Green Bond Market in the New Context: A Financial Bubble or an Effective Financing Tool?

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Abstract

Ensuring economic growth in the 21st century is inextricably linked to attempts to address pressing human development challenges, including poverty and inequality, climate change, accelerating ecosystem degradation and other

environmental concerns. The concept of corporate social responsibility (CSR) has gradually transformed into an ESG approach, which is largely synchronized with the internationally benchmarked Sustainable Development Goals. The growing popularity of this approach was also reflected in the development of the financial market and financial institutions, which responded with the first issue of green bonds in 2007. One of the drivers of the subsequent growth of this segment of the financial market was a high green premium, which persisted until the crisis events of the early 2020s. The challenges facing the global economy in 2022 had a negative impact on the dynamics and state of the green securities segment and led to the disappearance of the green premium in the fourth quarter of 2022. In the coming years, we can expect the market to recover, as well as its transition to a new state, including through changes in the structure of green bond issuers.

Introduction

The growing concern about climate change and the active environmental efforts of economic agents at various levels, from international to local, have led to the emergence of the concept of "green projects" [ICMA 2021b]. These initiatives aim to reduce the negative impact of economic activity on the environment and, most importantly, to decrease greenhouse gas emissions. Implementing such projects requires substantial financial resources. One financial instrument used to attract investors is green bonds. According to the International Capital Markets Association (ICMA), green bonds are defined as debt instruments whose proceeds or equivalent amounts are exclusively used to finance or refinance green projects. It is important to note that this definition covers not only climate-related projects but also other environmental initiatives. The perception of green bonds as climate bonds is often due to the fact that the first issue of this type of security in 2007 aimed to reduce greenhouse gas emissions and ensure environmental sustainability. These securities were called "climate awareness bonds" [Financial Research Institute 2016]. The International Bank for Reconstruction and Development became an issuer of green bonds a year later in 2008 [World Bank 2022], and the development of this new financial instrument has been very active since then.

Currently, green bonds are classified as part of the World Bank's targeted or thematic bonds, which also include blue bonds for marine and water projects, social bonds for financing socially-oriented initiatives, gender-related bonds, sustainable bonds for projects that combine social and environmental objectives or contribute to the realization of the SDGs [Chase 2021], green sukuks, and sustainable development bonds. The latter ones are different, as their focus is on achieving a specific, predetermined goal and the greater flexibility that comes from not being tied to a specific project [Ul Haq, Doumbia 2022]. Additionally, the term "ESG bonds" is increasingly being used as a synonym for thematic bonds.

The green bond system is quite diverse and includes various types of bonds, such as corporate and sovereign bonds, direct issue and securitized bonds, project bonds,

and others. The International Capital Markets Association [ICMA 2021b] proposes a division of bonds based on the use of proceeds in the "Principles of Green Bonds." Thus, the proceeds of green bonds should finance projects related to renewable energy and energy efficiency, pollution prevention and control, sustainable natural resource management and land use, biodiversity conservation, clean transportation, sustainable water and wastewater management, climate change adaptation, circular economy, and green buildings [ICMA 2021a]. Thus, when analyzing green bonds, we consider a broad range of debt securities that meet the aforementioned requirements and aim to raise funds for sustainable development and green economy projects. This study is dedicated to identifying the overall development trends of such bonds.

The purpose of this paper is to identify and explain the changes in incentives for issuing and purchasing green bonds from their inception to the present. The following section provides a literature review that highlights these incentives. The second section examines the impact of the 2020-2022 crisis on these incentives. The third section supplements this analysis with an empirical study. Finally, the last section discusses a potential trajectory for the future development of the green bond market.

1. Green premium as a growth driver of green bonds: A review of studies

The nature of green bonds explains their focus on obtaining economic benefits as well as achieving altruistic goals of improving environmental quality and solving global problems. While such goals are relevant for states and international institutions, commercial organizations prioritize financial results.

Despite the higher price and lower yields of green bonds compared to conventional issues with long durations (over 3 years) [Agliardi and Agliardi 2019], they are increasingly popular in international markets. The factors driving interest in this financial instrument have changed over time. Previously, the popularity of green securities was attributed to their potential to diversify portfolios, enhance a company's image through participation in environmental projects, and minimize reputational and regulatory risks [Maltais and Nykvist 2020]. Currently, their popularity is determined by their high credit rating (A and above), tax benefits, and the reduction of investment risks for companies that transfer from the issuer to the investor [Khmyz 2019; Flammer 2021]. Certification is considered a factor in the increasing demand for green bonds [Daubanes, Mitali and Rochet 2021]. Estimates of premiums and costs for issuers and bondholders suggest that the attractiveness of the security decreases if the issuer is responsible for certification [Emets 2020]. When issuers shift the costs of certification to investors, the price of green bonds increases compared to conventional securities. This suggests that investors have greater confidence in third-party certification of green bonds. Secondary market studies indicate that the yields of green and conventional bonds are gradually equalizing. This may be due to the gradual distribution of the cost of bond certification, as well as the participation in market transactions of investors who are not willing to overpay for the special status of a green bond.

