corporate bond yield relative to the 10-year Treasury bond yield. This measure depicts shifts in economic conditions that change the likelihood of default (see, e.g., Elton et al. 2001; Bhanot 2005; Giesecke et al. 2011; Han and Zhou 2014; Huynh and Xia 2021).

v. Term spread: We utilize the term spread, calculated as the difference between the long-term government bond return and the 3-month Treasury bill return, as a proxy for interest rate risk (see, e.g., Roma and Torous 1997; Huynh and Xia 2021).

vi. Financial stress: We control for financial stress in global financial markets. We utilize the OFR Financial Stress Index (OFR FSI), which is a proxy for a daily market-based indicator of stress in global financial markets. This OFR SI is constructed from 33 financial market variables, including yield spreads, valuation measures, and interest rates. The positive values of OFR SI indicate that stress levels are above average, while negative values show that stress levels are below average (Office of Financial Research 2025). The index has only recently been considered a proxy in the financial economics literature (e.g., Liang et al. 2023; Maghyereh and Ziadat 2024).

In sum, our sample period spans from January 1st, 2013, to May 11th, 2023.[8]

3.2 | Descriptive Statistics

Table 1 displays descriptive statistics. Panel A contains daily index returns for ESG Emerging Markets Bond Index (JESG EMBI) on the aggregate and regional levels, tracking the performance of USD-denominated emerging markets government bonds. Panel B contains daily index returns for ESG Government Bond Index—Emerging Markets Index (JESG GBI-EM) on the aggregate and regional levels, tracking the

TABLE 1 | Descriptive statistics.

	Observations	Mean	Std. Deviation	Min	Max
Panel A. ESG Sovereign bonds (USD)					
EMBI Aggregate	2585	0.00008	0.00393	−0.05111	0.03517
EMBI Africa	2585	0.00007	0.00612	−0.07219	0.03501
EMBI Asia	2585	0.00008	0.00383	−0.06040	0.03201
EMBI Europe	2585	0.00000	0.00565	−0.15101	0.06665
EMBI Latin	2585	0.00008	0.00499	−0.07273	0.04712
EMBI Middle East	2585	0.00014	0.00350	−0.04784	0.03221
Panel B. ESG Sovereign bonds (local curr.)					
GBI EM Aggregate	2593	−0.00005	0.00597	−0.04895	0.03569
GBI EM Asia	2593	0.00008	0.00426	−0.03575	0.03706
GBI EM EMEA	2593	−0.00019	0.00799	−0.11340	0.04216
GBI EM Europe	2593	−0.00021	0.00771	−0.13848	0.04416
GBI EM Latin	2593	0.00001	0.00822	−0.07379	0.04690
GBI EM Middle East	2593	−0.00008	0.01394	−0.10858	0.08813
Panel C. ESG CEMBI (corporate bonds)					
CEMBI Aggregate	2585	0.00012	0.00199	−0.03113	0.01196
CEMBI Asia	2585	0.00011	0.00190	−0.01719	0.01773
CEMBI Europe	2585	0.00006	0.00518	−0.11354	0.02304
CEMBI Latin	2585	0.00013	0.00272	−0.04410	0.02211
CEMBI Middle East	2585	0.00016	0.00184	−0.03150	0.01580
Panel D. Uncertainty measures					
Risk aversion	2580	0.00000	0.06094	−1.17911	1.29795
Economic uncertainty	2580	0.00011	0.03927	−0.27749	0.43546
Ambiguity	2507	0.00028	0.59526	−2.44490	2.05444
Geopolitical risk	2593	0.00032	0.43428	−2.99588	2.34488
Panel E. Control variables					
GABI	2593	0.00001	0.00305	−0.02275	0.02145
Move	2593	0.00030	0.04500	−0.30018	0.37312
FFR	2594	0.91788	1.15383	0.04000	5.08000
Default spread	2589	2.36966	0.43721	1.56000	4.31000

(Continues)

TABLE 1 | (Continued)

	Observations	Mean	Std. Deviation	Min	Max
Term spread	2593	1.26260	0.96219	−1.89000	2.97000
FSI	2590	1697.129	969.637	1.000	4866.000

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Panel F. Correlation													
(1) Sovereign local	1												
(2) Sovereign USD	0.6889	1											
(3) Corporate bonds	0.6006	0.8579	1										
(4) Risk aversion	−0.2544	−0.3149	−0.2184	1									
(5) Economic uncertainty	−0.2389	−0.2567	−0.2168	0.6326	1								
(6) Ambiguity	0.2026	0.1471	0.0679	−0.2565	−0.3201	1							
(7) Geopolitical risk	−0.0442	−0.04	−0.0381	−0.0384	−0.019	0.0163	1						
(8) GABI	0.5217	0.5019	0.4882	0.0256	0.1346	−0.0313	−0.0447	1					
(9) MOVE	−0.292	−0.3246	−0.2416	0.2292	0.2034	−0.2049	0.0284	−0.1506	1				
(10) FFR	0.0443	0.0372	0.054	0.0064	0.0223	−0.0034	−0.0021	0.0406	0.0032	1			
(11) Default spread	0.0125	0.0292	0.0057	−0.0334	−0.0067	0.019	−0.0003	0.04	−0.0379	−0.3986	1		
(12) Term spread	−0.0555	−0.0574	−0.0871	−0.0086	−0.0132	0.0039	0.0012	−0.0695	−0.0031	−0.7616	0.2395	1	
(13) FSI	−0.0009	−0.0213	−0.0549	−0.0117	−0.0007	0.0099	−0.0076	−0.0115	−0.0327	0.1928	0.0412	−0.2021	1

Note: This table presents descriptive statistics for our variables during the sample period from January 1, 2013, to May 11, 2023. Panel A contains daily index returns for the ESG Emerging Markets Bond Index (JESG EMBI) on the aggregate and regional levels, tracking the performance of USD-denominated emerging markets government bonds. Panel B contains daily index returns for ESG Government Bond Index—Emerging Markets Index (JESG GBI-EM) on the aggregate and regional levels, tracking the performance of local currency emerging markets government bonds. Panel C shows daily index returns for the ESG CEMBI Index (USD-denominated emerging market fixed and floating-rate debt instruments issued by corporates) on the aggregate and regional levels. All returns reported in Panels A, B, and C are calculated as the first logarithmic difference and expressed as percentages. Panel D contains uncertainty measures (expressed as logarithmic change): Risk Aversion (by Bekaert et al. 2022), Economic Uncertainty (by Bekaert et al. 2022), Ambiguity (by Izhakian 2017, and Brenner and Izhakian 2018), and Geopolitical Risk Index (by Caldara and Iacoviello 2022). Panel E reports control variables: global bond market returns (GABI), global bond market volatility (MOVE Index), global liquidity conditions (US Federal Funds Rate, FFR), default spread, term spread, and the OFR Financial Stress Index. Panel F reports correlation.

performance of local currency emerging market government bonds. Panel C shows daily index returns for the ESG CEMBI Index (US Dollar-denominated emerging market fixed and floating-rate debt instruments issued by corporates) on the aggregate and regional levels. All of these returns are calculated as the logarithmic first difference of the bond price indices and are expressed in percentages. Panel D contains uncertainty measures in a broad sense (expressed as logarithmic change): Risk Aversion (by Bekaert et al. 2022), Economic Uncertainty (by Bekaert et al. (2022), Ambiguity (by Izhakian 2017; Brenner and Izhakian 2018; Izhakian 2020), and Geopolitical Risk Index (by Caldara and Iacoviello 2022). Panel E reports control variables: global bond market benchmark (GABI), bond market volatility (MOVE Index), US Federal Funds Rate (FFR), default spread, term spread, and financial stress. Panel F reports correlation.

3.3 | Methodology

Methodological framework is similar to Baur and Smales (2020) and Benkraiem et al. (2025). More specifically, we apply regression analysis with different specifications to investigate the impact of various uncertainty sources on the ESG thematic bond returns from emerging markets.

The regression specification is expressed by the following equation:

$$R_t = \beta_0 + \beta_1 \Delta \log(U) + \beta_2 \quad GABI_t + \beta_3 \quad MOVE_t + \beta_4 \quad FFR_t + \beta_5 \quad Default\ Spread_t + \beta_6 \quad Term\ Spread_t + \beta_7 \quad FSI_t + \varepsilon_t \tag{1}$$

where R_t denotes the daily log return of the particular ESG emerging bond index (sovereign denominated in USD, sovereign denominated in local currency, and corporate), U denotes different uncertainty sources (risk aversion, economic uncertainty, ambiguity, and geopolitical risk), while $GABI_t$represents the global bond market returns, $MOVE_t$ is global bond market volatility, FFR_t is U.S. federal funds rate, $Default\ Spread_t$ is default spread, $Term\ Spread_t$ represents term spread, and FSI_t represents financial stress index.

The estimation results from Equation (1) are reported for different model specifications, including each uncertainty source separately: Model 1 displays the results with risk aversion as the main explanatory variable, Model 2 reports economic uncertainty, Model 3 shows ambiguity, Model 4 reports geopolitical risk, while Model 5 shows the results of the regression specification with all uncertainty sources together.

4 | Empirical Results

In this section, we report empirical results on the impact of uncertainty and risk aversion on ESG thematic bond returns in emerging market countries. To facilitate the interpretation of results from the bond issuer perspective, in the following subsections, we present the results separately for sovereign and corporate ESG thematic bonds. Similarly, to provide further insight from the currency aspect, we present the results separately for USD and local currency ESG sovereign thematic bonds.

4.1 | USD-Denominated ESG Sovereign Emerging Bond Markets

Table 2 reports the impact of uncertainty sources on USD-denominated ESG sovereign emerging bond markets on the aggregate index level (JESG EMBI). The first four columns display the results for each uncertainty source separately (Model 1 displays the results with risk aversion as the main explanatory variable, Model 2 reports economic uncertainty, Model 3 shows ambiguity, and Model 4 displays geopolitical risk), while Model 5 shows the results of the regression specification with all uncertainty sources together. All specifications include the following control variables: global bond market returns (GABI), global bond market volatility (MOVE), global liquidity conditions (FFR), default spread, term spread, and financial stress (FSI).

The results from Models 1 and 2 indicate that the relationship of USD-denominated ESG sovereign emerging bond market returns with both risk aversion and economic uncertainty is negative and statistically significant at a 1% level. This result points out that increases in risk aversion and economic uncertainty are associated with declines in ESG sovereign emerging bond market returns. Our findings align with results in general bond literature that utilizes a high-frequency novel measure of Bekaert et al. (2022) in the US context. Specifically, Bianchi et al. (2020) find that time-varying risk aversion and economic uncertainty play important roles in US government bond return predictability. Our study extends this evidence in the context of emerging sovereign bond markets and the ESG framework. In Model 3, we establish a positive and statistically significant relationship between ambiguity and USD-denominated ESG sovereign emerging bond market returns. The findings are noteworthy and along the lines of the predicted behaviour of financial assets with respect to the pricing of ambiguity, as in Brenner and Izhakian (2018). Moreover, it represents additional evidence that ambiguity matters in international asset pricing, as also noted by Kim and Byun (2021), who examine the impact on equity prices. However, the research on the impact of ambiguity on bond returns in emerging markets is almost nonexistent, and our results provide novel evidence in this framework. Model 4 shows that geopolitical risk has an insignificant relationship with the USD-denominated ESG sovereign emerging bond market returns at the aggregate level.

Finally, Model 5, which reports specifications with all uncertainty sources together, validates the importance of risk aversion, economic uncertainty, and ambiguity in explaining returns of ESG thematic bonds in emerging markets (documented in the baseline models with individual uncertainty sources). Consequently, we document that broad uncertainty sources that are found to be important in the general asset pricing literature are also relevant in ESG emerging market settings.

Table 3 reports the results on the performance of USD-denominated ESG sovereign emerging bond returns for each

TABLE 2 | ESG sovereign bonds (USD-denominated): Aggregate level.

	(1)	(2)	(3)	(4)	(5)
Risk aversion	−0.0182***				−0.0111***
	(−17.8959)				(-8.6921)
Economic uncertainty		−0.0284***			−0.0171***
		(−17.8336)			(−8.2981)
Ambiguity			0.0008***		0.0002*
			(6.8212)		(1.7881)
Geopolitical risk				−0.0001	−0.0002
				(−0.7251)	(-1.5256)
GABI	0.6338***	0.6754***	0.6092***	0.6083***	0.6529***
	(31.8173)	(33.4045)	(27.9848)	(28.8976)	(31.5481)
MOVE	−0.0160***	−0.0161***	−0.0204***	−0.0219***	−0.0148***
	(−11.5378)	(−11.6000)	(−13.6189)	(−15.3300)	(−10.3560)
FFR	−0.0000	0.0000	0.0000	−0.0000	0.0000
	(−0.4525)	(0.0687)	(0.2738)	(−0.1851)	(0.4399)
Default spread	0.0000	0.0001	0.0001	0.0001	0.0001
	(0.0789)	(0.6345)	(0.6023)	(0.5996)	(0.4332)
Term spread	−0.0001	−0.0001	−0.0001	−0.0001	−0.0001
	(−1.3328)	(−0.9533)	(−1.1597)	(−1.1790)	(−1.1109)
FSI	−0.0000*	−0.0000	−0.0000*	−0.0000*	−0.0000**
	(−1.7885)	(−1.5574)	(−1.9217)	(−1.6547)	(−1.9919)
N	2574	2574	2500	2580	2499
r^2	0.3990	0.3986	0.3296	0.3239	0.4131

Note: This table reports the estimation results from Equation (1), where the dependent variable is the daily return on USD-denominated ESG sovereign emerging bond markets index on the aggregate index level (JESG EMBI). The key explanatory variables are Risk aversion, Economic uncertainty, Ambiguity, and Geopolitical risk. The set of control variables includes global bond market returns (GABI), global bond market volatility (MOVE Index), global liquidity conditions (US Federal Funds Rate, FFR), default spread, term spread, and Financial Stress Index (FSI). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively.

region separately (Africa, Asia, Europe, Latin America, Middle East). For the risk aversion variable, the negative relationship with ESG thematic bond returns is documented in all individual regression specifications (Model 1). The pattern of negative and significant coefficients for economic uncertainty observed at the aggregate level also holds across all regions (Model 2). However, in the specification, when all our explanatory variables are included (Model 5), the statistically significant results remain for Africa, Latin America, and the Middle East. This is aligned with the narrative that, for instance, the Latin American region is usually perceived as an economically unstable and uncertain market segment characterized by episodes of financial crises, unsustainable sovereign spreads, sudden stops in capital flows, capital flight, and growth rate collapses (Dachraoui et al. 2020). The relationship between ambiguity and USD-denominated ESG sovereign emerging bond market returns (Model 3) shows a statistically significant and positive relationship for Africa, Europe, Latin America, and the Middle East in individual regression specifications. When all the uncertainty sources are included (Model 5), ambiguity importance is shown to be present only in the Latin America region.

Similarly, as for the ambiguity measure, our analysis of regional markets reveals heterogeneity regarding geopolitical risk as well. In particular, we establish statistically significant and negative relationships between geopolitical risk and USD-denominated ESG sovereign emerging bond market returns for Asia and the Middle East (Model 4). The significant results for the Asian region might be connected to geopolitical tensions between China and the US related to the trade war and the US withdrawal from the Trans-Pacific Partnership during Trump's administration (Li and Whalley 2021). Additionally, Model 5 reveals that in addition to the Asia and Middle East regions, geopolitical risk is a significant factor in the African region as well.

4.2 | Local Currency Denominated ESG Sovereign Emerging Bond Markets

Understanding sovereign debt risk and choices of debt currency denomination are important issues in the finance literature, as the local currency emerging bond markets have grown substantially (Burger et al. 2012). In their research, both Du and Schreger (2022) and Eichengreen et al. (2023) emphasize the gradual shift toward local currency sovereign bonds in emerging markets. Furthermore, Amstad et al. (2020) point out that sovereign risk is lower for local currency-denominated bonds compared to foreign currency-denominated bonds; however, these differences have a converging trend over time. To understand the reaction of the local currency sovereign bonds to the broad sources of uncertainty, we present the results below.

