Sinergie SIMA
Management Conference

Rediscovering local roots and interactions in management

Conference Proceedings

Short papers

Bari (Italy)

29-30 June 2023

Sinergie-SIMA Management Conference Proceedings
Rediscovering local roots and interactions in management
29-30 June 2023
Mercure Villa Romanazzi Carducci (Bari)

ISBN 978-88-94-7136-3-3

The Conference Proceedings are published online on *https://www.sijmsima.it*

Via Interrato dell'Acqua Morta, 26
37129 Verona - Italy

Rediscovering local roots and interactions in management

29-30 June 2023

Conference Proceedings

Short Papers

edited by

Arabella Mocciaro Li Destri, Marta Ugolini,
Angeloantonio Russo and Savino Santovito

Conference chairs

ANGELOANTONIO RUSSO	*LUM University*
SAVINO SANTOVITO	*University of Bari "Aldo Moro"*
ARABELLA MOCCIARO LI DESTRI	*University of Palermo - SIMA*
MARTA UGOLINI	*University of Verona - Sinergie Italian Journal of Management*

Scientific committee

BEATRICE LUCERI (Coordinator)	*University of Parma*
CLAUDIO BACCARANI	*University of Verona*
DANIELA BAGLIERI	*University of Messina*
ANGELO BONFANTI	*University of Verona*
FRANCESCA CABIDDU	*University of Cagliari*
SANDRO CASTALDO	*Bocconi University*
ELENA CEDROLA	*University of Macerata*
MARIA CHIARVESIO	*University of Udine*
FRANCESCO CIAMPI	*University of Florence*
DANIELE DALLI	*University of Pisa*
GAETANO M. GOLINELLI	*Sapienza University of Roma*
MONICA GROSSO	*Emlyon Business School, France*
CHARLES HOFACKER	*Florida State University, USA*
GENNARO IASEVOLI	*University of Roma LUMSA*
JACQUES MARTIN	*University of Toulon, France*
UMBERTO MARTINI	*University of Trento*
CLELIA MAZZONI	*University of Campania Luigi Vanvitelli*
ANTIGONI PAPADIMITRIOU	*Lehigh University, USA*
ALBERTO PASTORE	*Sapienza University of Roma*
TONINO PENCARELLI	*University of Urbino Carlo Bo*
RICCARDO RESCINITI	*University of Sannio*
ELITA SCHILLACI	University of Catania
ALFONSO VARGAS-SÁNCHEZ	*University of Huelva, Spain*
DONATA VIANELLI	*University of Trieste*
ROBERTO VONA	*University of Naples Federico II*

Organizing committee

FABRIZIO BALDASSARRE	*University of Bari "Aldo Moro"*
RAFFAELE CAMPO	*University of Bari "Aldo Moro"*
DOMENICO MORRONE	*LUM University*
FABIO MUSSO	*University of Urbino*
LARA PENCO	*University of Genova*
PIERFELICE ROSATO	*University of Bari "Aldo Moro"*
ROSAMARTINA SCHENA	*LUM University*

Editorial staff

FABIO CASSIA	*University of Verona*
NICOLA COBELLI	*University of Verona*
LAURA CIARMELA	*Sinergie Italian Journal of Management*
ADA ROSSI	*Sinergie Italian Journal of Management*

Registration and invoicing

ANNALISA ANDRIOLO	*Sinergie Italian Journal of Management*
ADELE FERRAGAMO	*SIMA*

Does the Greenium in Green Bond still exist? Empirical analysis in a sample of international Green Bond[1]

MARIANTONIETTA INTONTI[*] MATTEO DE LEONARDIS[•]
CANDIDA BUSSOLI[♠] LAURA SERLENGA[**]

Abstract

The green bond market has seen exponential growth since the issuance of the first sustainable bond by the European Investment Bank (EIB) in June 2007. The increase in market size and interest in sustainability topics, in particular green, in the financial field, has led to the dissemination of many studies on the topic. Among these, studies focused on the relationship between Corporate Social Responsibility (CSR) and the Financial Performance of an issuing company have mainly shown a direct and significant positive relationship between the two dimensions (Yu-Shang Wang Yi-Jie Chen, 2018, Attig, N. et al, 2013, Alan, Y. Et al. 2016). The literature on sustainable investor behavior (Flammer C., 2021) has shown, on the other hand, the presence of the so-called Green Bond Premium (or greenium), a negative difference in yield (or positive in price) between Green Bonds and Traditional Bonds that can be considered as equivalent, except for the green component. It therefore seems that for financial products, investors are willing to pay a higher price in order to obtain the sustainable green product, in this case green bonds. The literature in recent years has been characterized by the presence of many works on the subject based on very different methodologies of analysis, with non-homogeneous results and, consequently, with a lack of clarity on the dynamics and determinants of this particular phenomenon. The work, therefore, is aimed at investigating the presence of greenium in the financial market, using a large sample of Green Bonds and Traditional Bond counterparts, applying analysis methodologies shared in the literature (Zerbib, 2019), also in order to evaluate the persistence of the effect in periods of high growth in emissions and market turbulence due to the crises related to the pandemic, the war in Ukraine, the rise in gas prices and inflation. The paper also intends to highlight what the determinants of greenium are, identifying some independent reference variables that can also allow to highlight the effect of greater transparency in terms of sustainability of the issuer on the value of greenium.

