

Corporate Green Bond and Stock Price Reaction

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Abstract

The aim of this paper is to investigate the investors' reaction to environmental actions taken by companies such as the issues of "green bond". We conduct an event study around the announcement of green bond issuances for all publicly traded companies in the World in the period 2013-2019 (the largest period in literature on this field). Using CARs, we investigate the stock price behavior to green bond issues for 414 listed companies and we demonstrated significant stock price increases around the announcement date of first-time green bond issues. For second issues, the positive stock price reaction to eco-friendly initiatives decreases while it completely disappears for the subsequent issues. From the management perspective, green bond issue seems an eco-friendly action with decreasing marginal benefits, because after the first issue, the market is already aware about the firm's commitment to green projects.

Keywords: CSR, green bond, financial performance

1. Introduction

In the last decades, global warming and environmental protection have become an increasingly issue all over the world, pushing governments to find and promote eco-friendly solutions. The principal aim is to cut down the CO₂ emissions and reduce the use of environmentally harmful resources. Environmental sustainability is gradually becoming an important key to achieve specific goals, either as a driver for investment opportunities and to mitigate economic and reputational risk besides being a powerful tool against climate change. The environmental projects have been financed with the use of the so-called "green bonds". Institutional investors started to observe the green bonds market with interest because both environmental impact and sustainability of projects are becoming essential elements for portfolio investments decisions.

Green bonds are fixed-income financial instruments whose proceeds must exclusively fund or re-fund new or existing projects linked to environmental sustainability benefits. The recent growth of the green bonds' phenomenon involves an analysis for what concerns the reaction of the stock market to these issues, the relative benefits for the companies and if they contribute effectively to the improvements in companies' environmental footprint or if it is merely a form of "greenwashing" (Pimonenko et al., 2020) (note 1).

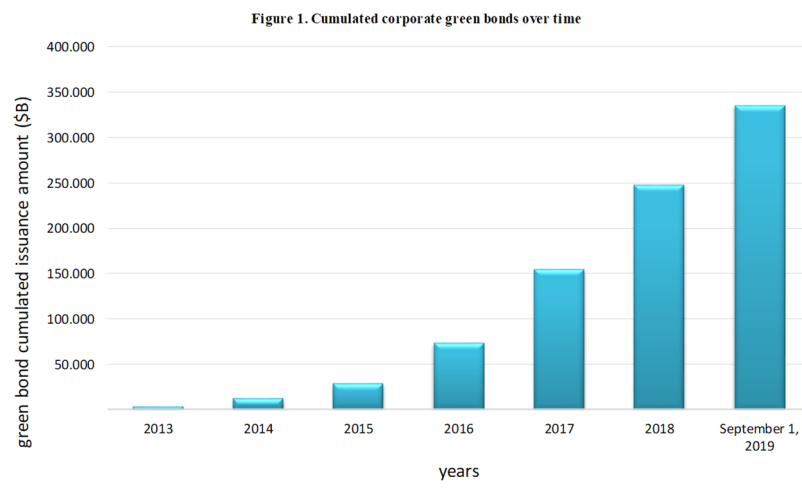
Until 2013, green bonds issuance predominantly came from supranational entities, such as European Investment Bank (EIB) in 2007 and World Bank in 2008 and other public development agencies while corporate green bonds were almost inexistent. The first corporate green bond was issued in November 2013 by Électricité de France (EDF) to support its development in renewable energy sources. The total issuance of corporate green bonds in that year was estimated about \$3B and then had more than doubled every year becoming increasingly important over time.

The green bond market had taken off in 2015 when 195 countries signed the Paris Agreements, starting to finance low-emission development projects, especially by supporting renewable energy infrastructure reaching about \$45 billion. As a result, global green bond issuance increased and 2017 was a record year with issuances of around \$155.5 billion. The leading countries were the US, China and French, which account 56% of the total 2017 issuance. In 2018, green bonds' market has grown of 7.5% regarding the previous year reaching \$167.3 billion. This slow growth reflects decreased issuance in some bond markets, particularly from US issuers. In the first half of 2019,

the volume was up by 51% on the final 2018 figure and it was primarily driven by the wider European market, which accounted for 45% of global issuance. Therefore, the growth in the green bond market decreased in the last two years, respectively, to the average growth rate between 2013 and 2017 that was approximately 80%. The underlined factors can be traced to maturity reached by green bonds market but also the bearish global fixed-income market as well as macro-economic uncertainty. Despite this, the green bond market remains relatively resilient compared to the broader fixed-income market that declined by 3-4% in recent years. This resilience is mainly due to the policy regulation and the rising of awareness of entities around climate change that push them to diversify their investment towards "green projects".

The analysts expect Europe to remain the dominant region for green bond issuance with most of the proceeds allocated to the energy, transportation and building sectors. For a growing number of sovereign issuers, green-labelled bonds have become a new tool to finance the country's green strategy. In the past two years, sovereign issuance grew by more than 60%.