TABLE 3 | ESG sovereign bonds (USD-denominated): Regional level.

	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Panel A: Africa						*Panel B: Asia*				
Risk aversion	−0.0265***				−0.0160***	−0.0040***				0.0020
	(−14.8695)				(−7.1715)	(−3.5829)				(1.3857)
Economic uncertainty		−0.0426***			−0.0261***		−0.0136***			−0.0163***
		(−15.2913)			(−7.2607)		(−7.7988)			(−7.1503)
Ambiguity			0.0011***		0.0002			0.0001		−0.0001
			(5.6311)		(1.2463)			(1.1217)		(−1.0213)
Geopolitical risk				−0.0003	−0.0005*				−0.0003**	−0.0003**
				(−1.2042)	(−1.9287)				(−2.0867)	(−2.1949)
GABI	0.6220***	0.6853***	0.5931***	0.5833***	0.6580***	0.5528***	0.5788***	0.5302***	0.5446***	0.5585***
	(17.8000)	(19.3757)	(15.8740)	(16.0771)	(18.2063)	(25.1338)	(26.1774)	(23.1667)	(24.7995)	(24.3446)
MOVE	−0.0258***	−0.0257***	−0.0314***	−0.0344***	−0.0231***	−0.0106***	−0.0091***	−0.0127***	−0.0118***	−0.0107***
	(−10.6329)	(−10.6106)	(−12.2151)	(−13.9830)	(−9.2414)	(−6.9320)	(−6.0206)	(−8.0425)	(−7.9329)	(−6.7123)
FFR	−0.0002	−0.0001	−0.0000	−0.0002	0.0000	−0.0000	−0.0000	−0.0000	−0.0000	0.0000
	(−1.1898)	(−0.7507)	(−0.0348)	(−1.0238)	(0.0968)	(−0.4595)	(−0.2844)	(−0.1496)	(−0.3394)	(0.0693)
Default spread	−0.0001	0.0001	0.0001	0.0001	0.0001	−0.0001	−0.0001	−0.0001	−0.0001	−0.0000
	(−0.1940)	(0.2689)	(0.4371)	(0.2117)	(0.2905)	(−0.4758)	(−0.3627)	(−0.3153)	(−0.3189)	(−0.2148)
Term spread	−0.0003	−0.0002	−0.0002	−0.0002	−0.0002	−0.0002	−0.0001	-0.0002	−0.0002	−0.0001
	(−1.3353)	(−1.0156)	(−1.2310)	(−1.2115)	(−1.1795)	(−1.3048)	(−1.1736)	(−1.3309)	(−1.3053)	(−1.1846)
FSI	−0.0000*	−0.0000	−0.0000**	−0.0000*	−0.0000**	−0.0000*	−0.0000	−0.0000**	−0.0000*	−0.0000**
	(−1.8016)	(−1.6084)	(−2.0065)	(−1.7344)	(−2.0573)	(−1.7151)	(−1.6322)	(−2.0886)	(−1.6863)	(−2.0609)
N	2574	2574	2500	2580	2499	2574	2574	2500	2580	2499
r^2	0.2381	0.2415	0.1809	0.1722	0.2576	0.2329	0.2469	0.2196	0.2300	0.2404
Panel C: Europe						*Panel D: Latin*				
Risk aversion	−0.0141***				−0.0022	−0.0262***				−0.0206***
	(−8.2546)				(−1.0114)	(−20.7362)				(−12.8505)
Economic uncertainty		−0.0321***			−0.0301***		−0.0334***			−0.0120***
		(−12.1576)			(−8.6297)		(−16.4028)			(−4.6553)
Ambiguity			0.0007***		0.0001			0.0011***		0.0004***
			(3.8498)		(0.4882)			(7.6335)		(2.8410)
Geopolitical risk				−0.0001	-0.0002				0.0001	−0.0000
				(−0.5137)	(−0.8252)				(0.5308)	(−0.2875)

(Continues)

TABLE 3 | (Continued)

	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
GABI	0.4876***	0.5431***	0.4645***	0.4679***	0.5251***	0.8139***	0.8566***	0.7848***	0.7788***	0.8290***
	(14.5170)	(16.1749)	(13.0958)	(13.7983)	(14.9544)	(32.7588)	(33.0569)	(28.4608)	(29.1098)	(31.8591)
MOVE	−0.0152***	−0.0131***	−0.0187***	−0.0197***	−0.0136***	−0.0197***	−0.0214***	−0.0255***	−0.0282***	−0.0182***
	(−6.4857)	(−5.7150)	(−7.6568)	(−8.5784)	(−5.5730)	(−11.3928)	(−12.0331)	(−13.4228)	(−15.5885)	(−10.0824)
FFR	0.0002	0.0003	0.0003	0.0002	0.0003*	−0.0001	−0.0000	−0.0000	−0.0001	−0.0000
	(1.3139)	(1.6446)	(1.5727)	(1.4299)	(1.8517)	(−0.7901)	(−0.2464)	(−0.0322)	(−0.4310)	(−0.0364)
Default spread	0.0004	0.0004*	0.0004*	0.0004*	0.0005*	−0.0001	−0.0000	−0.0000	−0.0000	−0.0001
	(1.4493)	(1.7368)	(1.6737)	(1.6937)	(1.7545)	(−0.6835)	(−0.0435)	(−0.0525)	(−0.0234)	(−0.4359)
Term spread	0.0000	0.0001	0.0000	0.0000	0.0001	−0.0002	−0.0001	−0.0001	−0.0002	−0.0001
	(0.1083)	(0.3477)	(0.1692)	(0.1430)	(0.3590)	(−1.2183)	(−0.8165)	(−1.0101)	(−1.0355)	(−1.0634)
FSI	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000*	−0.0000	−0.0000*	−0.0000*	−0.0000*
	(−0.1589)	(−0.0062)	(−0.2298)	(−0.1363)	(−0.1604)	(−1.8362)	(−1.5725)	(−1.8480)	(−1.6515)	(−1.9550)
N	2574	2574	2500	2580	2499	2574	2574	2500	2580	2499
r2	0.1319	0.1574	0.1102	0.1090	0.1551	0.4232	0.3904	0.3352	0.3264	0.4265

	(1)	(2)	(3)	(4)	(5)
Panel E: Middle East					
Risk aversion	−0.0132***				−0.0093***
	(−12.8606)				(−7.1396)
Economic uncertainty		−0.0189***			−0.0103***
		(−11.7144)			(−4.9002)
Ambiguity			0.0003***		−0.0001
			(3.1089)		(−0.5010)
Geopolitical risk				−0.0003*	−0.0003**
				(−1.7694)	(−2.4164)
GABI	0.4425***	0.4689***	0.4185***	0.4232***	0.4465***
	(21.9565)	(22.8116)	(19.3493)	(20.4210)	(21.0691)
MOVE	−0.0082***	−0.0086***	−0.0125***	−0.0125***	−0.0084***
	(−5.8494)	(−6.1113)	(−8.3940)	(−8.8803)	(−5.6944)
FFR	−0.0001	−0.0001	−0.0001	−0.0001	−0.0001
	(−1.1035)	(−0.7434)	(−0.7755)	(−0.9527)	(−0.7358)
Default spread	−0.0000	0.0000	0.0000	0.0000	0.0000

(Continues)

TABLE 3 | (Continued)

	(1)	(2)	(3)	(4)	(5)
	(−0.0983)	(0.2982)	(0.1816)	(0.2290)	(0.0437)
Term spread	−0.0002	−0.0001	−0.0002	−0.0002	−0.0002
	(−1.5224)	(−1.2598)	(−1.4110)	(−1.4132)	(−1.4050)
FSI	−0.0000	−0.0000	−0.0000*	−0.0000	−0.0000*
	(−1.5458)	(−1.3860)	(−1.7493)	(−1.4845)	(−1.8078)
N	2574	2574	2500	2580	2499
r^2	0.2309	0.2228	0.1786	0.1820	0.2351

Note: This table reports the estimation results from Equation (1), where the dependent variable is the daily return on USD-denominated ESG sovereign emerging bond markets on the regional level (Africa, Asia, Europe, Latin America, Middle East). The key explanatory variables are Risk aversion, Economic uncertainty, Ambiguity, and Geopolitical risk. The set of control variables includes global bond market returns (GABI), global bond market volatility (MOVE Index), global liquidity conditions (US Federal Funds Rate, FFR), default spread, term spread, and Financial Stress Index (FSI). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 4 reports the impact of uncertainty sources on local currency-denominated ESG sovereign emerging bond markets on the aggregate level. The results from Models 1 and 2 confirm the same negative and highly statistically significant relationship observed in the case of the USD-denominated ESG sovereign emerging bond market returns. These findings imply that increases in risk aversion and economic uncertainty are associated with decreases in local currency-denominated ESG sovereign emerging bond market returns. Our results are in line with the findings of Asgharian et al. (2023) that risk aversion and economic uncertainty play an important role in the international portfolio analysis. In Model 3, we document a positive and statistically significant relationship between ambiguity and local currency-denominated ESG sovereign emerging bond market returns. The results reported in Model 4 indicate that geopolitical risk has no significant impact on the aggregate level, as noted before for USD-denominated sovereign emerging market bonds.

The specification in Model 5 with all uncertainty sources in the same regression indicates a negative and statistically significant relationship for both risk aversion and economic uncertainty, while ambiguity exhibits a positive and statistically significant impact on ESG thematic local currency-denominated bonds. To sum up, our evidence shows that the impact of the uncertainty sources on emerging market government bonds is equal regardless of the currency denomination.

Table 5 reports the results of the impact of broad uncertainty sources on the local currency regional emerging market ESG bond indices (Asia, EMEA, Europe, Latin America, Middle East). In all models, risk aversion and economic uncertainty exhibit negative and statistically significant relationships with ESG thematic local currency-denominated emerging bonds (Models 1 and 2). On the other hand, ambiguity exhibits a positive and statistically significant relationship across all markets (Model 3). In principle, our results hold for Model 5 (all uncertainty sources included) as well, with the exception of the Asian region. The comparison between local and USD currency denominations on a regional level reveals that ambiguity plays a more important role in local currency-denominated ESG bonds, as presented results in Table 5 (Models 3 and 5) show significance across all emerging market regions. The geopolitical risk still might have an influence, and there is heterogeneity across regions (EMEA and the Middle East regions being most vulnerable to geopolitical exposure). These findings can lend support to a wider literature on the heterogeneity of emerging financial markets (Tillmann 2016; Agur et al. 2019; Chaieb et al. 2020; Dimic et al. 2021).

4.3 | ESG Corporate Emerging Bond Markets

As sovereign emerging market ESG bond participation represents 23% of overall issuances (World Bank Treasury 2024), the remaining share of the participating issuers is allocated to the corporate sector. Consequently, to reflect the importance of the corporate sector in the emerging market context, in this section, we examine corporate ESG thematic bonds.

Table 6 displays the effects of uncertainty sources on USD-denominated ESG corporate emerging bond markets on the aggregate level. The results on risk aversion and economic

TABLE 4 | ESG sovereign bonds (local currency): Aggregate level.

	(1)	(2)	(3)	(4)	(5)
Risk aversion	−0.0224***				−0.0086***
	(−14.2228)				(−4.4045)
Economic uncertainty		−0.0425***			−0.0297***
		(−17.5844)			(−9.4309)
Ambiguity			0.0018***		0.0011***
			(11.0474)		(6.6263)
Geopolitical risk				−0.0002	−0.0003
				(−1.1152)	(−1.6301)
GABI	0.9878***	1.0564***	0.9938***	0.9590***	1.0591***
	(31.9877)	(34.3626)	(30.3992)	(29.9821)	(33.4173)
MOVE	−0.0230***	−0.0215***	−0.0242***	−0.0301***	−0.0175***
	(−10.6861)	(−10.2040)	(−10.7792)	(−13.9129)	(−7.9548)
FFR	0.0001	0.0001	0.0001	0.0001	0.0001
	(0.5282)	(1.0123)	(0.5978)	(0.5233)	(0.8455)
Default spread	−0.0002	−0.0001	−0.0001	−0.0001	−0.0001
	(−0.7116)	(−0.2713)	(−0.4782)	(−0.3363)	(−0.5876)
Term spread	−0.0001	−0.0000	−0.0001	−0.0001	−0.0000
	(-0.5317)	(−0.1864)	(−0.3998)	(−0.4391)	(−0.2454)
FSI	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000
	(−0.5118)	(−0.3006)	(−0.4479)	(−0.5822)	(−0.3879)
N	2578	2578	2504	2586	2503
r^2	0.3748	0.3980	0.3515	0.3259	0.4094

Note: This table reports the estimation results from Equation (1), where the dependent variable is the daily return on local currency-denominated ESG sovereign emerging bond markets index on the aggregate index level (JESG GBI-EM). The key explanatory variables are Risk aversion, Economic uncertainty, Ambiguity, and Geopolitical risk. The set of control variables includes global bond market returns (GABI), global bond market volatility (MOVE Index), global liquidity conditions (US Federal Funds Rate, FFR), default spread, term spread, and Financial Stress Index (FSI). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

uncertainty (Models 1 and 2) are aligned with the negative and significant relationship identified in the case of ESG sovereign bonds (both USD and local currency denominated). Similar to sovereign bond results, individual specification with ambiguity (Model 3) shows a positive and significant coefficient. Furthermore, the results regarding geopolitical risk (Model 4) are similar to the results obtained for sovereign bonds, pointing out that geopolitical risk has no significant impact on ESG corporate bond returns in emerging markets. Model 5, including all uncertainty sources, confirms that all sources except geopolitical risk are significant. However, ambiguity impacts corporate bonds with a negative sign.

Table 7 presents the results of the relationship between broad sources of uncertainty and thematic ESG corporate emerging bonds at the regional level. Model 1 reveals that risk aversion remains important for corporate bonds, confirming a significant negative relationship in all the regions except Asia, where it exhibits a positive coefficient. The specification with economic uncertainty (Model 2) shows slight differences across regions, as in the Asian region, there is no significant impact on the ESG corporate bond returns. The results of Model 3, where ambiguity is a proxy for uncertainty, reveal positive and significant coefficients in all regions except Asia, where the coefficient is negative. This heterogeneous response to ambiguity has support in the literature as it arises from heterogeneity of attitudes with respect to ambiguity (Bossaerts et al. 2010). Geopolitical risk remains insignificant across all regions (Model 4). Finally, in Model 5, we observe that in the corporate segment, there is more heterogeneity across regions than in the sovereign segment of ESG thematic bonds. In particular, the risk aversion and ambiguity coefficients vary across the regions, and the sign is not as consistent as in the specifications with sovereign bonds.

In sum, our results for all three categories of ESG thematic bonds in emerging markets (sovereign denominated in USD, sovereign denominated in local currency, and corporate bonds) indicate that risk aversion, economic uncertainty, and ambiguity play important roles in determining bond returns. Geopolitical uncertainty is less relevant, although it exhibits a significant effect on sovereign bonds in certain regions.

Our empirical findings provide support for Hypotheses 1 and 2, indicating that increases in investor risk aversion and economic uncertainty are consistently associated with lower returns on ESG thematic bonds in emerging markets. Hypothesis 3 is also supported by the data: we find a positive and statistically significant relationship between ambiguity and ESG bond returns across bond categories in most specifications, suggesting that investors demand compensation for exposure to ambiguity regarding ESG risks and uncertain policy environments. This finding aligns with theoretical models of ambiguity aversion, in which investors form worst-case expectations and price

TABLE 5 | ESG sovereign bonds (local currency): Regional level.