Framing of the research. *The research is part of the existing literature on the theme of greenium, on the importance of developing projects of environmental, social and governance sustainability in companies, and on the methods of financing these projects. Among the latter, the decision to issue GB has shown its importance for both issuers and investors.*

The numerous empirical evidence on GB issues have shown the existence of a greenium, i.e. a negative yield premium, which investors are willing to accept in the presence of a bond that has a high impact in terms of environmental sustainability. Studies on the existence of the phenomenon show interesting and significant results. However, despite the greater precision and increasingly refined methodologies, a univocal vision on the topic has not yet been reached as the results are often conflicting. Moreover, the pandemic and the war in Ukraine made it more difficult to evaluate the results, due to the sudden succession of market shocks and instability.

The literature developed over the years highlights the presence of a negative yield premium for green bonds, the implications of which can be analyzed both from the point of view of the issuers and from that of the investors.

In the context of the literature that analyzes the phenomenon from the point of view of the issuers, in terms of analysis of the relationship between Corporate Social Performance (CSP) and returns on securities, many studies show a positive relationship between the CSP and the return on shares (Konar and Cohen , 2001; Derwall et al., 2005;

[1] Although the paper is the result of a common effort, M. Intonti and M. De Leonardis wrote Sections 1, C. Bussoli wrote Sections 2, L. Serlenga wrote Sections 3, L. Serlenga and M. De Leonardis wrote Section 4, M. Intonti wrote Section 5, C. Bussoli and M. De Leonardis wrote Section 6. Grateful to M. De Leonardis for data collection.

[*] Associate Professor *of Economics of financial intermediaries* - University of Bari Aldo Moro
e-mail: mariantonietta.intonti@uniba.it

[•] Phd Student - LUM University
e-mail: deleonardis.phdstudent@lum.it

[♠] Full Professor *of Economics of Financial Intermediaries* - LUM University
e-mail: bussoli@lum.it

[**] Associate Professor *of Econometrics* - University of Bari Aldo Moro
e-mail: laura.serlenga@uniba.it

Kempf and Osthoff, 2007), with a consequent lower cost of capital for issuing companies characterized by a sustainable approach in the ESG, environmental, social and governance dimensions. The company's commitment to complete sustainability projects or to transform the production chain to make it less polluting seems to be rewarded on the stock market. Many studies address the issue of the applicability of the results indicated above also to the cost of debt that the company has to face with a bond issue, considering that the investor in debt securities has a different profile than the shareholder (Oikonomou et al., 2014; Ge and Liu, 2015, Russo et al., 2020). The presence of a lower cost of debt linked to the issue of sustainable bonds can be measured by comparing it with traditional type bonds, which differ only in the greenness typical of Green Bonds. Among the reference papers, Zerbib (2019) analyzes a sample of 110 Green Bonds, compared with a double amount of Traditional Bonds. The methodology applied uses the matching method to link two traditional bonds to each green bond and, from this comparison, calculate any differences in terms of yield. The particularity of the model is related to the use as a dependent variable of a liquidity proxy (the Bid-Ask Spread): the constant of the model is identified in the greenium as the "time invariant" effect of the panel fixed effect regression. The result is significant and shows a negative greenium of around 2bps in the secondary market. In Bachelet (2019), on the other hand, both a Pooled OLS and a panel fixed effect regression are used, and the value assumed by the constant is both negative and positive depending on the type of issuer, with non-univocal results on the existence of greenium.

