

# The Main Determinants of Green Bond Issuance: A Systematic Review

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## Abstract

The adoption of the Paris Agreement in December 2015 led to a notable increase in the number of academic publications related to green financial instruments, climate change, and sustainable development. Green bonds are considered investment instruments that are issued by corporations, governments, and financial institutions to finance green sustainable initiatives that consist of low-carbon activities, renewable energy, etc. This paper conducts a bibliometric analysis and a systematic literature review of studies that focus on the various determinants that affect green bond issuance to provide a comprehensive framework for the green bond market. This review examines the studies on green bond issuance between the period 2007-2023. The results identified the key determinants of green bond issuance that are presented comprehensively in the article. The study also provides some opportunities for future research on the green bond market which can benefit researchers for further studies.

## Keywords

Green Bond Issuance, Conceptual Framework, Systematic Review, Literature Review, Green Finance

## 1. Introduction

The rapid increase of Global Climate Change issues has made it a vital concern for all nations to deal with sustainable projects to increase the growth of the green economy. This led the Governments to recognize Global Climate Change as a crucial policy issue and hence has increased the demand for a permanent solution to preserve economic growth while ensuring the planet's ecological sustainability going forward (Bolton & Kacperczyk 2020; Trippel, 2020). According to the United Nations (UN) Report (Dickie, 2022), rapid economic growth has accelerated CO<sub>2</sub>

emissions in the previous years and has been expected to rise by 10.6% in 2030. Those statistics have led the (UN) to hold a Climate Change Conference (COP21), which took place in Paris in December 2015 to set long-term and legally binding goals for all countries. Moreover, during the COP28 conference that was held in the United Arab Emirates focused more on sustainability and green bond markets, as governments strive to achieve net-zero emissions (Nagraj, 2023). This led to specific policy initiatives including the provision of financing within, and to emerging countries to reduce global greenhouse emissions (United Nations, n.d.). The 194 parties who ratified the Paris Agreement sought to reduce climate change by keeping the global temperature change below 2°C (Wu, 2022). In response, various public and private entities started to shift their strategies and objectives toward investing in environmentally friendly, low-emission projects. Financing such projects has led to the emergence of new financial instruments, including green bonds (Flaherty et al., 2017). The green bond is defined as a debt instrument issued to finance new or existing environmentally friendly projects that will assist in reducing greenhouse gas emissions (International Capital Market Association, 2022). The European Investment Bank issued the first green bond in 2007. Later the World Bank followed in 2008. Green bonds come in various forms, including corporate bonds, project or “special purpose vehicle” bonds, municipal bonds, and financial sector bonds (OECD, n.d.). Initially, sovereign national government agencies were the leading issuers of green bonds, however, later municipal, regional governments, and private corporations started around 2013 (Climate Bonds Initiative, n.d.). From 2013 onwards corporate green bonds grew in number and scale, despite the challenges associated with the issuance of green bonds in place of conventional bonds due to their limited scope and relative novelty. In response, many companies amended their policies and investment plans to pivot towards green bond issuance and investments (Flammer, 2021). Firms have started to take an interest in capital acquisition through green bond issuance to limit their environmental impact, especially for sensitive pollution sectors that are increasingly regulated (Lebelle et al., 2020). This tends to have a significant positive effect on the company’s environmental performance. The fixed income associated with green bonds tends to be lower than conventional bonds, expanding the financing capacity of issuing companies (Liaw, 2020). Therefore, companies are progressively releasing green bonds and deploying them where relevant as one of their capital acquisition strategies (Wei et al., 2022).

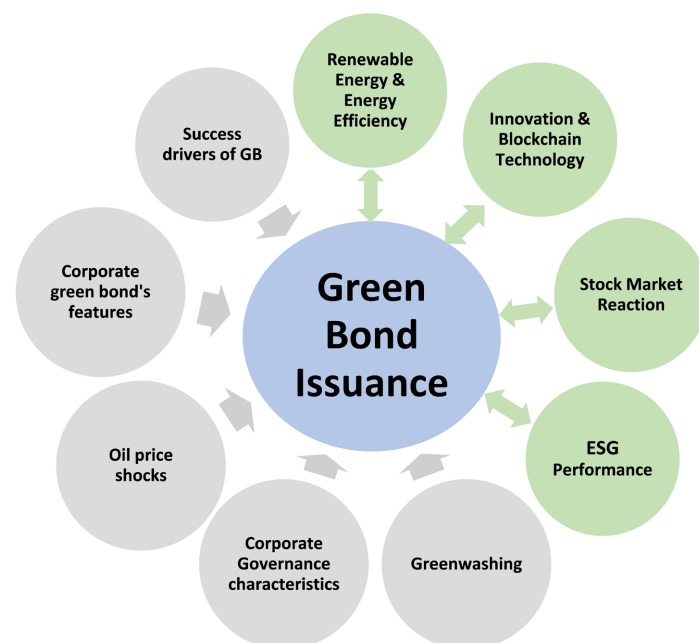
This paper provides contributions to literature in several ways. First, while a considerable interest is growing in green bonds and their effect on the green economy, the necessity to pinpoint the vital determinants that affect green bond issuances in literature remains limited. The main reason for this is perhaps the fragmented character of the earlier research studies. Hence, bringing prior studies together can contribute theoretically by determining the aspects of green bond issuance since it is difficult to view those factors segregated in various research articles. According to Bhutta et al. (2022), it has been indicated that the green bonds

market is in the growing stage and is recently considered by scholars as a great area of research. Second, studies that summarize, synthesize, and determine the factors that tend to impact the issuance of green bonds for future research are limited in literature. Given this scholarly research gap on the determinants that affect green bond issuance, a systematic literature review has been provided, along with the identification of areas where extensive future research can be conducted on the green bond market. Third, the study will also provide insights into the factors that impact green bond issuance in different countries that were not addressed in prior literature. Despite its growth, the green bond market comprises a small segment of the entire bond market (Syzykov & Lacombe, 2020). Thus, this review of the literature seeks to fill those research gaps and recommends future research areas that were not examined previously on green bond issuance. The current study aims to address the following research questions:

**RQ1.** What are the determinants that affect green bond issuance?

**RQ2.** Which determinants are the most frequently measured with green bond issuance in literature?

To address those research questions, this study develops a novel and significant framework for the determinants that impact green bond issuance as shown in **Figure 1**. Those factors are organized into the significant impacts that influence green bond issuance which are: Renewable Energy and Energy Efficiency; Innovation and Blockchain Technology; Stock Market Reaction; Environmental, Social, and Governance (ESG) Performance; Greenwashing; Corporate governance characteristics, Oil price shocks, and features of Corporate Green Bonds. The study involves the articles that were published between 2007-2023 where a total of 87 peer-reviewed articles matched the scope and objectives of the study.