The literature reveals that divestment from dirty industries has led to relatively low investment risks, which has contributed to the increase in green bond issuance. This trend is linked to the long-term goal of sustainability [Maltais and Nykvist 2020]. Additionally, Alonso-Conde and Rojo-Suárez (2020) note that the lower interest rate of green bonds compared to bank loans is due to the lower cost of capital for financing green projects relative to other debt securities. This effect can be especially noticeable in the case of bullet repayments. Assuming all other factors are equal, the shorter maturity of green bonds compared to conventional bank loans results in a lower internal rate of return. However, the lower rate on green bonds, relative to a simple loan, compensates for this effect and leads to an increase in the internal rate of return on the borrower's equity.

The studies mentioned above indicate that the main reason for issuing green bonds is the presence of a financial premium which is commonly referred to as the green premium or greenium. It is characterized by a reduced yield [MacAskill et al. 2021] or an increased price of green bonds compared to conventional issues [Emets 2020]. It can also be defined as a "yield discount [...] to the common senior debt of the same issuer" [Hilinsky 2023]. Greenium can be viewed as a premium to the cost of capital, indicating progress in the development and deployment of low-carbon solutions. A higher green premium in an industry necessitates more innovation to make the energy transition accessible to different social classes [Gates 2021]. In their analysis of China's Belt and Road Initiative, Zhang, Fang, and Zhao (2022) found that government green bonds are particularly associated with greenium. MacAskill et al. (2021) studied the social, economic, and environmental factors affecting the growth of green securities yields and concluded that the green premium exists in both primary and secondary stock markets. At the same time, there is a shift from financial to non-financial drivers. For instance, investors are becoming increasingly aware of environmental issues, and there is a change in the value paradigm and patterns of consumer behavior towards conscious consumption.

Researchers and analysts cite several reasons for the emergence of the green premium. One reason is the increasing tendency of investors to select companies and financial instruments that exhibit a commitment to sustainable business practices and ESG strategies. It is noteworthy that this trend is not only characteristic of retail investors, but also of institutional players who influence the situation in global and national financial markets. For instance, a 2018 report from Edelman, the American international public relations and strategic communications agency, revealed that 90% of institutional investors have altered their investment selection process to prioritize sustainable development principles [Edelman 2018]. This trend has increased demand for sustainable financial instruments and subsequently raised their yields, impacting the cost of capital. A study of the green bond market between 2016 and 2019 shows that the credit rating and institutional status of the issuer are the determining factors. Large companies with high credit ratings have lower capital costs, while small and medium-sized issuers have higher costs due to the presence of a green premium for investors [Dorofeev 2020].

The emergence of greenium can also be explained by the use of green bonds as a means to diversify investment portfolios. Han and Li (2022) conducted a study analyzing US and EU market data and found that portfolios with green bonds have better risk-adjusted return metrics than those with only common bonds [Han, Li 2022]. This is due

to less correlation of returns between green bonds and other asset types compared to common bonds. This could be explained by the fact that holders of green bonds are less inclined to sell securities during stock market shocks. This tendency promotes the growth of demand for green bonds.

The correlation between a company's ESG rating and the emergence of a green premium is evident. Babkin and Malevskaia-Malevich (2021) analyzed the share price dynamics of several companies and concluded that there is a positive correlation between a company's environmental performance and its financial growth. The authors note that the cost of capital for implementing green initiatives is comparatively lower for projects that are not linked to a sustainable agenda. In such cases, the costs of green initiatives are offset by an increase in greenium as companies improve their environmental performance.

There are a number of endeavors that investigate greenium from the perspective of the supply-demand balance of the relevant industry [Azevedo et al. 2022]. For instance, McKinsey estimates that there may be a shortage of low-carbon steel and recycled plastic in 2025-2030 due to the growing demand for their use in producing components and parts for renewable energy equipment in Europe and China. This is expected to result in a high green premium in these segments. Meanwhile, materials with abundant supply, such as green aluminum and low-carbon copper, will have little to no green premium.

