Sovereign green bonds as an unconventional tool to address climate change

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Abstract. Creative efforts are necessary as global efforts seek to undertake projects focused on environmental, social, and governance (ESG) initiatives. Among various financial products that provide funding for projects, green bonds, particularly sovereign green bonds (SGB or SGrB) issued with sovereign guarantees by central governments, have gained prominence. Proceeds from SGBs are used to finance green projects such as non-conventional and renewable energy projects, alternative energy solutions, greenhouse gas emission reduction, climate change mitigation, or reduced use of carbon-based energy sources. SGB will receive increasing global attention as governments attempt to meet UN climate change goals. This research uses descriptive research methodology to examine the evolution, operational aspects, challenges, and investor expectations associated with SGrBs by taking India as a case. The study period is taken from 2016 to 2023. It used a conceptual approach to discuss the market's evolution. The findings highlight how SGBs provide an unconventional way to link green finance with ecological priorities by combining fiscal policy, investment and science-based solutions. The insights are intended to inform future SGB frameworks and strategies to target funded green growth towards pressing global sustainability issues.

Keywords: sustainable finance, green bonds, climate change, sovereign bonds, greenium, sovereign issuance, thematic bond, sovereign debt

1. Introduction

Globally, increased focus on Environmental, Social, and Governance (ESG) has led to the emergence of new financial investment products. Bonds or Fixed-income instruments are financial products through which corporates or governments raise debt. Bonds of ESG flavour come under thematic bonds. Thematic bonds can be of the "Use of Proceeds" (UoP) variety, encompassing green, social, and sustainability bonds, or of the "Key Performance Indicator" (KPI) variety, which comprises sustainability-linked bonds (Jain, 2022). ESG Bonds cover

many topics, including affordable housing to enhance infrastructure, reducing racial or gender imbalance, and renewable energy. Like a typical debt security (or financial instrument), it offers its investors periodic capital repayment with interest. ESG Bonds come in various flavours, including Green, Social, and Sustainable (GSS) Bonds, Social Bonds, and Sustainable Development Goal (SDG) Bonds.

Currently, there are many problems in the world related to climate change (Rehmat et al., 2023; Hincks et al., 2023; Abunyewah et al., 2023), the search for alternative energy sources (Majeed et al., 2023; Vambol V. et al., 2023; Sonsale et al., 2021), waste management (Shirkhan et al., 2022; Vambol S. et al., 2016), environmental pollution (Hulai et al., 2022; Zahorodniuk et al., 2022; Rafique et al., 2023) and diseases resulting from environmental pollution (El Morabet R. et al., 2023; Kryvenko et al., 2022; Khan et al., 2023).

Green bonds are ESG bonds focusing only on funding projects addressing climate and environmental issues. These are big projects relating to renewable energy, alternative energy solutions, greenhouse gas emissions reduction, reduced reliance on carbon-based energy sources, or LCR (Low-Carbon and Climate-Resilient) infrastructure projects. They are dedicated to using the funds for financing (and refinancing) sustainability-focused projects such as those linked to climate change. The quantum of investments slated to go into this investment will grow manifold as countries race towards meeting the United Nations Sustainable Development Goals (UN SDG).

While there is no formal definition, a Sovereign Green Bond (SGB) can be roughly defined as *"a debt instrument issued by the government to borrow money from investors" promising that the funds raised will be utilized for climate or ecosystem-related activities"*. Furthermore, SGBs are a subset of Green Bonds issued by national (central) governments, carry a sovereign promise, and hence are seen to be more secure and reliable. From an economic perspective, Governments are generally better placed than individuals or corporates in managing finances or working towards large-size natural preservation projects because their policy influence can have a wider reach and long-lasting impact. Therefore, with a necessary green push, big countries like China, India, and the US have enormous opportunities for SGBs (Battistella, 2021).

Table 1. ESG-focused investments globally.

Geography	**ESG-focused investments as a per cent of AUM**
India	7%

Japan	18%
US	26%
EU	49%
Canada	51%
Australia	63%

Data Source: ESGRisk.ai; Data was taken in August 2022

Table 1 shows a few big countries with very little ESG investment penetration and considerable opportunities to attract investments and positively impact the environment. While there are many different methods of raising funds, research shows that the issuance of SGBs does not significantly impact the issuance of corporate green bonds (Azhgaliyeva & Kapsalyamova, 2023).

While issuers may be prone to selling **Sustainability-linked Bonds (SLBs)** due to resource fungibility, investors prefer green bonds based on issuance trends, demonstrating a lower perceived greenwashing risk associated with green bonds (Jain, 2022). Greenwashing is *"the act of misleading consumers regarding the environmental practices of a company or the environmental benefits of a product or service"* (Seele & Gatti, 2017).

SGB and Ecology

Sovereign green bonds are a powerful new financial tool that can help protect the global environment. National governments issue these debt instruments to fund projects with favourable climate and environmental benefits. As concerns over climate change and biodiversity loss intensify, sovereign green bonds are increasingly seen as a way for countries to demonstrate climate leadership and work towards their commitments under international agreements like the Paris Accord.

When a government issues a sovereign green bond, it pledges that the proceeds will go towards initiatives like renewable energy development, clean transportation, sustainable agriculture, biodiversity conservation, and improving water and air quality. Investors are attracted to these bonds because they know their money directly supports projects that mitigate ecological threats. For ecologists and environmentalists, sovereign green bonds represent an important new source of large-scale financing that can scale up vital green infrastructure and help repair damaged natural systems.

Key green bond-funded projects could include expanding protected area networks, restoring degraded forests and wetlands, developing more sustainable farming practices,

installing green building retrofits, and transitioning to non-polluting public transportation. With adequate volumes of capital raised through sovereign green bonds, entire national economies may transition more rapidly to sustainable, low-carbon models that significantly reduce humanity's environmental footprint. This level of public green investment could significantly aid global efforts to stabilize the climate, reverse biodiversity decline, and build a more ecological civilization.