**Figure 1.** Comprehensive conceptual framework.

This article is structured as follows: Section 2 reviews the related literature on green bond issuance. Section 3 summarizes the review approach followed in this article. Sections 4 and 5 present the results of the systematic review on green bond issuance along with the discussion of the findings. The final section summarizes the implications of the study, limitations, future research directions, and a conclusion that are presented in Sections 6, 7, and 8 respectively.

## 2. Literature Review—Green Bonds Issuance

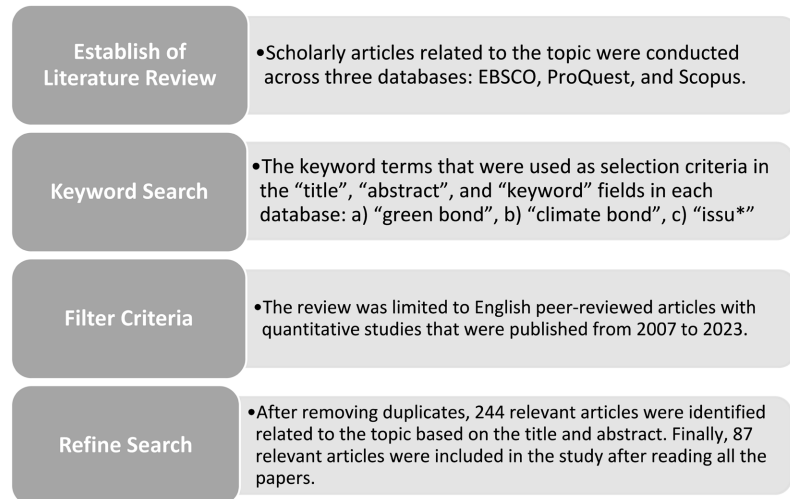
According to [Chen & Zhao, \(2021\)](#), green bonds are considered an appropriate financial instrument for allocating domestic and foreign capital to green investments. This will lead to reducing Greenhouse Gas (GHG), fostering economic growth and future sustainable development in the country. However, the issuance of green bonds is considered a complex process involving several intermediaries such as issuers, investors, regulators, etc. ([Giri et al., 2023](#)). The ICMA Green Bond Principles (GBP) were created in 2014 to provide voluntary process guidelines (not regulations) to strengthen trustworthiness and transparency in the expanding green bonds market ([International Capital Market Association, 2022](#)). Green bond issuance in the international markets is regulated by global standards that are established by both GBP and the Climate Bonds Standard (CBS) Authority ([Lin, 2023](#)).

The green bonds market is increasingly growing across countries where the determinants and implications for issuing them were rarely justified in literature. There are limited studies in the literature about the determinants of green bond issuance ([Chiesa & Barua, 2019](#)). However, current literature focuses on the benefits that the green bond market affords to investors by allowing them to diversify their portfolios ([Goss & Roberts, 2011](#); [Huynh et al., 2020](#); [Huynh et al., 2022](#)). Investors are willing to pay a higher price for green bonds, so they accept a lower yield ([Ning et al., 2023](#)). Consequently, policymakers, corporations, scholars, etc. are examining this new financial instrument frequently to enrich the literature on green bonds with significant contributions that will help in understanding the subject phenomena ([Cortellini & Panetta, 2021](#)). This systematic study will highlight the determinants that influence green bond issuance in the empirical literature.

## 3. Methodology

This review employed a systematic literature review (SLR) to allocate all research studies in alignment with the proposed research questions, according to highly conducted quality steps performed at each level and with high transparency ([MacAskill et al., 2021](#); [Stechemesser & Guenther, 2012](#)) and to limit the existence of error and bias ([Goyal & Kumar, 2021](#)). A systematic review aims to review published academic studies using organized methods to identify, select, and assess literature searches ([Jones, 2020](#); [Tranfield et al., 2003](#)). This review incorporates previous research on the main determinants affecting green bond issuance. **Figure**

2 illustrates the thorough SLR method that has been followed in this paper.

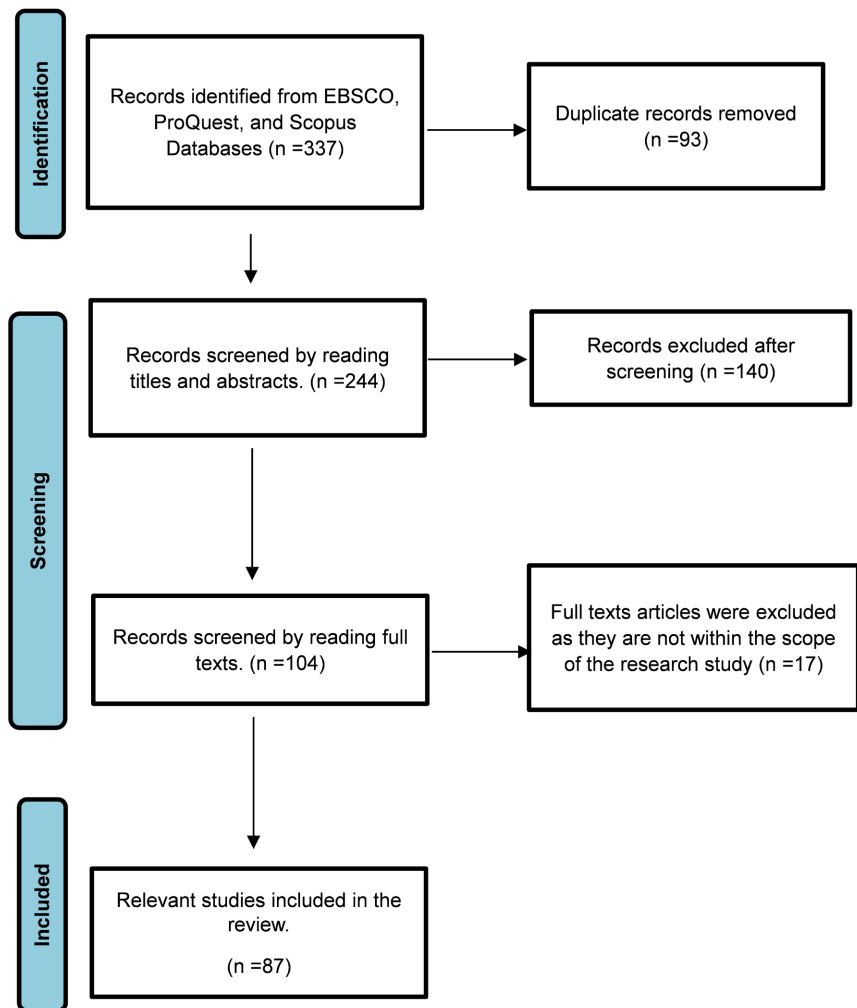


**Figure 2.** Process of systematic literature review.

The criteria for inclusion in this study were full-text, peer-reviewed, academic quantitative papers published between 2007 and July 2023, published in the English language, focusing on green bond issuance. The reason behind the period selection is the first green bond issuance was in 2007 and then the green bonds got attention from scholars after that year. Considering their availability, multiple databases were used to collect pertinent articles, including EBSCO, ProQuest, and Scopus, since those databases are usually regarded as trustworthy and extensively used in research studies (Tawfik et al., 2019).