In the studies that look at investors, however, the definition of the model and the choice of variables is linked to the Willingness to Pay (WTP) for green products. A large branch of literature from the 90s to today has analyzed the WTP for green products and found in many cases positive and significant values for investors (Louriero M., 2003, Thompson D., 2010), showing how the price for a green financial product that consumers are willing to pay for is superior to that of traditional bonds, all other things being equal. A higher price is linked to a lower yield, with a consequent lower cost of the debt for the issuer. In Agliardi & Agliardi (2019) the case of the issue of a green bond by an Italian company is analyzed in depth. The GB, compared with a previous traditional bond, not only shows a price in the primary market clearly higher than the traditional one but also a negative greenium of 86bps in the secondary market. This paper also specifies the still current tendency to find themselves in situations of oversubscription in the issuance phase of Green Bonds in the primary market. This trend, which could have effects on the composition and existence of greenium, is certainly a consequence of the very large interest that these financial instruments have created among investors.

The literature also focuses on the importance of the green project linked to the bond, which would make the investment more attractive. In this context, Bour (2019), based on the methodology used by Zerbib (2019), expands the potential of the model by inserting a proxy variable of non-financial disclosure. The results are very interesting and show a significant greenium of -23 bps, which increases dramatically if it is accompanied by a second party opinion and CBI certification (respectively -111 bps and -110bps). Therefore, greenium is influenced by the transparency of the security, which reduces the possibility of greenwashing, and by the perception of the final consumer/investor regarding the correctness of the issuer. In this context, however, the literature had also verified rather anomalous cases of significant positive greenium, as in the case of Karpf and Mandel (2018) who used the quantity of transactions carried out in the previous 30 days as an approximation of liquidity.

Among the most important studies we also find the research by CBI (2016) and Barclays (2015) which, applying an analysis by indices in the first case and an OLS regression in the secondary market in the second case, found respectively insignificant results and a greenium of -1.1bps.

Gianfrate and Peri, in 2019, analyzed a sample of about 120 Green Bonds, which, compared through an OLS, show significant results especially for corporate issuers. In Ehlers (2017) a greenium of -18 bps emerges in both the primary and secondary markets, using an initial matching method and a subsequent analysis of the yield curve of the green and brown bond pairs. The aforementioned Baker (2018) uses a large sample consisting of 2083 GB in a period between 2010 and 2016 and, through a regression on bond yields, arrives at an interesting result of -5.7 bps in the primary market, and at a similar result in the secondary. Finally, Fatica, Panzica and Rancan (2021), with a dataset containing 1397 GB and the same methodology used by Baker in the previous year, obtained non-homogeneous results for the whole sample. For this reason, the authors conclude that greenium does not appear to be present for all categories of issuers and explain that in non-financial corporations the use of bond proceeds is more transparent about the greenness of projects than in financial institutions.

The most recent research has refined the compositions of the models, reaching further and interesting results. Koziol et al. (2022) carry out an experiment on greenium through a sentiment analysis, including in the panel regression model three variables representing searches on Google for the terms ESG, Green Bonds and Sustainability. The results show an increase in greenium when interest and searches are greatest. Sergei (2022) applies a matching method similar to the one constructed by Zerbib and, through a fixed effects panel regression, finds a greenium of about -38 bps on a sample of over 2000 bonds (of which 12% belong to the green category.

In summary, based on Bhutta (2022), we can state that the literature, in 56% of cases, sees a greenium with a statistically significant negative value in the primary market and in 70% of cases sees a negative greenium statistically significant in the secondary market. The most important literature is summarized in Table 1.