	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Panel A: Asia						*Panel B: EMEA*				
Risk aversion	−0.0039***				0.0058***	−0.0246***				−0.0068**
	(−2.9237)				(3.4863)	(−11.5564)				(−2.5582)
Economic uncertainty		−0.0190***			−0.0234***		−0.0510***			−0.0386***
		(−9.2458)			(−8.6856)		(−15.5779)			(−9.0449)
Ambiguity			0.0006***		0.0003**			0.0023***		0.0015***
			(4.4428)		(2.1823)			(10.4184)		(6.4994)
Geopolitical risk				−0.0001	−0.0001				−0.0004	−0.0005*
				(−0.7184)	(−0.6527)				(−1.3101)	(−1.8049)
GABI	0.4364***	0.4749***	0.4332***	0.4313***	0.4729***	1.3703***	1.4554***	1.3808***	1.3375***	1.4607***
	(16.7392)	(18.2220)	(16.0025)	(16.5818)	(17.4680)	(32.7520)	(34.9733)	(31.5809)	(31.2530)	(34.0589)
MOVE	−0.0103***	-0.0076***	−0.0104***	−0.0115***	−0.0085***	−0.0240***	−0.0216***	−0.0235***	−0.0319***	−0.0159***
	(−5.6613)	(−4.2710)	(−5.6083)	(−6.5108)	(−4.5235)	(−8.2597)	(−7.5641)	(−7.8250)	(−11.0021)	(−5.3491)
FFR	−0.0001	−0.0001	−0.0001	−0.0002	−0.0000	0.0002	0.0003	0.0002	0.0002	0.0003
	(−1.1758)	(−0.9976)	(−0.5344)	(−1.2144)	(−0.2557)	(1.0555)	(1.4842)	(1.0973)	(0.9498)	(1.3633)
Default spread	−0.0001	−0.0001	−0.0001	−0.0001	−0.0000	−0.0001	0.0000	−0.0000	−0.0000	−0.0000
	(−0.4510)	(−0.3575)	(−0.3375)	(−0.3846)	(−0.1617)	(−0.2955)	(0.0695)	(−0.0997)	(−0.0506)	(−0.1317)
Term spread	−0.0004***	−0.0004***	−0.0004***	−0.0004***	−0.0004**	0.0001	0.0001	0.0001	0.0001	0.0001
	(−2.7141)	(−2.5919)	(−2.6763)	(−2.6925)	(−2.5035)	(0.3122)	(0.6277)	(0.4344)	(0.3702)	(0.6251)
FSI	0.0000	0.0000	−0.0000	0.0000	−0.0000	−0.0000	−0.0000	0.0000	−0.0000	0.0000
	(0.4813)	(0.6020)	(-0.1845)	(0.4216)	(−0.1075)	(−0.1956)	(−0.0043)	(0.0117)	(−0.2966)	(0.0890)
N	2578	2578	2504	2586	2503	2578	2578	2504	2586	2503
r^2	0.1297	0.1549	0.1309	0.1271	0.1579	0.3563	0.3813	0.3444	0.3229	0.3887
Panel C: Europe						*Panel D: Latin*				
Risk aversion	−0.0217***				−0.0044*	−0.0376***				−0.0254***
	(−10.4364)				(−1.6884)	(−16.1431)				(−8.6126)
Economic uncertainty		−0.0476***			−0.0387***		−0.0545***			−0.0249***
		(−14.9455)			(−9.3239)		(−14.8304)			(−5.2386)
Ambiguity			0.0020***		0.0012***			0.0022***		0.0012***
			(9.0901)		(5.2782)			(8.9185)		(4.8377)
Geopolitical risk				−0.0002	−0.0004				−0.0001	−0.0003
				(−0.8682)	(−1.3215)				(−0.3463)	(−0.8642)

(Continues)

TABLE 5 | (Continued)

	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
GABI	1.3260***	1.4072***	1.3402***	1.2979***	1.4189***	0.9693***	1.0455***	0.9695***	0.9230***	1.0425***
	(32.5516)	(34.7686)	(31.5741)	(31.3240)	(33.9946)	(21.2034)	(22.3810)	(19.6890)	(19.2953)	(21.8155)
MOVE	−0.0191***	−0.0164***	−0.0186***	−0.0261***	−0.0116***	−0.0348***	−0.0359***	−0.0398***	−0.0470***	−0.0293***
	(−6.7434)	(−5.9036)	(−6.3591)	(−9.2927)	(−4.0040)	(−10.9493)	(−11.2023)	(−11.7434)	(−14.5185)	(−8.8476)
FFR	0.0004**	0.0005***	0.0005**	0.0004**	0.0005**	0.0001	0.0002	0.0001	0.0002	0.0001
	(2.2049)	(2.6350)	(2.1650)	(2.1755)	(2.4808)	(0.6500)	(1.0889)	(0.3942)	(0.7491)	(0.4674)
Default spread	0.0003	0.0004	0.0003	0.0004	0.0003	−0.0003	−0.0001	−0.0002	−0.0002	−0.0003
	(0.9164)	(1.2728)	(1.0761)	(1.1549)	(1.1185)	(−0.9111)	(−0.4087)	(−0.6628)	(−0.4298)	(−0.9475)
Term spread	0.0002	0.0002	0.0002	0.0002	0.0002	−0.0000	0.0001	−0.0000	-0.0000	0.0000
	(0.7389)	(1.0477)	(0.8732)	(0.7783)	(1.0909)	(−0.1160)	(0.2048)	(−0.0281)	(−0.0367)	(0.0268)
FSI	0.0000	0.0000	0.0000	0.0000	0.0000	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000
	(0.0814)	(0.2700)	(0.3463)	(0.0187)	(0.4382)	(−1.3197)	(−1.1217)	(−1.0544)	(−1.2996)	(−1.0599)
N	2578	2578	2504	2586	2503	2578	2578	2504	2586	2503
r^2	0.3438	0.3707	0.3335	0.3166	0.3756	0.2806	0.2701	0.2294	0.2082	0.2968

	(1)	(2)	(3)	(4)	(5)
Panel E: Middle East					
Risk aversion	−0.0368***				−0.0155***
	(−8.7614)				(−2.9046)
Economic uncertainty		−0.0670***			−0.0416***
		(−10.2464)			(−4.8586)
Ambiguity			0.0037***		0.0026***
			(8.5194)		(5.8575)
Geopolitical risk				−0.0010*	−0.0012**
				(−1.7783)	(−2.1079)
GABI	1.5558***	1.6619***	1.5572***	1.5035***	1.6474***
	(18.8858)	(19.9904)	(18.0706)	(18.0150)	(19.1200)
MOVE	−0.0455***	−0.0437***	−0.0455***	−0.0570***	−0.0350***
	(−7.9479)	(−7.6779)	(−7.6816)	(−10.0855)	(−5.8656)
FFR	−0.0006	−0.0004	−0.0005	−0.0006	−0.0005
	(−1.3918)	(−1.1187)	(−1.2365)	(−1.5566)	(−1.1517)
Default spread	−0.0016**	−0.0014**	−0.0015**	−0.0015**	−0.0016**

(Continues)

TABLE 5 | (Continued)

	(1)	(2)	(3)	(4)	(5)
	(−2.5446)	(−2.2838)	(−2.3575)	(-2.3764)	(−2.4741)
Term spread	−0.0003	−0.0002	−0.0003	−0.0003	−0.0002
	(−0.6212)	(−0.4154)	(−0.5646)	(−0.5548)	(−0.4936)
FSI	−0.0000v	−0.0000	−0.0000	−0.0000	−0.0000
	(−0.5690)	(−0.4430)	(−0.5241)	(-0.6966)	(−0.4925)
N	2578	2578	2504	2586	2503
r^2	0.1846	0.1932	0.1781	0.1608	0.2034

Note: This table reports the estimation results from Equation (1), where the dependent variable is the daily return on local currency-denominated ESG sovereign emerging bond markets index on the regional level (Asia, EMEA, Europe, Latin America, Middle East). The key explanatory variables are Risk aversion, Economic uncertainty, Ambiguity, and Geopolitical risk. The set of control variables includes global bond market returns (GABI), global bond market volatility (MOVE Index), global liquidity conditions (US Federal Funds Rate, FFR), default spread, term spread, and Financial Stress Index (FSI). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

ambiguity as a distinct source of risk. Rather than viewing the positive effect as a hedge or anomaly, we posit that it likely reflects pricing of non-traditional risks in ESG emerging markets (e.g., unclear sustainability regulations, weak enforcement, or unreliable ESG disclosure standards) where investor heterogeneity and institutional constraints can mitigate traditional flight-to-safety behaviour. In contrast, Hypothesis 4 is not supported by the data, as geopolitical risk does not exhibit a robust or consistent relationship with ESG bond returns, apart from limited effects in specific sovereign bond segments.

4.4 | Comparative Angle: ESG Versus Non-ESG Emerging Bond Markets

In this section, we focus on the non-ESG bonds (aggregate and regional level) and compare the results with those obtained for ESG bonds.

The non-ESG bonds data set includes the sovereign bonds segment of emerging markets, tracked by the J.P. Morgan EMBI Global Diversified (EMBI) and Government Bond Index—Emerging Markets Index (GBI-EM). The J.P. Morgan EMBI Global Diversified (EMBI) is a comprehensive fixed-income benchmark that offers exposure to the USD-denominated sovereign emerging markets asset class, while GBI-EM represents a benchmark that provides exposure to the local currency-denominated sovereign bonds of emerging markets. The corporate market segment is proxied by the J.P. Morgan CEMBI Index that tracks the performance of liquid, US Dollar-denominated emerging market fixed and floating-rate debt instruments issued by corporates.

Table 8 reports the results for non-ESG sovereign USD-denominated bonds on the aggregate index level. The results from all model specifications with separate individual uncertainty sources (Models 1–4) and with all uncertainty sources together (Model 5) are the same as for ESG bonds in terms of signs and significance of uncertainty source variables. Table 9 shows the results from the regional analysis. The results are generally almost the same, with the exception in only 2 cases: (1) risk aversion in Model 5 for Asia and Europe, as this uncertainty source was not significant for ESG bonds, but it became significant for non-ESG bonds, and (2) geopolitical risk in specification with individual uncertainty source (Model 4) for Middle East, where geopolitical risk is not significant for non-ESG bonds.

Table 10 displays the results for non-ESG sovereign local currency bonds at the aggregate index level, while Table 11 shows the same segment at the regional level. The results reveal that non-ESG bonds respond to uncertainty sources in an identical way to their ESG counterparts, and this result holds true in both the aggregate and regional levels.

Table 12 shows the results for non-ESG corporate bonds at the aggregate index level, while Table 13 reports the same segment at the regional level. Similar to sovereign local currency bond segment, the corporate bond segment exhibits the same results for non-ESG and ESG bonds in terms of signs and significance of uncertainty source variables.

In summary, the comparison between ESG and non-ESG emerging market bonds reveals that uncertainty sources are

TABLE 6 | ESG CEMBI (corporate bonds): Aggregate level.

	(1)	(2)	(3)	(4)	(5)
Risk aversion	−0.0065***				−0.0023***
	(−11.8302)				(−3.4002)
Economic uncertainty		−0.0129***			−0.0114***
		(−15.2788)			(−10.3525)
Ambiguity			0.0002***		−0.0001*
			(2.8335)		(−1.6724)
Geopolitical risk				−0.0001	−0.0001
				(−0.7705)	(−1.2133)
GABI	0.3173***	0.3386***	0.3032***	0.3081***	0.3276***
	(29.4751)	(31.5269)	(26.4875)	(27.9751)	(29.5316)
MOVE	−0.0055***	−0.0049***	−0.0074***	−0.0076***	−0.0050***
	(−7.3098)	(−6.7030)	(−9.3381)	(−10.1404)	(−6.5224)
FFR	−0.0001	−0.0001	−0.0000	−0.0001	−0.0000
	(−1.4822)	(−1.0991)	(−0.3813)	(−1.2530)	(−0.1354)
Default spread	−0.0001	−0.0000	−0.0000	−0.0000	−0.0000
	(−0.7181)	(−0.3527)	(−0.1374)	(−0.3147)	(−0.1752)
Term spread	−0.0002***	−0.0002***	−0.0002***	−0.0002***	−0.0002***
	(−3.0703)	(−2.8157)	(−2.9160)	(−2.9430)	(−2.8457)
FSI	−0.0000***	−0.0000***	−0.0000***	−0.0000***	−0.0000***
	(−3.6858)	(−3.5530)	(−3.9272)	(−3.5722)	(−4.0235)
N	2574	2574	2500	2580	2499
r^2	0.3207	0.3434	0.2773	0.2839	0.3427

Note: This table reports the estimation results from Equation (1), where the dependent variable is the daily return on USD- denominated ESG corporate emerging bond markets index on the aggregate level (ESG CEMBI). The key explanatory variables are Risk aversion, Economic uncertainty, Ambiguity, and Geopolitical risk. The set of control variables includes global bond market returns (GABI), global bond market volatility (MOVE Index), global liquidity conditions (US Federal Funds Rate, FFR), default spread, term spread, and Financial Stress Index (FSI). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

generally reflected in bond returns in the same way, regardless of the ESG nature of the bonds. This finding might be explained by the fact that investors in emerging bond markets consider these bonds as 'equity-like' (Panchenko and Wu 2009; Piljak 2013; Dimic et al. 2021) due to their higher risks. The finding that ESG-related preferences do not yield any difference in uncertainty perception in emerging bond markets might be related to a less advanced regulatory framework and limited governmental support for ESG initiatives in emerging markets (Tansan et al. 2023). In addition, geopolitical uncertainty can lead to heightened market volatility, affecting bond yields and overall market sentiment (Dong et al. 2023; Sohag et al. 2022; Tang et al. 2023), which consequently might influence the perception of sovereign and country risks in emerging economies (NguyenHuu and Örsal 2023). Furthermore, investors in emerging markets are facing heightened geopolitical uncertainty (Zaremba et al. 2022), which can either boost demand for green bonds given their hedging potential or diminish it by raising uncertainty about future market prospects (Liu et al. 2024; Mertzanis and Tebourbi 2025).

4.5 | Robustness

This section provides several robustness checks. First, we perform a robustness check by utilizing maturity-specific sub-indices for all three categories (sovereign emerging USD-denominated, sovereign emerging local currency, and corporate emerging) of analyzed ESG and non-ESG indices. In particular, short-term is proxied with sub-indices with maturity of 1–3 years, while the long-term is represented with sub-indices with maturity of 10+ years. The goal of maturity analysis is to check whether results differ between short and long term, as one might expect that longer maturity bonds are more sensitive to uncertainty than short-maturity ones. The results are reported in Table 14, with Panel A showing the ESG and Panel B, the non-ESG category. Comparison between the results on short- and long-term maturity for ESG bonds (Panel A) reveals that the differences are related to ambiguity in the case of sovereign USD-denominated bonds and to geopolitical uncertainty in the case of sovereign local currency bonds. In particular, for sovereign USD-denominated bonds, ambiguity is not significant for short maturities, but it becomes significant for long maturities. In a similar manner, for sovereign local currency bonds, geopolitical uncertainty does not show significance for short maturities, while for long maturities it exhibits significance. On the contrary, for the corporate bond segment, there are no differences between short and long maturities, as the signs and significance levels of each uncertainty source are the same.

Panel B displays the results for non-ESG bonds. The analysis of the maturity aspect shows higher sensitivity of long maturity bonds with regard to ambiguity in sovereign local currency bonds and to geopolitical uncertainty in the case of sovereign

TABLE 7 | ESG CEMBI (corporate bonds): Regional level.

