XXII ENGEMA
Encontro Internacional sobre Gestão Empresarial e Meio Ambiente

ISSN: 2359-1048
Novembro 2020

CORPORATE GREEN BONDS: MARKET ANALYSIS AND EVALUATION OF THE EFFICIENCY FOR PROMOTING SUSTAINABLE DEVELOPMENT

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1)Objective and Context

Being aware of the investments needs and the challenge to raise funds for transitioning to a resilient and sustainable economy, the objective of this work is to analyze corporate green bonds as a financial tool that can collaborate in funding sustainable development activities and green projects. A secondary objective is to identify and explore some particularities about the issues that make up the corporate green bonds market.

Initially, the corporate green bonds market is reviewed, by exploring the issuances according to the Green Bond Principles (GBP) guidelines. A value creation analysis is performed by both associating the issuances to the support of the SDG and investigating the business case for the bonds' sustainability initiatives.

Sustainable development and sustainability are well-recognized concepts since at least 1987 within the Brundtland Report, and in recent decades it's increasingly drawing more attention globally. In 2015, 193 countries agreed on the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDG). Regarding the need for climate action, world leaders have found a general consensus on the issue, as stated in the Paris Agreement within the United Nations Framework Convention on Climate Change (UNFCC). Also in 2015, the Paris Agreement was approved and sealed by 195 countries. The changes required to address and mitigate all those issues will require profound transitions in land, energy, industry, buildings, transport, and cities (Gianfrate & Peri, 2019).

While member countries of both pacts have agreed to work cooperatively on achieving the 17 goals, one of the major challenges is regarding the financing of mitigation and adaption action to sustainability and climate change (Zhang, Zhang, & Managi, 2019). The transition to a resilient, sustainable and lower-carbon economy requires significant investment from both the public and private sectors. The OECD's Group of Twenty's (G20) forecast that investment of some US$ 90 trillion is needed up to 2035 to achieve global sustainable development and climate objectives (GFSG, 2016). Organizations such as the International Energy Agency (IEA), the World Bank, and the World Resource Institute (WRI) estimate that investments required for maintaining the 2°C temperature threshold of the Paris Agreement could reach US$ 5 trillion per year.

The financial system will be crucial to support and accelerate the needed investments to foster sustainable development. Among the financial instruments available to fill this gap, there are the so-called green bonds. The first green bond appeared in 2007 with the issuance of a so-called "climate awareness bond" worth US$ 1 billion, from the European Investment Bank (EIB). Green bonds possess the same standard financial characteristics of any other regular bond – a face value, yield, maturity date, and issuer, but they differ from regular bonds as they are labeled as "green" by the issuer.

Broadly speaking, green bonds are fixed income securities issued by capital raising entities to fund their eligible environmentally friendly projects, such as renewable energy, sustainable water management, pollution prevention, climate change adaptation and so on (Tang & Zhang, 2018). This financial instrument provides an opportunity for long-term and sustainable infrastructure financing. Previously carried out by multilateral development banks (MDBs), such as the World Bank and the European Investment Bank, green bond issuance has promptly spread to other traditional investors, like institutional investors, commercial banks, municipalities, and some of the world's largest companies (Banga, 2019). A few key players in the green bond market are the International Capital Markets Association (ICMA), responsible for the development of the Green Bond Principles (GBP); the World Bank; the

International Finance Corporation (IFC); and the Climate Bonds Initiative (CBI), responsible for the Climate Bonds Standard, a globally recognizable green bond labeling scheme.
The evolution of the market over the last years confirms the potential of this financial instrument. According to the CBI, green bond issuance has grown drastically from US$ 1 billion in 2007 to over US$ 1.2 trillion by 2018, of which there is a total of US$ 389 billion labeled green bond volume, and an amount of US$ 811 billion climate aligned bonds volume in the market. Climate aligned bonds are bonds that promote low carbon economy but are not self-labeled as green by their issuers (CBI, 2018a).
The remaining of the paper is structured as follows: Section 2 reviews the literature on green financing, with a focus on green bonds. Section 3 explains the research method; Section 4 discusses the findings; and Section 5 shows final remarks.