The presence of the green premium can also be explained by investors' perception of the risk associated with these types of bonds. This includes the company's moral capital, which evaluates its philanthropic activities [Godfrey 2005]. In this case, investors associate actions taken to reduce or prevent negative environmental impact or implemented as part of the policy to achieve the Sustainable Development Goals with a reduced probability of default. That is, turning to green long-term investments signals a company's confidence that it has the necessary resources and capabilities to continue its operations over the long term. The presence of moral capital can impact the perception of default risk for the entire company. If the market is efficient, this impact should be consistent across all debt instruments. However, differences in approaches to company valuation by different categories of investors can lead to varying yields, which can affect the appearance of the greenback.

Thus, the factors mentioned above determine the possibility for companies to offer investors lower yields when issuing green debt and thereby reduce their future costs. Empirically, many researchers have confirmed the existence of the green premium, including Ivashkovskaya and Mikhaylova (2020), MacAskill et al. (2021), and Pietch and Salakhova (2022). Partridge and Medda (2018) concluded, based on yield curve analysis, that there is a presence of greenium in the primary and secondary markets at the municipal level in the United States. This is consistent with the improved performance of climate and green indices of US companies during the period under review (2013-2017). Based on the Climate Bond Initiative study, the authors suggest that green bond yield curves with multiple maturity points can serve as a benchmark for pricing new green bonds. This can help reduce capital expenditure on green infrastructure in the primary market [MacAskill 2018].

Partridge and Medda (2018) analyzed municipal green bond issues and found that they are becoming increasingly popular. City governments and municipalities use them

to raise funds for green building projects, transportation, water treatment plants, and energy efficiency. They also refinance and improve existing projects to make them more environmentally friendly [Chhachhar et al. 2023]. One reason for the increasing number of green initiatives at the city level is the need to compensate for underfunding by regional and federal governments. This has become more common in recent years due to increased social spending resulting from COVID-19. Municipal issues are often considered a reliable investment instrument. The issuer, typically a city, guarantees loan repayment with its own resources, which are often backed by public federal funds [Hilbrandt and Grubbauer 2020]. Municipal green bonds enable cities to diversify their resource base and invest in projects that meet local demand [Gorelick 2018]. In addition to financial incentives, the increasing prevalence of these securities in the stock market is due to the potential for greater public and investor participation in local environmental and resource conservation initiatives [García-Lamarca and Ullström 2022].

2. Disappearance of greenium

There has been a significant increase in the issuance of green bonds, with financial commercial organizations experiencing a growth rate of +154.2% per year and non-financial organizations experiencing a growth rate of +117.3%. Accordingly, this growth coincided with an increase in the green premium in 2021 [Ando et al. 2023]. The change in issuance can be attributed to the recovery of business activity after the pandemic and increased investment in green projects. The spread between green and "brown" (ordinary) bonds grew, indicating that players were more enthusiastic about purchasing green financial instruments compared to their traditional counterparts.

However, in 2022, there was an annual decline in issuance, marking the first time in the history of green bonds. S&P Global reports a 25.6% decrease in investment issuance from $596.3 billion in 2021 to $443.7 billion in 2022. The decline was largely driven by decreases in green investment issuance in Europe (-32.5%) and North America (-43.2%), which accounted for approximately 74% of issuance in 2021. Meanwhile, the decline in the Asia-Pacific region was less significant, amounting to approximately 2.5% [Wass et al. 2022; Wass et al. 2023].

Behind the reasons for the sharp decline, it was the destabilization of the world economic system in 2022 caused by the energy crisis, imbalances in energy supply and demand, aggravation of the geopolitical situation, and increased use of sanctions as a foreign policy instrument. The rise in hydrocarbon prices has prompted both developing and developed countries to invest in energy sources that reduce dependence on external shocks. As a result, investment in renewable energy sources increased by 17% in 2022, according to Bloomberg data. Similarly, investment in electric transportation has increased due to rising gasoline costs. This sector showed an unprecedented 54% growth in 2022 [BloombergNEF 2023]. More than half of the investment was made in China. The US and Europe, which were previously the main players in the green investment market, have experienced a significant decline in activity due to several factors that have weakened green investment flows. The primary factor was the inflationary surge, which was associated with both post-quota output growth and excessive government stimulus.

