

The Impact of Sustainable Bond Issuance on Global Macroeconomic Indicators: An Econometric Analysis for the Period 2013-2023

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Abstract. *This paper assesses the impact of green, social, and sustainable bonds on the key macroeconomic variables of gross domestic product, inflation, and unemployment across the global economy for the period 2013–2023. Green, social and sustainable bonds are new financial instruments developed to align economic growth with environmental and social goals. Though previous studies have focused mainly on specific types of bonds or regions, this research will undertake a comprehensive study of their aggregate and individual impacts on the macroeconomy.*

It considers the linear regression model in order to investigate the relation of green, social and sustainable bonds issuances with selected economic indicators. It has been observed that the coefficients of green bonds are highly significant, consistent with positives for both gross domestic product and inflation, since such bonds play a financing role in sustainable infrastructure and are expected to ensure economic growth. Social bonds also contribute positively to gross domestic product but show an insignificant relationship with inflation, as befits their welfare-oriented objectives. Sustainable bonds show moderate positive effects on both gross domestic product and inflation but limited impacts on the unemployment and growth rates.

These results highlight the importance of green, social and sustainable bonds in fostering economic resilience and furthering sustainable development. The findings suggest that targeted strategies should be implemented by policymakers to enhance the efficiency of social and sustainable bonds, and to make use of green bonds as an instrument for financial stability and growth. This paper adds to the emerging literature on sustainable finance by providing the first aggregated assessment of the macroeconomic impacts of green, social and sustainable bonds and by offering actionable insights for policymakers and investors. Future research should be done on the long-term and sectoral impacts of green, social and sustainable bonds to deepen the understanding of their economic implications.

Keywords: sustainable bonds, green bonds, social bonds, macroeconomic indicators, econometric analysis.

Introduction

Sustainable bonds, including green, social, and sustainability (GSS) bonds, have emerged as critical financial instruments in addressing climate change and socio-economic challenges. Over the past decade, their issuance has grown exponentially, driven by global support for responsible investments and sustainable development initiatives.

Green bonds fund environmentally focused projects like renewable energy and sustainable infrastructure (International Capital Market Association, 2022), while social bonds target social priorities such as education and healthcare (European Investment Bank, 2024). Sustainability bonds integrate these objectives, addressing both environmental and social challenges (BloombergNEF, 2024b).

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Despite their increasing relevance, the short- and long-term effects of GSS bonds on macroeconomic indicators—GDP growth, inflation, and unemployment—remain insufficiently explored. While green bonds have been linked to economic growth through investments in sustainable infrastructure (IMF, 2024), the differentiated impacts of social and sustainability bonds require further examination.

This study investigates the distinct macroeconomic effects of GSS bonds, utilizing simple and multiple linear regression econometric methods to analyze data from 2013–2023.

By exploring the relationship between bond issuance and macroeconomic variables, the article provides insights into their policy implications and potential for sustainable economic development (Stock & Watson, 2020; Wooldridge, 2010). The findings aim to enrich the literature and guide policymakers and investors in leveraging GSS bonds for long-term economic resilience and sustainability.

Literature review

The growing role of green, social, and sustainability bonds in promoting macroeconomic stability and sustainable development

Green, social, and sustainability (GSS) bonds have emerged as vital instruments in sustainable finance, addressing critical environmental, social, and economic challenges.

Their increasing importance is linked to their contributions to key macroeconomic performance indicators, such as economic growth, inflation, and unemployment.

Green bonds finance projects focused on environmental sustainability, including renewable energy development, green infrastructure, energy efficiency, and carbon emission reductions (Tolliver et al., 2020; Zhang et al., 2022).

Between 2013 and 2023, the global green bond market experienced exponential growth, driven by regulatory frameworks like the EU Green Taxonomy and the Sustainable Finance Disclosure Regulation (SFDR), which enhanced transparency and accountability in sustainable investments (European Commission, 2020).

This growth, documented by the Climate Bonds Initiative (2024) and BloombergNEF (2024a), underscores their pivotal role in mobilizing capital for climate-related investments. Green bonds drive economic growth by funding sustainable infrastructure and fostering innovation in clean technologies, while also playing a crucial role in mitigating climate change (Reboredo, 2018).