This figure shows the total issuance amount (in \$B) of corporate green bonds from January 1, 2013 until September 1, 2019.



From 2013, corporate green bonds, have more than doubled, especially in first years, increasing to approximately \$335.980 billion on August 31, 2019. This trend will probably continue in the coming years, given the importance that this phenomenon is representing worldwide. Before Coronavirus phenomenon, Moody's forecasts for 2020 show an important growth around 24%.

The objective of this paper is to investigate the stock market reaction to the green bond issues to understand whether these issues create value for shareholders. We would find managerial implications related to the corporate strategy in implementing environmental projects or R&D projects to improve company's environmental performances. To examine this phenomenon, we hypothesize that stock market prices react positively to the announcement of green bond issuances. We use a dataset of corporate green bonds that covers all the private and public companies since the early days of this market in 2013 until September 2019, the largest period in the recent literature on this field. Cumulative Abnormal Returns (CARs) in several event windows measured value creation. Data are extracted from the Bloomberg's fixed income database, increased with the Climate Bonds Initiative's labelled green bond data and other information found in official companies' websites, news and press conferences.

The paper is divided into four sections. The first section is a literature review on Environmental CSR and stakeholder reaction with focus on green bonds history and green bonds characteristic vs conventional ones; the second section explains the data and research methodology; the third section analyzes the results and presents some robustness tests of our models; the final section concludes with suggestions for future research.

2. Literature Review and Hypothesis

Corporate social responsibility (CSR) has its origin in the 1950s, but it received increasing attention after 2000, either in the academic literature either among market operators. The previous focus of CSR was on "social" point of view, but recently the "environmental CSR" (e.g., focused on the reduction of CO₂ emissions) became an integral part of CSR and played an increasingly important role in corporate strategy and in academic research. A growing literature studied the reasons why companies invest in environmental actions and which is the relationship

with corporate performance: several authors (Ambec and Lanoie, 2008; Berchicci and King, 2007; Etzion, 2007) showed that environmental performance disclosures are value relevant for market players such as investors and financial analysts, since they influence stock market prices and market value of firm. Other authors (Holm and Rikhardsson, 2008), (Aerts, Cormier and Magnan, 2008) conducted studies on continental European, US and Canadian firms and showed that high quality environmental disclosures make financial analysts' earnings forecasts more precise and concrete. However, the impact diminished for firms belonging to environmentally sensitive industries. However, there is also a negative relationship following the 'cost-concerned approach' because high environmental activities require costly investments and thus, lead to decrease in firm earnings and decline in market value (Hassel et al., 2005).

Benabou & Tirole (2010) showed the link between superior CSR and better stakeholder engagement with a limited probability of short-term opportunistic behavior. Lee & Faff (2009) found a negative correlation between CSR scores and idiosyncratic risk. Liu and Ge (2012) instead found that voluntary disclosure of CSR activities leads to lower cost of capital, while others (El Ghoul et al., 2011) found that firms with better CSR scores have a lower cost of equity. More recently, Flammer (2013) and Krueger (2013) highlight a positive relation between CSR and stock market performance.

All mentioned studies point toward a positive relationship between environmental CSR and stock prices, while another branch of literature reveals no single precise association between environmental and financial performance (Wagner et al., 2002) or it links financial performance to environmental disclosure (Cormier and Magnan, 2015).

In this context, we focus our research only on green bond (Note 2) issuances that are a recent financial environmental instrument.

The literature about the green bonds' phenomena had proliferated since 2013 when the issuance of green bonds reached \$3 billion while before this date it was practically inexistent. An essential part of this literature focuses on the benefits of green bonds in terms of bond market premium, the so-called "Greenium". Recent studies (Ehlers & Packer, 2017; Zerbib, 2017, 2019) identify a small bond market premium for green bonds compared to conventional bonds. Zerbib (2016) examines the yield premium of green bonds during a period from July 2013 to December 2017, using a matching method and finding a small negative premium of about two basis points for its entire sample. He also shows that the main determinants are the rating and the issuer type highlighting the vital role that plays the credibility. Baker, Bergstresser, Serafeim, & Wurgler (2018) show that US municipal green bonds compared to conventional ones are issued at a bond market premium. Karpf & Mandel (2017) investigate the yield term structure of green US municipal bonds compared to conventional ones and conclude that green bonds have a higher average yield. Febi, Schäfer, Stephan, & Sun (2018) find that the liquidity of green bonds is one of the drivers of the relative yield spread and Reboredo (2018) shows that green bonds imply diversification benefits when they are part of energy and stock investment portfolios. There are also several studies which do not find a consistently significant premium for green bond issuances (Tang and Zhang, 2020) or studies that show a general positive market reaction, but no for green bonds with higher coupon rates (Baulkaran, 2019). Furthermore, Hyun et al. (2020) find that green bonds certified by an external reviewer enjoy a discount of about 6 bps, and green bonds that obtain a Climate Bonds Initiative certificate show a discount of around 15 bps.