2)Literature Review

Sustainability in business refers to the integration of social and environmental considerations, such as resource scarcity, climate change and income inequality, into business strategy and practices. Defined in this way, sustainability is a subject of growing interest to investors and companies alike, who are asking themselves if this business approach is finance-worthy—that is, capable of earning high enough rates of return to continue to attract capital from private investors (Kotsantonis, Pinney, & Serafeim, 2016). Although they are different concepts, sustainability, ESG, and green finance are mentioned in the present work within a similar point of view.
Significant amount of research has been carried out to better understand the economic effects of integrating ESG issues into corporate financial decision-making, from both a company and an investor perspective. At least for some kinds of companies in some industries, such stakeholder investment can prove to be a source of competitive advantage and value that is increasingly being recognized by investors (Kotsantonis et al., 2016). A report by Calvert[1] provides a framework to help companies and their investors understand the ways in which corporate social and environmental activities can and have led to value creation (Serafeim, 2015). To the extent that investors view a company's efficient use of natural capital resources as a reliable proxy for management's efficiency in using other resources, particularly investor capital, such savings can translate into a significant increase in corporate values.
Epstein & Roy (2003) suggest that companies are increasingly attempting to link environmental initiatives to financial performance, but are not typically making a clear business case for broader issues of sustainability.
The public development banks members of the International Development Finance Club (IDFC)[2] defined green finance as financing for climate change mitigation or adaptation, as well as environmental protection and remediation at the project level. Drawing from this approach, Yuan & Gallagher (2018) grouped green finance into three categories that are in line with the UN SDGs:

1) Clean energy and mitigation of greenhouse gas emissions
2) Adaptation to climate change impacts and
3) Water, sanitation, and other environmental objectives.

Gianfrate & Peri (2019) claim that increasingly more institutional investors are decarbonizing their portfolios and redirecting resources towards environment-friendly investments as they consider climate change a growing threat to long-term economic growth. According to the CBI (2015), the investor demand for green bonds indicates that, over time, the market can be

[1] https://www.calvert.com/

[2] https://www.idfc.org/

a significant contributor to closing the investment gap for climate-friendly infrastructure in both developed economies and emerging markets.
Zerbib (2019) argues that in response to environmental crises, financial investors have taken up the challenge and become central actors of the environmental and energy transition. Several initiatives were launched to redirect assets toward green investments.
Heike (2010) argued that for achieving success in channeling larger sums of capital (both public and private) into green initiatives, investment products should appeal to investors with large volumes of assets under management. These are the pension funds, endowments, asset managers and sovereign wealth funds.
New financial instruments have been created to tap sustainability and green investing (UN, 2019). A remarkable and promising financial instrument of that kind are the green bonds, debt instruments with a bonus environmental feature (Pham, 2016). As pointed out by the Organization for Economic Co-operation and Development (OECD), with banks having restricted lending capabilities and public budgets under strain in many countries, private sector sources of capital need to be engaged and so, green bonds are considered among the key instruments to mobilize private financial resources towards the progressive decarbonization of the global economy (OECD, 2017).
A green bond can either be labeled or unlabeled. Labeled green bonds are usually in alignment with the GBP guidelines and its components, being formally marketed as green by the issuers, who define the types of green projects they plan to support with the bond proceeds and report back to investors on a regular basis (Pham, 2016). In the other hand, unlabeled green bonds do not have a formal green tag but are issued by firms whose businesses are naturally aligned with environmental causes, like wind or solar energy companies (Chiesa & Barua, 2019). In general, there are two green bonds "standards": the Green Bond Principles (GBP), and the CBI Climate Bonds Standard and Certification. The identification and labeling of green bonds typically follow the GBP, a set of voluntary standards established in 2014 by industry participants (including major banks such as Bank of America Merrill Lynch, Citi, JPMorgan, BNP Paribas, and HSBC) and non-profit organizations (ICMA, 2018).
The other most acknowledged way for identifying and labeling a green bond is via the Climate Bonds Standard and Certification procedure from the CBI. Conversely of the generality of GBP, the CBI provides some eligible criterion and a detailed green taxonomy by sector that third parties can apply to assess the qualification of a green bond. They also request an external review by an independent third party assurance provider or auditor that has been approved by the Climate Bonds Standard Board (CBI, 2018b).
An important feature of green bonds, external reviews from an independent party confirm alignment with the GBP and/or compliance with the Climate Bonds Standard. In 2018, approximately 90% of issued green bonds received at least one external review (CBI, 2019).
As green bonds are a recent phenomenon with popularity increase across countries starting not earlier than 2013, the academic literature on the topic is limited. Ge & Liu (2015) examined how a firm's Corporate Social Responsibility (CSR) performance is associated with the cost of its new bond issues in the US market. They state that a higher CSR strength (concern) score is associated with lower (higher) yield spreads, with results indicating that firms with better CSR performance are able to issue bonds at a lower cost and that both CSR strengths and concerns are considered by bondholders.
Gianfrate & Peri (2019) believe green bonds have recently emerged as one of the best candidates to mobilize financial resources towards sustainable and clean investments. They examined how the financial market prices green bonds, and whether issuers can lower their financial costs by issuing a bond labeled as "green" rather than an equivalent non-green (conventional) bond.