The significant growth of the global green bond market, as illustrated in Figure 1, highlights their pivotal role in mobilizing capital for climate-related investments. Between 2013 and 2023, the issuance of green bonds surged significantly, driven by regulatory frameworks such as the EU Green Taxonomy and the Sustainable Finance Disclosure Regulation (SFDR), which enhanced transparency and accountability in sustainable investments (European Commission, 2020).

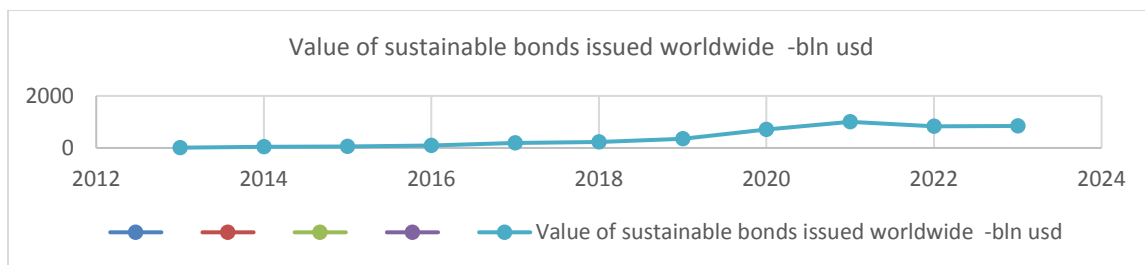


Figure 1. Global green bond growth between 2013-2023 (billion USD)

Source: (Climate Bonds Initiative, 2024).

Social bonds address societal challenges, focusing on funding healthcare, education, and community welfare projects, particularly in underserved communities (European Investment Bank, 2024). These bonds generate positive social outcomes by channeling resources into human capital development, indirectly contributing to economic growth by improving workforce productivity and reducing inequalities. While their impact on macroeconomic variables like unemployment and inflation is less pronounced than that of green bonds, social bonds significantly enhance access to essential services in developing regions (IFC, 2020).

Sustainability bonds combine the objectives of green and social bonds, addressing both environmental and social concerns simultaneously. These instruments align closely with the United Nations' Sustainable Development Goals (SDGs), advancing projects that balance environmental resilience with social equity (BloombergNEF, 2023). By fostering holistic development, sustainability bonds contribute to macroeconomic stability and societal progress (Flammer, 2021).

Relationship Between Indicators and Sustainable Bonds

The global GDP value has shown a steady increase (with fluctuations during crises, e.g., the 2020 pandemic) alongside the growth in the sustainable bond market.

However, the correlation between the value of sustainable bonds issued and global GDP remains weak, as the cumulative value of these bonds represents a small fraction of total global economic activity.

While sustainable bonds contribute to targeted sectors like renewable energy and social welfare, their macroeconomic impact is limited compared to the scale of global GDP.

The unemployment rate has generally decreased since 2013, apart from a temporary increase in 2020 during the COVID-19 pandemic.

Green bonds have been linked to job creation in renewable energy and infrastructure sectors, with estimates suggesting that every \$1 billion invested can create approximately 15,000 jobs (Tolliver et al., 2020). However, the total issuance of sustainable bonds does not correlate strongly with global unemployment rates, as their value remains relatively small compared to global labor markets.

The global inflation rate has fluctuated over the years, with significant spikes in 2021 and 2022 due to supply chain disruptions and geopolitical tensions. Sustainable bonds, particularly green bonds, help stabilize inflation over the long term by fostering energy efficiency and reducing energy price volatility (Reboredo, 2018). However, their overall impact on inflation trends remains modest due to the small scale of investments relative to global economic dynamics.

The growth rate of global GDP shows a weak correlation with the value of sustainable bonds issued.

While the global GDP growth rate recovered in 2021 following the pandemic-induced contraction of 2020, the continued increase in sustainable bond issuance did not exhibit a direct proportional relationship with GDP growth.

This can be attributed to the fact that sustainable bond proceeds are often directed toward long-term projects that yield intangible or delayed economic benefits, such as improved environmental resilience and social equity (Flammer, 2021).

The value of sustainable bonds has grown dramatically, from \$11 billion in 2013 to \$848.7 billion in 2023. This increase reflects heightened global commitments to sustainability, driven by frameworks like the EU Green Taxonomy and the United Nations Sustainable Development Goals (SDGs).