2. Literature study

Literature reviews as a research method are found to be more critical and relevant in the context of ESG. It is acknowledged that much of the academic research is related to understanding what motivates ESG investors, which is not what institutional investors are looking for. Institutional investors appeared concerned about the financial viability of portfolio construction incorporating ESG-related preferences. An enormous amount of academic research on sustainable investing is generated daily. Green Bonds and Sovereign Green Bonds, owing to their newness and innovation as financial products, were the primary motives for this. The green bond market is in a nascent stage, still weak and underdeveloped but evolving (Honcharenko & Liakhova, 2018).

Considerable differences are found to exist amongst various sovereign green bond issuers – from coupon rates, maturity (in years), the total amount raised, investor structures, and various indicators (such as YTD, CY, or price) (Mosionek-Schweda & Szmelter, 2019). Like in the case of other forms of investments, the financial performance of the bonds is of interest to investors. Greenium or Green Premium is a word used to describe the cost savings an issuer can realize by issuing a green bond (or other green instruments) instead of a conventional instrument (ACT, 2022). One of the first research on greenium, done on sovereign EU countries and the EU itself, showed that a small but negative greenium exists for sovereign green bonds (Grzegorczyk & Wolff, 2022). There are mixed research findings regarding sovereign green bonds' performance against conventional bonds. While some studies showed outperformance, few others reported underperformance (Doronzo et al., 2021).

2.1. Research Gap

Considering the newness of the topic and with several governments still exploring how these bonds can be positioned and targeted, there is immense scope for countries like India to take advantage of the opportunity to fund public projects. This research work attempts to enhance the understanding of SGBs.

3. Research Methodology

3.1. Research Objectives

The current research seeks to achieve the following objectives:

1. To become aware of the basic concepts of Sovereign Green Bonds
2. To track the evolution and development of the bonds over the years globally
3. To examine how India is getting prepared to issue its own Sovereign Green Bonds.

3.2. Significance of the study

1. Helps understand how various Governments across the world are strategizing their issue of SGBs
2. Helps India learn from the experiences drawn from others and position its maiden SGB issuance accordingly.

3.3. Research Method

The study *collects* preliminary information using the Descriptive Research Method, *observes* historical growth and experiences collected from many countries, *records* the experiences, and *describes* how India should handle its fundraising.

3.4. Data Collection

Secondary data from several academic and trade journals, academic textbooks, research papers, and governmental websites is used in this study. In addition, being a newly evolving subject, data necessary for this research is collected from business media. Finally, government and rating agencies obtained and studied reports (such as rating reports and frameworks).

4. Results and Discussions

4.1. Green Bonds

Green bonds are debt securities that fund (or refinance) ecologically friendly green initiatives, assets, or commercial activities. These bonds will have a reduced cost of capital, but the proceeds must be utilized for the credibility and commitments related to the means of issuing them, such as climate change. Governments like India, which are working towards reducing their carbon intensity, can immensely benefit by raising funds in the form of Green bonds. Some leading issuers of green bonds include Corporates, Financial Institutions, Local Governments, and National Governments.

4.2. World Bank Green Bonds

In November 2008, the World Bank was the first to issue Green Bonds under Climate Awareness Bonds (CAB). Approximately USD 18 billion equivalent is raised through the Green Bonds in 200 bond issuances in 25 currencies. The World Bank will utilize the bond revenues to lend to qualifying projects aiming to reduce climate change or assist affected communities in adapting. Skandinaviska Enskilda Banken (SEB) collaborated on the product design. The concept is based on investor demand for a triple-A-rated fixed-income instrument that supports climate-related projects.

4.3. Sovereign Green Bonds (SGB)

The concept of National Governments issuing Sovereign Green Bonds only began in 2016. Of course, these financial instruments are slightly late entrants and slower than their corporate counterparts. These bonds assist governments in funding public projects and realizing sustainable energy objectives that reduce environmental hazards and address the intergenerational trade-off in climate-related policy (Doronzo et al., 2021). SGBs are dated securities with a fixed maturity date (tenor) and interest rate. Generally, funds rising through SGBs are part of the government's overall borrowing programs.

While SGBs come with a cheaper financing option, that should not be the sole motive for raising funds, and no wonder the World Bank suggests nations exercise caution in this regard (International Finance Corporation, 2018). Even experts echo the same views and say that SGBs will face credibility issues, so issuers' needs should have established a clear long-term path (Battistella, 2021). Apart from this, SGBs suffer from being small in size and less liquid in most cases. Some research suggests switching to a green certificate system with insufficient liquidity (Yao, 2021).

According to a 2021 Climate Bonds Initiative study, Ministers led the critical decision to issue a Sovereign GSS bond in Emerging Markets (EM). In contrast, the Ministry of Finance (MoF) or Economic Affairs drove the choice in Developed Markets (DM). The primary reasons for the issuances were discovered to be combating climate change and promoting the creation of a local green bond market. All DM interviewees and 72% of EM respondents reported having a team of professionals dedicated to their link. Most respondents reported expenditures from the previous two years rather than projects acquiring prominence in budget consumption (CBI, 2021).

4.4. Evolution of SGBs

Poland ushered in a new bond-market era by issuing the first Sovereign Green Bonds to combat climate change. The issue came in December 2016 for USD 790 million to achieve the country's National Renewable Energy Action Plan (Whiley, 2016). Following six policy

recommendations, the issue exceeded supply so much that Poland went ahead for second and third issuances. The Polish experience demonstrated that government-issued SGBs are essential in mitigating climate change. A structured approach in the form of a Green Bond Framework is necessary for the issuance to be successful. Cooperation and inclusive communication will help prepare for green bond issuance (Nowak et al., 2021). Regarding the Visegrad Countries (V4), which are comprised of four Central European nations, i.e., Poland, the Czech Republic, Slovakia, and Hungary, Hadaś-Dyduch et al. (2022) focused on necessary legal advocacy both at the country and UN levels to increase the seriousness towards ECG provided with great importance to the "profitability" patrons can achieve as this is the great motivation to build solid financial infrastructure for making our earth more green and blue instead of brown.