Zerbib (2019) identified the impact of pro-environmental preferences on prices when using green bonds as an instrument: he compared each green bond with an otherwise identical counterfactual conventional bond, through a matching method for 110 green bonds on the secondary market between July 2013 and December 2017. The effect of pro-environmental preferences is identified through a green bond premium, defined as the yield differential between a green bond and an otherwise identical conventional bond

Tang & Zhang (2018) analyzed the market's reaction to firms ESG activities. They investigated the announcement returns and real effects of green bond issuance by firms in 28 countries during 2007–2017. Results show that the issuers' stock prices increase significantly around the announcement of green bond issuance, with market reactions being stronger for first-time issuers than for repeated ones. Reactions are also stronger for corporate issuers than for financial institution ones.

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3) Research Method

The green bond dataset has been built in the first half of 2019, adding Bloomberg database with both the Climate Bond Initiative (CBI) and the International Capital Market Associations (ICMA) labeled green bonds data. An advantage of using the Bloomberg database as an initial source to compile the green bonds dataset is that, for each issue, it uses it Bloomberg Industry Classification System (BICS) to classify the issuer's sector. The BICS is a proprietary hierarchical classification system, which classifies firms' general business activities. BICS for fixed-income security issuers contains 11 macro sectors, which represent the broadest classification of general business activities. Each sector is further broken down into a hierarchical system of industry groups (up to 8 levels of detail), which are classified into more narrowly defined business activities (Di Clemente, Chiarotti, Cristelli, Tacchella, & Pietronero, 2014). The BICS system is adopted throughout the rest of this work, to standardize the identification sectors and industry groups of green bond issuers.

The first round of analysis resulted in 2140 entries from the Bloomberg database. From this total, the bonds whose issuer's sector (BICS Level 1) is identified as "Government" were excluded, leaving the dataset with 1262 entries. Those issuers include development banks and supranational entities (African Development Bank, European Investment Bank). While these entities qualify as "corporate" due to their private status, they are not "corporations" in a traditional sense. Inside this "Government" category there are also government agencies, and government (local, municipal, regional and sovereign). All these institutions play a big role in financing sustainable development, as they redirect risen proceeds to projects that are eligible in a Green Bond Portfolio. However, it is difficult to track where the investments are allocated, as they are spilled into a range of projects.

The green bonds issuance data period that is covered in the analysis is from January 1st, 2014 until December 31st, 2017. The year of 2014 was the first complete year with corporate green bond issuances; when corporations entered the green bond market. The end of data collection was set in 2017 as, according to the GBP, issuers should make, and keep, readily available up to date information on the use of proceeds to be renewed annually until full allocation (ICMA, 2018b). In other words, to be in conformance with the GBP standards, the issuer has to publish an annual green bond impact report including a list of the projects to which green bond proceeds have been allocated, as well as a brief description of the projects and the amounts allocated, evidencing expected impact. As some companies disclose this information in their Annual reports, it was left a gap of a full fiscal year period, so it is possible to check the conformance of the issuer with the Green Bond Principles reporting component. The period screening criteria reduced the dataset further to 743 entries.

Finally, multiple tranches from the same issuer on a single day were combined with the tranche with higher volume, forming one single green bond issue with cumulated amounts.