However, despite their growth, the scale of sustainable bonds relative to global economic indicators is insufficient to produce a direct, measurable impact on GDP growth, inflation, or unemployment at the macroeconomic level.

Justification for the Selection of Indicators

The inclusion of these four macroeconomic indicators allows for a comprehensive evaluation of the impacts of sustainable bonds on global economic and societal well-being:

Global GDP (at current prices): This indicator provides a snapshot of overall economic activity, reflecting the size and performance of the global economy. Sustainable bonds aim to fund projects that enhance productivity and infrastructure, making this an essential metric to assess their broader economic contribution.

Global Unemployment Rate: Employment levels are a key measure of economic inclusivity and social stability. Sustainable bonds, particularly green bonds, play a role in generating employment in sectors like renewable energy and infrastructure, making unemployment a relevant indicator.

Global Inflation Rate: Inflation reflects price stability, an important aspect of economic resilience. Sustainable bonds influence inflation dynamics by promoting energy efficiency and reducing dependence on volatile fossil fuel markets, particularly in the case of green bonds.

Growth of Global GDP: This indicator captures changes in economic output, providing insights into the rate at which the global economy expands. While sustainable bonds address long-term development goals, their relationship with GDP growth highlights the time lag and challenges in translating sustainable investments into immediate economic returns.

By analyzing these indicators, researchers can assess the multidimensional impacts of sustainable bonds on economic stability, growth, and societal equity. This approach aligns with the broader goals of sustainable development to balance environmental, social, and economic objectives.

The role of regulatory frameworks in shaping sustainable investments and addressing research gaps

Regulatory Frameworks - such as the EU Green Taxonomy and the SFDR provide a structured approach to defining, classifying, and guiding sustainable investments.

The EU Green Taxonomy, for instance, establishes specific objectives and criteria to identify environmentally sustainable economic activities. Table 1 summarizes the taxonomy's primary objectives, including climate change mitigation, climate adaptation, sustainable resource use, pollution prevention, and the promotion of a circular economy (European Commission, 2020).

Table 1. Green Taxonomy: Objectives and Key Focus Areas

Green Taxonomy Objectives	Details
Climate change mitigation	Reducing greenhouse gas emissions
Climate change adaptation	Promoting adaptation measures to prevent natural disasters caused by climate change
Sustainable use of water and marine resources	Projects focused on conservation and sustainable use of water and marine resources
Circular economy	Transitioning to economic models that prioritize recycling and waste prevention
Pollution prevention	Funding projects that help reduce pollution and improve air quality

Source: European Commission. (2020). EU Taxonomy for Sustainable Activities. European Commission. (2020).

Despite the recognized importance of green, social, and sustainability bonds in promoting economic growth and resilience, gaps remain in understanding their long-term impacts on macroeconomic stability.

Existing studies primarily focus on the immediate contributions of these bonds to GDP growth and employment creation. However, limited attention has been paid to their effects on inflation, sectoral variations, and regional disparities.

Additionally, there is a need for deeper analysis into the broader environmental and economic impacts of corporate green bonds, particularly in relation to carbon performance and sustainability goals (Wei, Li, & Zhang, 2022).

Future research should employ robust econometric modeling and comparative case studies to quantify these impacts and explore how sustainable finance can mitigate economic vulnerabilities over time (Tolliver et al., 2020; Zhang et al., 2022; Flammer, 2021).

Methodology

This study employs an econometric regression approach to investigate the impact of green, social, and sustainability (GSS) bonds on key macroeconomic variables, including GDP, inflation, and unemployment.

By adopting this methodology, the research ensures a robust and data-driven analysis, leveraging international datasets and established econometric techniques to draw statistically significant conclusions.

Data Collection and Sources: The analysis is based on a dataset encompassing global GDP, GDP growth, inflation, unemployment rates, and sustainable bond issuance values spanning the period from 2013 to 2023.

These data points were sourced from reliable and widely recognized institutions, ensuring accuracy and consistency:

Macroeconomic indicators: Statista (n.d.a,c) and World Bank Group (2022).

Sustainable bond issuance data: Climate Bonds Initiative (2024) and BloombergNEF (2022).