Another stream of literature studies the way through which the issuance of green bonds can affect financial results in a company. Bauer & Hann (2012) identify a higher cost of debt for firms with environmental concerns, while firms with active environmental management imply a lower one. Flammer (2013, 2019) finds that the issuance of green bonds yields a positive announcement returns and improvements in long-term value operating and environmental performance in addition to an increase in green innovations and ownership by long-term and green investors. Other authors (Wang et al., 2020; Zhou and Cui, 2019) explore the impact of green bond issuance not only on companies' stock prices, but also on financial performance and corporate social responsibility (CSR). The empirical results indicate positive effects also on innovation capacity and companies' CSR.

By issuing green bonds, a company not only acquires a new source of capital but also invests in its environmental standards. It could reduce its operational costs, for example, through energy efficiency measures. There are also improvements in corporate's environmental performance and reduction in reputational risks because of the creation of a green public image. It also allows the company to improve the faith of existent investors or to attract new ones. For example, institutional investors with a green mandate could invest in green bonds to increase their ESG investments. Their interest could lead to a high bond price that could result in a lower cost of debt, improving the firm's appeal in the stock market. Thus, we believe in a significant relationship between financial performance and green bond issuances, and we propose the following hypothesis.

Hypothesis 1: Stock prices react positively to the announcement of green bond issuances.

As an empirical result of this following analysis, we expect that Cumulative Abnormal Returns (CAR) around the announcement date, on average, are significantly different from zero.

Regarding seasoned bond issues, we believe that the positive effect on stock prices disappears since investors are already aware about the company attitude to the environmental projects and the benefits of eco-friendly behavior is already “priced”. We propose the following hypothesis:

Hypothesis 2: *The stock market reaction to seasoned green bond issuances is not significant.*

This research contributes to the growing literature about corporate green bonds in several ways. First, we believe that the empirical evidences obtained in this study may confirm or reject the theory that the stock markets positively react to the announcement of corporate green bonds due to the environmental and long-run orientation of investors, and the awareness that green projects can lead to an improvement of the business performances. Second, in comparison to the previous literature, our analysis is based on a larger database of bond issues over a longer period, allowing us to investigate investors’ reactions in a more complete way. Third, we investigate the differential impact on stock prices generated by first-time green bond issuances and seasoned bonds.

3. Data, Variables and Methodology

Our empirical tests refer to a sample of corporate green bonds from Bloomberg’s fixed income database. We extract all corporate green bonds identified with the “use of proceeds” labelled as “Green Bond/Loan”, and we exclude the ones whose issuer’s Bloomberg Industry Classification System (BICS) is “Government”. We increase the Bloomberg’s dataset with the Climate Bonds Initiative’s labelled green bond data, and, for each security, we manually identify the announcement dates searching in the official company website, news and press conferences.

In this way, we obtain an integrated green bonds dataset with green bonds’ announcement dates with an initial sample of 1545 green bonds of private and public firms from January 1, 2013, until September 1, 2019. For each bond, we also extract the amount, the currency, the maturity, the coupon and the credit rating from Bloomberg to provide some stylized facts based on these data.

The sample of 1545 corporate green bonds (column 1) is divided into 414 issued by public firms (column 2) and 1131 by private firms (column 3) and it is identified the related amount issued, the fixed-rate bond, the average coupon, the average time to maturity and the median Bloomberg composite rating.

As can be seen, the average amount of green bonds issued are relatively large, \$259.1M. The 75% of the issue are fixed-rate bond with an average coupon of 3.48% and time to maturity of 7.11 years. The median Bloomberg composite rating is BBB+.

Table 1. Summary statistics of corporate bond issuance

	All (1)	Private (2)	Public (3)
Number of green bonds issuances	1545	1131	414
Amount issued (in \$M)	259,1 (405)	203 (298)	409 (580)
Fixed-rate bond	0,75	0,76	0,71
Coupon (for fixed-rate bonds)	3,48 (2,29)	3,77 (2,22)	2,64 (2,30)
Time to maturity	7,11 (5,71)	7,31 (5,64)	6,18 (5,90)
Bloomberg composite rating (median)	BBB+	BBB+	A-

The statistics show that public firms, on average issue more massive amounts of green bonds (\$409M) respect to private firms (\$203M). Moreover, these bonds, on average, have smaller maturities (6.18), pay a lower coupon rate (2.64) and are less likely to be fixed-rate bonds even if they remain the most common type (0.71). The Bloomberg composite rating’s median is BBB+ for the first two columns and A- for the public firms, which means that green bonds issued by public firms are on average, more secure investments.

In table 2, are reported the market share, the number of shares and the amount relating to the different industries.