	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Panel A: Asia						*Panel B: Europe*				
Risk aversion	0.0017***				0.0035***	−0.0113***				−0.0001
	(3.3540)				(5.3857)	(−6.7573)				(−0.0272)
Economic uncertainty		−0.0012			−0.0056***		−0.0286***			−0.0289***
		(−1.4942)			(−5.4100)		(−11.0268)			(−8.4081)
Ambiguity			−0.0001**		−0.0002***			0.0006***		0.0000
			(−2.5400)		(−2.9200)			(3.2090)		(0.1835)
Geopolitical risk				−0.0001	−0.0001				−0.0001	−0.0002
				(−1.0619)	(−0.8000)				(−0.6257)	(−0.8342)
GABI	0.3569***	0.3620***	0.3439***	0.3587***	0.3511***	0.2424***	0.2934***	0.2277***	0.2263***	0.2838***
	(35.3341)	(35.2566)	(33.4834)	(35.5654)	(33.9000)	(7.3524)	(8.8980)	(6.5474)	(6.8279)	(8.2061)
MOVE	−0.0006	0.0003	−0.0007	0.0000	−0.0008	−0.0114***	−0.0092***	−0.0140***	−0.0150***	−0.0096***
	(−0.7918)	(0.3631)	(−1.0535)	(0.0342)	(−1.1300)	(−4.9512)	(−4.0567)	(−5.8427)	(−6.6784)	(−4.0080)
FFR	−0.0000	−0.0000	0.0000	0.0000	0.0000	0.0001	0.0002	0.0002	0.0002	0.0002
	(−0.0488)	(−0.0611)	(0.8677)	(0.0063)	(1.0900)	(0.8779)	(1.1641)	(1.1661)	(0.9563)	(1.4339)
Default spread	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0003	0.0003	0.0003	0.0003
	(0.1942)	(0.0962)	(0.5020)	(0.1581)	(0.7200)	(0.9939)	(1.2270)	(1.1926)	(1.1912)	(1.2857)
Term spread	−0.0001*	−0.0001*	−0.0001*	−0.0001*	−0.0001*	−0.0001	−0.0000	−0.0001	−0.0001	−0.0000
	(−1.7718)	(−1.7629)	(−1.8872)	(−1.7992)	(−1.7500)	(−0.4746)	(−0.2698)	(−0.4144)	(−0.4395)	(−0.2362)
FSI	−0.0000***	−0.0000***	−0.0000***	−0.0000***	−0.0000***	0.0000	0.0000	0.0000	0.0000	0.0000
	(−3.6102)	(−3.5867)	(−4.1308)	(−3.5942)	(−4.1100)	(0.1782)	(0.3210)	(0.0721)	(0.1823)	(0.1477)
N	2574	2574	2500	2580	2499	2574	2574	2500	2580	2499
r2	0.3438	0.3415	0.3315	0.3418	0.3414	0.0595	0.0860	0.0457	0.0428	0.0859
Panel C: Latin						*Panel D: Middle East*				
Risk aversion	−0.0128***				−0.0076***	−0.0080***				−0.0045***
	(−16.7110)				(−7.8883)	(−15.1995)				(−6.8205)
Economic uncertainty		−0.0206***			−0.0138***		−0.0134***			−0.0097***
		(−17.1863)			(−8.8347)		(−16.3641)			(−9.0390)
Ambiguity			0.0004***		−0.0001			0.0001**		−0.0001**
			(4.4698)		(-0.6105)			(2.4312)		(−2.4785)
Geopolitical risk				−0.0000	−0.0001				−0.0000	−0.0001

(Continues)

TABLE 7 | (Continued)

	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
				(−0.1361)	(−0.7710)				(−0.5342)	(−1.2893)
GABI	0.3427***	0.3734***	0.3319***	0.3252***	0.3663***	0.2304***	0.2508***	0.2220***	0.2192***	0.2450***
	(22.7098)	(24.4598)	(20.1222)	(20.5403)	(23.3170)	(22.2474)	(24.0312)	(19.7549)	(20.3398)	(22.7652)
MOVE	−0.0088***	−0.0087***	−0.0118***	−0.0130***	−0.0076***	−0.0057***	-0.0056***	−0.0080***	−0.0083***	−0.0053***
	(−8.3714)	(−8.3425)	(−10.3598)	(−12.0797)	(−7.0268)	(−7.9607)	(−7.8055)	(−10.3058)	(−11.4013)	(−7.1097)
FFR	−0.0002***	−0.0002**	−0.0001	−0.0002**	−0.0001	−0.0001**	−0.0001*	−0.0001	−0.0001*	−0.0001
	(−2.6649)	(−2.1757)	(−1.4912)	(−2.3009)	(−1.4161)	(−2.1140)	(−1.6625)	(−1.3454)	(−1.8257)	(−1.2367)
Default spread	−0.0002**	−0.0002	−0.0002	−0.0002	−0.0002*	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000
	(−2.0833)	(−1.5691)	(−1.3724)	(−1.4731)	(−1.6520)	(−0.6310)	(−0.1589)	(−0.1384)	(−0.1386)	(−0.3104)
Term spread	−0.0003***	−0.0003***	−0.0003***	−0.0003***	−0.0003***	−0.0002***	−0.0002***	−0.0002***	−0.0002***	−0.0002***
	(−3.5372)	(−3.1842)	(−3.2139)	(−3.2862)	(−3.2769)	(−3.2145)	(−2.8935)	(−2.9423)	(−3.0155)	(−2.9600)
FSI	−0.0000***	−0.0000***	−0.0000***	−0.0000***	−0.0000***	−0.0000***	−0.0000***	−0.0000***	−0.0000***	−0.0000***
	(-4.0403)	(−3.8298)	(−4.0100)	(−3.8177)	(−4.1971)	(−2.8169)	(−2.6244)	(−2.8258)	(−2.6788)	(−2.9149)
N	2574	2574	2500	2580	2499	2574	2574	2500	2580	2499
r^2	0.2862	0.2902	0.2118	0.2083	0.3072	0.2664	0.2759	0.1996	0.2000	0.2882

Note: This table reports the estimation results from Equation (1) where the dependent variable is the daily return on the USD-denominated ESG corporate emerging bond markets index on the regional level (Asia, Europe, Latin, Middle East). The key explanatory variables are Risk aversion, Economic uncertainty, Ambiguity, and Geopolitical risk. The set of control variables includes global bond market returns (GABI), global bond market volatility (MOVE Index), global liquidity conditions (US Federal Funds Rate, FFR), default spread, term spread, and Financial Stress Index (FSI). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively.

TABLE 8 | Non-ESG sovereign bonds (USD denominated): Aggregate level.

	(1)	(2)	(3)	(4)	(5)
Risk aversion	−0.0190***				−0.0121***
	(−18.3541)				(−9.2920)
Economic uncertainty		−0.0290***			−0.0168***
		(−17.7877)			(−7.9836)
Ambiguity			0.0008***		0.0002*
			(6.7259)		(1.6485)
Geopolitical risk				−0.0001	−0.0002
				(−0.6402)	(−1.4424)
GABI	0.6148***	0.6567***	0.5892***	0.5882***	0.6336***
	(30.1866)	(31.6679)	(26.3959)	(27.2619)	(29.9186)
MOVE	−0.0170***	−0.0172***	−0.0216***	−0.0231***	−0.0158***
	(−11.9840)	(−12.1159)	(−14.0519)	(−15.8293)	(−10.7712)
FFR	−0.0001	−0.0000	0.0000	−0.0000	0.0000
	(−0.5762)	(−0.0528)	(0.2057)	(−0.2929)	(0.3479)
Default spread	0.0000	0.0001	0.0001	0.0001	0.0001
	(0.0103)	(0.5777)	(0.5683)	(0.5527)	(0.3774)
Term spread	−0.0002	−0.0001	−0.0001	−0.0001	−0.0001
	(−1.3409)	(−0.9571)	(−1.1676)	(−1.1826)	(−1.1396)
FSI	−0.0000**	−0.0000*	−0.0000**	−0.0000*	−0.0000**
	(−2.0024)	(−1.7698)	(−2.0920)	(−1.8595)	(−2.1852)
N	2578	2578	2504	2586	2503
r^2	0.3889	0.3845	0.3147	0.3085	0.4025

Note: This table reports the estimation results from Equation (1), where the dependent variable is the daily return on USD-denominated non-ESG sovereign emerging bond markets index on the aggregate index level (EMBI). The key explanatory variables are Risk aversion, Economic uncertainty, Ambiguity, and Geopolitical risk. The set of control variables includes global bond market returns (GABI), global bond market volatility (MOVE Index), global liquidity conditions (US Federal Funds Rate, FFR), default spread, term spread, and Financial Stress Index (FSI). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively.

USD-denominated bonds, as these uncertainty sources are not significant for short maturities, while they are significant for long maturities. For the corporate bonds segment, the difference is observed for risk aversion, which is significant only for long maturity bonds.

The overall conclusion from maturity analysis is that generally long maturity bonds are more sensitive to uncertainty than short maturity ones for both ESG and non-ESG categories; however, the sensitivity patterns vary slightly across uncertainty sources and across sovereign and corporate segments. Economic uncertainty is the only source that is significant in both short and long maturities for all three segments (sovereign USD, sovereign local currency, and corporate), and both ESG and non-ESG categories.

Second, we conduct a robustness check by dividing the sample period into pre- and post-COVID periods.[9] The aim is to examine whether Covid-19 structurally altered the sensitivity of ESG and non-ESG bonds in emerging markets to global uncertainty. The results are reported in Table A1 in the Online Appendix. Looking into results across market segments shows that the only segment where post-Covid period exhibits more sensitivity to uncertainty than pre-Covid period is for the corporate bonds segment (both ESG and non-ESG), and only with regard to ambiguity source. In the case of sovereign USD and local currency segments (both ESG and non-ESG categories), ambiguity is significant in pre-Covid, but not in post-Covid period. On the contrary, risk aversion and economic uncertainty have consistent statistical significance and a negative sign in pre- and post-COVID periods across all three market segments for both ESG and non-ESG categories.

Third, in order to consider heterogeneity within ESG thematic bonds themselves, we extend the analysis on the aggregate level by analyzing separately three universes of the ESG thematic bonds in emerging markets: (i) green, (ii) social, and (iii) sustainable universes. In particular, we utilize JESG Emerging Markets Credit Green, Social and Sustainability Bond Diversified Index (JESG GESSIE EM CREDIT DIV), which is an ESG-aligned variant of the benchmark incorporating the J.P. Morgan ESG methodology for fixed income indices. The universe for this index comprises sovereign, quasi-sovereign, corporate, and supranational issuers from emerging markets, and it is further partitioned into sub-indices tracking separately green, social, and sustainability components. Furthermore, we also analyze separately the corporate segment of the JESG Emerging Markets Green Bond Index (GENIE), which is designed to specifically track the green bond universe. We report these results in the Online Appendix (Table A2). The

TABLE 9 | Non-ESG sovereign bonds (USD-denominated): Regional level.

	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Panel A: Africa						*Panel B: Asia*				
Risk aversion	−0.0321***				−0.0223***	−0.0019**				0.0023**
	(−16.7686)				(−9.2888)	(−2.1360)				(2.0349)
Economic uncertainty		−0.0469***			−0.0251***		−0.0087***			−0.0118***
		(−15.5350)			(−6.4986)		(−6.2792)			(−6.5603)
Ambiguity			0.0011***		0.0001			0.0000		−0.0002
			(5.2568)		(0.6246)			(0.1492)		(−1.5973)
Geopolitical risk				−0.0003	−0.0004*				−0.0002*	−0.0002*
				(−0.9596)	(−1.7250)				(−1.7464)	(−1.8022)
GABI	0.6319***	0.6978***	0.5957***	0.5863***	0.6652***	0.5293***	0.5467***	0.5095***	0.5245***	0.5293***
	(16.8321)	(18.1931)	(14.6931)	(14.8908)	(17.1202)	(30.3765)	(31.1387)	(28.2268)	(30.1957)	(29.1631)
MOVE	−0.0270***	−0.0278***	−0.0342***	−0.0373***	−0.0244***	−0.0084***	−0.0073***	−0.0099***	−0.0090***	−0.0086***
	(−10.3441)	(−10.5857)	(−12.2681)	(−14.0059)	(−9.0874)	(−6.9541)	(−6.0342)	(−7.9396)	(−7.6126)	(−6.8784)
FFR	−0.0002	−0.0002	−0.0000	−0.0002	−0.0000	−0.0001	−0.0000	−0.0000	−0.0000	0.0000
	(−1.3015)	(−0.8291)	(−0.1217)	(-1.0744)	(−0.0447)	(−0.5934)	(−0.4630)	(−0.1768)	(-0.4567)	(0.0293)
Default spread	−0.0001	0.0000	0.0001	−0.0000	−0.0000	−0.0001	−0.0001	−0.0001	−0.0001	−0.0000
	(−0.5117)	(0.0074)	(0.2007)	(−0.0142)	(−0.0361)	(−0.5904)	(−0.5225)	(−0.4118)	(−0.4481)	(−0.2964)
Term spread	−0.0003	−0.0002	−0.0003	−0.0003	−0.0003	−0.0001	−0.0001	−0.0001	−0.0001	−0.0001
	(−1.3589)	(−1.0147)	(−1.2517)	(−1.2115)	(−1.2500)	(−1.4574)	(−1.3563)	(−1.4885)	(−1.4674)	(−1.3518)
FSI	−0.0000*	−0.0000	−0.0000*	−0.0000*	−0.0000**	−0.0000**	−0.0000**	−0.0000***	−0.0000**	−0.0000***
	(−1.7590)	(−1.5493)	(−1.9189)	(−1.6764)	(−1.9921)	(−2.3568)	(−2.2953)	(−2.6812)	(−2.3311)	(−2.6566)
N	2578	2578	2504	2586	2503	2578	2578	2504	2586	2503
r^2	0.2433	0.2326	0.1681	0.1603	0.2597	0.2962	0.3056	0.2828	0.2953	0.2974
Panel C: Europe						*Panel D: Latin*				
Risk aversion	−0.0170***				−0.0045**	−0.0282***				−0.0224***
	(−9.4880)				(−1.9781)	(−21.4915)				(−13.4393)
Economic uncertainty		−0.0358***			−0.0314***		−0.0356***			−0.0124***
		(−12.9222)			(−8.5941)		(−16.8047)			(−4.6229)
Ambiguity			0.0008***		0.0001			0.0012***		0.0004***
			(4.2883)		(0.6852)			(7.8969)		(2.9977)
Geopolitical risk				−0.0001	−0.0002				0.0001	−0.0000

(Continues)

TABLE 9 | (Continued)

	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
				(-0.5262)	(-0.9002)			.	(0.6130)	(−0.2147)
GABI	0.4909***	0.5509***	0.4675***	0.4673***	0.5329***	0.7926***	0.8377***	0.7623***	0.7550***	0.8092***
	(13.9595)	(15.6638)	(12.5424)	(13.1161)	(14.4925)	(30.8096)	(31.1288)	(26.5498)	(27.1278)	(30.0046)
MOVE	−0.0173***	−0.0155***	−0.0214***	−0.0228***	−0.0155***	−0.0209***	−0.0228***	−0.0270***	−0.0301***	−0.0192***
	(−7.0743)	(−6.4254)	(−8.3626)	(−9.4399)	(−6.0922)	(−11.6825)	(−12.3493)	(−13.6850)	(−15.9566)	(−10.2974)
FFR	0.0002	0.0003	0.0003	0.0002	0.0003*	−0.0001	−0.0000	−0.0000	−0.0001	−0.0000
	(1.2625)	(1.6170)	(1.5501)	(1.4097)	(1.8188)	(−0.7959)	(−0.2381)	(−0.0613)	(-0.4419)	(−0.0777)
Default spread	0.0004	0.0005*	0.0005*	0.0005*	0.0005*	−0.0001	0.0000	0.0000	0.0000	−0.0001
	(1.4495)	(1.7742)	(1.7046)	(1.7397)	(1.7596)	(-0.6110)	(0.0493)	(0.0231)	(0.0533)	(-0.3695)
Term spread	0.0000	0.0001	0.0000	0.0000	0.0001	−0.0002	−0.0001	−0.0002	−0.0002	−0.0001
	(0.0182)	(0.2742)	(0.0858)	(0.0576)	(0.2617)	(−1.1881)	(−0.7753)	(−0.9796)	(−1.0016)	(−1.0447)
FSI	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000**	−0.0000*	−0.0000**	−0.0000*	−0.0000**
	(-0.2125)	(−0.0537)	(−0.2794)	(−0.1843)	(−0.2168)	(−2.0340)	(−1.7579)	(−2.0000)	(−1.8370)	(−2.1328)
N	2578	2578	2504	2586	2503	2578	2578	2504	2586	2503
r^2	0.1385	0.1627	0.1120	0.1086	0.1626	0.4122	0.3752	0.3169	0.3064	0.4161