Of course, the first country to announce such bonds was France. While the French announcement came in April 2016, the actual fund rise happened in January 2017, for USD 7.5 billion (EUR 7 billion) (Phys.org, 2017). These bonds are widely regarded as the first sovereign green benchmark bonds. By the end of the year, France was able to raise more, taking the total fund to USD 10.7 billion (EUR 10 billion), making it the most significant bond of 2017.

Despite its small size and remote location, the volcanic island country of Fiji became the third nation to launch its SGB (MoE, 2020). Launched on the stage of Conference of Parties 23 (COP23) in November 2017, Fiji did a five-month exercise with IFC and World Bank teams, took their guidance and succeeded in raising USD 50 million (FJ $100 million) (International Finance Corporation, 2018). The bond issue is the first from an Asian country and an emerging market. This was closely followed by Nigeria (December 2017; USD 29.7m), Belgium (February 2018; EUR4.5bn), and Indonesia (February 2018; USD 1.25 billion).

Indonesia issued the first Sovereign Green Sukuk in 2018, thereby opening doors for a new green bond market. Green Sukuk (plural for *sakk,* meaning Arabic name for financial certificates; *Sukuk* is often used in both singular and plural contexts) is a Sharia-compliant alternative to regular fixed-income investments for funding environmental projects. Indonesian issuances attracted a geographically diverse investor base, with 32% coming from the Islamic market, 25% from Asia, 15% from the European Union, 18% from the United States, and 10% from Indonesia (UNDP Indonesia, 2018). GCC is the leader in ESG sukuk issuance, and Saudi Arabia has become the largest market.

Four of the first six countries were quick and promised repeat issuance (Honcharenko & Liakhova, 2018). Some studies compared the first issues of the EU (Dencheva Tsonkova, 2019). Preliminary studies showed that investors see these issues as value-enhancing and risk-

reducing products (Dell'Atti et al., 2022). Many of these fundraising programs have seen manifold oversubscriptions denoting strong investor interest. As a result, they are viewed as instruments that can enhance circulation size, which can help reduce the costs of funding green public duties (Wiśniewski & Zieliński, 2019). As a result, the share of SGBs in total outstanding GSS bonds rose from 4.2% in December 2019 to 7.5% by June 2022.

The United Kingdom has a plan to reach net zero emissions by 2050. It is a laggard in raising funds using SGBs, but it leads the way by being the first to do so for retail investors. The UK announced its intention to raise funds via SGBs on November 9, 2020. Structuring advisors are appointed, and the Budget 2021 had few mentions. The UK Government's Green Financing Framework was published on June 30, 2021. On September 21, 2021, the first 12-year green gilt was issued through syndication. On October 21, 2021, a second green gilt (a new 32-year maturity) was introduced. Issuances worth £10.0 billion (cash) are planned in 2022-23, and approximately one green gilt transaction will be scheduled each quarter (UK DMO, 2022).

2021 is considered a 'landmark' year (Battistella, 2021). Eleven countries were able to raise USD 72.8 billion through SGBs. Italy (USD 10 billion), the UK (USD 21 billion; UK supported COP-26 hosting duties), Serbia (USD 100 million), Spain (USD 5.9 billion), and South Korea (USD 812 million) issued their maiden SGBs. The growth rate is 111%, and SGBs now constitute 10% of the green bond funds raised in 2021. Total funds in SGBs are at USD 161 billion. European countries were able to raise more funds. Germany has as many as four sovereign green bond issuances. France made its second sovereign green bond for USD 13 billion at the end of 2021, taking the total funds raised to USD 44 billion. The debt issues from Latin America and the Caribbean (LAC) have come down during the year. Chile is the only issuer from the LAC in 2021. As many as 12 nations (Poland, France, Belgium, Ireland, Lithuania, the Netherlands, Germany, Hungary, Sweden, Spain, Italy, and Latvia) published SGBs at various stages between 2016 and 2021. When measured as a proportion of GDP, Italy, France, and Spain rank first and second, respectively (Avgousti et al., 2023).

The city-country of Singapore extended its dream of positioning itself as an environmental finance hub by launching its first Green Singapore Government Securities on August 4, 2022. The Monetary Authority of Singapore issued the Singapore dollar-denominated bonds. The bonds are for a 50-year tenor, mature in 2072 and yield 3.04%. The bonds raised $1.7 billion (S$2.4 billion) and were 2.25 times oversubscribed (Yap, 2022). Monies raised will be used to finance Singapore’s Green Plan 2030 – precisely, two lines of the MRT electric rail system. Its green plan seeks to attain 75% use of mass public transportation by mid-century, resulting in

an 80% reduction in land transit emissions. The Singapore Government aims to raise S$35 billion in environment-focused funding by 2030. New Zealand issued its Sovereign Green Bonds in September 2022. The bonds will mature in 2034 and are raised as part of the overall forecast core Crown borrowing program (Robertson & Shaw, 2022). The country also has its SGB Framework in September 2022 (The Treasury, 2022).

Regarding the African continent, Egypt is the first from the MENA region to raise funds through SGBs. The first bonds are for five years and came up in September 2020, raised $750 million, and carried a 5.25% yield. A year later, the government reaffirmed plans to issue more green bonds (Reuters, 2021). By the end of 2020, about sixteen sovereigns have issued green bonds and raised about USD 80 billion (OECD, 2020). Few other reports have put the number to be 19 sovereigns who made 32 issuances for an outstanding amount of USD 93 billion as of November 2020 (CBI, 2021). According to a study conducted on the African continent, notably Kenya, most climate investment is concentrated in the energy sector. As a developing country, the study justifies the government's attitude of taking baby steps toward ESG, i.e., only 3% of the budget. More emphasis is being placed on changing investor behaviour to shift from brown finance to green and blue finance (Sabare, 2022). The Nigerian experience, in which the Nigerian Federal Government generated USD 29.7 million (NGN 10.7 billion) in 2017, became the first sovereign green bond to earn Climate Bonds Certification. According to research on the issuance, for every 1% increase in sovereign green bond issuance by the Nigerian Federal Government, the country's GDP improves by around 107%. The evidence used the Cobb-Douglas production function framework to show that SGBs contribute more and are more critical in improving the GDP than corporate green bonds (Saka & Akinde, 2022). Nigeria’s Debt Management Office (DMO) said the country raised US$56 million during the sovereign green issuances from December 2017 to June 2019. The funds were deployed to seven projects across sectors, such as renewable energy, agriculture, water, transport and afforestation (Zawya, 2022).