Corporate green bonds are more common in the financial sector, particularly in the banking one (41.6%). Moreover, companies belonging to sectors where the environment is a crucial element for firms' operations (e.g. utilities, power generation, renewable energy, transportation, etc) issue most of the green bonds.

Table 2. Corporate green bonds across industries

Industry	Market share (%)	# shares	Amount (\$B)
Financials	50.3678	746	169.226
Banking	41.6011	487	139.771
Real estate	8.7667	259	29.455
Industrials	49.6322	799	166.754
Utilities	19.2823	153	64.785
Power Generation	10.7823	177	36.226
Renewable Energy	4.1927	257	14.087
Transportation & Logistics	3.0921	26	10.389
Industrial Other	1.7458	41	5.866
Travel & Lodging	1.3769	23	4.626
Automobiles Manufacturing	1.3674	19	4.594
Forest & Paper Products Manufacturing	1.2304	13	4.134
Chemicals	1.0113	10	3.398
Waste & Environment Services & Equipment	1.0046	29	3.375
Communications Equipment	0.7441	2	2.500
Containers & Packaging	0.5953	4	2.000
Wireless Telecommunications Services	0.5478	2	1.840
Wireline Telecommunications Services	0.3396	1	1.141
Retail - Consumer Discretionary	0.2729	3	917
Food & Beverage	0.2554	3	858
Medical Equipment & Devices Manufacturing	0.2491	1	837
Life Insurance	0.2489	2	836
Managed Care	0.1711	1	575
Retail - Consumer Staples	0.1694	1	569
Railroad	0.1664	1	559
Electrical Equipment Manufacturing	0.161	5	541
Construction Materials Manufacturing	0.1339	1	450
Educational Services	0.1101	1	370
Machinery Manufacturing	0.1028	2	345
Supermarkets & Pharmacies	0.0982	2	330
Hardware	0.0893	1	300
Others	0.0911	18	306
Total	100	1545	335.980

Table 3 finally provides a breakdown by countries, reporting the market share, the number of shares and the total amount issued. As can be seen, China is the largest issuer of corporate green bonds either for numbers of shares and amount issued, followed by France and the United States. At a continental level, corporate green bonds are more prevalent in Europe.

Table 3. Corporate green bonds across countries

Country	Market share (%)	# shares	Amount (\$B)	Country	Market share (%)	# shares	Amount (\$B)
CHINA	27.2842	276	91.670	CANADA	1.3542	14	4.550
FRANCE	9.9858	190	33.550	HONG KONG	1.3449	29	4.519
UNITED STATES	9.9208	216	33.332	FINLAND	0.8496	8	2.854
GERMANY	6.0652	83	20.378	PORTUGAL	0.5464	2	1.836
NETHERLANDS	6.0136	38	20.204	AUSTRIA	0.507	6	1.704
SPAIN	4.7443	36	15.940	TAIWAN	0.4161	20	1.398
SWEDEN	3.9282	193	13.198	UAE	0.3682	3	1.237
ITALY	3.6796	21	12.363	LUXEMBOURG	0.3611	7	1.213
INDIA	3.6583	37	12.291	SINGAPORE	0.3377	10	1.135
JAPAN	2.8389	58	9.538	MALAYSIA	0.3273	115	1.100
MEXICO	2.5556	9	8.586	PHILIPPINES	0.3268	5	1.098
BRITAIN	1.9449	20	6.534	SWITZERLAND	0.3007	9	1.010
SOUTH KOREA	1.9402	20	6.519	CHILE	0.3006	3	1.010
NORWAY	1.6702	31	5.612	MAURITIUS	0.2828	2	950
AUSTRALIA	1.6192	18	5.440	NEW ZEALAND	0.2431	6	817
DENMARK	1.4729	13	4.949	OTHERS	1.3737	37	4.615
BRAZIL	1.4379	10	4.831				
Total				Total	100	1545	335.980

We exclude from the empirical analysis the bond issuances completed by private companies and we limit our analysis to the green bond issuances completed by listed companies in the period 01/01/2013-31/08/2019. After making some adjustments, our dataset is made of 414 public firms. When the same firm issues several tranches of green bonds on the same day, we consider them as one single green bond. After excluding missing values, we obtain 280 corporate green bonds, both first-time and seasoned issues and we divide the dataset in two different subsamples, companies with only one issuance in the observation period and the other includes companies with many issuances over the time.

To examine the stock market reaction to the green bond issuance, we use the event study methodology with cumulative abnormal returns estimated through the market model (Brown & Warner, 1985 and MacKinlay, 1997). This model relies on the actual returns of a reference market and the correlation of the company's stock return with the reference market. The reference indexes used to calculate the market returns are the country's leading stock market indexes (e.g. S&P 500 for U.S., CAC 40 for France, IBEX 35 for Spain, FTSE MIB for Italy, NIKKEI 225 for Japan, etc.) and we define as event date "0" the announcement date for every corporate green bond. Then, around this date, we download the stock and index prices for each related security using 200 trading days as estimation window [-220; -21] while the event window considered includes 20 days prior and after the announcement date [-20; 20].