Tab. 1: An overview of the greenium literature

AUTHORS	DESCRIPTION	GREENIUM	METHODOLOGY and MODEL	SAMPLE SIZE
Bachelet et al. (2019)	A sample of 89 private and institutional green bonds to which a pooled OLS and panel analysis was applied	Between 2.06bps and 5.9 bps	Pooled OLS e Fixed Effect $\Delta yi,t=\alpha 0+\alpha 1\Delta Liqi,t+\alpha 2\Delta ZTDi,t+\alpha 3\Delta \sigma i,t+\sum j\beta j\Delta Bji+\eta i+\varepsilon i,t$ Dipendent Variable: Yield differential Regressors: iquidity difference, zero trading day, 20-day yield difference, amount issued, coupon and maturity	89 green bond (2013-2018)
Ehlers & Paker (2017)	Greenium estimation on a 21 green bond sample	-18bps	Greenium estimation using a regression on yield curves	21 green bonds (2013-2017)
Zerbib (2019)	Greenium estimation on 110 green bonds and 220 traditional bonds	-2bps	Panel Regression Fixed effect, control liquidity $\tilde{}yi,t=pi+\beta Liquidityi,t+i,t$	110 green bonds, 220 traditional (2013-2017)
Gianfrate & Peri (2019)	Investigation of green bond premium in Euro-Dominated primary market	Between -18bps and -21 bps	Propensity score matching and OLS regression of spreads (on variables used to estimate the PSM)	121 green bonds (2007-2017)
Baker (2018)	Greenium analysis on 2083 U.S. Munis [2]19 green U.S. corporate bonds	-5,7 bps (U.S. munis) -8.2bps CBI certified green bonds	Afer tax-yield regression and OLS regression	2083 green bonds U.S. munis (2010-2018) 19 corporate green bonds (2016-2018)
Sergei G. (2022)	Estimated greenium on European green bonds, particularly in the UK, France, the Netherlands and Germany markets	-4 bps (overall) No significant greenium in green bond market of the UK, France, Netherlands and Germany	Multiple OLS regression Dependent variable: current Ask Yield of bond issue.	462 green bonds (2007-2021)
Karpf &Mandel (2018)	Estimated greenium on 1880 green bonds in the secondary market	+7.8 bps	Yield curve (Svensson 1994) Oaxaca- Blinder decomposition	1880 green bonds (2010-2016)
Tang e Zhang (2018)	Estimated greenium in the primary market of 1510 green bonds	No greenium. The green bond issue is, however, positive for shareholders	Evet study. Regressione del differenziale di rendimento su molteplici variabili	1510 green bonds (2007-2017)
Koziol C (2022)	Stima del greenium nei green bond governativi tedeschi	Between – 68bps and 81bps	Pooled Ols panel regression with bond fixed effect nd robust standard error $GBPit=\beta 0+\beta 1\cdot LPit+b\cdot Bit+i\cdot It+s\cdot St+\varepsilon$ GBP (green bond premium) = observable yield differential and liquidity premium	4 green bond tedeschi (2021-2022)
Larker D et al (2020)	Estimation of greenium by calculating the price differential between green bonds and traditional bonds	No consistent greenium	Baker et al. (2018) Methodology	2896 green bonds
Loffler et al (2021)	Estimated greenium in the primary and secondary bond market from 650 international issuers	Between -15bps and -20 bps	Matching approaches: - CEM (coarsened exact metching) - PSM (Propensity score) using probit model	2000 green bonds
Huang et al (2023)	Estimating greenium as a function of the spread between non-green bonds	Between -10bps and 20 bps, more significant and sensitive in non green bond treasury spread	$Yg,i=\beta 0+\beta 1Yng,i+\beta 2Y2ng,i+\gamma 1CSDi+\gamma 2CPDi+\varepsilon i;\varepsilon i\sim N(0,\sigma)$ Where: Yg,i è $Yg,i=Yg,i\varepsilon$	5983 green bonds (2014-2022)
Bour(2019)	Estimation of greenium and simultaneous calculation of the relevance of non-financial disclosure on the value of the differential	-23.2bps (up to -110bps for bonds with higher transparency)	Zerbib (2019) methodology, adding the variables related to CBI certification, second-party opinion and Green Bond Principles	631 green bonds

Source: Authors Elaboration

[2] Muni-bonds, short for "municipal bonds", are bonds issued by local authorities and administrations with the aim of raising funds to be used in their area to finance projects, infrastructure works and other public interest objectives.

Purpose of the paper. *The objective of the paper is to verify the existence of greenium, as a "time invariant" effect of the panel regression expressed in the methodology, in a large sample of green bonds and over an extended period. Therefore, the analysis tests the following two hypotheses:*

HP1: The greenium, as a "time invarian" effect of the price difference between GB and traditional bonds in the selected sample, exists and is significant.

HP2: The greenium is affected by the following variables:

1) *Bid-Ask spread;*
2) *Amount issued;*
3) *Financial rating of the bond (S&P);*
4) *Sustainability rating of the bond (degree of transparency, presence of a second party opinion, adherence to the CBI or European standard according to the Action Plan on sustainable finance);*
5) *Type of issuer (States or Companies);*
6) *Currency (euro or dollar).*

Data

The data were collected from Refinitiv Workspace database and selected, through a matching methodology between green bonds and traditional bonds, within the Green Bond Guide, an area of the database that contains data on the entire green and sustainable bond market. The sample size is 1216 GB. The original sample size of 1429 GB was stripped of smaller, insignificant issues of less than USD 10 million. The large number of GBs selected required the use of the application programming interfaces (APIs) provided by the database to collect daily price and yield data for each bond over a period of 1/03/2020 to 1/03/2023.

Following the analysis methodology of Zerbib (2019), data were collected for two Traditional Bonds per GB, bringing the sample size to 4642 bonds. In the following section, the methodology and criteria for matching GBs and TBs are explained. In the section on analysis methodology, the reason for choosing two Traditional Bonds for each green is explained.