The data indicate a substantial growth in sustainable bond issuance, rising from \$11 billion in 2013 to \$848.7 billion in 2023, as illustrated in Table 2.

Table no. 2. Worldwide Macroeconomic Indicators (2013-2023)

Year	Global GDP (T USD)	Global unemployment rate (as a share of the total labour force %)	Global inflation rate (%)	Growth of the global GDP (%)	Sustainable bonds issued (bln usd)
2013	77.5	6.17	3.63	3.45	11
2014	79.5	6.02	3.22	3.56	39
2015	75.1	6.05	2.73	3.46	51.3
2016	76.3	6.01	2.73	3.26	93.7
2017	81.3	5.92	3.25	3.82	189.6
2018	86.2	5.76	3.65	3.63	227.4
2019	87.5	5.58	3.51	2.84	357.9
2020	85.3	6.59	3.24	-2.69	712.7
2021	96.9	6.03	4.71	6.47	1003.9
2022	100.7	5.26	8.73	3.46	831
2023	104.7	4.96	6.78	3.21	848.7

Source: Authors' own research results/contribution using data collected from Statista, n.d. a, b,c d.

Regression Model Specification: The study applies the regression model of Stock & Watson (2020) to analyze the potential relationships between GSS bonds and macroeconomic variables. The econometric model is expressed as: $Y_t = \beta_0 + \beta_1 X_t + \epsilon_t$, where: Y_t the dependent variable (e.g. Global GDP, inflation rate), X_t the independent variable (the value of the issued GSS bonds), β_0 is the intercept, β_1 is the regression coefficient, ϵ is the error term.

The model centers on three pivotal macroeconomic areas to evaluate the impacts of GSS bonds.

GDP growth serves as a proxy for economic development, capturing the influence of green projects and infrastructure investments on overall output.

The inflation rate is analyzed to reflect cost structures influenced by green energy adoption and sustainable production practices, providing insights into potential price stability.

Unemployment rates are examined to assess the job creation potential of investments in green sectors, highlighting their capacity to generate employment opportunities across various skill levels.

Additionally, global GDP is considered to measure the overall size and growth of the global economy, expressed in trillions of USD, offering a broad perspective on macroeconomic trends.

Validation and Limitations of the Methodology for Assessing GSS Bonds' Macroeconomic Impact: The regression analysis demonstrates significant relationships between GSS bond issuance and macroeconomic indicators.

Green bonds show a strong and positive impact on GDP and inflation, with an R^2 value of 0.805 and a p-value of 0.00018, highlighting their effectiveness in stimulating economic activity through investments in infrastructure and renewable energy.

Social bonds, while contributing positively, have a weaker impact, primarily through advancements in social welfare, including education and healthcare.

Sustainability bonds offer moderate yet steady contributions by integrating economic, social, and environmental objectives, fostering balanced development.

The findings validate key hypotheses by confirming the link between sustainable bond issuance and GDP growth and demonstrating that higher issuance levels help stabilize inflation through renewable energy investments and sustainable production.

Green investments also play a role in reducing unemployment due to their labor-intensive nature, particularly in green sectors.

These results underscore the transformative potential of GSS bonds in shaping macroeconomic stability and sustainable development.

To ensure reliability, the models employed validation techniques such as Pearson correlation coefficients to measure relationships, R-squared values to assess explanatory power, and p-values to confirm statistical significance (Wooldridge, 2010).

The methodology has limitations, including data inconsistencies from differing reporting standards, exclusion of factors like geopolitical risks, sector-specific variations, and limited regional analyses. Future research addressing these gaps could provide a more thorough understanding of GSS bonds' impacts.

Future studies should incorporate variables like energy prices, carbon emissions, and fiscal policies to enhance analysis. Regional and sector-specific studies, particularly in industries such as renewable energy and healthcare, could provide insights into localized and targeted impacts. These approaches could refine understanding of the long-term effects of GSS bonds on economic and societal development.

In conclusion, green bonds significantly drive GDP growth and inflation, while social and sustainability bonds provide broader but less pronounced macroeconomic benefits. When complemented by targeted policies, GSS bonds can support macroeconomic stability and sustainable development (IMF, 2021a; Flammer, 2021).