For each firm i , we calculate the cumulative abnormal returns during the event window using the market model. First, we estimate the coefficient α_i and β_i through the Ordinary Least Squares (OLS) based on the trading days related to estimation window [-220; -2]. Second, we compute the estimated daily return of each stock i on day t ($\hat{R}_{i,t}$) as:

$$\hat{R}_{i,t} = \hat{\alpha}_i + \hat{\beta}_i \times R_{m,t}$$

Then, we calculate the abnormal return (AR) of company i on day t as follows:

$$AR_{i,t} = R_{i,t} - \hat{R}_{i,t}$$

Finally, we compute the cumulative abnormal returns (CAR) for each company in several event windows [-20, -15], [-14, -10], [-9, -6], [-5, -2], [-2, 1], [-1, 1], [-1, 0], [1, 5], [6, 9], [10, 14], and [15, 20] [note 4].

We expect that the market responds on average positively and significant around the announcement date and particularly in the two-day event window [-1, 0]. To check whether CARs are statistically significant, we use the parametric T-test, which verifies whether the average value of a distribution deviates significantly from a specific reference value. The null hypothesis to be tested is CARs equal to zero.

4. Result of the Empirical Analysis

4.1 Event Study

Table 4 reports the event study results. For each time window, it shows the average and the standard error of CARs.

Table 4. The stock market reaction to the announcement of corporate green bond

The table shows the average of the Cumulative Abnormal Returns (CARs) for different time windows around the announcement of green bond issues. The sample of green bond issues are equal to N=280. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.						
Event time	Average	Median	Stan. D.	Stan. E	Av. T-st	Med. T-stat
CAR [-20 ; -15]	-0,15%	-0,06%	3,11%	0,19%	-0,82	-0,35
CAR [-14 ; -10]	-0,27%	-0,21%	2,98%	0,18%	-1,51	-1,18
CAR [-9 ; -6]	-0,13%	0,04%	2,58%	0,15%	-0,85	0,28
CAR [-5 ; -2]	0,22%	0,15%	2,59%	0,15%	1,41	0,95
CAR [-2 ; 2]	0,19%	0,27%	2,70%	0,16%	1,16	1,67*
CAR [-2 ; 1]	0,31%	0,17%	2,39%	0,14%	2,19**	1,20
CAR [-1 ; 1]	0,25%	0,19%	2,10%	0,13%	2,00**	1,54
CAR [-1 ; 0]	0,30%	0,22%	1,78%	0,11%	2,85***	2,06**
CAR [2 ; 5]	-0,09%	-0,15%	2,47%	0,15%	-0,61	-0,99
CAR [6 ; 9]	0,30%	0,22%	2,63%	0,16%	1,93	1,39
CAR [10 ; 14]	0,23%	0,12%	2,91%	0,17%	1,33	0,70
CAR [15 ; 20]	0,01%	0,01%	3,36%	0,20%	0,06	0,07

For each event window, we report the average and the median CAR as a percentage, with the corresponding T-statistics. In support of Hypothesis 1, the average CAR in the two-day event window [-1, 0] is positive (0.30%) and significant at 1% level. The average CAR for the event windows [-2, 1], [-1, 1] are both positive and significant at 5% level.

All other intervals yield CARs that are small and insignificant. The announcement of green bond generates an increase in the issuer stock price. This result may be perceived as confirm of the positive effect around the announcement dates and it confirms that the results are not driven by unrelated trends around the event dates.

This result shows that investors positively react to the announcement of corporate green bonds and confirms the theory that these issuances are perceived as value added event for a company. This is probably due to the new growth opportunities for the company or risk mitigation effects generated by ESG actions.

4.2 Robustness Check

In order to strengthen the results, we test alternative ways to compute the average cumulative abnormal returns in the event window $[-1, 0]$. Table 5 presents the robustness checks.

Table 5. Robustness checks

The table shows the average \overline{CAR} and the standard error in the $[-1; 0]$ time window. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.		
	$\overline{CAR} [-1; 0]$	Std. Error
Market Adjusted Model	0,33% ***	0,11%
Crude dependence Test	0,30% **	0,15%
Outlier Correction	0,30% ***	0,08%
Excluding banking	0,44% ***	0,14%
Median \overline{CAR}	0,22% **	0,11%

In the Market Adjusted Model, we compute abnormal returns without applying the market model and so without considering the coefficients α and β estimated through the OLS previously mentioned. More specifically, we subtract the market returns to the stock return in the event window considered. In the Crude Dependence Adjustment Test (CDA), we recomputed standard errors to compensate for potential dependence of returns across events in abnormal returns. This test avoids the potential problem arising from cross-sectional correlation of security returns.