Additionally, markets experienced price shocks in food and energy due to restrictions on hydrocarbon imports from Russia and disruptions in agricultural production chains. Macroregulatory policies that raised interest rates resulted in an increase in the weighted average cost of capital, leading to a general decline in the profitability of investments in leveraged finance instruments, including green finance. At the same time, the profitability of green projects was negatively affected by the general increase in costs due to the inflationary wave. As a result, green projects with lower internal rates of return due to high investments required for insufficiently developed technologies and infrastructure, and relatively small positive cash flows in the near term, often become unprofitable for companies. This significantly reduces the interest of players in such projects. For instance, in 2022, there was a 47% reduction in demand for wind turbines in Europe [Windflix 2023].

Environmentally responsible construction was another green industry affected by global shocks. In 2022, housing affordability decreased significantly, and the volume of mortgage programs also declined. Across Europe, mortgage demand fell by 10% year-on-year in the second quarter [European Central Bank 2023b], followed by declines of 42% and 74% in the subsequent quarters [European Central Bank 2023a]. The current situation, despite the growing trend towards energy efficiency and decarbonization, has led to a freeze in investment plans for green building and a decline in the issuance of related green bonds.

Demand for green bonds has also decreased. Investors, faced with increasing uncertainty and rising inflation expectations, have stopped considering green bonds as a way to diversify their portfolios. Furthermore, the crisis has led to a reallocation of resources towards more stable and conventional financial instruments. Consequently, the discount for green securities is decreasing or disappearing, resulting in a reduction of the greenium to zero.

3. Empirical analysis: In search of the vanishing green premium

Ivashkovskaya and Mikhaylova (2020) propose a methodology for quantitatively analyzing the presence of the green premium. The methodology can be used to analyze the EU and US debt capital markets as of the fourth quarter of 2022, when the debt market dynamics were at their worst. The methodology of Ivashkovskaya and Mikhaylova (2020) was modified by excluding the simultaneous inclusion of modified duration and number of years of paper to maturity in the model due to their expected high correlation. The analysis was conducted for the secondary market with the assumption that if a premium exists in the secondary market, it should also exist in the primary market [Partridge and Medda 2018]. The statistical analysis was conducted solely on European green corporate bonds. The focus on European green bonds is justified because this region was most affected by the energy crisis related to geopolitical instability. The rapid withdrawal of Russian energy resources disrupted the energy balance, causing inflationary pressures and worsening economic growth prospects. This could significantly affect investor sentiment in the debt markets. The source of all bond issue information is the Cbonds platform.

The null hypothesis (H0) that green bonds do not have a green premium during an inflationary crisis is accepted.

The dependent variable used was the G-spread (SPREAD) of the bonds. For the given date, we calculated the difference between the bond yield and the interpolated values of the zero-coupon yield curve of government bonds in the corresponding countries of issue for the remaining life of the bond. The zero-coupon yield curve was constructed using a polynomial model based on the available discrete values. Table 1 (p. 77) displays the list of independent regressors.

Table 1. Independent regressors

Variable	Description
Y_fr_is	number of years since the bonds were issued
Cp	amount of annual coupon on the bond in percent
l_am_out	logarithm of value in circulation at outstanding par value*
MD	modified duration of the bond
Ask_bid_sp	spread between ask and bid prices
Ratin	bond credit rating [1]
GB	a dummy variable that takes the value "1" if the bond is classified at listing as "green," "0" if not
CPI	annual inflation rate in the month prior to issue
GDP	GDP growth in annualized terms in the previous month

* *Note:* The logarithm was originally taken in euros (in the case of Swiss francs, it was translated according to the exchange rate on the date under study). Logarithmization was necessary to normalize the data.

Thus, the original model equation takes the following form:

$$SPREAD = \beta_0 + \beta_1 \times Yfris + \beta_2 \times Cp + \beta_3 \times lamout + \beta_4 \times MD + \beta_5 \times Ratin + \beta_6 \times Ask\_bid\_sp + \beta_7 \times GB + \beta_8 \times CPI + \beta_9 \times GDP$$

The null hypothesis would be rejected if the coefficient in front of the GB variable is statistically significant. The model utilized data from 4 November 2022, which was almost in the middle of the fourth quarter, showing the most pessimistic dynamics in the debt market in 2022. This is because the expectations of the energy crisis and the EU economy entering stagflation have peaked. We limited ourselves to modeling using cross-sectional data for a single day. This was due to the low liquidity of green European instruments, which could cause their value to fluctuate significantly each day. Including variables related to the news background would be necessary in an

[1] Based on data from Moody's, Fitch, and S&P rating agencies. Each rating was assigned integer values in ascending order from best to worst.

alternative time-series scenario. However, creating accurate news-related numerical indices to explain the variation within the time series is problematic due to the presence of bonds linked to different countries and industries. Additionally, the heterogeneity of issuers and issues themselves would result in a different cyclical autocorrelation component, making the t-statistics of coefficient estimates for the variables included in the model inadequate.