Results and discussions

Our study highlighted some of the key findings related to the effect of sustainable bond issuance on global macroeconomic indicators. Based on the regression carried out on data collected during the period 2013-2023, the remarks are given below.

The Role of Sustainable Bonds in Stimulating Global GDP

The econometric analysis reveals a strong and significant positive impact of sustainable bonds on global GDP.

The regression coefficient of 0.0242 indicates that each additional billion USD issued in sustainable bonds contributes to a 0.0242 trillion USD increase in global GDP.

The model explains 80.5% of the variation in GDP ($R^2 = 0.805$, $p = 0.00018$), underscoring the robustness of this relationship.

These findings emphasize the critical role of sustainable bonds in financing green infrastructure and technologies, aligning with prior research such as Stock & Watson (2020), which highlights the transformative potential of sustainable finance.

Table 3. Regression Summary – Impact of Sustainable Bonds on Global GDP

Metric	Value	Interpretation
Multiple R	0.897	Strong correlation between sustainable bonds and global GDP.
R Square	0.805	80.5% of GDP variation is explained by sustainable bonds issued.
Adjusted R Square	0.784	A well-fitting model, even after adjustments for variables and observations.
Standard Error	4.733	Reflects the model's residual variability.
Observations	11	Number of data points used in the regression analysis.
ANOVA (df, SS, MS, F, p)	df: 1 (Regression)	Regression SS: 833.017; MS: 833.017; F: 37.194; p = 0.00018
	df: 9 (Residual)	Residual SS: 201.571; MS: 22.397
	df: 10 (Total)	Total SS: 1034.587
Intercept	76.849 ± 2.125	Baseline GDP is 76.85 trillion USD when no sustainable bonds are issued ($p = 4.69E-11$).
Sustainable Bonds Coefficient	0.0242 ± 0.00397	Each additional billion USD issued increases GDP by 0.0242 trillion USD ($p = 0.00018$).
Confidence Interval	0.015 to 0.033	Does not include zero, confirming a significant positive effect

Source: Results of the regression model conducted by the author using data collected from Statista (n.d.) and Climate Bonds Initiative (2024).

Unemployment and Sustainable Bonds: A Limited Relationship

While sustainable bonds have the potential to create jobs in specific sectors, the regression analysis shows no statistically significant impact on global unemployment rates.

The coefficient (-0.00043) indicates a negligible effect, and the model explains only 12.9% of the variation in unemployment ($R^2 = 0.129$, $p = 0.278$).

These results suggest that the impact of sustainable bonds on unemployment is indirect and depends on external factors such as labor market policies and the scale of projects funded.

Similar findings have been reported by the (European Investment Bank, 2022), which highlights that social and sustainability bonds improve workforce productivity indirectly through investments in healthcare and education.

Table 4. Regression Summary – Correlation Between Sustainable Bonds and Unemployment Rate

Metric	Value	Interpretation
Multiple R	0.359	Weak correlation between sustainable bonds and unemployment rate.
R Square	0.129	Only 12.9% of unemployment rate variation is explained by sustainable bonds.
Adjusted R Square	0.032	Low explanatory power after adjustment.
Standard Error	0.440	Reflects residual variability in the model.
Observations	11	Number of data points used in the regression.
ANOVA (df, SS, MS, F, p)	df: 1 (Regression)	Regression SS: 0.258; MS: 0.258; F: 1.33; $p = 0.278$
	df: 9 (Residual)	Residual SS: 1.745; MS: 0.194
	df: 10 (Total)	Total SS: 2.003
Intercept	6.019 ± 0.198	Baseline unemployment rate when sustainable bonds = 0; significant ($p = 2.18E-10$).
Sustainable Bonds Coefficient	-0.00043 ± 0.00037	Slight negative effect; not statistically significant ($p = 0.278$).
Confidence Interval	-0.00126 to 0.00041	Includes zero, confirming the lack of significant relationship.

Source: Results of the regression model conducted by the author using data collected from Statista (n.d.) and Climate Bonds Initiative (2024).

The Impact of Sustainable Bonds on Inflation

Sustainable bond issuance shows a moderate and statistically significant positive impact on inflation.