In the Outlier correction, we re-estimate the CARs correcting for values below the 5th percentile and above the 95th percentile. We also run another test excluding the financial companies since they invest in “green loans” (note 5) that are somewhat different from using the proceeds to invest in green projects. In the median \overline{CAR} test, we compute the median \overline{CAR} to mitigate the risk that a few stock prices might drive the price value with a crucial positive price reaction. All robustness checks confirm previous results. CARs are positive and significant in the event window $[-1, 0]$, reinforcing the theory that green bond issuances are perceived as a value-added event.

4.3 Heterogeneity in Stock Market Response

Following previous literature (Flammer, 2013) we investigate how the stock price reaction differs between first-time issue and subsequent issues of corporate green bonds.

We compare green bonds that are issued for the first-time (table 6) with the seasoned issuers (table 7). The first-time issues between January 2013 and September 2019 are 155 while the seasoned ones are 125.

Table 6 and 7 show the average CAR and the standard error for each event window analysed. *, **, *** denotes the significance at 10%, 5%, 1% level, respectively.

In table 6, the average CAR in the two-day event window $[-1, 0]$ relative to the first-time issues is positive and significant. The CARs are higher than those presented in table 4 and 5. While considering the seasoned-time issues in table 7, we show that the CARs are non-significant in all event windows.

Moreover, concerning the main event window $[-1, 0]$, the first-time green bond issues are positive and significant also applying the market model, the crude dependence test, the outlier correction, excluding banks and looking to the median (CAR), as shown in Table 4. The second-time issues instead show non-significant effects.

Table 6. First-time green bond issue (n=155)

Event time	Average	Median	Stan. Dev.	Stan. Error	Av. T-stat.	Med. T-stat
CAR [-20 ; -15]	-0,41%	-0,42%	3,26%	0,26%	-1,56	-1,60
CAR [-14 ; -10]	-0,08%	-0,05%	2,80%	0,22%	-0,34	-0,22
CAR [-9 ; -6]	-0,18%	0,08%	2,25%	0,18%	-0,99	0,45
CAR [-5 ; -2]	0,30%	0,46%	2,90%	0,23%	1,29	1,97
CAR [-2 ; 2]	0,33%	0,34%	2,67%	0,21%	1,53	1,57
CAR [-2 ; 1]	0,43%	0,13%	2,46%	0,20%	2,17	0,68
CAR [-1 ; 1]	0,38%	0,26%	2,14%	0,17%	2,23	1,53
CAR [-1 ; 0]	0,43%	0,35%	1,81%	0,15%	2,93**	2,41**
CAR [2 ; 5]	0,05%	0,21%	2,49%	0,20%	0,27	1,05
CAR [6 ; 9]	0,25%	0,05%	2,18%	0,18%	1,39	0,26
CAR [10 ; 14]	0,35%	0,10%	2,89%	0,23%	1,49	0,44
CAR [15 ; 20]	-0,03%	0,03%	3,13%	0,25%	-0,11	0,12

This table shows the 155 first-time issues between January 2013 and September 2019. The average CAR and the

median CAR in the two-day event window $[-1, 0]$ are positive and significant and they are higher than those presented in table 4 and 5.

Table 7. Seasoned-time green bond issue (n=125)

Event time	Average	Median	Stan. Dev.	Stan. Error	Av. T-stat.	Med. T-stat
CAR $[-20; -15]$	0,18%	-0,14%	2,99%	0,27%	0,66	-0,52
CAR $[-14; -10]$	-0,34%	-0,39%	3,10%	0,28%	-1,22	-1,40
CAR $[-9; -6]$	0,20%	0,31%	3,09%	0,28%	0,71	1,13
CAR $[-5; -2]$	0,17%	-0,33%	2,47%	0,22%	0,79	-1,52
CAR $[-2; 2]$	-0,04%	0,19%	3,01%	0,27%	-0,15	0,70
CAR $[-2; 1]$	0,18%	0,21%	2,60%	0,23%	0,75	0,92
CAR $[-1; 1]$	0,20%	0,14%	2,33%	0,21%	0,94	0,65
CAR $[-1; 0]$	0,20%	0,23%	1,89%	0,17%	1,20	1,37
CAR $[2; 5]$	-0,02%	-0,02%	2,80%	0,25%	-0,08	-0,07
CAR $[6; 9]$	0,34%	0,44%	2,78%	0,25%	1,37	1,77
CAR $[10; 14]$	0,27%	0,36%	3,43%	0,31%	0,86	1,17
CAR $[15; 20]$	0,20%	-0,06%	3,72%	0,33%	0,59	-0,17

This table shows the 125 seasoned issues between January 2013 and September 2019. The average CAR and the median CAR in the two-day event window $[-1, 0]$ are positive, but lower than first-time issues and they are non-significant.