A total of 293 green bond issues were analyzed. For each bond, two common bonds with similar remaining periods to maturity from the same company were selected. However, sometimes only one common bond was included in the analysis due to the limited number of similar issues.[2] In the end, the sample of common bonds consisted of 564 issues. To ensure the accuracy of the analysis, only fixed coupon bonds without call and put options were included in the sample. The sample only included bonds denominated in euros and Swiss francs, excluding Eurobonds.

A linear regression model was constructed using the least squares method (LSM) (see Table 2 on p. 79). The variables that were found to be significant in the model after backward selection were the volume of bond issue (l_am_out), modified duration (MD), bond rating (Ratin), GDP growth rate (GDP) in the previous period, and the size of the ask spread (Ask_bid_sp). All of these variables were significant at a level of less than 1%. It was observed that bonds with lower duration exhibited a larger spread compared to more common variants. The relationship between modified duration and spread is typically positive, as shorter durations are associated with lower investor risk. Additionally, the model demonstrated a positive relationship between the Ratin variable and bond spread, indicating that higher levels of risk result in higher required returns and spreads. Regarding the GDP variable, there was a positive relationship indicating a specific trend in the markets at that time. The more positive dynamics the country's economy showed in terms of gross product or business activity indices, the more restrictive measures of fiscal and monetary policy were expected by investors investing in instruments from the issuers of this country [Akitaka, Kenichi 2023]. In other words, the positive news for them may actually indicate future market deterioration and increased risks.[3] The negative relationship between the ask-bid spread and G-spread can be explained by the fact that investors have higher confidence in more actively traded instruments. This means that in case of new risks, they will be able to sell these securities quickly, reducing the level of risk and the required return of the instrument.

The GB variable was already not a significant variable at this stage. However, the White's test revealed heteroscedasticity, which could potentially distort the results, so the weighted least squares method was further applied to minimize the sum of squared deviations and obtain effective estimates (see Table 3 on p. 79).

[2] For some issues, no more than one was found.

[3] For this situation, the authors of the review of the European economy from the Central Bank of Japan use the phrase "good news is bad news" (see: [Akitaka, Kenichi 2023]).

Table 2. Results of linear regression, least squares method

Dependent variable: SPREAD

Robust estimates of standard errors (adjusted for heteroscedasticity), variant HC1

	Coefficient	Standard error	t-statistics	p-value
const	0.0183609***	0.00457702	4.012	<0.0001
l_am_out	–0.00108069***	0.000197881	–5.461	<0.0001
MD_pog	0.00112167***	0.000123501	9.082	<0.0001
Ratin	0.00115298***	0.000200460	5.752	<0.0001
GDP	0.0177479***	0.00391678	4.531	<0.0001
ask_bid_sp	–0.222031***	0.0709039	–3.131	0.0018
GB	–3.14729e-05	0.000501429	–0.06277	0.9500

Average dependent variable	0.013244	St. deviation of dependent variable	0.008857
Residual sum of squares	0.047928	St. model error	0.007518
R-squared	0.284596	Adjusted R-squared	0.279534
F(6, 848)	40.44305	P-value (F)	2.08e-43
Log. plausibility	2971.668	Akaike information criterion (AIC)	–5929.337
Schwartz criterion (SC)	–5896.079	Hannan–Quinn information criterion (HIC)	–5916.601

Note: *** – significance at the 0.01 level.

Table 3. Linear regression results, weighted least squares method

Observations 1-857 (n = 855) were used

Excluded missing or incomplete observations: 2

Dependent variable: SPREAD

Robust estimates of standard errors (adjusted for heteroscedasticity), variant HC1

Weighted variable: WE2

	Coefficient	Standard error	t-statistics	p-value
Const	0.0144423***	0.00510832	2.827	0.0048
l_am_out	–0.000822464***	0.000205848	–3.995	<0.0001
MD_pog	0.000763001***	0.000145808	5.233	<0.0001
Ratin	0.00174806***	0.000176502	9.904	<0.0001
GDP	0.0140203***	0.00417568	3.358	0.0008
ask_bid_sp	–0.225129***	0.0721957	–3.118	0.0019
GB	0.000257615	0.000451179	0.5710	0.5682

Note: *** – significance at the 0.01 level.