	(1)	(2)	(3)	(4)	(5)
Panel E: Middle East					
Risk aversion	−0.0144***				−0.0098***
	(−13.0061)				(−6.9376)
Economic uncertainty		−0.0211***			−0.0121***
		(−12.1756)			(−5.3539)
Ambiguity			0.0004***		−0.0000
			(3.4136)		(−0.3109)
Geopolitical risk				−0.0002	−0.0003**
				(−1.5904)	(−2.1985)
GABI	0.4367***	0.4666***	0.4114***	0.4157***	0.4436***
	(20.1518)	(21.1402)	(17.6688)	(18.6460)	(19.4710)
MOVE	−0.0111***	−0.0115***	−0.0158***	−0.0158***	−0.0113***
	(−7.3915)	(−7.5865)	(−9.8418)	(−10.4579)	(−7.1344)
FFR	−0.0001	−0.0000	−0.0001	−0.0001	−0.0001
	(−0.8050)	(−0.4399)	(−0.5920)	(−0.6499)	(−0.5343)

(Continues)

TABLE 9 | (Continued)

	(1)	(2)	(3)	(4)	(5)
Default spread	−0.0000	0.0000	0.0000	0.0000	−0.0000
	(−0.1501)	(0.2518)	(0.0774)	(0.1862)	(−0.0488)
Term spread	−0.0001	−0.0001	−0.0001	−0.0001	−0.0001
	(−0.9568)	(−0.6914)	(−0.8282)	(−0.8650)	(−0.7970)
FSI	−0.0000*	−0.0000	−0.0000*	−0.0000*	−0.0000*
	(−1.7861)	(−1.6247)	(−1.8749)	(−1.7137)	(−1.9393)
N	2578	2578	2504	2586	2503
r^2	0.2220	0.2160	0.1703	0.1712	0.2289

Note: This table reports the estimation results from Equation (1) where the dependent variable is the daily return on USD-denominated non-ESG sovereign emerging bond markets on the regional level (Africa, Asia, Europe, Latin America, Middle East). The key explanatory variables are Risk aversion, Economic uncertainty, Ambiguity, and Geopolitical risk. The set of control variables includes global bond market returns (GABI), global bond market volatility (MOVE Index), global liquidity conditions (US Federal Funds Rate, FFR), default spread, term spread, and Financial Stress Index (FSI). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively.

results indicate that economic uncertainty is the only uncertainty source that is consistently statistically significant (negative sign) across all analyzed specifications for green, social and sustainable universes. Risk aversion is significant for the aggregate JESG Emerging Markets Credit Green, Social and Sustainability Bond Diversified Index (column 1) and for its social sub-index (column 3), while geopolitical risk does not exhibit a significant impact on any of the analyzed universes.

Fourth, we conduct robustness checks for all three segments (sovereign USD-denominated, sovereign local currency, and corporate) of ESG bond indices on the regional level by using country-specific geopolitical risk indices from the analyzed regions instead of the global geopolitical risk index. The aim of this exercise is to examine whether country-specific geopolitical risk plays a more important role than the global one in explaining bond returns of emerging markets, as it might be expected that investments in ESG bonds might be largely affected by country-specific geopolitical events. Caldara and Iacoviello (2022) provide country-specific geopolitical risk indices only on a monthly frequency; hence, our robustness check is also conducted by using monthly data.[10] We follow the classification of countries grouped in regions by Caldara and Iacoviello (2022) and run regressions from Equation (1) where the dependent variable is the ESG bond index return at the regional level and the explanatory variable of geopolitical risk is the country-specific geopolitical risk index.[11] The results are shown in Tables A3 (sovereign USD denominated bonds), A.4., (sovereign local currency bonds) and A.5.(corporate bonds) in the Online Appendix. In summary, the country-specific geopolitical risk variable is, in most cases, non-significant, except for the geopolitical risk index of Russia for sovereign USD bonds and corporate bonds, Chile for corporate bonds, and South Africa for sovereign local bonds.

Fifth, in order to disentangle the effects of uncertainty measures, we perform an additional analysis where the effect of each uncertainty variable is evaluated on subsamples where other uncertainty measures are below median levels. The results for the ESG bonds category are reported in Tables A6, A7, and A8 in the Online Appendix. Table A6 shows the results for the sovereign USD-denominated segment (aggregate level) and indicates that economic uncertainty and ambiguity remain significant even when other uncertainty sources are below median. Table A7 displays the corresponding results for the sovereign local currency segment and shows similar results to the USD-denominated segment, as economic uncertainty and ambiguity also remain significant even when other uncertainty sources are below median. Table A8 shows the results for the corporate segment, suggesting that risk aversion and economic uncertainty have a significant effect even when other uncertainty sources are below the median level.

Finally, we repeat the main analysis for the three segments of ESG bonds (sovereign USD-denominated, sovereign local currency, and corporate) on the aggregate level by

TABLE 10 | Non-ESG sovereign bonds (local currency): Aggregate level.

	(1)	(2)	(3)	(4)	(5)
Risk aversion	−0.0244***				−0.0101***
	(−14.1640)				(−4.6751)
Economic uncertainty		−0.0455***			−0.0309***
		(−17.0919)			(−8.9066)
Ambiguity			0.0020***		0.0012***
			(10.8738)		(6.5431)
Geopolitical risk				−0.0002	−0.0004
				(−0.9883)	(−1.5407)
GABI	1.0323***	1.1049***	1.0427***	1.0008***	1.1116***
	(30.4693)	(32.6730)	(29.0584)	(28.5296)	(31.8910)
MOVE	−0.0240***	−0.0226***	−0.0252***	−0.0318***	−0.0179***
	(−10.1780)	(−9.7511)	(−10.2112)	(−13.4033)	(−7.4025)
FFR	0.0002	0.0003	0.0002	0.0002	0.0002
	(1.0940)	(1.5762)	(1.1287)	(1.0740)	(1.3807)
Default spread	−0.0001	0.0000	−0.0000	−0.0000	−0.0001
	(−0.4147)	(0.0289)	(−0.1664)	(−0.0511)	(−0.2752)
Term spread	0.0000	0.0001	0.0000	0.0000	0.0001
	(0.1345)	(0.4838)	(0.2557)	(0.2011)	(0.4273)
FSI	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000
	(−0.5351)	(−0.3290)	(−0.3076)	(−0.5992)	(−0.2444)
N	2578	2578	2504	2586	2503
r^2	0.3553	0.3759	0.3319	0.3053	0.3891

Note: This table reports the estimation results from Equation (1), where the dependent variable is the daily return on the local currency-denominated non-ESG sovereign emerging bond markets index on the aggregate index level (GBI-EM). The key explanatory variables are Risk aversion, Economic uncertainty, Ambiguity, and Geopolitical risk. The set of control variables includes global bond market returns (GABI), global bond market volatility (MOVE Index), global liquidity conditions (US Federal Funds Rate, FFR), default spread, term spread, and Financial Stress Index (FSI). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

orthogonalizing the uncertainty measures. Specifically, we regress each uncertainty measure on the three other uncertainty measures and use the residuals as orthogonal components. The aim of this exercise is to elaborate further on disentangling the effects of uncertainty measures. The results are presented in Tables A9, A10, and A11 in the Online Appendix. Table A9 reports the results for the sovereign USD-denominated segment, Table A10. displays the corresponding results for the sovereign local currency segment, and Table A11 shows the results for the corporate segment. The results obtained with orthogonalized uncertainty measures confirm our baseline results. The only difference is observed in the case of ESG sovereign bonds (USD-denominated) with respect to ambiguity, as in the specification where uncertainty sources are shown individually (Model 3), ambiguity was not statistically significant. However, in the specification with all uncertainty sources together (Model 5), ambiguity is highly significant. Overall, the results with orthogonalized uncertainty measures are aligned with our hypotheses.

5 | Conclusions

This paper studies the impact of the various sources of uncertainty (ambiguity, risk aversion, economic, and geopolitical) on the ESG thematic bond markets in emerging countries. Specifically, we focus on sovereign (both USD and local currency-denominated) and corporate bond markets at the aggregate and regional levels. The importance of this topic is reflected in the recent growth of ESG thematic bonds in emerging markets.

The results regarding risk aversion and economic uncertainty as measured by high-frequency novel measures developed by Bekaert et al. (2022) indicate that increases in these uncertainty sources are associated with significant declines in ESG sovereign emerging bond market returns. These results are robust for both USD and local currency-denominated sovereign ESG thematic bonds as well as for corporate emerging market bonds. Our findings extend the evidence on US government bonds (Bianchi et al. 2020) to the emerging markets setting and ESG framework in the context of the relevance of time-varying risk aversion and economic uncertainty.

Ambiguity, labelled as 'unmeasurable uncertainty', exhibits mainly a positive relationship with emerging market bond returns. The rationale behind this result is that ambiguity-averse investors tend to overestimate the probabilities of unwanted outcomes and at the same time underestimate probabilities of wishful outcomes (Brenner and Izhakian 2018). That leads to the situation where investors prefer to fund the least risky assets, such as bonds.

TABLE 11 | Non-ESG sovereign bonds (local currency): Regional level.

	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Panel A: Asia						*Panel B: Europe*				
Risk aversion	−0.0024*				0.0045***	−0.0231***				−0.0050*
	(−1.8064)				(2.6280)	(−10.2927)				(−1.7950)
Economic uncertainty		−0.0130***			−0.0160***		−0.0501***			−0.0405***
		(−6.2744)			(−5.8821)		(−14.5383)			(−9.0066)
Ambiguity			0.0005***		0.0003**			0.0020***		0.0012***
			(3.5409)		(2.0214)			(8.6318)		(4.8947)
Geopolitical risk				0.0000	0.0000				−0.0002	−0.0004
				(0.1227)	(0.1773)				(−0.8006)	(-1.2297)
GABI	0.3102***	0.3370***	0.3117***	0.3082***	0.3392***	1.2439***	1.3290***	1.2556***	1.2142***	1.3386***
	(11.8448)	(12.7727)	(11.4624)	(11.7988)	(12.3633)	(28.2698)	(30.3506)	(27.2964)	(27.1393)	(29.5512)
MOVE	−0.0088***	−0.0069***	−0.0087***	−0.0096***	−0.0075***	−0.0208***	−0.0180***	−0.0208***	−0.0282***	−0.0133***
	(−4.8508)	(−3.8384)	(−4.6501)	(−5.4089)	(−3.9468)	(−6.7996)	(−6.0072)	(−6.5596)	(−9.3193)	(−4.2414)
FFR	−0.0002	−0.0002	−0.0001	−0.0002	−0.0001	0.0005**	0.0006***	0.0006**	0.0005**	0.0006***
	(−1.5389)	(−1.4191)	(−0.9566)	(−1.5845)	(−0.7640)	(2.3521)	(2.7725)	(2.4401)	(2.3160)	(2.7508)
Default spread	−0.0002	−0.0002	−0.0002	−0.0002	−0.0002	0.0004	0.0005	0.0005	0.0005	0.0005
	(−1.2448)	(−1.1918)	(−1.1736)	(−1.2128)	(−1.0479)	(1.2597)	(1.6161)	(1.4672)	(1.4890)	(1.5139)
Term spread	−0.0004**	−0.0003**	−0.0003**	−0.0004**	−0.0003**	0.0002	0.0003	0.0002	0.0002	0.0003
	(−2.4547)	(−2.3626)	(−2.3815)	(−2.4388)	(−2.2472)	(0.8516)	(1.1540)	(0.9628)	(0.8921)	(1.1746)
FSI	0.0000	0.0000	0.0000	0.0000	0.0000	−0.0000	−0.0000	0.0000	-0.0000	0.0000
	(1.1884)	(1.2736)	(0.7314)	(1.1280)	(0.7942)	(−0.1809)	(−0.0025)	(0.0568)	(-0.2422)	(0.1368)
N	2578	2578	2504	2586	2503	2578	2578	2504	2586	2503
r^2	0.0742	0.0870	0.0769	0.0731	0.0900	0.2943	0.3210	0.2820	0.2656	0.3254
Panel C: Latin						*Panel D: Middle East*				
Risk aversion	−0.0338***				−0.0221***	−0.0360***				−0.0144***
	(−14.6898)				(−7.5892)	(−8.8641)				(−2.8050)
Economic uncertainty		−0.0500***			−0.0237***		−0.0669***			−0.0433***
		(−13.8266)			(−5.0585)		(−10.5699)			(−5.2219)
Ambiguity			0.0021***		0.0012***			0.0036***		0.0025***
			(8.5148)		(4.7011)			(8.3808)		(5.6275)
Geopolitical risk				−0.0001	−0.0002				-0.0009*	−0.0011**

(Continues)

TABLE 11 | (Continued)

	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
				(−0.2791)	(−0.7562)				(−1.6547)	(−1.9862)
GABI	0.9032***	0.9742***	0.9164***	0.8615***	0.9841***	1.4624***	1.5692***	1.4521***	1.4109***	1.5452***
	(20.0067)	(21.1751)	(18.9678)	(18.3847)	(20.8318)	(18.3308)	(19.5083)	(17.4025)	(17.4431)	(18.5400)
MOVE	−0.0330***	−0.0337***	−0.0372***	−0.0440***	−0.0278***	−0.0438***	−0.0418***	−0.0440***	−0.0551***	−0.0336***
	(−10.5027)	(−10.6899)	(−11.1941)	(−13.8598)	(−8.4833)	(−7.9014)	(−7.5885)	(−7.6725)	(−10.0564)	(−5.8138)
FFR	0.0002	0.0003	0.0001	0.0002	0.0001	−0.0005	−0.0004	−0.0004	−0.0006	−0.0004
	(0.7549)	(1.1615)	(0.4276)	(0.8822)	(0.5050)	(−1.2149)	(−0.9351)	(−1.0366)	(−1.4075)	(−0.9384)
Default spread	−0.0004	−0.0002	−0.0003	−0.0003	−0.0004	−0.0014**	−0.0012**	−0.0013**	−0.0013**	−0.0014**
	(−1.1625)	(−0.7047)	(−0.9645)	(−0.6989)	(−1.2240)	(−2.3250)	(−2.0613)	(−2.1135)	(−2.1737)	(−2.2240)
Term spread	0.0000	0.0001	0.0001	0.0000	0.0001	−0.0002	−0.0001	−0.0002	−0.0002	−0.0001
	(0.1359)	(0.4320)	(0.2201)	(0.1897)	(0.2879)	(−0.4330)	(−0.2209)	(−0.3908)	(−0.3676)	(−0.3083)
FSI	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000	−0.0000
	(−1.1969)	(−1.0161)	(−0.8237)	(−1.1708)	(−0.8120)	(−0.3461)	(−0.2154)	(−0.3600)	(−0.4786)	(−0.3214)
N	2578	2578	2504	2586	2503	2578	2578	2504	2586	2503
r^2	0.2547	0.2480	0.2147	0.1928	0.2725	0.1789	0.1890	0.1700	0.1540	0.1972

Note: This table reports the estimation results from Equation (1) where the dependent variable is the daily return on local currency-denominated non-ESG sovereign emerging bond markets index on the regional level (Asia, EMEA, Europe, Latin America, Middle East). The key explanatory variables are Risk aversion, Economic uncertainty, Ambiguity, and Geopolitical risk. The set of control variables includes global bond market returns (GABI), global bond market volatility (MOVE Index), global liquidity conditions (US Federal Funds Rate, FFR), default spread, term spread, and Financial Stress Index (FSI). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

TABLE 12 | Non-ESG CEMBI (corporate bonds): Aggregate level.