The review period for this research started in April 2023 and ended in August 2023. The authors ensured a thorough search in those listed databases using several keywords: (“green bond” OR “climate bond”) AND (“issu\*”). The search results were set to appear with selected keywords anywhere in the title, abstract, or full text without any time limit. **Figure 3** includes the complete search string. With 168 articles in Scopus, 94 in EBSCO, and 75 in ProQuest, the first search results yielded a total of 337 articles. A duplicate of 93 articles were discarded from the study within the subject databases. Before being added to the list of chosen studies, the authors examined the article’s title, abstract, and keywords. Moreover, the authors also checked for irrelevant research studies with a total of 17 articles, that were not related to the scope of the research study and focused on those studies that covered the vital scope of green bonds and climate bonds. To reduce any bias existence the authors debated, reviewed, and clarified the articles for selection in case of any ambiguity existence and mutually decided which article to include and which to exclude from this study. A total of 244 papers were included after removing duplicates. In the next stage, the title and abstracts of the remaining articles were reviewed, and 140 non-relevant articles were excluded from the study. Lastly, 87 full-text articles were included in the final process that were relevant to the

study's scope, after both authors examined independently each other's study classifications, and discussed mutually for any difference existence.



**Figure 3.** The flow of the research process.

## 4. Results

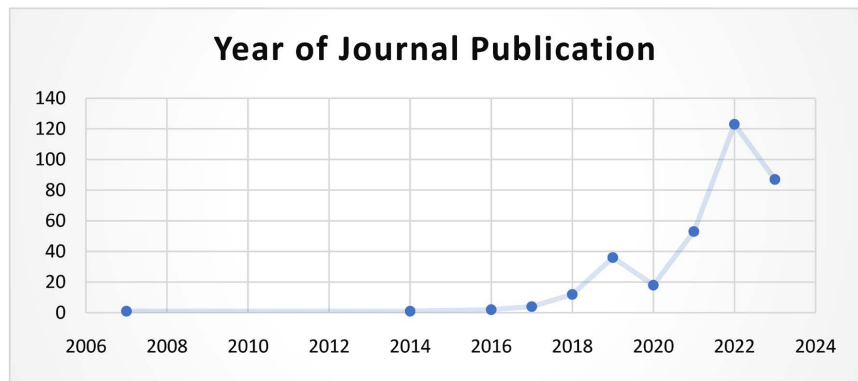
### 4.1. Performance Analysis

Performance analysis was conducted throughout this study. This analysis reveals the performance of any specific research area (Donthu et al., 2021) by presenting the publication trends, and the most contributing journals in the topic field.

#### 4.1.1. Green Bond Research Publication Trends

The year-by-year Green Bond academic publications have been illustrated in **Figure 4**. From 2007 to July 2023, 337 academic papers about the issuing of green bonds were published. A total of four articles were published between the years 2007 to 2016 on the topic of interest. From 2016 and onward, a significant sharp increase in the frequency of green bond publications. This significant increase in green bond interest is due to the introduction of the Sustainable Development

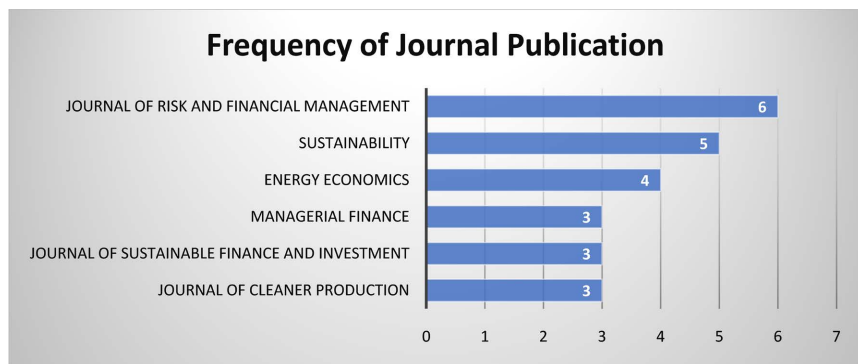
Goals and the Paris Accord.



**Figure 4.** Annual Publications on green bond issuance.

#### 4.1.2. The Most Contributing Journals in Green Bond Topics

The most contributing journals on green bond issuance have been illustrated in **Figure 5**. The relevant leading journals that published most of the relevant articles on the topic of interest in terms of a systematic review are “Journal of Risk & Financial Management”, “Sustainability”, “Energy Economics”, “Managerial Finance”, “Journal of Sustainable Finance & Investment”, and “Journal of Cleaner Production”. The 87 relevant articles that were included in this systematic review were published in 58 different journals as shown in more detail in **Appendix 1**.



**Figure 5.** Frequency of major journals publishing green bond issuance.

#### 4.1.3. The Most Influential Academic Articles Based on Citation Analysis

As presented in **Table 1**, the highest impact factor of the 19 most prominent publishers with more than two published articles on green bond issuance is indicated to analyze the contributions of both articles and journals to the research field (Nierop, 2010; Pan & Fortunato, 2014). “Journal of Cleaner Production” is the top publisher with the highest impact factor of 11.07 followed by “Finance Research Letters” with 9.850. The “Renewable Energy Journal”, “International Review of Financial Analysis”, and “Energy Economics” scored 9.74, 8.98, and 8.3 respectively.

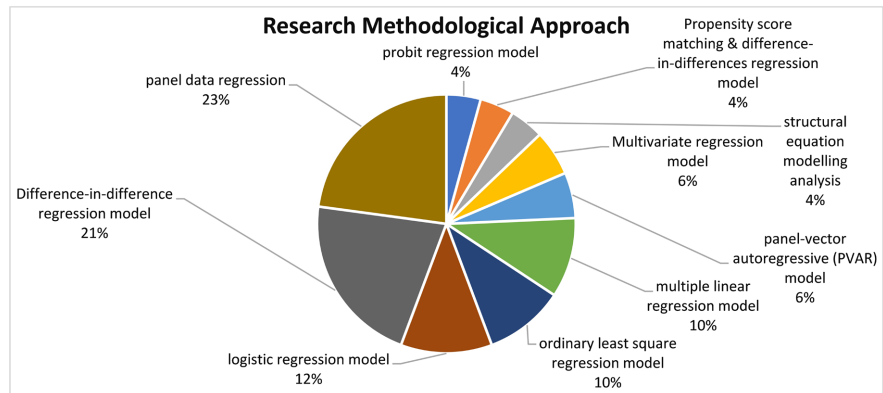
**Table 1.** Most prominent 17 publishers' impact factor.