Statistics derived from weighted data:

Residual sum of squares	1753.048	St. model error	1.437802
R-squared	0.430104	Adjusted R-squared	0.426071
F(6, 848)	48.23366	P-value (F)	5.08e-51
Log. plausibility	–1520.142	Akaike information criterion (AIC)	3054.283
Schwartz criterion (SC)	3087.541	Hannan–Quinn information criterion (HIC)	3067.019

Statistics derived from the raw data:

Average dependent variable	0.013244	St. deviation of dependent variable	0.008857
Residual sum of squares	0.050156	St. model error	0.007691

When constructing the new model, all significant variables from the model constructed by means of LSM also turned out to be significant. The signs at the coefficients remained the same, which confirms the correctness of the specification. The GB variable here also turned out to be insignificant. Thus, the null hypothesis was not rejected, which means that in Q4 the green premium of corporate green bonds could disappear.

4. Conclusion: Is there a future for green bonds?

Based on the study of changes in external factors and regression analysis, it has been illustrated that corporate borrowers in developed countries had little incentive to issue green bonds in Q4 2022. This can be attributed to macroeconomic and geopolitical instability, as well as a lack of willingness to pay a green premium. However, it is still uncertain whether this means the end of green bonds and their gradual infusion into the stream of brown bonds.

The green bond market exhibited characteristics of a financial bubble. In 2021, there was a post-crisis recovery and a natural increase in investment. Sustainable development is increasingly viewed as a potential source of growth for the new economy, given the significant efforts to decarbonize and transition to new production and consumption patterns, as well as the growing involvement of the corporate sector in the ESG agenda. In 2021, a historic milestone of one trillion dollars was recorded for the green bond market [Climate Bonds Initiative 2022]. Positive investor expectations drove activity so strongly that in the first 18 days of 2022, cumulative global bond issuance, according to Bloomberg data, totaled $572.2 billion [Bloomberg 2023], surpassing the values achieved by green bonds in all of 2021. The explosive growth in issuance led to a build-up in the green premium as well. From 2014 to 2022, green bonds accounted for over 45% of all corporate bond issuances, making them a popular tool for portfolio diversification [Climate Bonds Initiative n.d.].

The changes in the key conditions of the global economy and the debt capital market, which occurred in 2022, have had an impact on the green finance segment. In this vein, the decline in absolute green bond issuance rates and the simultaneous flattening of the greenium is a distressing trend. However, despite the recent crisis in the green bond

market, it is important to note that the sustainable development agenda and focus on green production and consumption remain a priority. This crisis can be seen as a period of turbulence caused by external shocks and a stage of transition to a new development paradigm.

In 2023, the green bond market showed signs of recovery as the global economy adapted to new conditions and recession risks decreased. This is evidenced by an 18.6% increase in the issuance of ESG debt instruments and a 22.2% increase in the volume of green bond sales in the first half of 2023 compared to the same period in 2022 [Gardiner and Freke 2023]. Green debt financing is expected to become even more widespread in the near future, especially in developed economies. For instance, in Europe, after enduring the 2022 shock, there is a growing desire to strengthen energy security by accelerating the green transition. The increase in geopolitical tensions in the Middle East region since the fall of 2023 may lead to a new oil and gas crisis in the next few years.

Additionally, changes in the structure of issuers in the green bond market are expected, including an increase in the share of sovereign issues by actors from developing countries. The transition to a new stage of growth, from extensive to intensive production, will facilitate the importance of investments in the preservation of natural and human capital. China, currently the world's second-largest issuer of green bonds after the United States, is ahead of Germany and France [Climate Bonds Initiative n.d.] in this regard. Developing countries may become a new center of attraction for green bonds and could contribute to a new wave of greenium growth.

The municipal sector shows promise for green bond development. Currently, municipal green bonds account for about 1% of total sustainable securities issuance [Capital Monitor 2022]. However, many green projects are implemented at the city level, including initiatives for green construction, waste management, and transportation, which are frequently included in municipal development strategies, just as often as at the corporate level. Successful examples of municipal bond issues can be found worldwide, including in cities such as New York, Paris, Moscow, Cape Town, and Mexico City. Investing in municipal bonds not only diversifies financial portfolios but also allows individuals to participate in the life of their city, increasing loyalty and reducing expectations for financial returns. The latter is critically important given high level of financial risk in conditions of macroeconomic and geopolitical instability.

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