	(1)	(2)	(3)	(4)	(5)
Risk aversion	−0.0074***				−0.0029***
	(−11.9499)				(−3.7029)
Economic uncertainty		−0.0145***			−0.0125***
		(−15.0506)			(−9.9249)
Ambiguity			0.0002***		−0.0001*
			(2.7361)		(−1.7113)
Geopolitical risk				−0.0001	−0.0001
				(−0.7438)	(−1.1700)
GABI	0.3438***	0.3673***	0.3316***	0.3332***	0.3586***
	(28.1198)	(30.0687)	(25.4094)	(26.6379)	(28.3224)
MOVE	−0.0069***	−0.0063***	−0.0090***	−0.0093***	−0.0064***
	(−8.1116)	(−7.5825)	(−10.0590)	(−10.9675)	(−7.2739)
FFR	−0.0001	−0.0000	−0.0000	−0.0001	0.0000
	(−1.2156)	(−0.8316)	(−0.1939)	(−0.9995)	(0.0408)
Default spread	−0.0000	0.0000	0.0000	0.0000	0.0000
	(−0.3287)	(0.0467)	(0.2170)	(0.0744)	(0.1803)
Term spread	−0.0002***	−0.0002**	−0.0002**	−0.0002**	−0.0002**
	(−2.6512)	(−2.3887)	(−2.4922)	(−2.5322)	(−2.4159)
FSI	−0.0000***	−0.0000***	−0.0000***	−0.0000***	−0.0000***
	(−3.0357)	(−2.8930)	(−3.2222)	(−2.9554)	(−3.2872)
N	2578	2578	2504	2586	2503
r^2	0.3093	0.3300	0.2668	0.2711	0.3312

Note: This table reports the estimation results from Equation (1), where the dependent variable is the daily return on the USD-denominated non-ESG corporate emerging bond markets index on the aggregate level (CEMBI). The key explanatory variables are Risk aversion, Economic uncertainty, Ambiguity, and Geopolitical risk. The set of control variables includes global bond market returns (GABI), global bond market volatility (MOVE Index), global liquidity conditions (US Federal Funds Rate, FFR), default spread, term spread, and Financial Stress Index (FSI). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

We find that geopolitical risk mainly has an insignificant relationship with the ESG thematic sovereign (USD-denominated and local currency) and corporate emerging market bonds returns at the aggregate level. We observe heterogeneity at the regional level analysis, as the relationship between bond returns and geopolitical risk was more pronounced. For instance, significant results for USD-denominated sovereign ESG thematic bonds in the Asian region might be related to elevated geopolitical risk arising from economic and political tensions between China and the US during the sample period (such as the trade war and the US withdrawal from the Trans-Pacific Partnership during the first Trump administration).

We also find that in emerging markets, ESG and non-ESG bonds are affected similarly by various sources of uncertainty. This suggests that investors do not differentiate ESG bonds from conventional emerging market debt, likely because the implementation of sustainability practices in these markets lags behind that of developed economies.

We acknowledge that bid-ask spreads of ESG thematic bonds or the indexes that we use are not available, so we cannot provide a good assessment of the liquidity risk within the portfolios. However, index providers focus on the liquid segments of the market, as their clientele are index trackers who need to be able to replicate the indexes they provide relatively cheaply. The indices that we use contain bonds that can be traded by foreign investors and are therefore not de jure segmented. Nevertheless, it could be that some of these markets are de facto segmented because foreign investors choose to shun those markets. We do not have additional data on the ownership of bonds in emerging markets.

This study has important practical implications for international investors and issuers of bonds. For portfolio managers, it is important to understand how bond returns in emerging markets react to changes in economic policy uncertainty and risk aversion. This is both relevant for portfolio managers of emerging markets debt strategies and for multi-asset portfolio managers. The latter has to understand whether emerging debt markets are portfolio diversifiers when these fundamental risk drivers change and affect their total portfolio. Sustainable emerging markets debt investors find that their portfolios react largely in line with those that do not incorporate sustainability. It seems that by including sustainability, the fundamental risks of the emerging markets debt portfolios are hardly affected. The issuers of emerging market debt cannot control global policy uncertainty or risk aversion. However, it may still be good to know to what extent their treasury departments are exposed to these fundamental risk drivers that are, to a large extent,

TABLE 13 | Non-ESG CEMBI (corporate bonds): Regional level.

	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Panel A: Asia						*Panel B: Europe*				
Risk aversion	0.0016***				0.0037***	−0.0139***				-0.0003
	(2.7256)				(5.1071)	(−5.5632)				(-0.0916)
Economic uncertainty		−0.0020**			−0.0069***		−0.0347***			-0.0347***
		(−2.2523)			(−5.8645)		(−8.9303)			(-6.7250)
Ambiguity			−0.0002**		−0.0002***			0.0007***		0.0001
			(−2.5677)		(−3.1773)			(2.7968)		(0.3244)
Geopolitical risk				−0.0001	-0.0001				-0.0001	-0.0002
				(−1.3117)	(-1.0283)				(-0.3665)	(-0.5576)
GABI	0.3735***	0.3803***	0.3635***	0.3749***	0.3729***	0.2286***	0.2902***	0.2112***	0.2091***	0.2790***
	(32.7962)	(32.8981)	(31.1626)	(33.0101)	(31.7140)	(4.6487)	(5.8722)	(4.0781)	(4.2467)	(5.3779)
MOVE	−0.0020***	−0.0011	−0.0023***	-0.0015*	-0.0023***	−0.0135***	−0.0109***	−0.0165***	-0.0179***	-0.0112***
	(−2.5859)	(−1.4018)	(−2.9266)	(−1.9518)	(−2.8146)	(−3.9411)	(−3.2108)	(-4.6258)	(-5.3832)	(-3.1131)
FFR	−0.0000	−0.0000	0.0000	−0.0000	0.0000	0.0003	0.0004	0.0004	0.0003	0.0005*
	(−0.2663)	(−0.2583)	(0.5708)	(−0.2199)	(0.7965)	(1.3049)	(1.5376)	(1.5609)	(1.3735)	(1.7725)
Default spread	0.0000	−0.0000	0.0000	0.0000	0.0000	0.0006	0.0007*	0.0007*	0.0007*	0.0007*
	(0.0767)	(−0.0015)	(0.3462)	(0.0652)	(0.5598)	(1.6115)	(1.8060)	(1.7908)	(1.7780)	(1.8657)
Term spread	−0.0001*	−-0.0001*	−0.0001*	−0.0001*	−0.0001	0.0000	0.0001	0.0000	0.0000	0.0001
	(−1.6911)	(−1.6690)	(−1.7742)	(-1.7147)	(-1.6277)	(0.1246)	(0.2970)	(0.1642)	(0.1509)	(0.3121)
FSI	−0.0000***	−0.0000***	−0.0000***	−0.0000***	−0.0000***	0.0000	0.0000	0.0000	0.0000	0.0000
	(−3.0492)	(−3.0218)	(−3.4475)	(−3.0634)	(−3.4199)	(0.5629)	(0.6794)	(0.4673)	(0.5643)	(0.5311)
N	2578	2578	2504	2586	2503	2578	2578	2504	2586	2503
r^2	0.3134	0.3128	0.3043	0.3123	0.3152	0.0355	0.0533	0.0266	0.0240	0.0535
Panel C: Latin						*Panel D: Middle East*				
Risk aversion	−0.0162***				−0.0108***	−0.0081***				−0.0045***
	(−18.4683)				(−9.7602)	(−13.8308)				(−6.1174)
Economic uncertainty		−0.0241***			−0.0141***		−0.0136***			−0.0099***
		(−17.4203)			(−7.9035)		(−14.9670)			(−8.3542)
Ambiguity			0.0005***		−0.0000			0.0001**		−0.0002**
			(4.7794)		(−0.4336)			(2.0766)		(−2.4372)
Geopolitical risk				0.0000	−0.0001				−0.0000	−0.0001

(Continues)

TABLE 13 | (Continued)

	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
				(0.0095)	(−0.6728)				(−0.4038)	(−1.0831)
GABI	0.4173***	0.4515***	0.4047***	0.3953***	0.4430***	0.2590***	0.2797***	0.2520***	0.2476***	0.2755***
	(24.2754)	(25.7209)	(21.3140)	(21.6951)	(24.6655)	(22.6563)	(24.2591)	(20.4357)	(20.9767)	(23.1113)
MOVE	−0.0105***	−0.0108***	−0.0143***	−0.0157***	−0.0093***	−0.0073***	−0.0072***	−0.0096***	−0.0099***	−0.0070***
	(−8.7629)	(−8.9793)	(−10.9543)	(−12.7366)	(−7.4910)	(−9.2204)	(−9.0676)	(−11.3665)	(−12.4105)	(−8.4267)
FFR	−0.0002**	−0.0001*	−0.0001	−0.0002*	−0.0001	−0.0001**	−0.0001*	−0.0001	−0.0001*	−0.0001
	(−2.3022)	(−1.7714)	(−1.1166)	(−1.9149)	(−1.0766)	(−2.0846)	(−1.6750)	(−1.4527)	(−1.8145)	(−1.3531)
Default spread	−0.0002*	−0.0002	−0.0001	−0.0002	-0.0002	−0.0001	−0.0000	−0.0000	−0.0000	−0.0000
	(−1.7975)	(−1.2179)	(−1.0484)	(−1.1352)	(−1.3853)	(−0.6052)	(−0.1756)	(−0.1838)	(−0.1350)	(−0.3478)
Term spread	−0.0003***	−0.0003***	−0.0003***	−0.0003***	−0.0003***	−0.0002***	−0.0002**	−0.0002**	−0.0002***	−0.0002**
	(−3.1872)	(−2.7928)	(-2.8477)	(−2.9176)	(−2.9464)	(−2.8089)	(−2.5143)	(−2.5635)	(−2.6533)	(−2.5498)
FSI	−0.0000***	−0.0000***	−0.0000***	−0.0000***	−0.0000***	−0.0000**	−0.0000**	−0.0000**	−0.0000**	−0.0000**
	(−3.6268)	(−3.3821)	(−3.6436)	(−3.3949)	(−3.8457)	(−2.1585)	(−1.9823)	(−2.0996)	(−2.0696)	(−2.1292)
N	2578	2578	2504	2586	2503	2578	2578	2504	2586	2503
r^2	0.3157	0.3067	0.2297	0.2246	0.3322	0.2679	0.2764	0.2129	0.2128	0.2868

Note: This table reports the estimation results from Equation (1) where the dependent variable is the daily return on USD-denominated non-ESG corporate emerging bond markets index on the regional level (Asia, Europe, Latin, Middle East). The key explanatory variables are Risk aversion, Economic uncertainty, Ambiguity, and Geopolitical risk. The set of control variables includes global bond market returns (GABI), global bond market volatility (MOVE Index), global liquidity conditions (US Federal Funds Rate, FFR), default spread, term spread, and Financial Stress Index (FSI). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively.

TABLE 14 | Maturity analysis: Aggregate level.

	(1) Sov. USD (1–3 years)	(2) Sov. USD (10+ years)	(3) Sov. Local (1–3 years)	(4) Sov. Local (10+ years)	(5) Corporate (1-3 years)	(6) Corporate (10+ years)
Panel A: ESG						
Risk aversion	−0.0042***	-0.0176***	−0.0057***	−0.0123***	−0.0012**	−0.0043***
	(−5.2143)	(−9.3175)	(−3.0424)	(−4.5859)	(−2.4706)	(−4.3957)
Economic uncertainty	−0.0102***	−0.0207***	−0.0294***	−0.0312***	−0.0082***	−0.0106***
	(−7.8572)	(−6.8208)	(−9.7190)	(−7.2426)	(−10.7282)	(−6.7976)
Ambiguity	0.0000	0.0004**	0.0010***	0.0013***	−0.0001**	−0.0002**
	(0.6674)	(2.3802)	(6.1007)	(5.9184)	(−2.2880)	(−2.2019)
Geopolitical risk	−0.0001	−0.0003	−0.0003	−0.0006*	−0.0000	−0.0000
	(−0.8043)	(−1.5017)	(−1.2907)	(−1.9105)	(−0.7869)	(−0.4633)
GABI	0.1491***	1.0528***	0.9015***	1.2154***	0.1338***	0.5842***
	(11.4057)	(34.4604)	(29.6449)	(28.0276)	(17.4860)	(37.0643)
MOVE	−0.0049***	−0.0229***	−0.0126***	−0.0286***	−0.0019***	−0.0076***
	(−5.4158)	(−10.8091)	(−5.9895)	(−9.5140)	(−3.5134)	(−6.9216)
FFR	0.0001	0.0000	0.0002	0.0000	0.0000	−0.0001
	(1.5436)	(0.0325)	(1.1112)	(0.0982)	(1.0468)	(−1.0702)
Default spread	0.0001	0.0000	−0.0002	−0.0004	0.0000	−0.0002
	(1.4467)	(0.1060)	(−0.8049)	(−1.1702)	(0.5138)	(−1.5363)
Term spread	0.0000	-0.0002	0.0001	−0.0002	−0.0001	−0.0003***
	(0.5088)	(−1.4612)	(0.5709)	(−0.9161)	(−1.5478)	(−3.3555)
FSI	−0.0000	−0.0000*	−0.0000	−0.0000	−0.0000***	−0.0000***
	(−1.3680)	(−1.7488)	(−0.5236)	(−0.3557)	(−3.3132)	(−4.4720)
N	2503	2503	2503	2503	2503	2503
r^2	0.1569	0.4404	0.3500	0.3504	0.1939	0.4152
Panel B: Non-ESG						
Risk aversion	−0.0054***	−0.0204***	−0.0041***	−0.0194***	−0.0010	−0.0037***
	(−2.7407)	(−6.4189)	(−4.9382)	(−10.1229)	(−1.2748)	(−3.5043)
Economic uncertainty	−0.0315***	−0.0299***	−0.0103***	−0.0206***	−0.0103***	−0.0120***
	(−9.8566)	(−5.8423)	(−7.6688)	(−6.6799)	(−8.1919)	(−6.9599)
Ambiguity	0.0010***	0.0017***	0.0001	0.0004**	−0.0002**	−0.0002*
	(5.9713)	(6.1891)	(1.3290)	(2.2212)	(−2.4258)	(−1.8078)
Geopolitical risk	−0.0003	−0.0007**	−0.0001	−0.0003	−0.0000	−0.0001
	(−1.3125)	(−1.9646)	(−0.6823)	(−1.4705)	(−0.2132)	(−0.6339)
GABI	0.9321***	1.3535***	0.1444***	1.0348***	0.1701***	0.6051***
	(28.9676)	(26.2453)	(10.7122)	(33.2982)	(12.4801)	(34.9984)
MOVE	−0.0122***	−0.0338***	−0.0059***	−0.0239***	−0.0020**	−0.0109***
	(−5.4916)	(−9.4669)	(−6.2935)	(−11.0983)	(−2.1602)	(−9.0737)
FFR	0.0003*	0.0001	0.0001	0.0000	0.0001	−0.0001
	(1.6537)	(0.2880)	(1.4137)	(0.0488)	(1.0042)	(−0.8247)
Default spread	−0.0001	−0.0005	0.0002*	0.0000	0.0001	−0.0002
	(−0.4576)	(−1.4188)	(1.7838)	(0.1170)	(1.5100)	(−1.2893)
Term spread	0.0002	−0.0001	0.0000	−0.0002	−0.0001	−0.0003***
	(1.1121)	(−0.2856)	(0.3385)	(−1.3781)	(−1.3728)	(−3.0257)

(Continues)

TABLE 14 | (Continued)

	(1) Sov. USD (1–3 years)	(2) Sov. USD (10+ years)	(3) Sov. Local (1–3 years)	(4) Sov. Local (10+ years)	(5) Corporate (1-3 years)	(6) Corporate (10+ years)
FSI	−0.0000	−0.0000	−0.0000	−0.0000*	−0.0000**	−0.0000***
	(−0.3399)	(−0.2785)	(−1.5306)	(−1.8072)	(−2.3366)	(−3.8240)
N	2503	2503	2503	2503	1818	2503
r^2	0.3386	0.3369	0.1568	0.4356	0.1506	0.3992

Note: This table reports the estimation results from Equation (1) where the dependent variables are maturity-specific daily returns on USD denominated ESG sovereign emerging bond markets index (columns 1–2), local currency denominated ESG sovereign emerging bond markets index (columns 3–4), and USD denominated ESG corporate emerging bond markets index (columns 5–6) on the aggregate level. Columns 1, 3, and 5 show the results for short-term (1–3 years), while columns 2, 4, and 6 show the results for long-term (10+ years). Panel A reports results for ESG indices, while Panel B shows the results for non-ESG indices. The key explanatory variables are Risk aversion, Economic uncertainty, Ambiguity, and Geopolitical risk. The set of control variables includes global bond market returns (GABI), global bond market volatility (MOVE Index), global liquidity conditions (US Federal Funds Rate, FFR), default spread, term spread, and Financial Stress Index (FSI). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

exogenous to them (such as uncertainty around trade tariffs). They may save a few basis points on financing costs (the 'greenium') for issuing sustainable bonds, but the risk characteristics remain very similar to those of the regular bonds they issued. Hence, incorporating sustainability into an emerging markets debt portfolio does not seem to increase its riskiness.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Bond market data that supports the findings of this study are available from J.P. Morgan. Restrictions apply to the availability of these data, which were used under license for this study.