Journal	Impact Factor	Total Number of Articles cited by year	ABDC Journal Category as 2022
Journal of Cleaner Production	11.072	3	A
Finance Research Letters	9.850	2	A
Renewable Energy	9.740	2	NR*
International Review of Financial Analysis	8.980	2	A
Energy Economics	8.300	4	A
Journal of Sustainable Finance & Investment	5.040	3	NR*
Emerging Markets Review	4.360	2	A
Sustainability	3.890	5	C
Vision	2.800	1	C
European Business Organization Law Review	2.310	2	B
Journal of Asset Management	1.870	2	B
Journal of Economic Dynamics & Control	1.870	2	NR*
Environment & Development Economics	1.780	2	NR*
Managerial Finance	1.770	3	B
Applied Economics Letters	1.220	2	B
Filtration Industry Analyst	1.100	2	NR*
The Journal of Alternative Investments	0.740	2	B
Journal of Risk and Financial Management	0.70	6	B
Journal of Risk Finance	0.365	1	B

\*ABDC Journal Rankings in 2022, NR indicates Not Ranked.

#### 4.1.4. Methodology of the Relevant Articles

From the analysis of relevant articles, there are five dominant methodological statistical models adopted for green bond issuance. These are the “panel data regression model”, “difference-in-difference regression model”, “logistic regression model”, “ordinary least square regression model” and “multiple linear regression model” with more detail shown in **Figure 6**. The panel regression model was ranked first with **23%** appearing in 20 journals followed by the difference-in-difference regression model with **21%** appearing in 18 journals. Moreover, the logistic regression model was ranked third with **12%** appearing in 10 journals.



**Figure 6.** Research methodological approach adopted for green bond issuance.

#### 4.1.5. Leading Green Bond Contributing Countries

Globally, China (31%) and Europe (13%) are among the highest contributing countries across the world in the Green Bond academic research field, as represented in **Table 2**. As stated by (Climate Bonds Initiative, 2023), China is not only leading in the academic field but also it is also considered the second-leading country in Green Bond issuance after Germany with a market share of 13% (USD 37.4bn) and 14% (USD 39.2bn). Hence, this indicates the need to expand to more geographical areas to study the green bonds market in depth.

**Table 2.** Research setting related to green bond issuance.

Country/Region	Articles	Percentage Score
Global	32	37%
Chinese Mainland	27	31%
Europe	11	13%
India	3	3%
US	3	3%
Asia	2	2%
Japan	2	2%
OECD Members	2	2%
South-East Asia	2	2%
Lithuania	1	1%
Taiwan <b>Region</b>	1	1%
UK	1	1%

#### 4.1.6. Main Contributions of Green Bond Literature Review

The key significant contributions of those reviewed articles are depicted in **Appendix 2**. *Azhgaliyeva et al. (2022)* is regarded as one of the first empirical studies to examine how oil price shocks affect a company's ability to issue green bonds. Furthermore, the study conducted by *Dan & Tiron-Tudor (2021)* served as the first evidence of the importance of macroeconomic variables and the ESG risk

index in the development of the green bond market. The study examined the factors that influence the issuing of green bonds in the European Union. Moreover, Wang and Wang (2022) were the first to employ an ESG index for each component independently to analyze the impact of investment recognition and ESG standards on green bond issuance. The impact of blockchain technology on green bond issuance in the financial market is still not yet addressed in the literature, considering it as a future research direction by studying such effects empirically will assist in the literature contribution (Giri, et al., 2023) should be in future research. The study of Rao et al., (2022) is regarded as one of the first empirical studies that examined how corporate green innovation is impacted by the issuance of green bonds, demonstrating novel empirical evidence on the importance of green bonds.

## 5. Discussion

In this section, the main themes around which the current literature review on green bonds was structured are discussed in the following section and depth in **Appendix 2**. It includes the impacts of green bond issuance on various industrial sectors, in addition to the major factors that are affecting green bond issuance.

### 5.1. The Major Impacts of Green Bond Issuance

Green bonds are considered a new asset type that promotes green finance (Zhou et al., 2022). It assists in decarbonizing the economy, lowering carbon emissions, and protecting both the global environment and the economy (Al Mamun et al., 2022; Ma et al., 2022). Hence, as stated by (Wang & Taghizadeh-Hesary, 2023) green bond issuance tend to have a direct impact on various industrial sectors. Based on the reviewed literature, the following section discusses the main impacts of green bond issuance on the various industrial sectors across the globe.

#### 5.1.1. Renewable Energy and Energy Efficiency Through Green Bonds

The impact of green bond issuance on renewable energy and energy efficiency is vital but is studied rarely. According to (Hesary et al., 2023) the issuance of green bonds has a positive effect on the development of renewable energy (wind, solar, and hydro). Japan for example (Hesary et al., 2023), is currently investing heavily in solar and hydro energy sources due to its geographical location and lack of other energy sources, where green bond issuance aligns with the investment priorities of the nation. Furthermore, the importance of green bond issuance on energy efficiency is increasing as it plays a vital role in protecting the environment and reducing global warming (Saboori et al., 2022). This enhancement in energy efficiency leads to a decrease in energy consumption causing less greenhouse gas emissions. Moreover, according to Li et al. (2023), it has been found that green bond issuance improves energy efficiency, by leading to an increase in the number of sustainable projects being raised in the European Union countries. In addition, it has been found that the green bond issuance and regulatory quality index have a positive effect on energy efficiency (Tu & Rasoulinezhad, 2021). This indicates

the major role of green bond issuance in improving energy efficiency projects in countries increasing the number of investors (Tang & Zhang, 2020).

### 5.1.2. Green Innovation and Blockchain Technology Through Green Bonds

Rao et al. (2022) stated that green bond issuance has a significant positive impact on corporate green innovation when state-owned companies, large companies, and less polluted companies issue them to facilitate the financial constraints. Moreover, Wu et al., (2022), stated that the issuance of corporate green bonds has a positive significant impact on a firm's green innovation leading to a higher environmental performance, enhancing the corporate's innovation performance and corporate value in the long term (Khurram et al., 2023). Green innovation can be a main driver for the company to achieve a sustainable transformation of the economy (Yan et al., 2020; Lin et al., 2022), but depends on the government's policies (Peng et al., 2021; Lin et al., 2023). This will encourage governments to stimulate the green bond market which will help mitigate environmental pollution (Rao et al., 2022). Moreover, the governance structure and environmental regulations can affect the relationship between green bond issuance on green innovation (Wang et al., 2022).