After these final adjustments, 406 green bond issuances were identified in the period using the Bloomberg green bonds dataset.

Next is setting up the business case for evaluating the impact of each issuance from a value creation perspective. This was done by checking alignment with the GBP's management of proceeds and reporting steps; evaluating environmental and/or financial value creation to the corporation through the Green Bonds report; and analyzing collaboration in achieving the Sustainable Development Goals (SDGs) targets.

The data collected was of secondary origin and constitute of public information. These include the documents, reports, and second party opinions made available through the websites of the green bond issuers.

For qualifying the green bond issue, the world regions are separated as follows: Europe; China (including Hong Kong and Taiwan); North America (only USA & Canada); Asia (excluding China, Hong Kong and Taiwan); Oceania; Latin America; Africa

USA and China are the world top issuers, representing respectively 22% and 15% of cumulative labeled green bond issuances from 2007 until the end of 2018 (CBI, 2019c). For this reason, they are analyzed separately as singular world regions.

With the green bond reporting information, it is possible to analyze each issuance by the kind of activities, assets & projects in which majority of proceeds were allocated, and identify the location of the financed activity or asset. The criteria adopted to classify the activities derives from the Climate Bonds Taxonomy, a guide developed by the CBI to identify the assets and projects needed for sustainable development and to deliver a low carbon economy (CBI, 2018b). The six possible categories for the use of proceeds are: Energy; Buildings; Transport; Water & wastewater; Waste management; Sustainable land use & agriculture

Next, the business case for the sustainability of the issuance is performed, by checking the impact reporting information provided within each Green Bond report. Adapted from Epstein & Roy (2003), a reported issuance falls in one of the following situations.

- Level 1: information on expenditure – the amount of the issuance spent with green eligible projects;
- Level 2: descriptive socio-environmental benefits information not linked to financial performance;
- Level 3: quantified socio-environmental benefits information not linked to financial performance;
- Level 4: monetized information on the benefits of expenditure (i.e. measures of benefits in addition to measures of costs), fully linked to financial performance;

Finally, the last step consists in evaluating the most financed assets & activities of a given Green or Sustainability Bond against the UN Sustainable Development Goals (SDG). The guide "Green and Social Bonds: a high-level mapping to the Sustainable Development Goals"[3], developed by the ICMA, is used as frame of reference. It has been created for public and private sector issuers and investors to review their green, social and sustainability bond issuances and investments against the SDG (ICMA, 2018a).

Hypothesis tests of proportions were performed to assess whether some population proportion was statistically significant. The tests were based on the binomial distribution, since, for each group of issuers, there were only two alternatives (e.g. to display a Green Bond Framework or Second Opinion Report or not). The critical values were extracted directly from the binomial distribution and the probability function followed the classical model of this distribution, as recorded in Equation 1.

[3] Available at https://www.icmagroup.org/green-social-and-sustainability-bonds/mapping-to-the-sustainable-development-goals/

$$P(x) = \frac{n!}{(n-x)!x!}\, p^x q^{n-x} \quad \text{(Equation 1)}$$

The following hypotheses were formulated and for all hypothesis tests a significance level of 5% was considered.

$$H_0: p = 0$$
$$H_1: p > 0$$

The second group of tests examined whether the difference among two or more sample proportions are statistically significant. It's tested the null hypothesis that probabilities of an event happening is independent of the green bond issuer's region, green bond issuer's sector or most financed project category that occurred from the issuance. The following hypothesis were formulated:

$$H_0: p_1 = p_2 = p_3 = p_n$$
$$H_1: p_1\,, p_2\,, p_3 \; and \; p_n \; are \; not \; equal$$

We based the comparison on the usual chi-square statistic (Equation 2):

$$\boldsymbol{\chi^2} = \sum \frac{(o-e)^2}{e} \quad \text{(Equation 2)}$$

Each cell on the contingency tables is presented with the observed values, proportion within the observed values, and expected values. Whenever necessary, the tables were reorganized to perform the chi-square test: some cells were combined (when logically viable) or excluded from the analysis.

4)Main Results

Table1 shows the conformity with the pre-issuance components from the GBP. Due to the low number of green bond issuances in Africa, those are grouped with Latin America issuances in the rest of analysis, as both continents present least developed corporate bond markets. Each cell on the descriptive analysis tables are presented with the observed values and (below) the proportion within the observed values.