A regression coefficient of 0.0035 implies that every additional billion USD issued in sustainable bonds leads to a 0.0035% increase in the inflation rate.

The model explains 48.9% of the variation in inflation ($R^2 = 0.489$, $p = 0.0166$).

Short-Term and Long-Term Implications: In the short term, investments in green technologies may lead to inflationary pressures due to increased resource demand and the costs associated with transitioning to sustainable infrastructure.

However, these investments are likely to stabilize inflation in the long term by reducing dependence on conventional energy sources (IMFb, 2021).

Table 5. Regression Summary – Impact of Sustainable Bonds on Inflation Rate

Metric	Value	Interpretation
Multiple R	0.699	Moderate to strong correlation between sustainable bonds and inflation rate.
R Square	0.489	48.9% of inflation rate variation is explained by sustainable bonds issued.
Adjusted R Square	0.432	The model explains inflation variation well after adjustments for variables and observations.
Standard Error	1.422	Reflects the residual variability in the model.
Observations	11	Number of data points used in the regression.
ANOVA (df, SS, MS, F, p)	df: 1 (Regression)	Regression SS: 17.436; MS: 17.436; F: 8.617; p = 0.0166
	df: 9 (Residual)	Residual SS: 18.211; MS: 2.023
	df: 10 (Total)	Total SS: 35.647
Intercept	2.808 ± 0.639	Baseline inflation rate is 2.81% when no sustainable bonds are issued (p = 0.0017).
Sustainable Bonds Coefficient	0.0035 ± 0.0012	Each additional billion USD issued increases inflation by 0.0035% (p = 0.0166).
Confidence Interval	0.0008 to 0.0062	Does not include zero, confirming a significant positive effect of sustainable bonds on inflation.

Source: Results of the regression model conducted by the author using data collected from Statista (n.d.) and Climate Bonds Initiative (2024).

Impact on Economic Growth

The regression analysis reveals a negligible and statistically insignificant relationship between sustainable bonds and economic growth rates, as shown by a regression coefficient of -0.0002 and an R^2 value of 0.001, indicating that only 0.1% of the variation in growth rates can be attributed to sustainable bond issuance.

The p-value of 0.920 further confirms the lack of statistical significance, suggesting no measurable direct impact.

Despite this, the long-term potential of sustainable bonds to foster sustainability, improve infrastructure, and enhance economic resilience remains significant.

Realizing these benefits requires complementary policies that integrate sustainable bond issuance into broader economic strategies.

Measures such as fiscal incentives, stronger public-private partnerships, and expanded green investments are essential to maximize the role of sustainable finance in driving growth.

While the immediate impact on economic growth is limited, the indirect and cumulative contributions of sustainable bonds to macroeconomic stability and sustainable development underscore their importance.

By embedding these instruments into long-term development policies, governments can leverage them as tools for resilience, inclusivity, and economic progress.

Table 6. Regression Summary – Impact of Sustainable Bonds on Economic Growth Rate

Metric	Value	Interpretation
Multiple R	0.034	Very weak correlation between sustainable bonds and economic growth rate.
R Square	0.001	Only 0.1% of the variation in growth rate is explained by sustainable bonds.
Adjusted R Square	-0.110	Negative value indicates the model does not fit the data well.
Standard Error	2.268	Reflects high residual variability in the model.
Observations	11	Number of data points used in the regression.
ANOVA (df, SS, MS, F, p)	df: 1 (Regression)	Regression SS: 0.055; MS: 0.055; F: 0.011; p = 0.920
	df: 9 (Residual)	Residual SS: 46.312; MS: 5.146
	df: 10 (Total)	Total SS: 46.366
Intercept	3.211 ± 1.019	Baseline growth rate is 3.21% when no sustainable bonds are issued (p = 0.0117; significant).
Sustainable Bonds Coefficient	-0.0002 ± 0.0019	Negligible negative effect; not statistically significant (p = 0.920).
Confidence Interval	-0.0045 to 0.0041	Includes zero, confirming no significant relationship between sustainable bonds and growth rate.

Source: Results of the regression model conducted by the author using data collected from Statista (n.d.) and Climate Bonds Initiative (2024).

Comparative Analysis: Green, Social, and Sustainability Bonds

A comparative analysis reveals significant differences in the macroeconomic effects of green, social, and sustainability bonds.