The financial markets industry is continuously progressing, and the introduction of blockchain technology has aided in tracking the funds allocated to green bonds (Malamas et al., 2020). This is particularly encouraging the issuance of green bonds and investors' intent to invest in the stock market (Giri et al., 2023), allowing the investors to view the green bond information at any point in time (Casino et al., 2019).

### 5.1.3. Stock Price Informativeness and Stock Market Returns

Wang and Jiang (2023) stated that green bond issuance can significantly impact the stock price informativeness (SPI), by facilitating the environmental performance and information transparency of the company. According to (Roll, 1988; Durnev et al., 2003), stock price informativeness (SPI) can be defined as the variation in stock returns that is justified by the firm's amount of knowledge. Companies need to truly disclose the use of funds caused by green bonds along with the progress of green projects. This will encourage green investors to use the accurate information disclosed by the company which will reduce the information asymmetry between the company and investors. This will result in improving the firm's stock price, hence promoting SPI (Chan & Chan, 2014; Sila et al., 2017; Grewal et al., 2021). Moreover, previous literature suggests that the market negatively responds to the announcement of green bond issuances where the cumulative abnormal return is approximately between  $-0.5\%$  and  $-0.2\%$  (Lebelle et al., 2020). Thus, this shows that investors react similarly whether it is conventional or green bonds. However, few studies found that the issuer's stock price positively reacts to the announcement of green bond issuance which can enhance the firm value. The stock market reactions are greater for corporate issuers and first-time

issuers than for financial institution issuers and frequent issuers (Tang & Zhang, 2020; Flammer, 2021; Xi & Jing, 2021). Hence, first-time issuers and green bonds that are certified by independent third parties have higher cumulative abnormal returns (Flammer, 2021).

#### **5.1.4. Environmental, Social, and Governance (ESG) Performance**

Zheng et al., (2023) found that a corporation's ESG performance is significantly impacted by the issuing of green bonds. Michelson et al., (2004) have acknowledged that as a fundamental component of corporate ESG performance, corporations ought to prioritize encouraging governance and safeguarding the environment. According to Zheng et al., (2023), green bond issuance can also improve corporate financing limitations by lowering corporate financing costs. Moreover, companies can reduce information asymmetry and build a positive reputation by using green bonds to help them raise capital from the capital market and draw in outside investors (Flammer, 2021). Accordingly, green bond issuance assists in promoting the low-carbon, sustainable growth of the economy as well as the company's green productivity, leading to a higher ESG performance (Lee & Lee, 2022; Zhou et al., 2022). Moreover, the ESG index, population, and credit rating are found to significantly impact the issuance of green bonds (Dan & Tiron-Tudor, 2021), leading to an increase in investments (Prajapati et al., 2021). Other studies found that the interaction of a company's brand reputation and ESG has a positive influence on green bond issuance (Cheng et al., 2023). In contrast, it has been acknowledged that when some companies prioritize environmental goals and embed them in their strategic objectives in the short term, it tends to have a negative impact between corporate financial performance and the issuance of green bonds when combining it with ESG performance (Wang & Wang, 2022).

## **5.2. The Major Factors Affecting Green Bond Issuance**

Global green bond issuance has increased gradually in the past few years as a result of trying to achieve (SDG) goals that reduce climate change. However, significant challenges affecting the issuance of green bonds tend to exist, which are discussed in the following section.

### **5.2.1. Success Criteria Drivers of Issuing Green Bonds**

Bužinskė & Stankevičienė (2023), stated that issuers' reputation, good credit rating, and Environmental, Social, and Governance (ESG) Performance score are the key components of successful green bond issuance. Hence, issuers should take these variables into account when issuing green bonds to assist in attracting both local and foreign investors, since investors consider them while making investment decisions in the green bond market. Issuance other factors such as issuance costs, certification, use of proceeds, etc. need to be considered when deciding to issue green bonds.

### **5.2.2. Greenwashing**

Greenwashing is defined as the practice of deceiving investors about the

company's environmental commitment (Flammer, 2021). Baldi & Pandimiglio, (2022), stated that the lower the greenwashing risk when issuing green bonds of local government, the more difficult it is to deceive investors about green projects due to the impactful monitoring mechanisms. Moreover, the lower the greenwashing risk that is associated with green bond issuance by service companies, the lower the returns that are requested by investors. This will lessen the costs and efforts required by investors to monitor green investments. When companies issue green bonds, the risks of greenwashing practices can be minimized as this will not encourage companies to issue such bonds for greenwashing (Makpotche et al., 2023). It has been acknowledged that a certified corporate green bond reduces greenwashing practices by demonstrating a credible commitment toward the environment. Hence, earlier literature found that companies do not issue green bonds to engage in greenwashing practices as they aim to enhance their environmental score for the emergence of the green bond market (Makpotche et al., 2023).

### 5.2.3. Corporate Governance Characteristics

According to García et al., (2023), it has been found that corporate green bond issuance leads to higher environmental ratings and having a board of directors with higher sustainability committees. The presence of a sustainability committee assists firms in improving environmental performance, the company's legitimacy, and promoting sustainable development (Michelon & Parbonetti, 2012; Haque, 2017; Hussain et al., 2018). The effectiveness of corporate governance characteristics (i.e., the board size, independent directors, and board gender diversity) show positive effects on green bond issuance which appears to be a more appealing choice for issuers (Cicchiello et al., 2022). In addition, companies with higher governance scores show a significant positive effect on green bond issuance and spread (Immel et al., 2022). Companies that focus on enhancing governance structures can affect green bond issuance by promoting transparency and integrity of environmental disclosure (Cheng et al., 2023). Hence, successful companies implement effective corporate governance mechanisms to maintain a strong environmental commitment to society leading to the company's profitability and higher sustainable performance (Foote et al., 2010; Zheng et al., 2023).

### 5.2.4. Oil Price Shocks

According to Azhgaliyeva et al., (2022), it has been found that crude oil flow demand and supply shocks have a significant positive relationship on the probability of corporate green bond issuance. A reduction in the oil price should decrease the issuance of green bonds as there will be a greater reliance on fossil fuels instead of renewable energy. Furthermore, the fluctuations in oil prices lead to a higher inflation rate and interest rate which will decrease the green bond prices in sequence to the treasury bond rates as most of the green bonds are issued by governments (Mokni et al., 2022). However, when the oil price increases, then businesses will switch to renewable energy which will lead to a rise in green bond issuance (Marín-Rodríguez et al., 2022). Hence, the oil price is considered a substantial factor

in economic performance and green bond markets where fluctuations in the oil prices will affect green bond markets.