Endnotes

[1] The World Bank defines thematic bonds as fixed-income securities issued in capital markets to raise financing for projects and activities related to a specific theme (e.g., climate change, ocean and marine conservation, social projects) and the Sustainable Development Goals. Thematic bonds are also labelled as environmental, social, and governance (ESG) bonds, and they include green, social, and sustainability bonds (also known as GSS bonds). Green bonds raise funds for projects and activities that will have a positive environmental impact, social bonds are designated to finance projects with expected positive social outcomes, while sustainability bonds are related to financing a combination of green and social projects or activities. Fora more comprehensive overview of thematic bonds, see the following link: https://thedocs.worldbank.org/en/doc/4de3839b85c57eb958dd207fad132f8e-0340012022/original/WB-GSS-Bonds-Survey-Report.pdf

[2] While acknowledging the limitation of using only one index provider, we focus on J.P. Morgan indices for emerging markets as they have been the most widely used indices in the literature on emerging bond markets (e.g., Agur et al. 2019; Arslanalp et al. 2020; Dimic et al. 2021; Moretti et al. 2024; Benkraiem et al. 2025).

[3] For the exact index rules, see Morgan (2022).

[4] RepRisk is, for example, used in Chasiotis et al. (2024) and Li et al. (2025), Sustainalytics in Liu et al. (2025) and Feng et al. (2025), and Climate Bond Initiative in Arouri et al. (2025).

[5] Top 25 countries included in the Index: UAE, Ecuador, Ghana, Romania, Egypt, Bahrain, Hungary, South Africa, Ukraine, Turkey, Kazakhstan, Mexico, Peru, Colombia, Dominican Republic, Oman, Brazil, Uruguay, Philippines, Chile, Russia, Indonesia, Qatar, Panama, Saudi Arabia.

[6] For detailed description and calculation of the Risk Aversion Index and Economic Uncertainty measure, see Bekaert et al. (2022) and https://www.nancyxu.net/risk-aversion-index.

[7] The Geopolitical Risk Index developed by Caldara and Iacoviello (2022) is constructed by utilizing the automated text-search results of the 10 major newspapers: Chicago Tribune, the Daily Telegraph, Financial Times, The Globe and Mail, The Guardian, the Los Angeles Times, The New York Times, USA Today, The Wall Street Journal, and The Washington Post. The Index is calculated by counting the number of articles about adverse geopolitical events in each newspaper for each month (as a fraction of the total number of news articles). For more details, see https://www.matteoiacoviello.com/gpr.htm.

[8] The exception is a measure of ambiguity, thankfully provided by Professor Yehuda Izhakian, and it is available from January 1st, 2013, to January 20th, 2023. (https://pages.stern.nyu.edu/~yizhakia/data.html)

[9]The starting date of the COVID-19 pandemic is 11 March 2020, as in Barrios and Hochberg (2021).

[10]We need to acknowledge that the number of observations with monthly data amounts to 125, which is much less than the number of observations with daily data. As pointed out in Bessembinder et al. (2008), using daily bond data significantly increases the power of the tests, relative to the monthly data.

[11]The country representation of the regions is as follows: Asia (China, Australia, Hong Kong, Japan, Korea, Philippines); Europe (Hungary, Poland, Russia, Ukraine), Latin (Argentina, Brazil, Chile, Peru, Venezuela), and the Middle East (Egypt, Israel, Saudi Arabia, South Africa, Turkey).

References

Agur, I., M. Chan, M. Goswami, and S. Sharma. 2019. "On International Integration of Emerging Sovereign Bond Markets." *Emerging Markets Review* 38: 347–363.

Amstad, M., F. Packer, and J. Shek. 2020. "Does Sovereign Risk in Local and Foreign Currency Differ?" *Journal of International Money and Finance* 101: 102099.

Andresen, L. L., and J. E. Sturm. 2024. "Do Geopolitical Interests Affect How Financial Markets React to IMF Programs?" *Review of International Political Economy* 31, no. 1: 304–329.

Arouri, M., M. Mhadhbi, and M. H. Shahrour. 2025. "Dynamic Connectedness and Hedging Effectiveness Between Green Bonds, ESG Indices, and Traditional Assets." *European Financial Management* 31: 1704–1719. https://doi.org/10.1111/eufm.12561.

Arslanalp, S., D. Drakopoulos, R. Goel, and R. Koepke. 2020. "Benchmark-Driven Investments in Emerging Market Bond Markets: Taking Stock." IMF Working paper WP/20/192.

Asgharian, H., C. Christiansen, and A. J. Hou. 2023. "The Effect of Uncertainty on Stock Market Volatility and Correlation." *Journal of Banking & Finance* 154: 106929.

Ashcraft, A. B., and D. Duffie. 2007. "Systemic Illiquidity in the Federal Funds Market." *American Economic Review* 97, no. 2: 221–225.

Ağca, Ş., and O. Celasun. 2012. "Sovereign Debt and Corporate Borrowing Costs in Emerging Markets." *Journal of International Economics* 88, no. 1: 198–208.

Baele, L., G. Bekaert, K. Inghelbrecht, and M. Wei. 2020. "Flights to Safety." *Review of Financial Studies* 33: 689–746.

Baker, M., D. Bergstresser, G. Serafeim, and J. Wurgler. 2022. "The Pricing and Ownership of US Green Bonds." *Annual Review of Financial Economics* 14, no. 1: 415–437.

Baker, M., and J. Wurgler. 2006. "Investor Sentiment and the Cross-Section of Stock Returns." *Journal of Finance* 61, no. 4: 1645–1680.

Baker, S. R., N. Bloom, and S. J. Davis. 2016. "Measuring Economic Policy Uncertainty." *Quarterly Journal of Economics* 131, no. 4: 1593–1636.

Balcilar, M., O. Usman, H. Gungor, D. Roubaud, and M. E. Wohar. 2021. "Role of Global, Regional, and Advanced Market Economic Policy Uncertainty on Bond Spreads in Emerging Markets." *Economic Modelling* 102: 105576.

Bali, T. G., A. Subrahmanyam, and Q. Wen. 2021. "The Macroeconomic Uncertainty Premium in the Corporate Bond Market." *Journal of Financial and Quantitative Analysis* 56, no. 5: 1653–1678.

Barrios, J. M., and Y. V. Hochberg. 2021. "Risk Perceptions and Politics: Evidence From the COVID-19 Pandemic." *Journal of Financial Economics* 142, no. 2: 862–879.

Bauer, R., T. Ruof, and P. Smeets. 2021. "Get Real! Individuals Prefer More Sustainable Investments." *Review of Financial Studies* 34, no. 8: 3976–4043.

Baur, D. G., and B. M. Lucey. 2009. "Flights and Contagion—An Empirical Analysis of Stock–Bond Correlations." *Journal of Financial Stability* 5, no. 4: 339–352.

Baur, D. G., and N. Schulze. 2009. "Financial Market Stability—A Test." *Journal of International Financial Markets, Institutions and Money* 19: 506–519.

Baur, D. G., and L. A. Smales. 2020. "Hedging Geopolitical Risk With Precious Metals." *Journal of Banking & Finance* 117: 105823.

Bekaert, G., E. C. Engstrom, and N. R. Xu. 2022. "The Time Variation in Risk Appetite and Uncertainty." *Management Science* 68, no. 6: 3975–4004.

Bekaert, G., and C. R. Harvey. 1995. "Time-Varying World Market Integration." *Journal of Finance* 50, no. 2: 403–444.

Bekaert, G., C. R. Harvey, C. T. Lundblad, and S. Siegel. 2016. "Political Risk and International Valuation." *Journal of Corporate Finance* 37: 1–23.

Benkraiem, R., N. Dimic, V. Piljak, L. Swinkels, and M. Vulanovic. 2025. "Media-Based Climate Risks and International Corporate Bond Market." *Journal of International Money and Finance* 151: 103260.

Bernal, O., J. Y. Gnabo, and G. Guilmin. 2016. "Economic Policy Uncertainty and Risk Spillovers in the Eurozone." *Journal of International Money and Finance* 65: 24–45.

Bernanke, B., M. Gertler, and S. Gilchrist. 1996. "The Financial Accelerator and the Flight to Quality." *Review of Economics and Statistics* 78, no. 1: 1–15.

Bernanke, B. S. 1983. "Irreversibility, Uncertainty, and Cyclical Investment." *Quarterly Journal of Economics* 98, no. 1: 85–106.

Bessembinder, H., K. M. Kahle, W. F. Maxwell, and D. Xu. 2008. "Measuring Abnormal Bond Performance." *Review of Financial Studies* 22, no. 10: 4219–4258.

Bhanot, K. 2005. "What Causes Mean Reversion in Corporate Bond Index Spreads? The Impact of Survival." *Journal of Banking & Finance* 29, no. 6: 1385–1403.

Bianchi, D., M. Büchner, and A. Tamoni. 2020. "Bond Risk Premiums With Machine Learning." *Review of Financial Studies* 34, no. 2: 1046–1089.

Bloom, N. 2009. "The Impact of Uncertainty Shocks." *Econometrica* 77, no. 3: 623–685.

Bonciani, D., and M. Ricci. 2020. "The International Effects of Global Financial Uncertainty Shocks." *Journal of International Money and Finance* 109: 102236.

Bossaerts, P., P. Ghirardato, S. Guarnaschelli, and W. R. Zame. 2010. "Ambiguity in Asset Markets: Theory and Experiment." *Review of Financial Studies* 23, no. 4: 1325–1359.

Boubaker, S., D. K. Nguyen, V. Piljak, and A. Savvides. 2019. "Financial Development, Government Bond Returns, and Stability: International Evidence." *Journal of International Financial Markets, Institutions and Money* 61: 81–96.

Brenner, M., and Y. Izhakian. 2018. "Asset Pricing and Ambiguity: Empirical Evidence." *Journal of Financial Economics* 130, no. 3: 503–531.

Brogaard, J., L. Dai, P. T. H. Ngo, and B. Zhang. 2020. "Global Political Uncertainty and Asset Prices." *Review of Financial Studies* 33, no. 4: 1737–1780.

Brooks, J., S. Richardson, and Z. Xu. 2020. "(Systematic) Investing in Emerging Market Debt." *The Journal of Fixed Income* 30, no. 2: 44–61.

Burger, J. D., F. E. Warnock, and V. C. Warnock. 2012. "Emerging Local Currency Bond Markets." *Financial Analysts Journal* 68, no. 4: 73–93.

Caldara, D., and M. Iacoviello. 2022. "Measuring Geopolitical Risk." *American Economic Review* 112, no. 4: 1194–1225.

Campbell, J. Y., and J. H. Cochrane. 1999. "By Force of Habit: A Consumption-Based Explanation of Aggregate Stock Market Behavior." *Journal of Political Economy* 107, no. 2: 205–251.

Caramichael, J., and A. C. Rapp. 2024. "The Green Corporate Bond Issuance Premium." *Journal of Banking & Finance* 162: 107126.

Carroll, C. D., and A. A. Samwick. 1997. "The Nature of Precautionary Wealth." *Journal of Monetary Economics* 40, no. 40: 41–71.

Chaieb, I., V. Errunza, and R. Gibson Brandon. 2020. "Measuring Sovereign Bond Market Integration." *Review of Financial Studies* 33, no. 8: 3446–3491.

Chasiotis, I., D. Gounopoulos, D. Konstantios, V. C. Naoum, and V. Patsika. 2024. "Does ESG Reputational Risk Affect the Efficiency and Speed of Adjustment of Corporate Investment?" *European Financial Management* 30, no. 2: 839–878.

Choi, S., G. Ciminelli, and D. Furceri. 2023. "Is Domestic Uncertainty a Local Pull Factor Driving Foreign Capital Inflows? New Cross-Country Evidence." *Journal of International Money and Finance* 130: 102764.

Christiansen, C. 2007. "Volatility-Spillover Effects in European Bond Markets." *European Financial Management* 13, no. 5: 923–948.

Christopher, R., S.-J. Kim, and E. Wu. 2012. "Do Sovereign Credit Ratings Influence Regional Stock and Bond Market Interdependencies in Emerging Countries?" *Journal of International Financial Markets, Institutions and Money* 22, no. 4: 1070–1089.

Costantini, M., and R. M. Sousa. 2022. "What Uncertainty Does to Euro Area Sovereign Bond Markets: Flight to Safety and Flight to Quality." *Journal of International Money and Finance* 122: 102574.

Dachraoui, H., M. Smida, and M. Sebri. 2020. "Role of Capital Flight as a Driver of Sovereign Bond Spreads in Latin American Countries." *International Economics* 162: 15–33.

Dimic, N., J. Kiviaho, V. Piljak, and J. Äijö. 2016. "Impact of Financial Market Uncertainty and Macroeconomic Factors on Stock–Bond Correlation in Emerging Markets." *Research in International Business and Finance* 36: 41–51.

Dimic, N., V. Piljak, L. Swinkels, and M. Vulanovic. 2021. "The Structure and Degree of Dependence in Government Bond Markets." *Journal of International Financial Markets, Institutions and Money* 74: 101385.

Dittmar, R. F., and K. Yuan. 2008. "Do Sovereign Bonds Benefit Corporate Bonds in Emerging Markets?" *Review of Financial Studies* 21, no. 5: 1983–2014.

Dong, X., Y. Xiong, S. Nie, and S. M. Yoon. 2023. "Can Bonds Hedge Stock Market Risks? Green Bonds vs Conventional Bonds." *Finance Research Letters* 52: 103367.

Du, W., and J. Schreger. 2022. "Sovereign Risk, Currency Risk, and Corporate Balance Sheets." *Review of Financial Studies* 35, no. 10: 4587–4629.

Duyvesteyn, J., M. Martens, and P. Verwijmeren. 2016. "Political Risk and Expected Government Bond Returns." *Journal of Empirical Finance* 38: 498–512.

Easley, D., and M. O'Hara. 2009. "Ambiguity and Nonparticipation: The Role of Regulation." *Review of Financial Studies* 22, no. 5: 1817–1843.

Eichengreen, B., R. Hausmann, and U. Panizza. 2023. "Yet It Endures: The Persistence of Original Sin." *Open Economies Review* 34, no. 1: 1–42.

Ellsberg, D. 1961. "Risk, Ambiguity, and the Savage Axioms." *Quarterly Journal of Economics* 75: 643–669.