The collection followed four steps:

(1) All GBs with the following characteristics were identified:
(i) Issue value of at least USD 10 million.
(2) Traditional bonds with the following characteristics were selected.
(i) Same issuer as GB.
(ii) Similar maturity.
(iii) Same rating.
(iv) Similar issue size.
(v) Same currency.
(3) The final dataset consists of two traditional bonds for each selected green bond.
(4) Finally, a data table was constructed which includes.
(i) difference in yields over the time period;
(ii) difference in prices over time;
(iii) changes in liquidity over time;
(iv) issuance volume;
(v) type of issuer;
(vi) rating;
(vii) currency.

A table with descriptive statistics referring to the sample is presented below:

Tab. 2: Descriptive statistics of the international GB sample

	ABSOLUTE VALUE	***PERCENTAGE OF THE SAMPLE***
ISSUER TYPE		
Corporate	*897*	*73,70%*
Government	*194*	*16%*
Agency	*125*	*10,30%*
Tot	*1216*	*100%*
AMOUNT ISSUED		
Between 10 mln and 50mln	*264*	*21,71%*
Between 50 mln and 100 mln	*208*	*17,10%*
Between 100 mln and 250 mln	*203*	*16,69%*
Between 250 mln and 500 mln	*152*	*12,50%*
Between 500 mln and 750 mln	*218*	*17,92%*
Between 750 mln and 1 mld	*55*	*4,52%*
Over 1mld	*114*	*9,37%*
Tot	*1216*	*100%*
COUNTRY OF ISSUE		
Eurobond[3]	*443*	*36,43%*
United States	*127*	*10,44%*
France	*63*	*5,18%*
Japan	*83*	*6,83%*
China	*126*	*10,36%*
Sweden	*58*	*4,77%*
Altro	*316*	*25,99%*
Tot	*1216*	*100%*
ISSUE DATE		
Before 2017	*158*	*12,99%*
Between 2017 and 2018	*165*	*13,57%*
Between 2018 and 2019	*261*	*21,46%*
Between 2019 and 2020	*631*	*51,89%*
Tot	*1216*	*100%*
USE OF PROCEEDS		
Agricolture	*25*	*2,06%*
Renewable energies	*301*	*24,75%*
Clean transport	*19*	*1,56%*
Green Projects	*60*	*4,93%*
Energy efficiency	*69*	*5,67%*
Sustainable constructions	*139*	*11,43%*
Sustainable water use	*106*	*8,72%*
Green Urbanistic	*59*	*4,85%*
Waste management	*142*	*11,68%*
Other	*296*	*24,34%*
Tot	*1216*	*100%*

Source: Authors Elaboration

The decision to include such a high amount of bonds from non-governmental issuers is an attempt to make the analysed sample as similar as possible to the current market situation. In fact, according to Refinitv Workspace's Green Bond Guide, the size of the global green bond market in 2023 is approximately $2.5 trillion. Of this, about 70 per cent will come from corporate issuers. Similarly, a percentage close to 40 per cent has been chosen for Eurobonds, consistent with the market figure of approximately 37 per cent of active Eurobonds in 2023.

Methodology. *The methodology of analysis (Zerbib, 2019) is suitable for the verification of hypotheses also in view of the reference period, which is characterised by great uncertainty.*

The quantitative analysis involves four steps.

The first step aims to determine whether there is a difference in performance between GBs and traditional bonds.

The second step aims to verify whether, based on the panel analysis, the model constant exists "naturally" for all green bonds. To this end, it is appropriate to develop a fixed-effects panel analysis precisely in order to have the "time invariant" effect of the difference in the performance of green bonds compared to their conventional counterparts as a constant. The suitability of the fixed effects model will be tested through a Hausman test. The starting formulation for the calculation of greenium therefore takes the following form:

$$\Delta\tilde{y}_{i,t} = g_i + \beta \Delta Liquidity_{i,t} + \epsilon_{i,t} \quad (1)$$

[3] Eurobonds are defined as all bonds, corporate and government, from European supranational entities

where:
$\Delta\tilde{y}_{i,t}$ *is the ask yield differential over time between the ask yields of GBs and the TB yield calculated by interpolation.*
g_i *is the greenium;*
$\Delta Liquidity_{i,t}$ *is the change in liquidity calculated as the difference between the liquidity of the GBs and the liquidity of the TB, using the Bid-Ask spread as a proxy.*
$\epsilon_{i,t}$ *is the error term.*