Figure 1 shows countries that have issued SGBs under the "Green" theme. Table 2 shows the CICERO Rating of various SGBs.

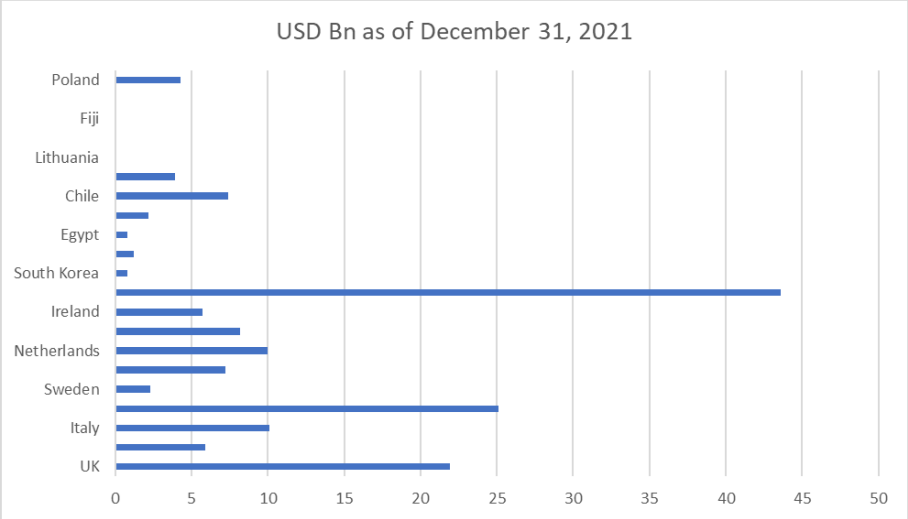

Figure 1. Sovereign Green Bonds under Green theme (Data Source: Sustainable Debt – Global State of the Market (2021))

Table 2. CICERO Rating of various SGBs.

SGB issuing country	Rating	Rating Report Date	Governance
Hungary	Medium Green / NA	May 25, 2020 / February 18, 2021	Good
India	Medium Green	October 28, 2022	Good
Israel	Dark Green	November 17, 2022	Good
Iceland	Dark Green	September 24, 2021	Good
Demark	Dark Green	November 18, 2021	Excellent
Indonesia	Medium Green	September 1, 2021	Good
Kenya	Medium Green	March 24, 2021	Good
Sweden	Dark Green	June 1, 2020	Excellent

Data Source: CICERO.Green

In terms of markets, Emerging Markets (EM) are found to be laggards compared to Developed Markets (DM) concerning overall green and climate investment (Jones, 2022). Saudi Arabia and Qatar are preparing to launch their first tranche of sovereign green bonds (Mutua, 2022).

5. Indian perspective

Green bonds, also known as SGB or Climate bonds, are fixed-income financial products issued by any sovereign institution, intergovernmental organization, or government body that is governed by the RBI, India (Saravaram & William, 2023). Recent advances have positioned

India as a lucrative and active participant in the race. After China, India is the most notable country in Asia actively engaged in SGB investments. India has been devoted to environmental preservation (Article 48-A). As a result, the Government of India is committed to implementing numerous programs on the ground, including the *Namami Gange Mission, Safai Abhiyaan, Plastic Waste Management, National Clean Air Programme,* and many others. India made numerous long-term promises in this area. India has now committed to decreasing its GDP Emissions Intensity by 45 per cent by 2030, compared to 2005, and to attain about 50 per cent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030. Under the Paris Agreement, India adopted an ambitious Nationally Determined Contribution (NDC) on a 'best effort basis' while keeping its developmental imperatives in mind (Economic Survey 2021-22), India's vision for the achievement of updated NDC, ambition to significantly reduce the carbon intensity of the economy (Ministry of Finance, 2022). *"As a part of the government's overall market borrowings in 2022-23, sovereign Green Bonds will be issued for mobilizing resources for green infrastructure. The proceeds will be deployed in public sector projects which help reduce the economy's carbon intensity"* (Union Budget 2022-23, para. 103).

There are nine key focused categories including Renewable Energy (RE), Energy Efficiency (EE), Clean Transportation (CT), Climate Change Adaptation (CCA), Sustainable Water and Waste Management (SWWM), Pollution Prevention and Control (PPC), Green Buildings (GB), Sustainable Management of Living Natural Resources and Land Use (SMLNR&LU), and Terrestrial and Aquatic Biodiversity Conservation (TABC) in which Government of India (GoI) is promoting investments through Sovereign Green Bonds (SGB) to reduce the carbon intensity and to meet its Sustainable Development Goals (SDGs) (Ministry of Finance, 2022). India has accepted its role in meeting current ecological needs and is collaborating successfully with the World Bank and other countries to achieve its promises. As a result, on January 25, 2023, India released the first tranche of its first sovereign green bond valued at INR 80 billion (equal to $980 million). In Asian marketing, India is the next largest green bond issuer, reaching $21 billion (as of February 2023) (Hussain & Dill, 2023).