These results suggest that the market is more interested in the first-time announcement of eco-friendly's actions implemented by a firm. The subsequent issues are non-significant since the market has already learned about the relative firm's commitment to green projects.

5. Conclusion

Environmental sustainability has become an increasingly common theme in everyday life, especially in this historical period in which both the financial world and civil society have a stronger focus on this subject.

With the Paris Agreements and, more recently the European Green Deal, governments are trying to drive the economy towards growth that is respectful both for the environment and for people, in order to improve well-being and preserve the planet for future generations. From an economic point of view, environmental sustainability represents a driver either to exploit new investment opportunities either to mitigate economic and reputational risk and it can be a key aspect in portfolio investment decisions.

This paper investigated the investors' reaction to green bonds issuances, a financial instrument used to raise capital for climate and environmental projects.

By using a large dataset of corporate green bond from January 31, 2013, to September 1, 2019, we compute the average cumulative abnormal returns in several event windows and we demonstrate that average CAR in the two-day event window $[-1, 0]$ is positive and significant at 1% level. Therefore, investors react positively to the announcement of green bonds issuance. Average CAR is positive and significant, also applying other approaches such as the market model, the crude dependence test, the outlier correction, or excluding banks and using Median CARs. We also demonstrate the existence of a positive and significant average CAR in the two-day event window $[-1, 0]$ relative to the first-time issues, while seasoned green bond issuances generate no effect on stock prices. Green bond issues are perceived as a value-creating event and help companies to attract investors with environment orientation. However, the market is more interested in the first-time announcement of eco-friendly's actions implemented by a firm, probably for company's environmental footprint.

Our findings have several managerial implications related to the corporate strategy, to the degree of innovation and to the investment decisions. Managers should design environmental projects or R&D projects to improve company's environmental performances since investors value eco-friendly actions taken by the firm. Despite this result, eco-friendly actions seem to have decreasing marginal benefits.

Our study is affected by several limitations. First, it addresses only the short-term investors' reactions without considering the long-term benefits of green projects. Second, we do not consider the effect of green bonds in different industries. Third, we do not analyze how the perception of shareholders about green projects and ESG evolved over time.

References

- Aerts, W., Cormier, D., & Magnan, M. (2008). Corporate environmental disclosure, financial markets and the media: An international perspective. *Ecological Economics*, 64(3), 643-659.
- Ambec, S., & Lanoie, P. (2008). Does it pay to be green? A systematic overview. *Academy of Management Perspectives*, 22(4), 45-62.
- Baker, M. P., Bergstresser, D. B., Serafeim, G., & Wurgler, J. A. (2018). Financing the Response to Climate Change: The Pricing and Ownership of U.S. Green Bonds. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3275327>
- Bauer, R., & Hann, D. (2012). Corporate Environmental Management and Credit Risk. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.1660470>
- Baulkaran, V. (2019). Stock market reaction to green bond issuance. *Journal of Asset Management*, 20(5), 331-340.
- Benabou, R., & Tirole, J. (2010). Individual and corporate social responsibility. *Economica*, 77(305), 1-19.
- Berchicci, L., & King, A. (2007). 11 Postcards from the Edge: A Review of the Business and Environment Literature. *Academy of Management Annals*, 1(1), 513-547.
- Brown, S. J., & Warner, J. B. (1985). Using daily stock returns. The case of event studies. *Journal of Financial Economics*, 14(1), 3-31.
- Cormier, D., & Magnan, M. (2015). The Economic Relevance of Environmental Disclosure and its Impact on Corporate Legitimacy: An Empirical Investigation. *Business Strategy and the Environment*, 24(6), 431-450.
- Ehlers, T., & Packer, F. (2017). Green bond finance and certification. *BIS Quarterly Review*, 89-104.
- El Ghoul, S., Guedhami, O., Kwok, C. C. Y., & Mishra, D. R. (2011). Does corporate social responsibility affect the cost of capital? *Journal of Banking and Finance*, 35(9), 2388-2406.
- Etzion, D. (2007). Research on organizations and the natural environment, 1992-present: A review. *Journal of Management*.
- Febi, W., Schäfer, D., Stephan, A., & Sun, C. (2018). The impact of liquidity risk on the yield spread of green bonds. *Finance Research Letters*, 27, 53-59.
- Flammer, C. (2013). Corporate social responsibility and shareholder reaction: The environmental awareness of investors. *Academy of Management Journal*, 56(3), 758-781.
- Flammer, C. (2019). Corporate Green Bonds. *Academy of Management Proceedings*, 1, 15250.
- Hassel, L., Nilsson, H., & Nyquist, S. (2005). The value relevance of environmental performance. *European Accounting Review*, 14(1), 41-61.
- Holm, C., & Rikhardsson, P. (2008). Experienced and novice investors: Does environmental information influence investment allocation decisions? *European Accounting Review*, 17(3), 537-557.
- Hyun, S., Park, D., & Tian, S. (2020). The price of going green: the role of greenness in green bond markets. *Accounting and Finance*. <https://doi.org/10.1111/acfi.12515>
- Karpf, A., & Mandel, A. (2017). Does it Pay to Be Green? <https://doi.org/10.2139/ssrn.2923484>
- Krueger, P. (2013). Corporate Goodness and Shareholder Wealth. <https://doi.org/10.2139/ssrn.2287089>
- Lee, D. D., & Faff, R. W. (2009). Corporate sustainability performance and idiosyncratic risk: A global perspective. *Financial Review*, 44(2), 213-237.
- Liu, M., & Ge, W. (2012). The Impact of Corporate Social Responsibility Disclosure and Performance on the Cost of Corporate Bonds. <https://doi.org/10.2139/ssrn.1985218>
- MacKinlay, A. C. (1997). Event Studies in Economics and Finance. *Journal of Economic Literature*, 35(1), 13-39.
- Pimonenko, T., Bilan, Y., Horák, J., Starchenko, L., & Gajda, W. (2020). Green brand of companies and greenwashing under sustainable development goals. *Sustainability (Switzerland)*. <https://doi.org/10.3390/su12041679>
- Reboredo, J. C. (2018). Green bond and financial markets: Co-movement, diversification and price spillover effects. *Energy Economics*, 74, 38-50.
- Tang, D. Y., & Zhang, Y. (2020). Do shareholders benefit from green bonds? *Journal of Corporate Finance*, 61, <https://doi.org/10.1016/j.jcorpfin.2018.12.001>