Table 1 – Results for issuances with and without Green Bond Framework criteria: all green bond issues by region of the issuer

	Europe	**China**	**North America**	**Asia**	**Oceania**	**LatAm & Africa**	**Total**
Issuance without Framework	13 0,07	41 0,31	23 0,43	3 0,07	0 0,00	4 0,17	84 0,18
Issuance with Framework	187 0,94	91 0,69	31 0,57	38 0,93	17 1,00	20 0,83	384 0,82
Total	200	132	54	41	17	24	468

Europe and China are responsible for more than 70% of the corporate green bonds market, amounting 332 issuances. It can be observed that the conformity with the pre-issuance components from the GBP is diffused way among the different regions of green bond issuers. Next, the conformity with the post-issuance core component of the GBP, reporting, is investigated. The results demonstrated that there is still work to be done, as shown in Table 2.

Table 2 – Results for issuances with and without Green Bond Report criteria: all green bond issues by region of the issuer

	Europe	China	North America	Asia	Oceania	LatAm & Africa	Total
Issuance without Report	66 0,33	107 0,81	32 0,59	18 0,44	3 0,18	9 0,38	235 0,50
Issuance with Report	134 0,67	25 0,19	22 0,41	23 0,56	14 0,82	15 0,63	233 0,50
Total	200	132	54	41	17	24	468

A bit less than half of total green bond issuers display accessible annual reporting information on their issuances. It is worth noting that some green bond reports do not display the minimum level of information recommended by the GBP. Overall, the results suggest lack of transparency by corporate issuers once the financial amounts are obtained through a green bond.

Europe and Oceania are leading the efforts on promoting the corporate green bond market. The issuances from the continent indicate better performance on full conformity with the GBP guidelines, respecting the four core components for this fixed-income instrument. Latin America and Africa, although being least developed financial markets, are also taking part in the corporate green bond market, with the proportion of the regions' issuers that are in conformity with the reporting principle of the GBP similar to Europe. A similar descriptive analysis was performed identifying the corporate green bond issuers by sector.

Table 3 shows the conformity with the pre-issuance components from the GBP.

Table 3 - Results for issuances with and without Green Bond Framework criteria: all green bond issues by sector of the issuer

	Financials	Utilities & Energy	Industrials, Mat. & CS	Others	Total
Issuances without Framework	26 0,12	42 0,24	14 0,27	2 0,07	84 0,18
Issuance with Framework	192 0,88	130 0,76	37 0,73	25 0,93	384 0,82
Total	218	172	51	27	468

The Financials and Utilities & Energy sector are responsible for vast majority of corporate green bond issues, representing more than 80% of market, amounting 390 issuances. Next, the alignment with the post-issuance core component of the GBP, reporting, is investigated. The results are presented on Table 4.

Table 4 - Results for issuances with and without Green Bond Report criteria: all green bond issues by sector of the issuer

	Financials	Utilities & Energy	Industrials, Mat. & CS	Others	Total
Issuances without Report	83 0,38	108 0,63	35 0,69	9 0,33	235 0,50
Issuance with Report	135 0,62	64 0,37	16 0,31	18 0,67	233 0,50
Total	218	172	51	27	468

The Financials sector is positively taking the lead on promoting the corporate green bonds market, in both number of issues and quality of its issuances in respect to following the GBP guidelines. This suggests that financial institutions, such as banks, financial service providers, insurance and real estate companies demonstrate some expertise on providing relevant up to date financial and socioenvironmental information for stakeholders and investors.
Oppositely, a negative outcome accrued from the results found in the Utilities & Energy and Industrials, Materials & Consumer Staples sectors. Although being core sectors for global achievement of the Sustainable Development Goals and the Paris Agreement targets, corporations within these sectors lack on showing transparency regarding the use of proceeds and measurement of financial and socioenvironmental benefits from its activities.

Table 5 presents the contingency table for the chi-square tests regarding the elaboration of Green Bond Framework among green bond issuances by region.