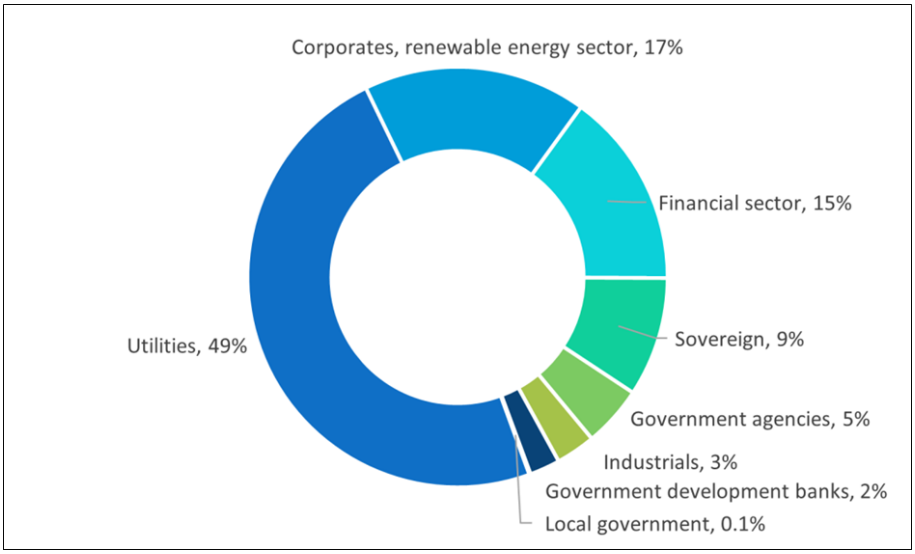

Figure 2. Green bond amounts issued in India by type of issuer (Source: World Bank with data from Bloomberg (Hussain & Dill, 2023))

Figure 2 depicts the Indian sector breakdown in the context of issuing SGB. Greenko Group is the largest issuer of green bonds, while Ghaziabad Nagar Nigam was the first local government body to issue green bonds in 2021, followed by Indore Municipal Corporation in 2023. It clearly states the government's stance on SGB (Hussain & Dill, 2023).

India recommended many actions in the Union Budget for 2023-2024 to address current ecological issues and attain the Sustainable Development Goals (SDGs), with SGB being one significant sustainable financial strategy. Every year, India raises $44 billion in green finance. Since India is working hard to meet its commitments for 2030, the gaps are large enough to attain net zero emission ambitions (Kumar, 2023).

The Climate Change Performance Index (CCPI), Germany, developed a grading system that provides transparent updates to international climate policy. CCPI developed and delivered an update report to the UN based on the weightage of four primary areas, including Greenhouse Gases (40%), Renewable Energy (20%), Energy Use (20%), and Climate Policy (20%) (Wikipedia, 2023).

Table 3. Country-wise Rank on Climate Change Performance Index (CCPI).

S. No.	Country	Score
1	Denmark	79.61
2	Sweden	73.28
3	Chile	69.54
4	Morocco	67.44

5	**India**	**67.35**
6	Estonia	65.14
7	Norway	64.47
8	United Kingdom	63.07
9	Philippines	62.75
10	Netherlands	62.24

Source: CCPI

The 57 countries and the EU are ranked in Table 3 based on their genuine efforts to safeguard the environment. According to the 2023 assessment, the CCPI found that no country can earn the first three places because they failed to meet the conditions to keep global warming far below 2 degrees Celsius, as stated in the Paris Agreement. As a result, the report begins with Rank 4 and progresses from there. According to the most recent study, India is ranked eighth, an increase over the previous publication, when India was ranked tenth. It demonstrates our commitment to and progress toward our environmental obligations. Figure 3 shows yields of SGBs as of January 25, 2023.

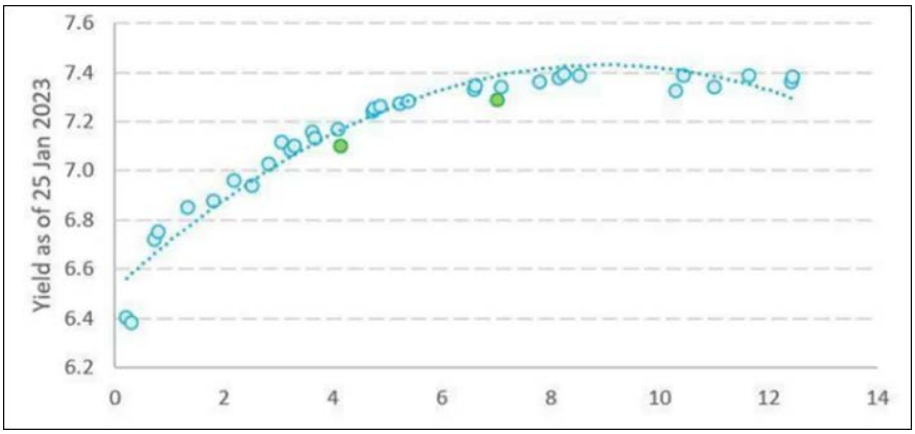

Figure 3. 2027 and 2033 – Greenium (Source: Climate Bonds Initiative)

Globally, sovereign issuers are motivated by investor diversification and the boost the issuance provides to local green/thematic bond market growth. The 'Greenium' (a combination of Green and premium) is simply a government incentive paid when you assist them in meeting their relevant commitments. Greenium is the financial assistance given to the issuer when they issue debt instruments or bonds that are specific to the nine key project categories outlined by the Indian government's ‘green’ taxonomy (Bibhudatta, 2023). Further, Greenium, like other bond premiums, is influenced by two sorts of factors: endogenous or internal and exogenous or

external. Endogenous or internal drivers include the issuer's reputation and the bond's trustworthiness, projects with a good record of success, credibility, and transaction transparency. Exogenous or external influences include domestic capital market credibility, sovereign climate targets, agreements to increase climate finance, and regulatory procedures (Bibhudatta, 2023). Cevik & Jalles (2022) discovered a link between "climate vulnerability" and the "cost of government borrowing." The greater a country's vulnerability to climate change, the higher the interest rate governments offer on green bonds, and vice versa. On the other hand, some countries take a 'climate resilient' approach and offer lower interest rates on green bonds.