### **5.2.5. Features of Corporate Green Bonds**

According to [Dutordoir et al. \(2023\)](#), it has been found that some various drivers/motivators impact the issuance of corporate green bonds than conventional bonds which are: reputational gains, disclosure benefits, and incentives. Regarding reputational gains, a company that shows its commitment toward environmental sustainability development specifically in corporate social responsibility (CSR) initiatives lead to a positive impact in building up the company's reputational status in the market. Hence, resulting in greater financial performance and attracting investors to finance the company's green projects when issuing corporate green bonds in the stock market. In addition, mixed results were obtained that show the impact of companies that disclose their sustainable initiatives and projects to the stakeholders resulting in stronger company growth and higher issuance rate of green bonds in the market. The study found no evidence that investors' preferences for environmentally green activities may change over time affecting green bond issuance.

## **6. Conclusion, Implications, and Future Research**

The continuous growth in the number of green bond issuance in the bond market is a positive indicator of the efforts that are been conducted by each country since the Climate Change Conference (COP21), which took place in Paris in December 2015, to lower the effect of climate change worldwide. Even though there is a huge expansion in green bond issuance globally, it has not yet reached the issuance volume of conventional bonds. In light of this phenomenon, academics are very interested in determining the different factors that are affecting green bond issuance and the direct impact of green bond issuance on various industrial sectors. Thus, this study systematically reviews simultaneously, the determinants that impact the issuance of green bonds and the impact of green bond issuance on various industrial sectors in the existing literature. The study highlights and reveals some intriguing results regarding the various determinants related to green bond issuance by reviewing 87 research articles related to the topic which are: Renewable Energy and Energy Efficiency; Innovation and Blockchain Technology; Stock Market Reaction; Environmental, Social, and Governance (ESG) Performance; Greenwashing; Corporate governance characteristics, Oil price shocks, and Features of Corporate Green Bonds. Furthermore, the most dominant factors that were measured with green bond issuance were: Environmental, Social, and Governance (ESG), Stock market reaction, and Innovation. Finally, the study provides future research directions for future studies to examine in-depth green bond issuance factors and barriers and a few implications that are particularly vital to both the regulators and domestic and foreign investors in terms of risk analysis.

The study undertakes a systematic literature review that defines the state of the area of research on green bond issuance in the global context at the present status

as well as the potential future directions. The review highlights the main impacts of green bond issuance on renewable energy and energy efficiency, green innovation and blockchain technology, stock price informativeness and stock market returns, and Environmental, Social, and Governance (ESG) Performance in a positive direction. Moreover, the review reveals that greenwashing, corporate governance characteristics, oil price shocks, and the features of corporate green bonds are determinants that act as a limitation towards green bond issuance at global markets. From a practical perspective and policy measures, the findings of this study will influence policymakers to evaluate and prioritize actions that support the emergence of the green bonds market by examining the various determinants of green bond issuance. Those determinants will help in attracting domestic and foreign investors to contribute toward environmentally friendly projects, seeking to generate funds for investing in sustainable projects. Moreover, the study shed light on establishing regulation controls that will support the development of green projects globally that can be conducted by regulators through reports disclosures, leading to a high level of transparency assured for domestic and foreign investors.

The study conducts a systematic literature review enriching the existing literature on green bonds. Nevertheless, there are few limitations to the study. First, the selected articles are limited to peer-reviewed scholarly articles published in the English language. Second, the data are extracted using limited key data such as year, source type, peer-reviewed scholarly articles, language, etc. Third, the sample size was small due to the limited scholarly articles that published about green bond issuance area of field. Finally, a limited number of databases are consulted, where unpublished research and conference papers have mainly been excluded. Thus, these limitations might be subject to selection bias when examining the green bond market. However, these limitations should be considered in future research as the green bond market is still in the emerging phase.

Based on the review findings, a few areas for future research were identified. First, the outcomes that were determined from the literature review indicate that with the development digital era after the COVID-19 pandemic, it is recommended to move toward the issuance of digital green bonds to increase the contribution of foreign investors through enabling greater geographical areas (Taghizadeh-Hesary et al. 2022). Second, there are limited studies examining green bond issuance in companies due to the lack of availability of observations which results in a smaller sample size. Third, greenwashing and its impact on corporate green bond issuance is recommended to be studied in the future, as a limited number of studies exist in the existing literature. Moreover, it is recommended that a new methodological approach to measuring greenwashing should be studied in depth. Fourth, more research studies need to account for corporate ESG and sustainability performance since there are a limited number of listed companies in China with outstanding ESG performance which is approximately 1.6% of AA grade and above (Zheng et al., 2023). This indicates that there is a lack of ESG performance in China's listed companies along with other countries. According to the World Bank's WDI database

(The World Bank Group, n.d.), China is considered one of the largest carbon emitters in the developing economy in 2020. Thus, this can also be applicable in emerging markets where the concept of ESG or green sustainability is still unexplored, so further research covering more geographical areas is recommended. Fifth, other research methodologies need to be applied to measure the direct effects between green bond issuance and ESG performance through questionnaires, interviews, and case studies to enrich the theoretical literature on green bond issuance. Sixth, it has been acknowledged that limited studies were conducted to measure oil price shocks on corporate green bond issuance, so more studies should be considered to study such effects in the future (Azhgaliyeva et al., 2022). Finally, and since most of the reviewed articles were examined in China, Europe, and the United States, further research is recommended to be conducted on the MENA region, as it remains unexplored.

### Consent for Publication

The author declare that they do not have any information on specific individual or company in any format, and we provide our consent for publication.

### Consent to Participate

The author confirm that they have participated in the research work and are fully aware of the ethical responsibilities.

### Data Availability

All data generated during this study are involved in the published article(s) that are cited within the text and acknowledged in the reference section.

### Conflicts of Interest

The author declares that no conflict of interest would have seemed to affect this paper's work.

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## Appendix 1

The number of relevant articles related to the issuance of green bonds per journal.