Table 5 – Contingency table for issuances with and without Green Bond Framework: all green bond issues by region

	Europe	China	North America	Others	Total
Issuance without Framework	13 0,07 (35,90)	41 0,31 (23,69)	23 0,57 (9,69)	7 0,09 (14,72)	84 0,18 (84)
Issuance with Framework	187 0,93 (164,10)	91 0,69 (108,31)	31 0,43 (44,31)	75 0,91 (67,28)	384 0,82 (384)
Total	200	132	54	82	468

With a p-value of 0,000, the null hypothesis is rejected, implying that there is a dependence on the issuer's region and it's alignment with the GBP prior to the green bond issuance. The same test was performed to investigate the dependence on elaboration of Green Bond Report and the region of the green bond issuer. With a p-value of 0,258, the null hypothesis is not rejected, implying that alignment with the GBP post-issuance, or reporting post the green bond issuance, is independent from the issuer being from different regions.
The same analysis was performed identifying green bond issuers by sector of the company.

Table 6 present the contingency table for issuances with and without Green Bond Framework, while Table 7 present the contingency table for issuances with and without Green Bond Report.

Table 6 - Contingency table for issuances with and without Green Bond Framework: all green bond issues by sector of the issuer

	Financials	**Utilities & Energy**	**Industrials, Mat. & CS**	**Total**
Issuances without Framework	26 0,12 (40,54)	42 0,24 (31,98)	14 0,27 (9,48)	82 0,19
Issuance with Framework	192 0,88 (177,46)	130 0,76 (140,02)	37 0,73 (41,52)	359 0,81
Total	218	172	51	441

Table 7 - Contingency table for issuances with and without Green Bond Report: all green bond issues by sector of the issuer

	Utilities & Energy	**Industrials, Mat. & CS**	**Others**	**Total**
Issuances without Report	108 0,63 (104,58)	35 0,69 (31,01)	9 0,33 (16,42)	152 0,61
Issuance with Report	64 0,37 (67,42)	16 0,31 (19,99)	18 0,67 (10,58)	98 0,39
Total	172	51	27	250

In both cases the null hypothesis is rejected (p-values of 0,002 and 0,006, respectively), suggesting that there is dependence between the sectors of the issuers and the alignment with the GBP pre- and post-green bond issuance.
In the second part of the work, only reported green bond issuances are considered in the analysis, as it is required to explore the Green Bond Reports to evaluate the issue in respect to the Epstein & Roy (2003) business case for sustainability-adapted methodology. The initial analysis is performed identifying issuers by region, as shown on Table 8.

Table 8 – Results for the business case for sustainability criteria: reported green bond issues by region of the issuer

	Europe	China	North America	Asia	Oceania	LatAM & Africa	Total
Up to Level 1: Monetary Expenditures	16 0,12	4 0,16	13 0,59	8 0,35	3 0,21	2 0,13	46 0,20
Up to Level 2: Qualitative Non-financial Impacts	22 0,16	3 0,12	2 0,09	3 0,13	1 0,07	1 0,07	32 0,14
Up to Level 3: Quantitative Non-financial Impacts	92 0,69	18 0,72	6 0,27	12 0,52	10 0,71	10 0,67	148 0,63
Up to Level 4: Quantitative Financial Impact	4 0,03	0 0,00	1 0,05	0 0,00	0 0,00	2 0,13	7 0,03
Total	134	25	22	23	14	15	233

The availability of monetized information on expenditures (hereafter Level 1) is present in all Green Bond Reports. This indicates that every green bond issuer that presented up to date report on the issuance at least disclosed information on the use of proceeds, but approximately 20% of issuers presented just this basic level of information, without any mention to environmental or social value creation arising from the issuance.

Reporting only on qualitative information is not a common practice in the corporate green bond market, what indicate that when aiming for impact reporting, companies usually put some effort in providing quantitative information based on socioenvironmental performance metrics.

Information provided up to Level 3 consists on taking in consideration the presentation of non-financial quantitative information. In respect to best practices on the green bond market, this the minimum level of information required from green bond issuers, as recommended by the GBP. Results suggest that around 65% of green bond issuers' present socioenvironmental performance measures. The most common reported metrics are greenhouse gases (GHG) avoided and energy savings. Other identified metrics were number of people powered with renewable energy, tons of recycled waste, volume of pollution prevented, and natural conserved area. These results suggest a positive attitude from majority of green bond issuers that reported on its funded activities, independent from the region of the issuer.