The third step is a cross-sectional analysis, which aims to verify whether the components of GB:
1) currency,
2) issuance volume
3) rating
4) type of issuer
5) certificates of transparency (CBI, ICMA, Second Party Opinion)
are determinants of the greenium factor. Finally, in order to draw conclusions, we proceed to the analysis of the constant of the above-mentioned model over the time span of the sample.
We then proceed to the explanation of the variables and their empirical composition:

$\Delta\tilde{y}_{i,t}$ *is the difference between the yield of the GB and the yield of the TB created by the interpolation of the two TB for each GB. The interpolation, in this case, occurred by calculating the average between the yields of the TB, chosen from GBs with similar maturities.*
The difference between the yields of the securities pairs is calculated as follows:

$$\Delta\tilde{y}_{i,t} = y_{i,t}^{GB} - y_{i,t}^{TB} \quad (2)$$

where:
$y_{i,t}^{GB}$ *is the yield of the GB$_i$ at time t;*
$y_{i,t}^{CB}$ *is the yield of the TB$_i$ (traditional, constructed by interpolation) at time t.*

Liquidity is therefore calculated as follows:
$$\Delta Liquidity_{i,t} = Liquidity_{i,t}^{GB} - Liquidity_{i,t}^{TB} \quad (3)$$
where:

$Liquidity_{i,t}^{GB}$ *is the measure of liquidity for GBs;*
$Liquidity_{i,t}^{TB}$ *is the measure of liquidity for TBs.*

The liquidity calculation for both GBs and TBs is as follows:

$$Liquidity_{i,t} = \frac{Ask\ Price_{i,t} - Bid\ Price_{i,t}}{(Ask\ Price_{i,t} + Bid_{i,t})/2}$$

Following the model presented by Zerbib (2019) and, therefore, having compared one green bond with two of its traditional counterparts, the calculation of the liquidity of traditional bonds requires an additional step. Should the coefficient of the independent variable of liquidity (bid - ask spread) not be significant and close to 0, it would be demonstrated that there is no correlation with the existence of greenium.

$$Liquidity_{i,t}^{TB} = \frac{d_2}{d_1 + d_2} Liquidity_{i,t}^{TB1} + \frac{d_2}{d_1 + d_2} Liquidity_{i,t}^{TB2}$$

with:

d_1 = |GB $_{maturity}$ - TB1 $_{maturity}$|
d_2= |GB $_{maturity}$ - TB2 $_{maturity}$|

In order to demonstrate which characteristics of green bonds are most impactful on the formation of greenium, as required in the second hypothesis, a second model was constructed, which involves the distribution of the constants resulting from the panel regression of model (1) as the dependent variable of formulation (4) and the development of a series of regressors referring to the characteristics of GBs that could be impactful in the existence of this phenomenon. The determinants chosen are: amount issued, rating (S&P), type of issuer, presence of documentation supporting the bond (second party opinion, CBI certification, ICMA, sustainability rating) and currency. The determinants just mentioned will be transformed into dummy variables and inserted as independent variables in the following model:

$$\hat{g}_i = a + \gamma_1 IssueAmount_1 + \gamma_2 Rating_i + \gamma_2 Currency_i + \gamma_2 IssueType_i + \gamma_2 Cert\epsilon_i \quad (4)$$

Where:

$\widehat{g_i}$ s the distribution of constants from the panel regression (1)

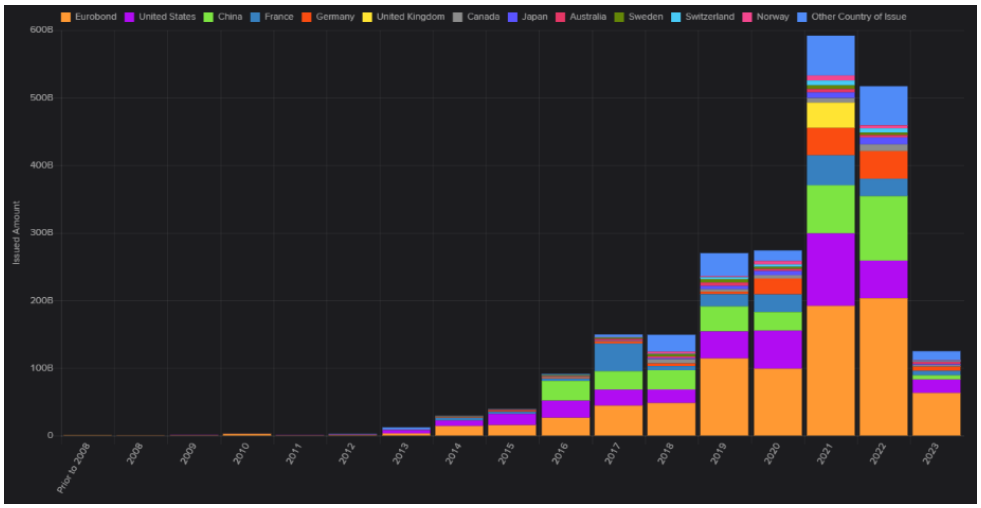
$\gamma_1 IssueAmount_1 + \gamma_2 Rating_i + \gamma_2 Currency_i + \gamma_2 IssueType_i + \gamma_2 Cert_i$ are the dummy variables of the determinants on which the analysis will be carried out.