In these regards, India's SGB issuing is commendable. The SGB was issued by the Reserve Bank of India (RBI) in two separate auctions, one in January and one in February 2023, with maturities ranging from five to ten years (Kumar, 2023). Based on the good market response from the previous year, it is recommended that the Ministry of Economic Affairs, GoI, capitalize on the opportunity and consider making public investments in SGB (Anshul, 2023) and building green infrastructure (Ravichandran & Roy, 2022) to accelerate the pace of work. Researchers incorporated green and fossil fuel bonds into a dynamic portfolio framework using cross-sectional data to measure variations (if they exist) in overall profitability in investor markets using risk-return techniques and time series analysis. As a result, experts have given a green signal to 'green bonds' in investor portfolios, helping to establish a low-carbon economy (Lichtenberger et al., 2022). Apart from taking baby steps like switching to LED energy-saving bulbs, adopting electric vehicles, steering clear of unnecessary prints, reducing pesticide consumption, utilizing modern agriculture technology, installing ground-level solar panels, and many more to breathe new life into our beloved ecosystem. Green bonds and green insurance have been added to the list. Green insurance is in its early stages, like green bonds, where buyers will receive interest in investing in green projects. The insurer can utilize lower premiums as an incentive for investing in green projects (Nagar, 2022). Regarding retail investment, one of the most serious risks from the investor side is 'greenwashing,' which requires stringent adherence to sustainability principles to be minimized (Ackah et al., 2022).

5.1. Green Bond Indices

Over the years, the SGB market grew manifold in terms of - so much so that sovereign issues comprise almost 20% of the Bloomberg MSCI Green Bond Index (MSCI, 2023). Figure 4 shows an increase in the value and weight of SGBs in the index. This added more value and a reason for investors to invest in SGBs and in products built on top of the green bond index because an SGB itself is diversified since it gives exposure to conservation, biodiversity, and

physical-risk adaptation projects. However, the flip side to adding these to the green bond index is that the index durations increase since almost all SGBs are for extremely long durations.

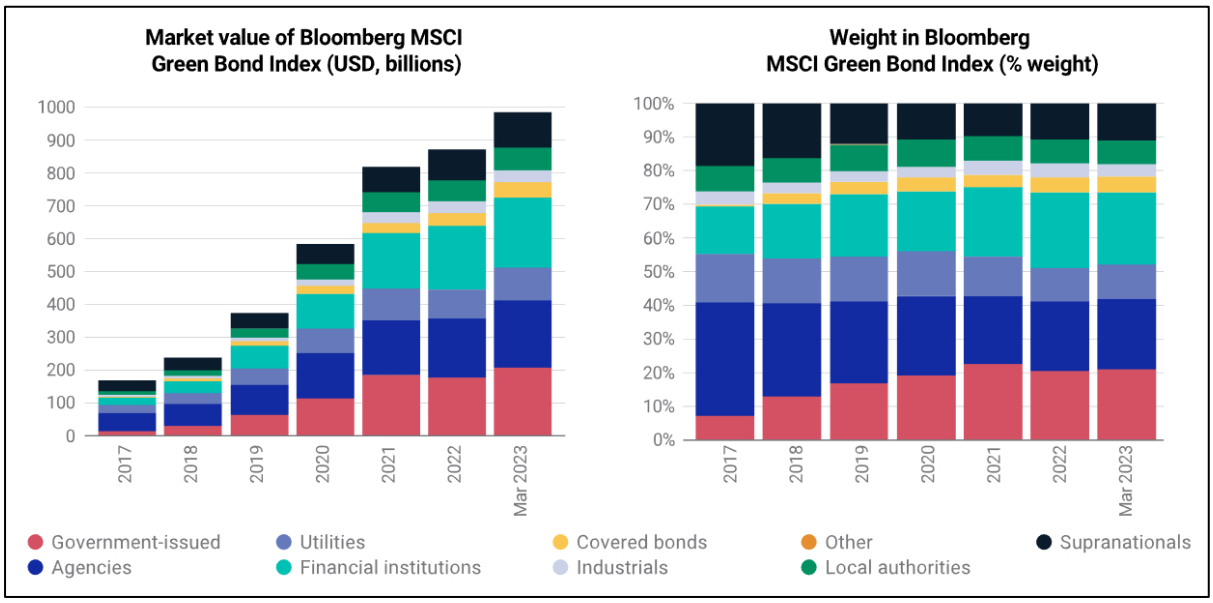

Figure 4. Increase in Sovereign Green Bonds in the index (Data Source: Bloomberg MSCI Green Bond Index, MSCI ESG Research, MSCI's BarraOne® (MSCI, 2023)

5.2. Challenges in issuances

A sound fiscal policy and good governance are prerequisites for establishing trust so the bonds can be well marketed. Accountability of sovereign green bonds remains a challenge. Climate tagging modifications done to existing accounting systems served to a limited extent. Transparency and traceability on how funds from green-labelled financial instruments are utilized and how those expenditures help to reduce substantial climate impacts. In Indonesia, the Green House Gases (GHG) accounting system uses an attributional territorial production method (Raeni et al., 2022).

A performance-linked bond with a payout based on the total emissions of greenhouse gases would be more transparent, less expensive to manage, and more compatible with a sustained policy commitment. However, market prices would be more politically demanding and challenging (Hardy, 2022).

Only a few member countries have included environmental evaluations in their regular budgeting cycle, indicating their considerable resource requirements. Furthermore, uniformity among various environmentally friendly practices and nomenclature at the national level is critical to avoid duplication of efforts (Pojar, 2022).