Level 4 is the ultimate business case for sustainability practice, in which corporate provide quantitative financial impacts on the issuance for their business. Results suggest that there is still a long way to go in respect of corporations exposing the perception that sustainability can bring economic benefits to its business. Only 7 out of the 233 reported green bond issuances connect sustainability (socioenvironmental value creation) and economic performance (financial value creation). Although just present in less than 5% of bond issues, the perception

that sustainability can bring economic benefits by at least a small number of players is an advance that can give rise to its practice and enable more detailed future green bond reporting. The connection between positive socioenvironmental impact and financial returns are the most advanced level on developing the business case for sustainability. It shows investors and stakeholders' overall that investing in activities that promote sustainable development can result in returns on its investments, in terms of financial value creation, while also promoting the long-term success and sustainability of the business. Surprisingly, the results suggest that in Latin America & Africa, the least developed bond markets, about 10% of green bond issuers presented the most advanced kind of information in respect to the business case for sustainability criteria. Table 9 presents this same analysis identifying the issuances by sector of the issuer.

Table 9 - Results for the business case for sustainability criteria: reported green bond issues by sector of the issuer

	Financials	**Utilities & Energy**	**Industrials, Mat. & CS**	**Others**	**Total**
Up to Level 1: Monetary Expenditures	20 0,15	20 0,31	2 0,13	4 0,22	46 0,20
Up to Level 2: Qualitative Non-financial Impacts	24 0,18	2 0,03	5 0,31	1 0,06	32 0,14
Up to Level 3: Quantitative Non-financial Impacts	90 0,67	37 0,58	9 0,56	12 0,67	148 0,63
Up to Level 4: Quantitative Financial Impact	1 0,01	5 0,08	0 0,00	1 0,06	7 0,03
Total	135	64	16	18	233

A positive highlight can be given to the Utilities & Energy sector, leading the connection of socioenvironmental value creation to financial returns, with 5 out of the 7 reported green bond issuances that provided quantitative financial impact information for investors and stakeholders.

A last analysis on the business case for sustainability was performed considering each issuance in respect to the most financed project category reported by the issuance, as shown in

Table 10. Due to the low number of reported green bond issuances that focused its investments in Waste Management, Water & Wastewater Treatment, or Sustainable Land Use & Agriculture, those are grouped as "Others" in the rest of analysis presented on this work.

Table 10 - Results for the business case for sustainability criteria: reported green bond issues by most financed project category

	Energy	Transport	Buildings	Others	Total
Up to Level 1: Monetary Expenditures	33 0,29	4 0,16	8 0,10	1 0,06	46 0,20
Up to Level 2: Qualitative Non-financial Impacts	9 0,08	0 0,00	18 0,23	5 0,29	32 0,14
Up to Level 3: Quantitative Non-financial Impacts	66 0,59	20 0,80	52 0,66	10 0,59	148 0,64
Up to Level 4: Quantitative Financial Impact	4 0,04	1 0,04	1 0,01	1 0,06	7 0,03
Total	112	25	79	17	233

Results suggest that almost half of reported green bond issues dedicated the proceeds to finance Energy projects: mostly renewable energy generation and smart electricity grid applications, resulting in improved energy performance. Energy projects are essential for the achieving Paris Agreement goals. In addition, they play a big role on boosting sustainable development and encouraging the progress for reaching the SDG's targets. It is good to see green bonds as a financial instrument that directs financial resources towards the expansion of a global cleaner energy matrix.

Table 10 also indicates a strong share of resources being dedicated for buildings projects, to know: certified buildings and resources (energy, water, materials) efficiency. During the exploration of Green Bond Reports, it was noticeable that many green bond issuances from companies in the financial sector (including real estate ones) dedicated its proceeds to fund activities in the buildings category. In fact, many LEED (Leadership in Energy and Environmental Design) certified buildings have been financed from resources raised by green bonds issues from the financial sector.

Hypothesis testing of proportions were performed and the results are summarized in Tables 11, 12 and 13.