Managerial Implications. *The issuance of bonds by firms has significant managerial implications:*

- *constitutes a tool for acquiring financial resources through an alternative channel to the banking one and makes it possible to diversify funding sources, reducing the risk associated with a too strong link with a single funding channel;*
- *it also implies an important organizational and transparency effort to make decisions regarding the technical characteristics of the security to be issued, the issue market, the timing of the issue, the choice of consultants to be involved, and constitutes an important moment for the growth of managerial skills and of the entire company structure.*

With regard to the issuance of GB, further considerations concern the importance of issuing a security that has an important environmental objective, in line with the indications of the 2030 Agenda of the United Nations and the European taxonomy on sustainable economic activities, in order to pursue the objectives of ecological transition and reduction of polluting emissions.

Fig. 1: Green bond issuance over the years and by country



Source: Refinitiv Workspace, Green Bond Guide

From a managerial point of view, therefore, the relevance profiles of a GB issue are very evident and represent an essential challenge for many companies. This is also demonstrated by the data relating to the growth of emissions over the years, above all due to the increase in global attention on the issues of environmental sustainability, on those of mitigation and adaptation to climate change and the reduction of pollution.

Among the profiles of managerial relevance, also from the point of view of marketing and communication, the transparency and clarity of the information to be provided to savers appears to be particularly important. This information concerns the issue, the second party opinion, the rating assigned to the issuer and the security and finally to the reporting on the use of the proceeds. To this end, the need for specific managerial skills and training courses on ESG sustainability is evident in order to change the corporate culture and direct it towards greater efficiency objectives. An adequate management structure, combined with adequate transparency, is essential to increase investor confidence, reduce the cost of debt, create value and feed greenium, to the benefit of issuers and savers and of the sustainable finance sector, of which GB are today an important tool.

Originality of the paper and expected results. *The analysis of the presence and of the determinants of the greenium factor in a context of strong uncertainty and instability in the markets, constitutes the first element of originality of the work. This analysis allows us to focus on what are the important elements at the time of issuance to reduce the cost of debt capital and to maximize the creation of financial and sustainability value of the GB. The chosen sample, with particularly significant dimensions even compared to the existing literature, can be considered as representative of the sustainable bond market, considering that the issues of social bonds, social impact bonds and other ESG bonds are decidedly less significant. Furthermore, the consideration of the transparency of the documentation supporting green bonds towards investors (based on the compliance of the bonds with the ICMA and European standards, on the adhesion to the Climate Bond Initiative and on the presence of an adequate second party opinion) represents an element of particular relevance to the analysis. In this regard, we expect to see more greenium*

in those bonds that demonstrate a greater degree of transparency and adherence to standards. This would highlight the sensitivity of investors to environmental sustainability issues in financial investments and could lead to a further increase in emissions, to the benefit of the environment and collective well-being.

Finally, the work intends to pave the way for research on the existence and the determinants of a different premium, that relating to social bonds, which can improve the characteristics of future issues, highlighting the variables that have the greatest impact on the premium and which most positively affect the 'investor. The issuance of social bonds has grown strongly in recent years, especially in the period of the COVID 19 pandemic, during which many social projects have been financed through the issuance of this type of bond. This condition justifies the deepening on the greenium of green bonds, in order to replicate the study on social bonds and possibly on new forms of sustainable bonds, the result of innovation in the field of positive impact finance.

Keywords: *greenium, green bond, green bond premium, sustainable finance, green finance*

References

AGLIARDI E., AGLIARDI R. (2019), "Financing Environmentally-Sustainable Projects with Green Bonds", *Environment and Development Economics*, vol. 24, n. 6, pp. 608-623.

AıAN Y.C. KUZEY M.F. ACAR, AÇIKGÖZ A. (2016), "The Relationships between Corporate Social Responsibility, Environmental Supplier Development, and Firm Performance", *Journal of Cleaner Production*, vol. 112, pp. 1872-1881.