Elton, E. J., M. J. Gruber, D. Agrawal, and C. Mann. 2001. "Explaining the Rate Spread on Corporate Bonds." *Journal of Finance* 56, no. 1: 247–277.

Epstein, L. G., and M. Schneider. 2008. "Ambiguity, Information Quality, and Asset Pricing." *Journal of Finance* 63, no. 1: 197–228.

Feldhütter, P., K. Halskov, and A. Krebbers. 2024. "Pricing of Sustainability-Linked Bonds." *Journal of Financial Economics* 162: 103944.

Feng, X., H. J. von Mettenheim, G. Sermpinis, and C. Stasinakis. 2025. "Sustainable Portfolio Construction via Machine Learning: ESG, SDG and Sentiment." *European Financial Management* 31, no. 3: 1148–1169. https://doi.org/10.1111/eufm.12531.

Fiorillo, P., A. Meles, D. Salerno, and V. Verdoliva. 2024. "Geopolitical Turmoil and Investor Green Preference: Evidence From the Corporate Bond Market." *Journal of International Money and Finance* 149: 103218.

Gagliardini, P., P. Porchia, and F. Trojani. 2009. "Ambiguity Aversion and the Term Structure of Interest Rates." *Review of Financial Studies* 22, no. 10: 4157–4188.

Gianfrate, G., and M. Peri. 2019. "The Green Advantage: Exploring the Convenience of Issuing Green Bonds." *Journal of Cleaner Production* 219: 127–135.

Giesecke, K., F. A. Longstaff, S. Schaefer, and I. Strebulaev. 2011. "Corporate Bond Default Risk: A 150-year Perspective." *Journal of Financial Economics* 102, no. 2: 233–250.

Gilboa, I. 1987. "Expected Utility With Purely Subjective Non-Additive Probabilities." *Journal of Mathematical Economics* 16, no. 1: 65–88.

Gilboa, I., and D. Schmeidler. 1989. "Maxmin Expected Utility With Non-Unique Prior." *Journal of Mathematical Economics* 18, no. 2: 141–153.

Gilchrist, S., J. W. Sim, and E. Zakrajšek. 2014. "*Uncertainty, Financial Frictions, and Investment Dynamics (Working paper 20038)*". National Bureau of Economic Research.

Goel, R., F. Natalucci, and D. Gautam. 2022. "Sustainable Finance in Emerging Markets: Evolution, Challenges, and Policy Priorities." IMF Working paper WP/22/182.

Guo, Y., Y. Deng, and H. Zhang. 2023. "How Do Composite and Categorical Economic Policy Uncertainties Affect the Long-Term Correlation Between China's Stock and Conventional/Green Bond Markets?" *Finance Research Letters* 57: 104148.

Hachenberg, B., and D. Schiereck. 2018. "Are Green Bonds Priced Differently From Conventional Bonds?" *Journal of Asset Management* 19: 371–383.

Hamilton, J. D. 1997. "Measuring the Liquidity Effect." *American Economic Review* 87, no. 1: 80–97.

Han, S., and X. Zhou. 2014. "Informed Bond Trading, Corporate Yield Spreads, and Corporate Default Prediction." *Management Science* 60, no. 3: 675–694.

Hanauer, M. X., and T. Kalsbach. 2023. "Machine Learning and the Cross-Section of Emerging Market Stock Returns." *Emerging Markets Review* 55: 101022.

Harvey, C. R. 1995. "Predictable Risk and Returns in Emerging Markets." *Review of Financial Studies* 8, no. 3: 773–816.

Hornuf, L., and G. Yüksel. 2024. "The Performance of Socially Responsible Investments: A Meta-Analysis." *European Financial Management* 30, no. 2: 1012–1061.

Huang, T., F. Wu, J. Yu, and B. Zhang. 2015. "International Political Risk and Government Bond Pricing." *Journal of Banking & Finance* 55: 393–405.

Huynh, T. D., and Y. Xia. 2021. "Climate Change News Risk and Corporate Bond Returns." *Journal of Financial and Quantitative Analysis* 56, no. 6: 1985–2009.

IFC & Amundi, "Emerging Market Green Bonds" IFC-Amundi Joint Report. Published May 2024. https://documents1.worldbank.org/curated/en/099734005282477873/pdf/IDU1f7d580db1e4541458918c591cb45dd4f3eb9.pdf.

Inderst, R., and M. M. Opp. 2025. "Sustainable Finance Versus Environmental Policy: Does Greenwashing Justify a Taxonomy for Sustainable Investments?" *Journal of Financial Economics* 163: 103954.

Ioannidis, C., and K. Ka. 2021. "Economic Policy Uncertainty and Bond Risk Premia." *Journal of Money, Credit and Banking* 53, no. 6: 1479–1522.

Izhakian, Y. 2017. "Expected Utility With Uncertain Probabilities Theory." *Journal of Mathematical Economics* 69: 91–103.

Izhakian, Y. 2020. "A Theoretical Foundation of Ambiguity Measurement." *Journal of Economic Theory* 187: 105001.

Julio, B., and Y. Yook. 2012. "Political Uncertainty and Corporate Investment Cycles." *Journal of Finance* 67, no. 1: 45–83.

Jurado, K., S. C. Ludvigson, and S. Ng. 2015. "Measuring Uncertainty." *American Economic Review* 105, no. 3: 1177–1216.

Keynes, J. M. 1921. *A Treatise on Probability*. Macmillan and Co.

Kim, E. B., and S. J. Byun. 2021. "Risk, Ambiguity, and Equity Premium: International Evidence." *International Review of Economics & Finance* 76: 321–335.

Knight, F. H. 1921. *Risk, Uncertainty and Profit*, Vol. 31. Houghton Mifflin.

Koepke, R. 2019. "What Drives Capital Flows to Emerging Markets? A Survey of the Empirical Literature." *Journal of Economic Surveys* 33, no. 2: 516–540.

Konstantinov, G. S. 2022. "Emerging Market Bonds: Expected Returns and Currency Impact." *Journal of Portfolio Management* 48, no. 8: 139–158.

Krueger, P., Z. Sautner, and L. T. Starks. 2020. "The Importance of Climate Risks for Institutional Investors." *Review of Financial Studies* 33, no. 3: 1067–1111.

Krüger, P. 2015. "Corporate Goodness and Shareholder Wealth." *Journal of Financial Economics* 115, no. 2: 304–329.

Larcker, D. F., and E. M. Watts. 2020. "Where's the Greenium?" *Journal of Accounting and Economics* 69, no. 2–3: 101312.

Lehkonen, H., and K. Heimonen. 2015. "Democracy, Political Risks and Stock Market Performance." *Journal of International Money and Finance* 59: 77–99.

Leippold, M., and F. Matthys. 2022. "Economic Policy Uncertainty and the Yield Curve." *Review of Finance* 26, no. 4: 751–797.

Li, C., and J. Whalley. 2021. "Effects of the Comprehensive and Progressive Agreement for Trans-Pacific Partnership." *World Economy* 44, no. 5: 1312–1337.

Li, Z., Z. Li, and W. Qin. 2025. "ESG Risk and Market Return Predictability: New Evidence From the Eurozone." *European Financial Management* 31: 1633–1651. https://doi.org/10.1111/eufm.12553.

Liang, C., Q. Luo, Y. Li, and L. D. T. Huynh. 2023. "Global Financial Stress Index and Long-Term Volatility Forecast for International Stock Markets." *Journal of International Financial Markets, Institutions and Money* 88: 101825.

Liu, F., C. Qin, M. Qin, P. Stefea, and D. Norena-Chavez. 2024. "Geopolitical Risk: An Opportunity or a Threat to the Green Bond Market?" *Energy Economics* 131: 107391.

Liu, X., W. Hou, and B. G. M. Main. 2025. "Charity Experience of Directors and Corporate Social Responsibility: Global Evidence." *European Financial Management* 31: 1445–1471. https://doi.org/10.1111/eufm.12540.

Long, S., H. Tian, and Z. Li. 2022. "Dynamic Spillovers Between Uncertainties and Green Bond Markets in the US, Europe, and China: Evidence From the Quantile VAR Framework." *International Review of Financial Analysis* 84: 102416.

Maghyereh, A., and S. A. Ziadat. 2024. "Oil Price Shocks and Financial Stress: Who Is the Influencer?" *International Journal of Finance & Economics* 29, no. 4: 4443–4461.

Mertzanis, C. 2023. "Energy Policy Diversity and Green Bond Issuance Around the World." *Energy Economics* 128: 107116.

Mertzanis, C., and I. Tebourbi. 2025. "Geopolitical Risk and Global Green Bond Market Growth." *European Financial Management* 31, no. 1: 26–71.

Miranda-Agrippino, S., and H. Rey. 2020. "Us Monetary Policy and the Global Financial Cycle." *Review of Economic Studies* 87: 2754–2776.

Moretti, M., L. Pandolfi, S. L. Schmukler, G. Villegas-Bauer, and T. Williams. 2024. "Inelastic Demand Meets Optimal Supply of Risky Sovereign Bonds." IMF Working paper WP/24/227.

Morgan, J. P. 2022. "Global Index Research—Index Product Guide." https://www.jpmorgan.com/content/dam/jpm/cib/complex/content/markets/index-research/Global-Index-Research-Product-Guide-2022.pdf.

NguyenHuu, T., and D. K. Örsal. 2023. "Geopolitical Risks and Financial Stress in Emerging Economies." *World Economy* 47: 217–237.

Office of Financial Research. n.d. 2025. *OFR Financial Stress Index*. U.S. Department of the Treasury. Retrieved January 23. https://www.financialresearch.gov/financial-stress-index.

Panchenko, V., and E. Wu. 2009. "Time-Varying Market Integration and Stock and Bond Return Concordance in Emerging Markets." *Journal of Banking & Finance* 33, no. 6: 1014–1021.

Pástor, Ľ., R. F. Stambaugh, and L. A. Taylor. 2022. "Dissecting Green Returns." *Journal of Financial Economics* 146, no. 2: 403–424.

Pástor, Ľ., and P. Veronesi. 2013. "Political Uncertainty and Risk Premia." *Journal of Financial Economics* 110, no. 3: 520–545.

Pedersen, L. H., S. Fitzgibbons, and L. Pomorski. 2021. "Responsible Investing: The ESG-Efficient Frontier." *Journal of Financial Economics* 142, no. 2: 572–597.

Pham, L., and C. P. Nguyen. 2022. "How Do Stock, Oil, and Economic Policy Uncertainty Influence the Green Bond Market?" *Finance Research Letters* 45: 102128.

Piljak, V. 2013. "Bond Markets Co-Movement Dynamics and Macroeconomic Factors: Evidence From Emerging and Frontier Markets." *Emerging Markets Review* 17: 29–43.

Piljak, V., and L. Swinkels. 2017. "Frontier and Emerging Government Bond Markets." *Emerging Markets Review* 30: 232–255.

Piñeiro-Chousa, J., M. Á. López-Cabarcos, J. Caby, and A. Šević. 2021. "The Influence of Investor Sentiment on the Green Bond Market." *Technological Forecasting and Social Change* 162: 120351.

Posedel Šimović, P., M. Tkalec, M. Vizek, and J. Lee. 2016. "Time-Varying Integration of the Sovereign Bond Markets in European Post-Transition Economies." *Journal of Empirical Finance* 36: 30–40.

Rey, H. 2015. "Dilemma Not Trilemma: The Global Financial Cycle and Monetary Policy Independence." (Working paper No. w21162). National Bureau of Economic Research.

Riedl, A., and P. Smeets. 2017. "Why Do Investors Hold Socially Responsible Mutual Funds?" *Journal of Finance* 72, no. 6: 2505–2550.

Roma, A., and W. Torous. 1997. "The Cyclical Behavior of Interest Rates." *Journal of Finance* 52, no. 4: 1519–1542.

Şahin, B. C., and S. Danışoğlu. 2022. "Ambiguity and Asset Pricing: An Empirical Investigation for an Emerging Market." *International Review of Financial Analysis* 84: 102338.

Sohag, K., S. Hammoudeh, A. H. Elsayed, O. Mariev, and Y. Safonova. 2022. "Do Geopolitical Events Transmit Opportunity or Threat to Green Markets? Decomposed Measures of Geopolitical Risks." *Energy Economics* 111: 106068.

Tang, Y., X. H. Chen, P. K. Sarker, and S. Baroudi. 2023. "Asymmetric Effects of Geopolitical Risks and Uncertainties on Green Bond Markets." *Technological Forecasting and Social Change* 189: 122348.

Tansan, B., N. Lang, M. Meyer, et al. 2023. The Sustainability Imperative in Emerging Markets. Boston Consulting Group.

Tao, X., B. Wang, J. Wang, and C. Wu. 2022. "Economic Policy Uncertainty and the Cross-Section of Corporate Bond Returns." *Journal of Fixed Income* 32, no. 1: 6–44.

The World Bank. 2024. "Green, Social, Sustainability, and Sustainability-Linked (GSSS) Bonds." https://thedocs.worldbank.org/en/doc/dacb969cc71f53abde2d2758f1cc13ed-0340012024/original/GSSS-Quarterly-Newsletter-Issue-No-8.pdf.

Tillmann, P. 2016. "Unconventional Monetary Policy and the Spillovers to Emerging Markets." *Journal of International Money and Finance* 66: 136–156.

Uddin, G. S., R. Jayasekera, D. Park, T. Luo, and S. Tian. 2022. "Go Green or Stay Black: Bond Market Dynamics in Asia." *International Review of Financial Analysis* 81: 102114.

Uppal, R. 1993. "A General Equilibrium Model of International Portfolio Choice." *The Journal of Finance* 48, no. 2: 529–553.

Wang, J., X. Chen, X. Li, J. Yu, and R. Zhong. 2020. "The Market Reaction to Green Bond Issuance: Evidence From China." *Pacific-Basin Finance Journal* 60: 101294.

Wang, X., Y. Wu, and W. Xu. 2024. "Geopolitical Risk and Investment." *Journal of Money, Credit and Banking* 56, no. 8: 2023–2059.

Wei, P., Y. Qi, X. Ren, and K. Duan. 2022. "Does Economic Policy Uncertainty Affect Green Bond Markets? Evidence From Wavelet-Based Quantile Analysis." *Emerging Markets Finance and Trade* 58: 4375–4388.

World Bank Treasury. 2024, July. *GSSS Bonds: Market Update—July 2024*. World Bank. https://thedocs.worldbank.org/en/doc/dacb969cc71f53abde2d2758f1cc13ed-0340012024/original/GSSS-Quarterly-Newsletter-Issue-No-8.pd.

Xu, G., N. Lu, and Y. Tong. 2022. "Greenwashing and Credit Spread: Evidence From the Chinese Green Bond Market." *Finance Research Letters* 48: 102927.

Xu, N. R. 2019. Global Risk Aversion and International Return Comovements. SSRN 3174176.

Yang, B., Q. Gao, and J. Li. 2025. "Market Ambiguity, Investor Sentiment and Market Anomalies: Evidence From the Chinese A-Share Market." *Research in International Business and Finance* 75: 102514.

Zaremba, A., N. Cakici, E. Demir, and H. Long. 2022. "When Bad News Is Good News: Geopolitical Risk and the Cross-Section of Emerging Market Stock Returns." *Journal of Financial Stability* 58: 100964.

Zerbib, O. D. 2019. "The Effect of Pro-Environmental Preferences on Bond Prices: Evidence From Green Bonds." *Journal of Banking & Finance* 98: 39–60.

Zhao, G. 2020. "Ambiguity, Nominal Bond Yields, and Real Bond Yields." *American Economic Review: Insights* 2, no. 2: 177–192.

Zhou, Y. 2014. "Modeling the Joint Dynamics of Risk-Neutral Stock Index and Bond Yield Volatilities." *Journal of Banking & Finance* 38: 216–228.

Supporting Information

Additional supporting information can be found online in the Supporting Information section.
Supporting Information