Public finances play a significant role when the government makes policies promoting green culture. India committed itself to being a net zero by 2070. Despite slowly moving towards renewable energy and electric vehicle culture, India still has a long way to go to move away from fossil fuel-based electricity. Unless a carbon price tax on coal-burnt electricity generation is hiked, there will not be an immediate motivation to make a swift move (Tilotia, 2022). However, incentives for turning Green have already started. There are three challenges in the international green bond markets (IIGF, 2020) :

1. Lack of a common green bond framework
2. Limited policy support
3. Insufficient demonstration effects.

The International Capital Market Association (ICMA) published its Green Bond Principles (GBP), which addressed four key aspects of green bonds: the use of proceeds, the process for project appraisal and selection, proceeds management, and reporting. Public institutions (such as Governments) play an active role in both capacity building (by way of setting up knowledge and learning hubs) and financial support (taking policy measures that make green bond issuance more attractive) (ICMA, 2021). The successful demonstration of public institutions will incentivize and make other institutions follow them. The process can be started by the highest credit-rated public institutions, followed by semi-public, corporate, asset-backed, and project-specific bonds.

Green energy indices follow different patterns compared to the traditional benchmark indices. Given that just a few companies are shared between the two, it was concluded that the current financial indexes may not be constructed to support a low-emissions economy (Nobletz, 2022).

5.3. Indian Green Bonds – The Status Check

The market for green bonds in India is still developing. Regulators such as the Reserve Bank of India (RBI) and the Securities and Exchanges Board of India (SEBI) have made recommendations within their respective jurisdictions to encourage raising funds under the ESG topic. As a result, renewable energy investments in the country are slowly increasing. Corporate India is making a solid commitment to green energy. According to Gautam Adani of the Adani Group, India will be a net exporter of green energy by 2050 (Express News Service, 2022). Sustainability-linked bonds are rapidly expanding and are mostly issued by industrial sector corporations such as JSW Steel, UPL, and Ultratech Cement, among others.

There was a 150% increase in inflows from FY2017 to FY2020, with public sector finance flows increasing by 179% and private sector flows by 130%. India has a vast potential for green

finance as the country will need Rs. 162.5 lakh crores by 2030 for NDCs and Rs. 716 lakh crores to achieve Net-Zero emissions by 2070. The Landscape of Green Finance in India made some interesting observations (Neha et al., 2022):

1. In order to meet the Panchamrit targets, India must increase green finance flows expeditiously.
2. Due to India's vulnerability to climate change, the country needs to focus on adaptation finance urgently.
3. For green finance to be mobilized and the current investment gap to be filled, a conducive policy and regulatory environment must be created.
    a. Development of a Green Taxonomy
    b. Diversifying finance flows to different priority sectors
    c. Financing for decentralized green activities needs earlier-stage intervention
4. Coordinating efforts across data collection, reporting, and access is crucial. An information asymmetry hinders investment, especially from the private sector and foreign investors.
    a. Standard disclosure requirements should be developed for both the real and financial sectors.
    b. Ensuring online availability of data
    c. Integrated domestic Measurement, Reporting, and Verification (MRV) system

5.4. India's Sovereign Green Bonds

Making a giant leap towards the broader goal, the Indian Union Budget 2022-23 proposed the issuance of Sovereign Green Bonds on February 1, 2022. A few days after the budget, the market is abuzz with the news that the government wishes to raise Rs. 24,000 crores ($3.3 billion) and that the first sale would be in the first half of 2022-23; however, the RBI and the government have decided to do the fundraising exercise during October – March period of FY23. Some estimates have said that the overall fundraising program of the government is at Rs. 5.92 lakh crores, and Rs. 16,000 crores of it is being proposed to be raised through SGBs issued in the second half of 2022-23. The government's entire market borrowing program includes these bond funds.

The January 2023 insurance attracted both domestic and international investors. The domestic investors list includes public sector banks (50% of the total investment), Life Insurance Corporation of India (nearly 25%), Mutual Funds (15%), and other domestic

investors (10%). Amongst foreign investors, Foreign Institutional Investors (FIIs) contributed about 5% of the total issuance. Considering the success of the first issuance, the government is getting ready to raise Rs. 20,000 crore in the second half of FY24. This is expected to attract even greater investor interest and further boost the development of India's green bond market.

India, the world's most populous country, India, has set lofty climate change goals. By 2030, the countries want to cut emissions intensity by 45% and boost the percentage of non-fossil energy sources to half of the installed capacity from current levels.

5.4.1. Fastest growing economy

Considering the global economic turmoil and heightened inflation, India is considered the fastest-growing economy. India also ranks ahead of its Chinese peers and has organic capabilities to raise funds.

5.4.2. G20 Presidency as a potential trigger

India's assumption of the G20 presidency in November 2022 provided a propitious platform to raise awareness and garner support for critical issues like climate finance. The subsequent issuance of a green bond aligns with this agenda and serves as an opportune move. Furthermore, experts commend this initiative as a "significant initial step by the government" towards fostering a robust bond market dedicated to financing environmentally sustainable projects.

On November 9, 2022, the government released the *Framework for Sovereign Green Bonds* document, which coincided with Egypt's COP27 summit on climate change. The framework promised that funds raised thus would be used to finance/refinance approved green projects. The government released a list of Green Project categories, environmental objectives, and eligibility criteria. The main categories identified are Renewable Energy, Energy Efficiency, Clean Transportation, Climate Change Adaptation, Sustainable Water and Waste Management, Pollution Prevention and Control, Green Buildings, and Sustainable Management of Living Natural Resources and Land Use. In addition, the document made it clear that equity will be provided only in the case of metro projects, and green spending will include investments, subsidiaries, grants-in-aid, or taxes that have been forgone, including their combination.

CICERO, a major global independent evaluator of green bond investment architecture based in Norway, has assessed the framework as "medium green" with a solid governance score - a notch below the top "dark green" rating. While the framework is an "encouraging step," IEEFA believes that conventional financial rather than green instruments should fund the growth of compressed natural gas infrastructure. It also suggested that an independent third

party audited the processes and controls at the beginning of the project selection (Srivastava & Ng, 2022).