Journal of publication	Number of articles	Weight	Journal of publication	Number of articles	Weight
Accounting and Finance	1	1.15%	International Journal of Finance and Economics	1	1.15%
Applied Economics	1	1.15%	International Journal of Green Economics	1	1.15%
Applied Economics Letters	2	2.30%	International Review of Financial Analysis	2	2.30%
Australasian Accounting, Business and Finance Journal	1	1.15%	IOP Conference Series. Earth and Environmental Science	1	1.15%
Business Strategy and the Environment	1	1.15%	IUP Journal of Applied Economics	1	1.15%
British Journal of Management	1	1.15%	Journal of Alternative Investments	1	1.15%
China Economic Review	1	1.15%	Journal of Asset Management	2	2.30%
Climate Policy (Taylor & Francis Ltd)	1	1.15%	Journal of Cleaner Production	3	3.45%
Cogent Business and Management	1	1.15%	Journal of Corporate Finance	1	1.15%
Econometrics	1	1.15%	Journal of Derivatives and Quantitative Studies (JDQS)	1	1.15%
Economic Analysis and Policy	1	1.15%	Journal of Economic Dynamics & Control	2	2.30%
Economic Change and Restructuring	1	1.15%	Journal of Economics & Finance	1	1.15%
Economies	1	1.15%	Journal of Economics and Management Strategy	1	1.15%
Emerging Markets Review	2	2.30%	Journal of Financial Economics	1	1.15%
Energies	1	1.15%	Journal of Investing	1	1.15%
Energy Economics	4	4.60%	Journal of Islamic Accounting and Business Research	1	1.15%
Environment & Development Economics	2	2.30%	Journal of Risk and Financial Management	6	6.90%
Environmental and Resource Economics	1	1.15%	Journal of Risk Finance	1	1.15%
Environmental Research Letters	1	1.15%	Journal of Structured Finance	1	1.15%
Environmental science and pollution research international	1	1.15%	Journal of Sustainable Finance and Investment	3	3.45%
European Business Organization Law Review	2	2.30%	Managerial Finance	3	3.45%
Filtration Industry Analyst	2	2.30%	Pacific Basin Finance Journal	1	1.15%
Finance	1	1.15%	Renewable Energy	2	2.30%
Finance Research Letters	2	2.30%	Research in International Business and Finance	1	1.15%
Frontiers	1	1.15%	Sustainability	5	5.75%
Global Finance Journal	1	1.15%	Technological Forecasting and Social Change	1	1.15%
Heliyon	1	1.15%	The Journal of Alternative Investments	2	2.30%
International Entrepreneurship and Management Journal	1	1.15%	Utilities Policy	1	1.15%
International Environmental Agreements: Politics, Law & Economics	1	1.15%	Vision	1	1.15%

## Appendix 2

Sample of green bond issuance literature review by type of sample, methodology, and findings.

Sr.	Author(s) & Year	Time Span	Geographical Scope	Methodological Approach	Sample Size	Main Findings	Key Contributions
1	Azhgaliyeva et al., (2022)	2010-2021	Globally	Structural z Vector Autoregressive (VAR) model in panel data framework	41 corporate green bonds in 8 sectors-Utility, Industrial, Consumer, Energy, Material, Technology, and Communication	It was found that the likelihood of issuing corporate green bonds is significantly increased by crude oil flow demand and supply shocks.	Examining the relationship between oil price shocks flow supply and demand shocks on corporate green bond issuance.
2	Baldi & Pandimiglio, (2022)	2012-2019 for Corporate green bonds. 2013-2019 for public sector green bonds.	Globally	Multiple Regression Model using the OLS method	199 issued green bonds	The study found that the lower the greenwashing risk when issuing green bonds to local government, the more difficult it is to deceive investors about green  projects due to the impactful monitoring mechanisms. Moreover, the lower the greenwashing risk that is associated with the green bond issuance by service companies, the lower the returns that are requested by investors.	1) Developing a conceptual framework to examine the link between ESG, sustainable impact, and greenwashing risk on green bond issuance for both public and corporate issuers. 2) Providing empirical evidence through an econometric model relating to both public and corporate green bond issuance. 3) Recommending that policymakers, rating agencies, and investors employ empirical findings to enhance the features of green bond issuance in the financial markets.
3	Bužinskė & Stankevičienė, (2023)	-	Lithuania	Survey via Analytical Hierarchy Process Method	42 experts	Success factors such as the issuer's reputation, good credit rating, and ESG score are the key components of the issuance of green bonds.	Providing insights on the success factors that impact the issuance of green bonds relevant to Lithuania.
4	Cicchiello et al., (2022)	2015-2020	European countries	Logistic regression model	794 corporate green bonds	According to the study, corporate governance characteristics such as board size, independent directors, and board gender diversity show positive effects on green bond issuance which appears to be a more appealing choice for issuers.	1) Contributing to the existing literature on the green bond market by shedding light on the European market. 2) Examining the determinants that are affecting the issuance of both corporate green and conventional bonds. 3) Examining the effects of corporate governance characteristics on the issuance of green bonds.

## Continued

5	Dan & Tiron-Tudor, (2021)	2014-2019	European country's members	Linear regression model	19 EU countries	<p>The study found that the ESG index, credit rating, and resident population of a jurisdiction can lead to a higher number of green bond issuances. When the ESG index is high, the investments will increase which enhances green bond issuance. Moreover, credit rating has a significant positive impact on green bond issuance. A large population can invest more funds in environmental projects which influences the issuance of green bonds.</p>	<ol style="list-style-type: none"> <li>1) Providing empirical evidence of various determinants that impact the issue size.</li> <li>2) Illustrating the impact of macroeconomic stability such as fiscal balance and inflation rate on green bond issuance.</li> <li>3) Providing empirical evidence of the ESG risk index in the emergence of the green bond market.</li> </ol>
6	Dutordoir et al. (2023)	2014-2021	United States, Western European, and Chinese-listed firms	Linear Probability regression model (Binary Regression)	307 green bonds and 9330 conventional bonds	<p>The study found that a company that shows its commitment toward environmental sustainability development specifically in CSR initiatives leads to a positive impact on reputational benefits in the market. Moreover, mixed evidence was obtained that shows the impact of firms when disclosing their sustainable projects to the stakeholders and the issuance of green bonds in the market. The study also found no evidence that investor's preferences for environmentally green activities may change over time affecting green bond issuance.</p>	<ol style="list-style-type: none"> <li>1) The study contributes to the literature on the firm's incremental funding decisions.</li> <li>2) Creating a framework by examining the main drivers that differentiate green bonds from conventional bonds.</li> <li>3) Investigating the investor's preferences in financing the company's green projects.</li> </ol>
7	Flammer, (2021)	2013-2018	Globally	Difference-in-differences (DID) regression model	1189 green bonds	<p>The study found that the stock process responds positively when green bonds are announced for issuance, more so for the bonds issued by first-time issuers and those certified by independent third parties. In addition, corporate green bond issuance improves firm environmental performance and increases ownership.</p>	<ol style="list-style-type: none"> <li>1) Providing insights on how firm-level results after the issuance of green bonds.</li> <li>2) Examining the effects of investments when issuing corporate green bonds.</li> <li>3) Showing the effects of ESG performance on the issuance of green bonds.</li> <li>4) Showing the link between corporate's environmental and stock market performance.</li> </ol>