ATTIG N., EL GHOUL S., GUEDHAMI O., SUH J. (2013), "Corporate Social Responsibility and Credit Ratings", *Journal of Business Ethics*, vol. 117, n. 4, pp. 679-694.

BACHELET M.J., BECCHETTI L., MANFREDONIA S. (2019), "The Green Bonds Premium Puzzle: The Role of Issuer Characteristics and Third-Party Verification", *Sustainability*, vol. 11, n. 4, pp. 1098.

BOUR T. (2019), The green bond premium and non-financial disclosure: Financing the future, or merely greenwashing?

DERWALL J., GUENSTER N., BAUER R., KOEDIJK K. (2005), "The Eco-Efficiency Premium Puzzle", *Financial Analysts Journal*, vol. 61, n. 2, pp. 51-63.

EHLERS T., PACKER F. (2017), *Green bond finance and certification*. Bank Int. Settlements Q. Rev. https://www.bis.org/publ/qtrpdf/r_qt1709h.pdf.

FATICA S., PANZICA R., RANCAN M. (2021), "The pricing of green bonds: are financial institutions special?", *Journal of Financial Stability*, vol. 54.

FLAMMER C. (2015), "Does Corporate Social Responsibility Lead to Superior Financial Performance? A Regression Discontinuity Approach", *Management Science*, vol. 61, n. 11, pp. 2549-2568.

GIANFRATE G., PERI M. (2019), "The Green Advantage: Exploring the Convenience of Issuing Green Bonds", *Journal of Cleaner Production*, vol. 219, pp. 127-135.

HUANG C.Y., DEKKER D., CHRISTOPOULOS D. (2023), "Rethinking Greenium: A Quadratic Function of Yield Spread", *Finance Research Letters*. doi:10.1016/j.frl.2023.103710.

KARPF A., MANDEL A. (2018), "The changing value of the 'green' label on the US municipal bond market", *Nature Clim Change*, vol. 8, 161–165.

KEMPF A., OSTHOFF P. (2007), "The Effect of Socially Responsible Investing on Portfolio Performance", *European Financial Management*, vol. 13, n. 5, pp. 908-922.

KONAR, S., COHEN M.A. 2001. "Does the Market Value Environmental Performance?", *Review of Economics and Statistics*, vol. 83, n. 2, pp. 281-289.

KOZIOL C.J. PROELSS P. ROßMANN, SCHWEIZER D. (2022), "The Price of being Green", *Finance Research Letters*, vol. 50. doi:10.1016/j.frl.2022.103285.

LARCKER D.F., WATTS E.M. (2020), "Where's the Greenium?", *Journal of Accounting and Economics*, vol. 69, n. 2-3.

LÖFFLER K.U., PETRESKI A., STEPHAN A. (2021), "Drivers of Green Bond Issuance and New Evidence on the "greenium"", *Eurasian Economic Review*, vol. 11, n. 1.

MACASKILL S., ROCA E., LIU B., STEWART R.A., SAHIN O. (2021), "Is there a Green Premium in the Green Bond Market? Systematic Literature Review Revealing Premium Determinants", *Journal of Cleaner Production*, vol. 280.

OIKONOMOU I., BROOKS C., PAVELIN S. (2014), "The Effects of Corporate Social Performance on the Cost of Corporate Debt and Credit Ratings", *Financial Review*, vol. 49, n. 1, pp. 49-75.

RUSSO A., MARIANI M., CARAGNANO A. (2021), "Exploring the determinants of green bond issuance: Going beyond the long-lasting debate on performance consequences", *Bus Strat Env*., vol. 30, pp. 38-59.

SERGEI G., ALESYA B. (2022), "In Search of Greenium. Analysis of Yields in the European Green Bond Markets", doi:10.1016/j.procs.2022.11.161.

TANG D.Y., ZHANG Y. (2020), "Do Shareholders Benefit from Green Bonds?", *Journal of Corporate Finance*, vol. 61.

THOMPSON D.W., ANDERSON R.C., HANSEN E.N., KAHLE L.R. (2010), Green segmentation and environmental certification: insights from forest products. *Bus. Strat. Env*., vol. 19, pp. 319-334.

WANG Y.S., CHEN Y.J. (2017), "Corporate Social Responsibility and Financial Performance: Event Study Cases", *Journal of Economic Interaction and Coordination*, vol. 12, n. 2, pp. 193-219.

ZERBIB O.D. (2019), "The Effect of Pro-Environmental Preferences on Bond Prices: Evidence from Green Bonds", *Journal of Banking and Finance*, vol. 98, pp. 39-60.