Green bond issuance represents only 1.1% of the government's total gross marketing borrowing objective for FY23, which is Rs 14.21 trillion. Experts feel that since the bonds have considerable demand in the market, there would not be any tax incentives for the investors. These bonds will almost certainly be issued in rupee-denominated papers available for foreign investment via the FPI (foreign portfolio investment) channel. They will be aimed at ESG-conscious investment funds. The yield on such bonds is likely to be slightly lower than the yield on equivalent government securities. Domestic investors might not be interested in them, considering that, unlike in other countries, Indian Domestic Institutional Investors (DII) do not have regulatory compulsions to invest in green bonds. After all, with no tax incentives and higher yields (lower returns) compared to traditional government bonds, investors will have fewer motives to subscribe to the bond and stay invested, considering returns from an investment get preference. Hence, the oversubscription in bonds need not always be a reflection of the strength of the bond, as can be seen from the Indonesian experience (Siswantoro, 2018). Of course, domestic banks and insurance companies would be interested in investing the money they raised in green products, considering the sovereign safety element of the investment. When sovereign green bond yields are released, better clarity will emerge because rightful comparisons can be drawn with similar papers for similar tenures. According to Soumyajit Niyogi, Director of India Ratings & Research, if the RBI makes sustainable financing a criterion for banks' priority sector lending, banks must pool funds for such purposes.

The response from the issue of this bond paper is essential because it can set the tone for future green debt paper from the government. If the Union Government successfully does this, the State Governments will follow the trend soon. With the government joining the Corporate, a new market segment called Green Bonds will evolve. Some new benchmark indices will soon be tracking them, which can lead to the emergence of thematic debt mutual funds to raise capital from investors, particularly small retail investors. Hence, a whole ecosystem can get created.

The Indian Union Government's massive borrowing plan and a small start, say 5 per cent of the money raised in Sovereign Green Bonds, will make a substantial impact. Of course, tracking the end-use of these funds will be challenging, and the onus for this would fall on the regulators to put in some disclosure rules. It will be easier for the government to sell the bonds overseas (which is not a general tradition, considering the BBB- outlook). The currency in

which they are allowed to be invested can give a choice to international investors (Sabnavis, 2022).

As seen in other countries, the government is considering raising more funds in the following years - FY24 as a part of its overall gross market borrowing in Sovereign Green Bonds. However, predicting the extent of the FY24 issue is premature.

5.5. SGRB - Global Status Check

As of December 21, 2023, as many as 43 countries have raised funds using the concept of SGRB. Different countries have identified different projects and focus areas to fund. Table 4 gives a glimpse of some important projects undertaken.

Table 4. Partial list of projects funded by SGRB in various countries.

Country	Projects
France	Renewable energy (wind and solar), energy efficiency improvements in buildings, sustainable transport (including electric buses and bicycles)
Germany	Renewable energy (wind and solar), sustainable water management, green buildings, and sustainable transport.
Sweden	Renewable energy (wind and solar), energy efficiency improvements in buildings, sustainable transport.
United Kingdom	Renewable energy (including offshore wind), sustainable transport, sustainable waste management, and nature conservation.
China	Renewable energy (solar and hydro), clean transportation (electric buses and subways), and pollution control projects.
India	Renewable energy (solar and wind), green hydrogen, sustainable metro lines, rural solar initiatives, and afforestation projects.
Indonesia	Renewable energy (solar and geothermal), sustainable water management, sustainable waste management, and climate-resilient agriculture.
Kenya	Renewable energy (geothermal and hydro), sustainable forestry, water conservation and sanitation projects.
Fiji	Climate-resilient infrastructure (sea walls, water supply systems), renewable energy (solar power), and sustainable tourism projects.

Rwanda	Renewable energy (hydropower), sustainable agriculture, and conservation of biodiversity.
Senegal	Renewable energy (solar power), sustainable water and sanitation projects, and climate-resilient agriculture.

Source: Multiple sources, including the International Capital Market Association (ICMA) and the Climate Bonds Initiative.

6. Research findings and implications

Drawing inspiration from the oversubscription of SGBs in other countries, India begins its exercise with a sovereign offering of green bonds. Considering a considerable demand for the bonds and a genuine ground-level need for India, the fundraising program will likely be oversubscribed. The problem will be ensuring that the money is used for green projects following the expectations of the international finance community, notably international institutional investors and rating agencies.

Policy implications drawn from this research work include the need for governments to raise funds through SGBs to ensure that funds are rightfully used for qualified green projects. Rising transparency levels are one immediate need of the hour.

6.1. Suggestions & recommendations

1. Raising funds through the issuance of SGBs should be a period and regular exercise instead of doing it only once

2. A dedicated Department under the Ministry of Finance could be set up to monitor the fund utilization.

3. Tax benefits can attract retail investor participation. The government should focus on successfully raising funds and allowing the bonds to be offered to a diversified class of investors.

6.2. Scope for further study

1. The success of a bond issue lies not only in the ability to raise funds but also in a diversified class of investors.

2. The quantity of SGBs in the government's overall borrowing programs can be examined.

7. Conclusion

Sovereign green bonds demonstrate the potential of hybrid financial tools to address interconnected economic and ecological challenges facing governments worldwide. As this

emerging asset class continues developing, opportunities to strengthen ties between capital markets and conservation outcomes remain. While countries like India are newly exploring SGB issuance, lessons from other national experiences point to the need for transparency regarding project selection and impact monitoring. Significant oversight from independent validators also signals the importance of accountability frameworks that build integrity into green finance initiatives. Moving forward, blending disciplines like policy studies, investment analysis and applied ecological science could help evaluate SGB programmes through an interdisciplinary lens. This may reveal avenues to make such platforms more receptive to innovations emerging at the science-society interface. Continual reassessment incorporating quantitative metrics and qualitative insights may further optimize strategies for SGBs to direct capital flow in ways that unlock solutions at the convergence of climate, development and biodiversity priorities.

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