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8	García et al., (2023)	2013-2021	Globally	Logistic regression model	201 corporate green bonds issuance.	According to the study, the issuance of corporate green bonds is predicted by having sustainability committees and a board of directors with a higher proportion of female members. It also results in higher environmental ratings and reduced CO <sub>2</sub> emissions.	1) Extending the time period of the empirical analysis to increase green bond issuances in line with the market's continuous growth. There will be more substantial evidence and higher trustworthy results. 2) Analyzing the corporate governance characteristics of the firms that issued green bonds. 3) Analyzing green bond issuance with environmental performance using five alternative measures.
9	Giri et al., (2023)	2020	India	Questionnaire-multiple linear regression-fixed models	304 individuals	The study found that blockchain technology promotes the issuance of green bonds which increases the intention of investors to invest in the stock market.	Examining the influence of blockchain technology on the issuance of green bonds among investors in the financial market which has been ignored in the literature.
10	Hesary et al., (2023)	1990-2020	Japan	Autoregressive distributed lag estimation method (ARDL) through annual data	1 country	The study found that green bond issuance has a positive effect on the development of renewable energy (wind, solar, and hydro) consumption in Japan	1) Green energy is split into three types: solar energy, wind energy, and water energy where each category is analyzed separately with issued green bonds. 2) The three categories of green energy are analyzed using short-term and long-term. Noting that there is a lack of empirical evidence in developing countries that analyzes the effect of green bond issuance on corporate value. Moreover, an interaction effect exists between the issuance of green bonds and corporate innovation performance on corporate value.
11	Khurram et al., (2023)	2016-2020	China	Difference-in-differences (DID) regression model	17 China's listed companies	The study found that the corporation's green bond issuance has a significant influence on improving its innovation performance and corporate value in the long term.	1) The study is the only one using the green bond database along with other databases in private access to list all the globally issued green bonds. 2) The study compares issuers from developed and developing economies along with financial and non-financial issuers using the new model approaches.
12	Lebelle et al., (2020)	2009-2018	Globally	Ordinary Least Square (OLS) regression model	145 companies issued 475 green bonds	It has been found that the announcement of green bond issuances causes the developed market to react negatively to the emerging markets, with a cumulative abnormal return is approximately between -0.5% and -0.2%.	1) Examining energy efficiency with green bonds and green tax. 2) Analyzing the causal association between energy efficiency, green bonds, and green tax. 3) Providing empirical evidence using advanced econometric analysis to estimate the coefficient of predictor variables.
13	Li et al., (2023)	2010-2021	European Union Members	Econometric Analysis through the Panel Data Framework.	27 EU members	Green bond issuance positively impacts energy efficiency in the EU. The power of green tax encourages corporations to conduct green projects enhancing energy efficiency in EU members.	

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14	Makpotche et al., (2023)	2013-2020	Globally	Difference-in-difference regression model	259 corporate green bonds issuers	It has been found that when companies issue green bonds, the risks of greenwashing practices can be minimized as a certified corporate green bond indicates a credible commitment to environmental protection. Moreover, the companies that issue green bonds mitigate CO <sub>2</sub> emissions, improving long-term environmental performance.	Examining corporate green bonds and environmental performance instead of using conventional bonds.
15	Rao et al, (2022)	2017-2019	China	Difference-in-difference regression model	7,835 China-listed companies	It has been found that corporate green bond issuance has a significant positive effect on green innovation. When state-owned companies, large companies, and less pollution-prone companies issue green bonds, it has a significant effect on green innovation.	Limited studies examined the effects of corporate green bonds on green innovation.
16	Tang & Zhang, (2020)	2007-2017	28 global countries	Panel data regression model	132 unique publicly listed companies	The study found that when green bonds are announced to be issued, the issuer's stock price responds positively, enhancing the firm value. Compared to the financial institutions and regular issuers, the stock market reaction is greater for corporate and first-time issuers. Furthermore, institutional ownership and stock liquidity have increased after the issuance of green bonds.	Examining how green bond issuance affects shareholders and firm performance.
17	Wang & Jiang, (2023)	2010-2021	China	Difference-in-difference regression model	18,173 listed firm-year observations	Green bond issuance has been found to have a significant influence on stock price informativeness (SPI) by facilitating the company's sustainable performance and information transparency. Moreover, a firm's SPI is significantly impacted by green bond issuance when there is a higher network centrality of independent directors, a greater digitalization level, and a greater environmental, social, and governance disclosure level.	1) Proving the first study examining how green bond issuance affects stock price informativeness (SPI). 2) Analyzing the impact of green bond issuance on SPI using two channels: information transparency and sustainable performance.

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18	Wang & Wang, (2022)	2016-2020	China	Probit regression model and Ordinary Least Square (OLS) regression model	94 China's listed companies	The study found that the issuance of green bond issuance has a significant effect on the firm's ESG performance. However, the study resulted in a negative impact on corporate financial performance and green bond issuance when combined with ESG performance.	<p>1) Noting that a few studies have examined the association between ESG practices and investment recognition on the issuance of green bonds.</p> <p>2) Noting limited studies have examined the effects of ESG on the issuance of green bonds using the ESG index for each indicator separately.</p> <p>3) Examining how financial performance affects the relationship between ESG practices and green bond issuance.</p> <p>4) Addressing the lack of studies of ESG practices in the emerging market, especially China.</p>
19	Wang et al., (2022)	2007-2020	China	Difference-in-differences (DID) regression model	32,122 China's listed companies	It has been found that issuing green bonds can significantly facilitate a company's green innovation. Moreover, environmental regulations and ownership structure significantly improve green innovation.	<p>1) Concluding few studies examine the association between the issuance of green bonds and a company's green innovation.</p> <p>2) Noting the impact of green bond issuance on corporate green innovation is analyzed by considering financial constraints.</p> <p>3) Analyzing how corporate ownership and environmental regulations affect the relationship between green bond issuance and corporate green innovation.</p>
20	Wu et al., (2022)	2010-2020	China	Propensity score matching (PSM) and difference-in-differences (DID) model	1324 China's listed non-financial firms	Corporate green bond issuance has been found to significantly improve a firm's green innovation, leading to higher environmental performance. In addition, when media attention arises on green bond issuers, the firm's green innovation will significantly be improved. According to the study, green bond issuance significantly impacts a company's ESG performance. This can assist in reducing corporate financing constraints and promoting the maturity structure of corporate debt and its profitability.	<p>By analyzing the driver factors of green innovation, it was discovered that limited studies have looked at how the issuance of green bonds affected the green innovation of peer firms</p> <p>1) Examining how green bond issuance affects ESG performance.</p> <p>2) Examining whether the issuance of green bonds can ease corporate financial constraints.</p> <p>3) Examining how the green bond's internal governance and external effects can help to ease financial constraints.</p>
21	Zheng et al., (2023)	2013-2019	China	Difference-in-differences (DID) regression model	5,340 China's listed companies		