- Wagner, M., Van Phu, N., Azomahou, T., & Wehrmeyer, W. (2002). The relationship between the environmental and economic performance of firms: an empirical analysis of the European paper industry. *Corporate Social Responsibility and Environmental Management*, 9(3), 133-146.
- Wang, J., Chen, X., Li, X., Yu, J., & Zhong, R. (2020). The market reaction to green bond issuance: Evidence from China. *Pacific Basin Finance Journal*. <https://doi.org/10.1016/j.pacfin.2020.101294>
- Zerbib, O. D. (2017). The Green Bond Premium. <https://doi.org/10.2139/ssrn.2889690>
- Zerbib, O. D. (2019). The effect of pro-environmental preferences on bond prices: Evidence from green bonds. *Journal of Banking and Finance*, 98, 39-60.
- Zhou, X., & Cui, Y. (2019). Green bonds, corporate performance, and corporate social responsibility. *Sustainability (Switzerland)*. <https://doi.org/10.3390/su11236881>

Notes

Note 1. Greenwashing is a neologism indicating the marketing strategy of companies and organizations focused on building a positive image of their environmental interest. It occurs when a company gives market misleading information about its ecological footprint. This strategy helps company to reach social investors and ethical funds or to divert public attention from the negative effects in the environment due to its activities or products. Generally, companies involved in greenwashing activities, invest in recycled materials or in energy-saving products, but they are not very interested in and exaggerate benefits to mislead consumers and markets.

Note 2. Green bonds were born in 2007 after the Berlin Declaration. The related article II states "We intend jointly to lead the way in energy policy and climate protection and make our contribution to averting the global threat of climate change." in 2007 the European Investment Bank (EIB) issued the first green bond which amount was €600 million, under the name "Climate Awareness Bond", to finance its climate-related project. In 2008 it was the time of the World Bank, which also coined the term "green bond" for the first time, with about \$400 million issued. Environmental projects are identified by the Climate Bond Taxonomy to deliver a low carbon economy and CO₂ emissions criteria under the 2-degree global warming target set by the Conference of the Parties (COP) 21 Paris Agreement by 195 Countries with the European Union. After the world's first issue operated by the European Investment Bank, the phenomenon of green bonds has been growing at a fast pace. Still, it continues to suffer from a lack of uniformity definition and standards across the countries. Green bonds have tax incentives such as tax exemption and tax credits, making them more attractive investment respect to a comparable taxable bond and providing monetary incentives to face the already mentioned prominent social and environmental issues.

Note 3. The reference indexes used to calculate the market returns are the country's leading stock market indexes (e.g. S&P 500 for U.S., CAC 40 for France, IBEX 35 for Spain, FTSE MIB for Italy, NIKKEI 225 for Japan, etc.)

Note 4. In the event window [-1, 0] the previous trading day [-1] is accounted to include the possibility that some information regarding the issuance of a corporate green bond is available prior the announcement date.

Note 5. "Green loans are governed by the same principles as green bonds - the Green Bond Principles, which promote integrity in this market and contain the norms established for these financial products: for example, which categories of investment qualify to use the funds, or how their environmental impact should be measured. For a loan to be considered "green," its objective must be to promote environmental sustainability." (BBVA 2017).

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