Green bonds have the strongest positive effect on GDP ($R^2 = 0.915$, $p = 4.10E-06$), primarily through investments in renewable energy and sustainable infrastructure.

Social bonds focus on improving human capital, resulting in moderate GDP effects and limited inflationary impacts.

Sustainability bonds provide balanced contributions across both dimensions.

Table 7. Impact on Global GDP

Bond Type	R Square	Adjusted R Square	P-value of Coefficient	Statistical Significance (p < 0.05)	Impact Coefficient (b)	General Interpretation	Key Conclusion
Green	0.915	0.905	4.10E-06	Yes	0.044	Significant and positive	the strongest effect on GDP, driven by investments in green infrastructure and renewable energy
Social	0.508	0.453	0.01388	Yes	0.075	Positive and significant	positive but less significant, focusing on social inclusion projects
Sustainable	0.599	0.555	0.00517	Yes	0.104	Significant and positive	combining features of both green and social bonds

Source: Authors' own research results/contribution (Climate Bonds Initiative, 2024), (European Commission, 2020).

Table 8. Impact on Inflation Rate

Bond Type	R Square	Adjusted R Square	P-value of Coefficient	Statistical Significance ($p < 0.05$)	Impact Coefficient (b)	General Interpretation	Key Conclusion about the impact of the green bonds
Green	0.576	0.528	0.0068	Yes	0.0065	Significant positive	increasing costs in scarce resources and green technologies
Social	0.294	0.216	0.0846	No	0.0107	Positive but insignificant	focused on improving social conditions
Sustainable	0.338	0.264	0.0609	Nearly	0.0145	Nearly significant	moderate impact

Source: Authors' own research results/contribution (International Capital Market Association, 2022).

New Insights and Original Contributions

This research reaffirms that green bonds make a significant contribution to GDP and inflation, confirming previous studies such as the work of the Climate Bonds Initiative.

This paper further develops the former by focusing on green, social, and sustainable bonds between 2013 and 2023, underlining their specific impacts: Green Bonds have a strong, continued positive effect on GDP and inflation, thereby fostering sustainable infrastructure and economic growth, and Social and Sustainable Bonds have variable impacts, with a very limited or insignificant role in affecting inflation and unemployment levels.

Contributions: Comprehensively describes the types of bonds, hence attempting to fill a gap in the literature. Embeds recent global regulations including EU Green Taxonomy.

Policy Relevance: The two major contributions to growth and financial stability are green bonds, while policy initiatives are essential to increase the effectiveness of social and sustainability bonds.

Directions for Future Research: Long-run impacts, differential sectoral impacts, and other variables would add great depth to the understanding of their macroeconomic consequences.

Conclusions

This study highlights the positive impact of green, social, and sustainable (GSS) bonds on macroeconomic stability, particularly on GDP and inflation.

Green bonds show the most pronounced effects due to their role in financing renewable energy and sustainable infrastructure, fostering long-term productivity and environmental benefits.

However, their influence on unemployment and economic growth rates remains limited, as external factors such as market conditions and government policies play a greater role in shaping these variables. GSS bonds are thus valuable tools for sustainable development but should be viewed within a broader economic context.

The findings emphasize the importance of GSS bonds in promoting stability and sustainability, providing policymakers with insights into their economic contributions. Green bonds exhibit stronger macroeconomic impacts, while social and sustainability bonds focus more on social equity and environmental resilience, respectively. These differences suggest the need for targeted policies to maximize the unique benefits of each bond type.

Future research should investigate the long-term effects of GSS bonds, particularly their influence on unemployment and regional or sectoral growth.

Analyzing these bonds over extended periods would offer a clearer understanding of their cumulative impact, while incorporating external factors such as global economic crises and energy price volatility would improve the accuracy of findings.

The study's limitations include its relatively short time frame (2013–2023), which restricts the assessment of long-term effects, and the lack of sectoral or regional analysis, which could provide more specific insights.

Furthermore, data limitations for social and sustainability bonds, compared to green bonds, may reduce the reliability of findings.

In conclusion, GSS bonds are effective instruments for advancing sustainability and economic stability, but their full potential requires supportive policies, long-term evaluation, and consideration of external economic dynamics.

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