Table 11 - Results of the statistical tests of proportions for different levels of the business case for sustainability criteria: reported green bond issues by region

	Europe	China	North America	Asia	Oceania	LatAM & Africa	Total
Up to Level 1: Monetary Expenditures	Reject H0	Reject H0	Reject H0	Reject H0	Reject H0	Reject H0	Reject H0
Up to Level 2: Qualitative Non-financial Impacts	Reject H0	Reject H0	Reject H0	Reject H0	Don't Reject H0	Don't Reject H0	Reject H0
Up to Level 3: Quantitative Non-financial Impacts	Reject H0	Reject H0	Reject H0	Reject H0	Reject H0	Reject H0	Reject H0
Up to Level 4: Quantitative Financial Impact	Reject H0	Don't Reject H0	Don't Reject H0	Don't Reject H0	Don't Reject H0	Reject H0	Reject H0

Table 12 - Results of the statistical tests of proportions for different levels of the business case for sustainability criteria: reported green bond issues by sector of the issuer

	Financials	Utilities & Energy	Industrials, Mat. & CS	Others	Total
Up to Level 1: Monetary Expenditures	Reject H0	Reject H0	Reject H0	Reject H0	Reject H0
Up to Level 2: Qualitative Non-financial Impacts	Reject H0	Don't Reject H0	Reject H0	Don't Reject H0	Reject H0
Up to Level 3: Quantitative Non-financial Impacts	Reject H0	Reject H0	Reject H0	Reject H0	Reject H0
Up to Level 4: Quantitative Financial Impact	Don't Reject H0	Reject H0	Don't Reject H0	Don't Reject H0	Reject H0

Table 13 - Results of the statistical tests of proportions for different levels of the business case for sustainability criteria: reported green bond issues by most financed project category

	Energy	Transport	Buildings	Others	Total
Up to Level 1: Monetary Expenditures	Reject H0	Reject H0	Reject H0	Don't Reject H0	Reject H0
Up to Level 2: Qualitative Non-financial Impacts	Reject H0	Don't Reject H0	Reject H0	Reject H0	Reject H0
Up to Level 3: Quantitative Non-financial Impacts	Reject H0	Reject H0	Reject H0	Reject H0	Reject H0
Up to Level 4: Quantitative Financial Impact	Reject H0	Don't Reject H0	Don't Reject H0	Don't Reject H0	Reject H0

The key message from the three tables is that there is a road ahead to reach a reasonable level of connection between socio-environmental performance and financial performance in the green bonds reports, so the business case for sustainability remains a challenge for the coming years.

5) Final Remarks

This research sought to contribute by investigating the efficiency of green bonds in promoting sustainable development and creating environmental, social and financial value for the corporations. Green bonds shows evidence of being an efficient financial tool for raising funds for green projects and activities that promote sustainable development. The 473 corporate green bond issuances analysed in this work raised a total of US$ 188 billion between 2014 and 2017 aiding to shorten the financing gap for supporting the sustainable development.

However, the corporate green bond market still lacks on best practices and commitment from the business community, investors, financial institutions, and government entities in respect to demanding and providing transparency with the use and management of proceeds. Thus, our findings suggest that the corporate green bond market is not yet mature enough and well disseminated among the agents with relevant participation in the segment.

For the corporate market and financial institutions, the research results served as a guide for the advancement of the theme among green bond issuers and bond underwriters. It suggests the need for greater disclosure on the use of proceeds, with prioritization on providing clear individual detailed information on the financed activities, such as location, type of project, promoted SDG, disbursed amount, and quantified socioenvironmental and financial impact metrics. Another relevant outcome from this survey for the corporate market is evidencing the

different categories of projects that fit well within the projects eligibility criteria for the green bond issuance, as well as the sectors that are taking the lead in the development of the market. For government agencies, it is clear that there is still considerable room for participation in the debate and better formulation of international guidelines and public policies that encourage and foster green financing.

For the academy, this work intended to contribute to the dissemination of knowledge, demonstrating the current stage in which the corporate green bond market is, and stimulate debate on a topic of fundamental importance for the development and sustainable growth of global economy. Finally, a suggestion for increased transparency on green bonds is concentrating pre- and post-issue information on a single platform open to all actors (issuers, external evaluation service providers, investors and underwriters) for the publication, verification and retrieval of information on the impact and use of resources from green bond issues.

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